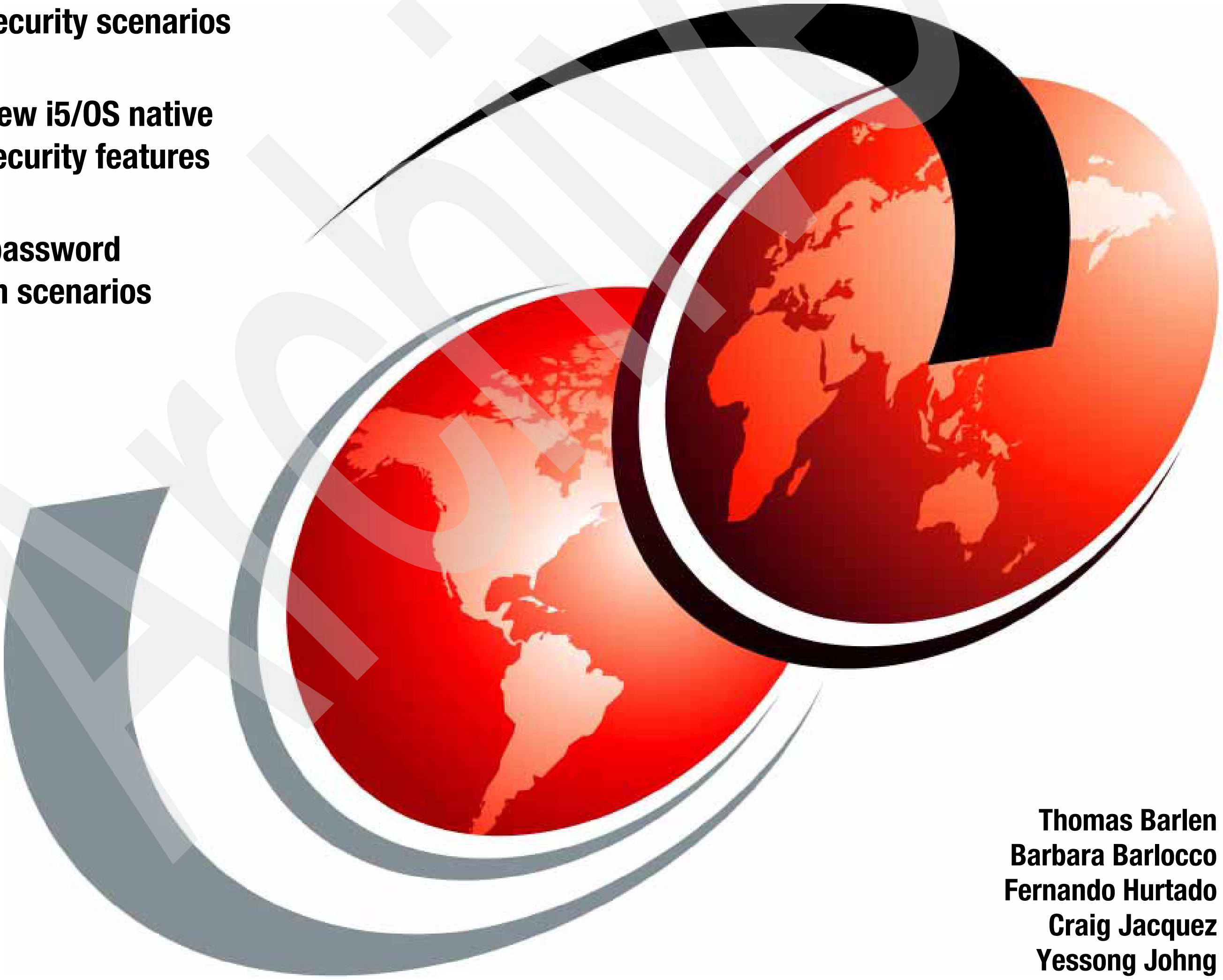
IBM i5/OS Network Security Scenarios

A Practical Approach

Step-by-step guide for practical network security scenarios

Includes new i5/OS native network security features

Practical password elimination scenarios



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IBM i5/OS Network Security Scenarios A Practical Approach

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Note: Before using this information and the product it supports, read the information in “Notices” on page vii.

First Edition (December 2007)

This edition applies to i5/OS Version 5 Release 3 and Version 5 Release 4, SLES9 and SLES10, and RHEL4.

Contents

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Preface

This IBM® Redbooks publication provides specific setup information for various cases of Internet security scenario. This book does *not* focus on theories and conceptual parts of related topics. We assume you have such knowledge, but if you need further discussion, see the following resources:

- For general discussion of i5/OS® security and network security, see the i5/OS V5R4 Information Center at:

  `http://publib.boulder.ibm.com/infocenter/iseries/v5r4/index.jsp`

- For general i5/OS security discussion, see *IBM System i Security Guide for IBM i5/OS V5R4,* SG24-6668-01.
- For a discussion of OpenSSH utilities, see *Securing Communications with OpenSSH on IBM i5/OS,* REDP-4163-00.

This book is useful for i5/OS network security administrators who need to set up any of the following scenarios:

- i5/OS Internet Protocol (IP) packet filtering
- Building a demilitarized zone (DMZ) with i5/OS
- Virtual Private Networking (VPN) connection with User Datagram Protocol (UDP) encapsulation
- VPN tunnel between Linux® and i5/OS
- VPN connection with Windows® XP clients
- Password elimination using Windows 2003 Kerberos Distribution (KDC)
- Securing Telnet for iSeries® access using Secure Sockets Layer (SSL)
- Securing File Transfer Protocol (FTP) using SSL
- Setting up and running the sshd daemon
- Establishing a Secure Shell (SSH) session
- File transfer and public key authentication with OpenSSH
- Protecting traffic with SSH tunnels
- Using SSH to control your Hardware Management Console (HMC)

The team that wrote this book

This IBM Redbooks publication was produced by a team of specialists from around the world working at the International Technical Support Organization (ITSO), Rochester Center.

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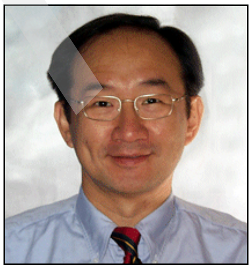

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1

i5/OS IP packet filtering

This chapter describes a scenario of a single i5/OS system implemented as a *secure shell* (SSH) server with limited telnet access. Two network interfaces are utilized. One is connected to a trusted network, the other to a non-trusted network.

> **Note:** This scenario assumes you are using OpenSSH to enable ssh daemon on a i5/OS server. For information about OpenSSH, see Chapter 9, “Introduction to OpenSSH for i5/OS” on page 281.

Internet Protocol (IP) packet filtering is the core component of any security server, such as a firewall, routers, and hosts. Packet filtering is implemented with IPv4. i5/OS V5R4 does not support packet filtering for IPv6. For security reasons, it is important to disable features that are not utilized. This creates a “smaller” attack surface for exposure to possible intrusion attempts.

Note how IP packet filtering relates to other security components available with i5/OS. i5/OS provides a set of components that protects your computing resources and provides value for your network.

1.1 i5/OS IP packet filtering with secure shell

The i5/OS IP packet filtering scenario uses a single System i with two network interfaces. One network connection is attached to a trusted network, the other to a non-trusted network. Note how IP packet filtering can protect resources above the network interface (Figure 1-1).

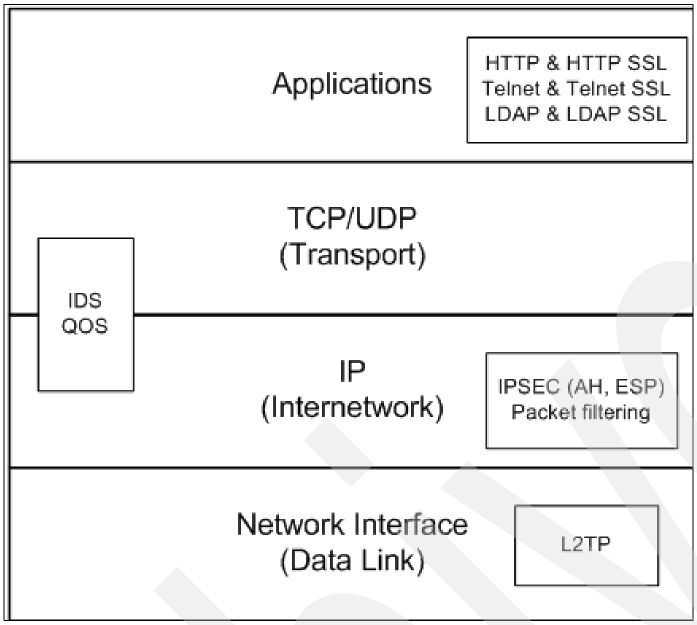


Figure 1-1 IP packet filtering implementation layers

1.1.1 Scenario characteristics

This scenario presents a single System i for a business. The i5/OS implementation provides the untrusted business network a SSH server with limited telnet access. i5/OS only provides SSH services when the SSH server is enabled and for a specific static IPv4 address.

This scenario has the following characteristics:

- One System i with two physical network interfaces. One network interface is connected to a trusted network, the other to an untrusted network.
- There is no firewall equipment in addition to the system i.
- Our scenario is using IPv4. IPv6 is disabled.
- We are only going to provide SSH access from a dynamic IP address (our technical support user) on the untrusted network (when enabled on i5/OS).
- SSH support is provided on an "as needed" basis.

1.1.2 Scenario objectives

The objectives are:

- Provide a secure environment on i5/OS and the trusted network behind it.
- Improve security by deploying a SSH server on i5/OS.
- Provide a logging of attempted intrusions when the SSH server is not enabled.
- Allow a technical support user to access i5/OS and the trusted network on an "as needed" basis.

1.1.3 Security policy

Before creating a network security policy, you *must* have an IT security policy for the entire organization. Otherwise, you do not know what guidelines to follow.

General security policies are:

- The default policy is to deny. Use high caution anytime a less trusted resource accesses a more trusted resource. Allow only what is needed. In our scenario, the only (untrusted) access is SSH when it is enabled.
- Hide theIP addressing with private IP addressing.
- Harden systems by disabling and removing unrequired resources.
- Push data to less trusted systems.
- Limit what data resides on less trusted systems.
- Encrypt data on systems.
- Log access and intrusion attempts. Intrusion detection system (IDS) is available for i5/OS.
- For systems accessed by untrusted sources, assume the system is fully compromised to help in your security design planning.
- Implement exit point programs when possible.
- Use i5/OS object security.

1.1.4 i5/OS security functions

The following i5/OS security functions are used in this scenario:

- Packet filtering
- lLogging
- Intrusion detection
- SSH services (encryption and tunneling)

1.2 IP packet filtering step-by-step set up

This section describes the steps to configure the i5/OS for this scenario:

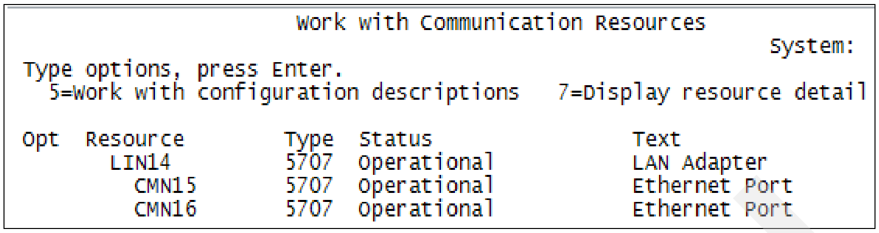
- "Creating the untrusted Ethernet line" on page 3.
- "Creating the IP interface for untrusted network" on page 4
- "Creating and starting IP filtering" on page 4
- "Configuring the sshd IP address" on page 12
- "Starting and stopping sshd" on page 12
- "Configuring IPv6 to not auto start during IPL" on page 13
- "Configuring IDS scan directives" on page 13

Creating the untrusted Ethernet line

To create the Ethernet line description, find the resource name using the following command:

```
WRKHDWRSC *CMN
```

Search for the resource name of communication resource type Ethernet port. In Figure 1-2 on page 4, the port we are configuring is CMN15. Create the Ethernet line description on our untrusted Ethernet network.



```
                     Work with Communication Resources
                                                                System:
 Type options, press Enter.
   5=Work with configuration descriptions   7=Display resource detail

 Opt  Resource          Type  Status                Text
        LIN14           5707  Operational           LAN Adapter
          CMN15         5707  Operational           Ethernet Port
          CMN16         5707  Operational           Ethernet Port
```

*Figure 1-2 WRKHDWRSC *cmn on i5/OS*

```
CRTLINETH LIND(ETHLINE) RSRCNAME(CMN15) LINESPEED(*AUTO) DUPLEX(*AUTO)
```

Creating the IP interface for untrusted network

Now create the TCP interface for the production interface of the Ethernet:

```
ADDTCPIFC INTNETADR('10.10.10.12') LIND(ETHLINE) SUBNETMASK('255.255.255.0')
```

Creating and starting IP filtering

1. In the iSeries Navigator, select <***yourserver***> → **Network** → **IP Policies** (Figure 1-3).

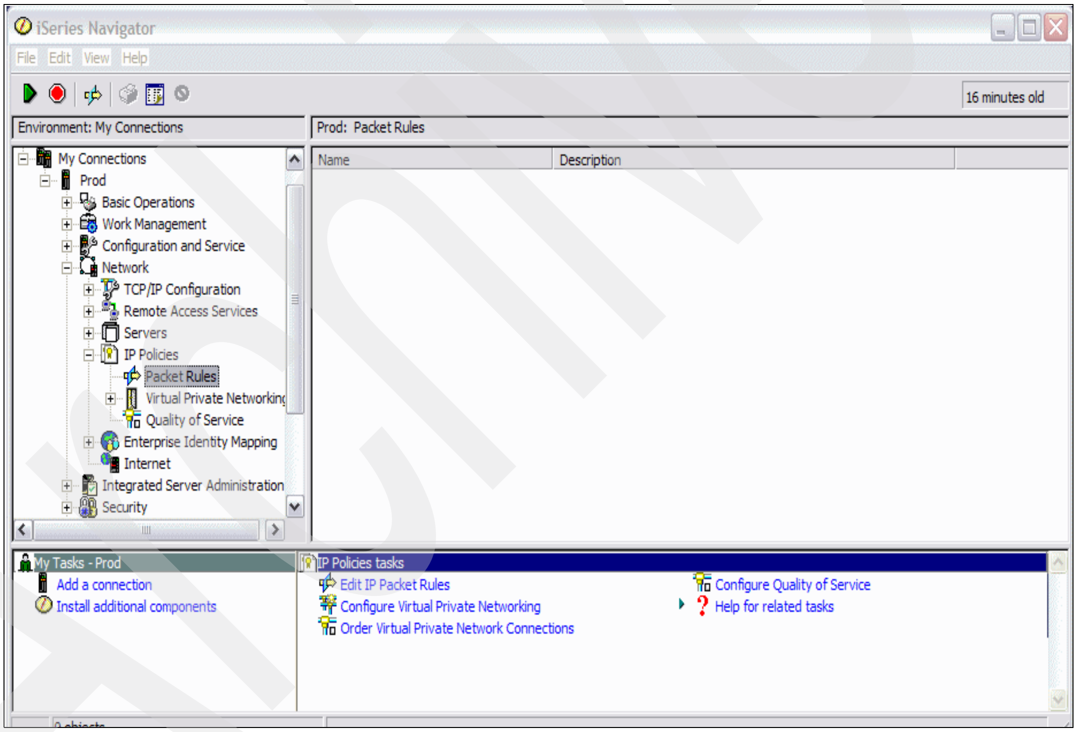
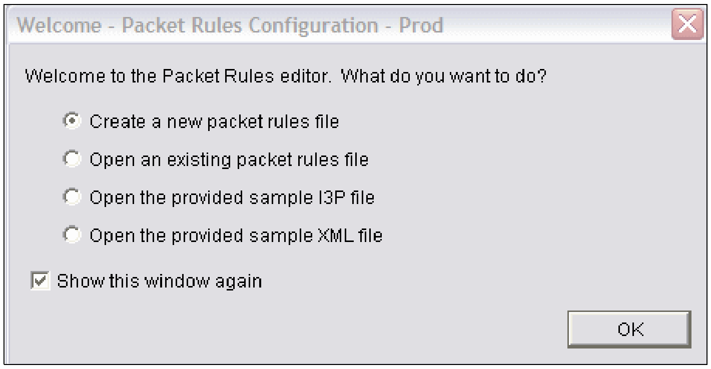


Figure 1-3 iSeries Navigator packet rules

2. Right-click **Packet Rules**, and select **Rules Editor**.

3. From the Welcome Packet Rules Configuration dialog, select **Create a new packet rules file**, and click **OK** (Figure 1-4).



Welcome - Packet Rules Configuration - Prod

Welcome to the Packet Rules editor. What do you want to do?

● Create a new packet rules file

○ Open an existing packet rules file

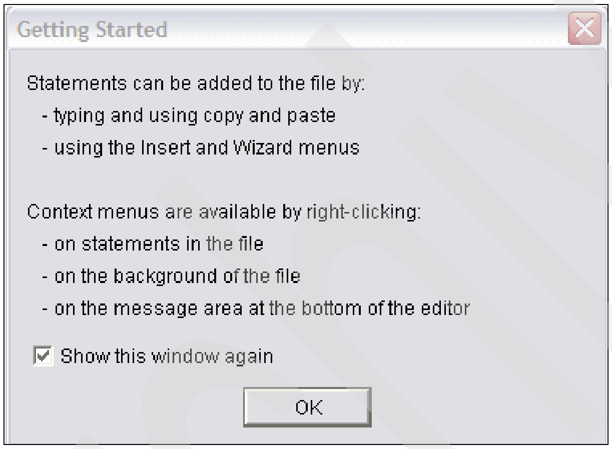
○ Open the provided sample I3P file

○ Open the provided sample XML file

☑ Show this window again

Figure 1-4 Welcome - packet rules configuration

4. On the Getting Started dialog (Figure 1-5), click **OK**.



Getting Started

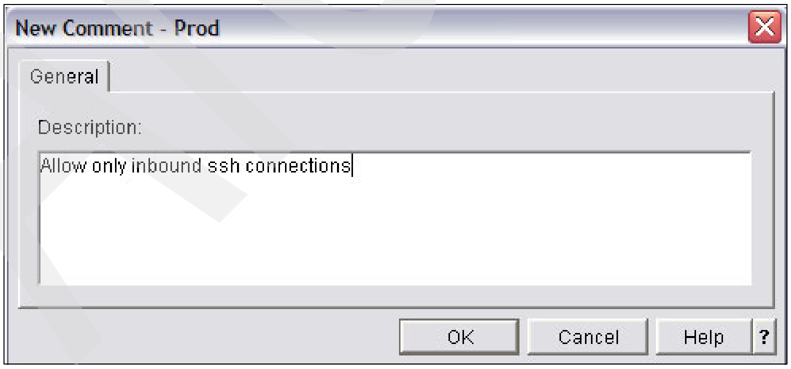
Statements can be added to the file by:
- typing and using copy and paste
- using the Insert and Wizard menus

Context menus are available by right-clicking:
- on statements in the file
- on the background of the file
- on the message area at the bottom of the editor

☑ Show this window again

Figure 1-5 Packet filter - getting started

5. From the **Insert** menu, select **Comment**. Enter a description and click **OK** (Figure 1-6).



New Comment - Prod

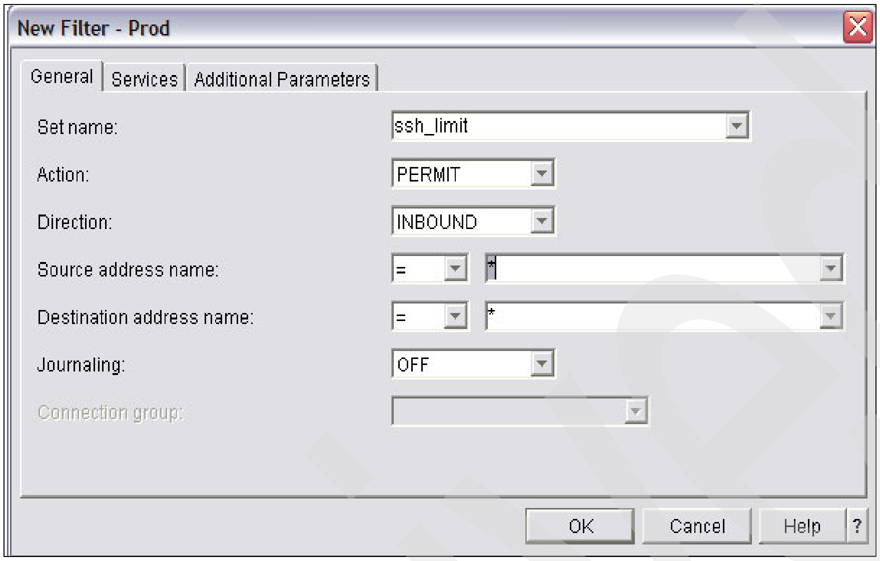
General

Description:

Allow only inbound ssh connections

Figure 1-6 Packet filter - adding a comment

6. From the **Insert** menu, select **Filter**. Select set name of **ssh_limit**, action of **PERMIT**, direction of **INBOUND**, source address name of *****, destination address name of ***** and click the **Services** tab (Figure 1-7). Use these entries to allow any IPv4 address to start an inbound connection to the SSH server on our production system from the ethline (untrusted) interface.


New Filter - Prod

Set name: ssh_limit

Action: PERMIT

Direction: INBOUND

Source address name: = *

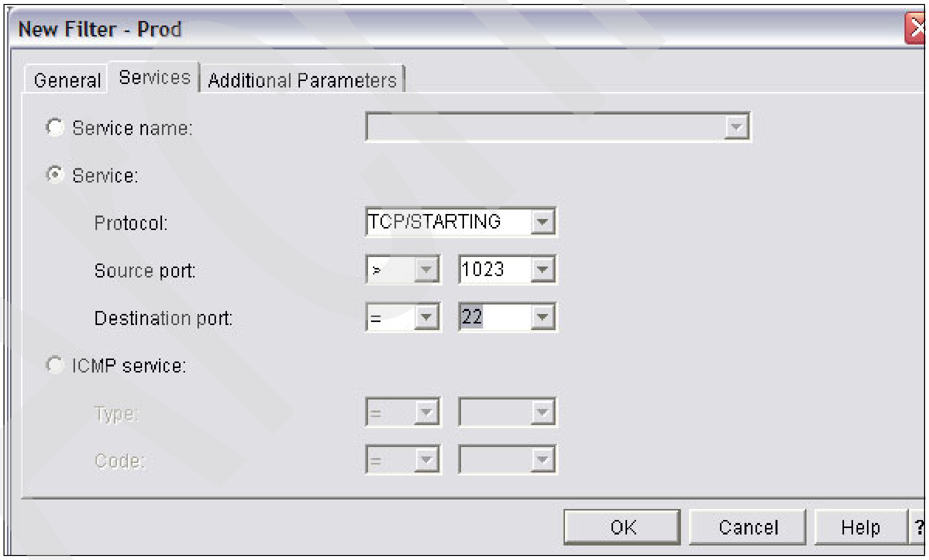
Destination address name: = *

Journaling: OFF

Connection group:

Figure 1-7 Packet filter - allow inbound ssh from untrusted (1 of 2)

7. Select the **Service** radio button. Select protocol of **TCP/STARTING**, source port of **> 1023**, destination port of **= 22** (SSH server), and click **OK** (Figure 1-8).


New Filter - Prod

○ Service name:

● Service:

Protocol: TCP/STARTING

Source port: > 1023

Destination port: = 22

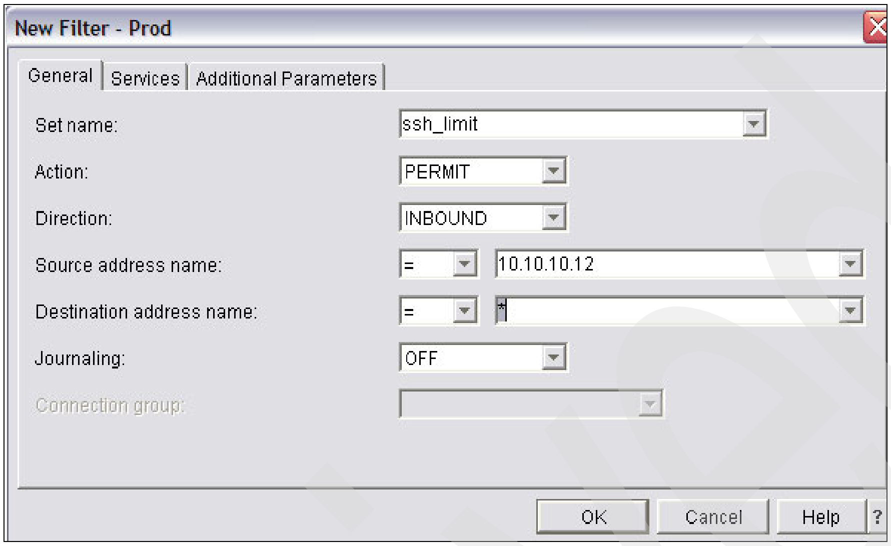
○ ICMP service:

Type: =

Code: =

Figure 1-8 Packet filter - allow inbound ssh from untrusted interface (2 of 2)

8. From the **Insert** menu, select **Filter**. Select the set name of **ssh_limit**, action of **PERMIT**, direction of **INBOUND**, source address name of **10.10.10.12** (the sshd server address), destination address name of *****, and click the **Services** tab (Figure 1-9). Use these entries to allow only IPv4 address telnet access from the sshd server on the production system.



New Filter - Prod

Set name: ssh_limit

Action: PERMIT

Direction: INBOUND

Source address name: = 10.10.10.12

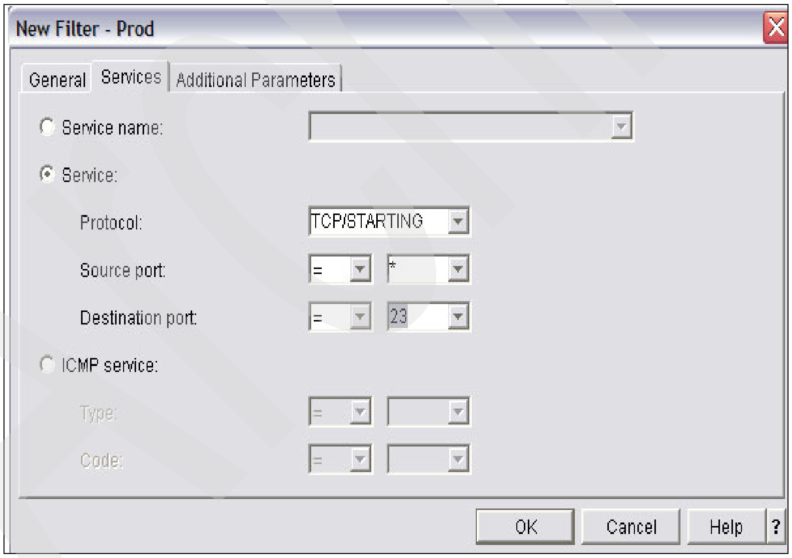
Destination address name: = *

Journaling: OFF

Connection group:

Figure 1-9 Packet filter - adding ssh telnet permit (1 of 2)

9. Select the **Service** radio button. Select protocol of **TCP/STARTING**, source port of **= ***, destination port of **= 23** (telnet server), and click **OK** (Figure 1-10). The asterisk denotes all available port numbers.



New Filter - Prod

○ Service name:

● Service:

Protocol: TCP/STARTING

Source port: = *

Destination port: = 23

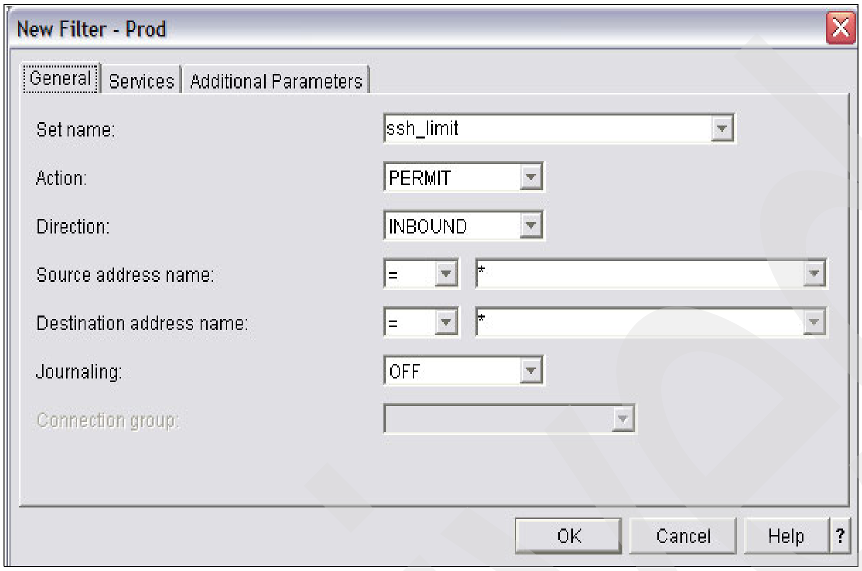
○ ICMP service:

Type: =

Code: =

Figure 1-10 Packet filter - adding ssh telnet permit (2 of 2)

10. From the **Insert** menu, select **Filter**. Select set name of **ssh_limit**, action of **PERMIT**, direction of **INBOUND**, source address name of *****, destination address name of *****, and click the **Services** tab (Figure 1-11). Use these entries to allow any IPv4 address originating from the production system to the untrusted network.



Set name: ssh_limit

Action: PERMIT

Direction: INBOUND

Source address name: = *

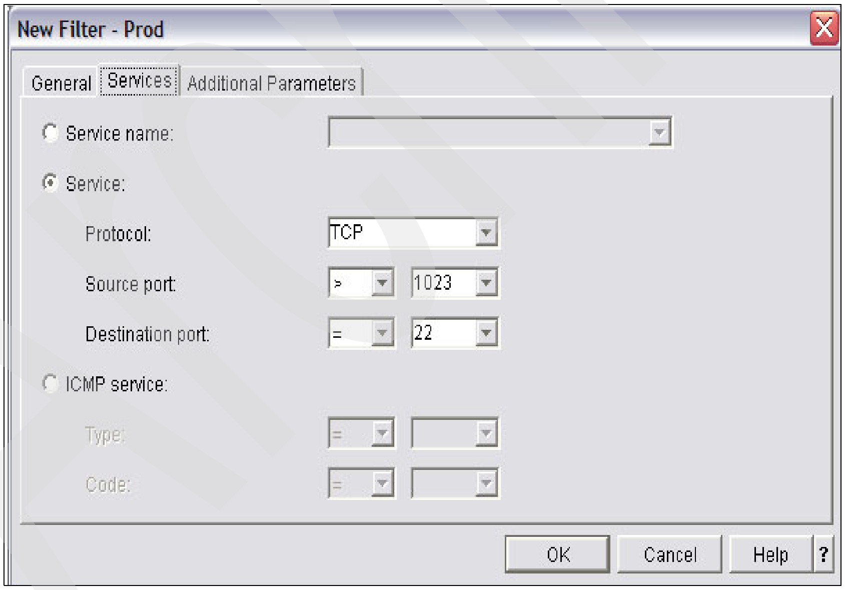
Destination address name: = *

Journaling: OFF

Connection group:

Figure 1-11   Packet filter - adding new ssh inbound filter (1 of 2)

11. Select the **Service** radio button. Select protocol of **TCP**, source port of **> 1023**, destination port of **= 22**, and click **OK** (Figure 1-12).



○ Service name:

● Service:

Protocol: TCP

Source port: > 1023

Destination port: = 22

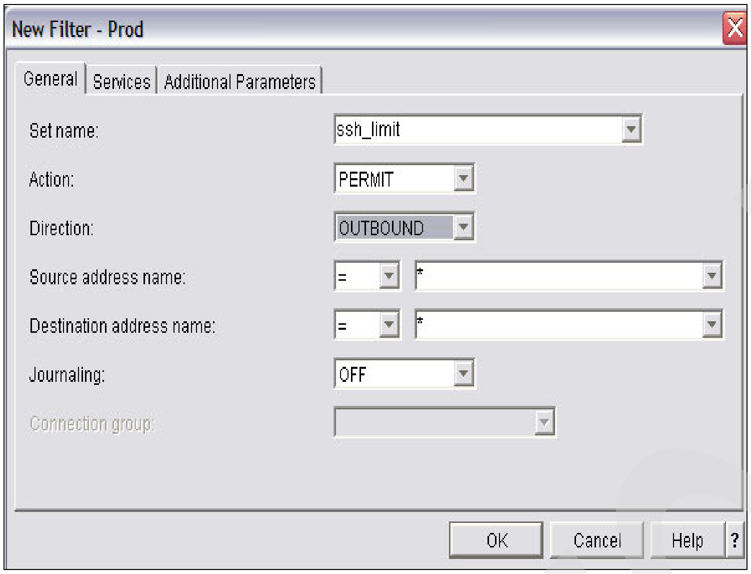
○ ICMP service:

Type: =

Code: =

Figure 1-12   Packet filter - adding new ssh inbound filter (2 of 2)

12. From the **Insert** menu, select **Filter**. Select set name of **ssh_limit**, action of **PERMIT**, direction of **OUTBOUND**, source address name of *****, destination address name of *****, and click the **Services** tab (Figure 1-13 on page 9). Use these entries to allow any IPv4 address originating from the production system to the untrusted network.



New Filter - Prod

Set name: ssh_limit

Action: PERMIT

Direction: OUTBOUND

Source address name: = *

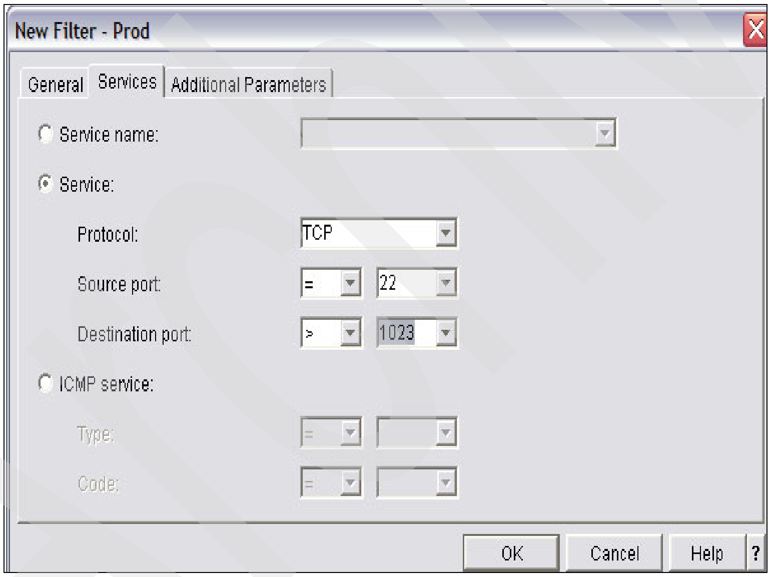
Destination address name: = *

Journaling: OFF

Connection group:

Figure 1-13 Packet filter - adding new ssh outbound filter (1 of 2)

13. Select the **Service** radio button. Select protocol of **TCP**, source port of **= 22**, destination port of **> 1023**, and click **OK** (Figure 1-14).



New Filter - Prod

○ Service name:

● Service:

Protocol: TCP

Source port: = 22

Destination port: > 1023

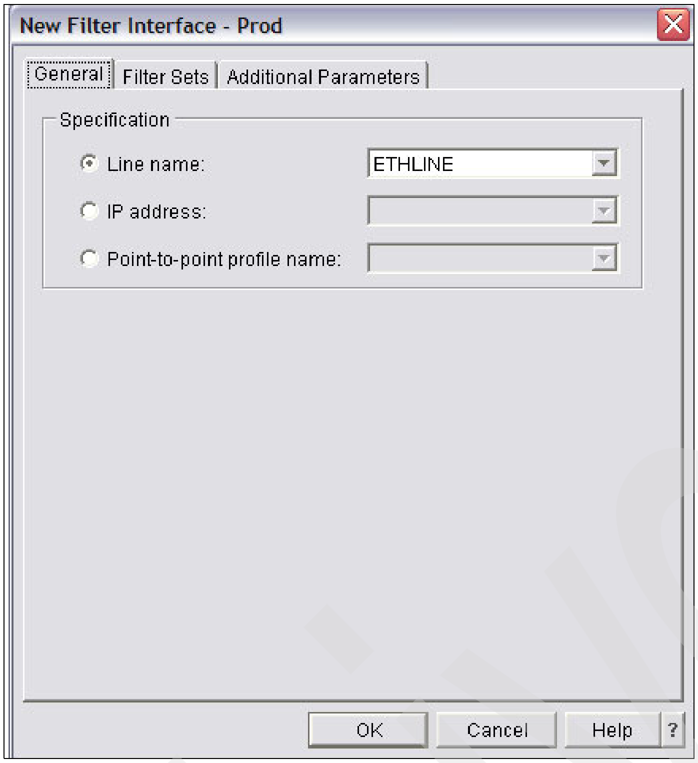
○ ICMP service:

Type: =

Code: =

Figure 1-14 Packet filter - adding new ssh outbound filter (2 of 2)

14. From the **Insert** menu, select **Filter Interface**. Select the line name of **ETHLINE**. Click the **Filter Sets** tab (Figure 1-15 on page 10). Use this entry to assign IPv4 IP filtering to the virtual Ethernet interface that connects to the untrusted network.



Specification

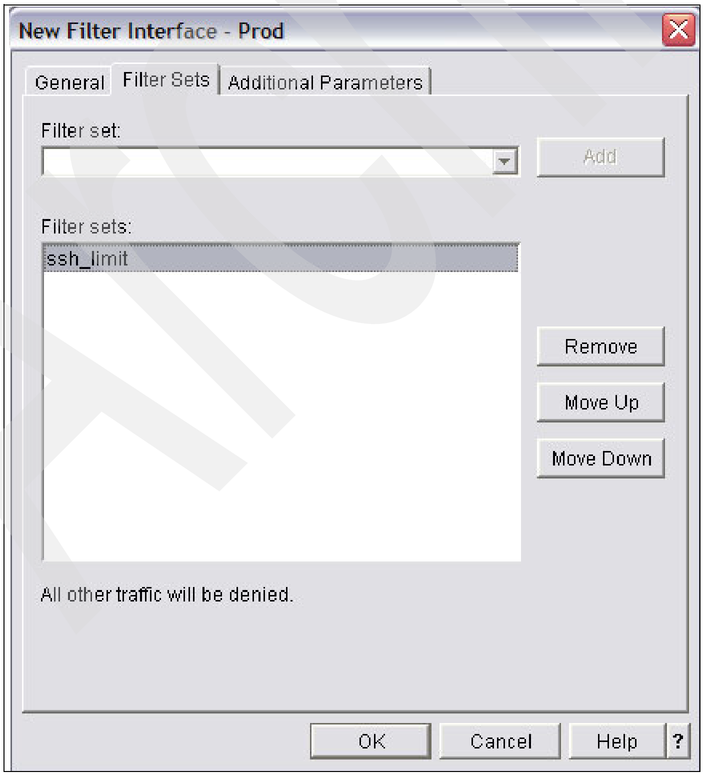
● Line name: ETHLINE

○ IP address:

○ Point-to-point profile name:

Figure 1-15 Packet filter - adding new ssh filter interface (1 of 2)

15. Select the filter set of **ssh_limit** and click **Add**. Click **OK** (Figure 1-16).



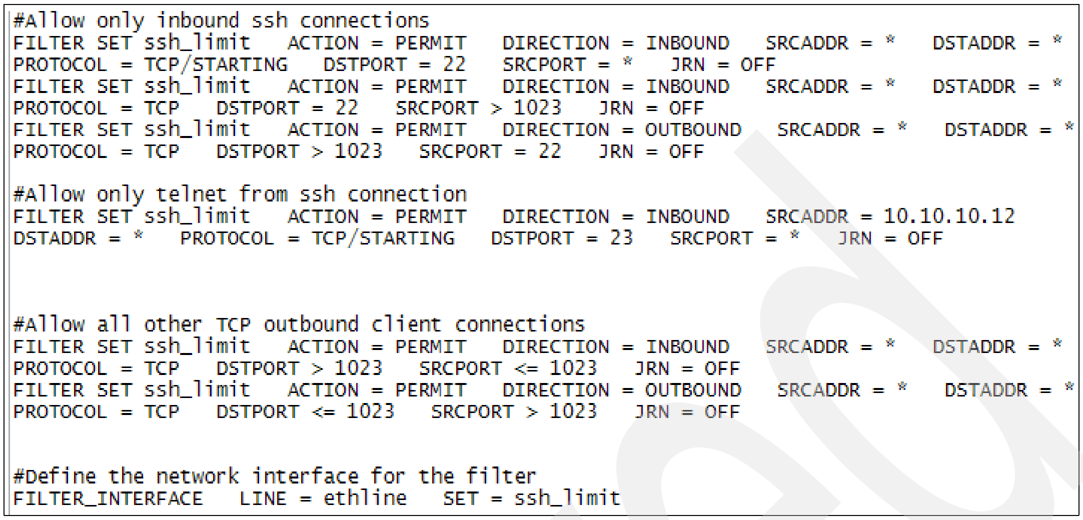
Filter set:

Filter sets: ssh_limit

All other traffic will be denied.

Figure 1-16 Packet filter - adding new ssh filter interface (2 of 2)

16. The complete rule set appears as shown in Figure 1-17.



```
#Allow only inbound ssh connections
FILTER SET ssh_limit   ACTION = PERMIT   DIRECTION = INBOUND   SRCADDR = *   DSTADDR = *
PROTOCOL = TCP/STARTING   DSTPORT = 22   SRCPORT = *   JRN = OFF
FILTER SET ssh_limit   ACTION = PERMIT   DIRECTION = INBOUND   SRCADDR = *   DSTADDR = *
PROTOCOL = TCP   DSTPORT = 22   SRCPORT > 1023   JRN = OFF
FILTER SET ssh_limit   ACTION = PERMIT   DIRECTION = OUTBOUND   SRCADDR = *   DSTADDR = *
PROTOCOL = TCP   DSTPORT > 1023   SRCPORT = 22   JRN = OFF

#Allow only telnet from ssh connection
FILTER SET ssh_limit   ACTION = PERMIT   DIRECTION = INBOUND   SRCADDR = 10.10.10.12
DSTADDR = *   PROTOCOL = TCP/STARTING   DSTPORT = 23   SRCPORT = *   JRN = OFF


#Allow all other TCP outbound client connections
FILTER SET ssh_limit   ACTION = PERMIT   DIRECTION = INBOUND   SRCADDR = *   DSTADDR = *
PROTOCOL = TCP   DSTPORT > 1023   SRCPORT <= 1023   JRN = OFF
FILTER SET ssh_limit   ACTION = PERMIT   DIRECTION = OUTBOUND   SRCADDR = *   DSTADDR = *
PROTOCOL = TCP   DSTPORT <= 1023   SRCPORT > 1023   JRN = OFF


#Define the network interface for the filter
FILTER_INTERFACE   LINE = ethline   SET = ssh_limit
```

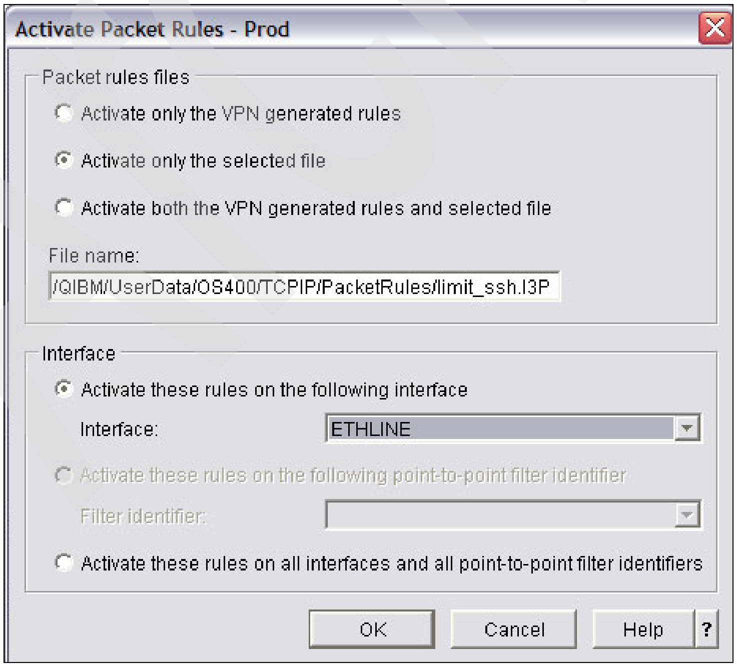
Figure 1-17 Packet filter - review ssh_limit rule set

> **Notes:**
>
> – When you enter the Filter Interface, all other traffic is explicitly denied.
>
> – Ensure our rules are applied to the *ETHLINE* line description (untrusted)

Note that other IPv4 protocols, such as UDP, ESP, AH, IPSEC IPCOMP, and RSVP are denied.

17. From the **File** menu, select **Save**. Assign the name **SSH_LIMIT.I3P** to our rules file.

18. From the **File** menu, select **Activate Rules** (Figure 1-18).



Activate Packet Rules - Prod

Packet rules files

○ Activate only the VPN generated rules

● Activate only the selected file

○ Activate both the VPN generated rules and selected file

File name: /QIBM/UserData/OS400/TCPIP/PacketRules/limit_ssh.I3P

Interface

● Activate these rules on the following interface

Interface: ETHLINE

○ Activate these rules on the following point-to-point filter identifier

Filter identifier:

○ Activate these rules on all interfaces and all point-to-point filter identifiers

Figure 1-18 Activate packet filtering

19. To ensure IP filters are active, open the iSeries Navigator and select **Network** → **IP Policies** → **Packet Rules**. The right-hand pane displays the status of active packet rules loaded by the network interface name (Figure 1-19).

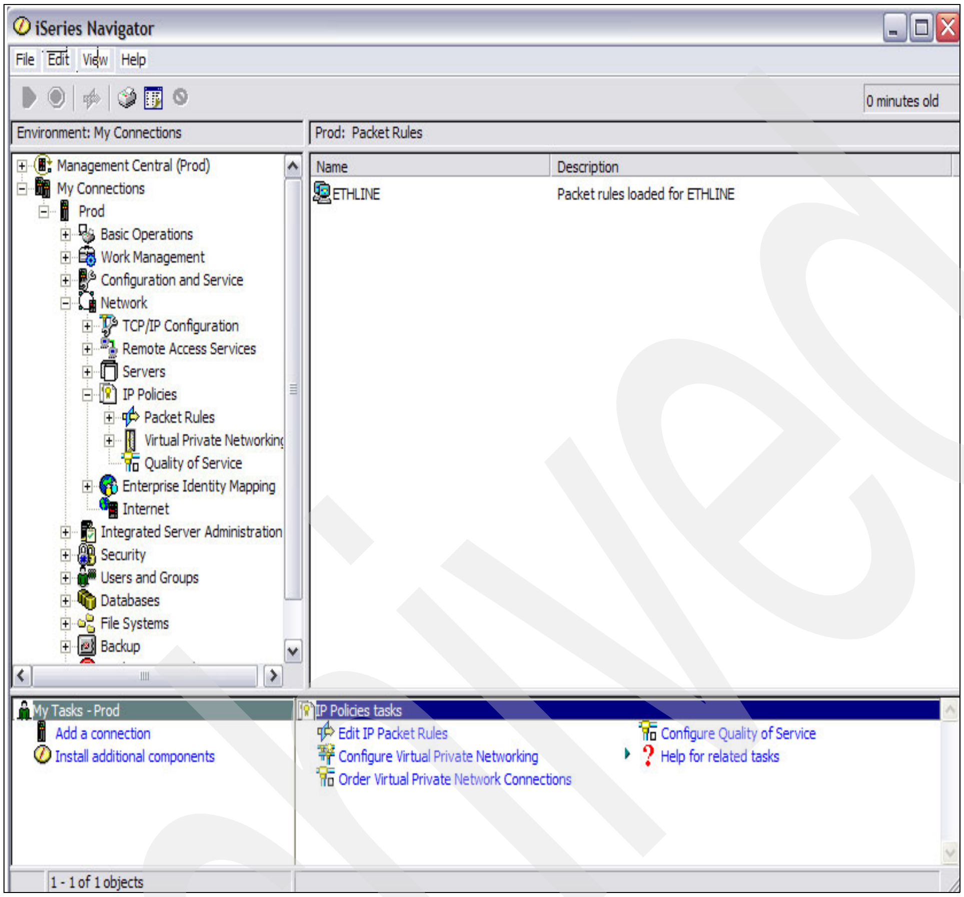


Figure 1-19 Packet filtering status

> **Note:** IP filtering is not supported for IPv6 with i5/OS V5R4. If you do *not* useIPv6, ensure that it is disabled. To confirm that it is disabled, run the following command: `ping '::1'`. If the ping command receives replies, then disable IPv6. To disable it, run `wrktcpsts, option 4`, work with the IPv6 interface status, and enter `10=End` by all Internet Addresses.

Configuring the sshd IP address

If you have multiple IP addresses on your i5/OS, limit what IP address the ssh server will listen on. This simplifies our IP packet filtering rules when permitting telnet access from the 10.10.10.12 address (which is used by the ssh tunnel). Edit the sshd_config file by adding the following entry:

```
ListenAddress 10.10.10.12
```

Starting and stopping sshd

Run the CALL QP2TERM command, then go to the /QOpenSys/usr/sbin directory and run `./sshd` to start sshd. To end sshd, find the active sshd job and run the ENDJOB command against it.

Note: For a detailed discussion about starting and stopping sshd daemon, see Chapter 10, “Setting up and running the sshd daemon” on page 287.

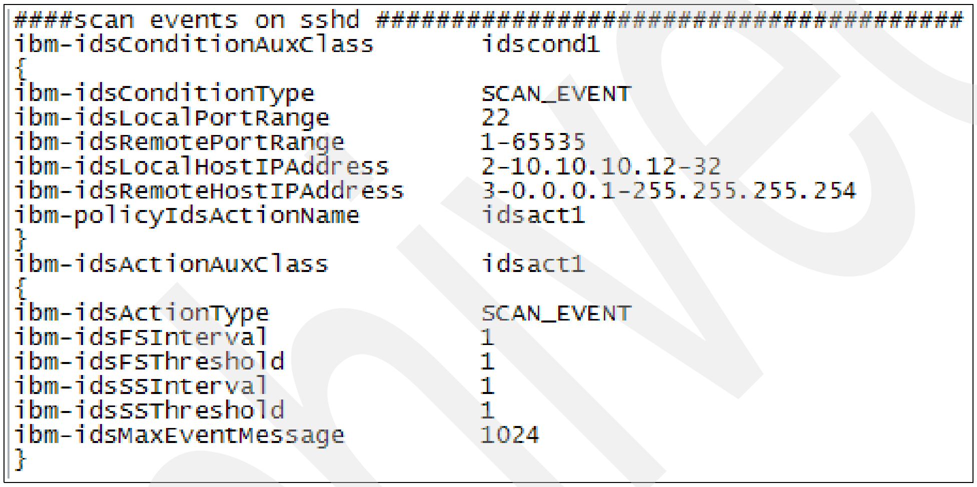
Configuring IPv6 to not auto start during IPL

By default, the i5/OS V5R4 IPL auto starts IP v4 and v6. The STRTCP command parameter default strip6 is *yes (start IPv6). To change this command parameter default, run the following command:

```
CHGCMDDFT CMD(STRTCP) NEWDFT(‘STRIP6(*NO)’)
```

Configuring IDS scan directives

Edit the file /qibm/userdata/os400/qos/etc/IDSPOLICY.CONFto include the following directives shown in Figure 1-20.



```
####scan events on sshd ########################################
ibm-idsConditionAuxClass       idscond1
{
ibm-idsConditionType           SCAN_EVENT
ibm-idsLocalPortRange          22
ibm-idsRemotePortRange         1-65535
ibm-idsLocalHostIPAddress      2-10.10.10.12-32
ibm-idsRemoteHostIPAddress     3-0.0.0.1-255.255.255.254
ibm-policyIdsActionName        idsact1
}
ibm-idsActionAuxClass          idsact1
{
ibm-idsActionType              SCAN_EVENT
ibm-idsFSInterval              1
ibm-idsFSThreshold             1
ibm-idsSSInterval              1
ibm-idsSSThreshold             1
ibm-idsMaxEventMessage         1024
}
```

Figure 1-20 IDS scan rules for sshd attempts when inactive

Note: The IDS directives will only log the entries when the sshd server is inactive.

1.3 Verifying the IP packet filtering implementation

To verify our limited ssh connection, do the following steps:

1. Use a SSH client to access our public IP address of 10.10.10.12.
2. Note the previous step will fail if the SSH server is inactive.
3. Use a tunnelled telnet connection to connect to the telnet server (port 23).
4. If there are other active servers, check if all other tunneled connections have failed.
5. Verify that IDS logging is active when the sshd server is inactive.

1.4 Tips and techniques

You must verify that your security policy is supported continually. Keep in mind that many network hosts might have IPv6 enabled by default. Therefore, ensure that you have security in place at each network host for IPv6.

In addition to using IP filtering, implement the Intrusion Detection System (IDS) for i5/OS to provide additional network security auditing.

If your IP filtering rules disable access to the iSeries Navigator or other important network access, enter the command RMVTCPTBL (Remove TCP/IP Table). Use *caution* because this command disables all IP packet filtering.

To assist in troubleshooting the IPv4 filtering rules, use the *journaling* functionality that is available. The QIPFILTER journal logs entries when an IPv4 datagram matches a definition of a defined filter rule.

To help mine the audit journal for intrusion monitoring, use the following commands:

```
CPYAUDJRNE IM
```

This copies the im entries, if any, to qtemp/qauditim.

```
RUNQRY *NONE QAUDITIM
```

This queries the im entries from qtemp/qauditim.

For information about IDS and IP packet filtering, see the iSeries Information Center at:

http://publib.boulder.ibm.com/infocenter/iseries/v5r4/index.jsp

For information about SSH, see *IBM Portable Utilities for i5/OS* in the Porting Central Web site at:

http://www.ibm.com/servers/enable/site/porting/tools/openssh.html

2

Building a DMZ with i5/OS

This scenario describes a single System i with two i5/OS logical partitions (LPAR) with one partition in a *demilitarized zone* (DMZ) for Web application serving, and the other for production. This configuration provides a solution for businesses that require Web application serving to the Internet. Both the public and employees of the business can use Web application serving. This configuration is viewed as more secure because it separates the public servers from all internal systems. All public servers are placed in a network segment called a DMZ. In addition to security, availability is improved because the production partition is dedicated for batch processing or backup while the application server is still available.

2.1 i5/OS LPAR in DMZ

You can implement the i5/OS LPAR in DMZ architecture discussed in this scenario by using a single System i with two logical partitions. One partition is for production and the other is for Web application serving (Figure 2-1).

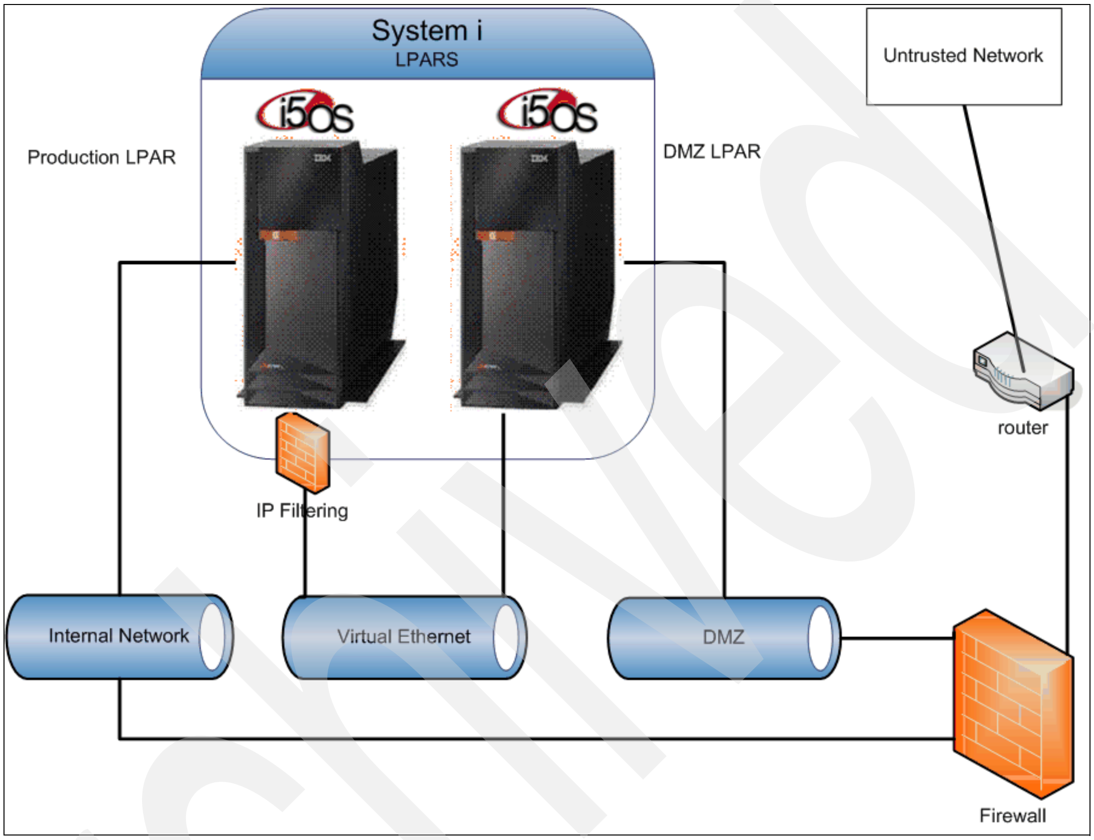


Figure 2-1 Basic DMZ scenario

2.1.1 Scenario characteristics

This scenario has the following characteristics:

- One System i with two logical partitions. One partition is for production and the other is for Web application serving.
- Four distinct networks - internal (trusted), virtual local area network (VLAN) (untrusted), DMZ (untrusted), and Internet (untrusted). The four are separated by a firewall and IP filtering on the virtual LAN.
- The router is connected to the Internet with a dedicated line.
- If intruders take control of the Web application server, they will only get a limited set of data (not the complete set of business data).They are not allowed to access any resource in the internal (trusted) network.
- The firewall provides packet filtering to the Web application server logical partition.
- The Web application server environment is limited from impacting the internal system resources.
- Each i5/OS partition has one physical network interface and a shared virtual Ethernet LAN interface.

2.1.2 Scenario objectives

The scenario objectives are:

- Provide a secure environment for i5/OS Web application services.
- Improve i5/OS Web application availability when dedicated batch processing and backups are being processed on production.
- Improve security because the public is not permitted to access any internal system direy. Only a portion of business data is available on the Web application server.
- Protect computer resources because the Web application server is separated from production resources.
- If the Web application server is compromised, prevent internal systems from intrusion.

2.1.3 Security policy

Before you create your network security policy, you must have an IT security policy for your entire organization. Otherwise, you do not know what guidelines you must follow.

General security policies are:

- The default policy is to deny. Use high caution anytime a less trusted resource accesses a more trusted resource. You allow only what is need. In our scenario, the only public (untrusted) access is to http and https.
- Hide IP addressing with private IP addressing.
- Harden systems by disabling and removing unrequired resources.
- Push data to less trusted systems.
- Limit what data resides on less trusted systems.
- Encrypt data in systems.
- Log access and intrusion attempts. Intrusion detection system (IDS) is available for i5/OS.
- For systems accessed by untrusted sources, assume the system is fully compromised to help in your security design planning.
- Limit IP traffic from Internet to DMZ systems.
- Eliminate inbound access completely for IP traffic from DMZ to internal systems. Minimize internal to DMZ system communication.

2.1.4 Firewall security functions

The following functions (shipped with your firewall) are required to implement the network security in this scenario:

- Packet filtering
- Port address translation (PAT) to DMZ partition
- Logging
- Optional: Intrusion detection and prevention

2.1.5 Web application server LPAR security functions

The following functions for the Web application server LPAR are required to implement the network security in this scenario:

- HTTP powered by Apache
- Virtual local area network (VLAN)

2.1.6 Production LPAR security functions

The following functions for the production LPAR are required to implement the network security in this scenario:

- IP packet filtering
- Virtual local area network (VLAN)
- Optional: Intrusion detection system (IDS)

2.2 Planning for implementation

The firewall is implemented using a three port security device. The public Web application server is an i5/OS logical partition located in the DMZ and runs an HTTP server. This Web application server might be running the Apache HTTP server, ASF Tomcat, WebSphere Application Server, CGI (RPG, COBOL, and so on), or PHP. The production i5/OS logical partition is located in the internal trusted network and holds the complete set of business data. The Web application server receives its data updates when the production partition pushes updates to it. For security and availability reasons, the Web application server only contains a subset of the business data. One key reason to have a separate logical partition for Web application serving is to provide data availability when the production system is unavailable because of dedicated processing and data backups.

The four networks require IP addressing assignments. This scenario uses the following addressing assignments:

- Internal network 10.1.1.0/24
- DMZ network 10.9.9.0/24
- Virtual Ethernet 192.168.9.0/24
- Public subnet 10.10.10.0/28
- Firewall outside 10.10.10.50, DMZ 10.9.9.1, and internal 10.1.1.1
- Web application server LPAR DMZ 10.9.9.2 and VLAN 192.168.9.2
- Production LPAR internal 10.1.1.7 and VLAN 192.168.9.120

Figure 2-2 illustrates this scenario with the required IP addresses.

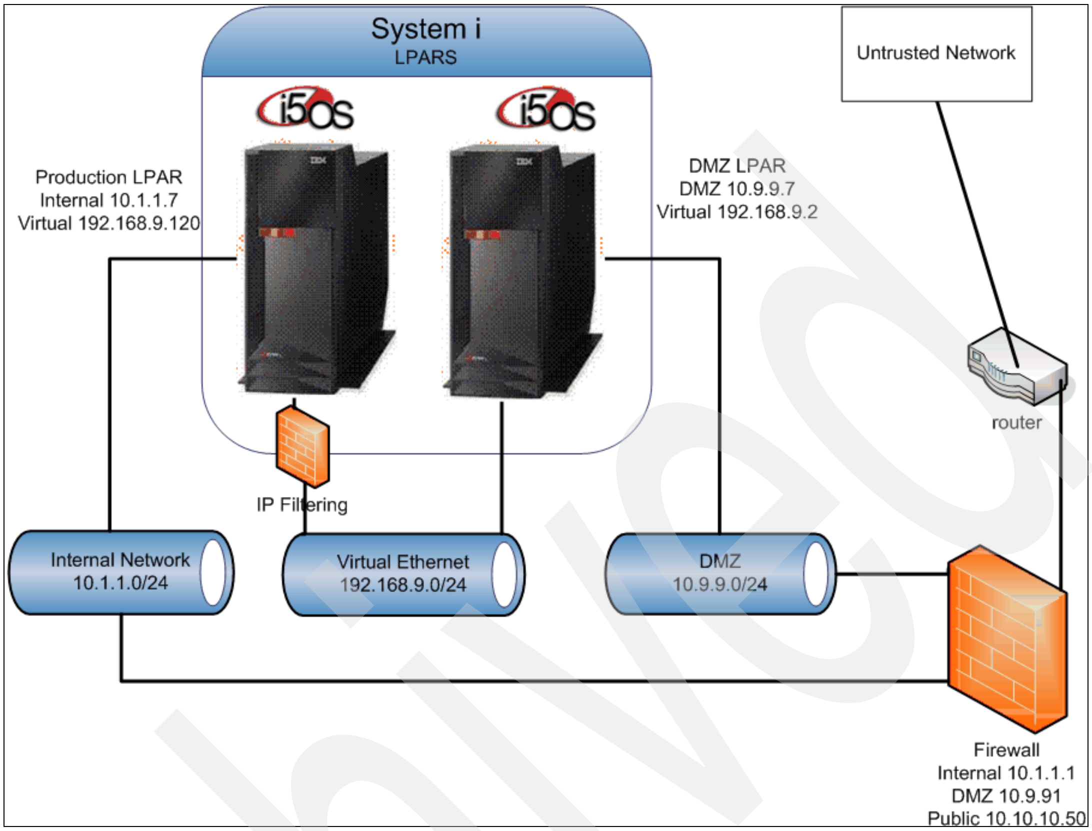


Figure 2-2 Basic DMZ scenario with IP addressing

2.3 LPAR DMZ step-by-step set up

This scenario involves two main tasks:

- "Configuring the production i5/OS LPAR partition" on page 19:
  - "Creating the virtual Ethernet line" on page 19
  - "Creating the IP interface" on page 20
  - "Creating and starting IP filtering" on page 20
  - "Configuring IPv6 to not auto start during IPL" on page 28
- "Configuring the DMZ logical partition network" on page 28:
  - "Creating the virtual Ethernet line" on page 29
  - "Creating the IP interface" on page 29
  - Configure and start the packet filters

2.3.1 Configuring the production i5/OS LPAR partition

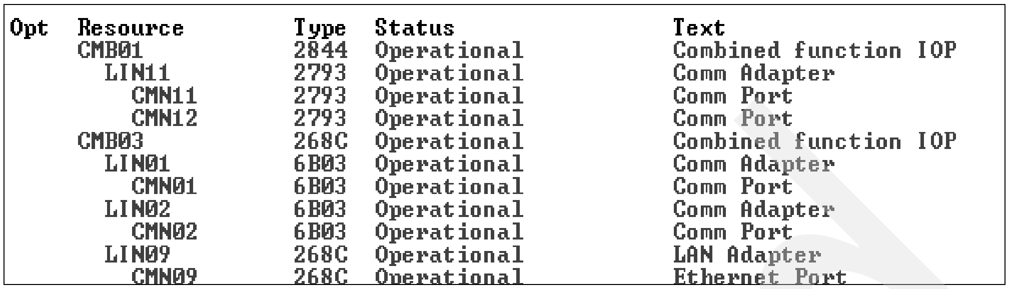
This section describes the steps we performed to configure the i5/OS logical partitions for this scenario.

Creating the virtual Ethernet line

1. To create the Ethernet line description, find the resource name. Run the following command:

```
WRKHDWRSC *CMN
```

2. Search for the communication resource type of 268C. Note the Ethernet port resource name. In Figure 2-3, the Ethernet port we are configuring is CMN09.



```
Opt  Resource         Type  Status                 Text
     CMB01            2844  Operational            Combined function IOP
       LIN11          2793  Operational            Comm Adapter
         CMN11        2793  Operational            Comm Port
         CMN12        2793  Operational            Comm Port
     CMB03            268C  Operational            Combined function IOP
       LIN01          6B03  Operational            Comm Adapter
         CMN01        6B03  Operational            Comm Port
       LIN02          6B03  Operational            Comm Adapter
         CMN02        6B03  Operational            Comm Port
       LIN09          268C  Operational            LAN Adapter
         CMN09        268C  Operational            Ethernet Port
```

*Figure 2-3 wrkhdwrsc *cmn on production LPAR*

3. Create the virtual Ethernet line description on our virtual Ethernet network:

```
CRTLINETH LIND(VETH0) RSRCNAME(CMN09) LINESPEED(*AUTO) DUPLEX(*AUTO)
```

Creating the IP interface

Now create the TCP interface for the production interface of the virtual Ethernet:

```
ADDTCPIFC INTNETADR('192.168.9.120') LIND(VETH0) SUBNETMASK('255.255.255.0')
```

Creating and starting IP filtering

1. In the iSeries Navigator, select <***yourserver***> → **Network** → **IP Policies** (Figure 2-4).

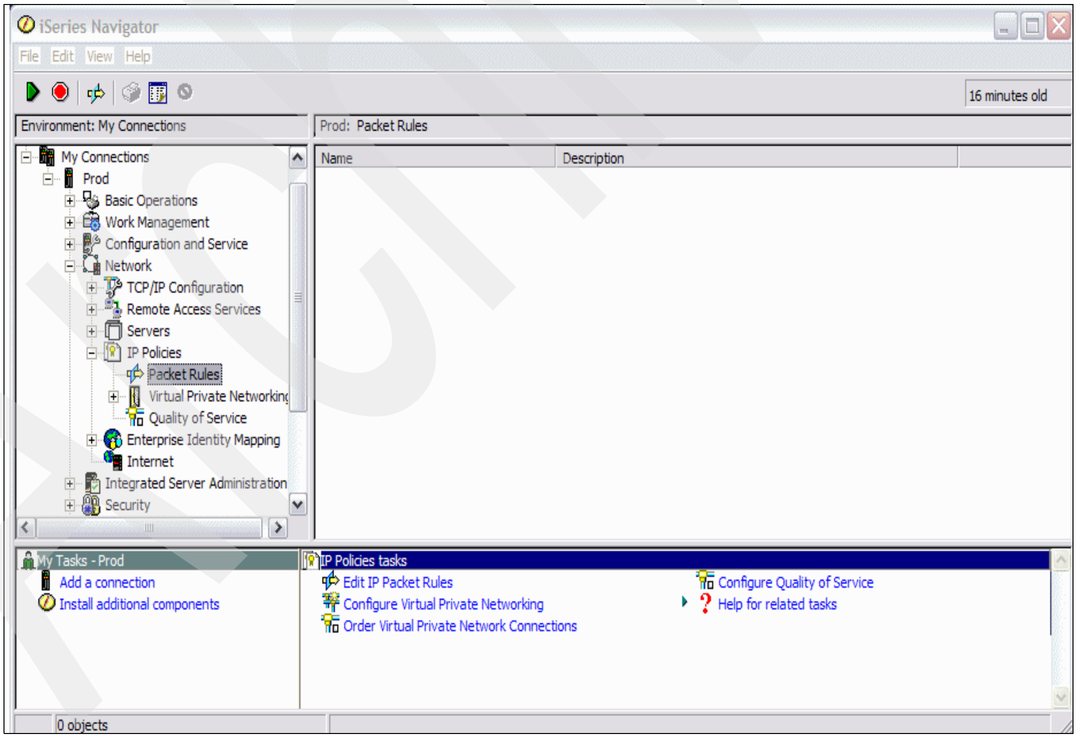
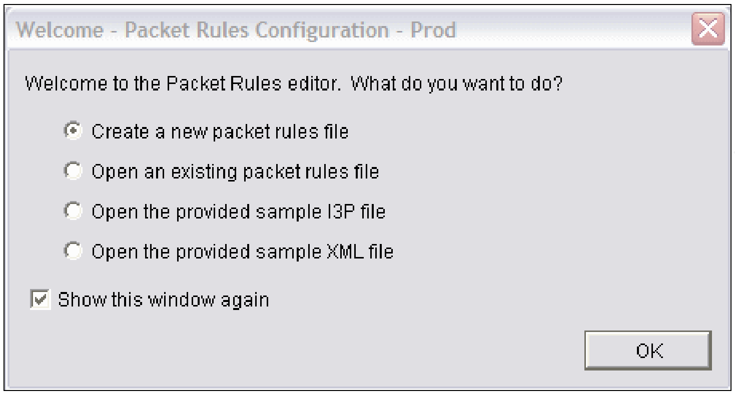


Figure 2-4 iSeries Navigator packet rules

2. Right-click **Packet Rules**, and select **Rules Editor** (Figure 2-5).



Welcome - Packet Rules Configuration - Prod

Welcome to the Packet Rules editor. What do you want to do?

● Create a new packet rules file

○ Open an existing packet rules file

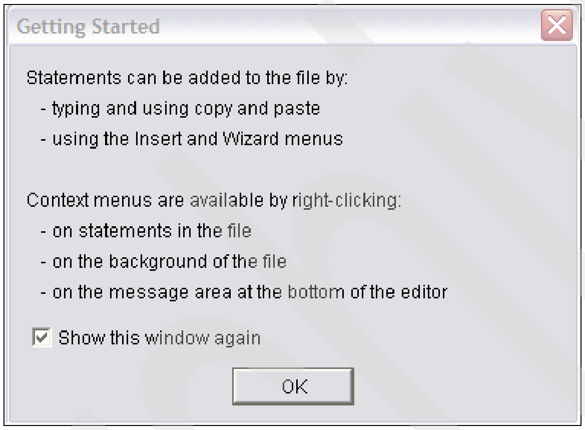
○ Open the provided sample I3P file

○ Open the provided sample XML file

☑ Show this window again

Figure 2-5 Welcome - Packet Rules Configuration window

3. From the Welcome Packet Rules Configuration dialog, select **Create a new packet rules file**, and click **OK** to receive the Getting Started dialog (Figure 2-6). Click **OK**.



Getting Started

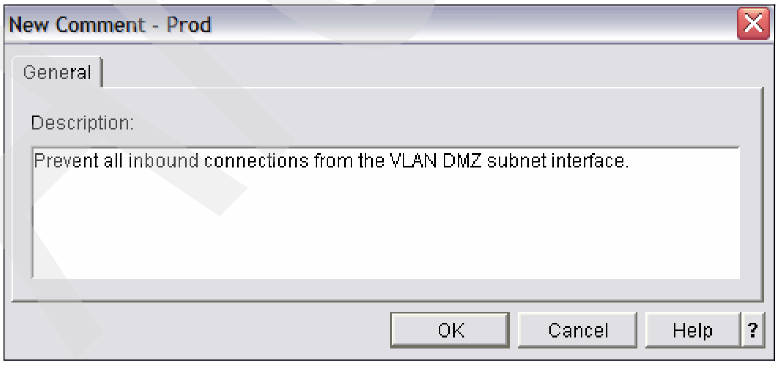
Statements can be added to the file by:
- typing and using copy and paste
- using the Insert and Wizard menus

Context menus are available by right-clicking:
- on statements in the file
- on the background of the file
- on the message area at the bottom of the editor

☑ Show this window again

Figure 2-6 Packet filter - Getting Started

4. From the Insert menu, select **Comment**. Enter a description and click **OK** (Figure 2-7).



New Comment - Prod

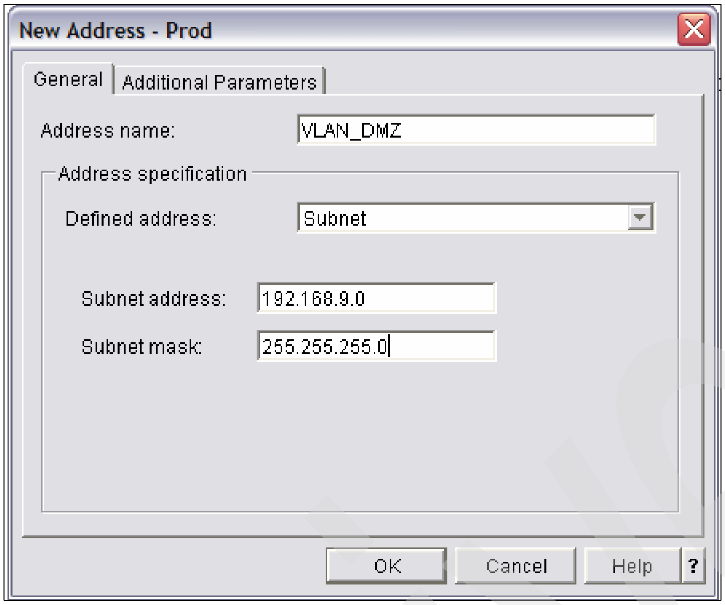
General

Description:

Prevent all inbound connections from the VLAN DMZ subnet interface.

Figure 2-7 Packet filter - adding a comment

From the Insert menu, select **Address**. Enter an address name, defined address of **Subnet**, the subnet address, the subnet mask, and click **OK** (Figure 2-8). This helps describe the DMZ subnet addresses.



New Address - Prod

Address name: VLAN_DMZ

Address specification

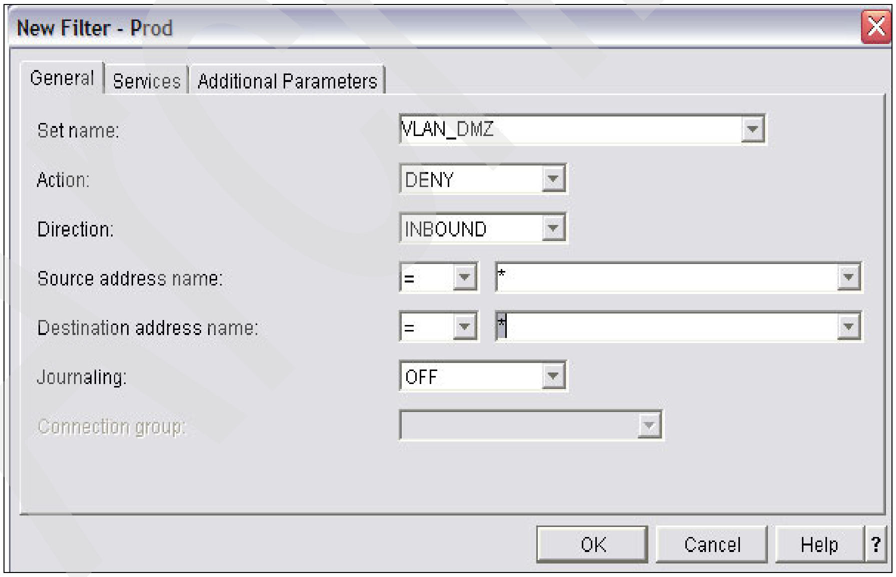
Defined address: Subnet

Subnet address: 192.168.9.0

Subnet mask: 255.255.255.0

Figure 2-8 Packet filter - adding an address

5. From the Insert menu, select **Filter**. Select set name of **VLAN_DMZ**, action of **DENY**, direction of **INBOUND**, source address name of *****, destination address name of *****, and click the **Services** tab (Figure 2-9). Use these entries to prevent any IPv4 address from starting an inbound connection to the production LPAR from the DMZ subnet.



New Filter - Prod

Set name: VLAN_DMZ

Action: DENY

Direction: INBOUND

Source address name: = *

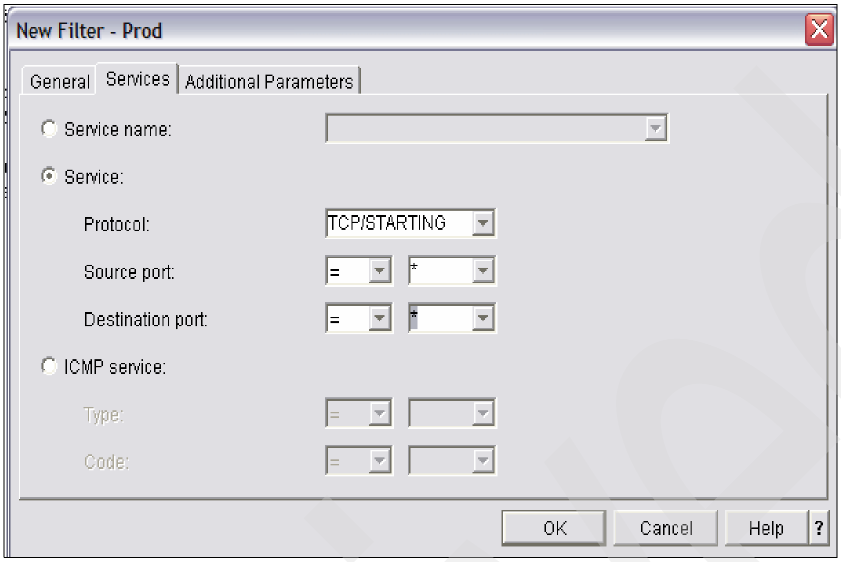
Destination address name: = *

Journaling: OFF

Connection group:

Figure 2-9 Packet filter - denying inbound from VLAN DMZ (1 of 2)

6. Select the **Service** radio button. Select protocol of **TCP/STARTING**, source port of **=** *****, destination port of **=** *****, and click **OK** (Figure 2-10). The asterisk denotes all available port numbers.


New Filter - Prod

○ Service name:

● Service:

Protocol: TCP/STARTING

Source port: = *

Destination port: = *

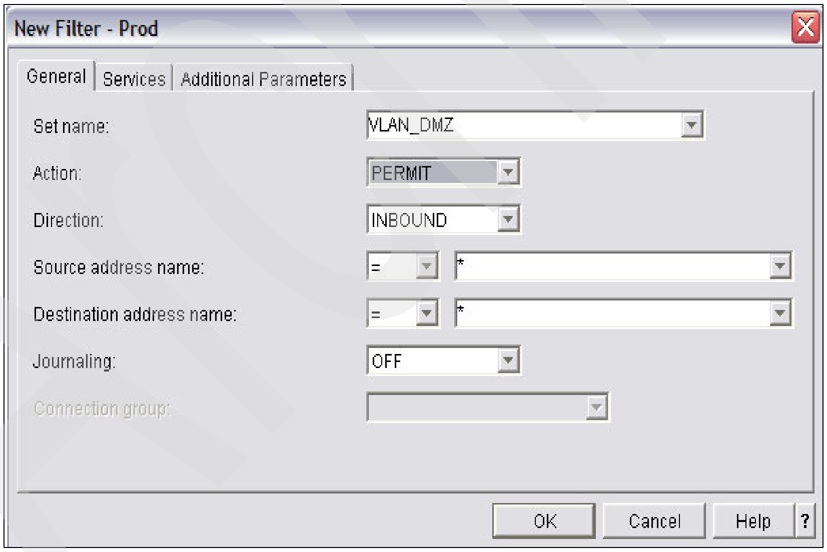
○ ICMP service:

Type: =

Code: =

Figure 2-10 Packet filter - denying inbound from VLAN DMZ (2 of 2)

7. From the Insert menu, select **Filter**. Select set name of **VLAN_DMZ**, action of **PERMIT**, direction of **INBOUND**, source address name of **=** *****, destination address name of **=** *****, and click the **Services** tab (Figure 2-11). Use these entries to allow any IPv4 address originating from the production LPAR to the DMZ subnet.


New Filter - Prod

Set name: VLAN_DMZ

Action: PERMIT

Direction: INBOUND

Source address name: = *

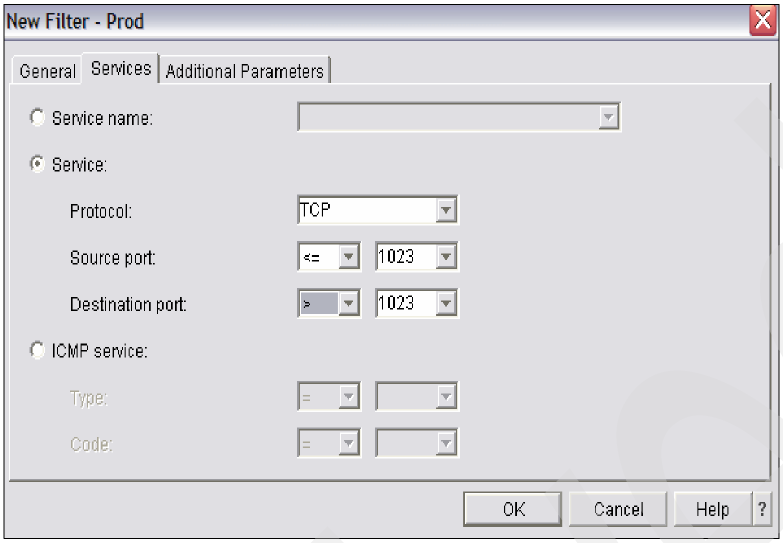
Destination address name: = *

Journaling: OFF

Connection group:

Figure 2-11 Packet filter - adding new inbound filter (1 of 2)

8. Select the **Service** radio button. Select protocol of **TCP**, source port of **<= 1023**, destination port of **> 1023**, and click **OK** (Figure 2-12).



○ Service name:

● Service:

Protocol: TCP

Source port: <= 1023

Destination port: > 1023

○ ICMP service:

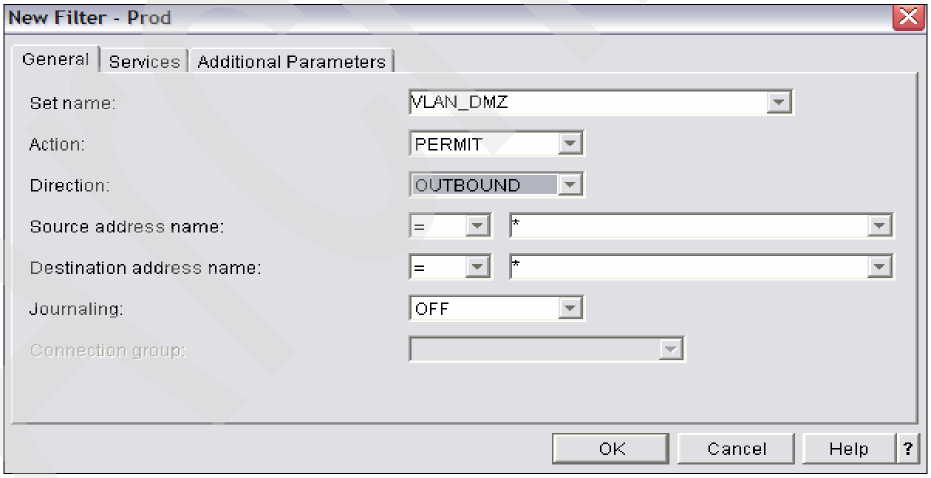
Type: =

Code: =

Figure 2-12 Packet filter - Adding new inbound filter (2 of 2)

9. From the Insert menu, select **Filter Interface**. Select the line name of **VETH0**. Click **Filter Sets** tab. Use this entry to assign IPv4 IP filtering to the virtual Ethernet interface that connects to the DMZ subnet.

10. From the Insert menu, select **Filter**. Select set name of **VLAN_DMZ**, action of **PERMIT**, direction of **OUTBOUND**, source address name of **= ***, destination address name of **= ***, and click the **Services** tab (Figure 2-13). Use this entry to allow any IPv4 address originating from the production LPAR to the DMZ subnet.



Set name: VLAN_DMZ

Action: PERMIT

Direction: OUTBOUND

Source address name: = *

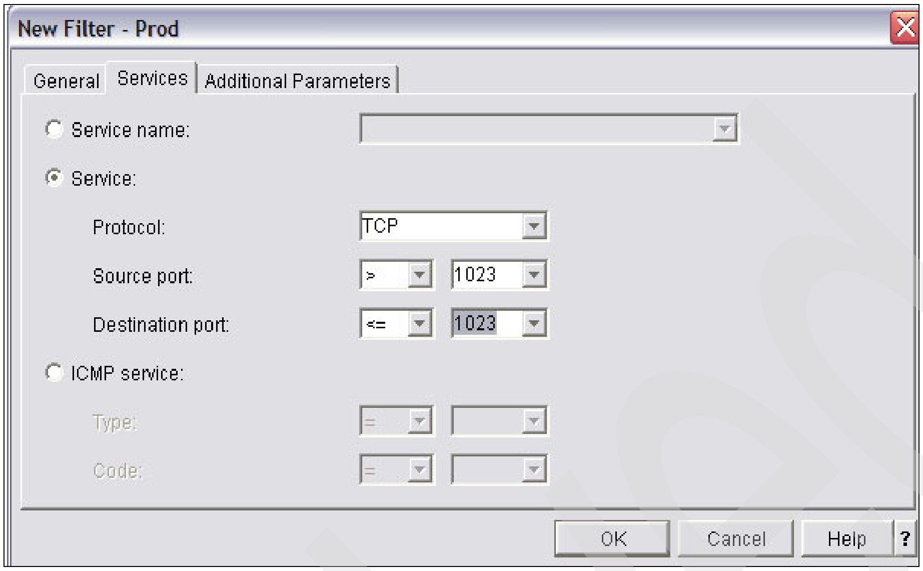
Destination address name: = *

Journaling: OFF

Connection group:

Figure 2-13 Packet filter - Adding new outbound filter (1 of 2)

11. Select the **Service** radio button. Select protocol of **TCP**, source port of **> 1023**, destination port of **<= 1023**, and click **OK** (Figure 2-14).



New Filter - Prod

○ Service name:

● Service:

Protocol: TCP

Source port: > 1023

Destination port: <= 1023

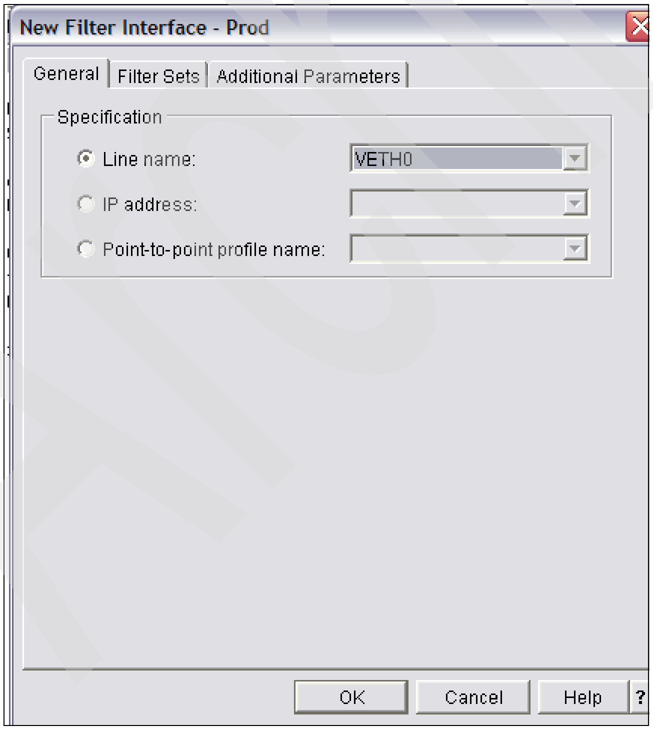
○ ICMP service:

Type: =

Code: =

Figure 2-14 Packet filter - Adding new outbound filter (2 of 2)

12. From the Insert menu, select **Filter Interface**. Select the line name of **VETH0** and click the **Filter Sets** tab (Figure 2-15). Use this entry to assign IPv4 IP filtering to the virtual Ethernet interface that connects to the DMZ subnet.



New Filter Interface - Prod

Specification

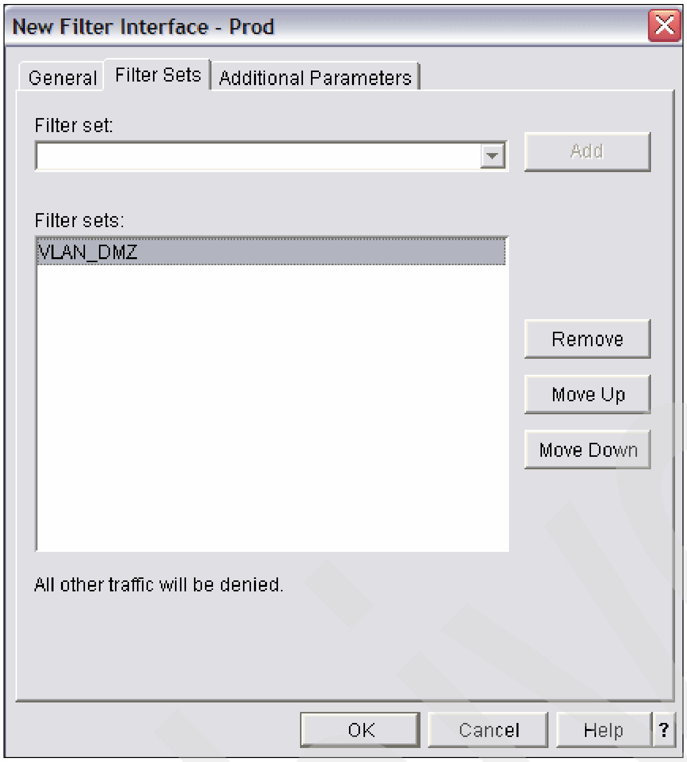
● Line name: VETH0

○ IP address:

○ Point-to-point profile name:

Figure 2-15 Packet filter - adding new filter interface (1 of 2)

13.Select the filter set of **VLAN_DMZ** and press **Add**. Click **OK** (Figure 2-16).

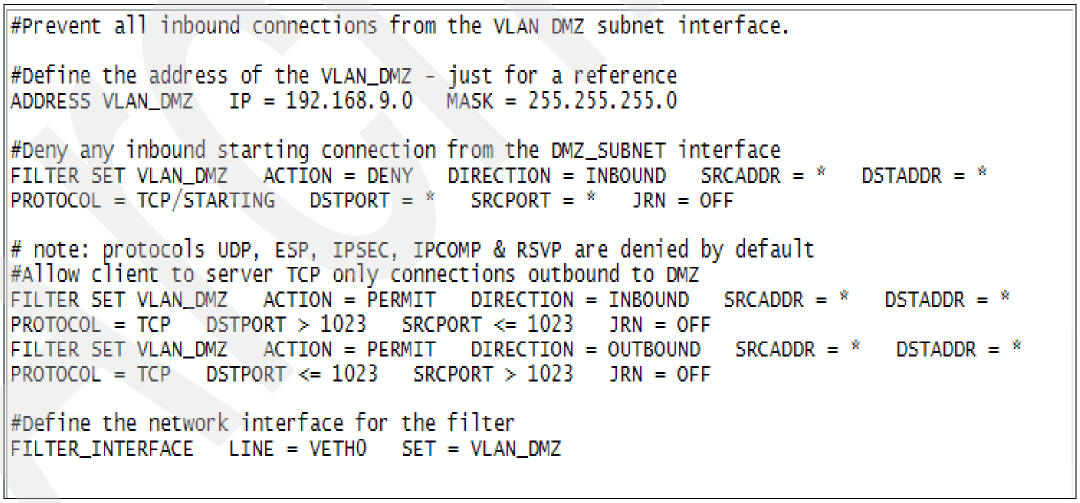


Filter sets:
VLAN_DMZ

All other traffic will be denied.

Figure 2-16 Packet filter - adding new filter interface (2 of 2)

14.Our complete rule set appears as shown in Figure 2-17.



```
#Prevent all inbound connections from the VLAN DMZ subnet interface.

#Define the address of the VLAN_DMZ - just for a reference
ADDRESS VLAN_DMZ   IP = 192.168.9.0   MASK = 255.255.255.0

#Deny any inbound starting connection from the DMZ_SUBNET interface
FILTER SET VLAN_DMZ   ACTION = DENY   DIRECTION = INBOUND   SRCADDR = *   DSTADDR = *
PROTOCOL = TCP/STARTING   DSTPORT = *   SRCPORT = *   JRN = OFF

# note: protocols UDP, ESP, IPSEC, IPCOMP & RSVP are denied by default
#Allow client to server TCP only connections outbound to DMZ
FILTER SET VLAN_DMZ   ACTION = PERMIT   DIRECTION = INBOUND   SRCADDR = *   DSTADDR = *
PROTOCOL = TCP   DSTPORT > 1023   SRCPORT <= 1023   JRN = OFF
FILTER SET VLAN_DMZ   ACTION = PERMIT   DIRECTION = OUTBOUND   SRCADDR = *   DSTADDR = *
PROTOCOL = TCP   DSTPORT <= 1023   SRCPORT > 1023   JRN = OFF

#Define the network interface for the filter
FILTER_INTERFACE   LINE = VETH0   SET = VLAN_DMZ
```

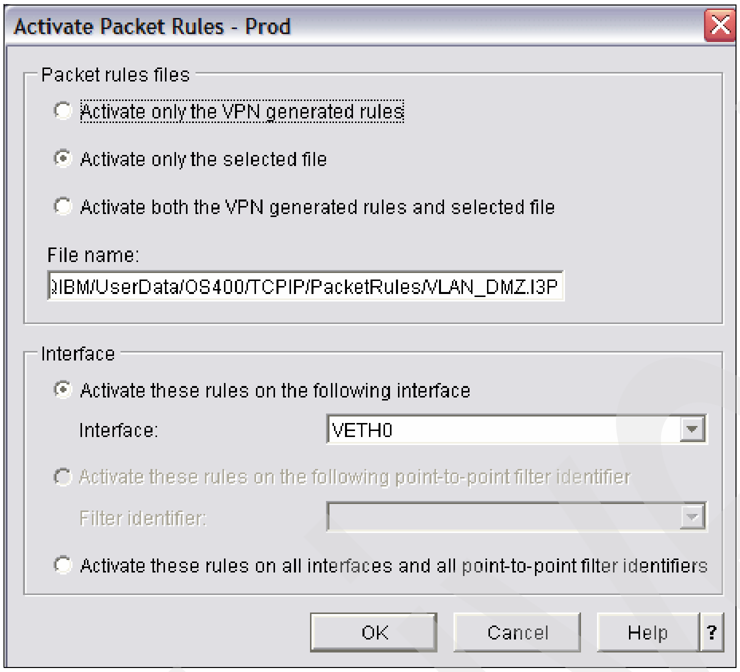
Figure 2-17 Packet filter - review rule set

Notes:

- When you enter the Filter Interface, all other traffic is explicitly denied.
- Ensure our rules are applied to the VETH0 line description.
- Other IP v4 protocols are denied, such as UDP, ESP, AH, IPSEC IPCOMP, and RSVP.

15. From the **File** menu, select **Save**. Assign the name **VLAN_DMZ.I3P** to the rules file.

16. From the File menu, select **Activate Rules** (Figure 2-18).



Activate Packet Rules - Prod

Packet rules files

○ Activate only the VPN generated rules

● Activate only the selected file

○ Activate both the VPN generated rules and selected file

File name: QIBM/UserData/OS400/TCPIP/PacketRules/VLAN_DMZ.I3P

Interface

● Activate these rules on the following interface

Interface: VETH0

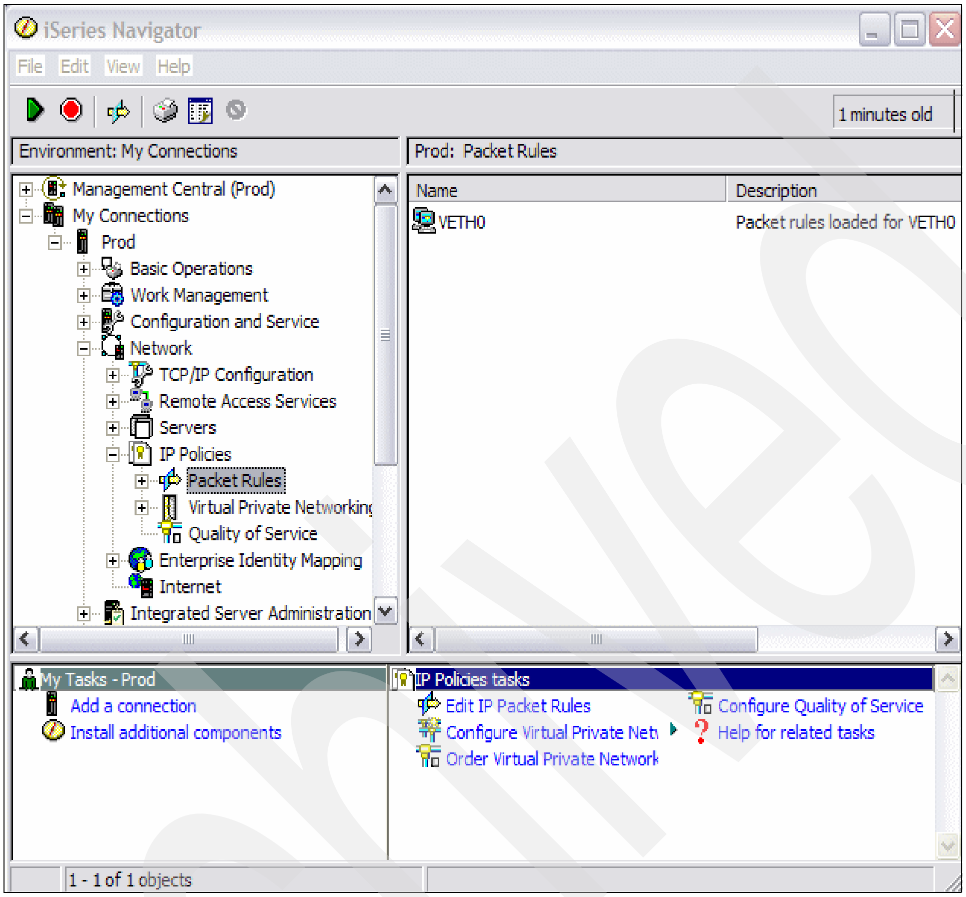
○ Activate these rules on the following point-to-point filter identifier

Filter identifier:

○ Activate these rules on all interfaces and all point-to-point filter identifiers

Figure 2-18 Activate packet filtering

17. To ensure that IP filters are active, open the **iSeries Navigator** → **Network** → **IP Policies** and select **Packet Rules**. The right-hand pane displays the status of the active packet rules loaded by the network interface name (Figure 2-19).



Name	Description
VETH0	Packet rules loaded for VETH0

Figure 2-19 Packet filtering status

Note: IP filtering is not supported for IPv6 with i5/OS V5R4. If you do not use IPv6, disable it. To confirm that it is disabled, run the following command: `ping '::1'`. If the ping command receives replies, then disable IPv6. To disable it, run `wrktcpsts, option 4`, work with the IPv6 interface status, and enter `10=End` by all Internet addresses.

Configuring IPv6 to not auto start during IPL

By default, the i5/OS V5R4 IPL auto starts IP v4 and v6. The STRTCP command parameter default strip6 is *yes (start IPv6). To change this command parameter default, run:

```
CHGCMDDFT CMD(STRTCP) NEWDFT('STRIP6(*NO)')
```

2.3.2 Configuring the DMZ logical partition network

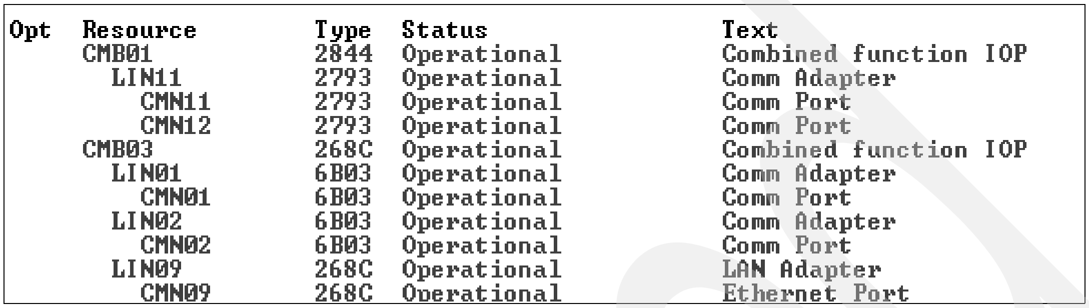
This section provides steps required for the DMZ logical partition's Ethernet configuration. Configure this only after IP filtering is enabled and IPv6 is disabled on the production partition. These configuration steps allow the production partition to access TCP services running on the DMZ logical partition.

Creating the virtual Ethernet line

1. To create the Ethernet line description, find the resource name:

   ```
   WRKHDWRSC *CMN
   ```

2. Search for the communication resource type of 268C. Note the Ethernet port resource name. In Figure 2-20, the Ethernet port we are configuring is CMN09.



```
Opt  Resource          Type  Status                  Text
     CMB01             2844  Operational             Combined function IOP
       LIN11           2793  Operational             Comm Adapter
         CMN11         2793  Operational             Comm Port
         CMN12         2793  Operational             Comm Port
     CMB03             268C  Operational             Combined function IOP
       LIN01           6B03  Operational             Comm Adapter
         CMN01         6B03  Operational             Comm Port
       LIN02           6B03  Operational             Comm Adapter
         CMN02         6B03  Operational             Comm Port
       LIN09           268C  Operational             LAN Adapter
         CMN09         268C  Operational             Ethernet Port
```

*Figure 2-20 wrkhdwrsc *cmn on DMZ LPAR*

3. Create the virtual Ethernet line description on our virtual Ethernet network:

   ```
   CRTLINETH LIND(VETHO) RSRCNAME(CMN09) LINESPEED(*AUTO) DUPLEX(*AUTO)
   ```

Creating the IP interface

Nowcreate the TCP interface for the production interface of the virtual Ethernet:

```
ADDTCPIFC INTNETADR('192.168.9.2') LIND(VETHO) SUBNETMASK('255.255.255.0')
```

> **Note:** IP filtering is not supported for IPv6. If you do not use IPv6, disable it. To confirm that it is disabled, run the following command: `ping '::1'`. If the ping command receives replies, then disable IPv6. To disable it, run `wrktcpsts`, `option 4`, work with the IPv6 interface status, and enter `10=End` by all Internet Addresses.

2.4 Verifying the DMZ implementation

Verify the following implementation:

- DMZ LPAR partition to production LPAR partition attempt to connect using TCP - failure.
- DMZ LPAR partition to production LPAR partition attempt to connect using UDP - failure.
- Production LPAR partition to DMZ LPAR partition attempt to connect using TCP - success.
- Production LPAR partition to DMZ LPAR partition attempt to connect using UDP - failure.
- DMZ LPAR partition to production LPAR partition attempt to ping using IPv6 - failure.
- IPv6 is disabled at the DMZ LPAR partition.
- IPv6 is disabled at production LPAR partition.

2.5 Tips and techniques

Keep in mind that for security reasons, more trusted to less trusted is preferred. Try to avoid less trusted to more trusted. It is important to verify that your security policy is continually supported. Keep in mind that many network hosts might have IPv6 enabled by default. Therefore, ensure that you have security in place at each network host for IPv6.

In addition to the use of IP filtering, implementing the Intrusion Detection System (IDS) for i5/OS might provide additional network security auditing.

If your IP filtering rules disable access to the iSeries Navigator or other important network access, enter the command RMVTCPTBL (remove TCP/IP Table). Use *caution* because this now opens up the DMZ virtual LAN to your inbound secure network.

To assist in troubleshooting IPv4 filtering rules, use the *journaling* functionality that is available. The QIPFILTER journal logs entries when an IPv4 datagram matches a definition of a defined filter rule.

3

VPN connection with UDP encapsulation

Virtual Private Networking (VPN) uses several important TCP/IP protocols to provide major security features, such as authentication and data privacy. A few examples of these protocols are Internet Protocol (IP) Security (IPSec), Network Address Translation (NAT), and IP filtering.

Security enhancements are achieved by combining different protocols, but this can create conflicts. For example, conventional NAT implementation does not allow the traffic of VPN IPSec packets. In this case, you can still use a VPN connection with NAT if you implement User Datagram Protocol (UDP) encapsulation.

This chapter describes how to implement a VPN connection that supports NAT with UDP encapsulation.

3.1 Scenario description

In this scenario, a company wants to establish a VPN connection between its manufacturing plant located in Buffalo, New York (Gateway A) and its corporate office in Dallas, Texas (Host D). Both networks are behind a firewall and use NAT to hide their unregistered private IP addresses behind a registered IP address.

Figure 3-1shows the network characteristics for this scenario.

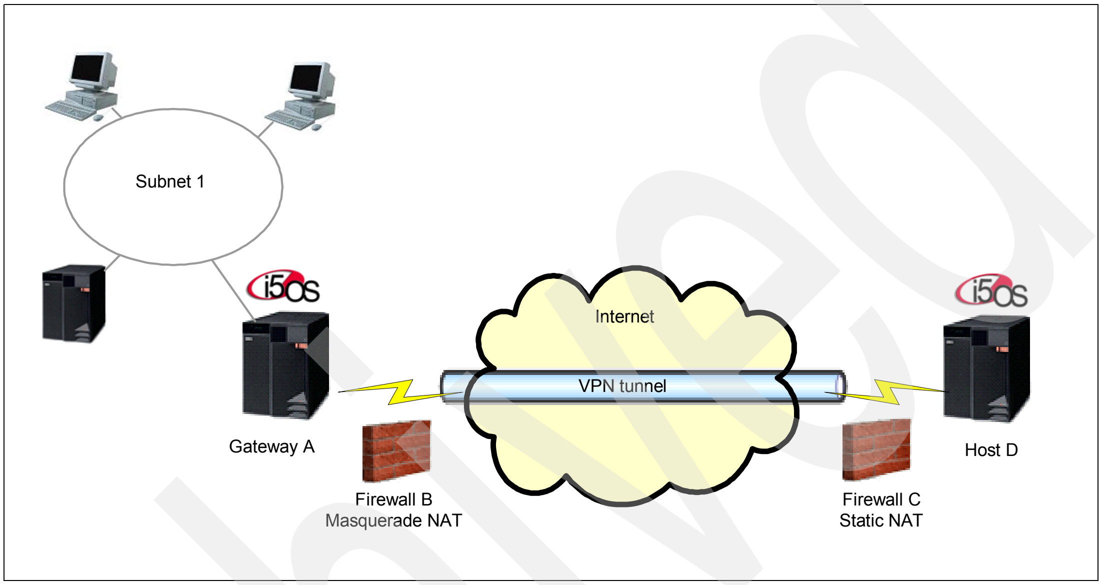


Figure 3-1 UDP encapsulation-based VPN: Both VPN hosts behind NAT firewalls

3.1.1 Scenario objectives

The objectives of this scenario are:

- The VPN tunnel must protect all data traffic between Gateway A and Host D.
- Connection is always initiated by Gateway A.
- When the VPN connection is established, authorized users in Gateway A subnet are allowed to access applications residing in Host D.

3.1.2 Scenario characteristics

This section describes the setting on both ends.

Buffalo network (VPN client):

- Gateway A runs on i5/OS V5R4.
- The internal network IP address is 192.168.100.0/24.
- Each system connected to Gateway A is the source and destination for data that flows across the VPN connection; therefore, they are the data end points of the VPN tunnel.
- Only Gateway A can initiate the connection with Host D; that is, Gateway A plays the role of VPN initiator.
- The private IP address for Gateway A is 10.2.1.1.

- Firewall B has a Masquerade NAT rule that hides the private IP addresses of Gateway A by using a pubic address; therefore, from the server network perspective, the IP address of Gateway A is the public address of Firewall B.
- The external IP address of Firewall B is 10.3.1.2 (this is not a real public address, we are using it for example purposes).

Dallas network (VPN server):

- Host D runs on i5/OS V5R4.
- Host D is the VPN responder in this scenario.
- The private IP address for Host D is 10.1.1.1.
- Firewall C has a static NAT rule that maps its public IP address to the private IP address of Host D; therefore, from the client network perspective, the IP address of Host D is the public address of Firewall C.
- The external IP address of Firewall C is 10.3.1.1 (this is not a real public address, we are using it for example purposes).

Figure 3-2 shows the network configuration used in this scenario.

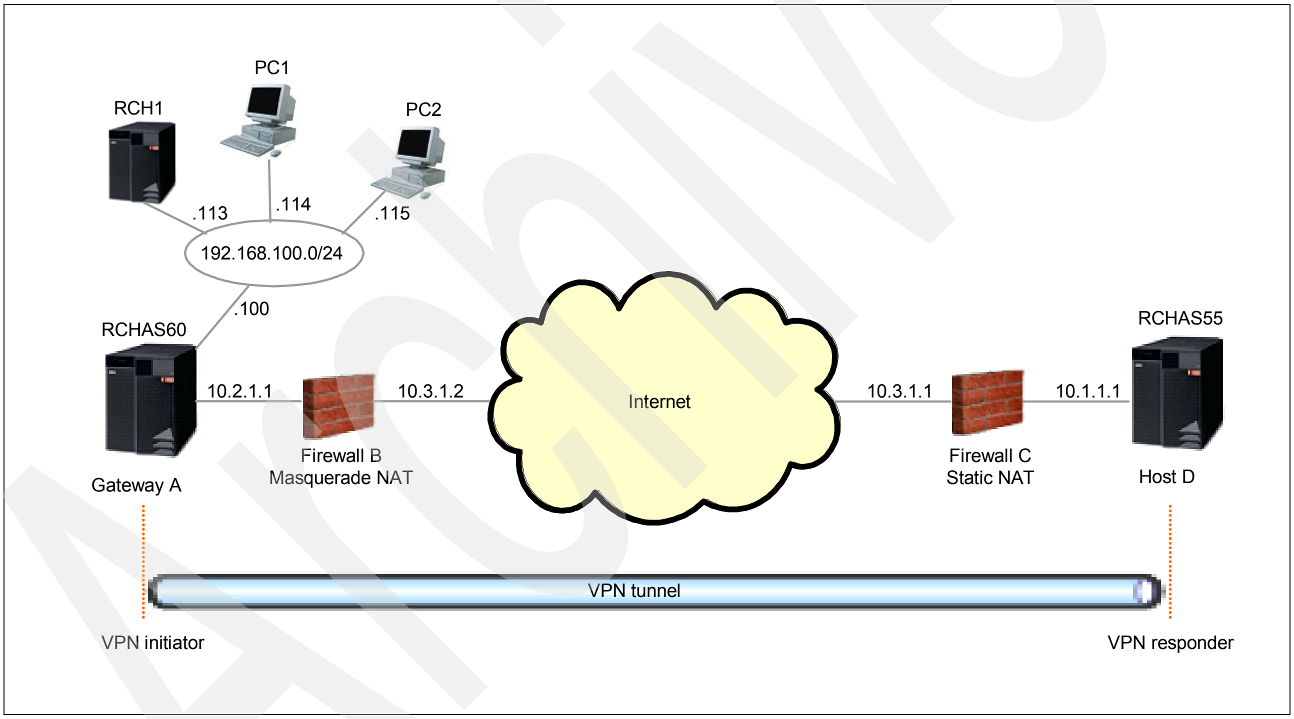


Figure 3-2 Network configuration for UDP encapsulation-based VPN scenario

3.1.3 Software prerequisites

This section describes the software prerequisites for this scenario.

In both i5/OS systems:

- i5/OS V5R4 (5722-SS1)
- Digital Certificate Manager V5R4 (5722-SS1 option 34)
- TCP/IP Connectivity Utilities for i5/OS V5R4 (5722-TC1)
- HTTP Server for i5/OS V5R4 (5722-DG1)
- iSeries Access for Windows V5R4 (5722-XE1)

- iSeries Navigator

3.2 Planning for implementation

Table 3-1, Table 3-2, and Table 3-3 on page 35 provide planning checklists that you need before you begin configuring VPN.

Table 3-1 System requirements (both i5/OS systems)

Prerequisite checklist	All answers need to be YES
Is your operating system i5/OS V5R4 (5722-SS1)?	Yes
Is the Digital Certificate Manager option (5722-SS1 Option 34) installed?	Yes
Is iSeries Access for Windows (5722-XE1) installed?	Yes
Is iSeries Navigator installed?	Yes
Is the Network subcomponent of iSeries Navigator installed?	Yes
Is TCP/IP Connectivity Utilities for i5/OS (5722-TC1) installed?	Yes
Have you applied the latest program temporary fixes (PTFs)?	Yes
Did you set the retain server security data (QRETSVRSEC *SEC) system value to 1?	Yes
Is TCP/IP configured on your i5/OS system (including IP interfaces, routes, local host name, and local domain name)?	Yes
Is normal TCP/IP communications established between the required endpoints?	Yes
If the VPN tunnel traverses firewalls or routers that implement IP packet filtering, do the firewall or router filter rules support AH and ESP protocols?	Yes
Are the firewalls or routers configured to permit traffic over port 4500 for key negotiations? Typically, VPN partners perform IKE negotiations over UDP port 500. When Internet Key Exchange (IKE) detects NAT, packets are sent over port 4500.	Yes
Are the firewalls configured to enable IP forwarding?	Yes
Do you have the proper authorities to administer packet rules on your i5/OS system?	Yes
If you plan to use certificates to authenticate the key servers, do you have certificates configured on your system?	Yes

Table 3-2 VPN configuration on the Gateway A system

VPN configuration checklist	Answers
What type of connection would you like to create?	gateway-to-host
What name will you assign to the dynamic-key group (individual VPN data connection between pair of endpoints)?	VPNUDPencap
What IKE policy do you want to use to protect your keys?	balanced security and performance

Are you using certificates to authenticate the connection? If no, what is the preshared key?	No certificates; preshared key is UDPSECRETKEY
What is the identifier (IP type and IP address) of the local key server?	IP version 4 10.2.1.1
What is the identifier (IP type and IP address) of the local connection endpoint?	IP version 4 10.2.1.1
What is the identifier (IP type and IP address) of the local data endpoint?	IP version 4 subnet 192.168.100.0/24
What is the identifier (IP type and IP address) of the remote key server?	IP version 4 10.3.1.1
What is the identifier (IP type and IP address) of the remote connection endpoint?	IP version 4 10.3.1.1
What is the identifier (IP type and IP address) of the remote data endpoint?	IP version 4 10.1.1.1
What are the ports and protocols of the data that this connection will protect?	Any
What data policy do you want to use to protect the data?	Balanced security and performance
To which interfaces on the local system does this connection apply?	ETHLIN2

Table 3-3 VPN configuration on the Host D system

VPN configuration checklist	**Answers**
What type of connection would you like to create?	host-to-gateway
What name will you assign to the dynamic-key group (individual VPN data connection between pair of endpoints)?	VPNUDPencap
What IKE policy do you want to use to protect your keys?	Balanced security and performance
Are you using certificates to authenticate the connection? If no, what is the preshared key?	No certificates; preshared key is UDPSECRETKEY
What is the identifier (IP type and IP address) of the local key server?	IP version 4 10.1.1.1
What is the identifier (IP type and IP address) of the local connection endpoint?	IP version 4 10.1.1.1
What is the identifier (IP type and IP address) of the local data endpoint?	IP version 4 10.1.1.1
What is the identifier (IP type and IP address) of the remote key server? **Note:** In this scenario, if the identifier of the remote key server (Firewall B) is unknown, you can use *ANYIP as the identifier for the remote key server.	IP version 4 10.3.1.2
What is the identifier (IP type and IP address) of the remote connection endpoint?	IP version 4 10.3.1.2
What is the identifier (IP type and IP address) of the remote data endpoint? **Note:** In this scenario, these values are the same as those specified for local data endpoint in the remote system	IP version 4 subnet 192.168.100.0/24

What are the ports and protocols of the data that this connection will protect?	Any
What data policy do you want to use to protect the data?	Balanced security and performance
To which interfaces on the local system does this connection apply?	ETHLIN1

3.2.1 Implementation task summary

This scenario describes the following tasks:

- “Configuring VPN on Gateway A (initiator)” on page 36
- “Configuring VPN on Host D (responder)” on page 46
- “Starting the VPN connection” on page 57

3.3 Step-by-step set up guide

The following sections describe detailed steps on how to configure and activate the VPN connection for this scenario.

3.3.1 Configuring VPN on Gateway A (initiator)

This section shows you how to use the iSeries Navigator functions to create and configure the VPN connection on the Gateway A system.

The VPN connection is created and configured by using the New Connections wizard of the iSeries Navigator.

To perform this task, use the information from your VPN planning checklist (Table 3-2 on page 34) and follow these steps:

1. Start an iSeries Navigator session: **Start** → **Programs** → **IBM iSeries Access for Windows** → **iSeries Navigator**.
2. In the iSeries Navigator window, select the i5/OS system that you will use as the VPN initiator by clicking its corresponding icon. In this example, we are using system RCHAS60.

   > **Note:** If a connection to that system has not been defined for iSeries Navigator, you can define it by right-clicking **My Connections**, and then clicking **Connection to Servers** → **Add connection.**

3. If the Sign-on to iSeries prompt appears, enter your user ID and password and then click **OK** to complete the sign-on.

4. On the navigation pane of iSeries Navigator, click the plus sign (**+**) boxes to expand the path **My Connections** → ***<Gateway A system>*** → **Network** → **IP Policies**. The expanded window is similar to Figure 3-3.

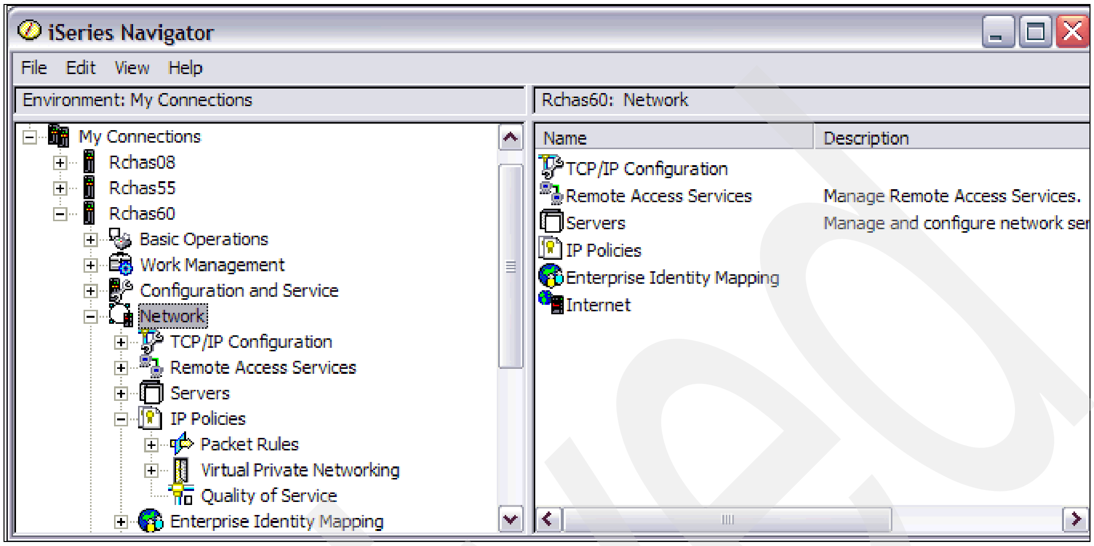


Figure 3-3 Expanded window of IP Policies tasks

5. In the expanded navigation pane, right-click **Virtual Private Networking**.
6. In the context menu for Virtual Private Networking, click **New Connection** (Figure 3-4).

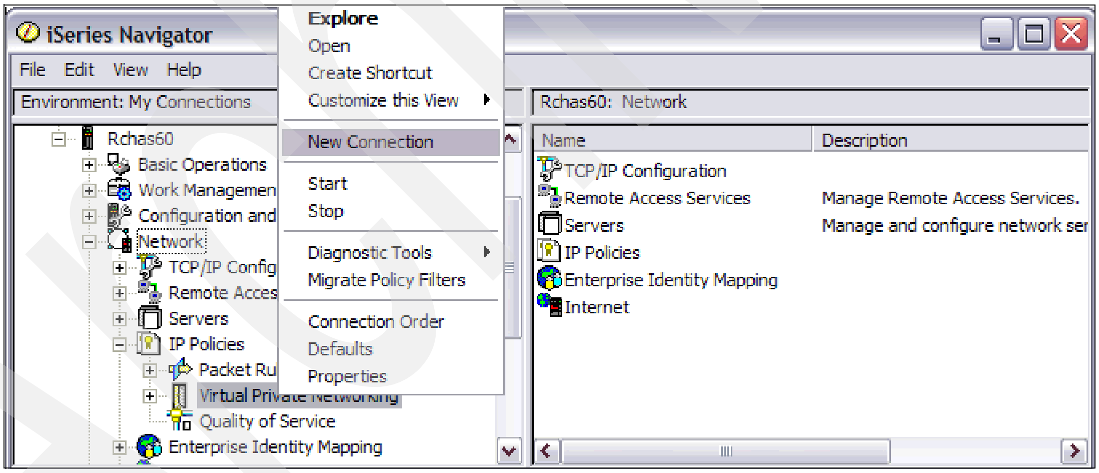
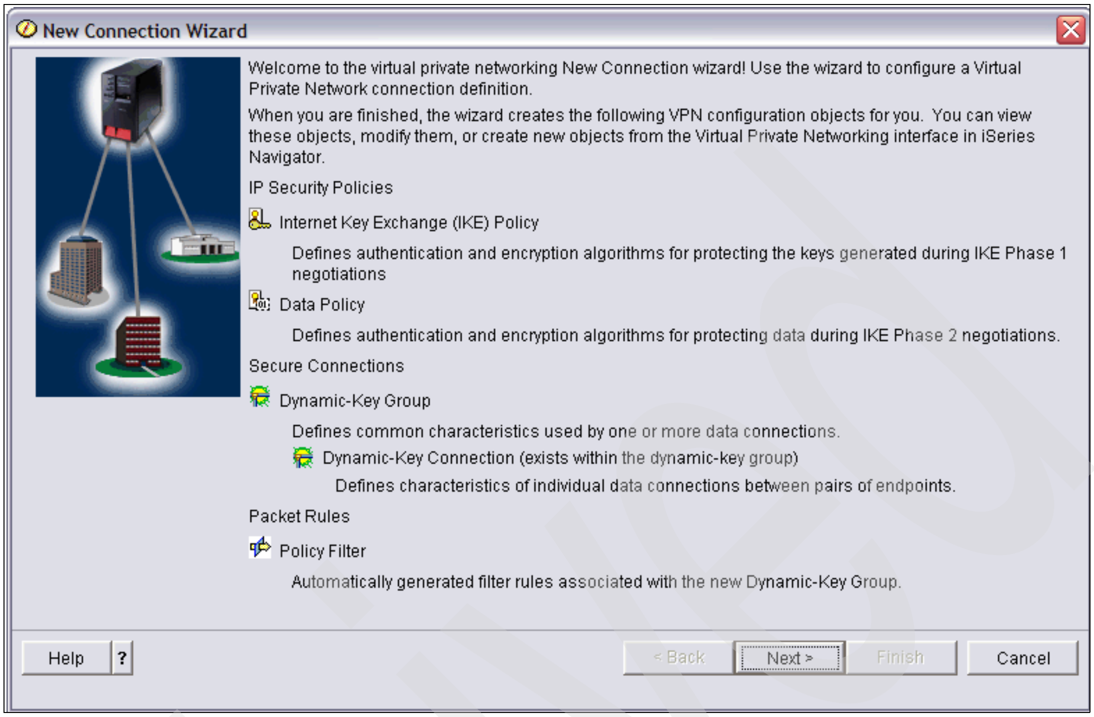


Figure 3-4 Context menu for Virtual Private Networking - New Connection

7. The welcome window of the New Connection Wizard displays as shown in Figure 3-5.


New Connection Wizard

Welcome to the virtual private networking New Connection wizard! Use the wizard to configure a Virtual Private Network connection definition.

When you are finished, the wizard creates the following VPN configuration objects for you. You can view these objects, modify them, or create new objects from the Virtual Private Networking interface in iSeries Navigator.

IP Security Policies

Internet Key Exchange (IKE) Policy

Defines authentication and encryption algorithms for protecting the keys generated during IKE Phase 1 negotiations

Data Policy

Defines authentication and encryption algorithms for protecting data during IKE Phase 2 negotiations.

Secure Connections

Dynamic-Key Group

Defines common characteristics used by one or more data connections.

Dynamic-Key Connection (exists within the dynamic-key group)

Defines characteristics of individual data connections between pairs of endpoints.

Packet Rules

Policy Filter

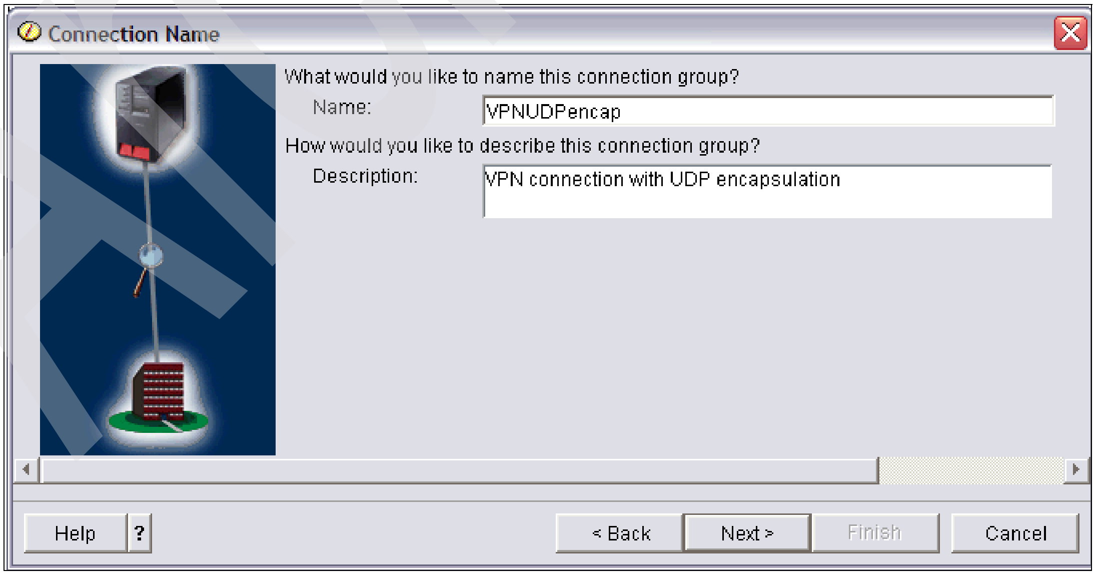
Automatically generated filter rules associated with the new Dynamic-Key Group.

Figure 3-5 New Connection Wizard - Welcome window

8. Review the Welcome window of the wizard for information about the objects that the wizard will create. Click **Next** to begin the wizard.

9. When the Connection Name window appears (Figure 3-6), take the following actions:

   a. In the Name field, enter `VPNUDPencap`.
   b. Optionally, specify a description for this connection group.
   c. Click **Next** to continue.


Connection Name

What would you like to name this connection group?

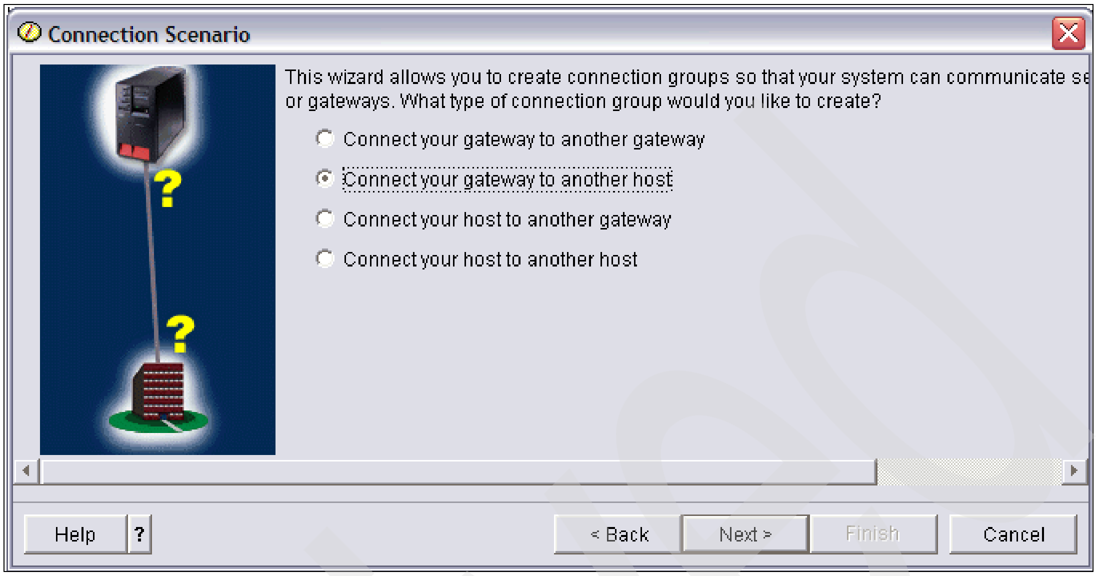
Name: VPNUDPencap

How would you like to describe this connection group?

Description: VPN connection with UDP encapsulation

Figure 3-6 New Connection Wizard - Connection Name window

10. When the Connection Scenario window appears (Figure 3-7), select **Connect your gateway to another host** and click **Next** to continue.



Connection Scenario

This wizard allows you to create connection groups so that your system can communicate se
or gateways. What type of connection group would you like to create?

○ Connect your gateway to another gateway

● Connect your gateway to another host

○ Connect your host to another gateway

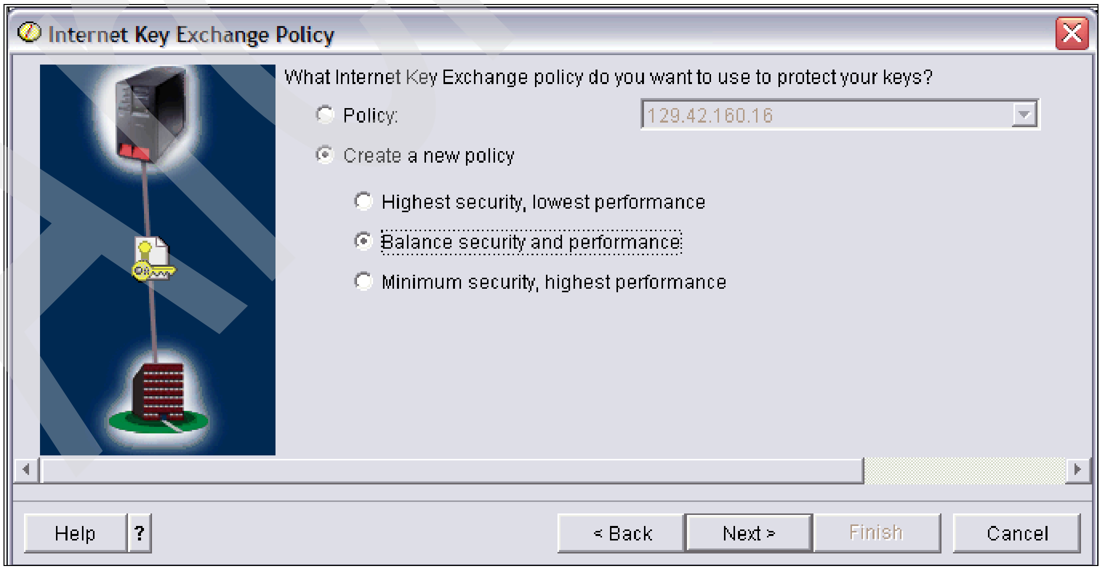
○ Connect your host to another host

Figure 3-7 New Connection Wizard - Connection Scenario window

11. In the Internet Key Exchange Policy window (Figure 3-8):

   a. Select **Create a new policy**.
   b. Select **Balance security and performance**.
   c. Click **Next** to continue.

> **Note:** If you get an error message stating “The certificate request could not be processed”, ignore it because you are not using certificates for the key exchange in the VPN.



Internet Key Exchange Policy

What Internet Key Exchange policy do you want to use to protect your keys?

○ Policy: 129.42.160.16

● Create a new policy

○ Highest security, lowest performance

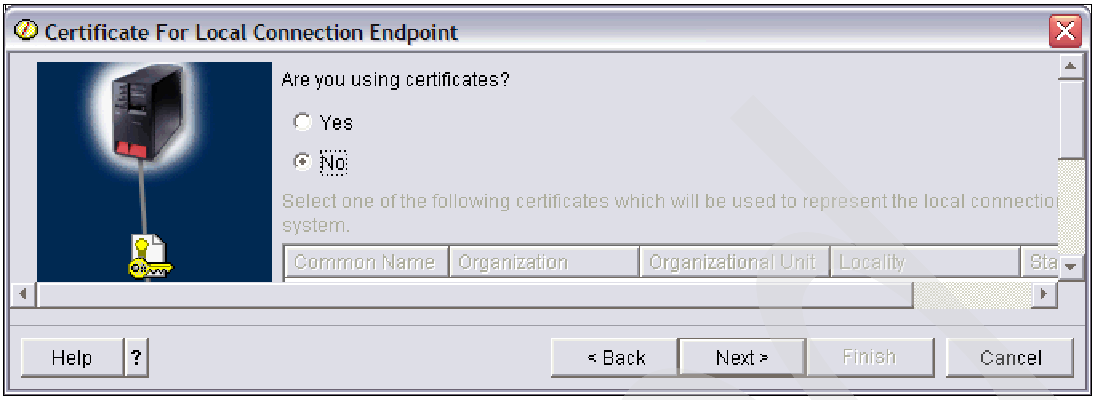
● Balance security and performance

○ Minimum security, highest performance

Figure 3-8 New Connection Wizard - Internet Key Exchange Policy window

12. Optional step: If you have certificates installed on your i5/OS system, you see the Certificate for Local Connection Endpoint window (Figure 3-9 on page 40). If this

windowdisplays, select **No** to indicate that you will not be using certificates to authenticate the VPN connection and click **Next**.



Certificate For Local Connection Endpoint

Are you using certificates?

○ Yes

● No

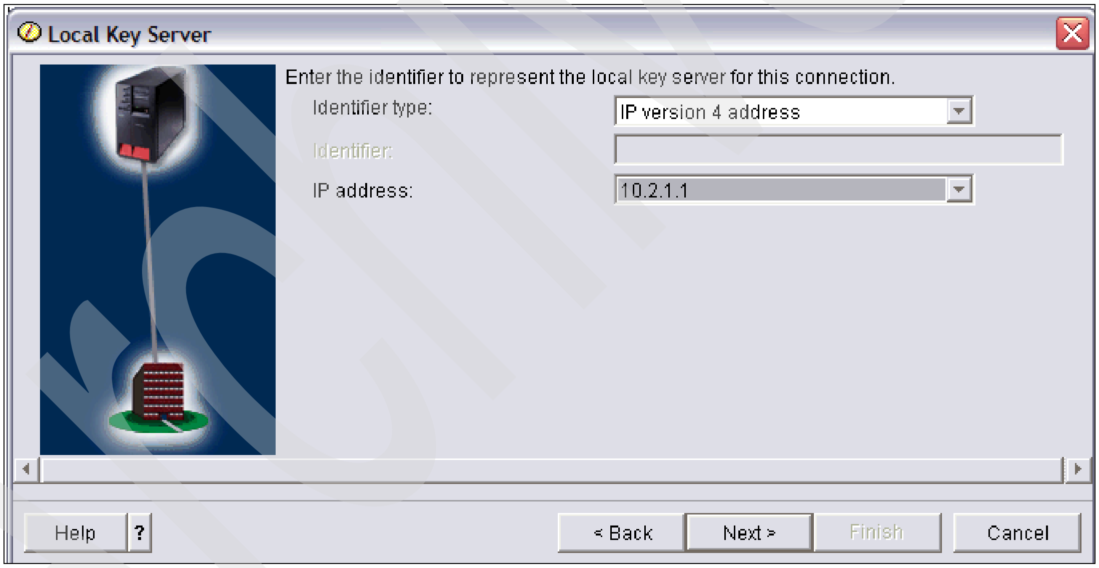
Select one of the following certificates which will be used to represent the local connectio system.

Common Name	Organization	Organizational Unit	Locality	Sta

Figure 3-9 New Connection Wizard - Certificate For Local Connection Endpoint window

13. When the Local Key Server window appears (Figure 3-10):

   a. In the Identifier type field, select **IP version 4 address**.
   b. In the IP address, select **10.2.1.1**.
   c. Click **Next**.



Local Key Server

Enter the identifier to represent the local key server for this connection.

Identifier type: IP version 4 address

Identifier:

IP address: 10.2.1.1

Figure 3-10 New Connection Wizard - Local Key Server window

14. In the Remote Key Server window (Figure 3-11):

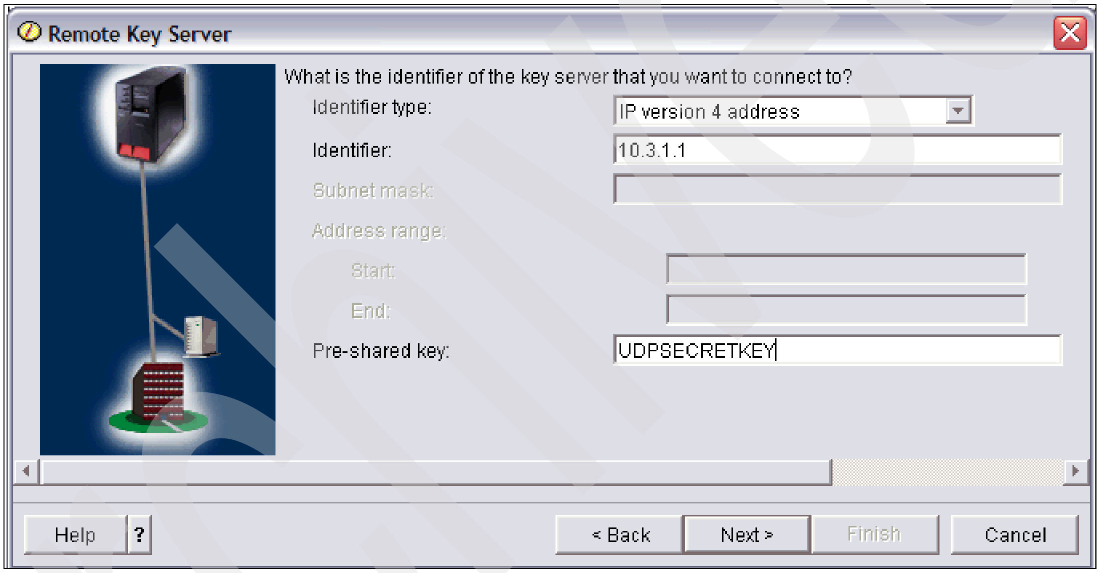
a. In the Identifier type field, select **IP version 4 address**.

b. In the Identifier field, enter `10.3.1.1`.

> **Note:** This value is the public IP address that the remote system uses to access the Internet (or other public network) for VPN connections. Here, we are using 10.3.1.1 t for example purposes, but in reality this value is not allowed as a public IP address.
>
> In this scenario, Gateway A initiates a VPN connection to a remote Static NAT network. Because of that, a single IP address needs to be specified here. However, this is only possible when the VPN defaults for key management are set to use IKE main mode negotiation. If the VPN defaults in your system are set to IKE aggressive mode, you *must* enter a non-IPv4 type of remote identifier for the remote key server.

c. In the pre-shared key field, enter `UDPSECRETKEY`.

d. Click **Next** to continue.



Remote Key Server

What is the identifier of the key server that you want to connect to?

Identifier type: IP version 4 address

Identifier: 10.3.1.1

Subnet mask:

Address range:

Start:

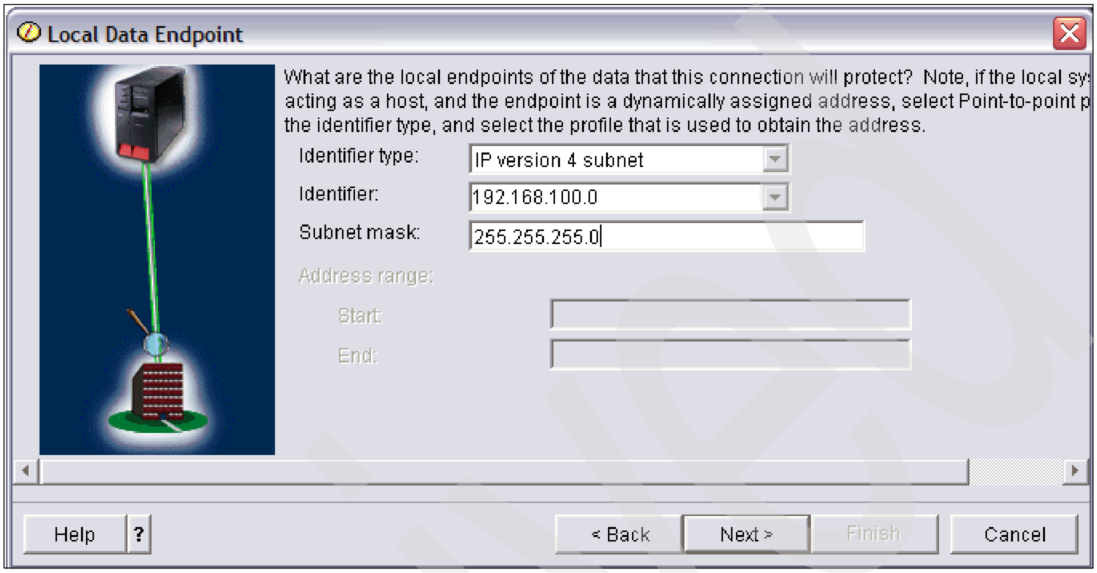
End:

Pre-shared key: UDPSECRETKEY

Figure 3-11 New Connection Wizard - Remote Key Server window

15. In the Local Data Endpoint window (Figure 3-12):

a. In the Identifier type field, select **IP version 4 subnet**.
b. In the Identifier field, enter `192.168.100.0`.
c. In the Subnet mask field, enter `255.255.255.0`.
d. Click **Next** to continue.



Local Data Endpoint

What are the local endpoints of the data that this connection will protect? Note, if the local sy acting as a host, and the endpoint is a dynamically assigned address, select Point-to-point p the identifier type, and select the profile that is used to obtain the address.

Identifier type: IP version 4 subnet

Identifier: 192.168.100.0

Subnet mask: 255.255.255.0

Address range:

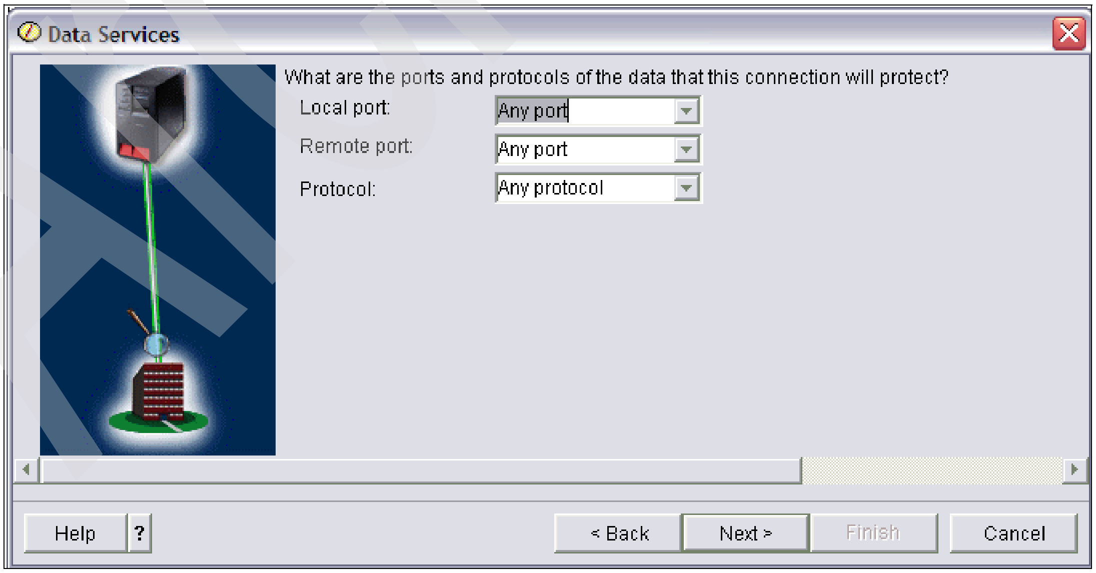
Start:

End:

Figure 3-12 New Connection Wizard - Local Data Endpoint window

16. The Data Services window displays (Figure 3-13). Accept the default values by clicking **Next**.

> **Note:** Accepting these defaults (any port, any protocol) allow you to protect all data traffic flowing across the VPN connection.



Data Services

What are the ports and protocols of the data that this connection will protect?

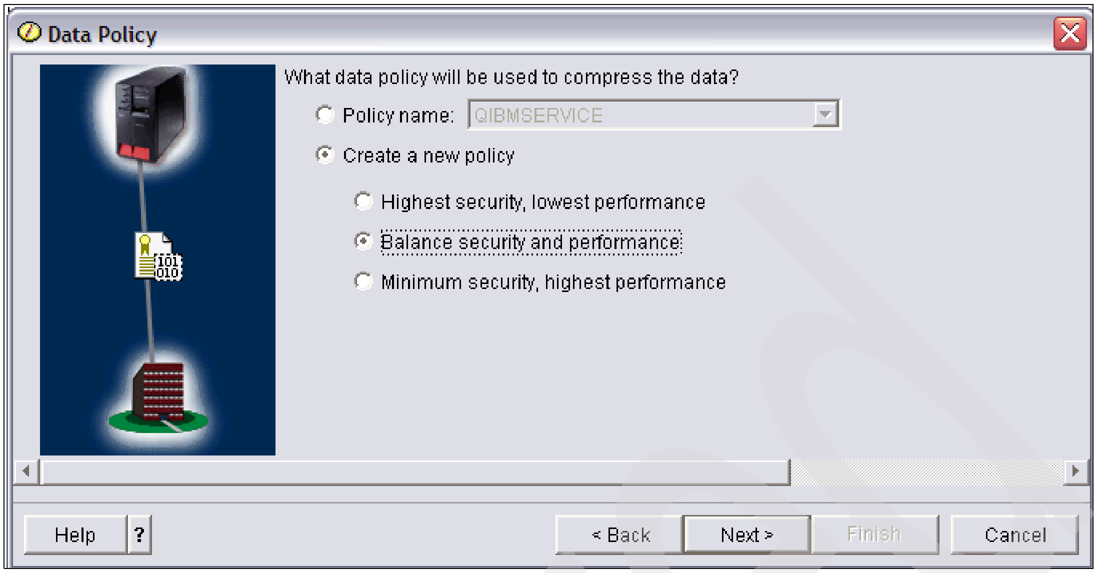
Local port: Any port

Remote port: Any port

Protocol: Any protocol

Figure 3-13 New Connection Wizard - Data Services window

17. The Data Policy window displays (Figure 3-14 on page 43). Select **Create a new policy,** select **Balance security and performance**, and click **Next**.



Data Policy

What data policy will be used to compress the data?

○ Policy name: QIBMSERVICE

● Create a new policy

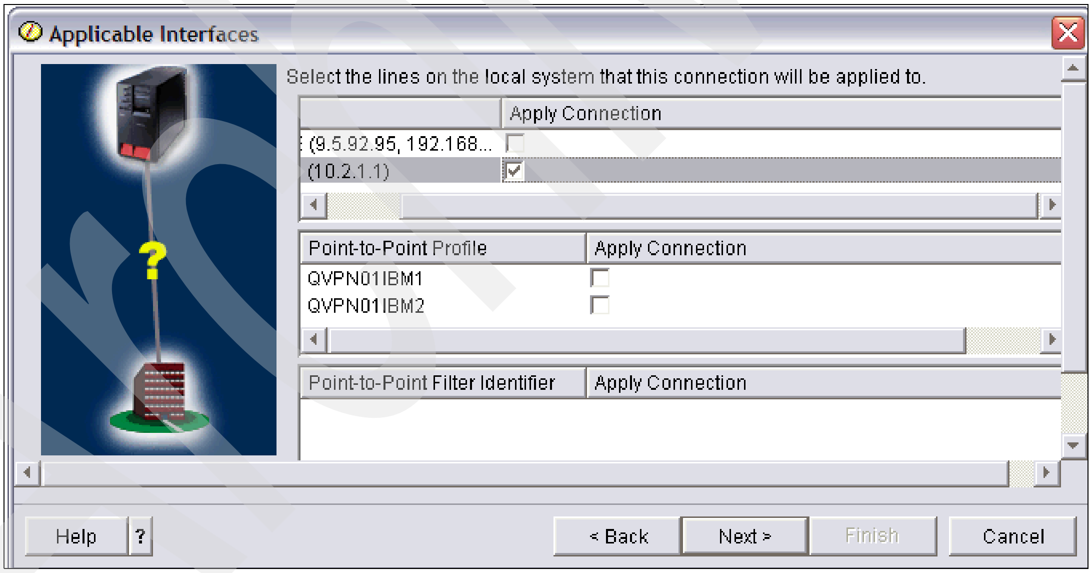
○ Highest security, lowest performance

● Balance security and performance

○ Minimum security, highest performance

Figure 3-14 New Connection Wizard - Data Policy window

18. The Applicable Interfaces window displays (Figure 3-15). From the list of lines and interfaces, select **ETHLIN2** by clicking its corresponding check mark box. In our example, the actual name of the line description, ETHLIN2, is hidden because the window is scrolled to the right. We know that line is selected by the interface address of 10.2.1.1.



Applicable Interfaces

Select the lines on the local system that this connection will be applied to.

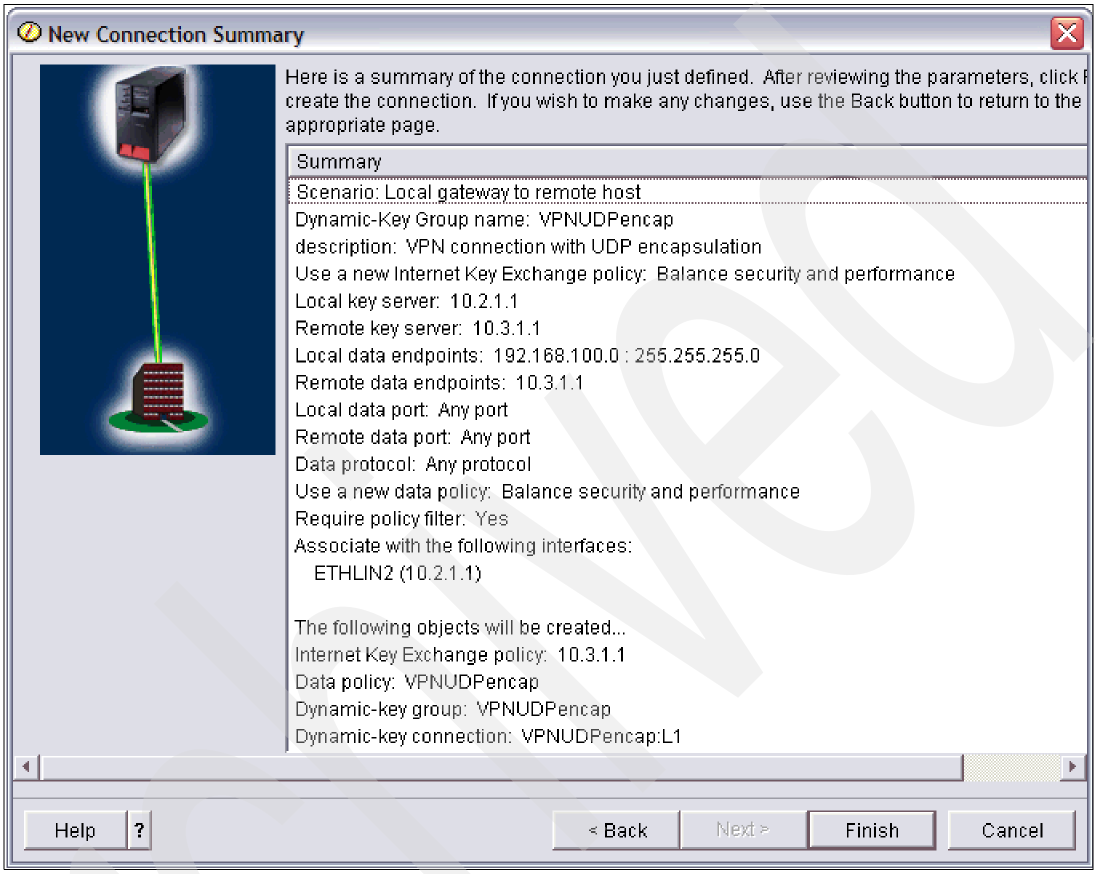
	Apply Connection
(9.5.92.95, 192.168...	□
(10.2.1.1)	☑

Point-to-Point Profile	Apply Connection
QVPN01IBM1	□
QVPN01IBM2	□

Point-to-Point Filter Identifier	Apply Connection

Figure 3-15 New Connection Wizard - Applicable Interfaces window

19. At this point, you specified all the parameters needed by the wizard and they are displayed on the New Connection Summary window (Figure 3-16). Review them to ensure they are correct. If you need to change something, click **Back** to go to previous windows and make the corrections. When all the attributes are correct, click **Finish** to complete the configuration.



Here is a summary of the connection you just defined. After reviewing the parameters, click F
create the connection. If you wish to make any changes, use the Back button to return to the
appropriate page.

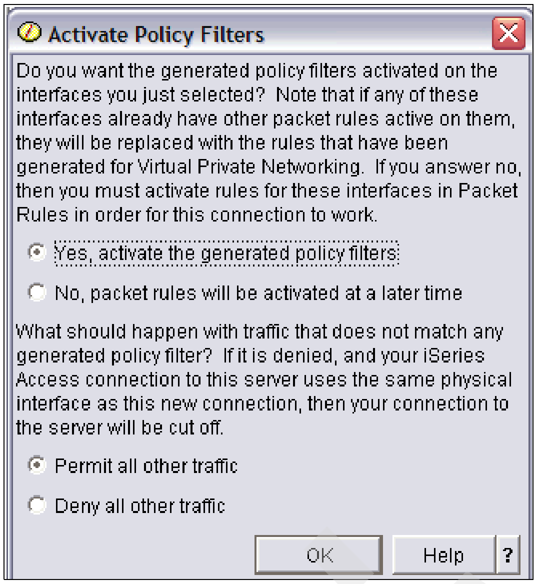
Summary

Scenario: Local gateway to remote host
Dynamic-Key Group name: VPNUDPencap
description: VPN connection with UDP encapsulation
Use a new Internet Key Exchange policy: Balance security and performance
Local key server: 10.2.1.1
Remote key server: 10.3.1.1
Local data endpoints: 192.168.100.0 : 255.255.255.0
Remote data endpoints: 10.3.1.1
Local data port: Any port
Remote data port: Any port
Data protocol: Any protocol
Use a new data policy: Balance security and performance
Require policy filter: Yes
Associate with the following interfaces:
ETHLIN2 (10.2.1.1)

The following objects will be created...
Internet Key Exchange policy: 10.3.1.1
Data policy: VPNUDPencap
Dynamic-key group: VPNUDPencap
Dynamic-key connection: VPNUDPencap:L1

Figure 3-16 New Connection Wizard - New Connection Summary window

20. When the Activate Policy Filters dialog box appears (Figure 3-17), select **Yes, activate the generated policy filters**, select **Permit all other traffic**, and click **OK**.


Activate Policy Filters

Do you want the generated policy filters activated on the interfaces you just selected? Note that if any of these interfaces already have other packet rules active on them, they will be replaced with the rules that have been generated for Virtual Private Networking. If you answer no, then you must activate rules for these interfaces in Packet Rules in order for this connection to work.

● Yes, activate the generated policy filters

○ No, packet rules will be activated at a later time

What should happen with traffic that does not match any generated policy filter? If it is denied, and your iSeries Access connection to this server uses the same physical interface as this new connection, then your connection to the server will be cut off.

● Permit all other traffic

○ Deny all other traffic

Figure 3-17 New Connection Wizard - Activate Policy Filters dialog box

Note: If the policy filters for VPN are already active, you see an error message at this step when the policy filters activation is attempted. This can happen if other VPN connections have been established in this system. In this case, you *must* activate the policy filters again to include the additional rules defined by the New Connection wizard. You might also need to stop the VPN server before reactivating the filters.

To reactivate the policy filters and restart the VPN server jobs, use the iSeries Navigator:

a. Expand to **My Connections** → ***<Gateway A system>*** → **Network** → **Servers**.
b. Click **TCP/IP**.
c. From the list of TCP/IP servers displayed on the right pane, verify the status of Virtual Private Networking.
d. If the status of the VPN server is *Started*, right-click **Virtual Private Networking** and then click **Stop** to end the VPN server.
e. Expand to **My Connections** → ***<Gateway A system>*** → **Network** → **IP Policies** → **Packet Rules**.
f. Right-click the line used for VPN connections (in this example, `ETHLIN1`).
g. Click **Deactivate Rules**.
h. Click **OK.**
i. Right-click **Packet Rules**.
j. Click **Activate Rules**.
k. Select **Activate only the VPN generated rules**.
l. Select **Activate these rules on the following interface**.
m. Select the line used for VPN connections (in this example, `ETHLIN1`).
n. Click **OK**.

You have now completed the task of configuring VPN on Gateway A (initiator).

3.3.2 Configuring VPN on Host D (responder)

This section shows you how to use the iSeries Navigator functions to create and configure the VPN connection on the responder system (Host D).

To perform this task, use the information from your VPN planning checklist (Table 3-3 on page 35. The steps are:

1. Start an iSeries Navigator session: **Start** → **Programs** → **IBM iSeries Access for Windows** → **iSeries Navigator**.
2. In the iSeries Navigator window, select the i5/OS system that you will use as the VPN responder by clicking its corresponding icon. In this example, we are using system RCHAS55.
3. If the Sign-on to iSeries prompt appears, enter your user ID and password and then click **OK** to complete the sign-on.
4. On the navigation pane of the iSeries Navigator, do the expansion for **My Connections** → ***<Host D system>*** → **Network** → **IP Policies**. The expanded window is similar to Figure 3-18.

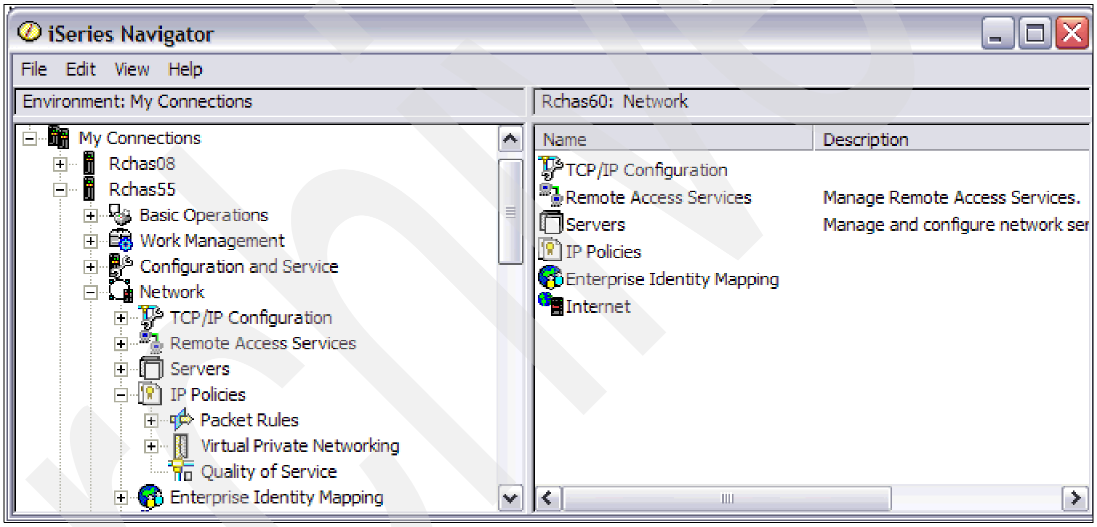


Figure 3-18 Expanded window of IP Policies tasks

5. In the expanded navigation pane, right-click **Virtual Private Networking**.

6. In the context menu for Virtual Private Networking (Figure 3-19), click **New Connection**.

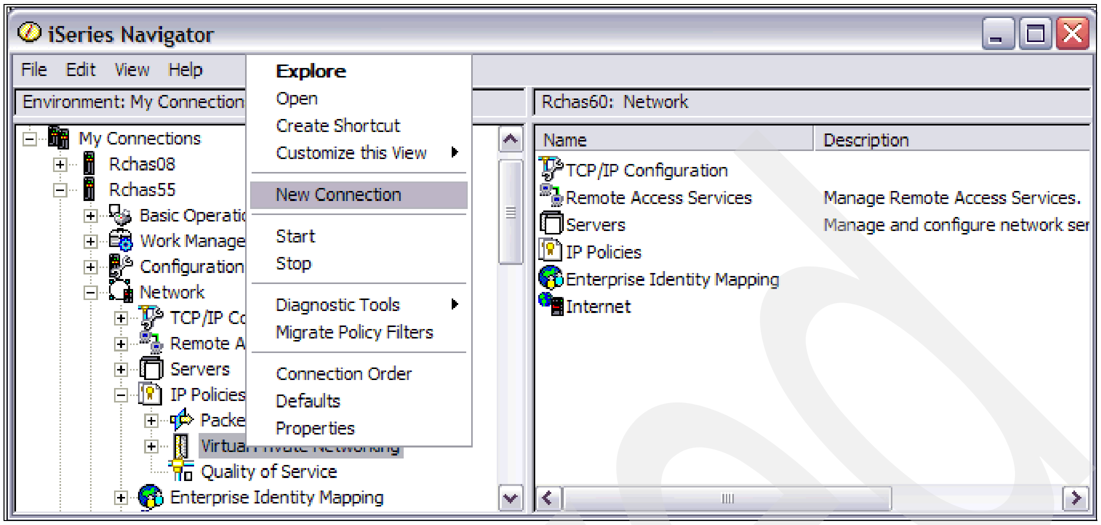
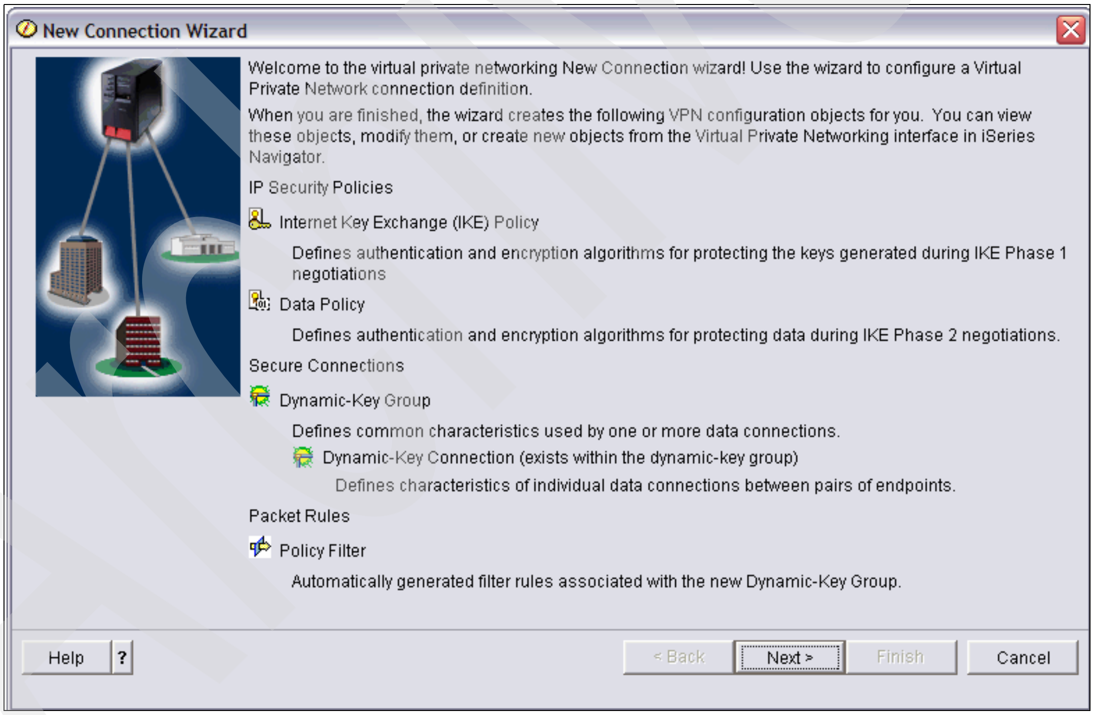


Figure 3-19 Context menu for Virtual Private Networking - New Connection

7. The welcome window of the New Connection Wizard displays as shown in Figure 3-20.


New Connection Wizard

Welcome to the virtual private networking New Connection wizard! Use the wizard to configure a Virtual Private Network connection definition.

When you are finished, the wizard creates the following VPN configuration objects for you. You can view these objects, modify them, or create new objects from the Virtual Private Networking interface in iSeries Navigator.

IP Security Policies

Internet Key Exchange (IKE) Policy

Defines authentication and encryption algorithms for protecting the keys generated during IKE Phase 1 negotiations

Data Policy

Defines authentication and encryption algorithms for protecting data during IKE Phase 2 negotiations.

Secure Connections

Dynamic-Key Group

Defines common characteristics used by one or more data connections.

Dynamic-Key Connection (exists within the dynamic-key group)

Defines characteristics of individual data connections between pairs of endpoints.

Packet Rules

Policy Filter

Automatically generated filter rules associated with the new Dynamic-Key Group.

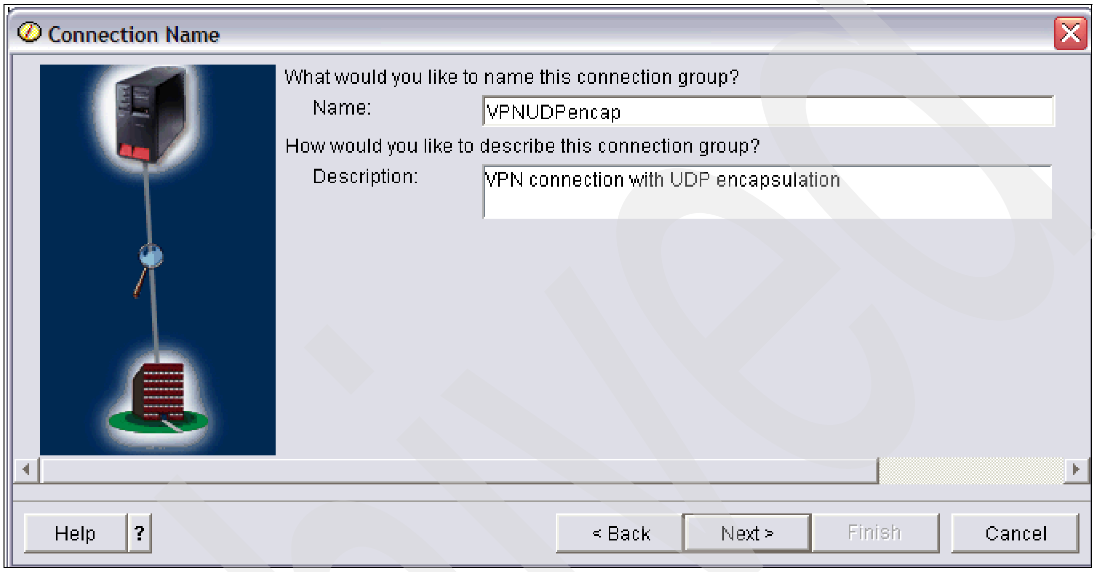
Figure 3-20 New Connection Wizard - Welcome window

8. Review the Welcome window of the wizard for information about the objects that the wizard will create. Click **Next** to begin the wizard.

9. When the Connection Name window appears (Figure 3-21), take the following actions:

   a. In the Name field, enter `VPNUDPencap`.
   b. Optionally, specify a description for this connection group.
   c. Click **Next** to continue.

> **Note:** The connection group name is the same in both systems (in this example, it is Host D and Gateway A).



Connection Name

What would you like to name this connection group?

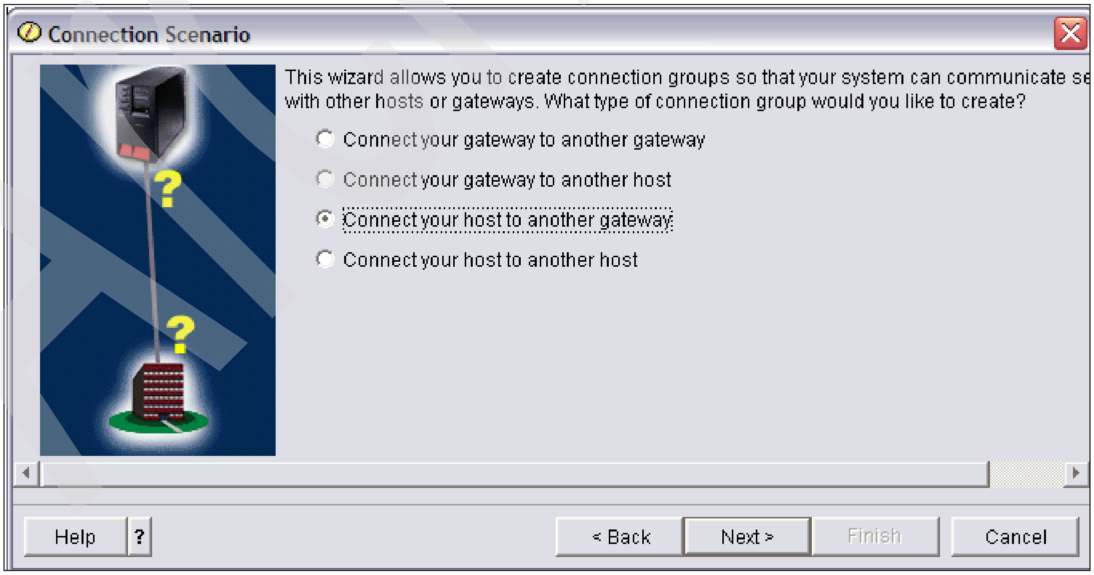
Name: VPNUDPencap

How would you like to describe this connection group?

Description: VPN connection with UDP encapsulation

Figure 3-21 New Connection Wizard - Connection Name window

10. When the Connection Scenario window appears (Figure 3-22), select **Connect your host to another gateway** and click **Next** to continue.



Connection Scenario

This wizard allows you to create connection groups so that your system can communicate se
with other hosts or gateways. What type of connection group would you like to create?

○ Connect your gateway to another gateway

○ Connect your gateway to another host

● Connect your host to another gateway

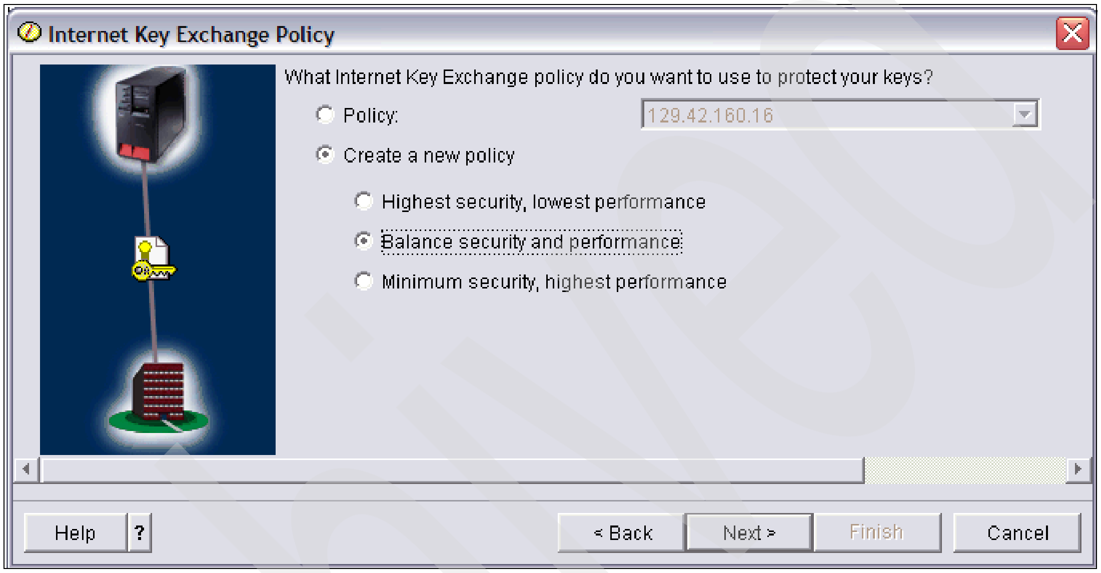
○ Connect your host to another host

Figure 3-22 New Connection Wizard - Connection Scenario window

11. In the Internet Key Exchange Policy window (Figure 3-23):

   a. Select **Create a new policy**.
   b. Select **Balance security and performance**.
   c. Click **Next** to continue.

> **Note:** If you get an error message stating “The certificate request could not be processed”, ignore it because you are not using certificates for the key exchange in the VPN.



Internet Key Exchange Policy

What Internet Key Exchange policy do you want to use to protect your keys?

○ Policy: 129.42.160.16

● Create a new policy

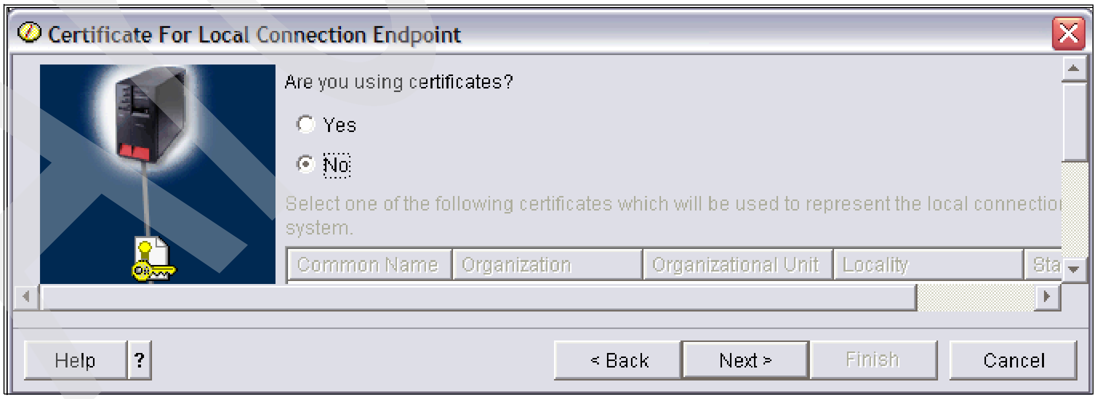
○ Highest security, lowest performance

● Balance security and performance

○ Minimum security, highest performance

Figure 3-23 New Connection Wizard - Internet Key Exchange Policy window

12. Optional step: If you have certificates installed on your i5/OS system, you see the Certificate for Local Connection Endpoint window (Figure 3-24). If this window displays, select **No** to indicate that you will not be using certificates to authenticate the VPN connection and then click **Next**.



Certificate For Local Connection Endpoint

Are you using certificates?

○ Yes

● No

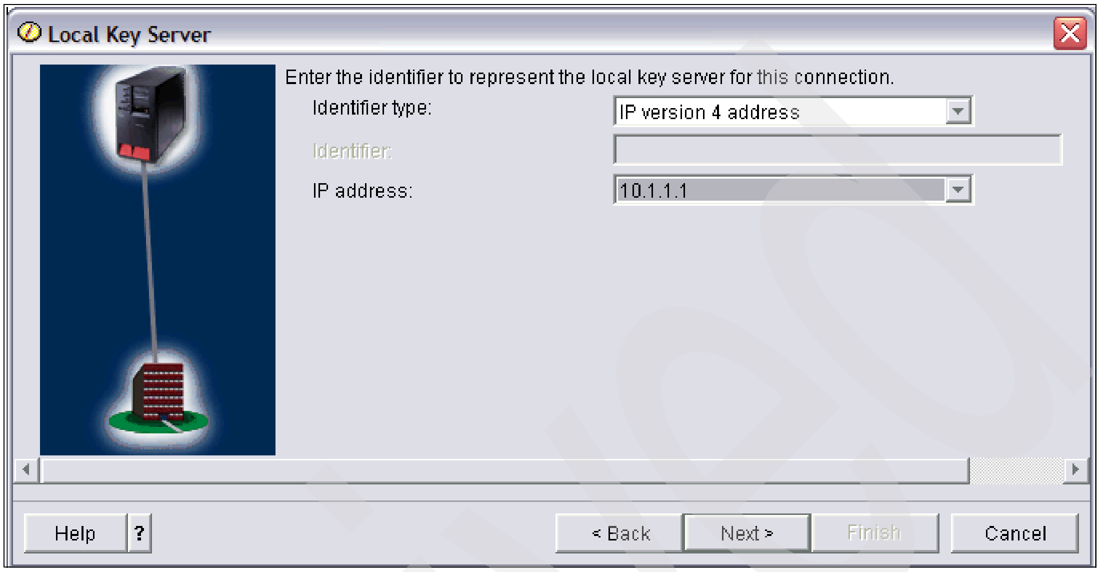
Select one of the following certificates which will be used to represent the local connectio system.

Common Name	Organization	Organizational Unit	Locality	Sta

Figure 3-24 New Connection Wizard - Certificate For Local Connection Endpoint window

13. When the Local Key Server window appears (Figure 3-25):

a. In the Identifier type field, select **IP version 4 address**.
b. In the IP address, select **10.1.1.1**.
c. Click **Next**.



Enter the identifier to represent the local key server for this connection.

Identifier type: IP version 4 address

Identifier:

IP address: 10.1.1.1

Figure 3-25 New Connection Wizard - Local Key Server window

14. In the Remote Key Server window (Figure 3-26):

   a. In the Identifier type field, select **IP version 4 address**.

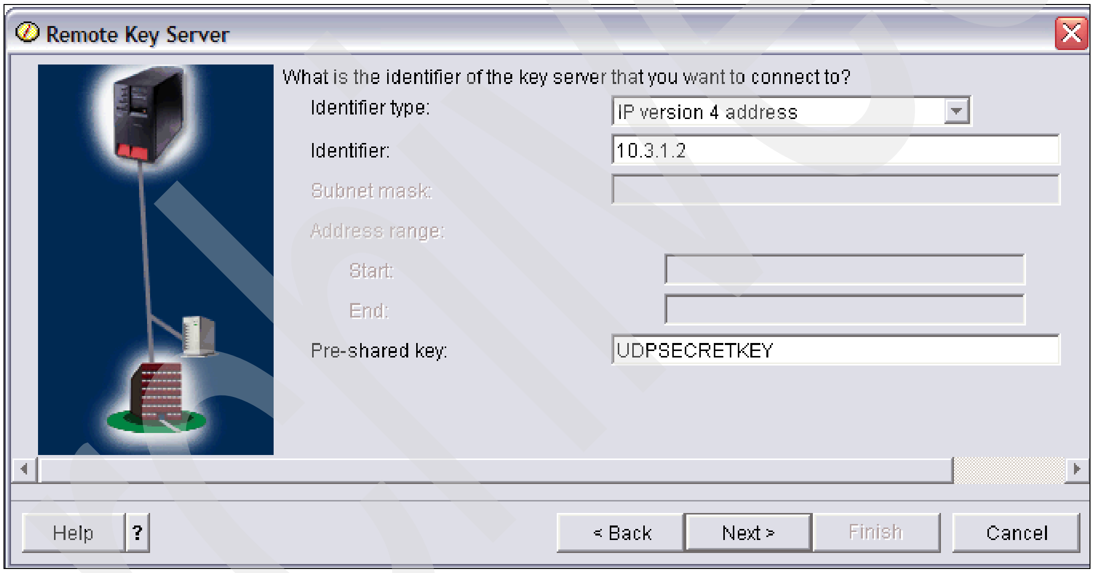
   b. In the Identifier field, enter `10.3.1.2`.

> **Note:** This value is the public IP address that the remote system uses to access the Internet (or other public network) for VPN connections. Here, we are using 10.3.1.2, which is not a real public IP address. We are using it for example purposes.
>
> If the IP address of the remote system is unknown, you can select **Any IP address** as the identifier type for the remote key server.

   c. In the pre-shared key field, enter `UDPSECRETKEY`.

> **Note:** The preshared key *must* be the same in both systems (in this example, it is Host D and Gateway A).

   d. Click **Next** to continue.



Remote Key Server

What is the identifier of the key server that you want to connect to?

Identifier type: IP version 4 address

Identifier: 10.3.1.2

Subnet mask:

Address range:

Start:

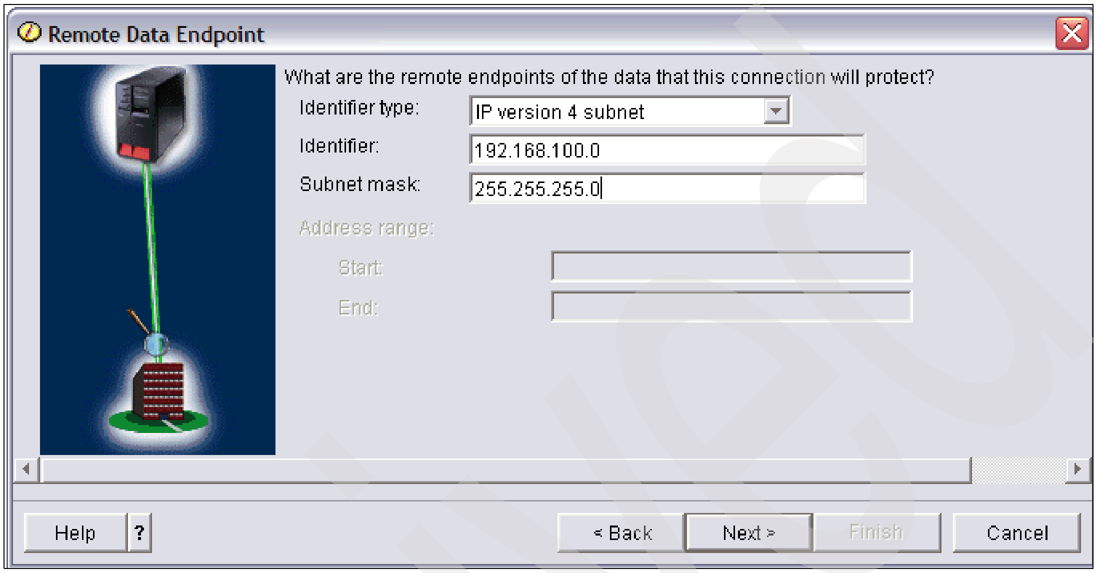
End:

Pre-shared key: UDPSECRETKEY

Figure 3-26 New Connection Wizard - Remote Key Server window

15. In the Remote Data Endpoint window(Figure 3-27):

a. In the Identifier type field, select **IP version 4 subnet**.
b. In the Identifier field, enter `192.168.100.0`.
c. In the Subnet mask field, enter `255.255.255.0`.
d. Click **Next** to continue.



Remote Data Endpoint

What are the remote endpoints of the data that this connection will protect?

Identifier type: IP version 4 subnet

Identifier: 192.168.100.0

Subnet mask: 255.255.255.0

Address range:

Start:

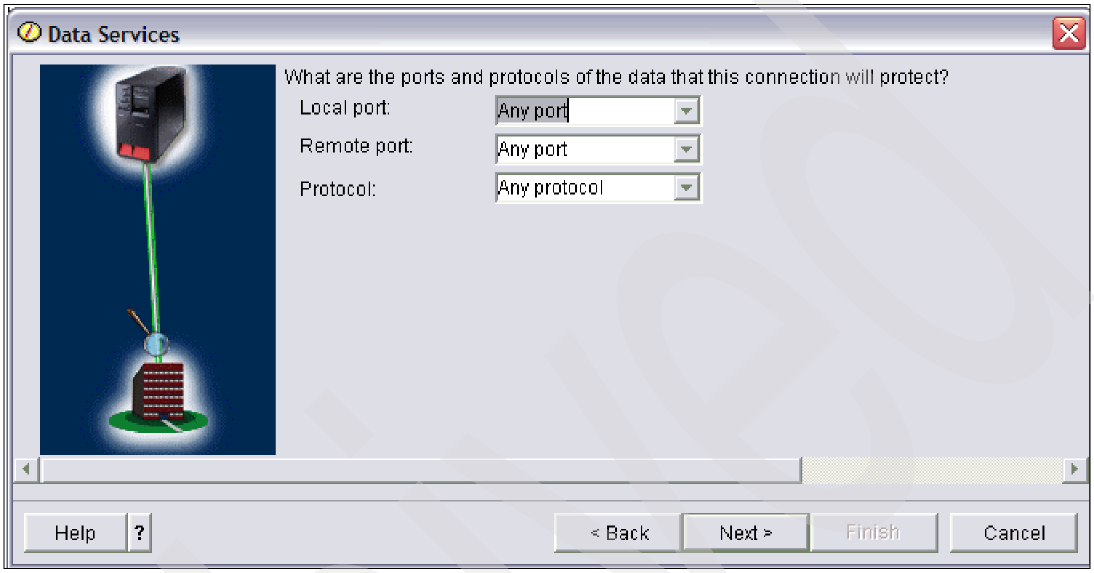
End:

Figure 3-27 New Connection Wizard - Remote Data Endpoint window

> **Note:** For host-to-gateway connections, these values are the same as those specified in the Local Data Endpoint window of the remote gateway system.

16. The Data Services window displays (Figure 3-28). Accept the default values by clicking **Next**.

> **Note:** Accepting these defaults (any port, any protocol) allow you to protect all data traffic flowing across the VPN connection.



What are the ports and protocols of the data that this connection will protect?

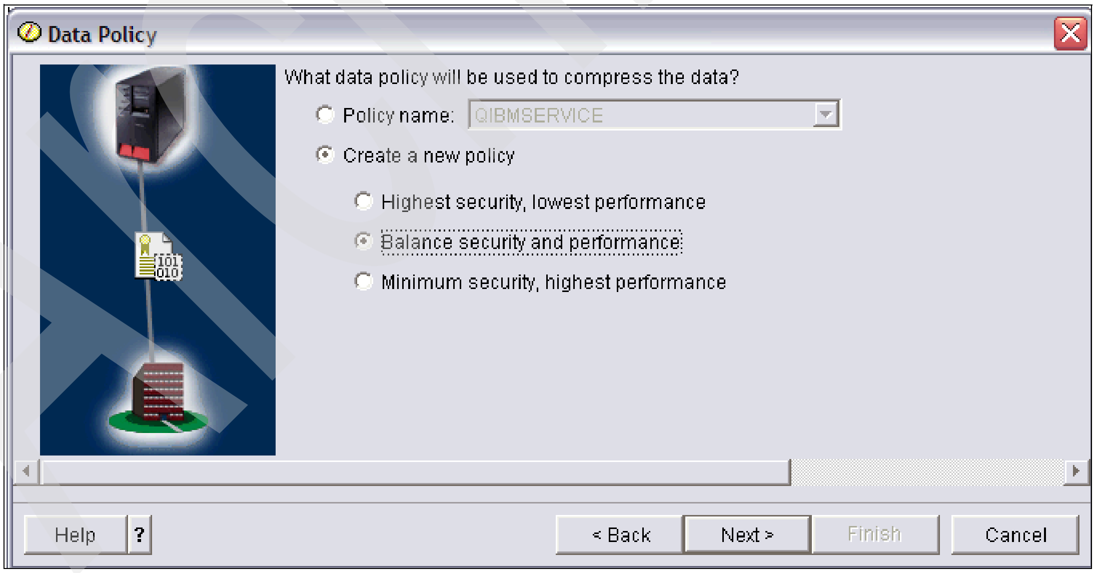
Local port: Any port

Remote port: Any port

Protocol: Any protocol

Figure 3-28 New Connection Wizard - Data Services window

17. The Data Policy window displays (Figure 3-29). Select **Create a new policy,** select **Balance security and performance**, and click **Next**.



What data policy will be used to compress the data?

○ Policy name: QIBMSERVICE

● Create a new policy

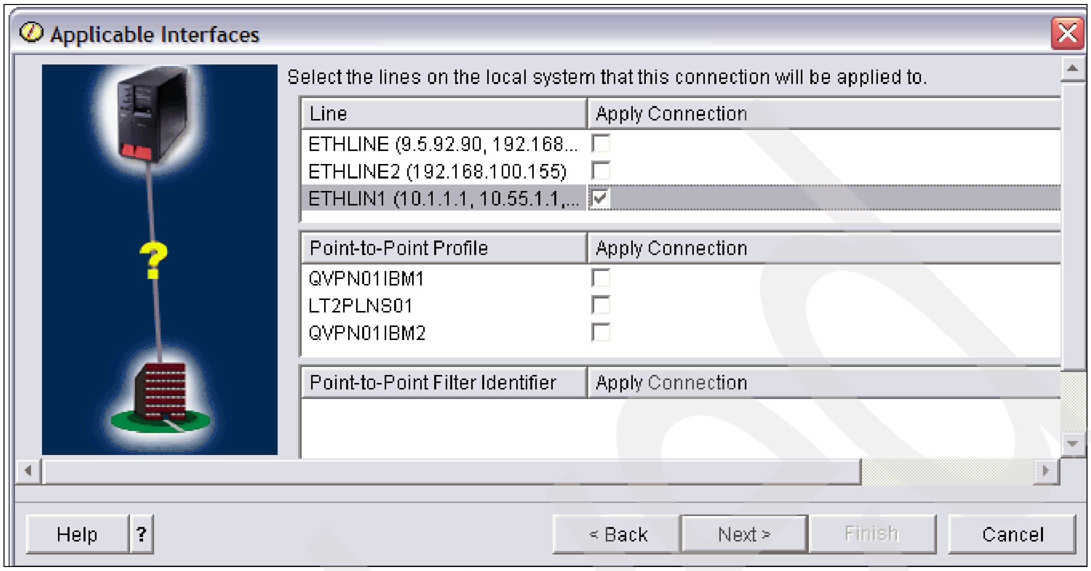
○ Highest security, lowest performance

● Balance security and performance

○ Minimum security, highest performance

Figure 3-29 New Connection Wizard - Data Policy window

18. The Applicable Interfaces window appears (Figure 3-30). From the list of lines and interfaces, select **ETHLIN1** by clicking its corresponding check mark box.



Select the lines on the local system that this connection will be applied to.

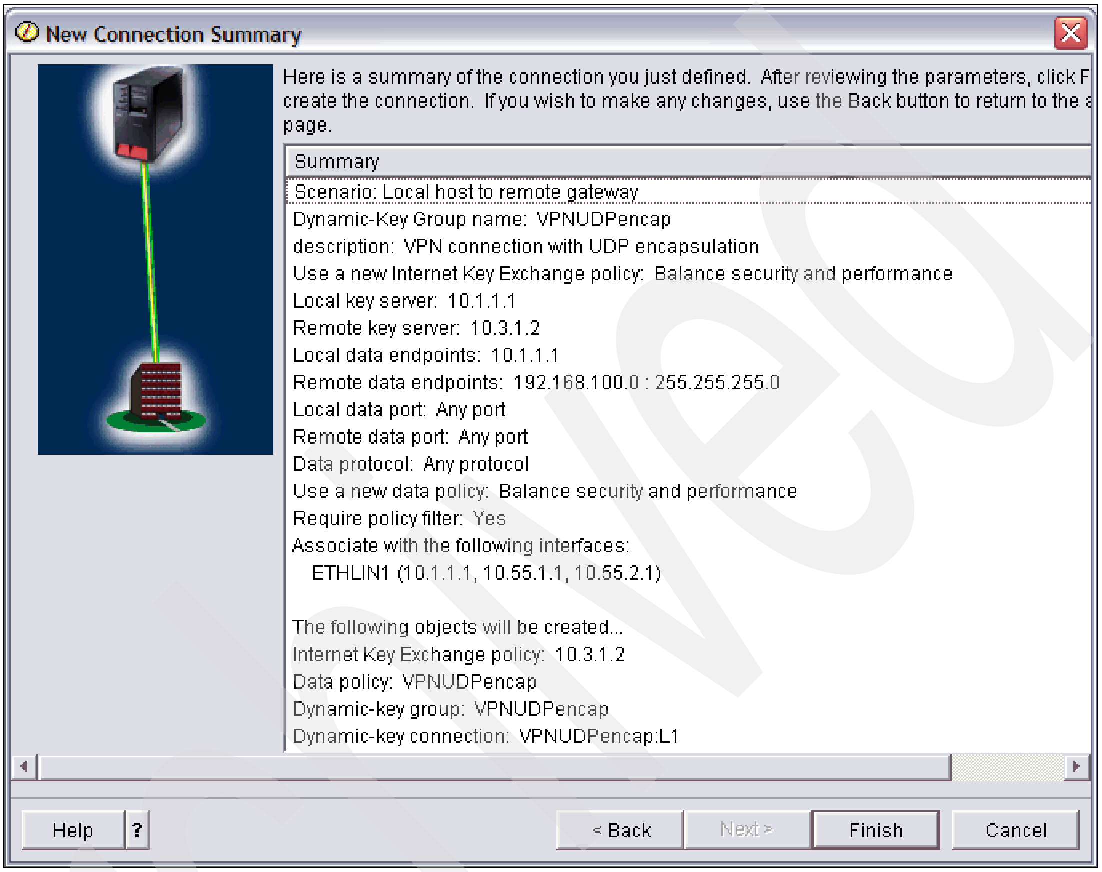
Line	Apply Connection
ETHLINE (9.5.92.90, 192.168...	□
ETHLINE2 (192.168.100.155)	□
ETHLIN1 (10.1.1.1, 10.55.1.1,...	☑

Point-to-Point Profile	Apply Connection
QVPN01IBM1	□
LT2PLNS01	□
QVPN01IBM2	□

Point-to-Point Filter Identifier	Apply Connection

Figure 3-30 New Connection Wizard - Applicable Interfaces window

19. At this point, you specified all the parameters needed by the wizard and they are displayed in the New Connection Summary window (Figure 3-31). Review them to ensure they are correct. If you need to change something, click **Back** to go to previous windows and make the corrections. When all the attributes are correct, click **Finish** to complete the configuration.



Here is a summary of the connection you just defined. After reviewing the parameters, click F create the connection. If you wish to make any changes, use the Back button to return to the a page.

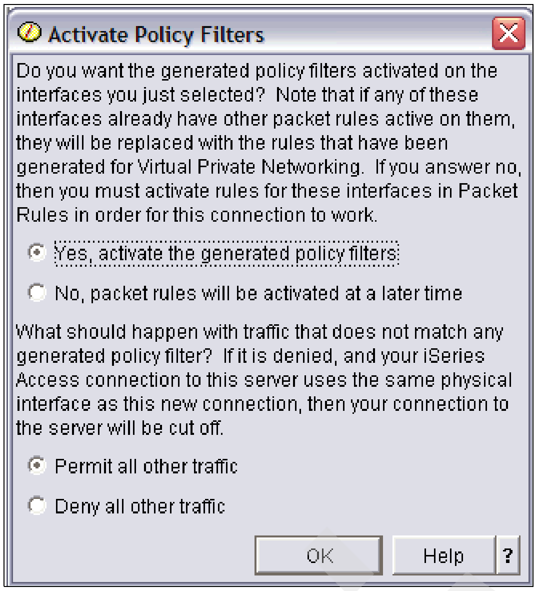
Summary

Scenario: Local host to remote gateway
Dynamic-Key Group name: VPNUDPencap
description: VPN connection with UDP encapsulation
Use a new Internet Key Exchange policy: Balance security and performance
Local key server: 10.1.1.1
Remote key server: 10.3.1.2
Local data endpoints: 10.1.1.1
Remote data endpoints: 192.168.100.0 : 255.255.255.0
Local data port: Any port
Remote data port: Any port
Data protocol: Any protocol
Use a new data policy: Balance security and performance
Require policy filter: Yes
Associate with the following interfaces:
ETHLIN1 (10.1.1.1, 10.55.1.1, 10.55.2.1)

The following objects will be created...
Internet Key Exchange policy: 10.3.1.2
Data policy: VPNUDPencap
Dynamic-key group: VPNUDPencap
Dynamic-key connection: VPNUDPencap:L1

Figure 3-31 New Connection Wizard - New Connection Summary window

20. In the Activate Policy Filters dialog box (Figure 3-32), select **Yes, activate the generated policy filters**, select **Permit all other traffic**, and click **OK**.



Activate Policy Filters

Do you want the generated policy filters activated on the interfaces you just selected? Note that if any of these interfaces already have other packet rules active on them, they will be replaced with the rules that have been generated for Virtual Private Networking. If you answer no, then you must activate rules for these interfaces in Packet Rules in order for this connection to work.

● Yes, activate the generated policy filters

○ No, packet rules will be activated at a later time

What should happen with traffic that does not match any generated policy filter? If it is denied, and your iSeries Access connection to this server uses the same physical interface as this new connection, then your connection to the server will be cut off.

● Permit all other traffic

○ Deny all other traffic

Figure 3-32 New Connection Wizard - Activate Policy Filters dialog box

> **Note:** If the policy filters for VPN are already active, you see an error message at this step when the policy filters activation is attempted. This can happen if other VPN connections have been established in this system. In this case, you *must* activate the policy filters again to include the additional rules defined by the New Connection wizard. You might also need to stop the VPN server before reactivating the filters.
>
> To reactivate the policy filters, use the iSeries Navigator:
>
> a. Expand to **My Connections** → ***<Host D system>*** → **Network** → **Servers**.
> b. Click **TCP/IP.**
> c. From the list of TCP/IP servers displayed on the right pane, verify the status of the Virtual Private Networking.
> d. If the status of VPN server is Started, right-click **Virtual Private Networking** and then click **Stop** to end the VPN server.
> e. Expand to **My Connections** → ***<Host D system>*** → **Network** → **IP Policies** → **Packet Rules**.
> f. Right-click the line used for VPN connections (in this example, ETHLIN1).
> g. Click **Deactivate Rules**.
> h. Click **OK**.
> i. Right-click **Packet Rules**.
> j. Click **Activate Rules**.
> k. Select **Activate only the VPN generated rules**.
> l. Select **Activate these rules on the following interface**.
> m. Select the line used for VPN connections (in this example, ETHLIN1).
> n. Click **OK**.

You have now completed the task of configuring VPN on Host D (responder).

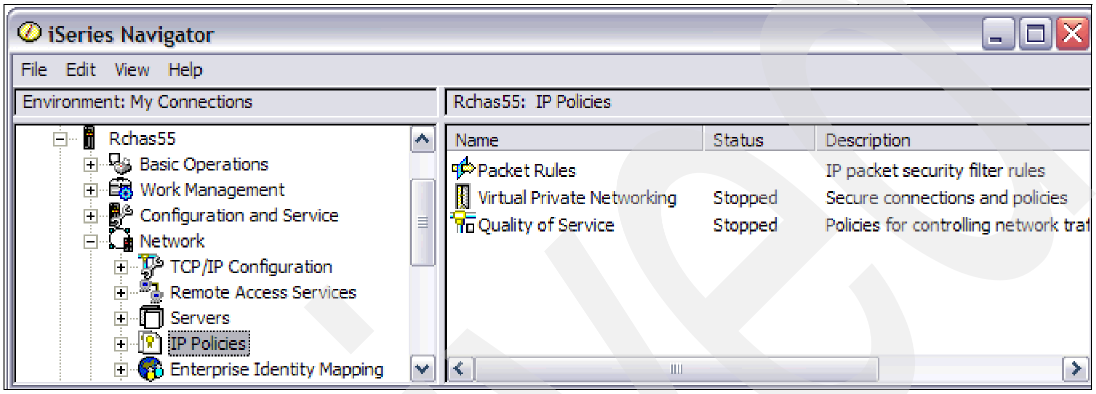
3.3.3 Starting the VPN connection

When you have configured the new VPN connection on both systems, you can start it. This section explains how to do that.

Starting VPN on the host system

Follow these steps to start VPN for the connection you configured on Host D:

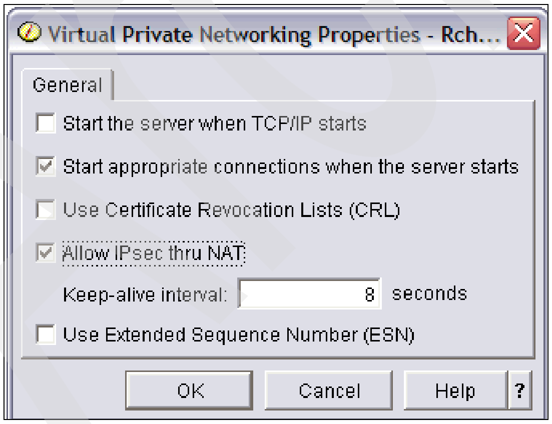
1. In the iSeries Navigator, expand **My Connections** → ***<Host D system>*** → **Network** and click **IP Policies** to display the status of VPN on the right pane (Figure 3-33).



Name	Status	Description
Packet Rules		IP packet security filter rules
Virtual Private Networking	Stopped	Secure connections and policies
Quality of Service	Stopped	Policies for controlling network traf

Figure 3-33 Virtual Private Networking status on Host D

2. If the status of VPN is `Started`, right-click **Virtual Private Networking** and click **Stop** to end the VPN server.
3. Before starting the VPN server, check the general attributes of VPN to make sure that they are configured properly for this scenario. To verify this, right-click **Virtual Private Networking** and then click **Properties**.
4. On the VPN Properties window (Figure 3-34), verify that **Allow IPsec thru NAT** is selected. If needed, click the check box to select it.



☐ Start the server when TCP/IP starts

☑ Start appropriate connections when the server starts

☐ Use Certificate Revocation Lists (CRL)

☑ Allow IPsec thru NAT

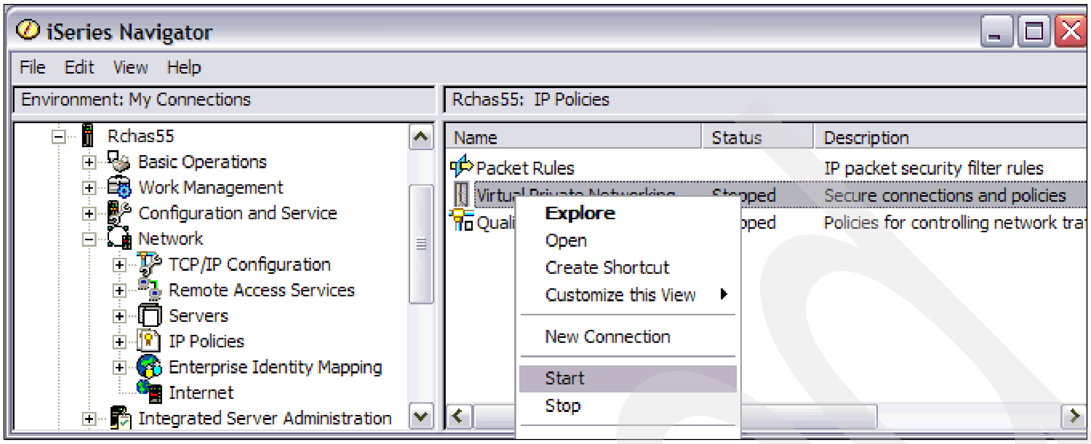
Keep-alive interval: 8 seconds

☐ Use Extended Sequence Number (ESN)

Figure 3-34 Virtual Private Networking Properties window

> **Note:** You can select this attribute even if your VPN connection does not pass through a NAT device. For this scenario, this setting is required, but it is transparent to other non-NAT scenarios.

5. To start the VPN server on this system, on the right pane of the IP Policies window, right-click **Virtual Private Networking** and then click **Start** (Figure 3-35).



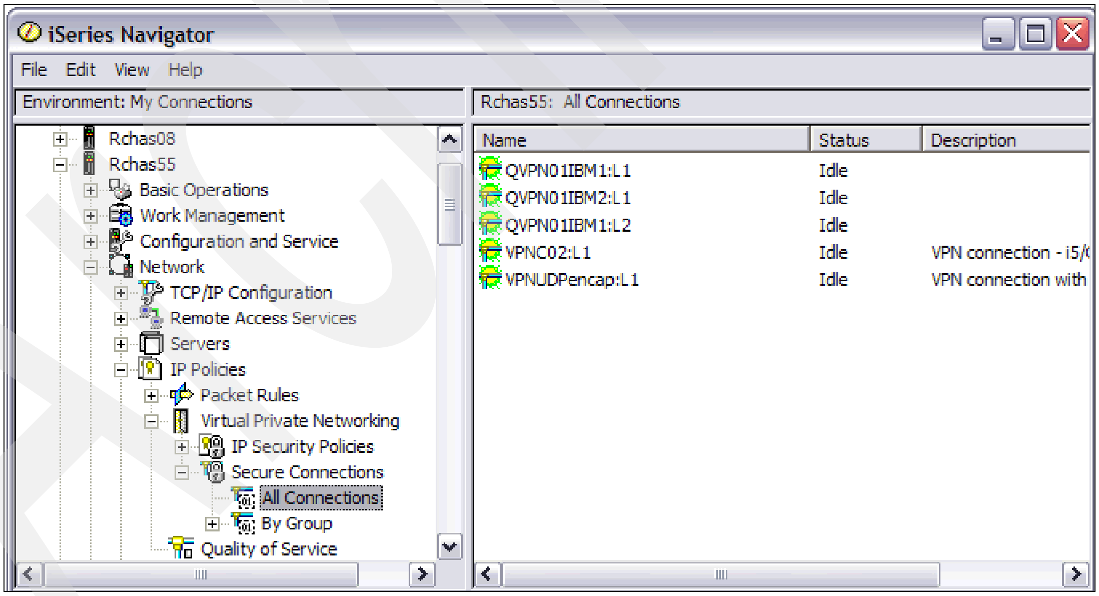
Name	Status	Description
Packet Rules		IP packet security filter rules
Virtual Private Networking	Stopped	Secure connections and policies
Quali	pped	Policies for controlling network tra

Figure 3-35 Starting the VPN server on Host D (responder)

6. The status of VPN changes to `Started`.

7. In the iSeries Navigator, expand **My Connections** → **Host D** → **Network** → **IP Policies** → **Virtual Private Networking** → **Secure Connections** and then click **All Connections**.

8. The new connection, VPNUDPencap, is listed on the right pane (Figure 3-36). Verify that the status field is Idle or On-Demand. This status indicates that Host D is ready to respond when this connection is initiated by Gateway A.



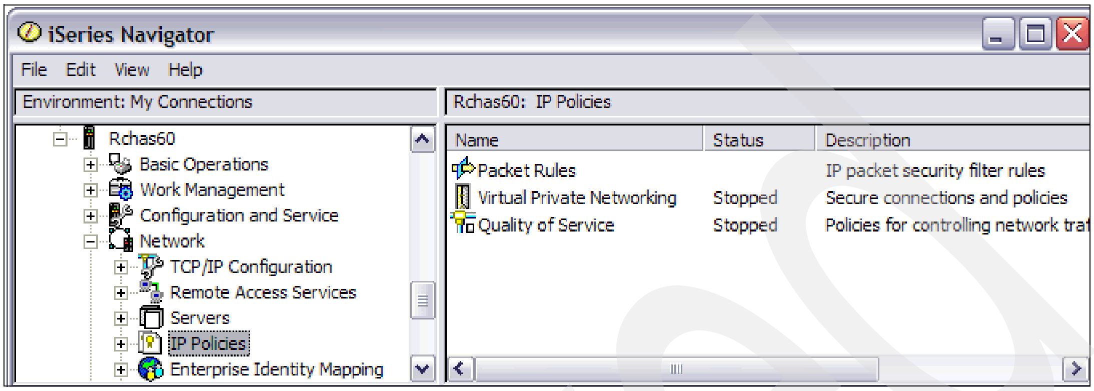
Name	Status	Description
QVPN01IBM1:L1	Idle	
QVPN01IBM2:L1	Idle	
QVPN01IBM1:L2	Idle	
VPNC02:L1	Idle	VPN connection - i5/(
VPNUDPencap:L1	Idle	VPN connection with

Figure 3-36 Status of VPN connection VPNUDPencap on Host D

Starting VPN and initiating the connection on the gateway system

Follow these steps to start VPN and initiate the VPNUDPencap connection from Gateway A:

1. In the iSeries Navigator, expand **My Connections** → ***<Gateway A system>*** → **Network** and then click **IP Policies** to display the status of VPN on the right pane (Figure 3-37).

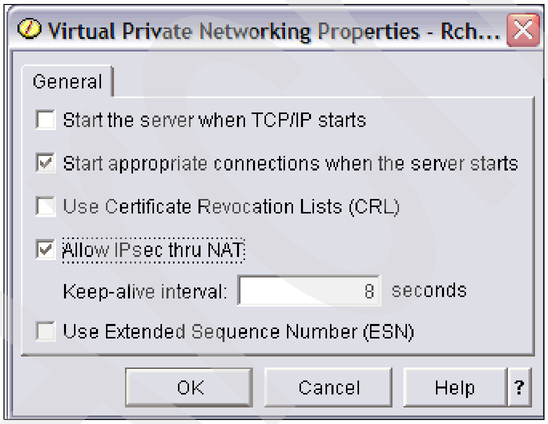


Rchas60: IP Policies

Name	Status	Description
Packet Rules		IP packet security filter rules
Virtual Private Networking	Stopped	Secure connections and policies
Quality of Service	Stopped	Policies for controlling network traf

Figure 3-37 Virtual Private Networking status on Gateway A

2. If the status of VPN is `Started`, right-click **Virtual Private Networking** and click **Stop** to end the VPN server.
3. Before starting the VPN server, check the general attributes of VPN to make sure that they are configured properly for this scenario. To verify this, right-click **Virtual Private Networking** and then click **Properties**.
4. On the VPN Properties window (Figure 3-38), verify that **Allow IPsec thru NAT** is selected. If needed, click the check box to select it.



☐ Start the server when TCP/IP starts

☑ Start appropriate connections when the server starts

☐ Use Certificate Revocation Lists (CRL)

☑ Allow IPsec thru NAT

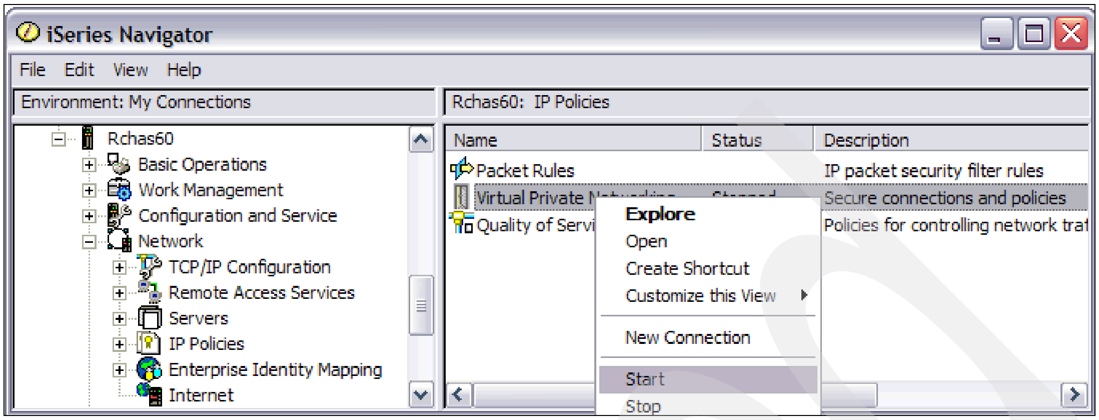
Keep-alive interval: 8 seconds

☐ Use Extended Sequence Number (ESN)

Figure 3-38 Virtual Private Networking Properties window

> **Note:** You can select this attribute even if your VPN connection does not pass through a NAT device. For this scenario, this setting is required, but it is transparent to other non-NAT scenarios.

5. To start the VPN server on this system, on the right pane of the IP Policies window, right-click **Virtual Private Networking** and then click **Start** (Figure 3-39).



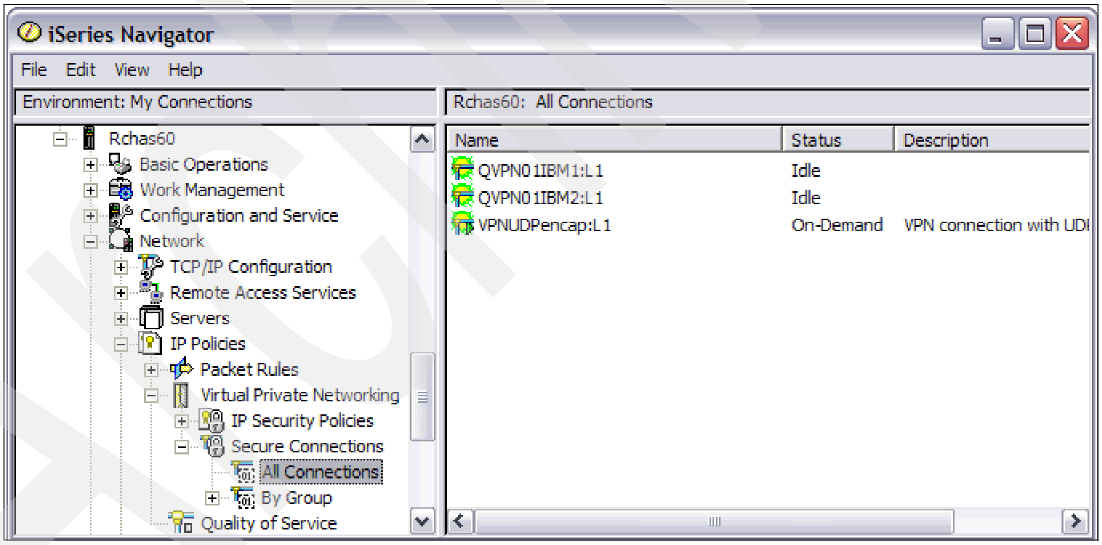
Name	Status	Description
Packet Rules		IP packet security filter rules
Virtual Private N		Secure connections and policies
Quality of Servi		Policies for controlling network tra

Figure 3-39 Starting the VPN server on Gateway A (initiator)

6. The status of VPN changes to `Started`.

7. Expand **My Connections** → ***Gateway A*** → **Network** → **IP Policies** → **Virtual Private Networking** → **Secure Connections** and click **All Connections**.

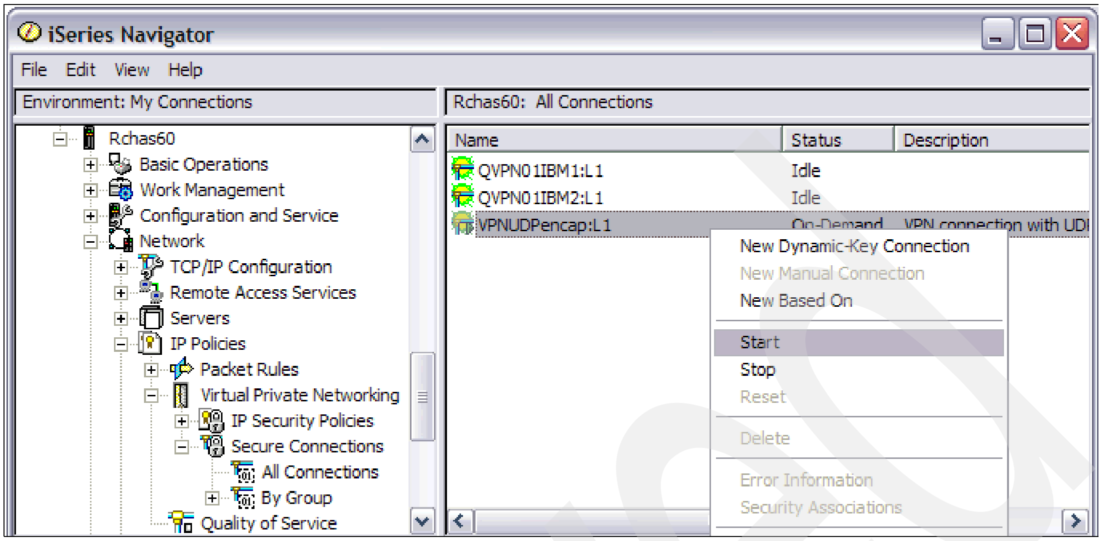
8. The new connection, VPNUDPencap, is listed on the right pane (Figure 3-40). Verify that the status field is `Idle` or `On-Demand`. This status indicates that Gateway A is ready to initiate this VPN connection.



Name	Status	Description
QVPN01IBM1:L1	Idle	
QVPN01IBM2:L1	Idle	
VPNUDPencap:L1	On-Demand	VPN connection with UD

Figure 3-40 Status of VPN connection VPNUDPencap on Gateway A

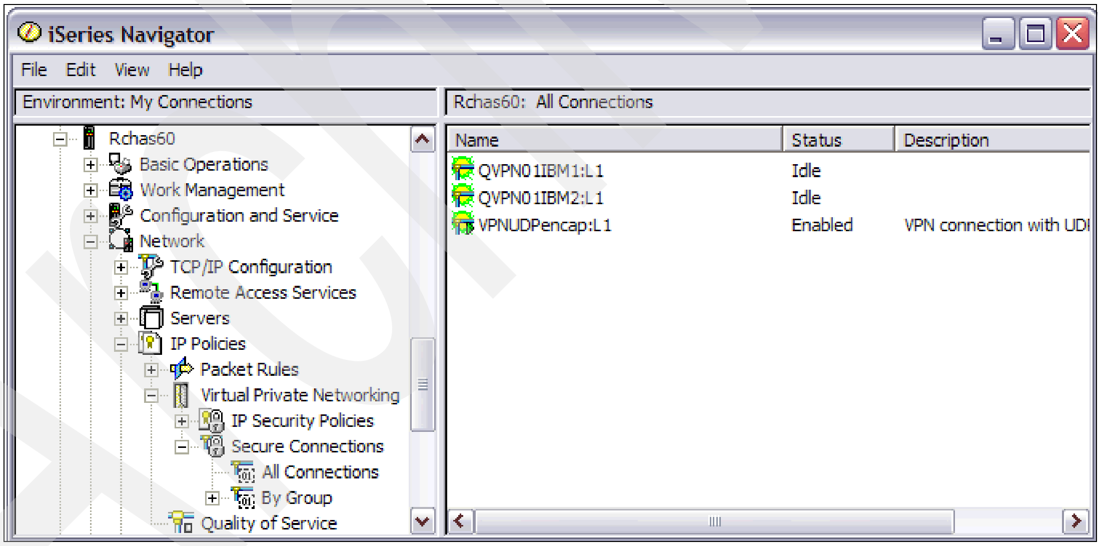
9. Right-click **VPNUDPencap** and click **Start** (Figure 3-41).



Name	Status	Description
QVPN01IBM1:L1	Idle	
QVPN01IBM2:L1	Idle	
VPNUDPencap:L1	On-Demand	VPN connection with UDI

Figure 3-41 Starting the VPN connection on Gateway A (initiator)

10. From the View menu, select **Refresh**. If the connection starts successfully, the status field of connection VPNUDPencap changes from `On-Demand` or `Starting` to `Enabled`. The connection might take a short time to start, so do a refresh periodically until the status changes to `Enabled` (Figure 3-42).



Name	Status	Description
QVPN01IBM1:L1	Idle	
QVPN01IBM2:L1	Idle	
VPNUDPencap:L1	Enabled	VPN connection with UDI

Figure 3-42 VPN connection VPNUDPencap successfully started (in Enabled status)

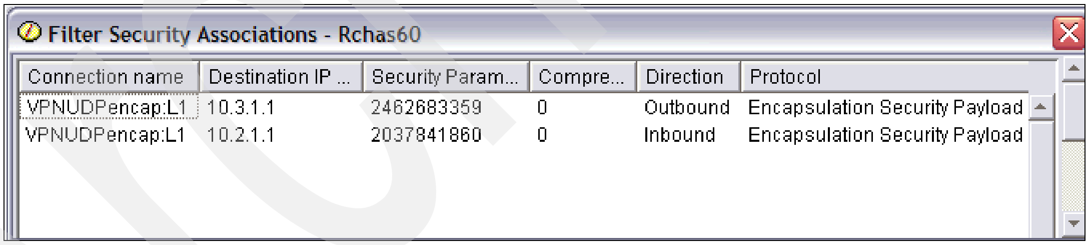
> **Note:** At this point, the VPN connection is established. The status field of connection VPNUDPncap on Host A (responder) changed to `Enabled`.

You have now completed the task of starting the VPN connection.

3.4 Verifying the implementation

When the VPN connection is successfully started, you can test it to ensure that both systems can use that connection to communicate with each other. The steps needed for this verification are:

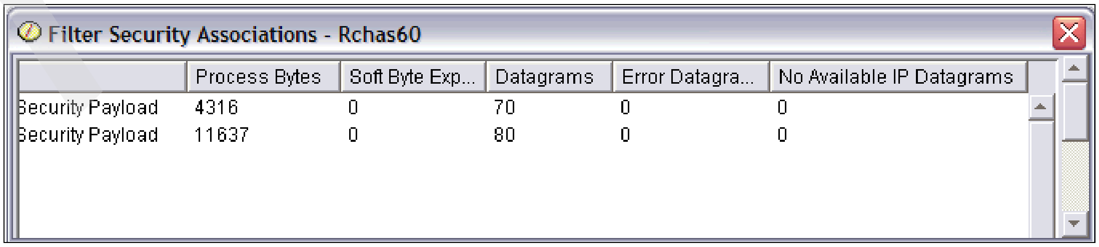
1. Find a system in the internal network secured by Gateway A (for example, system PC1, which in this scenario is connected to subnet 192.168.100.0/24).
2. On that system, open a Telnet session, specifying the public IP address of Host D (in this scenario: `telnet 10.3.1.1`).
3. If you can see the login window of the telnet target system (RCHAS55 in this scenario), then the VPN connection is working.
4. Optional step: To confirm that the telnet traffic is flowing through VPN, you can end the VPN connection from iSeries Navigator by expanding **My Connections** → ***<Gateway A system>*** → **Network** → **IP Policies**, right-clicking **Virtual Private Networking**, and selecting **Stop**. After that, attempt telnet 10.3.1.1 from system PC1 again. This time, the telnet fails because PC1 can only reach Host D when the VPN connection is active.
5. Optional step: You can also verify that the telnet traffic is flowing through VPN. Do the following steps:
   a. In the iSeries Navigator, expand **My Connections** → ***<Gateway A system>*** → **Network** → **IP Policies** → **Virtual Private Networking** → **Secure Connections**.
   b. Click **All Connections**.
   c. From the list of connections on the right pane, right-click **VPNUDPencap** and then click **Security Associations**.
   d. The Filter Security Associations window displays (Figure 3-43). Here, you can verify that the IP addresses for the VPN connection are correct (for example, private address of the local system, public address of the remote system).


Filter Security Associations - Rchas60

Connection name	Destination IP ...	Security Param...	Compre...	Direction	Protocol
VPNUDPencap:L1	10.3.1.1	2462683359	0	Outbound	Encapsulation Security Payload
VPNUDPencap:L1	10.2.1.1	2037841860	0	Inbound	Encapsulation Security Payload

Figure 3-43 Filter Security Associations window - Left section

   e. Scroll the Filter Security Associations window to the right (Figure 3-44). Here you see the number of outbound and inbound datagrams exchanged because of the telnet request. You also see the total bytes of counters for those datagrams.


Filter Security Associations - Rchas60

	Process Bytes	Soft Byte Exp...	Datagrams	Error Datagra...	No Available IP Datagrams
Security Payload	4316	0	70	0	0
Security Payload	11637	0	80	0	0

Figure 3-44 Filter Security Associations window - Right section

You have now completed the task of verifying the implementation of the VPN connection.

3.5 Tips and techniques

You can use iSeries Navigator to do additional customization for your VPN connection to better meet the needs of your environment. For example, you can review and change the attributes of an existing VPN connection by expanding to **My Connections** → ***servername*** → **Network** → **IP Policies** → **Virtual Private Networking** → **Secure Connections** → **By Group**, right-clicking your VPN connection to see its properties, and changing them as needed. You can use the online help for each property to get additional details about its purpose and allowed values.

For example, one of the most important properties is the *anti-replay protection* policy. This policy increases the security of VPN because it enables several mechanisms to protect the VPN connections against replay attacks.

If your environment requires multiple TCP/IP interfaces configured on the same subnet, you can configure the VPN connectivity in combination with the Schowler routes. For additional information about the Schowler routes, see the following URL at:

http://www-912.ibm.com/s_dir/slkbase.NSF/7250f367f6396d2f86256a4f007973d5/eb95209430bbcb7486256d170047484a?OpenDocument

If you experience problems when implementing or using your VPN connections, use the troubleshoot mechanisms described in the V5R4 Information Center at (**Networking** → **TCP/IP Applications, protocols and Services** → **Virtual Private Networking (VPN)** → **Troubleshoot VPN**):

http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/index.jsp.

4

VPN tunnel between Linux and i5/OS

This scenario describes a single i5/OS V5R4 system implemented as a VPN server (responder). The VPN initiator is a SUSE Linux Enterprise Server 10 (SLES10).

We will use IPSec with L2TP to protect information between the SLES10 host and i5/OS V5R4. This scenario is an example of a host-to-host configuration using preshared keys (PSK). Windows IPSec initiators are concurrently supported with the Linux IPSec initiators. i5/OS is the IPSec responder.

4.1 i5/OS IPSec VPN responder with Linux VPN initiator

Figure 4-1 illustrates the configuration for the scenario. The SLES10 Linux host is an IPSec initiator. It uses L2TP/PPP.

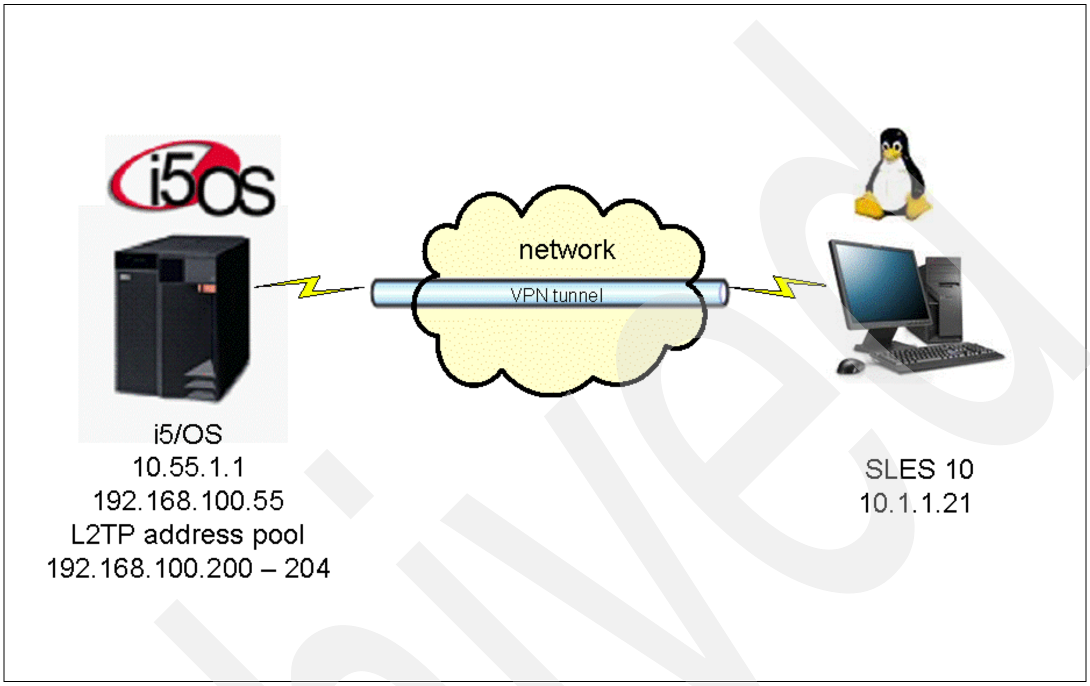


Figure 4-1 I5/OS IPSec VPN responder, SLES10 Linux VPN initiator with L2TP/PPP

4.1.1 Scenario characteristics

This scenario has the following characteristics:

- One system with i5/OS V5R4 is configured as a responder with IPSec and L2TP.
- One SLES10 system is configured as an initiator with IPSec and L2TP.
- Network address translation is not being used.
- IPSec host-to-host connection.
- IP addressing for this scenario is for example purposes only.
- Our scenario is using IPv4 and preshared keys (PSK).
- We are going to provide the Linux host with an encrypted connection to communicate with i5/OS.

4.1.2 Scenario objectives

This scenario's objectives are:

- Provide a secure connection between i5/OS and Linux SLES10.
- Reuse the same configured i5/OS VPN to support the Windows XP and Windows 2003 VPN clients.

4.1.3 Security policy

Before creating a network security policy, you must have an IT security policy for the entire organization. Otherwise, you do not know what guidelines to follow.

General security policies are:

- The default policy is to deny. Use high *caution* anytime a less trusted resource accesses a more trusted resource. Allow only what is needed. In our scenario, it is important to protect the preshared keys.
- Harden systems by disabling and removing unrequired resources.
- Encrypt data on systems.
- Log access and intrusion attempts. Intrusion detection system (IDS) is available for i5/OS.
- Implement exit point programs.
- Use i5/OS object security.

4.1.4 i5/OS security functions

The security functions are:

- Packet filtering
- Logging
- Intrusion detection
- VPN
- IPSec

4.2 Planning Linux SLES10 VPN configuration

This scenario presents a System i for a business. The i5/OS implementation provides services and data resources for the Linux server to use. i5/OS only provides the VPN responder role for a specific static IPv4 address.

4.2.1 Implementation task summary

This section describes how to configure the i5/OS production server (detailed previously for Windows XP preshared key VPN example). The tasks are:

- “Installing the required software on SLES10” on page 68
- “Configuring IPSec on Linux” on page 70
- “Starting the Linux IPSec initiator” on page 71
- “Verifying IPSec IKE modes” on page 72
- “Configuring L2TP/PPP on Linux” on page 74
- “Starting the Linux L2TP connection” on page 76
- “Verifying the L2TP connection” on page 77
- “Stopping the Linux L2TP connection” on page 78
- “Stopping the Linux IPSec connection” on page 78

4.3 Linux VPN with IPSec/L2TP step-by-step set up

This section describes the steps to configure the Linux SLES10 for this scenario. The overview includes references to the configuration files for better clarity. The configuration files include comments that explain the configuration. Read the comments in the example files because they are part of our scenario documentation.

4.3.1 Overview of Linux IPSec/L2TP configuration

This section provides an overview of the Linux VPN configuration for using IPSec as an initiator and L2TP.

4.3.2 Installing the required software on SLES10

In addition to the base SLES10 install, the following packages are required. Here are the package versions available at the time of configuring our scenario:

- ipsec-tools-0.6.5.-10.2 (included on SLES10 media)
- openswan-2.4.4-18.2 (included on SLES10 media)
- l2tpd-0.69-10jdl (downloaded from the Internet)

1. To install the packages use yast2 or the command line interface (CLI). Here is a command line interface install example:

```
rpm -i l2tpd-0.69-10jdl
```

2. From the SLES10 desktop, select **Computer** → **YaST** (Figure 4-2).

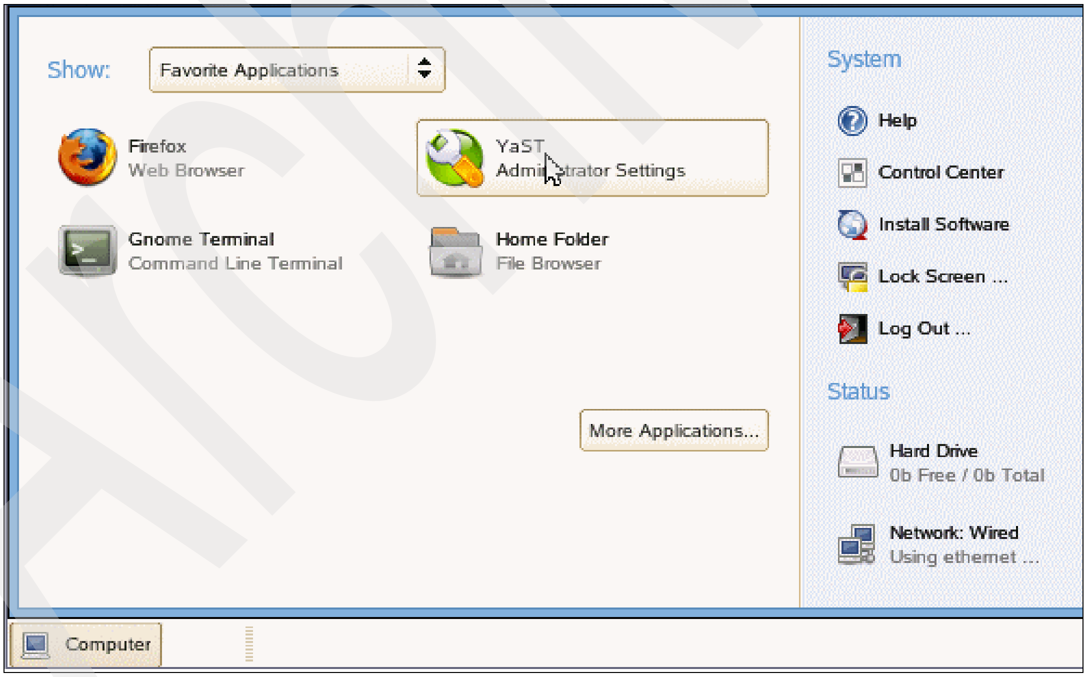


Figure 4-2 Starting YaST from the SLES10 desktop

3. Select Software Management (Figure 4-3).

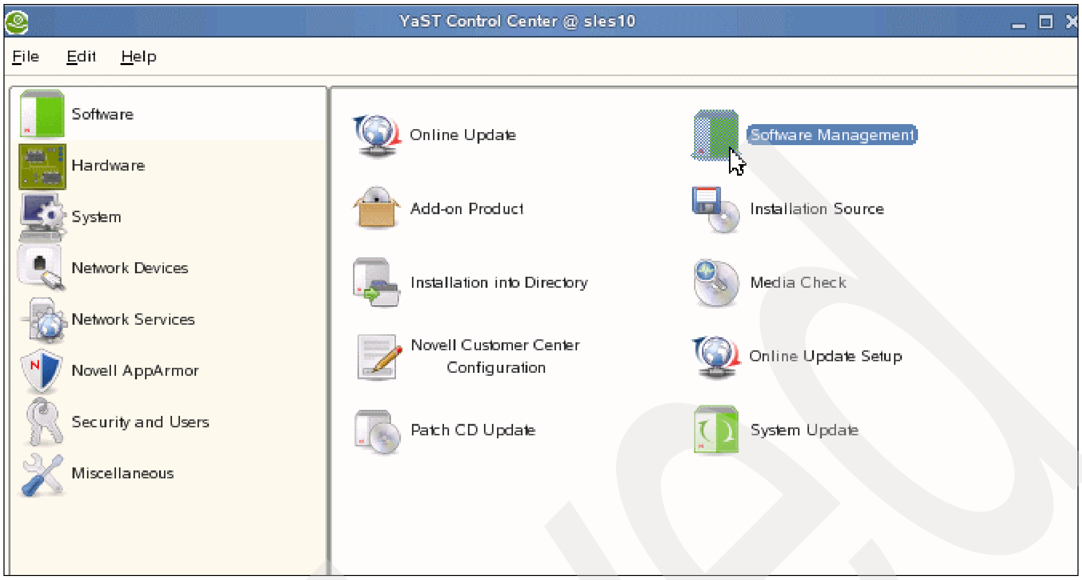
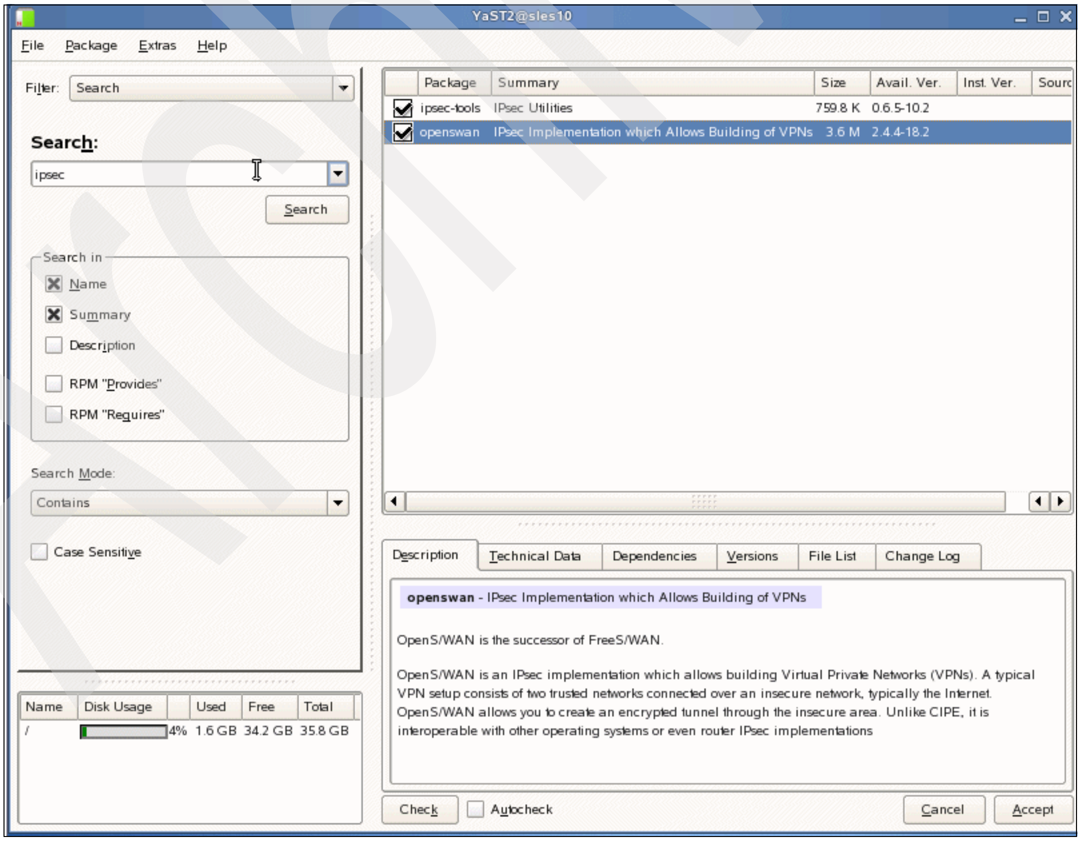


Figure 4-3 Selecting Software Management

4. Enter `ipsec` into the Search field and click **Search**. The ipsec-tools and openswan packages appear. Select both packages (ensure a check mark appears by both) and click **Accept** (Figure 4-4).



Filter: Search

Search:

ipsec

Search in

☒ Name

☒ Summary

☐ Description

☐ RPM "Provides"

☐ RPM "Requires"

Search Mode: Contains

☐ Case Sensitive

	Package	Summary	Size	Avail. Ver.	Inst. Ver.	Sourc
☑	ipsec-tools	IPsec Utilities	759.8 K	0.6.5-10.2		
☑	openswan	IPsec Implementation which Allows Building of VPNs	3.6 M	2.4.4-18.2		

openswan - IPsec Implementation which Allows Building of VPNs

OpenS/WAN is the successor of FreeS/WAN.

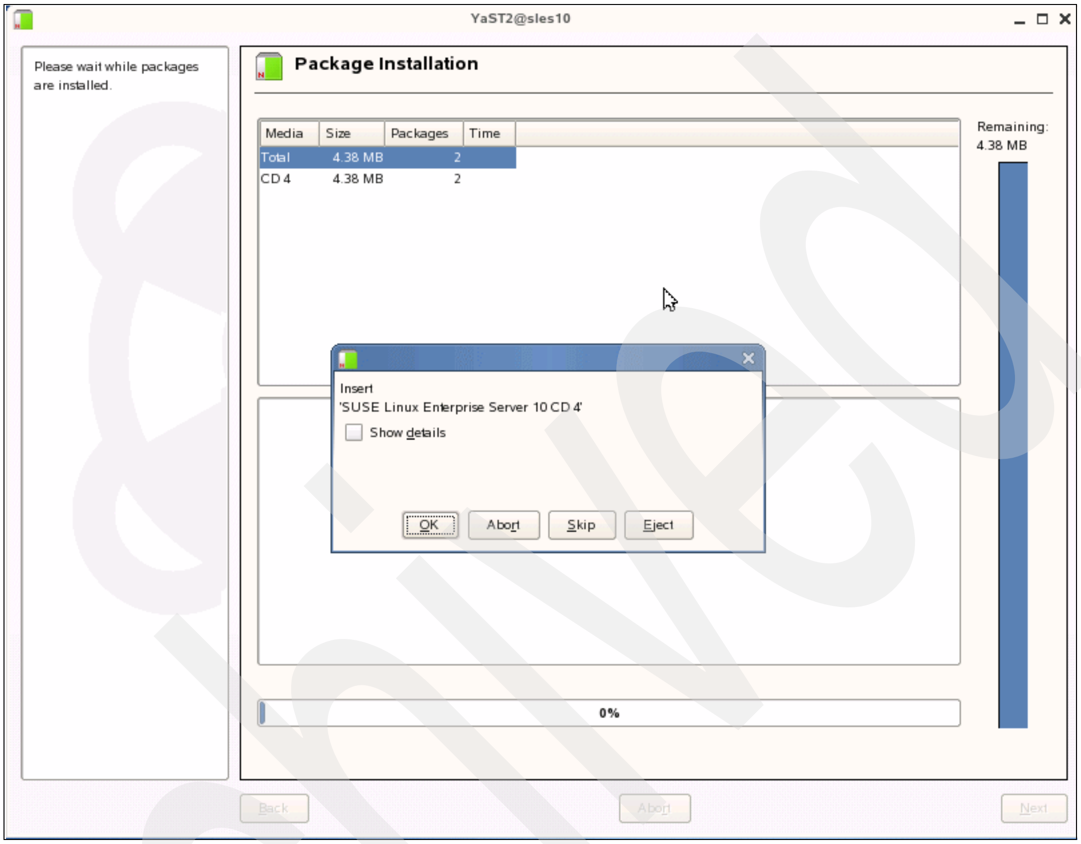
OpenS/WAN is an IPsec implementation which allows building Virtual Private Networks (VPNs). A typical VPN setup consists of two trusted networks connected over an insecure network, typically the Internet. OpenS/WAN allows you to create an encrypted tunnel through the insecure area. Unlike CIPE, it is interoperable with other operating systems or even router IPsec implementations

☐ Autocheck

Name	Disk Usage		Used	Free	Total
/		4%	1.6 GB	34.2 GB	35.8 GB

Figure 4-4 Selecting ipsec tools and openswan for install

5. A prompt to ready the SLES10 install media (CD 4) appears (Figure 4-5). Ready CD 4 in the YaST assigned install media. Click **OK** when ready. The install process will then complete. When prompted to install or remove more packages, click **No**. Close YaST when you are finished.



Please wait while packages are installed.

Media	Size	Packages	Time
Total	4.38 MB	2	
CD 4	4.38 MB	2	

Insert
'SUSE Linux Enterprise Server 10 CD 4'

Figure 4-5 Continue installing from the SLES10 install media

4.3.3 Configuring IPSec on Linux

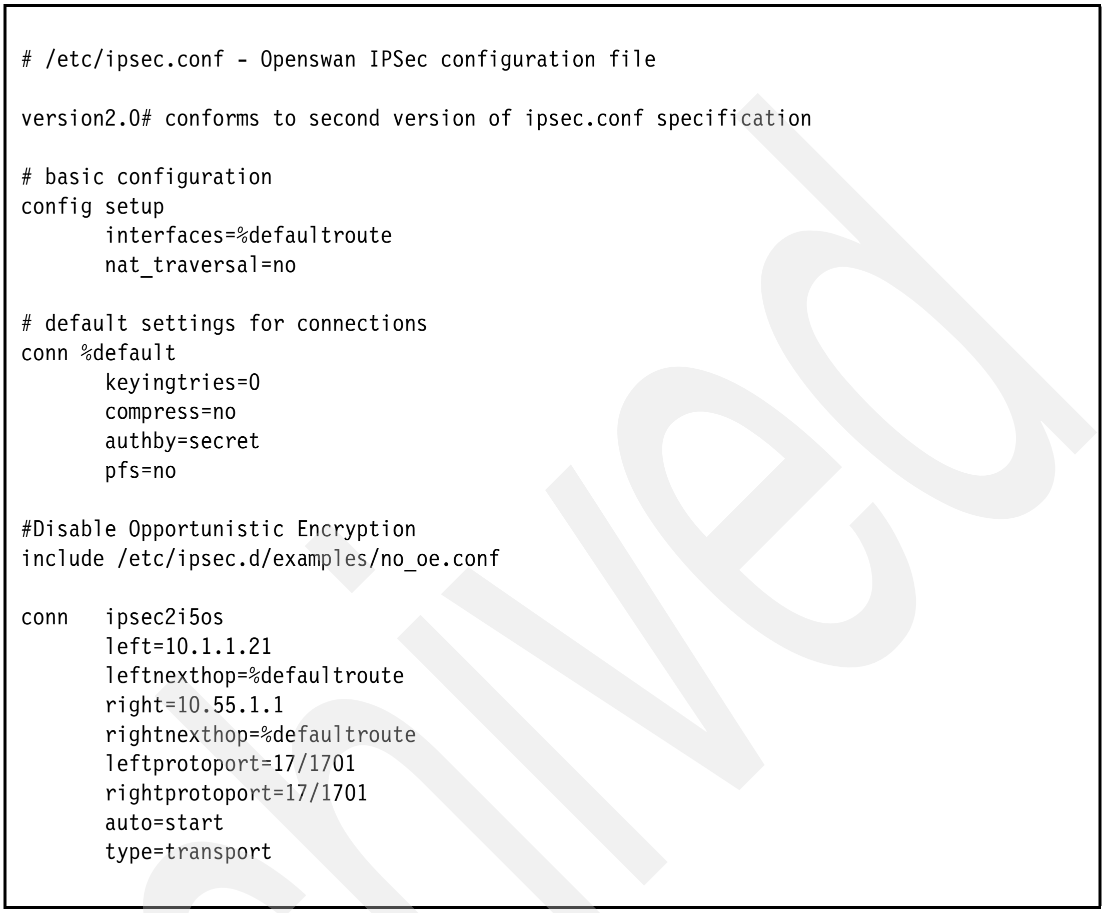
To configure an IPSec initiator, update the following two files to support our scenario:

1. The first file to update is /etc/ipsec.secrets with the initiator IP address followed by the responder IP address and the actual value of our preshared key (Figure 4-6).

```
10.1.1.21 10.55.1.1 : PSK "vpnclientkey"
```

Figure 4-6 /etc/ipsec.secrets

2. The second file to update is /etc/ipsec.conf. The lines with # are comment lines (Figure 4-7).



```
# /etc/ipsec.conf - Openswan IPSec configuration file

version2.0# conforms to second version of ipsec.conf specification

# basic configuration
config setup
       interfaces=%defaultroute
       nat_traversal=no

# default settings for connections
conn %default
       keyingtries=0
       compress=no
       authby=secret
       pfs=no

#Disable Opportunistic Encryption
include /etc/ipsec.d/examples/no_oe.conf

conn   ipsec2i5os
       left=10.1.1.21
       leftnexthop=%defaultroute
       right=10.55.1.1
       rightnexthop=%defaultroute
       leftprotoport=17/1701
       rightprotoport=17/1701
       auto=start
       type=transport
```

Figure 4-7 /etc/ipsec.conf

4.3.4 Starting the Linux IPSec initiator

To start IPSec initiator on Linux:

1. Type:

   ```
   sles10:/ # ipsec setup --start
   ```

   The response is:

   ```
   ipsec_setup: Starting Openswan IPSec 2.4.4...
   ipsec_setup: insmod /lib/modules/2.6.16.21-0.8-default/kernel/net/key/af_key.ko
   ipsec_setup: insmod /li/modules/2.6.16.21-0.8-default/kernel/net/ipv4/xfrm4_tunnel.ko
   ipsec_setup: insmod /lib/modules/2.6.16.21-0.8-default/kernel/net/xfrm/xfrm_user.ko
   ```

2. Because the /etc/ipsec.conf file contained the ipsec2i5os connection with the auto=start, you do not need to type:

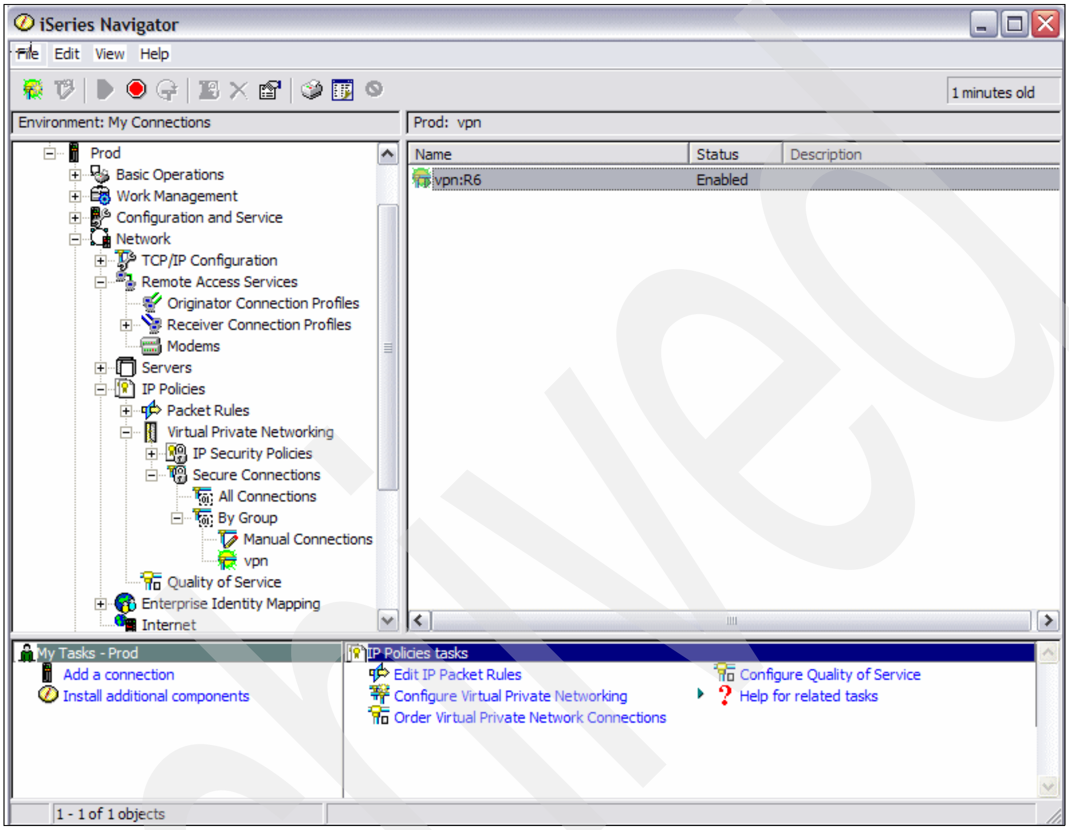
   ```
   sles10:/ # ipsec auto --up ipsec2i5os
   ```

If the ipsec2i5os connection had the value auto=add, then you need to separately type the above command.

4.3.5 Verifying IPSec IKE modes

The steps are:

1. To verify that our VPN connection is established on i5/OS, use the iSeries Navigator (Figure 4-8).



Name	Status	Description
vpn:R6	Enabled	

Figure 4-8 verify VPN connection using iSeries Navigator

2. To verify that our VPN connection is established on SLES10 view the system messages, type:

```
sles10:/ # tail -n 50 /var/log/messages
```

The parameter -n 50 tells the tail command to show the last 50 lines from the messages file.

To ensure the VPN is established, look for entry #1: STATE_MAIN_I4: ISAKMP SA established. This indicates the main mode (phase 1) IKE policy security association (SA) has completed successfully. Also look for an entry #2: STATE_QUICK_I2: sent QI2, IPSec SA established. This indicates the quick mode (phase 2) IKE policy security association (SA) has completed successfully. We have removed the date, time stamp, and server name from the system messages to improve readability. Note the two “SA established” for the modes in Figure 4-9.

```
ipsec_setup: ...Openswan IPsec started
ipsec_setup: Starting Openswan IPsec 2.4.4...
ipsec_setup: insmod /lib/modules/2.6.16.21-0.8-default/kernel/net/key/af_key.ko
ipsec_setup: insmod /lib/modules/2.6.16.21-0.8-default/kernel/net/ipv4/xfrm4_tunnel.ko
ipsec_setup: insmod /lib/modules/2.6.16.21-0.8-default/kernel/net/xfrm/xfrm_user.ko
pluto[4753]: added connection description "ipsec2i5os"
pluto[4753]: listening for IKE messages
pluto[4753]: adding interface eth0/eth0 10.1.1.21:500
pluto[4753]: adding interface lo/lo 127.0.0.1:500
pluto[4753]: adding interface lo/lo ::1:500
pluto[4753]: loading secrets from "/etc/ipsec.secrets"
pluto[4753]: "ipsec2i5os" #1: initiating Main Mode
ipsec__plutorun: 104 "ipsec2i5os" #1: STATE_MAIN_I1: initiate
ipsec__plutorun: ...could not start conn "ipsec2i5os"
pluto[4753]: "ipsec2i5os" #1: transition from state STATE_MAIN_I1 to state STATE_MAIN_I2
pluto[4753]: "ipsec2i5os" #1: STATE_MAIN_I2: sent MI2, expecting MR2
pluto[4753]: "ipsec2i5os" #1: I did not send a certificate because I do not have one.
pluto[4753]: "ipsec2i5os" #1: transition from state STATE_MAIN_I2 to state STATE_MAIN_I3
pluto[4753]: "ipsec2i5os" #1: STATE_MAIN_I3: sent MI3, expecting MR3
pluto[4753]: "ipsec2i5os" #1: Main mode peer ID is ID_IPV4_ADDR: '10.55.1.1'
pluto[4753]: "ipsec2i5os" #1: transition from state STATE_MAIN_I3 to state STATE_MAIN_I4
pluto[4753]: "ipsec2i5os" #1: STATE_MAIN_I4: ISAKMP SA established
{auth=OAKLEY_PRESHARED_KEY cipher=oakley_3des_cbc_192 prf=oakley_sha group=modp1024}
pluto[4753]: "ipsec2i5os" #2: initiating Quick Mode PSK+ENCRYPT+UP {using isakmp#1}
pluto[4753]: "ipsec2i5os" #2: IKE message has the Commit Flag set but Pluto doesn't
implement this feature; ignoring flag
pluto[4753]: "ipsec2i5os" #2: ignoring informational payload, type
IPSEC_RESPONDER_LIFETIME
pluto[4753]: "ipsec2i5os" #2: transition from state STATE_QUICK_I1 to state
STATE_QUICK_I2
pluto[4753]: "ipsec2i5os" #2: STATE_QUICK_I2: sent QI2, IPsec SA established
{ESP=>0xb712c76e <0x09c71be1 xfrm=3DES_0-HMAC_SHA1 NATD=none DPD=none}
pluto[4753]: "ipsec2i5os" #2: IKE message has the Commit Flag set but Pluto doesn't
implement this feature; ignoring flag
pluto[4753]: "ipsec2i5os" #2: message ignored because it contains an unexpected payload
type (ISAKMP_NEXT_HASH)
pluto[4753]: "ipsec2i5os" #2: sending encrypted notification INVALID_PAYLOAD_TYPE to
10.55.1.1:500
```

Figure 4-9 SA established

4.3.6 Configuring L2TP/PPP on Linux

The following files and configurations for each file are shown in the following figures. They are used to configure L2TP/PPP for our scenario:

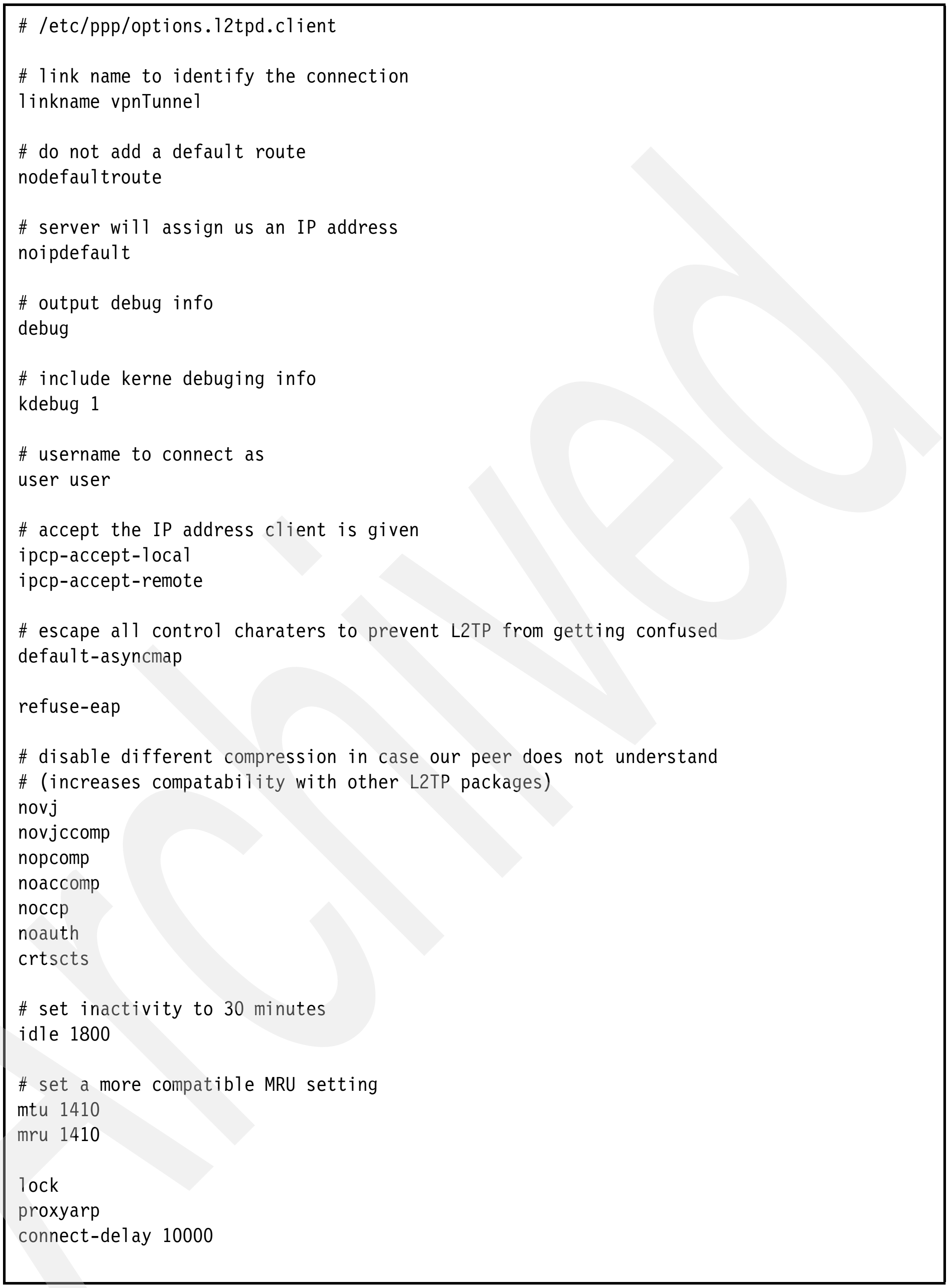
- /etc/ppp/chap-secrets (Figure 4-10)
- /etc/ppp/options.l2tpd (Figure 4-11)
- /etc/ppp/options.l2tpd.client (Figure 4-12 on page 75)
- /etc/l2tpd/l2tpd.conf (Figure 4-13 on page 76)

```
# Secrets for authentication using CHAP
# client       server          secret          IP addresses
user             *            "password"       192.168.100.0/24
*                user         "password"       192.168.100.0/24
```

Figure 4-10 /etc/ppp/chap-secrets

```
# /etc/ppp/options.l2tpd
linkname vpnTunnel
noipdefault
debug
kdebug 1
user user
default-asynchmap
nopcomp

ipcp-accept-local
ipcp-accept-remote
ms-dns  10.55.1.1
noccp
auth
crtscts
idle 1800
mtu 1400
mru 1400
nodefaultroute
debug
lock
connect-delay 5000
```

Figure 4-11 /etc/ppp/options.l2tpd



```
# /etc/ppp/options.l2tpd.client

# link name to identify the connection
linkname vpnTunnel

# do not add a default route
nodefaultroute

# server will assign us an IP address
noipdefault

# output debug info
debug

# include kerne debuging info
kdebug 1

# username to connect as
user user

# accept the IP address client is given
ipcp-accept-local
ipcp-accept-remote

# escape all control charaters to prevent L2TP from getting confused
default-asyncmap

refuse-eap

# disable different compression in case our peer does not understand
# (increases compatability with other L2TP packages)
novj
novjccomp
nopcomp
noaccomp
noccp
noauth
crtscts

# set inactivity to 30 minutes
idle 1800

# set a more compatible MRU setting
mtu 1410
mru 1410

lock
proxyarp
connect-delay 10000
```

Figure 4-12 /etc/ppp/options.l2tpd.client

The lines beginning with a semi-colon are comment lines.

```
; /etc/l2tpd/l2tpd.conf
; This is a minimal sample l2tpd configuration file for use
; with L2TP over IPSec.
;
; The idea is to provide an L2TP daemon to which remote Windows L2TP/IPSec
; clients connect. In this example, the internal (protected) network
; is 192.168.1.0/24.  A special IP range within this network is reserved
; for the remote clients: 192.168.1.128/25
; (i.e. 192.168.1.128 ... 192.168.1.254)
;
; The listen-addr parameter can be used if you want to bind the L2TP daemon
; to a specific IP address instead of to all interfaces. For instance,
; you could bind it to the interface of the internal LAN (e.g. 192.168.1.98
; in the example below). Yet another IP address (local ip, e.g. 192.168.1.99)
; will be used by l2tpd as its address on pppX interfaces.

[global]
port = 1701
access control = no
auth file = /etc/l2tp/l2tp-secrets

[lns default]
ip range = 10.1.1.200-10.1.1.220
local ip = 10.1.1.21
require chap = yes
refuse pap = yes
require authentication = yes
name = LinuxVPNserver
ppp debug = yes
pppoptfile = /etc/ppp/options.l2tpd
length bit = yes

; Connect as client to a server 10.55.1.1

[lac i5os]
lns = 10.55.1.1
require chap = yes
refuse pap = yes
redial=yes
require authentication = yes
; Name should be the username in the PPP authentication
name = user
ppp debug = yes
pppoptfile = /etc/ppp/options.l2tpd.client
length bit = yes
```

Figure 4-13 /etc/l2tpd/l2tpd.conf

4.3.7 Starting the Linux L2TP connection

To start the program l2tpd in the background:

1. Type:

   ```
   sles10:/ # l2tpd
   ```

   If you receive the message “This binary does not support kernel L2TP”, ignore it. This is an informational message only.

2. To run l2tpd interactively, type:

   ```
   sles10:/ # l2tpd -D
   ```

3. To initiate the L2TP connection definitions, type:

   ```
   sles10:/ # echo “c i5os” > /var/run/l2tp-control
   ```

   This tells the l2tpd daemon to connect the connection named i5os.

4. At this point, obtain an IP address for the new ppp0 interface. To begin routing remote traffic over IPSec using the new ppp0 interface, type:

   ```
   sles10:/ # route add -net 0.0.0.0 dev ppp0
   ```

4.3.8 Verifying the L2TP connection

To see if the L2TP/PPP connection via IPSec is successful:

1. Type:

   ```
   sles10:/ # ifconfig
   ```

   If L2TP/PPP is successful, you see an interface named ppp0 in the list of interfaces available.

2. To verify the L2TP/PPP traffic is protected by ESP start tcpdump, watch the traffic from/to the i5/OS VPN server address 10.55.1.1.

   ```
   sles10:/ # tcpdump host 10.55.1.1
   ```

3. Now start traffic via our related ppp0 address (this time we were issued 192.168.100.202). To test ICMP traffic with ESP, type:

   ```
   sles10:/ # ping 192.168.100.55
   ```

   The tcpdump shows the following entries (Figure 4-14) when traffic is protected by encapsulated security protocol (ESP).

```
hh:mm:ss.ssssss IP sles10.itso.com > i5os.itso.com: ESP(spi=0x485d7113,
seq=ox14e), length nnn

hh:mm:ss.ssssss IP i5os.itso.com > sles10.itso.com: ESP(spi=0x8b22a8bd,
seq=0x152), length nnn
```

Figure 4-14 tcpdump view of ESP protected network traffic

   Notice that there are two different *security parameter index* (SPI) IDs in use. One is for inbound traffic and the other is for outbound traffic. The SPI tells the kernel which encryption rule and algorithm to use on the traffic tagged with SPI.

4. Now test a TCP/IP application.

   ```
   sles10:/ # telnet 192.168.100.55
   ```

You see similar ESP packets again going back and forth between Linux and i5/OS (Figure 4-14).

4.3.9 Stopping the Linux L2TP connection

To stop our l2TP connection:

1. Type:

   ```
   sles10:/ # echo “d i5os” > /var/run/l2tp-control
   ```

   This disconnects the i5/OS L2TP/PPP connection, removed the default route assigned to the ppp0 interface, and removes the ppp0 interface.

2. To end l2tpd when running interactively, press **Ctrl+c**.
3. To end l2tpd when running in the background, type:

   ```
   sles10:/ # killall l2tpd.
   ```

4.3.10 Stopping the Linux IPSec connection

To stop the ipsec2i5os connection:

1. Type:

   ```
   sles10:/ # ipsec auto --down ipsec2i5
   ```

2. To stop the IPSec Openswan subsystem, type:

   ```
   sles10:/ # ipsec setup --stop
   ```

4.4 Tips and techniques

It is important to verify that your security policy is continually maintained.

For information about security, see the *Networking security* topic in the V5R4 Information Center at:

http://publib.boulder.ibm.com/infocenter/iseries/v5r4/index.jsp?topic=/rzahg/rzahgicinet2.htm

5

VPN connection with Windows XP clients

This chapter describes how to implement secure connections for travelling employees and virtual office employees that need access to the corporate office. The remote users (clients) access the corporate office i5/OS system (server) using a PC with Microsoft® Windows XP.

Windows XP does not support VPN/IPSec host-to-gateway connections; therefore, to achieve the gateway functionality, this scenario requires using the *Layer 2 Tunneling Protocol* (L2TP) in addition to IPSec. For that same reason, the VPN connection in the i5/OS system is configured as a host-to-host connection.

L2TP allows remote clients to get an IP address from a pool of addresses defined at the gateway system and therefore, to communicate with all hosts (IP addresses) that are configured in the L2TP profile. This extends the capabilities of the VPN connection from host-to-host to host-to-gateway.

You can use a combination of VPN connections and L2TP profiles to define which networks are accessed by the remote user.

Note: The scenario described in this chapter refers to a VPN connection between a Windows XP client and an i5/OS gateway system. However, this particular configuration is also applicable to VPN connections started from Windows Server® 2003 systems, when they play the role of VPN initiator (client) and the i5/OS acts as the VPN responder (server).

5.1 Scenario description

This scenario describes two alternatives for connecting the client to the Internet:

- Connection over a dedicated link, for example, a dedicated high speed link (DSL) or cable modem. This is a good option for small offices or virtual offices where employees telecommute from their home.
- Connection over a dial-up PPP link. This option is suitable for travelling employees that dial to the Internet service provider (ISP) over a telephone line to establish the connection.

> **Note:** In both cases, the ISP assigns the client a dynamic (random) IP address.

Figure 5-1 provides an overview of the scenario described in this chapter.

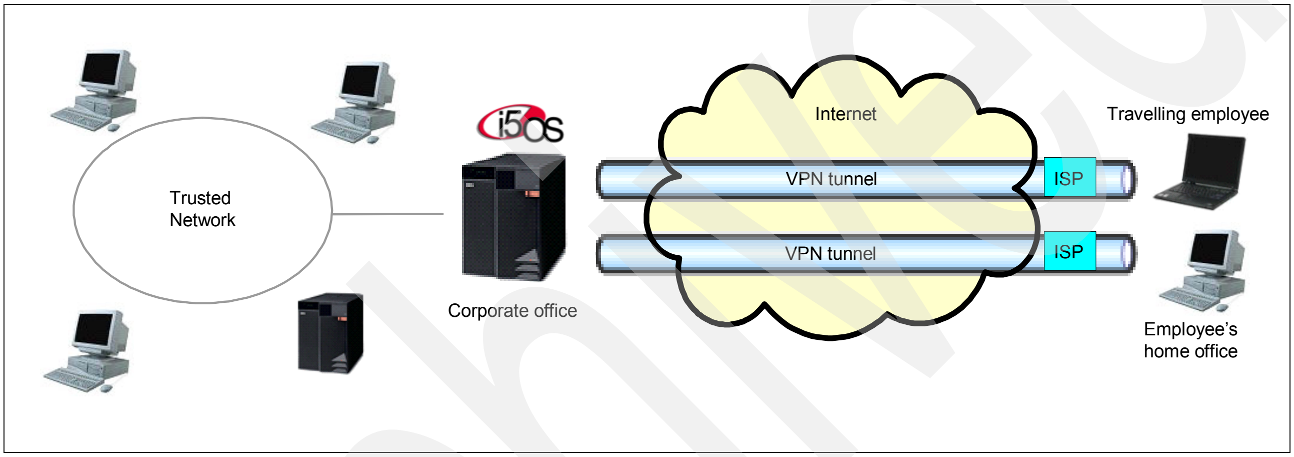


Figure 5-1 Virtual office and travelling employees connected to corporate office over a VPN tunnel

5.1.1 Scenario objectives

The objectives of this scenario are:

- IPSec *must* protect all traffic between the remote Windows XP clients and the corporate gateway i5/OS system.
- The company's private address space *must* assign remote clients an internal IP address. The company's policies control access to the company's resources for internal hosts.
- The i5/OS VPN gateway at the corporate office uses proxy ARP to route traffic between the remote clients and the internal network.

5.1.2 Scenario characteristics

The characteristics of this scenario are:

- Traveling employees access the corporate office by dialing an ISP Point of Presence (PoP).
- Telecommuters and small remote offices access the corporate office by a DSL or cable modem connection to the ISP.
- The ISP assigns dynamic IP addresses to the remote clients. In this scenario, we are assuming that the ISP has assigned an IP address of 10.1.1.4 to the client. This is not a real public address. We are using it for example purposes.

- The corporate office gateway runs on i5/OS V5R4.
- The internal corporate network IP address is 192.168.100.0/24.
- The private IP address for the corporate gateway system is 192.168.100.10.
- The corporate gateway system accesses the Internet using IP address 10.55.1.1. This is not a real public address. We are using it for example purposes).
- The VPN connections is only started from the remote Windows XP systems, playing the VPN initiator role.
- When the VPN connection is established, the corporate gateway system assigns a private IP address to the remote client from the pool of addresses defined in the L2TP profile.

Note: To simplify this scenario's configuration, a security gateway between the i5/OS system at the corporate office and the Internet is not shown, but it is assumed.

Figure 5-2 shows the network configuration used in this scenario.

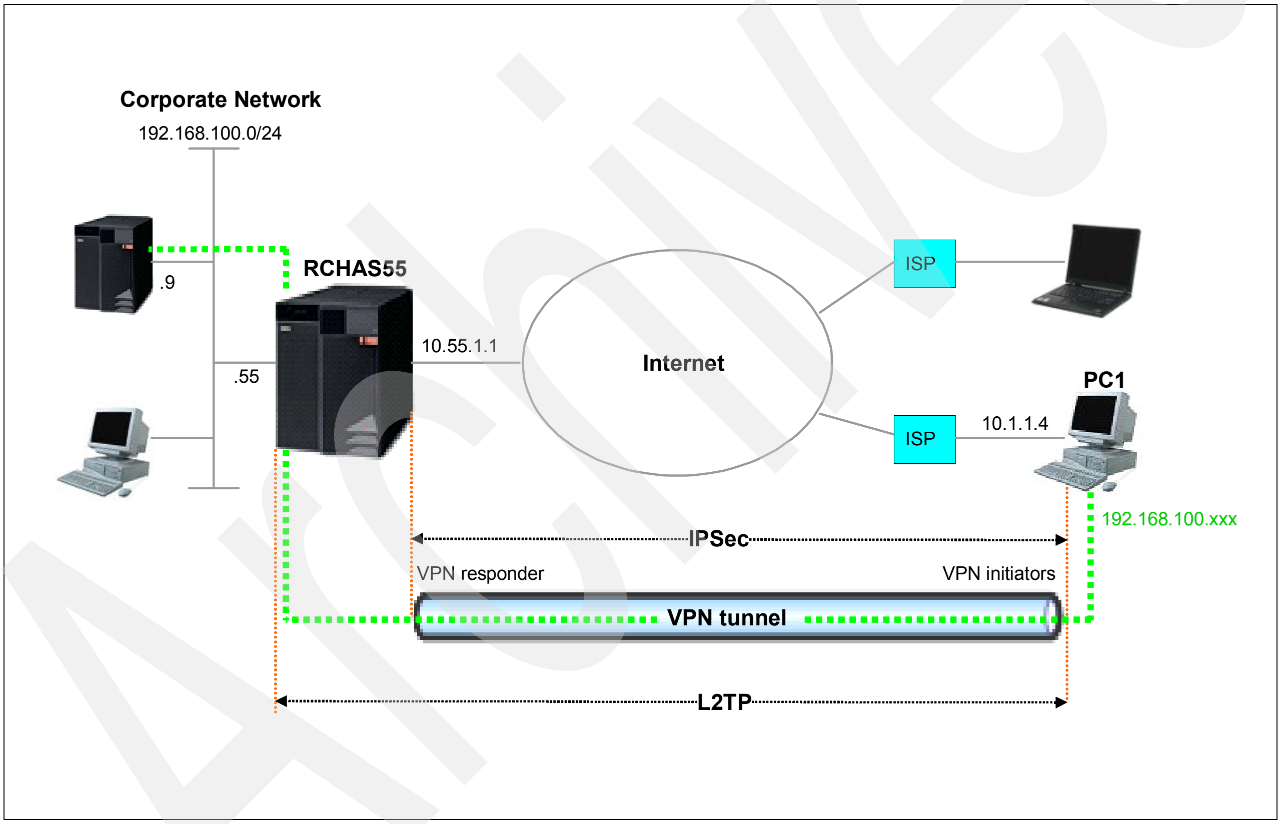


Figure 5-2 Network configuration for VPN connection between i5/OS and Windows clients

5.1.3 Software prerequisites

The following software requirements are used for the VPN connection described in this scenario.

i5/OS system

Th requirements are:

- i5/OS V5R4 (5722-SS1)
- Digital Certificate Manager V5R4 (5722-SS1 option 34)
- TCP/IP Connectivity Utilities for i5/OS V5R4 (5722-TC1)
- iSeries Access for Windows V5R4 (5722-XE1)
- iSeries Navigator

Windows XP system

The requirements are:

- Microsoft Windows XP Professional Version 2002 SP2
- Microsoft Management Console 2.0 Version 5.1 SP2
  - Snap-in for IPSecurity Monitor

5.2 Planning for implementation

The following planning checklists illustrate the type of information you need before you begin configuring VPN. All answers on the prerequisite checklist must be "Yes" before you proceed with the VPN setup.

Table 5-1 System requirements (i5/OS system)

Prerequisite checklist (i5/OS system)	Answers
Is your operating system i5/OS V5R4 (5722-SS1)?	Yes
Is iSeries Access for Windows (5722-XE1) installed?	Yes
Is iSeries Navigator installed?	Yes
Is the Network subcomponent of iSeries Navigator installed?	Yes
Is TCP/IP Connectivity Utilities for i5/OS (5722-TC1) installed?	Yes
Have you applied the latest program temporary fixes (PTFs)?	Yes
Did you set the retain server security data (QRETSVRSEC *SEC) system value to 1?	Yes
Is TCP/IP configured on your i5/OS system (including IP interfaces, routes, local host name, and local domain name)?	Yes
Is normal TCP/IP communications established between the required endpoints?	Yes
If the VPN tunnel traverses firewalls or routers that implement IP packet filtering, do the firewall or router filter rules support AH and ESP protocols?	Yes
Are the firewalls configured to enable IP forwarding?	Yes
Do you have the proper authorities to administer packet rules on your i5/OS system?	Yes

Table 5-2 VPN configuration on the i5/OS system

VPN configuration checklist (i5/OS system)	Answers
What type of VPN connection would you like to create?	host-to-host

VPN configuration checklist (i5/OS system)	Answers
What name will you assign to the dynamic-key group (individual VPN data connection between pair of endpoints)?	VPNC01
What Internet Key Exchange (IKE) policy do you want to use to protect your keys?	Balanced security and performance
Are you using certificates to authenticate the connection? If no, what is the preshared key? **Note:** All clients must use the same preshared key.	No certificates; preshared key is VPNCLIENTKEY
What is the identifier (IP type and IP address) of the local key server?	IP version 4 10.55.1.1
What is the identifier (IP type and IP address) of the local connection endpoint?	IP version 4 10.55.1.1
What is the identifier (IP type and IP address) of the remote key server?	IP version 4 Any address
What is the identifier (IP type and IP address) of the remote connection endpoint?	IP version 4 Any address
What are the ports and protocols of the data that this connection will protect?	Any
What data policy do you want to use to protect the data?	Balanced security and performance
What characteristics are used for IKE Phase 1 policy (key protection)? a. Authentication method b. Encryption algorithm c. Hash algorithm d. Diffie-Hellman group e. Keys lifetime f. IKE negotiation mode	a). Preshared key b). DES and 3DES c). MD5 and SHA d). Group 1 e). 1 day f). Main mode
What characteristics are used for IKE Phase 2 policy (data protection)? a. Protocol b. Encapsulation mode c. Keys lifetime d. Keys life size limit e. Diffie-Hellman perfect secrecy used?	a). ESP b). Transport c). 1 hour d). No size limit e). No
To which interfaces on the local system does this connection apply?	ETHLIN1

Table 5-3 L2TP configuration on the i5/OS system

L2TP configuration checklist (i5/OS system)	Answers
What is the name of the L2TP profile?	L2TPLNS01
What is the mode type of the L2TP profile	L2TP terminator
What is the local tunnel endpoint IP address?	10.55.1.1
What is the name of the virtual L2TP line description?	L2TPLNS01
Will the system be using tunnel keep alive messages?	Yes
What is the local host name?	RCHAS55
What is the maximum number of sessions for this L2TP profile?	5
What is the inactivity time-out for remote access users?	No time-out

L2TP configuration checklist (i5/OS system)	Answers
What is the local IP address of the i5/OS system on the local network?	192.168.100.10
What is the IP address pool for remote access users?	192.168.100.200 - 192.168.100.204
What protocol is used to authenticate remote access users?	CHAP-MD5
What is the name of the validation list used to authenticate remote access users?	L2TPVL001
What user names and passwords will be added to this validation list? **Note:** User names and passwords are used for CHAP authentication. Make them unique for each client.	craig/itsasecret ... ...
Will the system allow remote users to access other networks (IP forwarding)?	Yes

Table 5-4 VPN configuration on the Windows XP system

VPN configuration checklist (Windows XP system)	Answers
What name will you assign to the new VPN connection?	rchas55
What is the IP address of the VPN server?	10.55.1.1
What is the type of this connection?	L2TP IPSec VPN
What are the IPSec settings for this connection (for example, authentication method for IKE Phase 1)? **Note:** The preshared key must be the same as on the i5/OS system.	Preshared key: VPNCLIENTKEY
Does the VPN connection require dialing another connection first?	No
What user name and password will be used to start this connection? **Note:** User names and passwords used for CHAP authentication. Make them unique for each client.	craig/itsasecret
Is this connection available to all users or only for a specific user?	All users

5.2.1 Implementation task summary

This scenario describes the following tasks:

- “Configuring the VPN connection on the i5/OS system” on page 84
- “Verifying the system-wide VPN responding policy on the i5/OS system” on page 92
- “Configuring the L2TP profile on the i5/OS system” on page 94
- “Configuring the VPN connection on the Windows XP system” on page 105
- “Starting the VPN server on the i5/OS system (responder)” on page 113
- “Starting the VPN connection on the Windows XP system (initiator)” on page 117

5.3 Step-by-step set up guide

The following sections describe steps you need to configure and activate the VPN connection for this scenario.

5.3.1 Configuring the VPN connection on the i5/OS system

This section shows how to use the iSeries Navigator functions to create and configure the VPN connection on the i5/OS system (VPN responder).

You create and configure the VPN connection by using the New Connections wizard of the iSeries Navigator. To perform this task, use the information from your VPN planning checklist (Table 5-2 on page 82). The steps are:

1. Start an iSeries Navigator session: **Start** → **Programs** → **IBM iSeries Access for Windows** → **iSeries Navigator**.
2. In the iSeries Navigator window, select the i5/OS system that you will use as the VPN initiator by clicking its corresponding icon. In this example, we are using system RCHAS55.
3. If the Sign-on to iSeries prompt appears, enter your user ID and password and then click **OK** to complete the sign-on.
4. In the navigation pane of the iSeries Navigator, expand **My Connections** → **servername** → **Network** → **IP Policies**. The expanded window is similar to Figure 5-3.

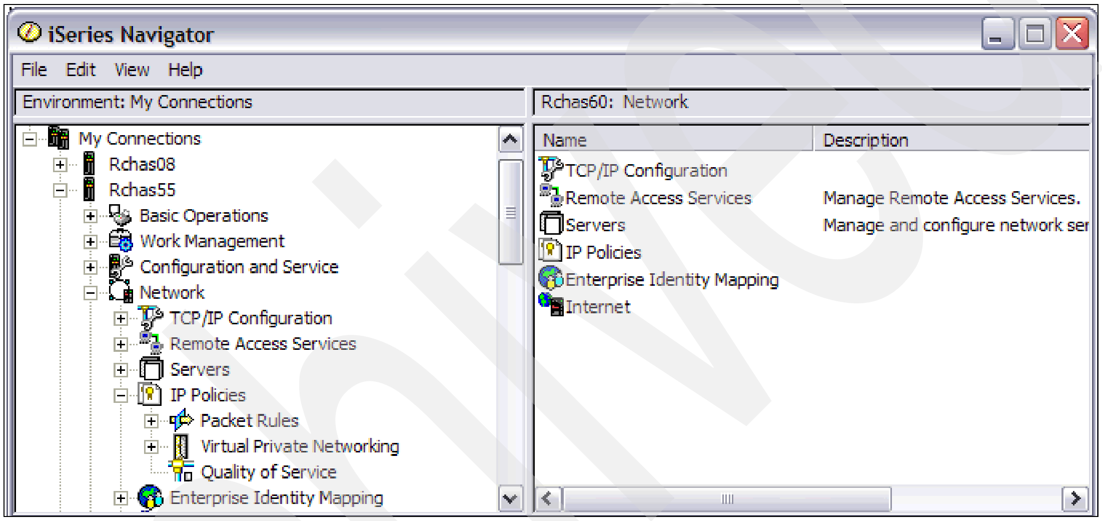


Figure 5-3 Expanded window of IP Policies tasks

5. In the expanded navigation pane, right-click **Virtual Private Networking**.
6. In the context menu for Virtual Private Networking, click **New Connection** (Figure 5-4).

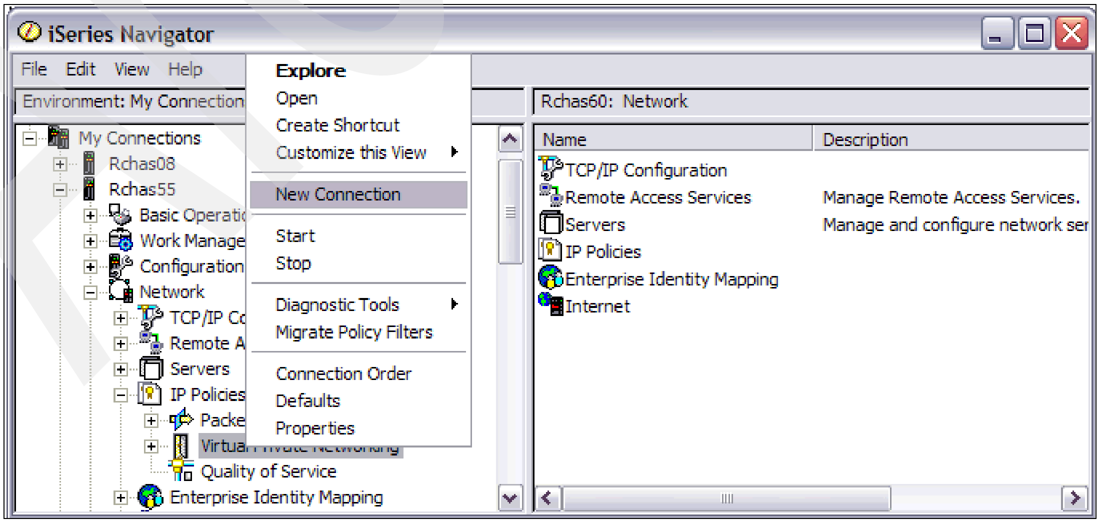
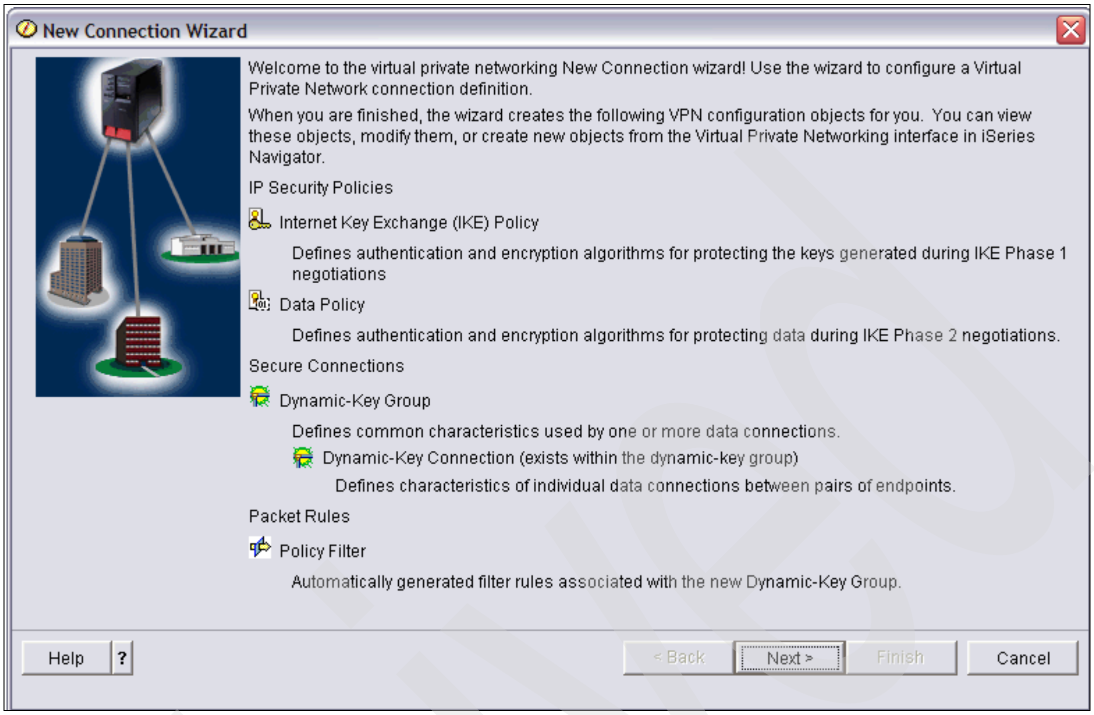


Figure 5-4 Context menu for Virtual Private Networking - New Connection

7. The welcome window of the New Connection wizard displays (Figure 5-5).



Welcome to the virtual private networking New Connection wizard! Use the wizard to configure a Virtual Private Network connection definition.

When you are finished, the wizard creates the following VPN configuration objects for you. You can view these objects, modify them, or create new objects from the Virtual Private Networking interface in iSeries Navigator.

IP Security Policies

Internet Key Exchange (IKE) Policy

Defines authentication and encryption algorithms for protecting the keys generated during IKE Phase 1 negotiations

Data Policy

Defines authentication and encryption algorithms for protecting data during IKE Phase 2 negotiations.

Secure Connections

Dynamic-Key Group

Defines common characteristics used by one or more data connections.

Dynamic-Key Connection (exists within the dynamic-key group)

Defines characteristics of individual data connections between pairs of endpoints.

Packet Rules

Policy Filter

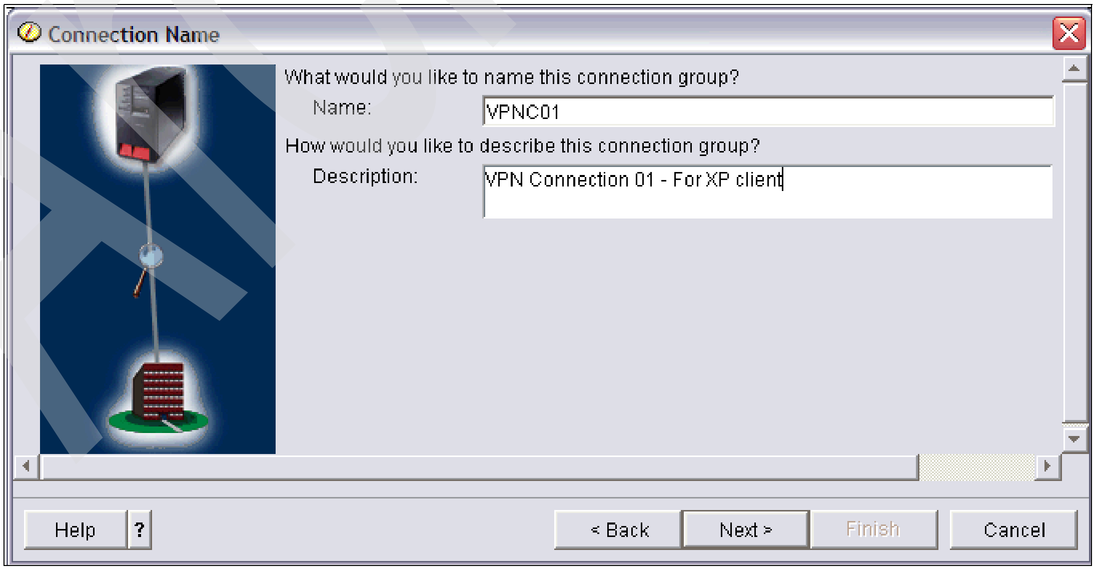
Automatically generated filter rules associated with the new Dynamic-Key Group.

Figure 5-5 New Connection Wizard - Welcome window

8. Review the Welcome window of the wizard for information about the objects that the wizard will create and click **Next** to begin the wizard.

9. When the Connection Name window appears, take the following actions:

   a. In the Name field, enter `VPNC01`.
   b. Optionally, specify a description for this connection group.
   c. After you have enter this information, click **Next** to continue (Figure 5-6).



What would you like to name this connection group?

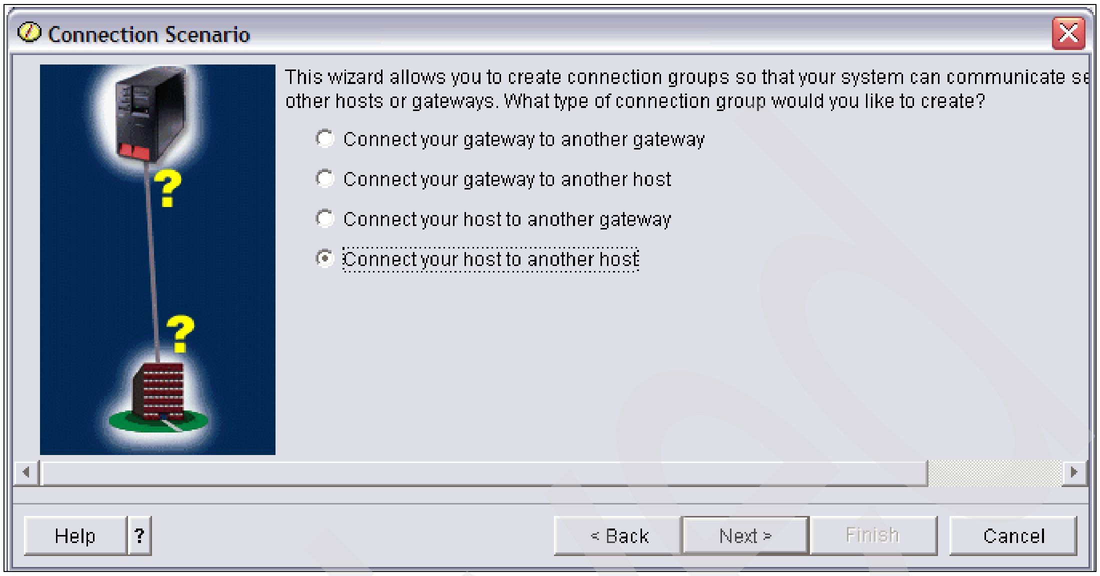
Name: VPNC01

How would you like to describe this connection group?

Description: VPN Connection 01 - For XP client

Figure 5-6 New Connection Wizard - Connection Name window

10. When the Connection Scenario window appears, select **Connect your host to another host** and click **Next** to continue (Figure 5-7).



Connection Scenario

This wizard allows you to create connection groups so that your system can communicate se
other hosts or gateways. What type of connection group would you like to create?

○ Connect your gateway to another gateway

○ Connect your gateway to another host

○ Connect your host to another gateway

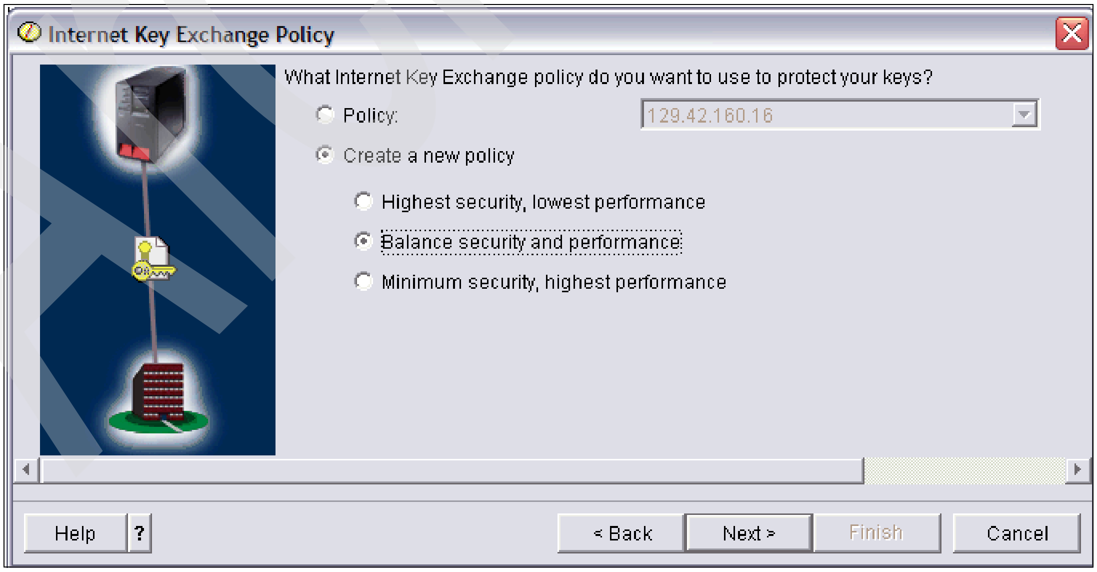
● Connect your host to another host

Figure 5-7 New Connection Wizard - Connection Scenario window

11. When the Internet Key Exchange Policy window displays in that window (Figure 5-8):

   a. Select **Create a new policy**.
   b. Select **Balance security and performance**.
   c. Click **Next** to continue.

> **Note:** If you get an error message stating “The certificate request could not be processed”, ignore it because in this scenario you are not using certificates for the key exchange in the VPN.



Internet Key Exchange Policy

What Internet Key Exchange policy do you want to use to protect your keys?

○ Policy: 129.42.160.16

● Create a new policy

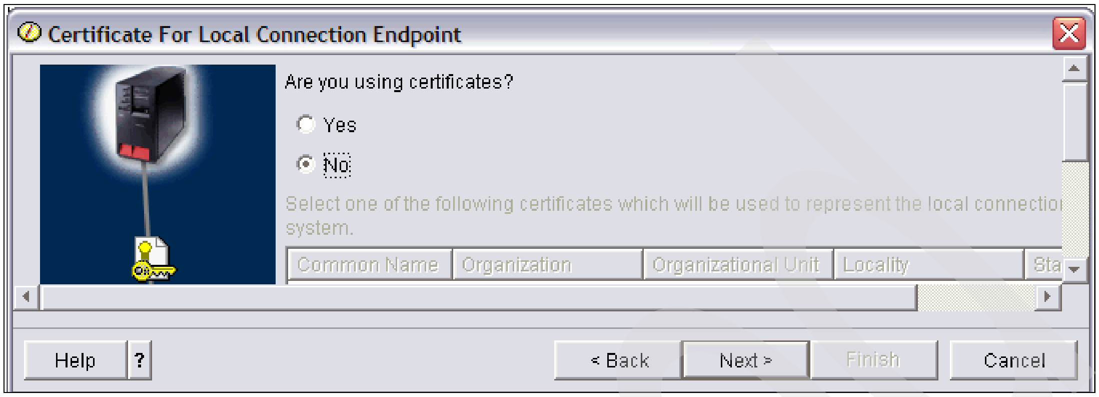
○ Highest security, lowest performance

● Balance security and performance

○ Minimum security, highest performance

Figure 5-8 New Connection Wizard - Internet Key Exchange Policy window

12. Optional step: If you have certificates installed on your i5/OS system, you see the Certificate for Local Connection Endpoint window (Figure 5-9). If this window displays, select **No** to indicate that you will not use certificates to authenticate the VPN connection and click **Next**.



Certificate For Local Connection Endpoint

Are you using certificates?

○ Yes

● No

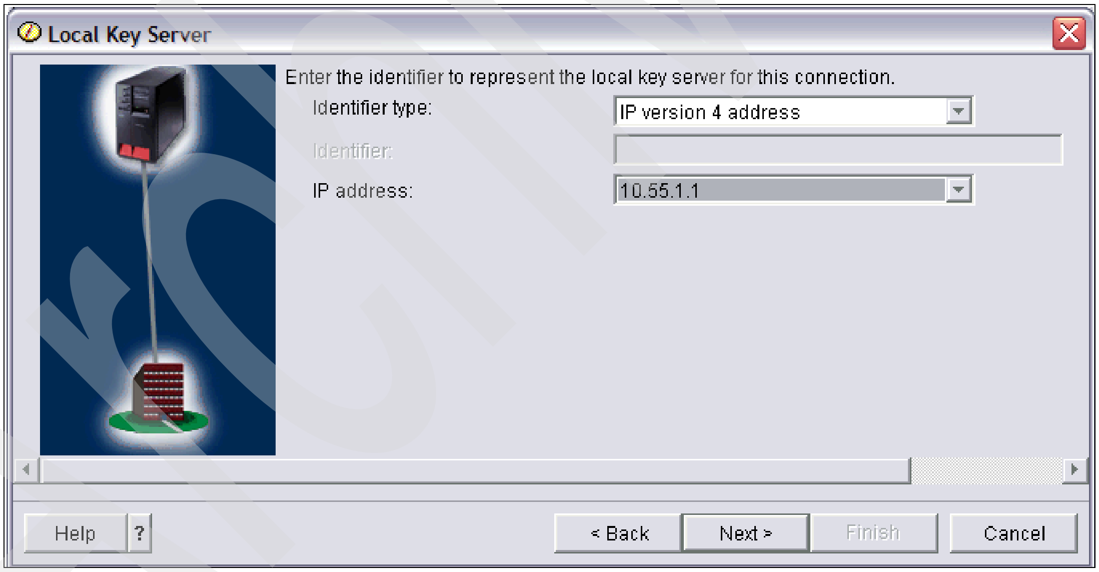
Select one of the following certificates which will be used to represent the local connectio system.

Common Name	Organization	Organizational Unit	Locality	Sta

Figure 5-9 New Connection Wizard - Certificate For Local Connection Endpoint window

13. When the Local Key Server window appears (Figure 5-10):

   a. In the Identifier type field, select **IP version 4 address**.
   b. In the IP address, select `10.55.1.1`.
   c. After these selections, click **Next**.



Local Key Server

Enter the identifier to represent the local key server for this connection.

Identifier type: IP version 4 address

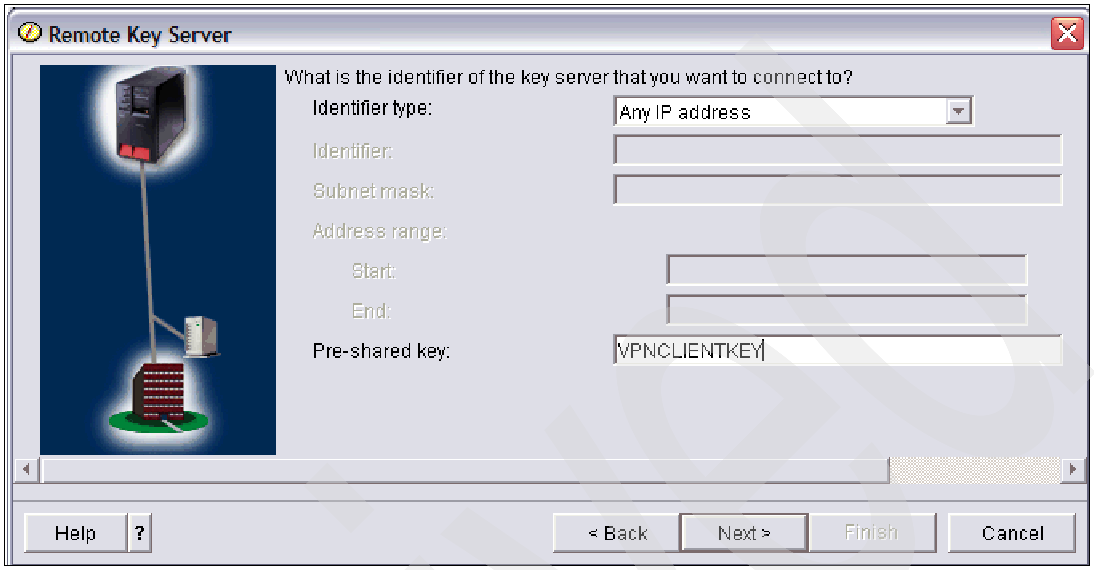
Identifier:

IP address: 10.55.1.1

Figure 5-10 New Connection Wizard - Local Key Server window

14. When the Remote Key Server window appears (Figure 5-11):

a. In the Identifier type field, select **Any IP address**.
b. In the Pre-shared key field, enter `VPNCLIENTKEY`.
c. After you have entered this information, click **Next** to continue.


Remote Key Server

What is the identifier of the key server that you want to connect to?

Identifier type: Any IP address

Identifier:

Subnet mask:

Address range:

Start:

End:

Pre-shared key: VPNCLIENTKEY

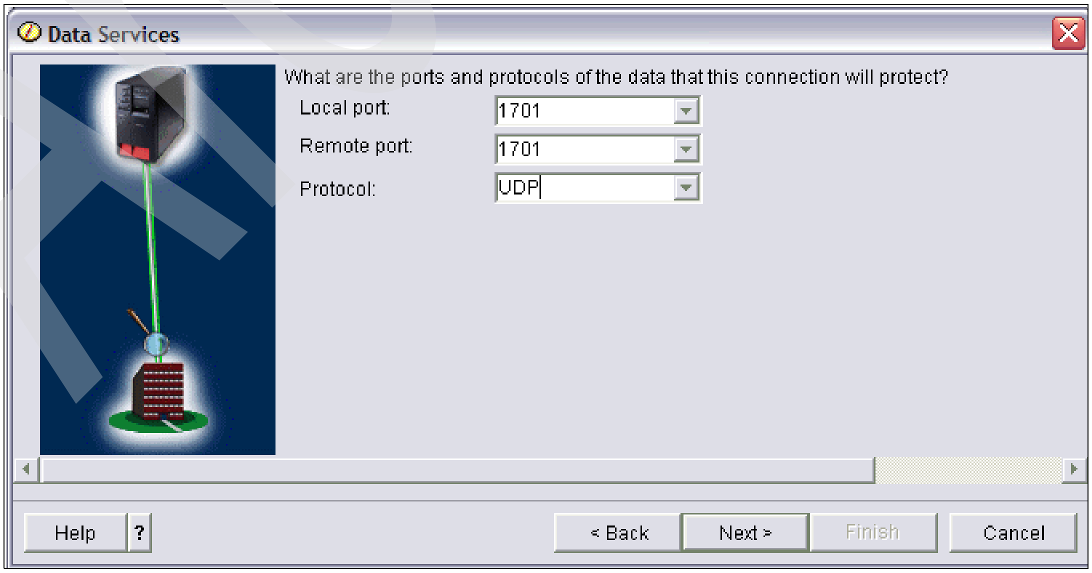
Figure 5-11 New Connection Wizard - Remote Key Server window

15. When the Data Services window displays (Figure 5-12):

a. In Local port field, enter `1701`.
b. In Remote port field, enter `1701`.
c. In Protocol field, select **UDP.**

You need to specify these values because LT2P uses UDP port 1701. This setting ensures that only L2TP traffic is allowed and protected by this VPN connection. As mentioned at the beginning of this chapter, the gateway functionality in this scenario is accomplished by using an L2TP tunnel protected by an IPSec VPN connection.

d. Click **Next** to continue.


Data Services

What are the ports and protocols of the data that this connection will protect?

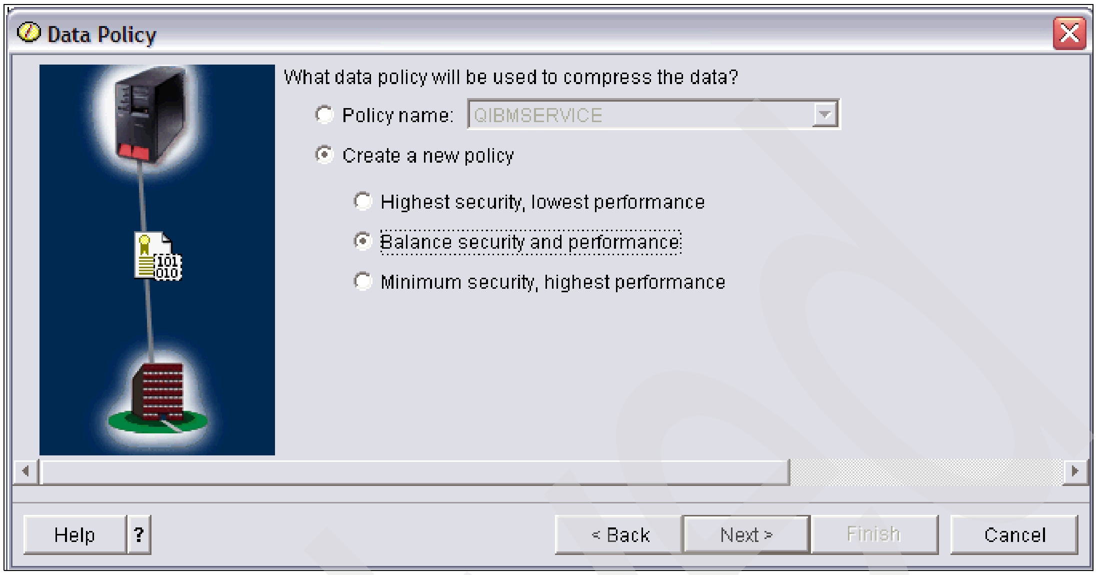
Local port: 1701

Remote port: 1701

Protocol: UDP

Figure 5-12 New Connection Wizard - Data Services window

16. The Data Policy window displays (Figure 5-13). Select **Create a new policy**, select **Balance security and performance**, and click **Next**.



Data Policy

What data policy will be used to compress the data?

○ Policy name: QIBMSERVICE

● Create a new policy

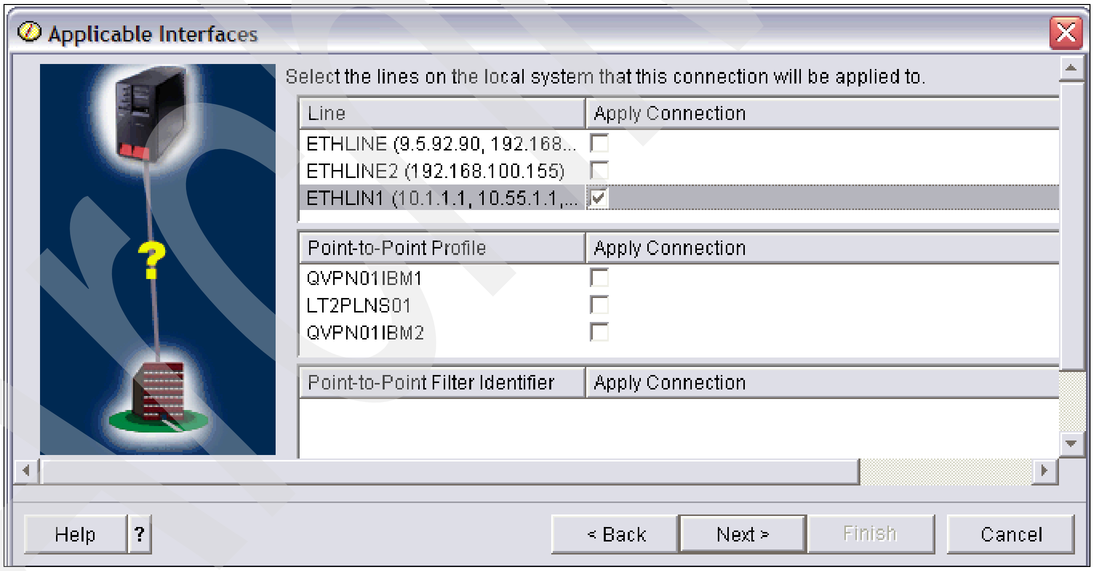
○ Highest security, lowest performance

● Balance security and performance

○ Minimum security, highest performance

Figure 5-13 New Connection Wizard - Data Policy window

17. The Applicable Interfaces window appears (Figure 5-14). From the list of lines and interfaces, select **ETHLIN1** by clicking its corresponding check mark box.



Applicable Interfaces

Select the lines on the local system that this connection will be applied to.

Line	Apply Connection
ETHLINE (9.5.92.90, 192.168...	□
ETHLINE2 (192.168.100.155)	□
ETHLIN1 (10.1.1.1, 10.55.1.1,...	☑

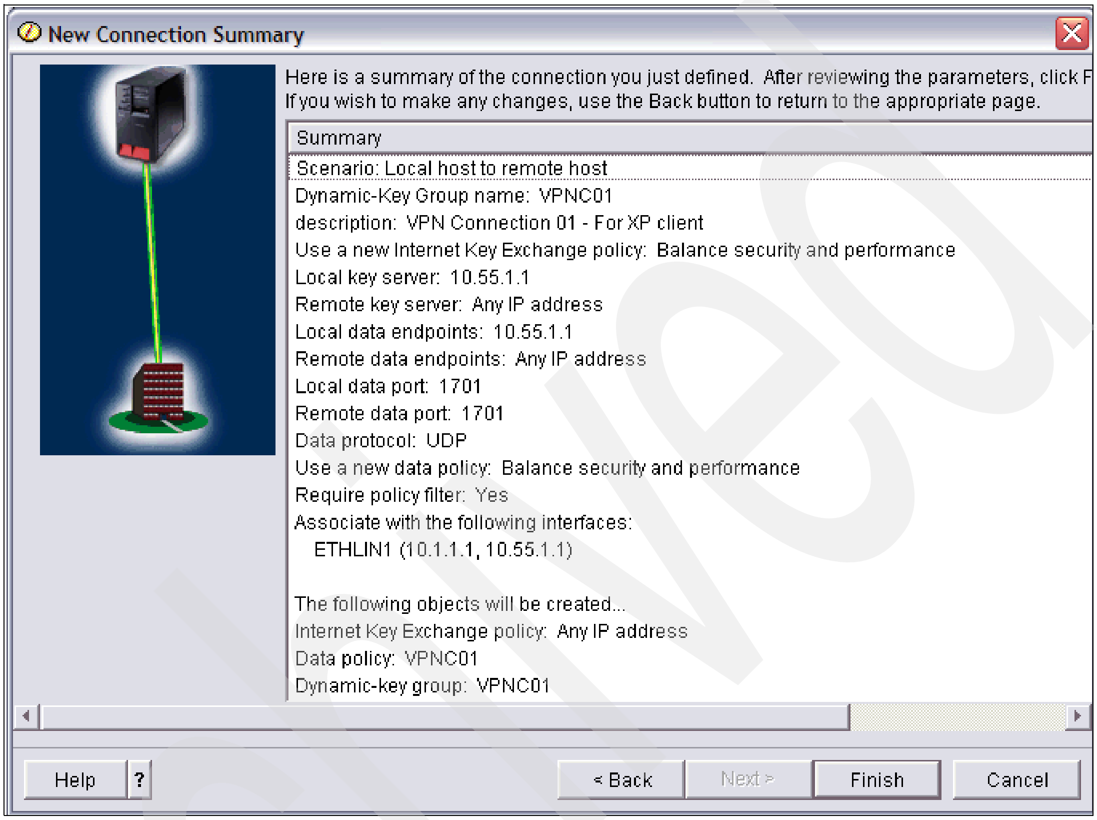
Point-to-Point Profile	Apply Connection
QVPN01IBM1	□
LT2PLNS01	□
QVPN01IBM2	□

Point-to-Point Filter Identifier	Apply Connection

Figure 5-14 New Connection Wizard - Applicable Interfaces window

18.At this point, you have specified all the parameters needed by the wizard and they are displayed on the New Connection Summary window (Figure 5-15). Review them to ensure they are correct.

If you need to change something, click **Back** to go to the previous windows and make the corrections. When all the attributes are correct, click **Finish** to complete the configuration.



Here is a summary of the connection you just defined. After reviewing the parameters, click F
If you wish to make any changes, use the Back button to return to the appropriate page.

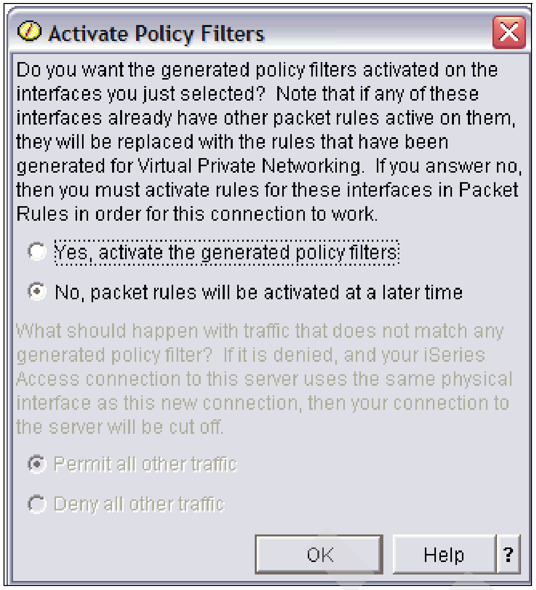
Summary

Scenario: Local host to remote host
Dynamic-Key Group name: VPNC01
description: VPN Connection 01 - For XP client
Use a new Internet Key Exchange policy: Balance security and performance
Local key server: 10.55.1.1
Remote key server: Any IP address
Local data endpoints: 10.55.1.1
Remote data endpoints: Any IP address
Local data port: 1701
Remote data port: 1701
Data protocol: UDP
Use a new data policy: Balance security and performance
Require policy filter: Yes
Associate with the following interfaces:
ETHLIN1 (10.1.1.1, 10.55.1.1)

The following objects will be created...
Internet Key Exchange policy: Any IP address
Data policy: VPNC01
Dynamic-key group: VPNC01

Figure 5-15 New Connection Wizard - New Connection Summary window

19. When the Activate Policy Filters dialog box appears (Figure 5-16), select **No, packet rules will be activated at a later time** and click **OK**.



Do you want the generated policy filters activated on the interfaces you just selected? Note that if any of these interfaces already have other packet rules active on them, they will be replaced with the rules that have been generated for Virtual Private Networking. If you answer no, then you must activate rules for these interfaces in Packet Rules in order for this connection to work.

○ Yes, activate the generated policy filters

● No, packet rules will be activated at a later time

What should happen with traffic that does not match any generated policy filter? If it is denied, and your iSeries Access connection to this server uses the same physical interface as this new connection, then your connection to the server will be cut off.

● Permit all other traffic

○ Deny all other traffic

Figure 5-16 New Connection Wizard - Activate Policy Filters dialog box

You have now completed the task of configuring VPN on the i5/OS system.

5.3.2 Verifying the system-wide VPN responding policy on the i5/OS system

The i5/OS VPN Key Manager function uses a single system-wide responding Internet Key Exchange (IKE) policy, which defines the algorithms that the system will use when responding to incoming IKE requests, specifically, when performing IKE Phase 1 negotiation.

In this scenario, the i5/OS is acting as the VPN responder for connections started by the Windows XP systems (VPN initiators). Therefore, the system-wide policy is used for all connections.

The following steps guide you through the configuration of the VPN responding policy:

1. In the iSeries Navigator, expand **My Connections** → ***servername*** → **Network** → **IP Policies** → **Virtual Private Networking** → **IP Security Policies** and right-click **Internet Key Exchange Policies**.

2. From the Internet Key Exchange Policies context menu (Figure 5-17), click **Responding Policy**.

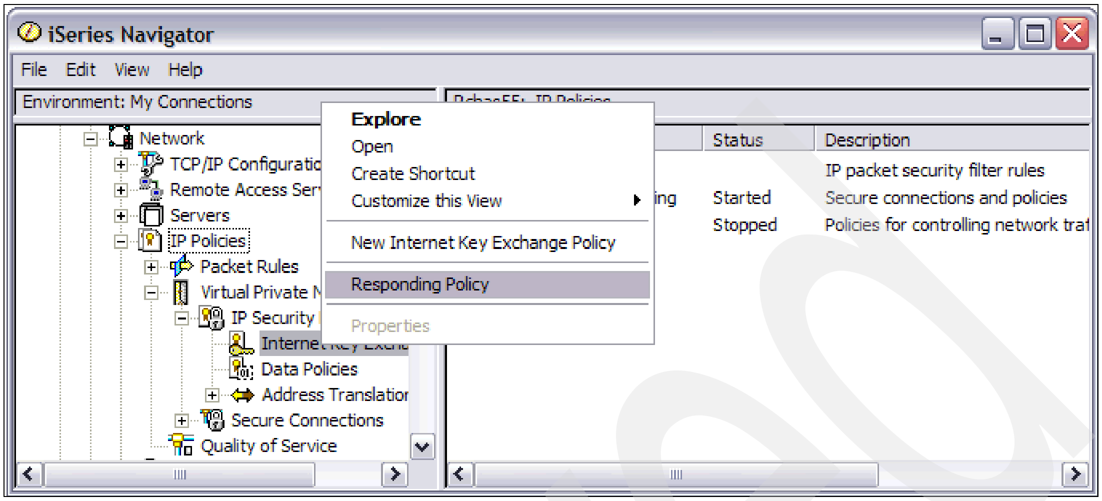
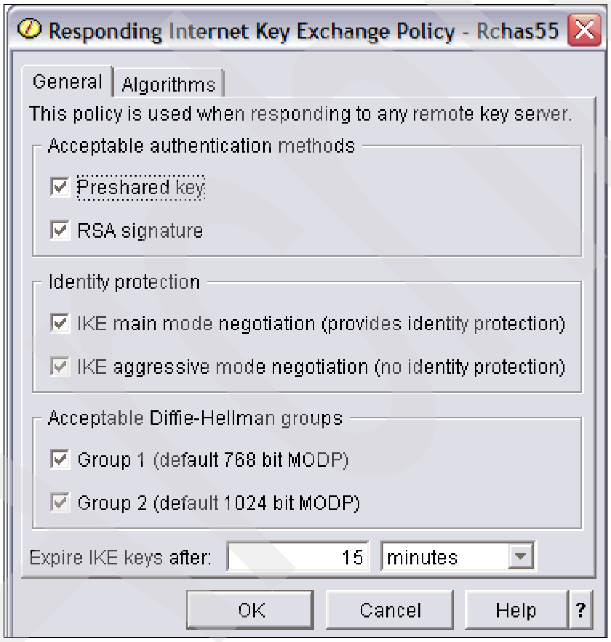


Figure 5-17 Selecting the Responding Policy option from the Internet Key Exchange window

3. On the General tab (Figure 5-18), review the options and select or deselect them as needed to fit your needs.


Responding Internet Key Exchange Policy - Rchas55

General | Algorithms

This policy is used when responding to any remote key server.

Acceptable authentication methods

☑ Preshared key

☑ RSA signature

Identity protection

☑ IKE main mode negotiation (provides identity protection)

☑ IKE aggressive mode negotiation (no identity protection)

Acceptable Diffie-Hellman groups

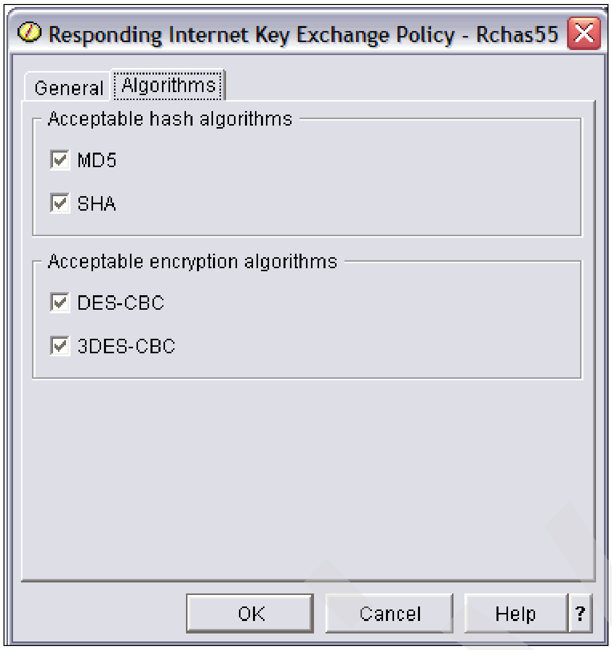
☑ Group 1 (default 768 bit MODP)

☑ Group 2 (default 1024 bit MODP)

Expire IKE keys after: 15 minutes

Figure 5-18 Responding Internet Key Exchange Policy - General tab

4. Click the **Algorithm** tab (Figure 5-19) and review the hash and encryption algorithms.


Responding Internet Key Exchange Policy - Rchas55

Acceptable hash algorithms

☑ MD5

☑ SHA

Acceptable encryption algorithms

☑ DES-CBC

☑ 3DES-CBC

Figure 5-19 Responding Internet Key Exchange Policy - Algorithms tab

5. When you have selected the options for your environment, click **OK** to complete the verification and customization of the VPN system-wide responding policy.

It is important to understand that the IKE policies generated by the New VPN Connection wizard (associated to specific IP addresses or groups of addresses) are only used for VPN connections initiated by the local i5/OS system and have no effect when the connection is started by a remote system, such as the scenario mentioned here.

The system-wide responding policy is the only policy that specifies what incoming IKE requests the i5/OS system accepts.

5.3.3 Configuring the L2TP profile on the i5/OS system

The gateway functionality for this scenario is accomplished by using an L2TP tunnel, protected by the VPN/IPSec connection. This section explains how to configure the L2TP Network Server (LNS) end of the L2TP tunnel.

To perform this task, use the information from your VPN planning checklist (Table 5-3 on page 83) and follow these steps:

1. In the navigation pane of the iSeries Navigator (Figure 5-20), expand **My Connections** → **servername** → **Network** → **Remote Access Services**, right-click **Receiver Connection Profiles**, and select **New Profile** from the context menu.

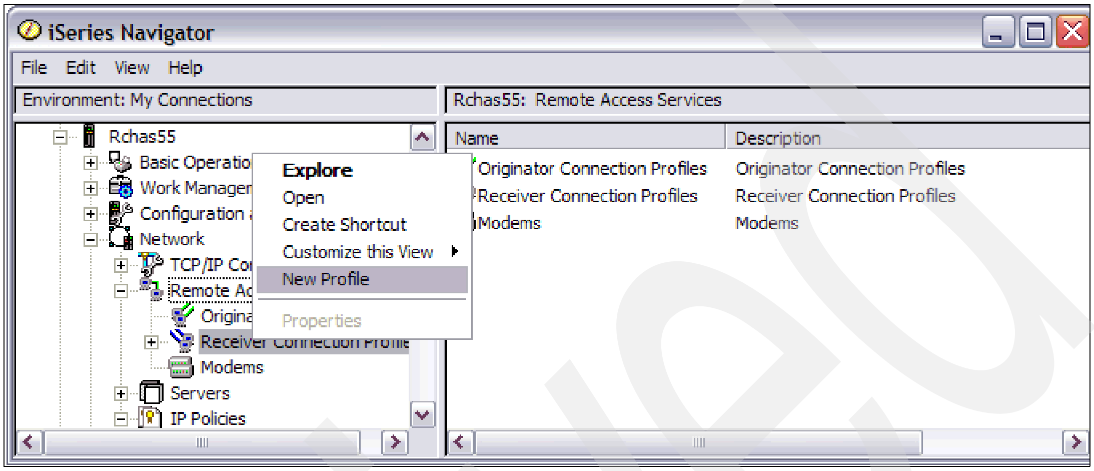
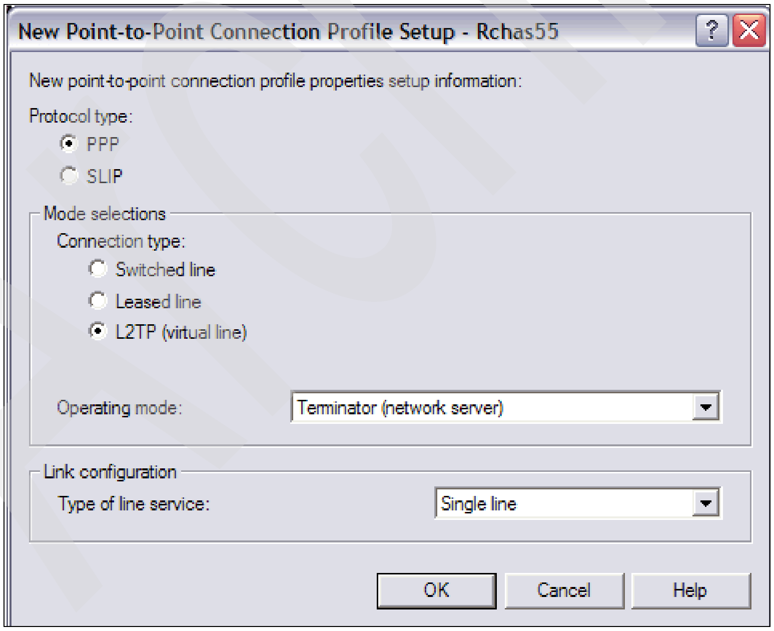


Figure 5-20 Selecting New Profile from the context menu of receiver Connection Profiles

2. When the New Point-to-Point Connection Profile Setup window displays (Figure 5-21):

   a. Select **PPP**.
   b. Select **L2TP (virtual line)**.
   c. In the Operating mode field, select **Terminator (network server)**.
   d. In the Type of line service field, select **Single line**.


New Point-to-Point Connection Profile Setup - Rchas55

New point-to-point connection profile properties setup information:

Protocol type:
● PPP
○ SLIP

Mode selections
Connection type:
○ Switched line
○ Leased line
● L2TP (virtual line)

Operating mode: Terminator (network server)

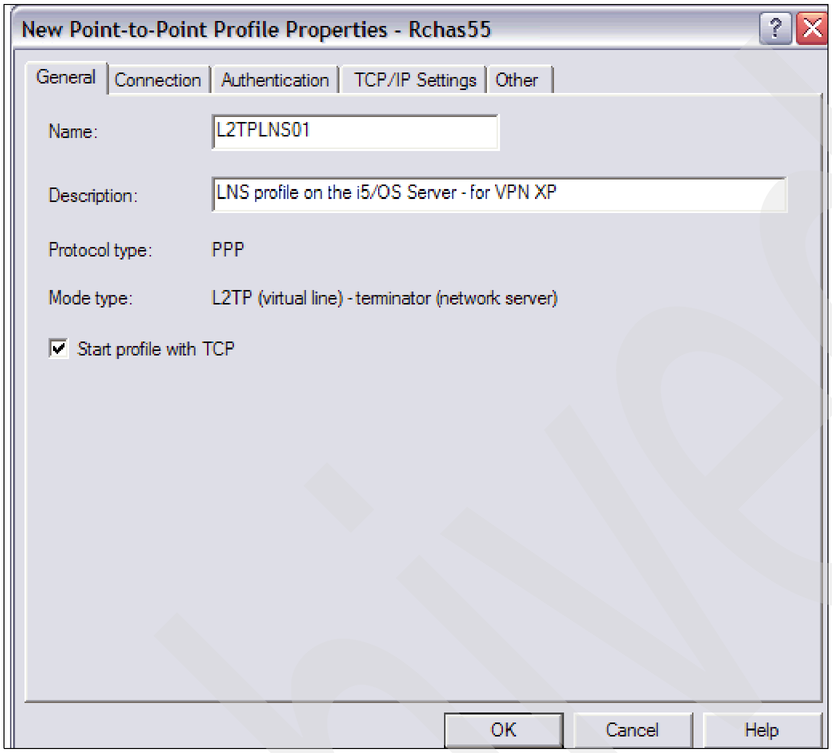
Link configuration
Type of line service: Single line

Figure 5-21 New Point-to-Point Connection Profile Setup window

3. Click **OK** to continue.

4. When Once the New Point-to-Point Profile Properties window appears (Figure 5-22), take the following actions on the General tab:

   a. In the Name field, enter `VL2TPLNs01`.
   b. Optionally, specify a description for this L2TP profile.



Name: L2TPLNS01

Description: LNS profile on the i5/OS Server - for VPN XP

Protocol type: PPP

Mode type: L2TP (virtual line) - terminator (network server)

☑ Start profile with TCP

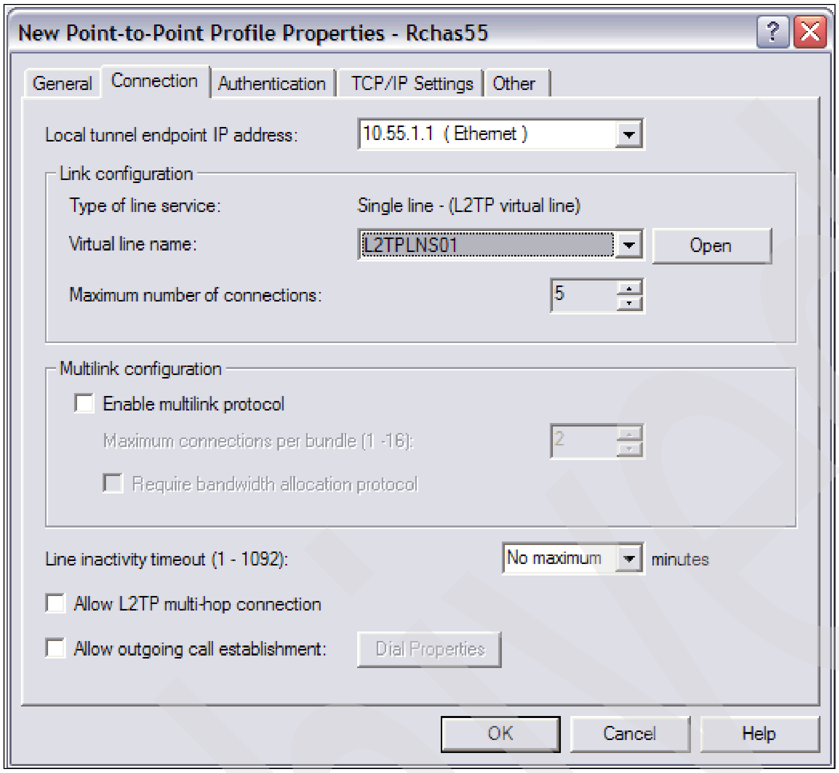
Figure 5-22 New Point-to-Point Profile Properties window - General tab

5. Click the **Connection** tab.

6. In the Connection tab of the New Point-to-Point Profile Properties window:

   a. In the Maximum number of connections field, specify the desired value (5 in this scenario).
   b. In the Local tunnel endpoint IP address field, select **10.55.1.1**.
   c. In the Virtual line name field, select **L2TPLNS01**.

After you select the virtual name, the New L2TP Line Properties window (Figure 5-23) appears automatically. If not, click **Open** to display the line properties.



Local tunnel endpoint IP address: 10.55.1.1 (Ethernet)

Link configuration

Type of line service: Single line - (L2TP virtual line)

Virtual line name: L2TPLNS01

Maximum number of connections: 5

Multilink configuration

☐ Enable multilink protocol

Maximum connections per bundle (1 -16): 2

☐ Require bandwidth allocation protocol

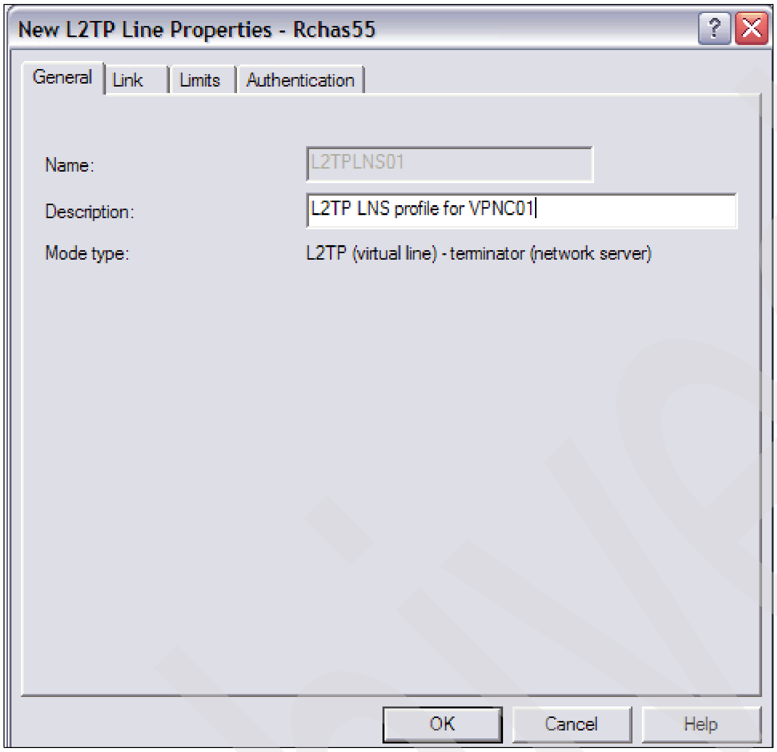
Line inactivity timeout (1 - 1092): No maximum minutes

☐ Allow L2TP multi-hop connection

☐ Allow outgoing call establishment:

Figure 5-23 New Point-to-Point Profile Properties window - Connection tab

7. You are now working with the properties of the new LT2P virtual line associated with the L2TP profile you are creating. In the General tab of the line properties window (Figure 5-24), enter meaningful text in the description for this line.



Name: L2TPLNS01

Description: L2TP LNS profile for VPNC01

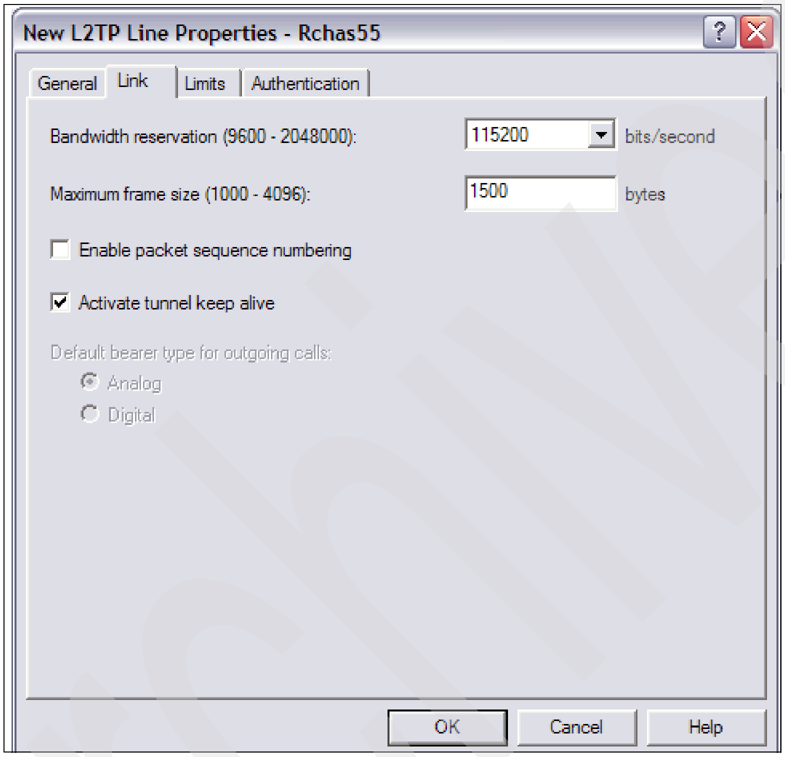
Mode type: L2TP (virtual line) - terminator (network server)

Figure 5-24 New L2TP Line Properties window - General tab

8. Click the **Link** tab.

9. In the Link tab of the line properties window (Figure 5-25), select **Activate tunnel keep alive**.

Important: Do *not* skip this step. Make sure that the Activate tunnel keep alive check box is selected to ensure that the i5/OS ends the L2TP tunnel when a remote connection ends. If the Activate tunnel keep alive option is not selected and the connection terminates abnormally (for example, if the user shuts down Windows XP without first ending the VPN connection), the connection on the i5/OS system remains active and other clients cannot use the connection.



Bandwidth reservation (9600 - 2048000): 115200 bits/second

Maximum frame size (1000 - 4096): 1500 bytes

□ Enable packet sequence numbering

☑ Activate tunnel keep alive

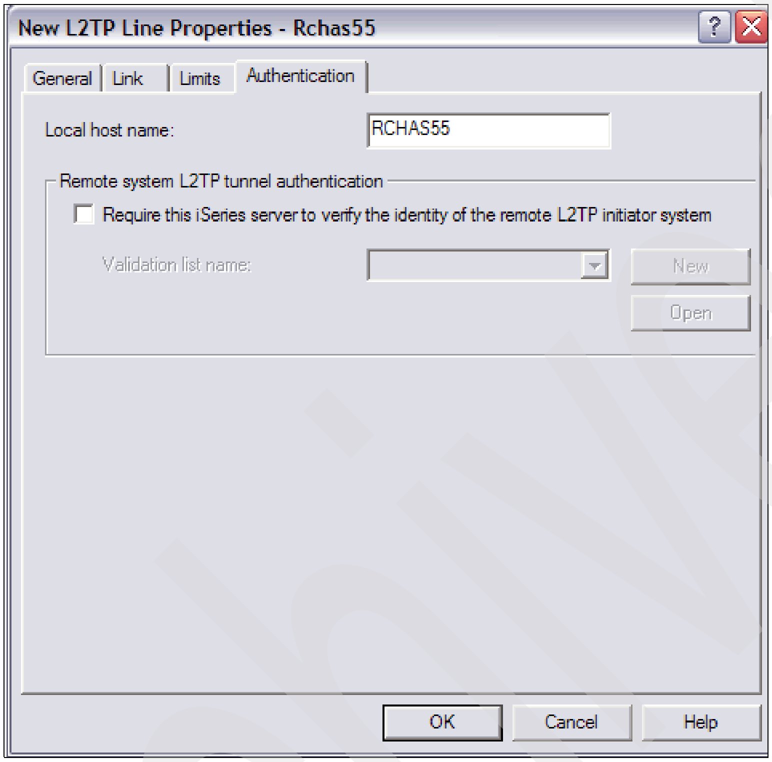
Default bearer type for outgoing calls:
● Analog
○ Digital

Figure 5-25 New L2TP Line Properties window - Link tab

10. Click the **Authentication** tab.

11. In the Authentication tab of the line properties window (Figure 5-26), enter the local host name of the i5/OS system (in this scenario, we are using RCHAS55 as the host name).

> **Note:** L2TP tunnel authentication is not needed when the L2TP tunnel is being protected by IPSec.



Local host name: RCHAS55

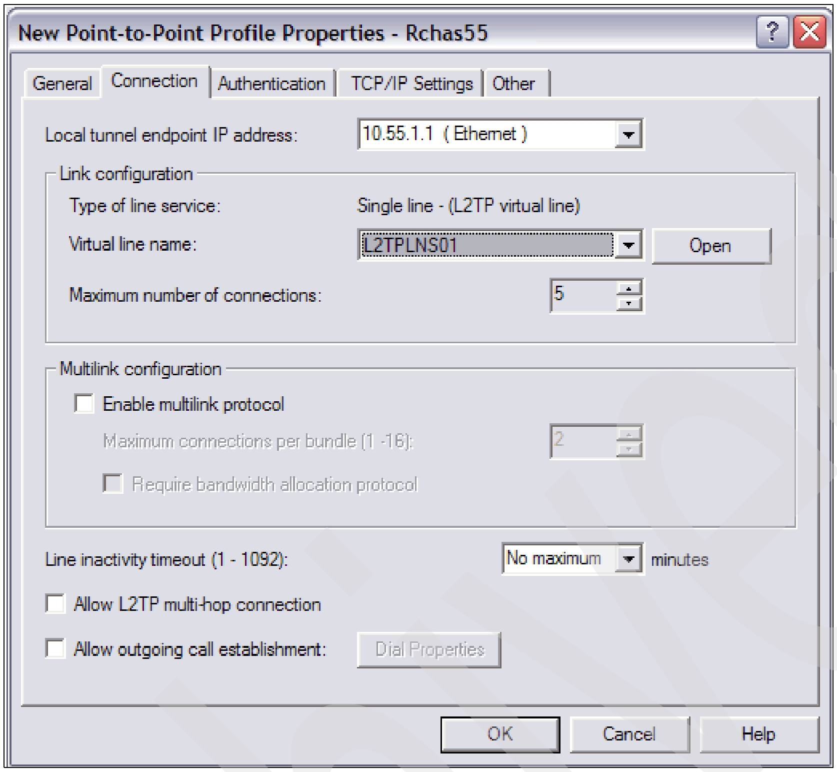
Remote system L2TP tunnel authentication

□ Require this iSeries server to verify the identity of the remote L2TP initiator system

Validation list name:

Figure 5-26 New L2TP Line Properties window - Authentication tab

12. Click **OK** to save the virtual line settings and return to the L2TP Profile Properties window (Figure 5-27).



New Point-to-Point Profile Properties - Rchas55

Local tunnel endpoint IP address: 10.55.1.1 (Ethernet)

Link configuration

Type of line service: Single line - (L2TP virtual line)

Virtual line name: L2TPLNS01

Maximum number of connections: 5

Multilink configuration

□ Enable multilink protocol

Maximum connections per bundle (1 -16): 2

□ Require bandwidth allocation protocol

Line inactivity timeout (1 - 1092): No maximum minutes

□ Allow L2TP multi-hop connection

□ Allow outgoing call establishment:

Figure 5-27 New Point-to-Point Profile Properties window - Connection tab

13. In the L2TP profile properties window, click the **Authentication** tab.

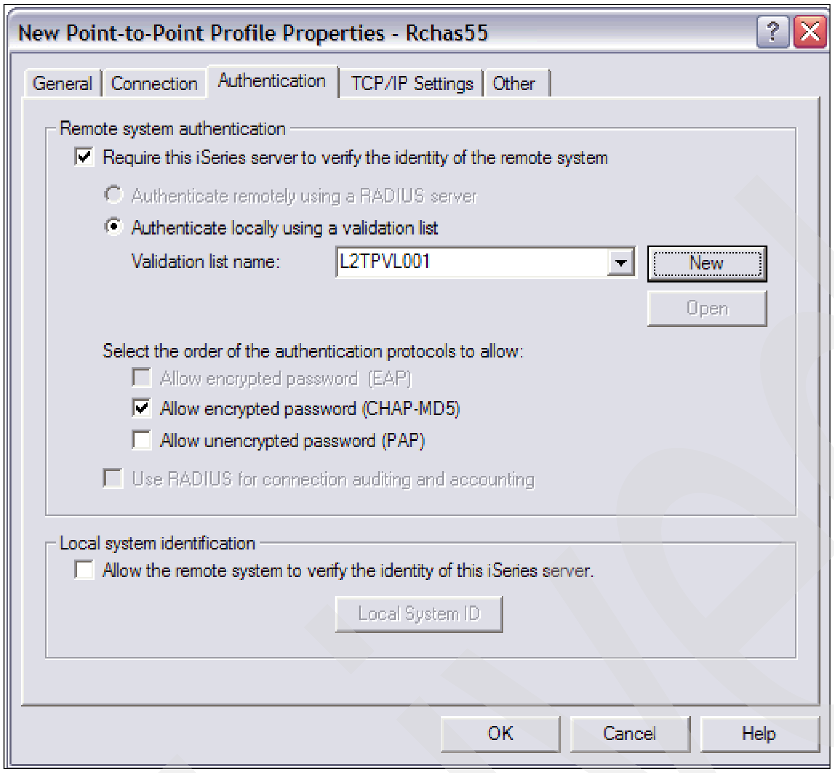
14. In the Remote system authentication section (Figure 5-28 on page 102):

   a. Select **Require this iSeries server to verify the identity of the remote system**.

   b. Select **Authenticate locally using a validation list**.

   c. Verify that **Allow encrypted password (CHAP-MD5)** is selected.

   d. Enter a value for the Validation list name (in this scenario, we are using L2TPVL001) and click **New** to create and configure this validation list.



New Point-to-Point Profile Properties - Rchas55

General | Connection | Authentication | TCP/IP Settings | Other

Remote system authentication

☑ Require this iSeries server to verify the identity of the remote system

○ Authenticate remotely using a RADIUS server

● Authenticate locally using a validation list

Validation list name: L2TPVL001

Select the order of the authentication protocols to allow:

□ Allow encrypted password (EAP)

☑ Allow encrypted password (CHAP-MD5)

□ Allow unencrypted password (PAP)

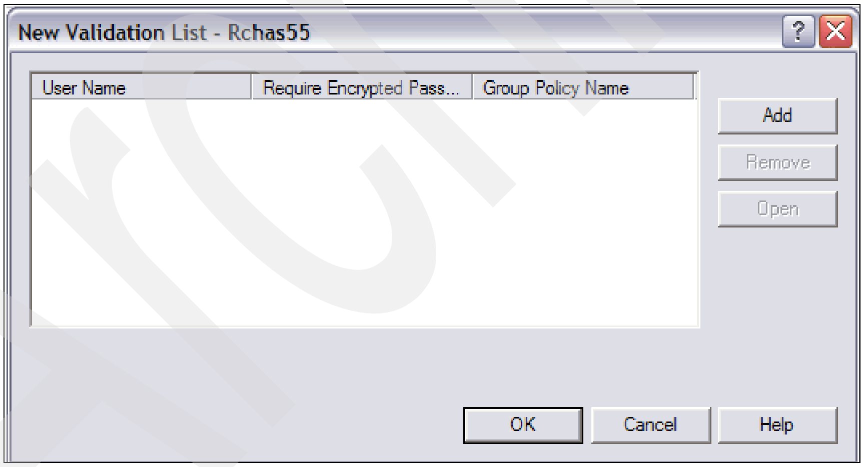
□ Use RADIUS for connection auditing and accounting

Local system identification

□ Allow the remote system to verify the identity of this iSeries server.

Figure 5-28 New Point-to-Point Profile Properties window - Authentication tab

15. When the New Validation List window (Figure 5-29) appears, click **Add**.

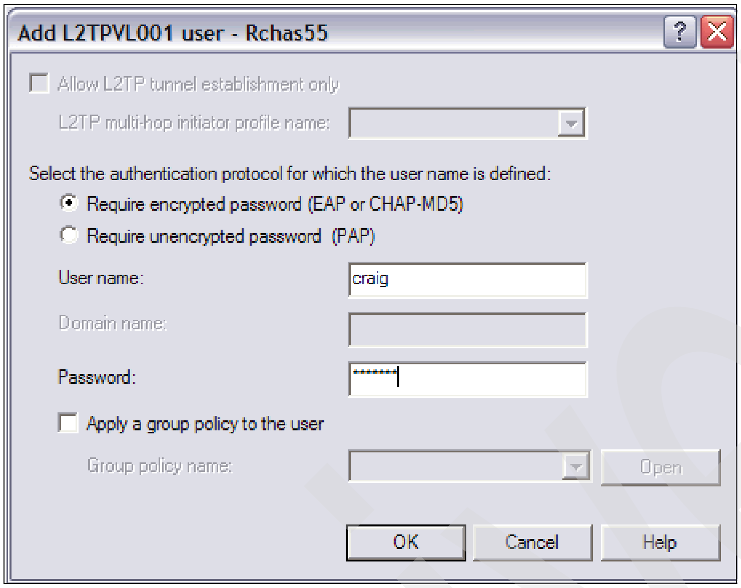


New Validation List - Rchas55

User Name	Require Encrypted Pass...	Group Policy Name

Figure 5-29 New Validation List window

16. To add a new user to the validation list, select **Require encrypted password (EAP or CHAP-MD5)** and then enter the user name and a password (Figure 5-30). This user is not related to i5/OS user profiles. It is the user and password that the remote Windows XP client uses to establish the VPN connection with the i5/OS gateway.



Add L2TPVL001 user - Rchas55

□ Allow L2TP tunnel establishment only

L2TP multi-hop initiator profile name:

Select the authentication protocol for which the user name is defined:

● Require encrypted password (EAP or CHAP-MD5)

○ Require unencrypted password (PAP)

User name: craig

Domain name:

Password: ********

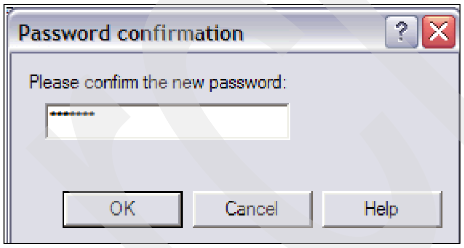
□ Apply a group policy to the user

Group policy name:

Figure 5-30 Add a user to the new validation list

17. Click **OK**.

18. Enter the password for the new user again on the password confirmation prompt (Figure 5-31).

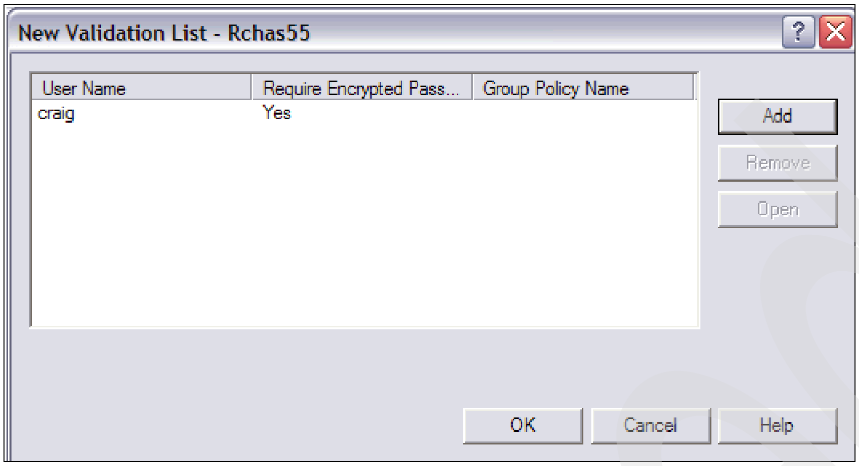


Password confirmation

Please confirm the new password: ********

Figure 5-31 Password confirmation prompt

19. Click **OK** to save the new user into the validation list. The updated validation list displays (Figure 5-32). If you need to add another user, click **Add**.



New Validation List - Rchas55

User Name	Require Encrypted Pass...	Group Policy Name
craig	Yes	

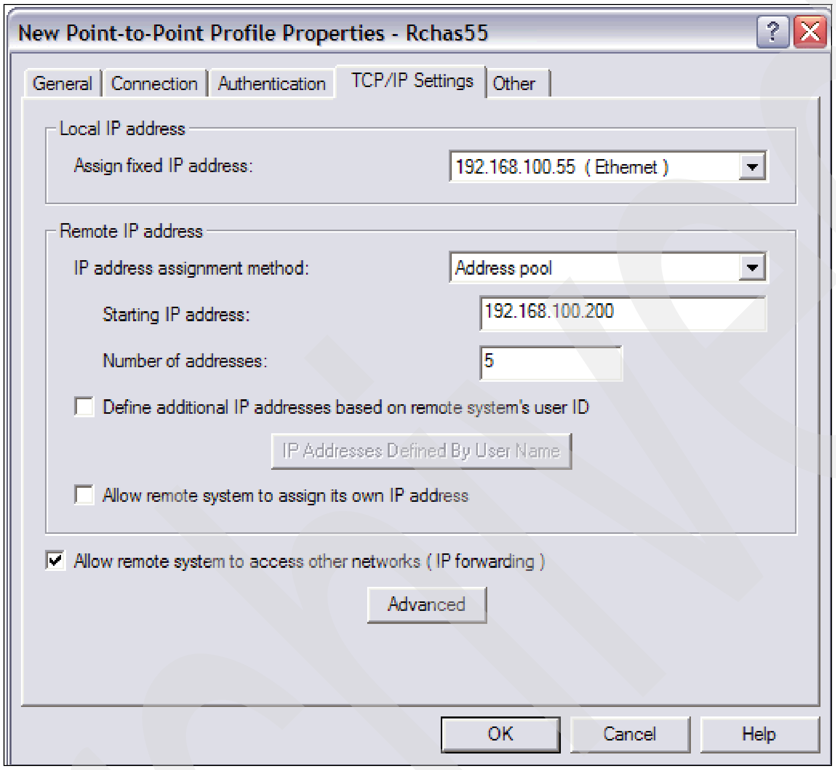
Figure 5-32 New Validation List window after a user has been added

20. After you finish adding users, click **OK** to return to the New Point to Point Profile Properties window.

21. Click the **TCP/IP Settings** tab.

22.On the TCP/IP Settings tab (Figure 5-33):

a. In the Assign fixed IP address field, select **192.198.100.10** (IP address of the i5/OS system on the local network).
b. In the IP address assignment method field, select **Address pool**.
c. In the starting IP address field, enter `192.168.100.200` (in this scenario, our pool of IP addresses for remote VPN access users goes from 192.168.199.200 to 192.168.204).
d. In the Number of addresses, enter `5`.
e. Select **Allow remote system to access other networks (IP forwarding)**.


New Point-to-Point Profile Properties - Rchas55
General
Connection
Authentication
TCP/IP Settings
Other
IP Addresses Defined By User Name
Advanced
OK
Cancel
Help

Local IP address
Assign fixed IP address: 192.168.100.55 (Ethernet)

Remote IP address
IP address assignment method: Address pool
Starting IP address: 192.168.100.200
Number of addresses: 5
☐ Define additional IP addresses based on remote system's user ID
☐ Allow remote system to assign its own IP address

☑ Allow remote system to access other networks (IP forwarding)

Figure 5-33 New Point-to-Point Profile Properties window - TCP/IP Settings tab

23.Click **OK** to complete. The new L2TP profile is now created and configured.

You have now completed the task of configuring the L2TP profile on the i5/OS system.

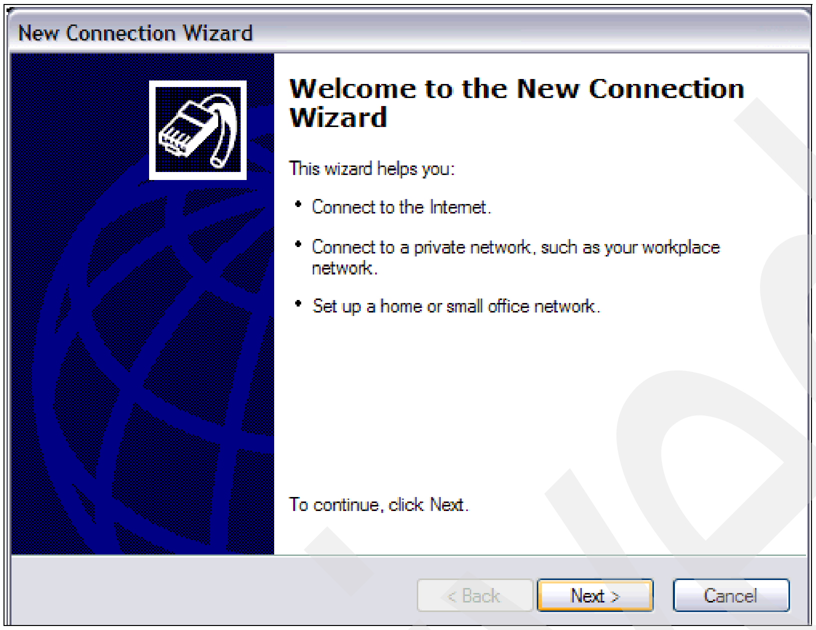
5.3.4 Configuring the VPN connection on the Windows XP system

This section shows how to create and configure the VPN connection on the Windows XP system (VPN initiator). The VPN connection is created and configured by using the New Connection Wizard of Windows XP.

To perform this task, use the information from your VPN planning checklist (Table 5-4 on page 84). The steps are:

1. On the Microsoft Windows XP task bar, click **Start** → **Programs** → **Accessories** → **Communications** → **New Connection Wizard**.

2. The New Connection Wizard welcome window appears (Figure 5-34). Click **Next** to continue.



New Connection Wizard

Welcome to the New Connection Wizard

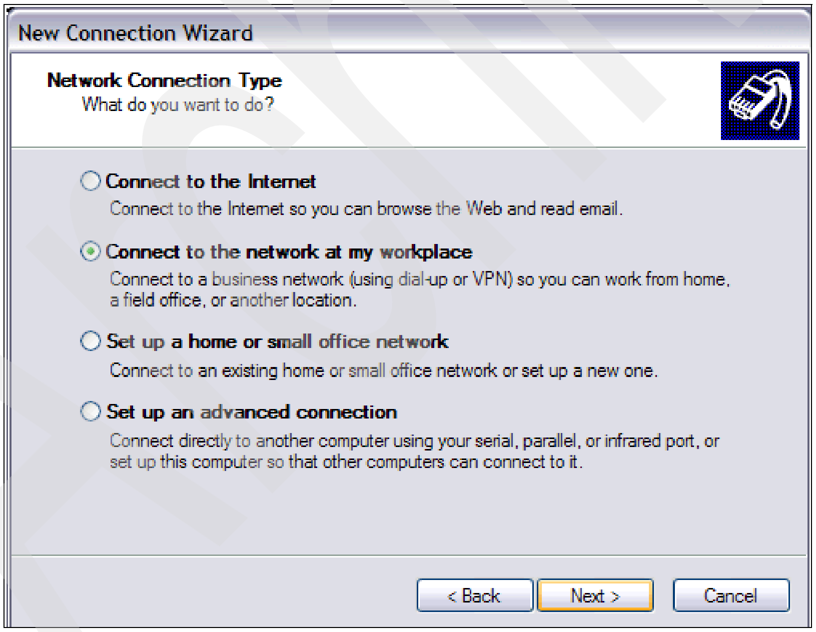
This wizard helps you:

- Connect to the Internet.
- Connect to a private network, such as your workplace network.
- Set up a home or small office network.

To continue, click Next.

Figure 5-34 New Connection Wizard - Welcome window

3. Select **Connect to the network at my workplace** (Figure 5-35) and click **Next**.



New Connection Wizard

Network Connection Type
What do you want to do?

○ **Connect to the Internet**
Connect to the Internet so you can browse the Web and read email.

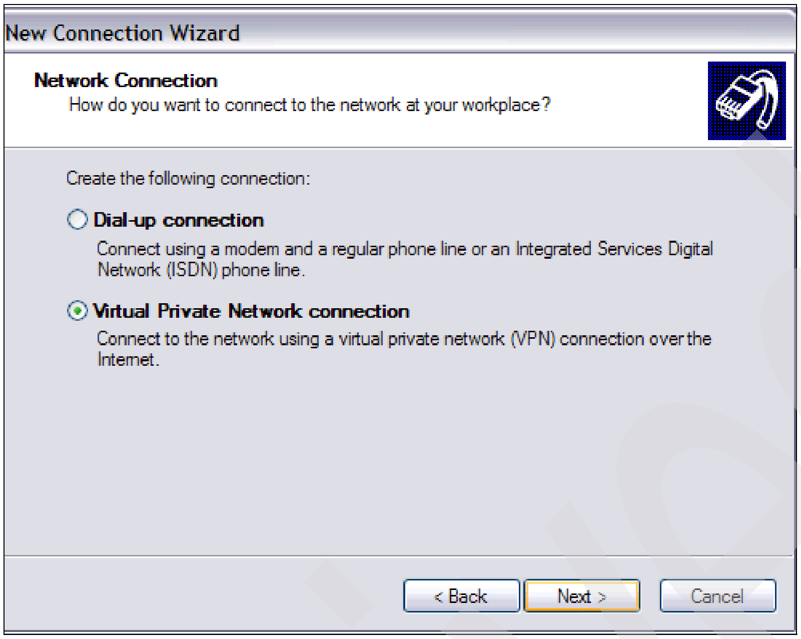
● **Connect to the network at my workplace**
Connect to a business network (using dial-up or VPN) so you can work from home, a field office, or another location.

○ **Set up a home or small office network**
Connect to an existing home or small office network or set up a new one.

○ **Set up an advanced connection**
Connect directly to another computer using your serial, parallel, or infrared port, or set up this computer so that other computers can connect to it.

Figure 5-35 New Connection Wizard - Connection type window

4. Select **Virtual Private Network connection** (Figure 5-36) and click **Next**.



New Connection Wizard

Network Connection
How do you want to connect to the network at your workplace?

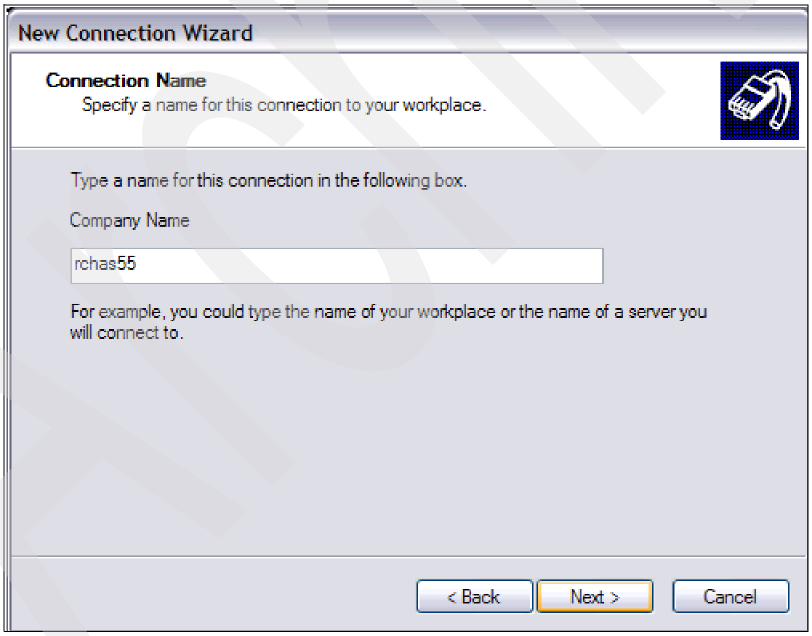
Create the following connection:

○ **Dial-up connection**
Connect using a modem and a regular phone line or an Integrated Services Digital Network (ISDN) phone line.

● **Virtual Private Network connection**
Connect to the network using a virtual private network (VPN) connection over the Internet.

Figure 5-36 New Connection Wizard - Workplace™ connection type window

5. In the Company Name field (Figure 5-37), enter the name of the i5/OS gateway system (in this scenario, we are using RCHAS55 as the gateway name), click **Next**.



New Connection Wizard

Connection Name
Specify a name for this connection to your workplace.

Type a name for this connection in the following box.

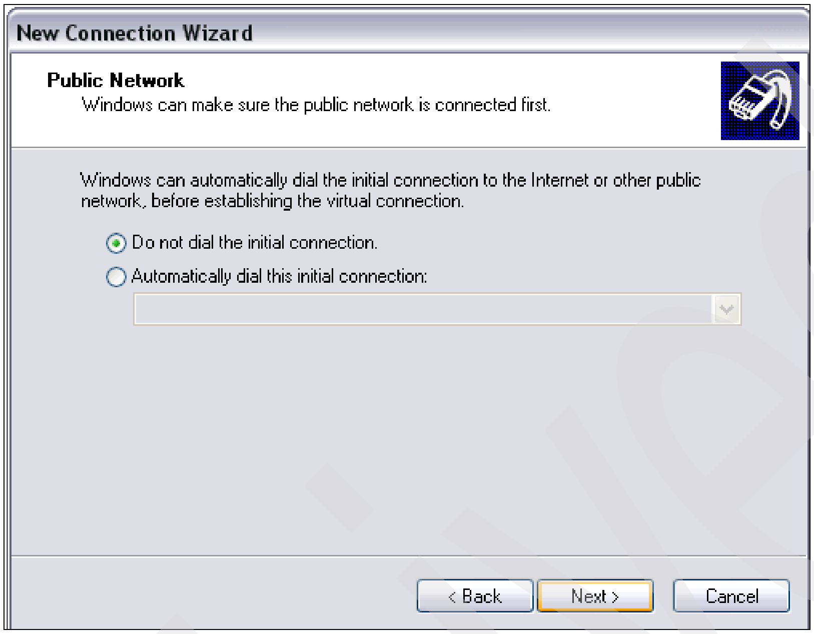
Company Name

rchas55

For example, you could type the name of your workplace or the name of a server you will connect to.

Figure 5-37 New Connection Wizard - Connection name window

6. Optional step: If you see the window shown in Figure 5-38, select **Do not dial the initial connection** and click **Next**. This option specifies whether the Windows XP workstation is connected through a LAN or dial-up interface to the Internet. If you do not have a cable or DSL connection to the Internet, select the PPP configuration for dialing into the ISP.



New Connection Wizard

Public Network
Windows can make sure the public network is connected first.

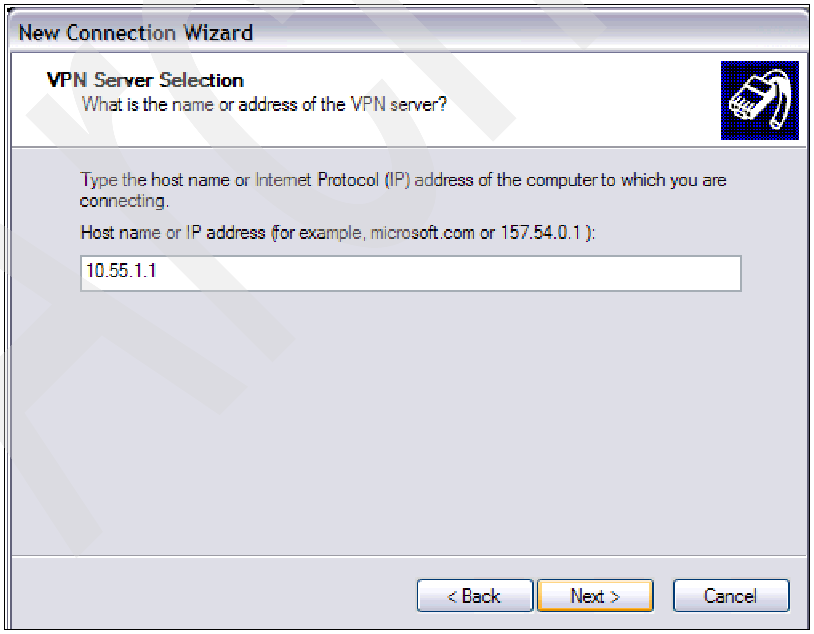
Windows can automatically dial the initial connection to the Internet or other public network, before establishing the virtual connection.

● Do not dial the initial connection.

○ Automatically dial this initial connection:

Figure 5-38 New Connection Wizard - Public Network window

7. In the VPN Server Selection window (Figure 5-39), enter the IP address of the i5/OS gateway system (in this scenario, we are using 10.55.1.1 as the gateway's IP address) and click **Next**.



New Connection Wizard

VPN Server Selection
What is the name or address of the VPN server?

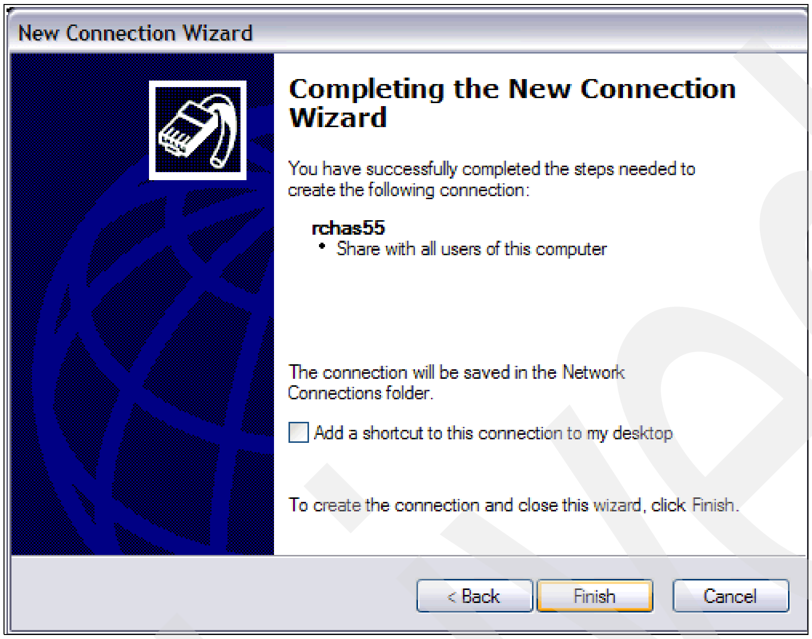
Type the host name or Internet Protocol (IP) address of the computer to which you are connecting.

Host name or IP address (for example, microsoft.com or 157.54.0.1):

10.55.1.1

Figure 5-39 New Connection Wizard - VPN Server Selection window

8. When you have completed the previous steps, the wizard is ready to create the connection (Figure 5-40). If you want to have a shortcut for this connection on your desktop, select **Add a shortcut to my desktop**. Click **Finish** to create the VPN connection and close the wizard.



New Connection Wizard

Completing the New Connection Wizard

You have successfully completed the steps needed to create the following connection:

rchas55
- Share with all users of this computer

The connection will be saved in the Network Connections folder.

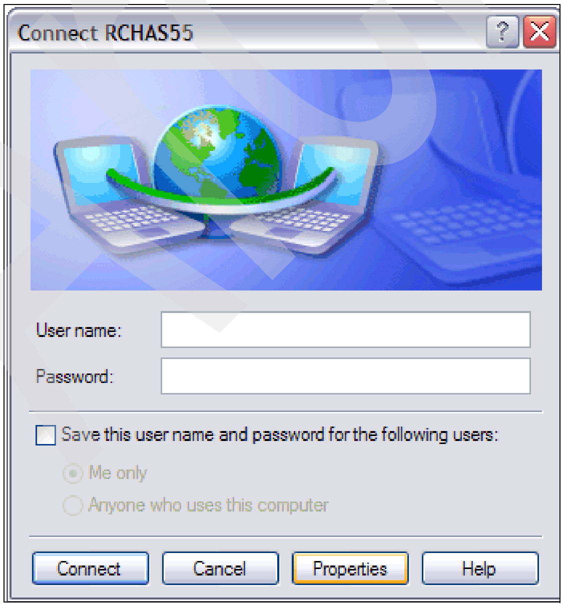
□ Add a shortcut to this connection to my desktop

To create the connection and close this wizard, click Finish.

Figure 5-40 New Connection Wizard - Completion window

9. The Connect window (Figure 5-41) automatically appears after finishing the wizard.

   At this point, you have configured the VPN connection and the LT2P tunnel on the Windows XP system. However, before trying to establish a connection, you need to change connection properties that did not appear during the wizard configuration. To do these changes, click **Properties** on the Connect window.



Connect RCHAS55

User name:

Password:

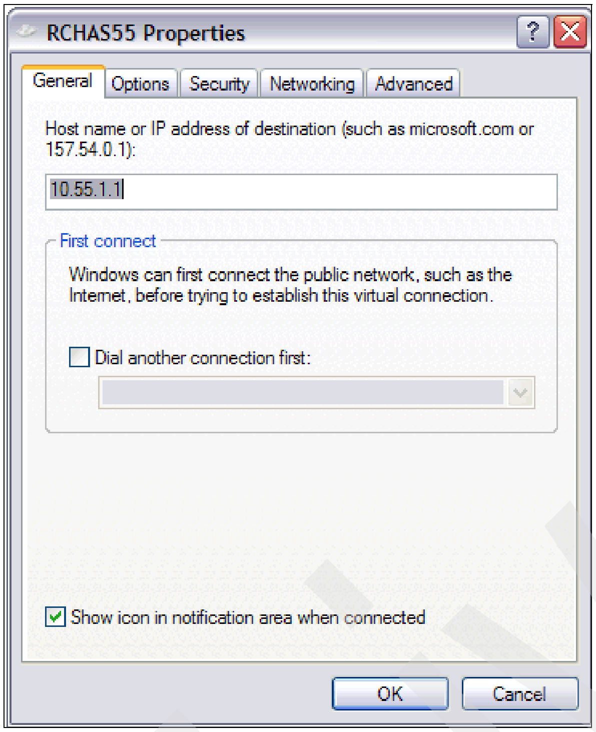
□ Save this user name and password for the following users:

● Me only

○ Anyone who uses this computer

Figure 5-41 Connect window

10.The VPN Connection Properties window appears (Figure 5-42).



Host name or IP address of destination (such as microsoft.com or 157.54.0.1):

10.55.1.1

First connect

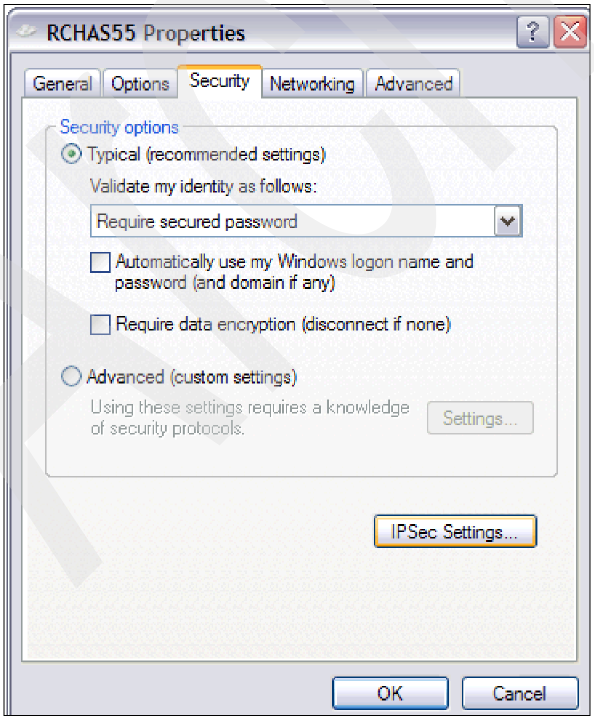
Windows can first connect the public network, such as the Internet, before trying to establish this virtual connection.

☐ Dial another connection first:

☑ Show icon in notification area when connected

Figure 5-42 VPN Connection Properties - General tab

11.Click the **Security** tab (Figure 5-43) and deselect the **Require data encryption (disconnect if none)** check box.



Security options

● Typical (recommended settings)

Validate my identity as follows:

Require secured password

☐ Automatically use my Windows logon name and password (and domain if any)

☐ Require data encryption (disconnect if none)

○ Advanced (custom settings)

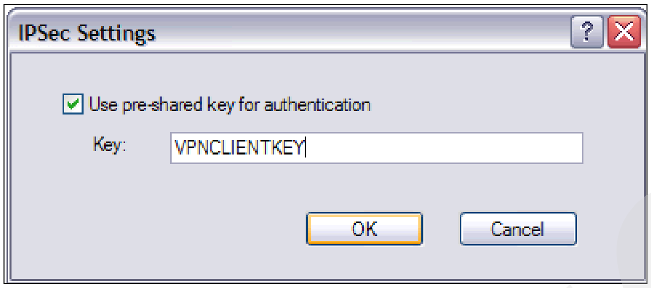
Using these settings requires a knowledge of security protocols.

Figure 5-43 VPN Connection Properties - Security tab

12. Click **IPSec Settings**.

13. In the IPSec Settings window (Figure 5-44), select the **Use pre-shared key for authentication** check box and enter the preshared key (in this scenario, the key is VPNCLIENTKEY).

> **Note:** The preshared key *must* be the same as the one on the i5/OS system.



☑ Use pre-shared key for authentication

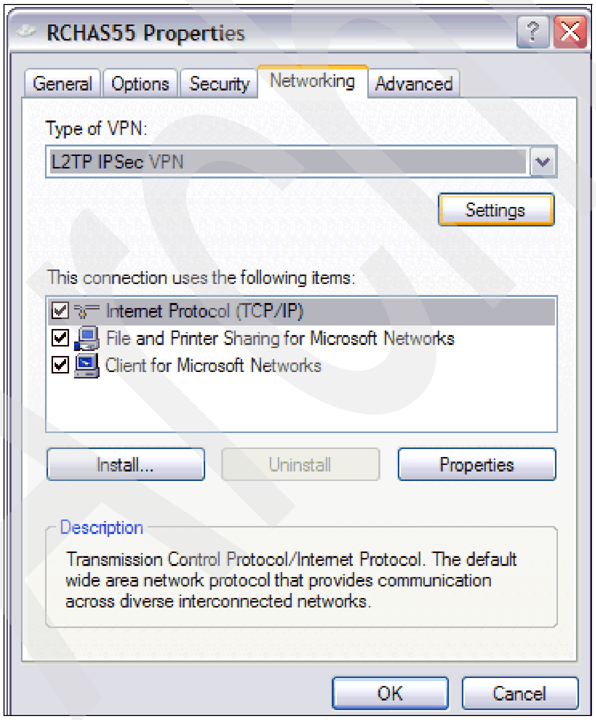
Key: VPNCLIENTKEY

Figure 5-44 IPSec Settings window

14. Click **OK** to return to the VPN Connection Properties window.

15. Click the **Networking** tab.

16. In the Type of VPN field (Figure 5-45), change the value from Automatic to **L2TP IPSec VPN** and click **Settings** to change the PPP properties.



Type of VPN: L2TP IPSec VPN

This connection uses the following items:

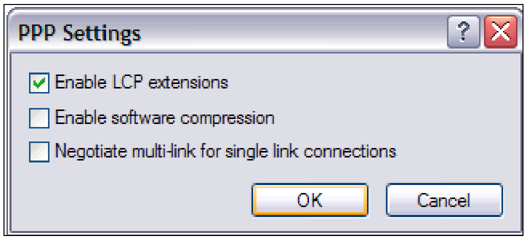
☑ Internet Protocol (TCP/IP)
☑ File and Printer Sharing for Microsoft Networks
☑ Client for Microsoft Networks

Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

Figure 5-45 VPN Connection Properties - Networking tab

17. In the PPP Settings window (Figure 5-46), deselect both **Enable software compression** and **Negotiate multi-link for single-link connections**.



PPP Settings

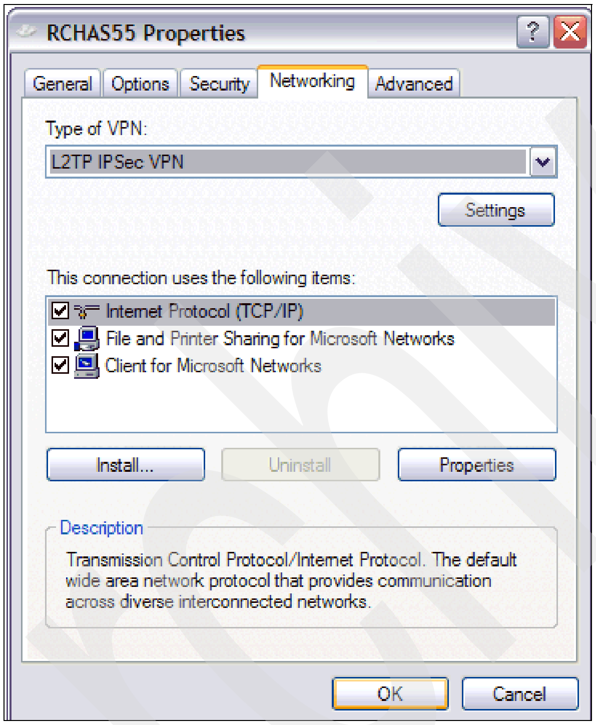
☑ Enable LCP extensions

□ Enable software compression

□ Negotiate multi-link for single link connections

Figure 5-46 PPP Settings

18. Click **OK** to return to the VPN Connection Properties window (Figure 5-47).



RCHAS55 Properties

Type of VPN:

L2TP IPSec VPN

This connection uses the following items:

☑ Internet Protocol (TCP/IP)

☑ File and Printer Sharing for Microsoft Networks

☑ Client for Microsoft Networks

Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

Figure 5-47 VPN Connection Properties - Networking tab

19. Click **OK** to return to the Connect window (Figure 5-48).

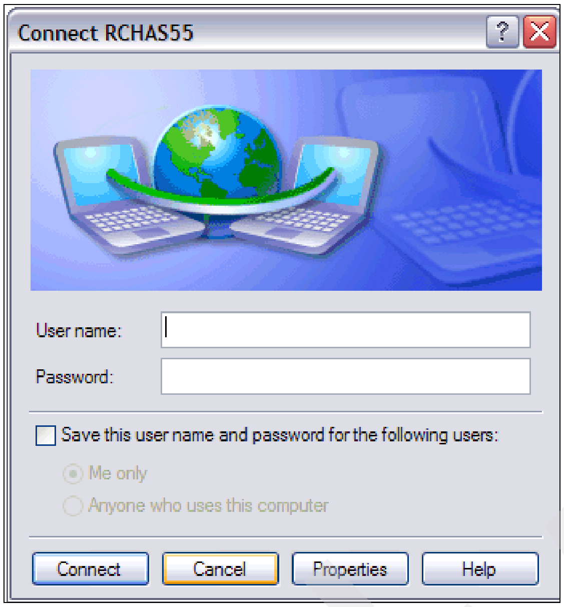

Connect RCHAS55
User name:
Password:
□ Save this user name and password for the following users:
● Me only
○ Anyone who uses this computer
Connect
Cancel
Properties
Help

Figure 5-48 Connect window

20. Click **Cancel** to close the Connect window without establishing the VPN connection. The steps needed to start the connection are described in the next sections.

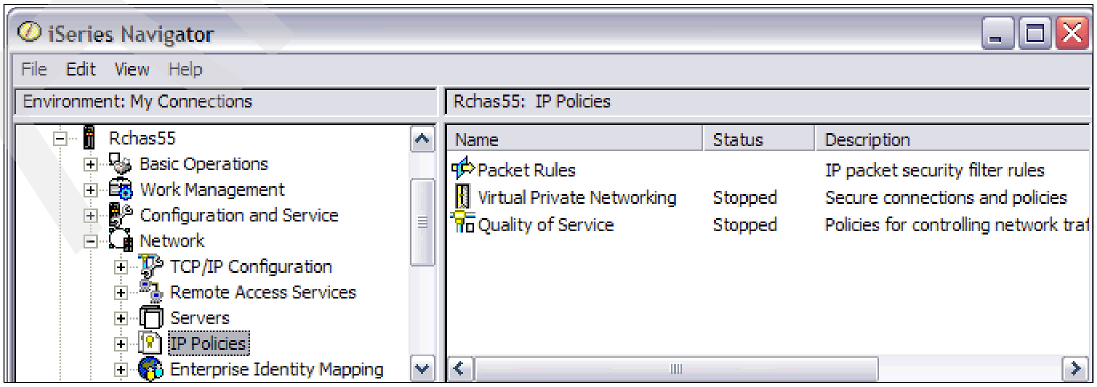
You have now completed the task of configuring the VPN connection on the Windows XP system.

5.3.5 Starting the VPN server on the i5/OS system (responder)

When you have configured the new VPN connection and the L2TP profile on the i5/OS systems, you need to activate the resources needed to establish the secured VPN connections initiated by the remote Windows XP systems.

Follow these steps to activate the resources needed by your new VPN connection:

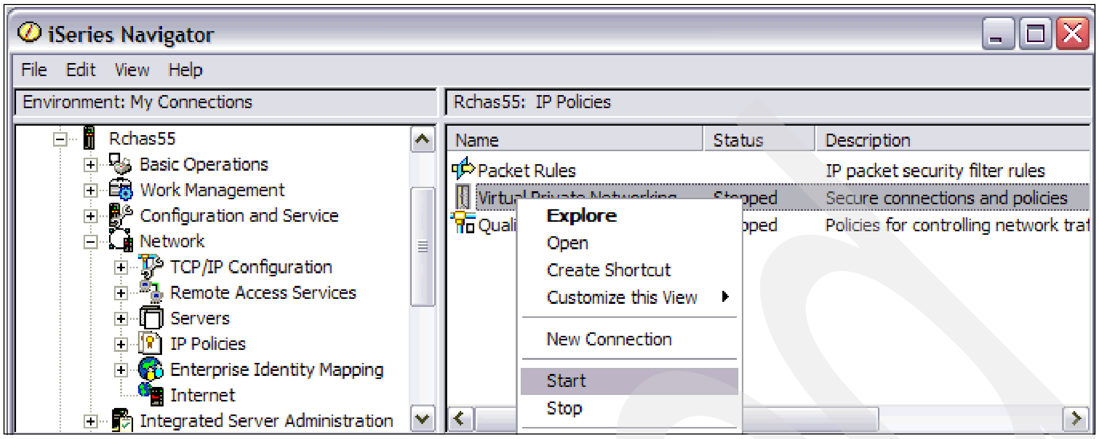
1. In the iSeries Navigator (Figure 5-49), expand **My Connections** → ***servername*** → **Network** and then click **IP Policies** to display the status of Virtual Private Networking on the right pane.



Name	Status	Description
Packet Rules		IP packet security filter rules
Virtual Private Networking	Stopped	Secure connections and policies
Quality of Service	Stopped	Policies for controlling network traf

Figure 5-49 Virtual Private Networking status

2. If the status of Virtual Private Networking is `Stopped` on the right pane of IP Policies, right-click **Virtual Private Networking** and click **Start** (Figure 5-50).

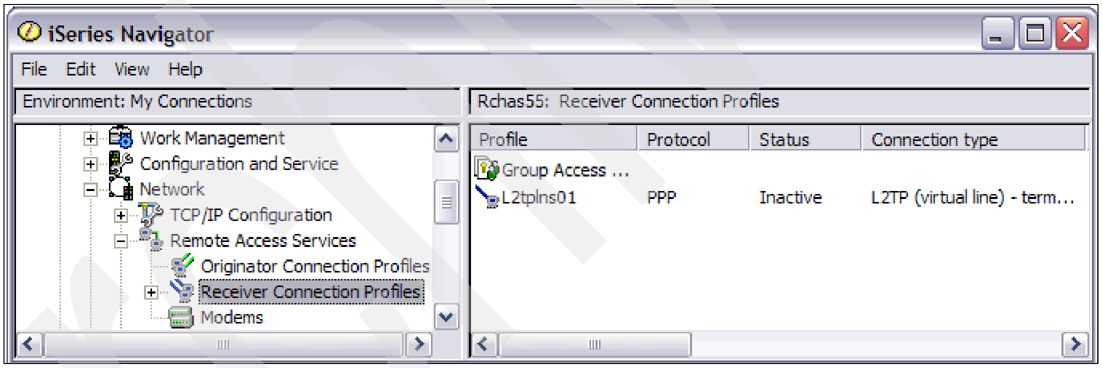


Name	Status	Description
Packet Rules		IP packet security filter rules
Virtual Private Networking	Stopped	Secure connections and policies
Quali	oped	Policies for controlling network traf

Figure 5-50 Starting VPN on the i5/OS system (responder)

3. The status of Virtual Private Networking changes to `Started`.

4. Expand **My Connections** → ***servername*** → **Network** → **Remote Access Services** and click **Receiver Connection Profiles** (Figure 5-51) to display the status of the receiver connection profiles on the right pane.


iSeries Navigator
File Edit View Help
Environment: My Connections
Work Management
Configuration and Service
Network
TCP/IP Configuration
Remote Access Services
Originator Connection Profiles
Receiver Connection Profiles
Modems
Rchas55: Receiver Connection Profiles

Profile	Protocol	Status	Connection type
Group Access ...			
L2tplns01	PPP	Inactive	L2TP (virtual line) - term...

Figure 5-51 Receiver Connection Profiles

5. If the status of the **L2TPLNS01** profile is `Inactive`, right-click **L2TPLNS01** and click **Start** on the profile's context menu (Figure 5-52).

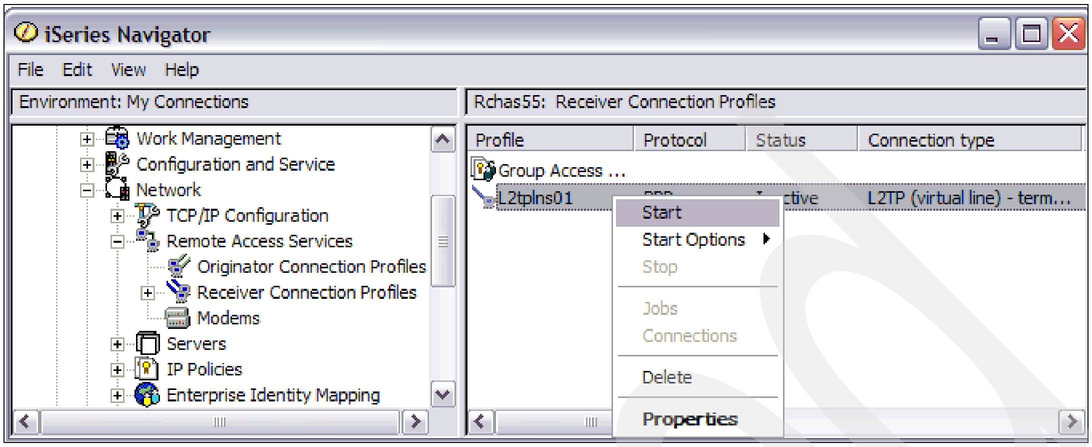


Figure 5-52 Starting the L2TP profile

6. The status of the L2TPLNS01 profile changes to `Waiting for connection requests`.

7. Expand **My Connections** → ***servername*** → **Network** → **IP Policies**.

8. In the navigation pane (Figure 5-53), right-click **Packet Rules** and on the context menu, click **Activate Rules.**

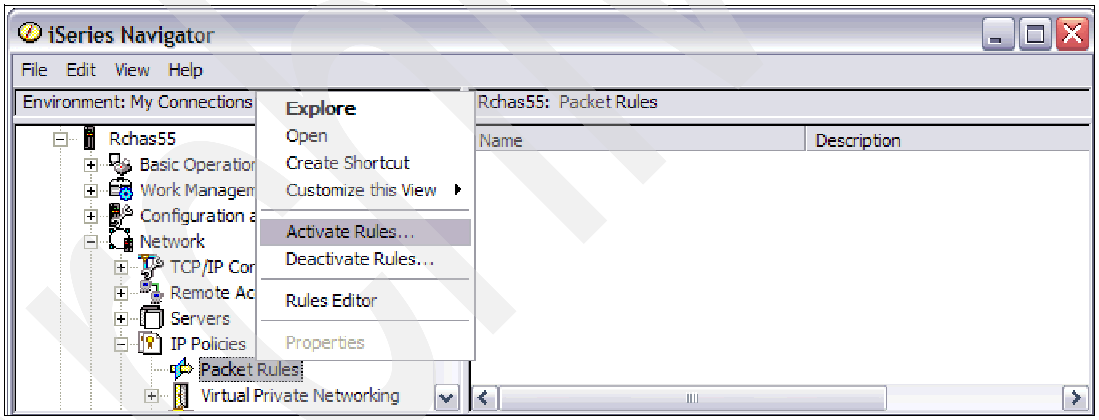
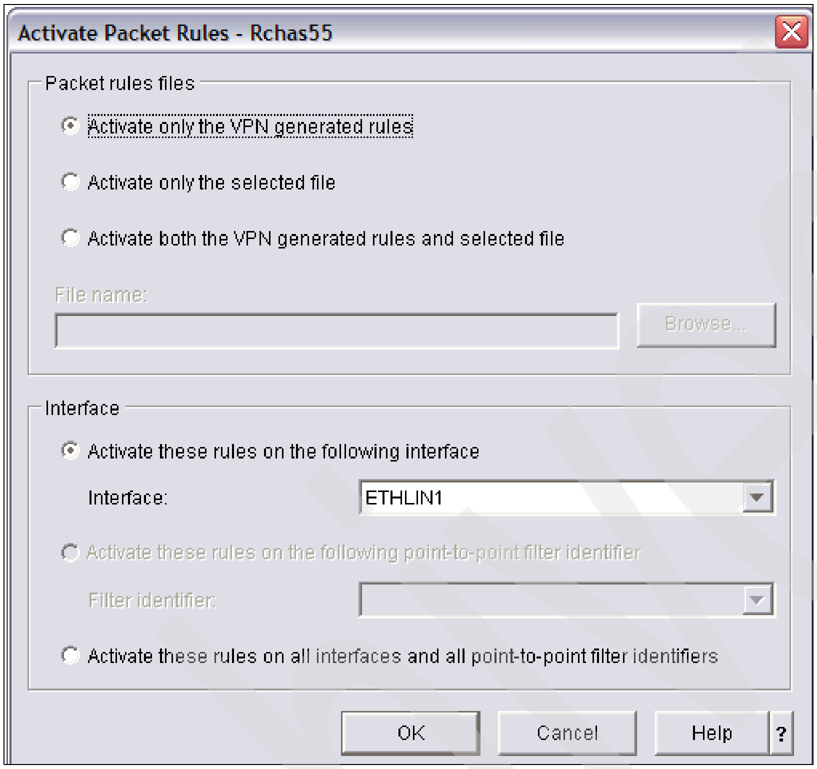


Figure 5-53 Activating Packet Rules (IP filtering)

9. When the Activate Packet Rules window appears (Figure 5-54):

   a. Select **Activate only the VPN generated packet rules**.
   b. Select **Activate these rules on the following interface**.
   c. In the Interface field, select **ETHLIN1**.



Activate Packet Rules - Rchas55

Packet rules files

● Activate only the VPN generated rules

○ Activate only the selected file

○ Activate both the VPN generated rules and selected file

File name:

Interface

● Activate these rules on the following interface

Interface: ETHLIN1

○ Activate these rules on the following point-to-point filter identifier

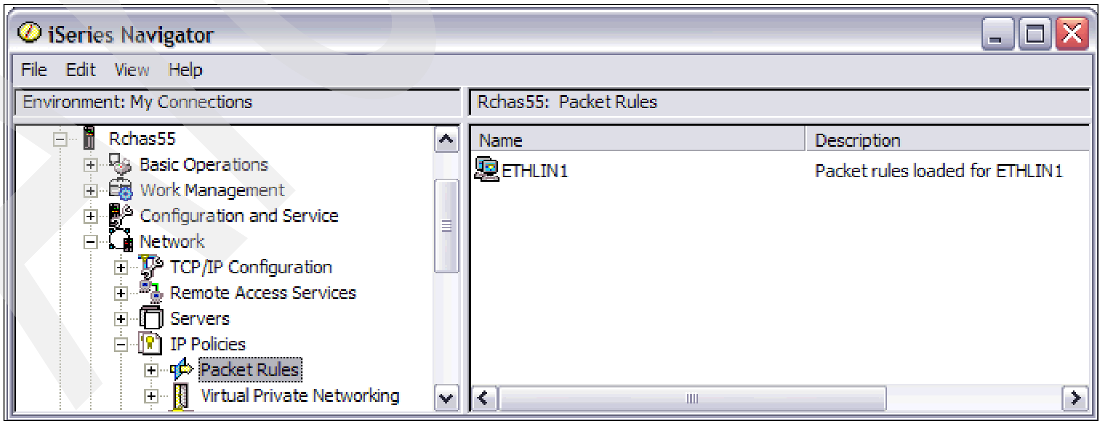
Filter identifier:

○ Activate these rules on all interfaces and all point-to-point filter identifiers

Figure 5-54 Activate Packet Rules window

10. Click **OK** to activate the VPN generated rules.

11. The IP packet filtering rules for your VPN are now active. The appear in the right pane (Figure 5-55).



Name	Description
ETHLIN1	Packet rules loaded for ETHLIN1

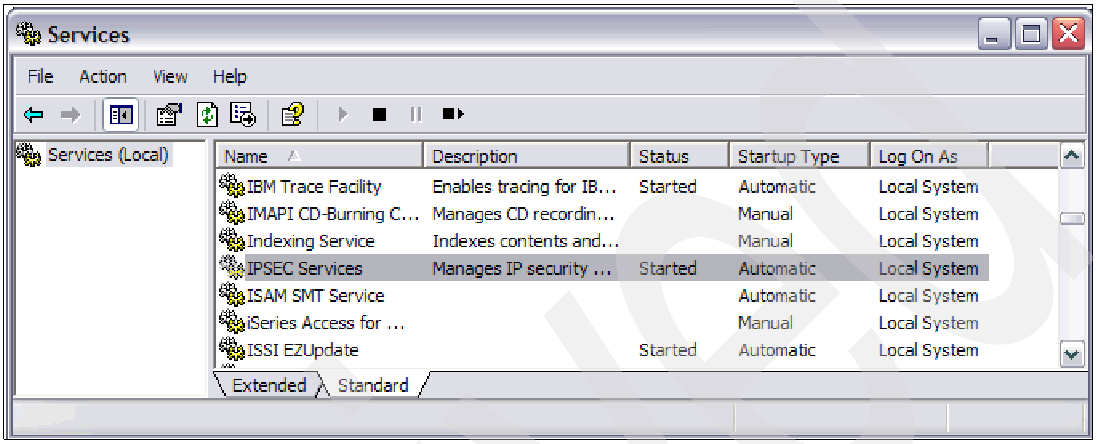
Figure 5-55 VPN packet rules activated

You have now completed the task of starting the VPN server on the i5/OS system (responder).

5.3.6 Starting the VPN connection on the Windows XP system (initiator)

To establish the VPN connection on the Windows XP system:

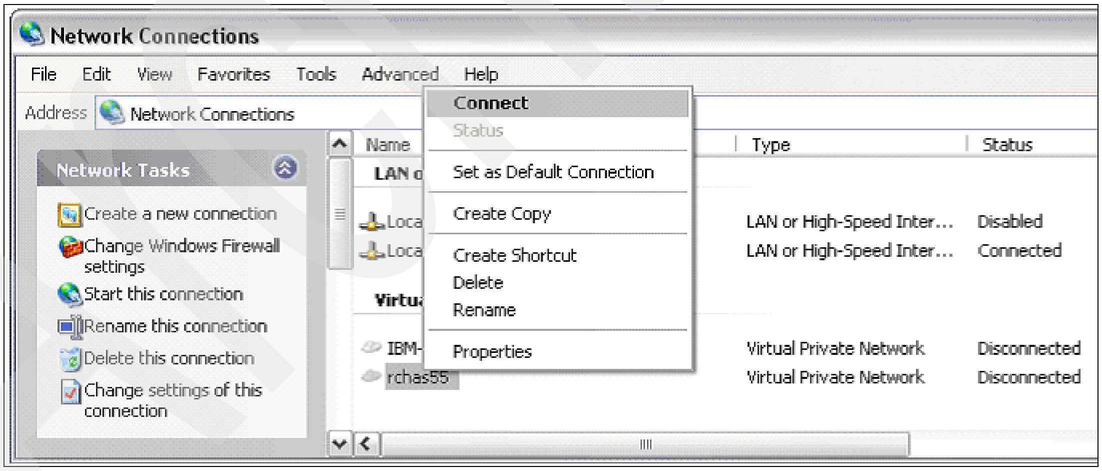
1. On the Microsoft Windows XP task bar, click **Start** → **Programs** → **Administrative Tools** → **Services**.
2. Verify that the status for IPSEC Services is `Started` (Figure 5-56). If not, start this service because it is a prerequisite for establishing VPN connections on the Windows XP system.



Name	Description	Status	Startup Type	Log On As
IBM Trace Facility	Enables tracing for IB…	Started	Automatic	Local System
IMAPI CD-Burning C…	Manages CD recordin…		Manual	Local System
Indexing Service	Indexes contents and…		Manual	Local System
IPSEC Services	Manages IP security …	Started	Automatic	Local System
ISAM SMT Service			Automatic	Local System
iSeries Access for …			Manual	Local System
ISSI EZUpdate		Started	Automatic	Local System

Figure 5-56 Services window

3. On the Microsoft Windows XP task bar, click **Start** → **Programs** → **Accessories** → **Communications** → **Network Connections**.
4. On the right pane, right-click **RCHAS55** (the VPN connection created for this scenario) and then click **Connect** on the context menu (Figure 5-57).

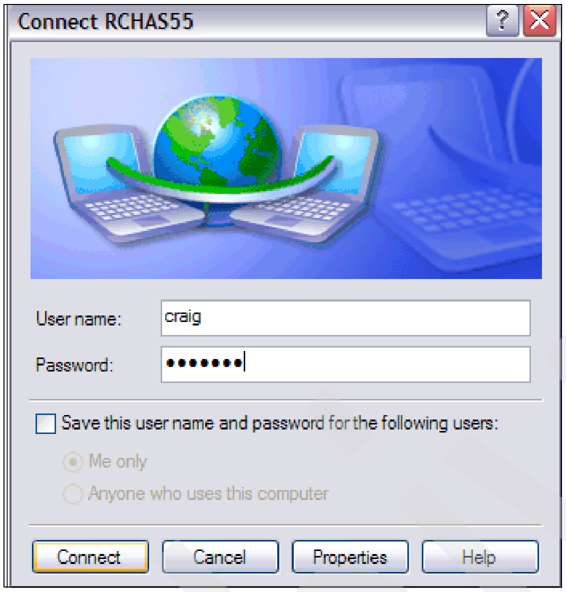


Name	Type	Status
LAN o		
Loca	LAN or High-Speed Inter…	Disabled
Loca	LAN or High-Speed Inter…	Connected
Virtu		
IBM-	Virtual Private Network	Disconnected
rchas55	Virtual Private Network	Disconnected

Figure 5-57 Network Connections window

5. The Connect window appears (Figure 5-58). Enter the user name and password required for this VPN connection and click **Connect** to start the connection.

> **Note:** The user name and password are case-sensitive. They were created in 5.3.3, “Configuring the L2TP profile on the i5/OS system” on page 94.



User name: craig

Password: •••••••

□ Save this user name and password for the following users:

● Me only

○ Anyone who uses this computer

Figure 5-58 Connect window

The VPN connection is successfully established using the L2TP tunnel and protected by IPSec.

To confirm that this connection has the expected host-to-gateway functionality, you can start a telnet session to a system in the corporate network (for example, to the system with IP address 192.168.100.9).

You have now completed the task of starting the VPN connection on the Windows XP system (initiator).

5.4 Verifying the implementation

This section describes the functions that are available to verify the VPN connection created for this scenario.

5.4.1 Verifying connectivity on the Windows XP system

There are several ways to verify the VPN connection on the Windows XP system (initiator).

ipconfig command

You can use the ipconfig command to verify the IP address that is assigned to your workstation. The steps are:

1. Click **Start** → **Programs** → **Accessories** → **Command Prompt**.
2. On the Command prompt window, enter `ipconfig` and press Enter. The information returned by the ipconfig command is similar to Example 5-1 on page 119.

Example 5-1 ipconfig output

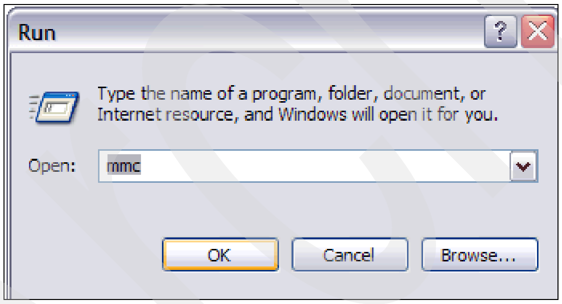
```
Ethernet adapter Local Area Connection 2:

        Connection-specific DNS Suffix  . :
        IP Address. . . . . . . . . . . . : 10.1.1.4
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . : 10.1.1.1

PPP adapter rchas55:

        Connection-specific DNS Suffix  . :
        IP Address. . . . . . . . . . . . : 192.168.100.200
        Subnet Mask . . . . . . . . . . . : 255.255.255.255
        Default Gateway . . . . . . . . . :
```

The IP address of the PPP adapter represents the address assigned from the L2TP Network Server (LNS) on the i5/OS system.

IP Security Monitor

Another way to check whether a secured connection is established and what type of protection is using the Microsoft Management Console, in combination with the IP Security Monitor snap-in. The steps are:

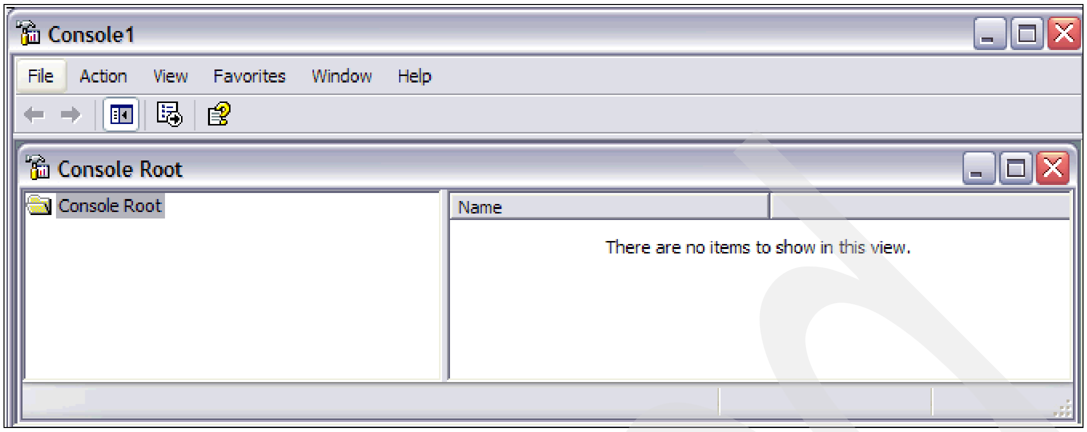
1. On the Microsoft Windows XP task bar, click **Start** → **Run**. The Run window appears (Figure 5-59).
2. Enter `mmc` and click **OK**.


Run
?
Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.
Open:
OK
Cancel
Browse...

mmc

Figure 5-59 Starting the Microsoft Management Console

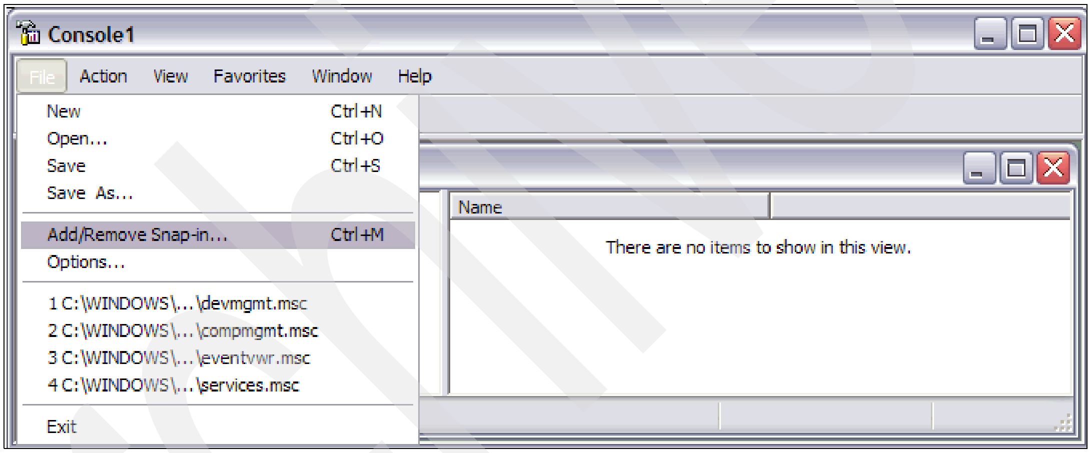
3. The Console window appears (Figure 5-60).



There are no items to show in this view.

Figure 5-60 Microsoft Management Console window

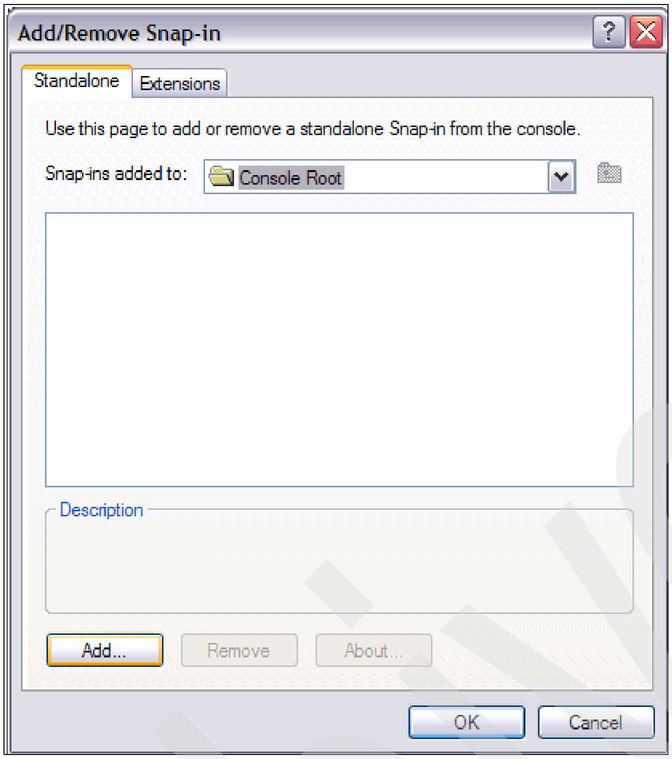
4. On the console menu (Figure 5-61), click **File** and then click **Add/Remove Snap-in.**


Console1
File
Action
View
Favorites
Window
Help
New Ctrl+N
Open... Ctrl+O
Save Ctrl+S
Save As...
Add/Remove Snap-in... Ctrl+M
Options...
1 C:\WINDOWS\...\devmgmt.msc
2 C:\WINDOWS\...\compmgmt.msc
3 C:\WINDOWS\...\eventvwr.msc
4 C:\WINDOWS\...\services.msc
Exit
Name

There are no items to show in this view.

Figure 5-61 Adding a new snap-in to the console

5. When the Add/Remove Snap-in window (Figure 5-62) displays, click **Add**.



Add/Remove Snap-in

Standalone | Extensions

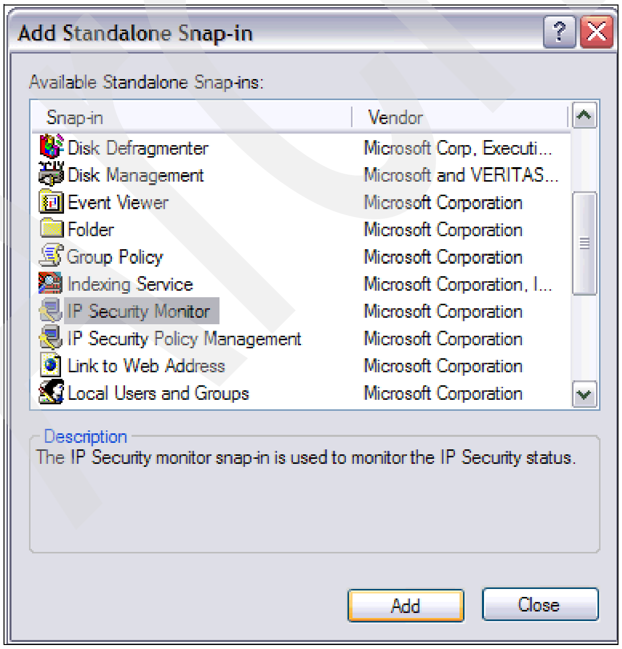
Use this page to add or remove a standalone Snap-in from the console.

Snap-ins added to: Console Root

Description

Figure 5-62 Add/Remove Snap-in window

6. The Add Standalone Snap-in window appears (Figure 5-63). Scroll down the list of available standalone snap-ins and click **IP Security Monitor** to select this snap-in. Click **Add** to add it to the console.



Add Standalone Snap-in

Available Standalone Snap-ins:

Snap-in	Vendor
Disk Defragmenter	Microsoft Corp, Executi...
Disk Management	Microsoft and VERITAS...
Event Viewer	Microsoft Corporation
Folder	Microsoft Corporation
Group Policy	Microsoft Corporation
Indexing Service	Microsoft Corporation, I...
IP Security Monitor	Microsoft Corporation
IP Security Policy Management	Microsoft Corporation
Link to Web Address	Microsoft Corporation
Local Users and Groups	Microsoft Corporation

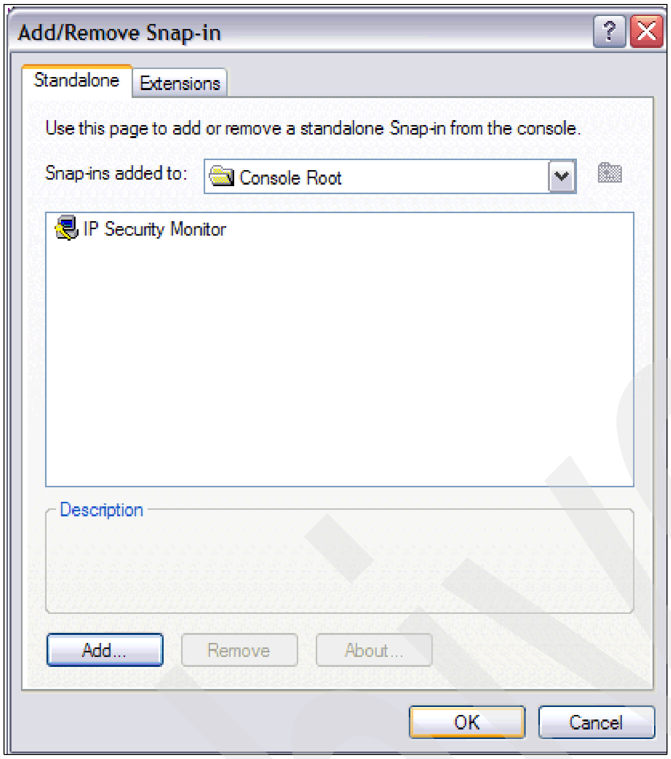
Description

The IP Security monitor snap-in is used to monitor the IP Security status.

Figure 5-63 Add Standalone Snap-in window

7. Click **Close** to return to the Add/Remove Snap-in window (Figure 5-64).

8. On the Add/Remove Snap-in window, click **OK** to complete the add snap-in process.



Use this page to add or remove a standalone Snap-in from the console.

Snap-ins added to: Console Root

IP Security Monitor

Figure 5-64 Add/Remove Snap-in window adding IP Security Monitor snap-in

9. The Console window (Figure 5-65) now shows the IP Security Monitor snap-in.

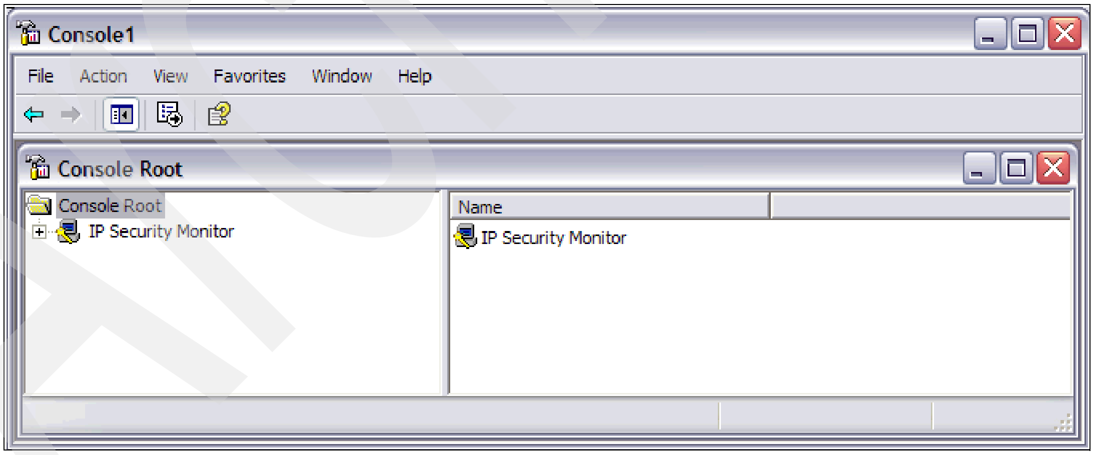
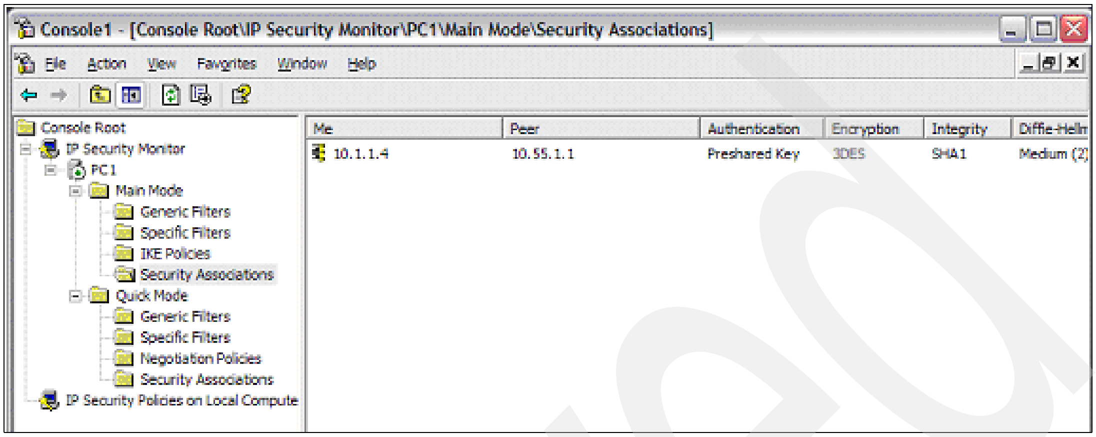


Figure 5-65 Microsoft Management Console window, after adding IP Security Monitor snap-in

10. Expand the console tree to **IP Security Monitor** → ***workstation*** → **Main Mode** and click **Security Associations**.

The security associations for main mode displays on the details pane as shown in Figure 5-66. These are the IPSec values negotiated when the VPN connection was established at IKE Phase 1 (for example, the authentication method, the hash, and encryption algorithms that are providing key protection).



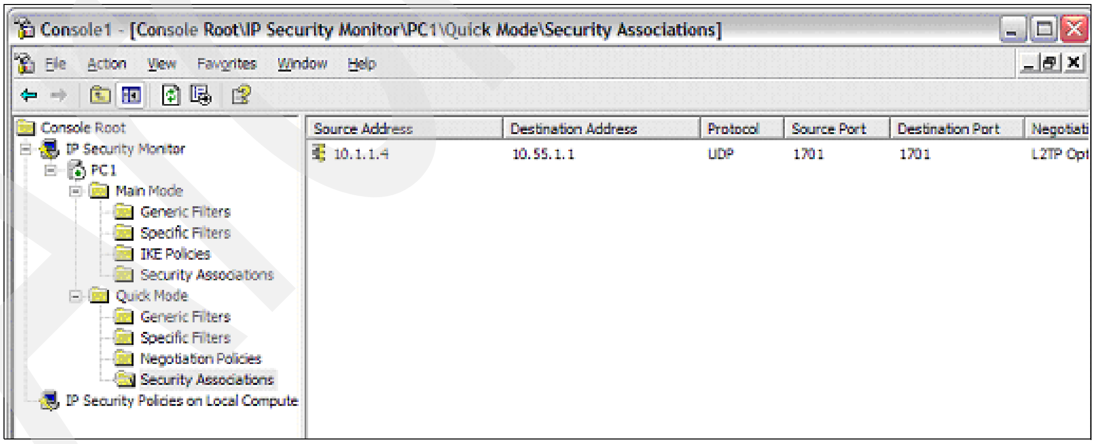
Me	Peer	Authentication	Encryption	Integrity	Diffie-Hellm
10.1.1.4	10.55.1.1	Preshared Key	3DES	SHA1	Medium (2)

Figure 5-66   Security Associations for IKE Phase 1 (main mode)

11. In the navigation pane of the Console window, expand **IP Security Monitor** → ***workstation*** → **Quick Mode** and click **Security Associations**.

    The security associations for quick mode display on the details pane as shown in Figure 5-67. These are the IPSec values negotiated at IKE Phase 2 (for example, the mechanism that is providing data protection).

    > **Note:** L2TP uses UDP port 1701. Seeing this port displayed in the security associations for quick mode confirms that all the traffic across the L2TP tunnel is protected by IPSec.



Source Address	Destination Address	Protocol	Source Port	Destination Port	Negotiati
10.1.1.4	10.55.1.1	UDP	1701	1701	L2TP Opt

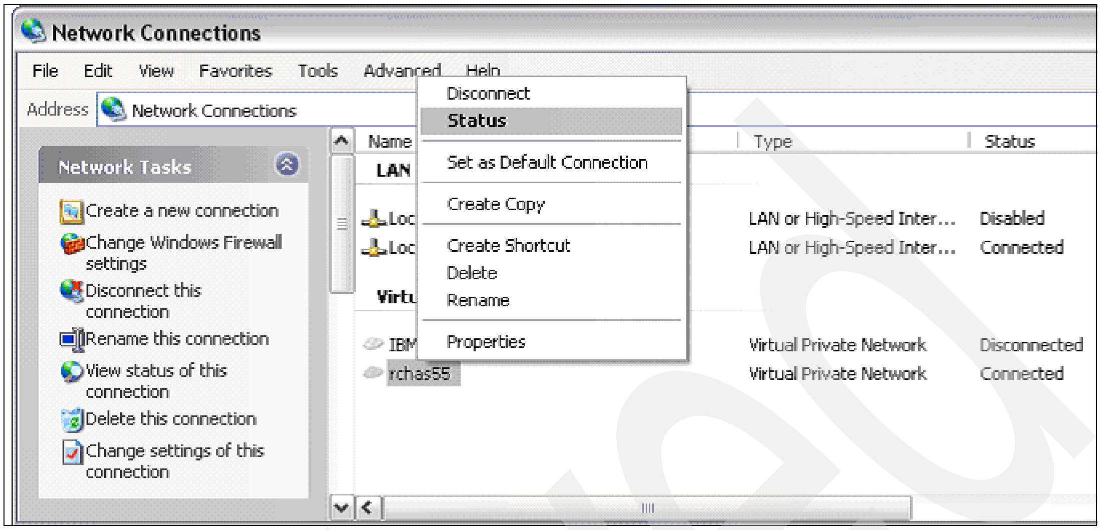
Figure 5-67   Security Associations for IKE Phase 2 (quick mode)

Network Connections interface

Another mechanism to verify the VPN connection is described in the following steps:

1. On the Microsoft Windows XP task bar, click **Start** → **Programs** → **Accessories** → **Communications** → **Network Connections**.

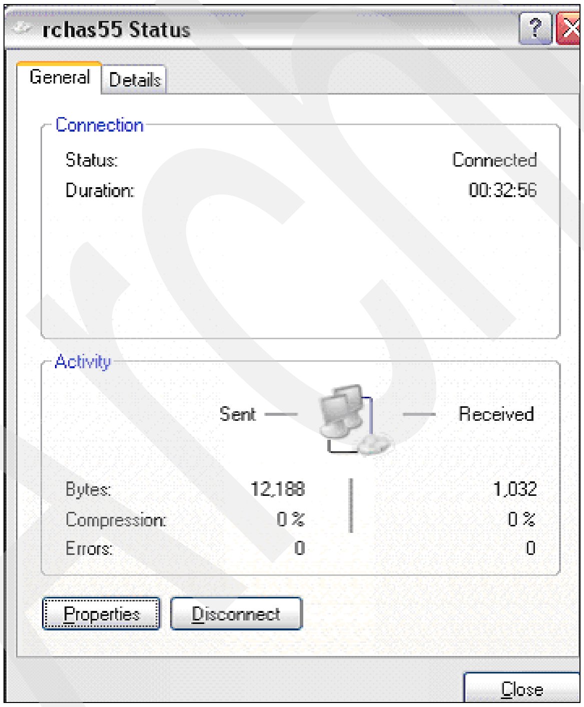
2. On the right pane, right-click **RCHAS55** (the VPN connection created for this scenario) and click **Status** on the context menu (Figure 5-68).



Name	Type	Status
LAN		
Loc	LAN or High-Speed Inter...	Disabled
Loc	LAN or High-Speed Inter...	Connected
Virtu		
IBM	Virtual Private Network	Disconnected
rchas55	Virtual Private Network	Connected

Figure 5-68 Network Connections window

3. The Connection Status window (Figure 5-69) displays, showing statistics about the connection.



Status: Connected

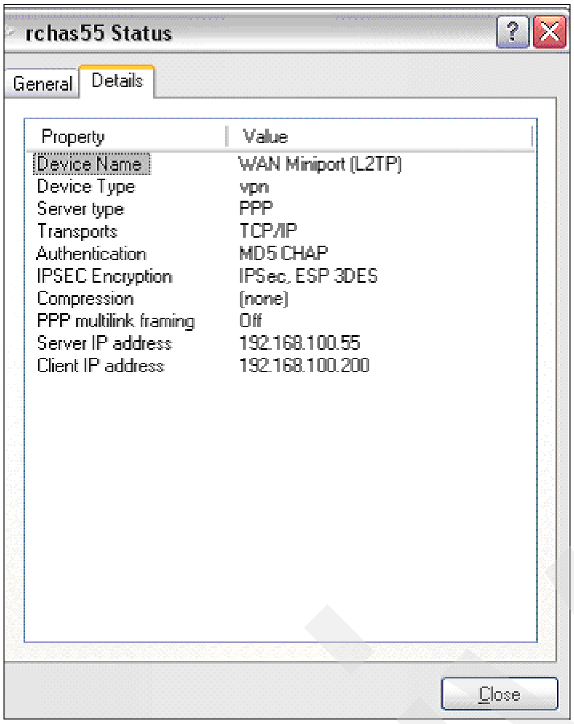
Duration: 00:32:56

	Sent	Received
Bytes:	12,188	1,032
Compression:	0 %	0 %
Errors:	0	0

Figure 5-69 Connection Status window - General tab

4. Click the **Details** tab.

   The Details tab (Figure 5-70 on page 125) information shows what kind of IPSec protocol is used to protect the data traffic. In this case, the data is protected by the Encapsulated Security Payload (ESP) protocol, which also encrypts the encryption key length, thus providing additional security. The DES encryption algorithm with a key length of 56 bits is used to encrypt the data traffic.



Property	Value
Device Name	WAN Miniport (L2TP)
Device Type	vpn
Server type	PPP
Transports	TCP/IP
Authentication	MD5 CHAP
IPSEC Encryption	IPSec, ESP 3DES
Compression	(none)
PPP multilink framing	Off
Server IP address	192.168.100.55
Client IP address	192.168.100.200

Figure 5-70 Connection Status window - Details tab

5. Click **Close** to close the Connection Status window.

5.4.2 Verifying connectivity on the i5/OS system

To verify the VPN connection on the i5/OS system, use the iSeries Navigator.

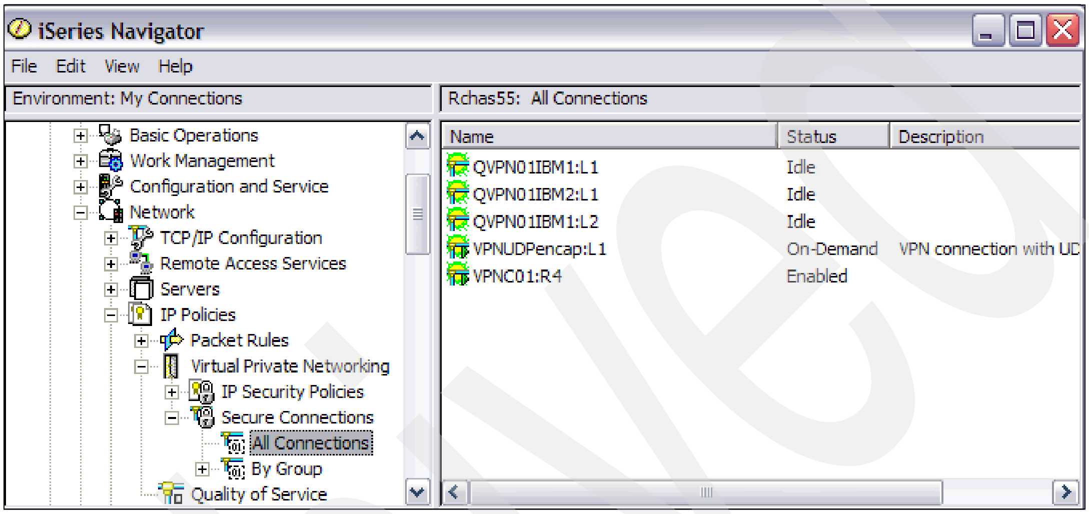
Verifying IPSec attributes

To verify the IPSec attributes of your VPN connection:

1. From the Navigation pane of the iSeries Navigator, expand **My Connections** → ***servername*** → **Network** → **IP Policies** → **Virtual Private Networking** → **Secure Connections**.

2. Click **All Connections**.

   The list of current connections will be displayed on the right pane as shown in Figure 5-71. The characters after the name of each connection identify the initiator (“:L” meaning local, “:R” meaning remote). For example, the connection established in this scenario appears as VPNC01:R4. The R means that the connection has been established from a remote system (the Windows XP workstation). The number after the R (4 in this example) represents a number for the connection and changes each time a connection is established. A restart of the VPN server resets the numbering.



Name	Status	Description
QVPN01IBM1:L1	Idle	
QVPN01IBM2:L1	Idle	
QVPN01IBM1:L2	Idle	
VPNUDPencap:L1	On-Demand	VPN connection with UD
VPNC01:R4	Enabled	

Figure 5-71 Virtual Private Networking - All Connections

3. On the right pane (Figure 5-72), right-click **VPNC01:R4** and click **Properties** to display the IPSec/IKE attributes of your VPN connection.

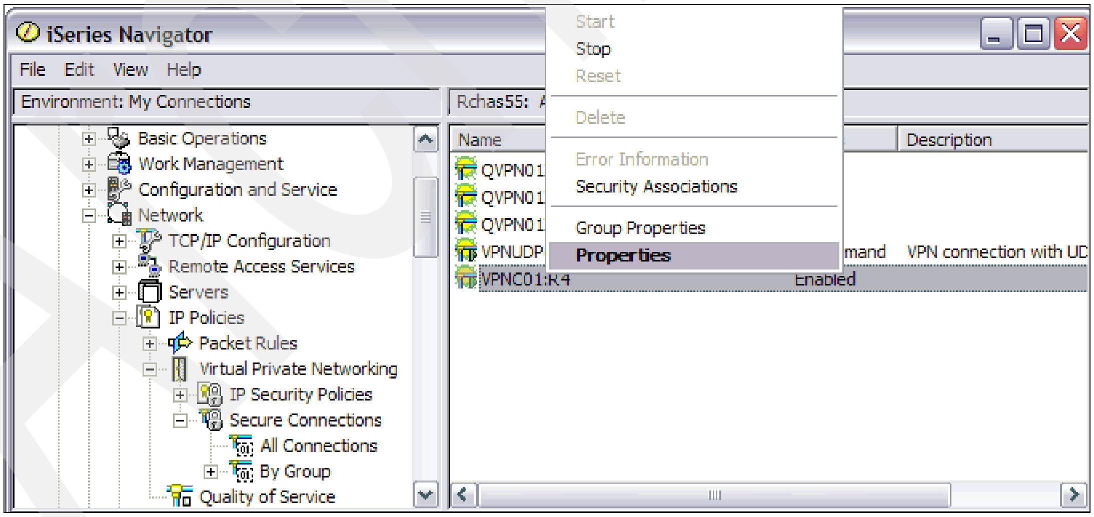
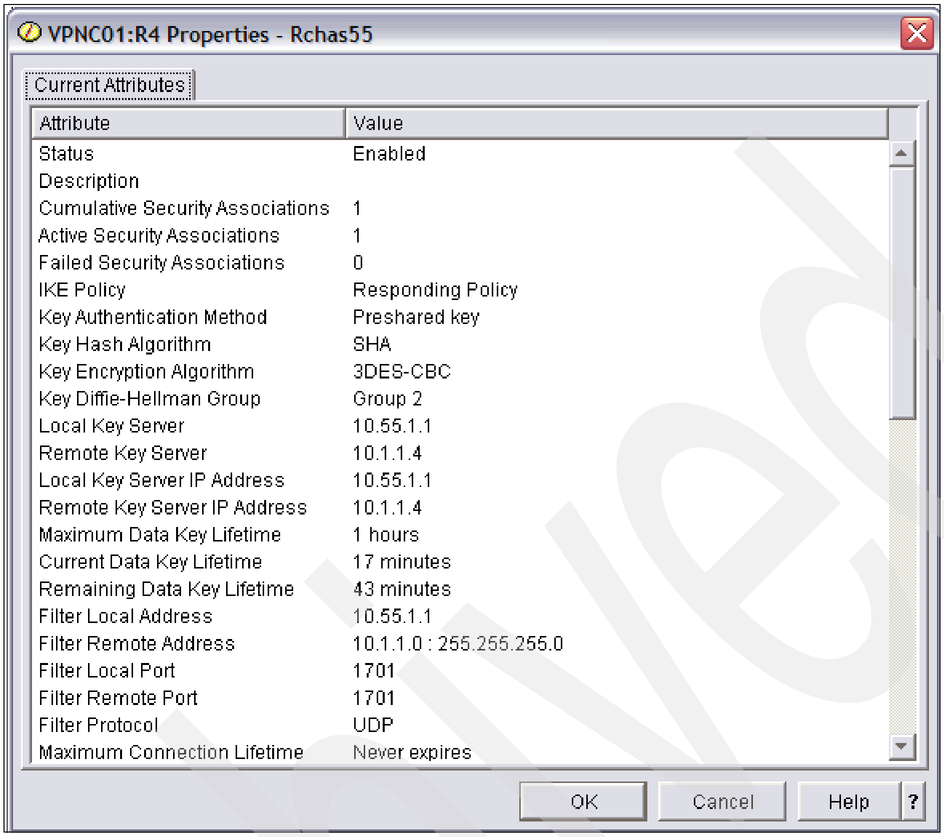


Figure 5-72 Virtual Private Networking - Displaying the properties of a remote connection

4. The IKE attributes of your VPN connection display (Figure 5-73).



Attribute	Value
Status	Enabled
Description	
Cumulative Security Associations	1
Active Security Associations	1
Failed Security Associations	0
IKE Policy	Responding Policy
Key Authentication Method	Preshared key
Key Hash Algorithm	SHA
Key Encryption Algorithm	3DES-CBC
Key Diffie-Hellman Group	Group 2
Local Key Server	10.55.1.1
Remote Key Server	10.1.1.4
Local Key Server IP Address	10.55.1.1
Remote Key Server IP Address	10.1.1.4
Maximum Data Key Lifetime	1 hours
Current Data Key Lifetime	17 minutes
Remaining Data Key Lifetime	43 minutes
Filter Local Address	10.55.1.1
Filter Remote Address	10.1.1.0 : 255.255.255.0
Filter Local Port	1701
Filter Remote Port	1701
Filter Protocol	UDP
Maximum Connection Lifetime	Never expires

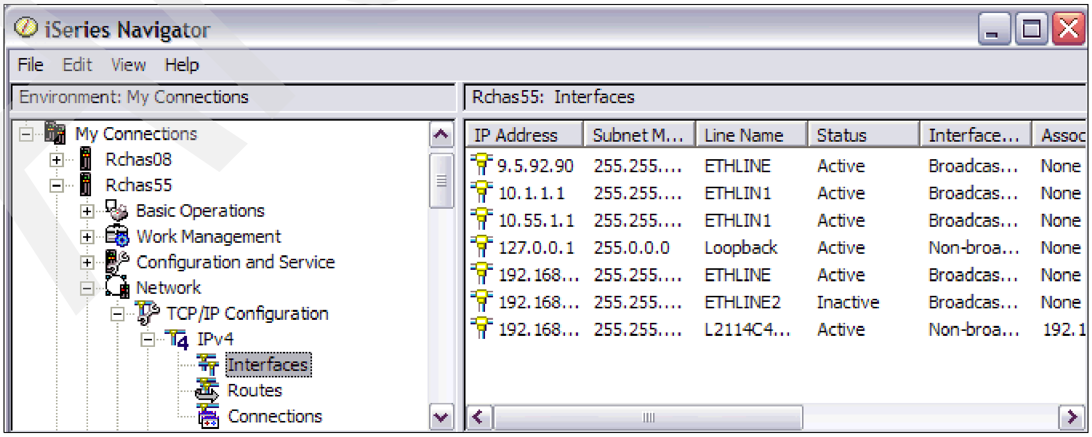
Figure 5-73 VPN Properties - Current attributes of the VPN/IPSec connection

5. Click **OK** to close the Connection Properties window.

6. From the Navigation pane of the iSeries Navigator, expand **My Connections** → ***servername*** → **Network** → **TCP/IP Configuration** → **IPv4**.

7. Click **Interfaces**.

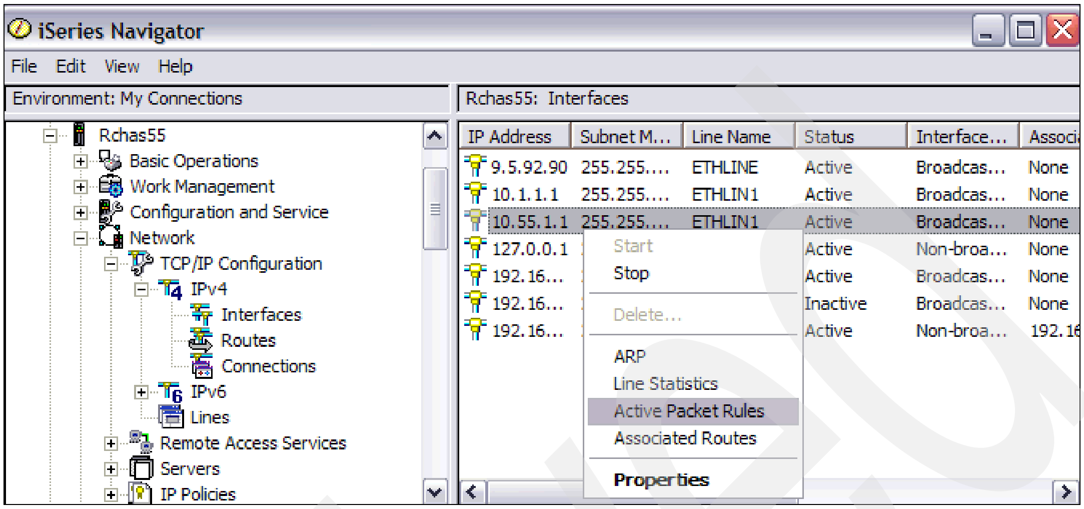
   The list of TCP/IP interfaces defined in your system displays on the right pane as shown in Figure 5-74.



IP Address	Subnet M...	Line Name	Status	Interface...	Assoc
9.5.92.90	255.255....	ETHLINE	Active	Broadcas...	None
10.1.1.1	255.255....	ETHLIN1	Active	Broadcas...	None
10.55.1.1	255.255....	ETHLIN1	Active	Broadcas...	None
127.0.0.1	255.0.0.0	Loopback	Active	Non-broa...	None
192.168...	255.255....	ETHLINE	Active	Broadcas...	None
192.168...	255.255....	ETHLINE2	Inactive	Broadcas...	None
192.168...	255.255....	L2114C4...	Active	Non-broa...	192.1

Figure 5-74 TCP/IP Configuration - Interfaces

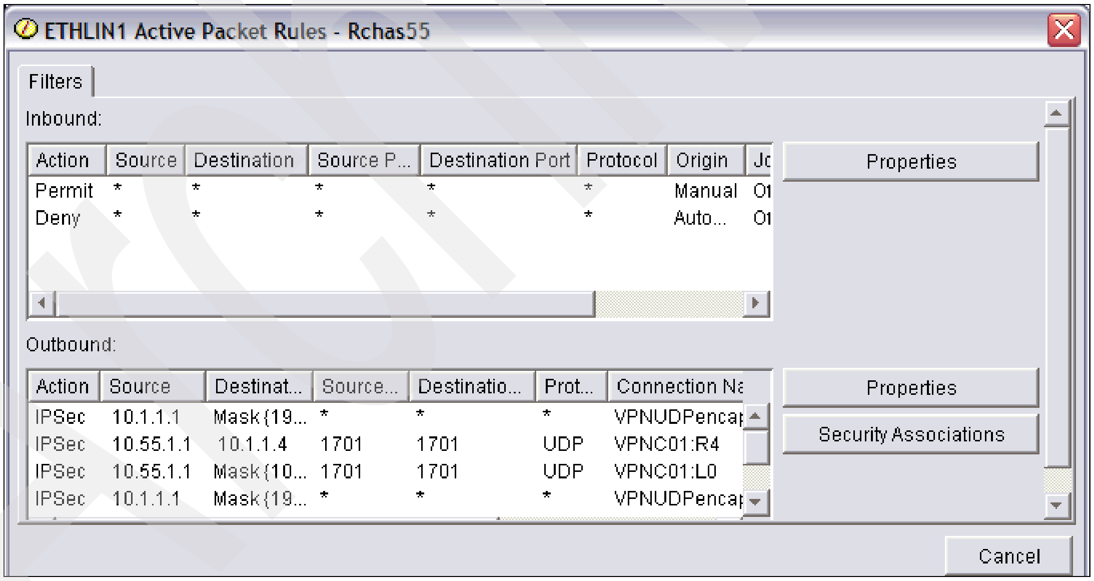
8. On the right pane (Figure 5-75), right-click **10.55.1.1** (the public IP address of your i5/OS gateway system) and click **Active Packet Rules** to display the IP packet filtering attributes of your VPN connection.



IP Address	Subnet M...	Line Name	Status	Interface...	Associ
9.5.92.90	255.255....	ETHLINE	Active	Broadcas...	None
10.1.1.1	255.255....	ETHLIN1	Active	Broadcas...	None
10.55.1.1	255.255....	ETHLIN1	Active	Broadcas...	None
127.0.0.1			Active	Non-broa...	None
192.16...			Active	Broadcas...	None
192.16...			Inactive	Broadcas...	None
192.16...			Active	Non-broa...	192.16

Figure 5-75 TCP/IP Configuration - Interfaces

9. The Active Packet Rules window (Figure 5-76) displays, showing the IP packet filtering rules applied on the interface used by your VPN connection. Both inbound and outbound packet rules are listed.



Inbound:

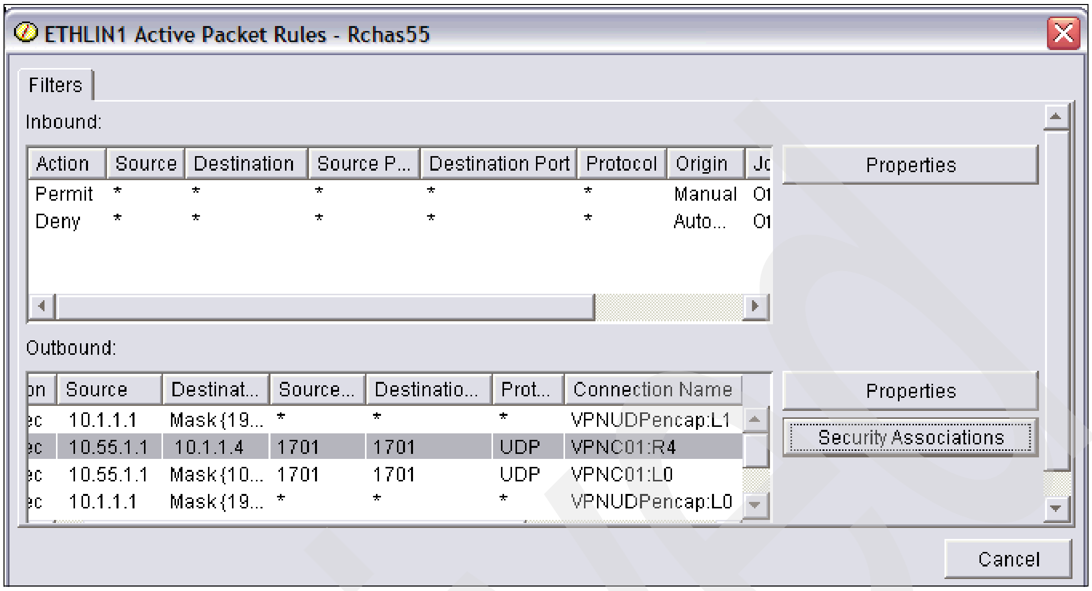
Action	Source	Destination	Source P...	Destination Port	Protocol	Origin	Jc
Permit	*	*	*	*	*	Manual	01
Deny	*	*	*	*	*	Auto...	01

Outbound:

Action	Source	Destinat...	Source...	Destinatio...	Prot...	Connection Na
IPSec	10.1.1.1	Mask{19...	*	*	*	VPNUDPencap
IPSec	10.55.1.1	10.1.1.4	1701	1701	UDP	VPNC01:R4
IPSec	10.55.1.1	Mask{10...	1701	1701	UDP	VPNC01:L0
IPSec	10.1.1.1	Mask{19...	*	*	*	VPNUDPencap

Figure 5-76 Active Packet Rules

10. From the list in the Outbound section (Figure 5-77), select the **VPNC01:R4** entry (the entry associated to your remote VPN connection) and click **Security Associations**.



Inbound:

Action	Source	Destination	Source P...	Destination Port	Protocol	Origin	Jc
Permit	*	*	*	*	*	Manual	01
Deny	*	*	*	*	*	Auto...	01

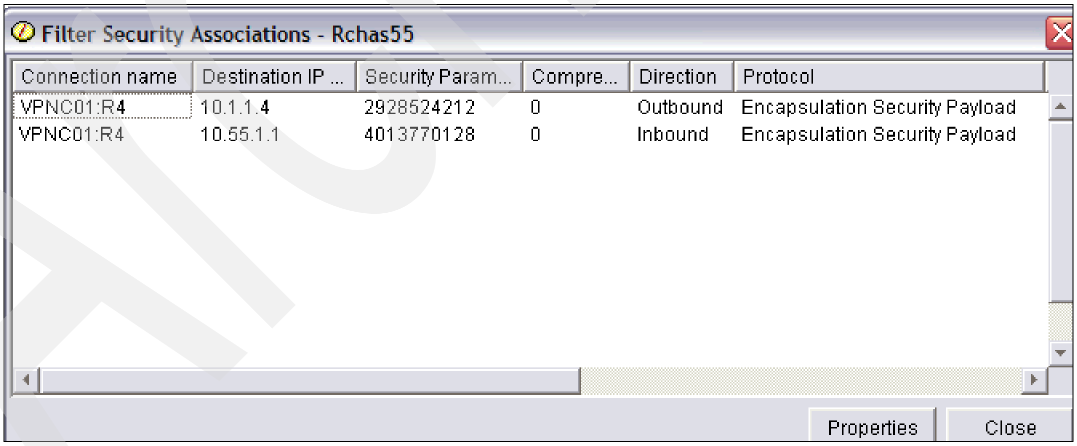
Outbound:

on	Source	Destinat...	Source...	Destinatio...	Prot...	Connection Name
ec	10.1.1.1	Mask{19...	*	*	*	VPNUDPencap:L1
ec	10.55.1.1	10.1.1.4	1701	1701	UDP	VPNC01:R4
ec	10.55.1.1	Mask{10...	1701	1701	UDP	VPNC01:L0
ec	10.1.1.1	Mask{19...	*	*	*	VPNUDPencap:L0

Figure 5-77 Active Packet Rules

11. The Filter Security Associations window (Figure 5-78) displays. You can see that a single VPN connection between two systems uses an inbound and an outbound security association (SA). The security parameter index (SPI) in conjunction with the IP address is used in IPsec-protected IP packets to find the corresponding SA on the VPN connection endpoint.

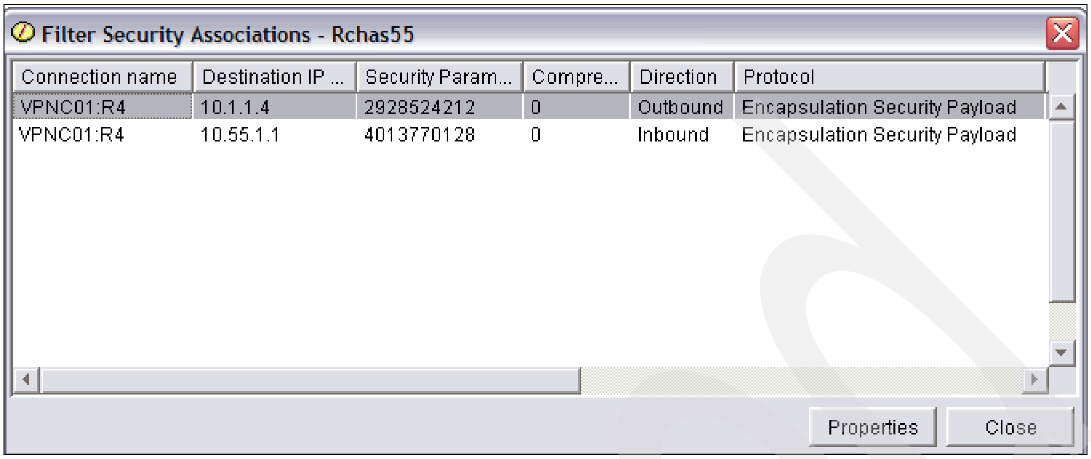
    You can also notice that both SAs (inbound and outbound) are using the Encapsulation Security Payload (ESP) protocol to protect the traffic across the VPN connection.



Connection name	Destination IP ...	Security Param...	Compre...	Direction	Protocol
VPNC01:R4	10.1.1.4	2928524212	0	Outbound	Encapsulation Security Payload
VPNC01:R4	10.55.1.1	4013770128	0	Inbound	Encapsulation Security Payload

Figure 5-78 Filter Security Associations

12. Select the **Outbound** entry and click **Properties** to see additional IPSec details (Figure 5-79).

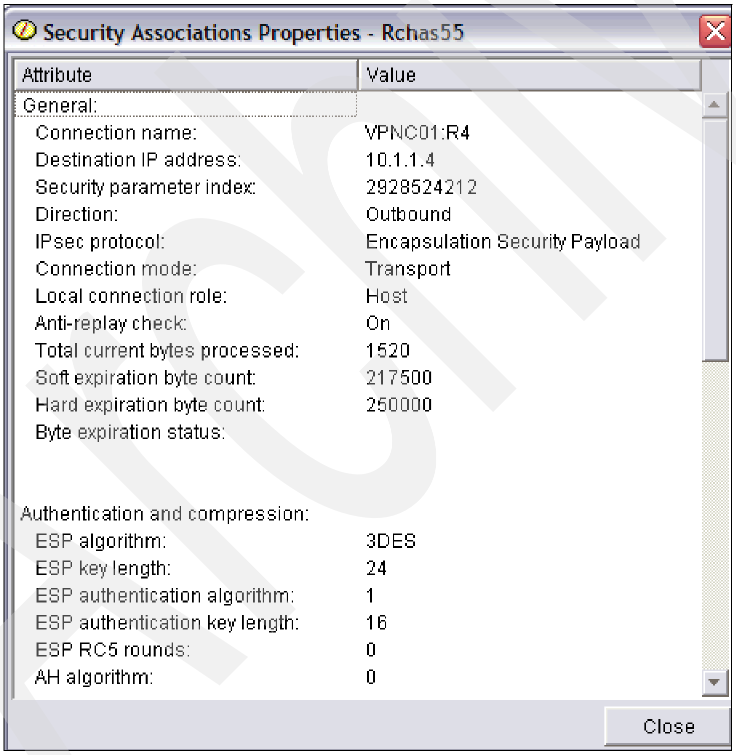


Filter Security Associations - Rchas55

Connection name	Destination IP ...	Security Param...	Compre...	Direction	Protocol
VPNC01:R4	10.1.1.4	2928524212	0	Outbound	Encapsulation Security Payload
VPNC01:R4	10.55.1.1	4013770128	0	Inbound	Encapsulation Security Payload

Figure 5-79 Filter Security Associations

13. The additional IPSec attributes of your VPN connection display similar to those in Figure 5-80.



Security Associations Properties - Rchas55

Attribute	Value
General:	
Connection name:	VPNC01:R4
Destination IP address:	10.1.1.4
Security parameter index:	2928524212
Direction:	Outbound
IPsec protocol:	Encapsulation Security Payload
Connection mode:	Transport
Local connection role:	Host
Anti-replay check:	On
Total current bytes processed:	1520
Soft expiration byte count:	217500
Hard expiration byte count:	250000
Byte expiration status:	
Authentication and compression:	
ESP algorithm:	3DES
ESP key length:	24
ESP authentication algorithm:	1
ESP authentication key length:	16
ESP RC5 rounds:	0
AH algorithm:	0

Figure 5-80 Security Association Properties

14. Click **Close** to return to the Filter Security Associations window.

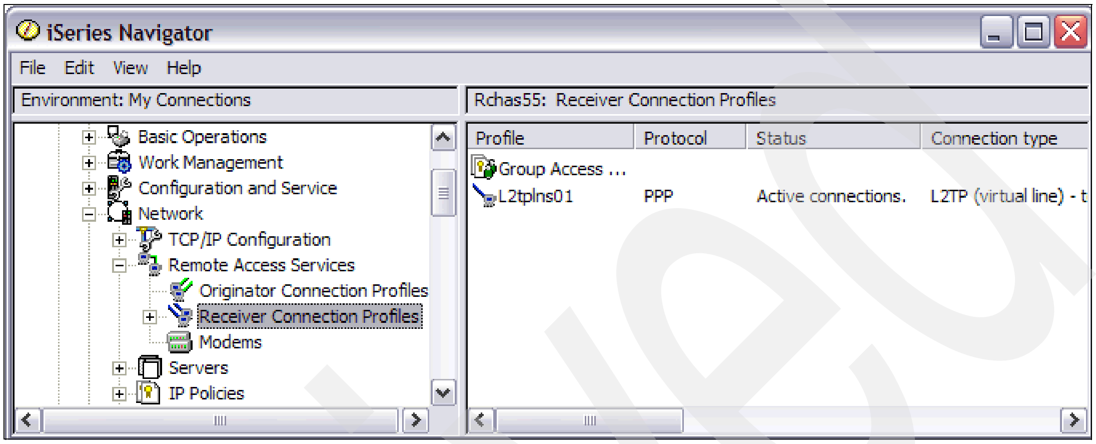
15. On the Filter Security Associations window, click **Close** to return to the Active Packet Rules window.

16. On the Active Packet Rules window, click **Cancel** to return to the iSeries Navigator.

Verifying L2TP attributes

To verify the L2TP attributes of the connection:

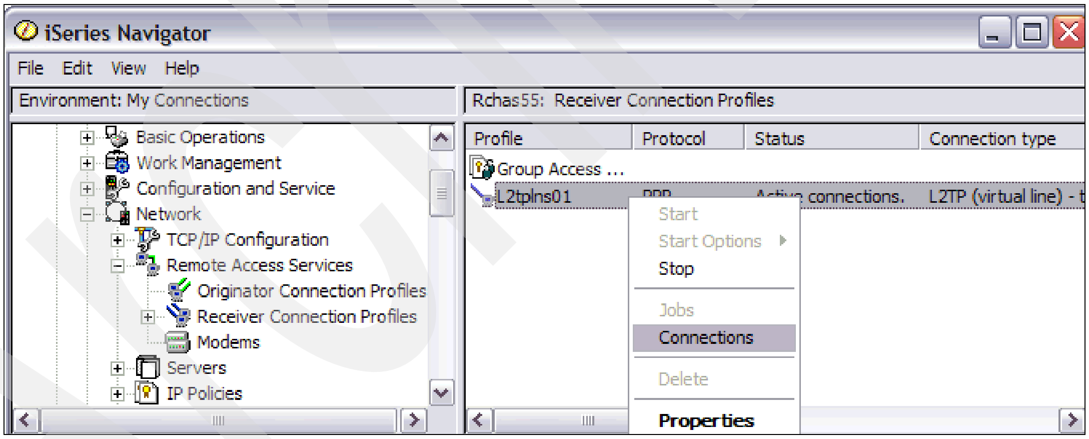
1. From the Navigation pane of the iSeries Navigator, expand **My Connections** → ***servername*** → **Network** → **Remote Access Services**.
2. Click **Receiver Connection Profiles** to see the list of L2TP profiles in your system (Figure 5-81). Your L2TP profile has a status of `Active Connections`.


iSeries Navigator
File
Edit
View
Help
Environment: My Connections
Basic Operations
Work Management
Configuration and Service
Network
TCP/IP Configuration
Remote Access Services
Originator Connection Profiles
Receiver Connection Profiles
Modems
Servers
IP Policies
Rchas55: Receiver Connection Profiles

Profile	Protocol	Status	Connection type
Group Access ...			
L2tplns01	PPP	Active connections.	L2TP (virtual line) - t

Figure 5-81 Receiver Connection Profiles - Status of L2TP profiles

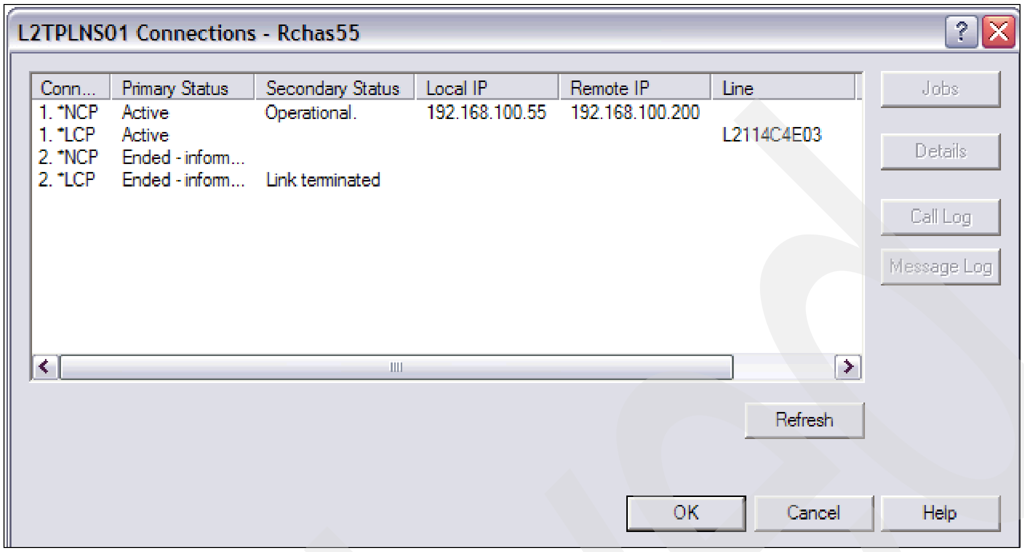
3. On the right pane (Figure 5-82), right-click **L2tpIns01** and click **Connections** to display information about the connections using this L2TP profile.



Profile	Protocol	Status	Connection type
Group Access ...			
L2tplns01	PPP	Active connections.	L2TP (virtual line) - t

Figure 5-82 Displaying information about L2TP connections

4. The L2TP Connections window displays (Figure 5-83) showing details of your L2TP connection, such as the status and the IP addresses for both sides of the L2TP tunnel.



L2TPLNS01 Connections - Rchas55

Conn...	Primary Status	Secondary Status	Local IP	Remote IP	Line
1. *NCP	Active	Operational.	192.168.100.55	192.168.100.200	
1. *LCP	Active				L2114C4E03
2. *NCP	Ended - inform...				
2. *LCP	Ended - inform...	Link terminated			

Figure 5-83 L2TP Connections - Details

5. Click **OK** to close the L2TP Connections window and return to the iSeries Navigator.

5.5 Tips and techniques

You can use most of the tools and functions described in 5.4, “Verifying the implementation” on page 118 for VPN troubleshooting.

If you experience problems when implementing or using your VPN connections, see *Troubleshooting VPN* in the V5R4 Information Center at*:*

http://publib.boulder.ibm.com/infocenter/iseries/v5r4/topic/rzaja/rzajatroubleshootvpn.htm

6

Password elimination using Windows 2003 KDC

Single Sign-on (SSO) represents different things and in different implementations. In this book, we use the term in the perspective of *password elimination*. In a network of multiple systems, or servers, each has its own way of authentication that involves a password. This existence of ‘multiple passwords for ‘the same user or server” causes headaches for both users and network and security administrators and great security hazards.

By “password elimination SSO - SSO realized through password elimination”, we suggest a scenario where this problem is fixed by eliminating multiple passwords for a single user or server. We use the *Network Authentication Services* (NAS) and the *Enterprise Identity Mapping* (EIM) to realize this concept. This chapter starts with a brief explanation of a password elimination SSO implementation.

You can also find a practical basic scenario updated for V5R4 on how to implement the SSO on iSeries Access (5250 telnet and its related host servers) and on iSeries NetServer™.

Finally, we cover how to back up your EIM domain to ensure high availability of your SSO solution.

For explanations related to the Kerberos and EIM, see *Windows-based Single Sign-on and the EIM Framework on the IBM eserver iSeries Server*, SG24-6975.

6.1 What is SSO?

In a typical environment today, most employees have multiple user profiles and passwords to remember. Each time they access a system, they must supply their ID and password to access the resources on that system. Single sign-on (SSO) allows a computer user to sign on when at the start of the day with no prompting for additional sign-on requests or challenges for additional passwords for the rest of the day. We have not reached that perfect status: not all applications support this solution. However, we are close to making the implementation of SSO worthwhile. 6.6, “Single sign-on tips” on page 234 provides a list of i5/OS applications that are SSO-enabled.

Starting with OS/400 V5R2, several services were enabled to function in a SSO environment. iSeries Access and NetServer, for example, are enabled for SSO. However, that implementation was weak because those services utilize SSO if the Microsoft Windows user ID matches the i5/OS user profile name and the passwords between the systems match.

This SSO is different from the older concept of SSO. It is not a password cache or a user and password synchronization. Here, the same user can run on his workstation on any number of applications already enabled for SSO that can access without being prompted for a user ID or password - even if his user ID in those applications is entirely different from his Windows user ID. One of the unique characteristics for this i5/OS SSO solution is that you can eliminate the password (for example, by setting it to *NONE). This provides the greatest value and potentially a less risky security exposure.

In this type of SSO, both the client and server make use of a network-authentication authority to control access to network resources. i5/OS service takes advantage of the Network Authentication Services (NAS). All the applications can use the Enterprise Identity Mapping (EIM) to find the corresponding user ID starting from the Windows one.

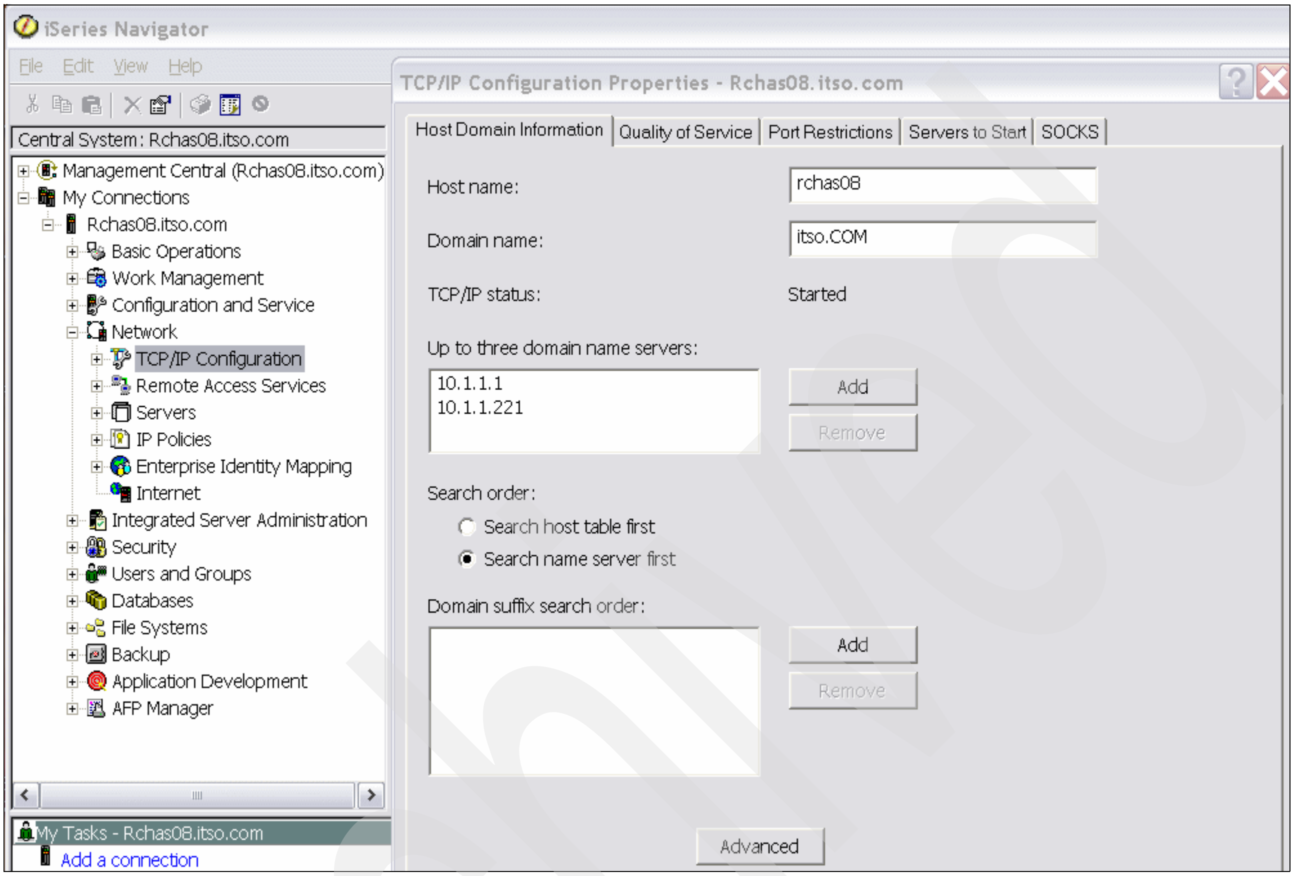
Another characteristic of this password elimination SSO is that you do not have to switch everyone over simultaneously. You combine with other SSO solutions for other systems or applications.

Password elimination SSO solution does not rely on user ID and password synchronization or caching. EIM works if a person has a different user ID on every system or application accessed that is enabled for SSO. The EIM architecture allows you to define relationships between individuals and entities in the enterprise. It is an enabling technology infrastructure and not a solution by itself. Put simply, EIM is a look-up table where each user’s various identities in user registries (different platforms and applications) are mapped to a single identifier. EIM-enabled applications can use this table to associate the identity certified by Kerberos with the identity in its own user registry and allow the user to proceed without further challenges.

The reasons to implement password elimination are to reduce the number of calls to the Help Desk about password management and the potential cost to manage it over time. However, implementing password elimination SSO solution enforces security letting you manage stronger passwords because users only have to create and remember one, making them less likely to write the passwords down. The downside is that if users do not lock their workstations when they walk away, anyone can use and access the workstation enabled for SSO. If you are concerned about this, consider that it is also an issue in the absence of SSO. If a user walks away from a workstation after signing into three systems, you still have risks.

6.2 Scenario description

Figure 6-1 shows a customer network schema.



Host name: rchas08

Domain name: itso.COM

TCP/IP status: Started

Up to three domain name servers:
10.1.1.1
10.1.1.221

Search order:
○ Search host table first
● Search name server first

Domain suffix search order:

Figure 6-1 SSO scenario

In this scenario, we implement a password elimination Single Sign-on solution to let users authenticate themselves only at the Windows domain and to use iSeries applications without other challenges.

We take advantage of the Windows *Active Directory®* users domain authentication that is already set up and working in the customer network on the user's Windows 2003 servers. We enroll two i5/OS systems (one used for production and the other one for testing) in the Active Directory to participate in the Kerberos authentication. Microsoft Active Directory is the most common component that provides Kerberos support so we will use it in our scenario.

Unknown to many users and administrators, Kerberos is implemented in Microsoft Windows 2000 and 2003 Servers and Windows 2000 and XP clients. When you install and set up the Active Directory server on your Microsoft Windows 2000 or 2003 server, you are also configuring the Kerberos server. Kerberos on a Windows server platform uses the Active Directory and the Microsoft implementation of the Lightweight Directory Access Protocol (LDAP) to store all information about principals on the Kerberos realm. You must enroll the Active Directory in the Windows client workstation to be part of the Windows domain.

Password elimination single sign-on solution is not an “all or none” solution. One of its strengths is the granularity of its implementation. We suggest to set up and test it with a few client workstations and then spread the solution for those users and applications where it can make a difference. In our scenario, we test the password elimination SSO implementation with one user and for the iSeries Access (both telnet 5250 and iSeries Access) and NetServer applications.

6.3 Planning for implementation

Before starting the configuration, there are considerations and checks to do. This scenario assumes that:

- There is a Windows domain already configured and that each user has his own user ID enrolled in the Active Directory server.
- There is a DNS server correctly populated with all hosts on the customer network and that all the hosts refer to it.

These are the most common implementations that you can find in the real world.

We configure only one i5/OS and one user to show the configuration steps required and to test the Kerberos implementation. For your network, configure the Kerberos only for a few client workstations at the beginning to test it and propagate the configuration later on the other ones because the password elimination SSO solution is not an “all or none” implementation.

6.3.1 Products prerequisites

This section discusses the requirements.

i5/OS prerequisites

This scenario is based on the V5R4 i5/OS level and the following are the licensed program options you *must* install:

- 5722-SS1 Option 12 - Host Servers
- 5722-SS1 Option 30 - QShell Interpreter
- 5722-XE1 iSeries Access for Windows
- 5722-TC1 TCP/IP Connectivity Utilities for iSeries

In V5R4, license program products 5722-AC3, Cryptographic Access Provider and 5722-CE3, and SSL Client Encryption at 128-bit are no longer required. The function of the first one is now integrated into the operating system, while the function of the second one is integrated into 5722-XE1, iSeries Access for Windows.

Note: In this scenario, we use a Windows 2003 Server as a Kerberos key distribution center (KDC) server. Starting with V5R3, you can use i5/OS as a Kerberos server, which means 5722-SS1 Option 33 i5/OS - PASE is required.

In V5R4, the Kerberos network authentication server is shipped as a separate product, 5722-NAE Network Authetication Enablement.

For more information, see *Setting up a Kerberos server in i5/OS PASE* in the V5R4 Information Center at:

http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/index.jsp?topic=/rzakh/rzakhscenpase.htm

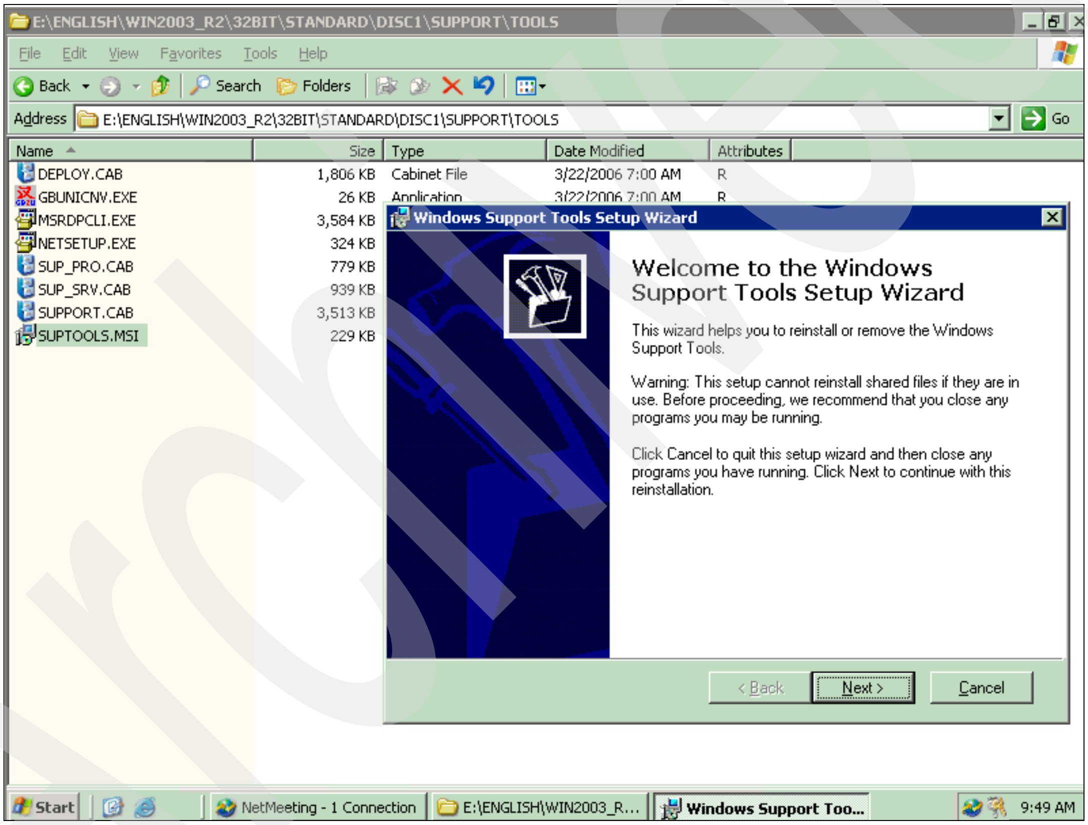
To verify that the required products are installed on i5/OS, from an iSeries Navigator session, expand ***your system connection*** → **Configuration and Service** → **Software** → **Installed products.**

Windows server prerequisites

In this scenario, we use a Windows 2003 server, but even with the Windows 2000 server, these considerations are valid. We assume that on those servers, the Active Directory has already been installed and configured with a Windows domain.

In addition, the Windows Kerberos support tools need to be explicitly installed.

Follow these steps to install the necessary Windows 2003 Server Kerberos support tools. The steps for installing these Kerberos support tools on other Windows operating systems are similar. Place the Windows 2003 Server CD into the CD-ROM drive on the server. Navigate to the CDROM\Support\Tools directory. The window you see looks similar to Figure 6-2.


E:\ENGLISH\WIN2003_R2\32BIT\STANDARD\DISC1\SUPPORT\TOOLS
File
Edit
View
Favorites
Tools
Help
Back
Search
Folders
Address
E:\ENGLISH\WIN2003_R2\32BIT\STANDARD\DISC1\SUPPORT\TOOLS
Go

Name	Size	Type	Date Modified	Attributes
DEPLOY.CAB	1,806 KB	Cabinet File	3/22/2006 7:00 AM	R
GBUNICNV.EXE	26 KB	Application	3/22/2006 7:00 AM	R
MSRDPCLI.EXE	3,584 KB			
NETSETUP.EXE	324 KB			
SUP_PRO.CAB	779 KB			
SUP_SRV.CAB	939 KB			
SUPPORT.CAB	3,513 KB			
SUPTOOLS.MSI	229 KB			

Windows Support Tools Setup Wizard

Welcome to the Windows Support Tools Setup Wizard

This wizard helps you to reinstall or remove the Windows Support Tools.

Warning: This setup cannot reinstall shared files if they are in use. Before proceeding, we recommend that you close any programs you may be running.

Click Cancel to quit this setup wizard and then close any programs you have running. Click Next to continue with this reinstallation.

Figure 6-2 Windows 2003 Server support tools directory

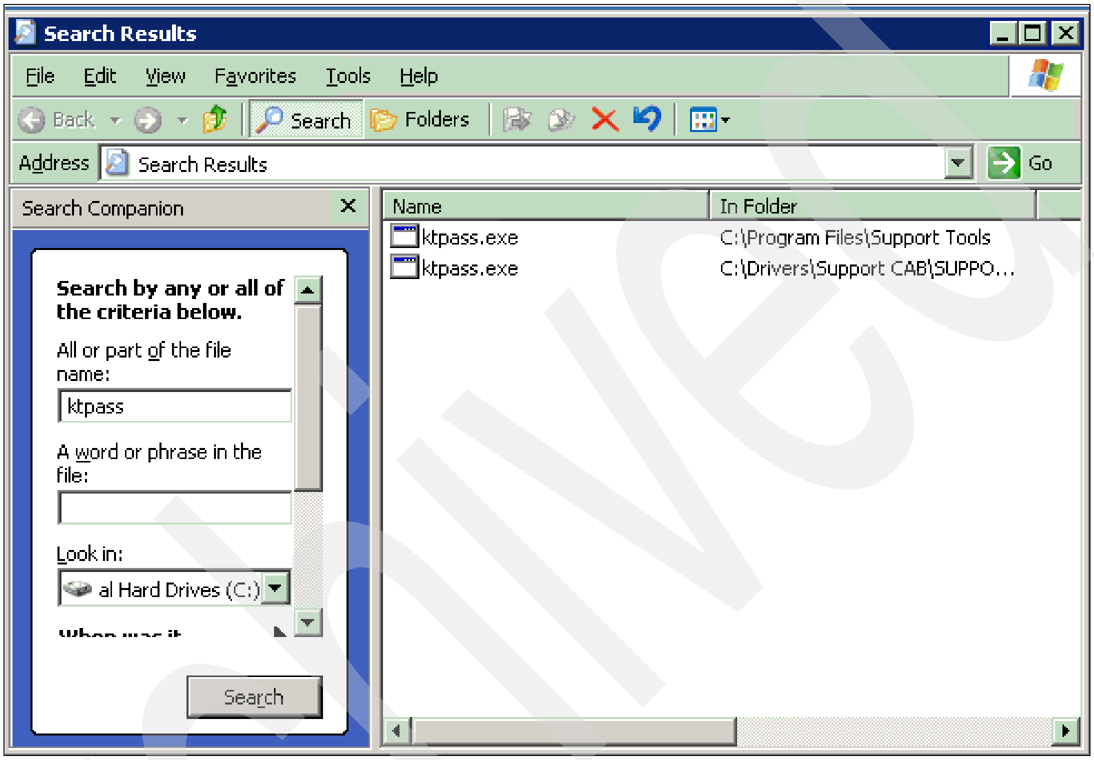
Double-click the **setup.exe** file. In this scenario, the file is netsetup.exe. Follow the default installation instructions until the support tools are installed.

We recommend that you verify that the specific support tools have been installed. There are several useful commands to debug Kerberos problems, but the most important one is ktpass, which is a prerequisite requirement to modify the Active Directory account that creates an associated Kerberos principal. To verify that the ktpass command has been installed, follow these steps:

1. Click **Start** in the lower-left corner of the window.
2. Select **Search** and then **Files and Folders**.

3. In the Search for files or folders named field, enter `ktpass`.
4. Make sure that the **Look in** field holds the value of the drive where the operating system is is installed.
5. Click **Search Now**.

The search results returns a reference to the ktpass command stored in C\ProgramFIles\Support Tools, as shown in Figure 6-3.



Search by any or all of the criteria below.

All or part of the file name: ktpass

A word or phrase in the file:

Look in: al Hard Drives (C:)

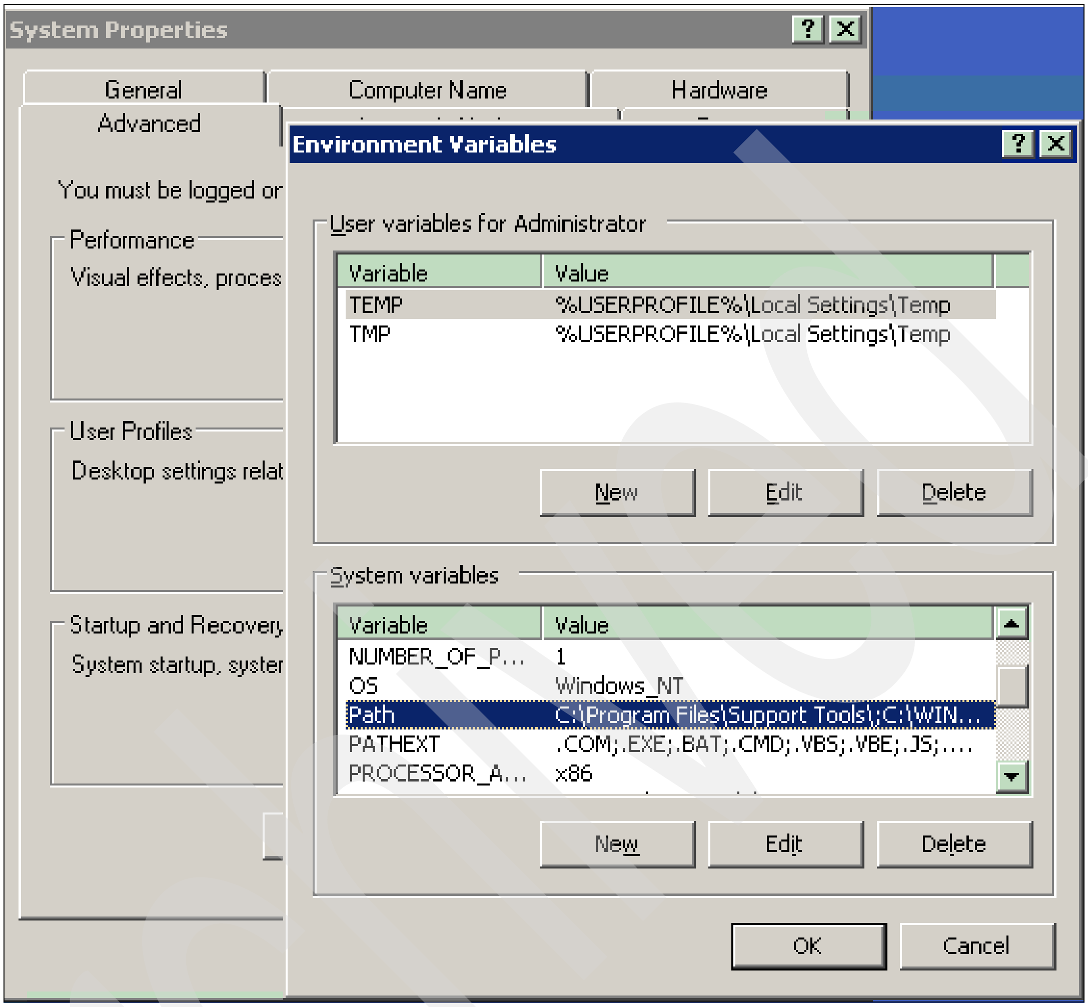
Name	In Folder
ktpass.exe	C:\Program Files\Support Tools
ktpass.exe	C:\Drivers\Support CAB\SUPPO...

Figure 6-3 Search result for the ktpass command

Verify that the support tools directory is in the Windows operating system's path environment variable. Follow these steps:

1. Right-click **My Computer** and click **Properties**.
2. Click the **Advanced tab** at the top of the window.
3. Click **Environmental Variables**.
4. In the System Variables, scroll to the Path variable and click **Edit**.

The value is C:\Program Files\Support Tools\ as shown in Figure 6-4.



User variables for Administrator

Variable	Value
TEMP	%USERPROFILE%\Local Settings\Temp
TMP	%USERPROFILE%\Local Settings\Temp

System variables

Variable	Value
NUMBER_OF_P...	1
OS	Windows_NT
Path	C:\Program Files\Support Tools\;C:\WIN...
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;....
PROCESSOR_A...	x86

Figure 6-4 Path environment variable showing Support Tools

Windows clients prerequisites

The Windows clients *must* authenticate to a Windows domain, such as Windows XP Professional or Windows 2000.

Windows 98 clients cannot do true SSO. However, you can load the Massachusetts Institute of Technology (MIT) Kerberos for Windows code to implement ticket caching and handle authenticating to Kerberos. It requires two sign-ons. All the applications that you have decided to use with the Kerberos authentication will open the connection without having to sign-on again.

Note: Windows 95 does not support Kerberos.

6.3.2 Before starting

Before starting with the configuration of SSO on iSeries, verify the host name resolution and synchronize the system’s time in the network.

Host name resolution

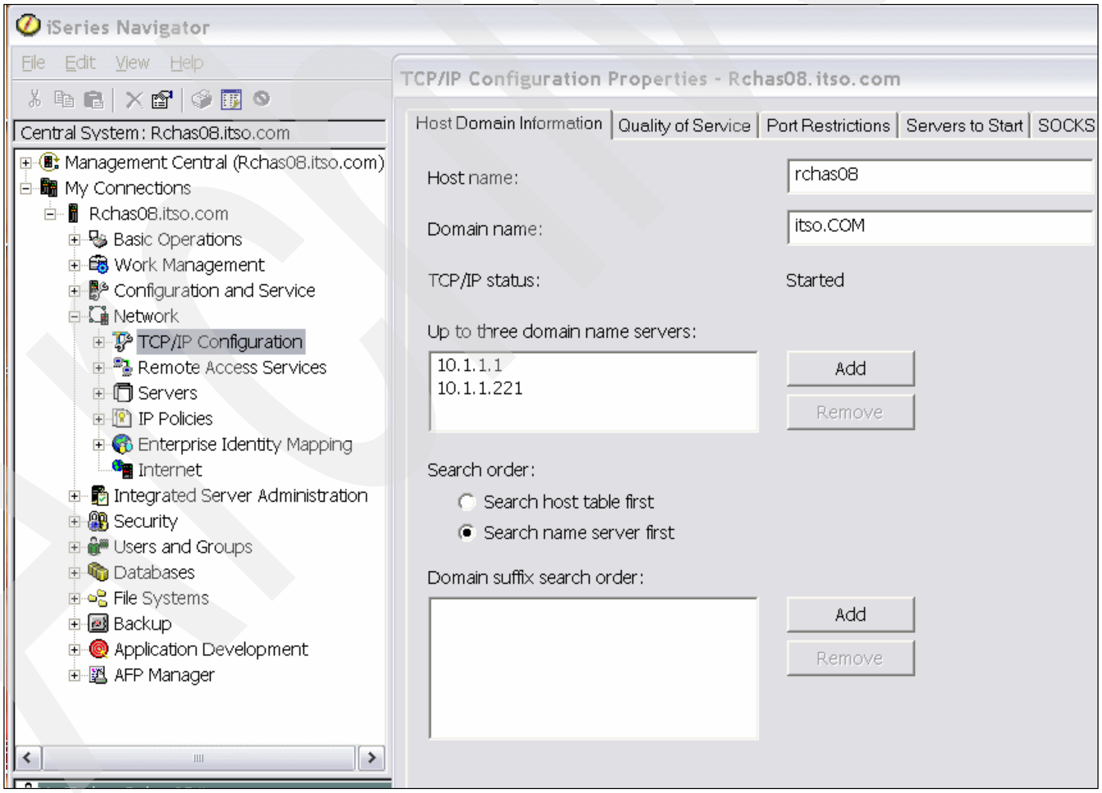
For Kerberos (and EIM) to properly work on your network, you must have a reliable IP address/host name resolution process.

Note that:

- You must have DNS names in lowercase and the real name (Windows domain) in uppercase. This is important because the Kerberos is case-sensitive and the DNS process is not.
- The reserve name resolution is required. The host name is solved with the IP address and vice-versa.

Using DNS gives you a single point to manage your name resolution, rather than having to make host entries in the host file on each of the workstations or systems in your network. Either verification technique works, but the DNS server method provides a more reliable, easier to manage solution for your name resolution. You can implement a DNS server on a variety of platforms, including i5/OS. For more information, see *i5/OS IP Networks: Dynamic,* SG24-6718.

1. To determine how your iSeries host name resolves, check your iSeries system's host domain properties as shown in Figure 6-5.
2. From the iSeries Navigator, expand ***your system connection*** → **Network** → **TCP/IP Configuration** and click to select **Properties**.



Host name: rchas08

Domain name: itso.COM

TCP/IP status: Started

Up to three domain name servers:

10.1.1.1
10.1.1.221

Search order:

○ Search host table first

● Search name server first

Domain suffix search order:

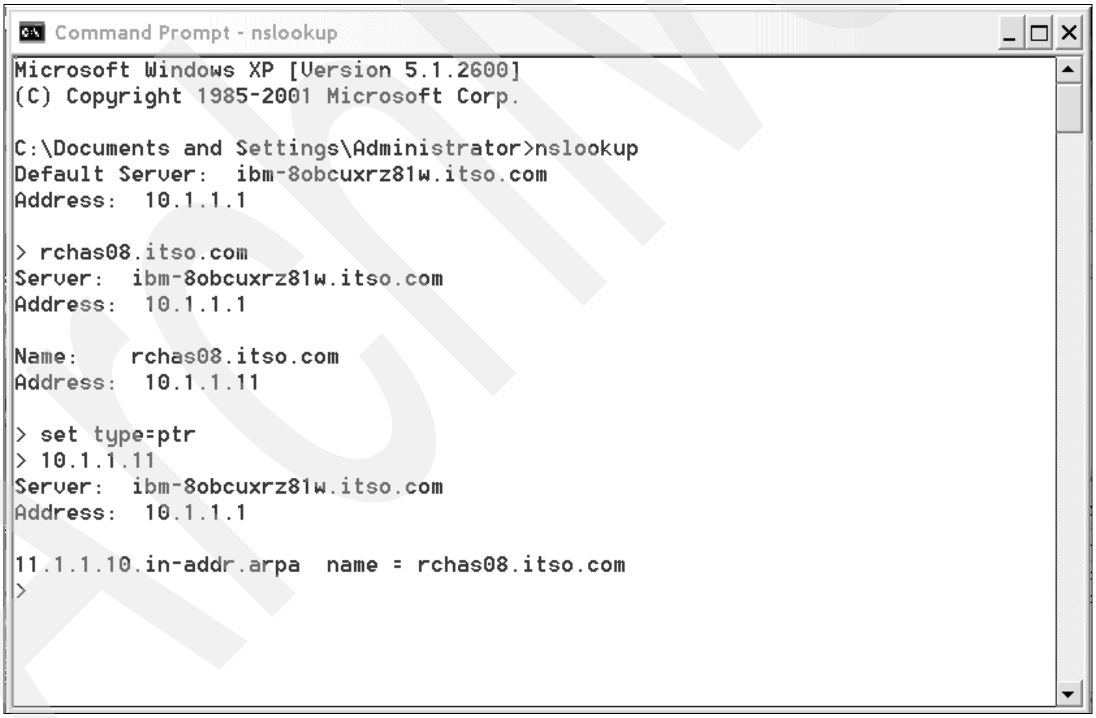
Figure 6-5 Host Domain Information window

Note that if you want modify the host and domain name shown, put the new value between single quotes (') so that i5/OS keeps the lowercase characters specified. Also notice that there is an ordered list of IP addresses for DNS servers. Having more than one DNS server in the network is useful for a better and reliable environment.

Now verify how this system's i5/OS name is being resolved in the network so that Kerberos-based transmissions are successful.

3. To determine how the DNS server is resolving the host name, run a Name Server Lookup (nslookup) command. Open a command prompt on the your PC, click **Start** → **Run**, and then type `cmd` when prompted. This opens the command window. T
4. Type `nslookup`, and press the Enter key. Type the fully qualified domain name of the iSeries that is used as the EIM domain controller and press the Enter key. This returns the TCP/IP address that the DNS is using for the iSeries, including the case of each of the characters (uppercase or lowercase). If the host name that has been used is an exact match with what you saw in Figure 6-5 on page 140, your resolution satisfies the Network Authentication Service and Kerberos requirements. If not, you can change either your iSeries host name and domain name to the value returned by the nslookup function, or change your DNS server to resolve to the name listed in the Host Domain Information window.
5. To verify that the DNS record is complete, from the same nslookup prompt that you used, type the command `set type=ptr` and press the Enter key.
6. Type the TCP/IP address that was returned from the iSeries fully qualified domain name. If the IP address returned is different than the one you used in the first nslookup, or there is not a resolution, contact the administrator of the DNS to correct the record.

   See Figure 6-6 for an example of the nslookup verification.



```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\Administrator>nslookup
Default Server:  ibm-8obcuxrz81w.itso.com
Address:  10.1.1.1

> rchas08.itso.com
Server:  ibm-8obcuxrz81w.itso.com
Address:  10.1.1.1

Name:    rchas08.itso.com
Address:  10.1.1.11

> set type=ptr
> 10.1.1.11
Server:  ibm-8obcuxrz81w.itso.com
Address:  10.1.1.1

11.1.1.10.in-addr.arpa  name = rchas08.itso.com
>
```

Figure 6-6 nslookup command output

Note: Not all DNS servers have the pointer (PTR) record for the reverse resolution. Single sign-on requires both A and PTR records in DNS before it works. If either is missing, contact the DNS server administrator and correct the issue.

Synchronizing system times

When using Kerberos for network authentication in your network, setting the time and time zone values on all your servers is an absolute requirement. Kerberos protocol uses time stamps and time skew values (difference in time values) as part of its security implementation. The maximum time skew allowed by default in Kerberos is 300 seconds (five minutes). If your server is outside this maximum skew, then Kerberos authentication fails.

On all servers, the time value, time zone, and time skew values are configurable. You can raise the time skew to a maximum of 900 seconds in the iSeries Network Authentication Service configuration, which we describe in 6.4.1, "Configuring NAS" on page 145.

On i5/OS, check and synchronize the following time and time zone system values with the rest of your network:

- QDATETIME or QTIME
- QUTCOFFSET: The Coordinated Universal Time Offset from the Greenwich mean time

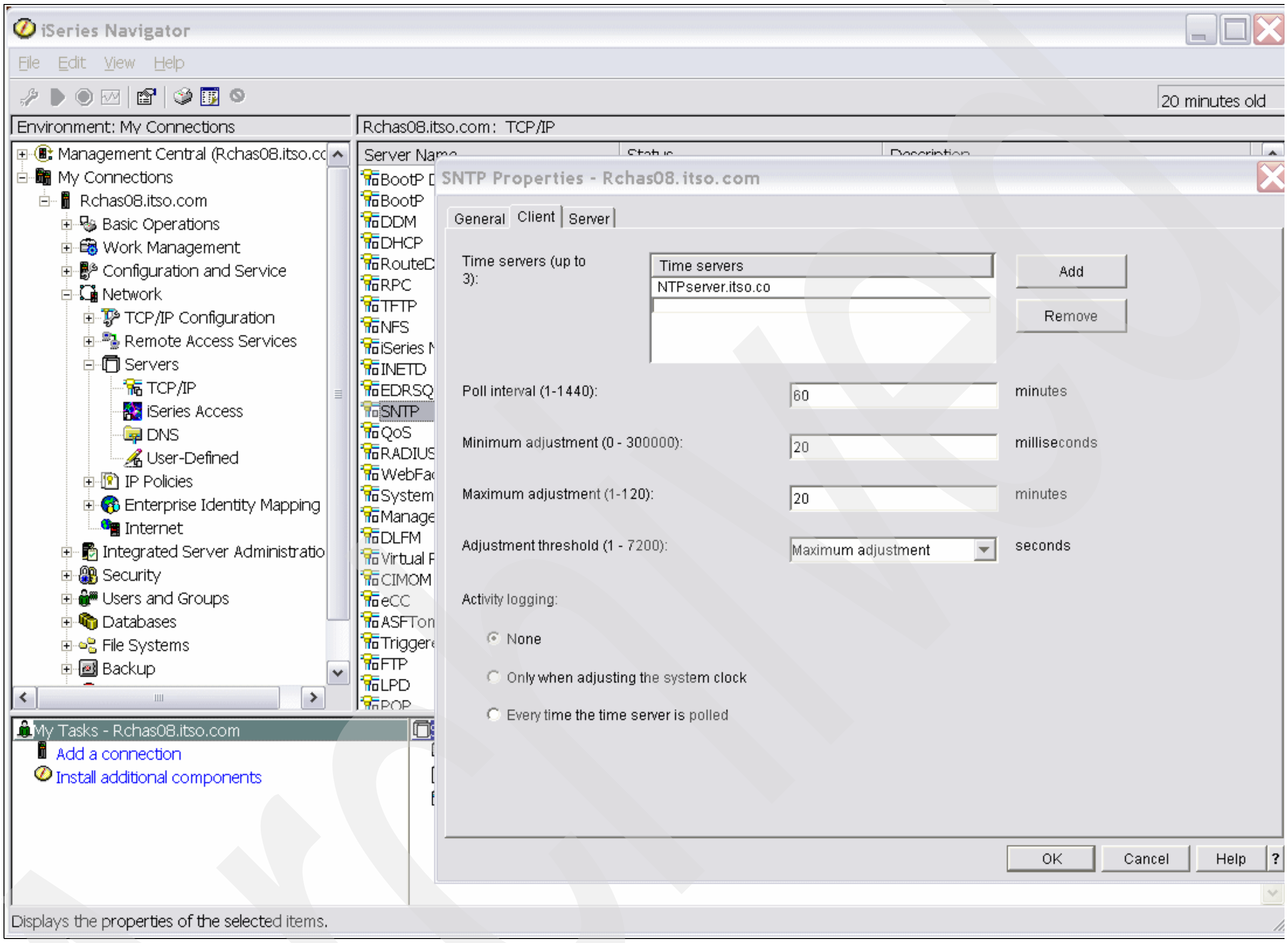
Before synchronizing service times in the network (corresponds to i5/OS QDATETIME or QTIME system values), check that the i5/OS QUTCOFFSET system value is set according to your time zone. This system values keeps track of how many hours you are away from Greenwich mean time or, as it is officially called, Coordinated Universal Time Offset. This is used by servers to change the time stamp to match your time. Prior to V5R3, the coordinated universal time offset was controlled by the QUTCOFFSET system value. Now, this system value is displayed only and you cannot change it. Instead of it, modify the QTIMZON system value. This system value specifies the time zone information used to calculate local system time. All current settings contain either the Standard Time or Daylight Saving Time values, depending on whether or not Daylight Saving Time is in effect. In addition, starting in V5R3, i5/OS automatically adjusts the QTIME on the Daylight Saving Time change.

You can synchronize the system times on servers within the Kerberos realm by changing the KDC time using the Windows operating system date and time interface and the QTIME system value to change the iSeries system time.

However, to keep system times in a network synchronized more easily, we recommend that you set up a Simple Network Time Protocol (SNTP) server in your network. SNTP allows multiple systems to base their time on a single time server.

On a Windows system, you can use NET HELP TIME from a DOS command window to access the SNTP setup:

1. To set up the iSeries to retrieve its time from an SNTP server, from an iSeries Navigator session, expand ***your system connection*** → **Network** → **Servers** → **TCP**. All the TCP servers are displayed in the right pane. Right-click the SNTP client server, select **Properties**, and select the **Client** folder (Figure 6-7).



Time servers (up to 3):

Time servers
NTPserver.itso.co

Poll interval (1-1440): 60 minutes

Minimum adjustment (0 - 300000): 20 milliseconds

Maximum adjustment (1-120): 20 minutes

Adjustment threshold (1 - 7200): Maximum adjustment seconds

Activity logging:

● None

○ Only when adjusting the system clock

○ Every time the time server is polled

Figure 6-7 SNTP Properties window

2. Enter the fully qualified name of a SNTP server in your network in the Time servers field. This might be an external SNTP server. There are many public time servers in the Internet. You can search for them with a query, such as "NTP server". Starting in V5R3, i5/OS can be both an SNTP client and an SNTP server. The default Poll interval is 60 minutes, which is satisfactory for most implementations.
3. Select the **General** folder and select **Client** in the SNTP services to start when the TCP/IP is started. Click **OK** to continue.

When you are changing the SNTP properties, we recommend that you stop (if active) and start the iSeries SNTP server job:

1. From an iSeries Navigator session, expand ***your system connection*** → **Network** → **Servers** → **TCP**. Right-click the **SNTP** client server, select **Stop**, and then **Start**.
2. Using our iSeries Navigator properties example, the iSeries SNTP client server now polls the SNTP server every 60 minutes and adjusts its software and hardware clock.

Gathering information

Collect the information shown in Table 6-1before starting the configuration of necessary services to activate password elimination single sign-on solution on your iSeries.

Table 6-1 Information to collect before starting the configuration

Item	Information to collect	Example values
A	What is the name of the Kerberos default realm to which the iSeries will belong? (The default is the domain name converted to uppercase.)	ITSO.COM
B	What is the KDC Kerberos for this default realm?	Win2003Server1
C	What is the KDC fully qualified host name?	Win2003Server1.itso.com
D	What is the port on which the KDC listens?	88 (default value)
E	What is the password server for this KDC?	Win2003Server1
F	What is the port of your password server?	464 (default value)
G	What is your iSeries host name?	rchas08
H	What is the iSeries fully qualified host name?	rchas08.itso.com
I	What services do you want to kerberized?	► 5250 Telnet and iSeries Navigator ► iSeries NetServer

We will use the values in the right column for our scenario.

Before users can input to EIM first, they must be identified. Users will have their user names on many systems that need to be collected. EIM provides a matching of all the principal user names in a master record. These user names are called *associations* and the master record is called the *EIM identifier*. Depending on the different types of systems involved, there are various ways of collecting lists of user IDs. This poses a problem for the systems administrator.

Because SSO is a scalable solution, we suggest you start with a few users to test the environment and spread the solution over the entries using the steps in the next section.

In this scenario, we want to test SSO with user May Smith.

6.4 Step-by-step setup guide

Enable the single sign-on on i5/OS on an application. Avoiding password authentication is the target of this scenario. To reach this goal, you need to configure:

- iSeries Network Authentication Service (NAS) to set up an iSeries server to accept Kerberos authenticated tickets.
- Enterprise Identity Mapping (EIM) that allows the same user to have different user IDs on various servers in the network.

Both service configurations are done through an iSeries Navigator interface.

6.4.1 Configuring NAS

This section provides information about how to configure NAS.

Setting up on i5/OS

To start the iSeries Navigator Network Authentication Service wizard on your client workstation, you must have the iSeries Navigator Security component installed on the client workstation. The iSeries Navigator Security component is not required on a workstation that initiates an iSeries Navigator session using Kerberos authentication.

Note: On the iSeries Navigator session that you use to set up the Network Authetication Service, ensure that the name of your system connection is your iSeries host's fully qualified name that is known and published by your DNS servers.

Perform the following steps:

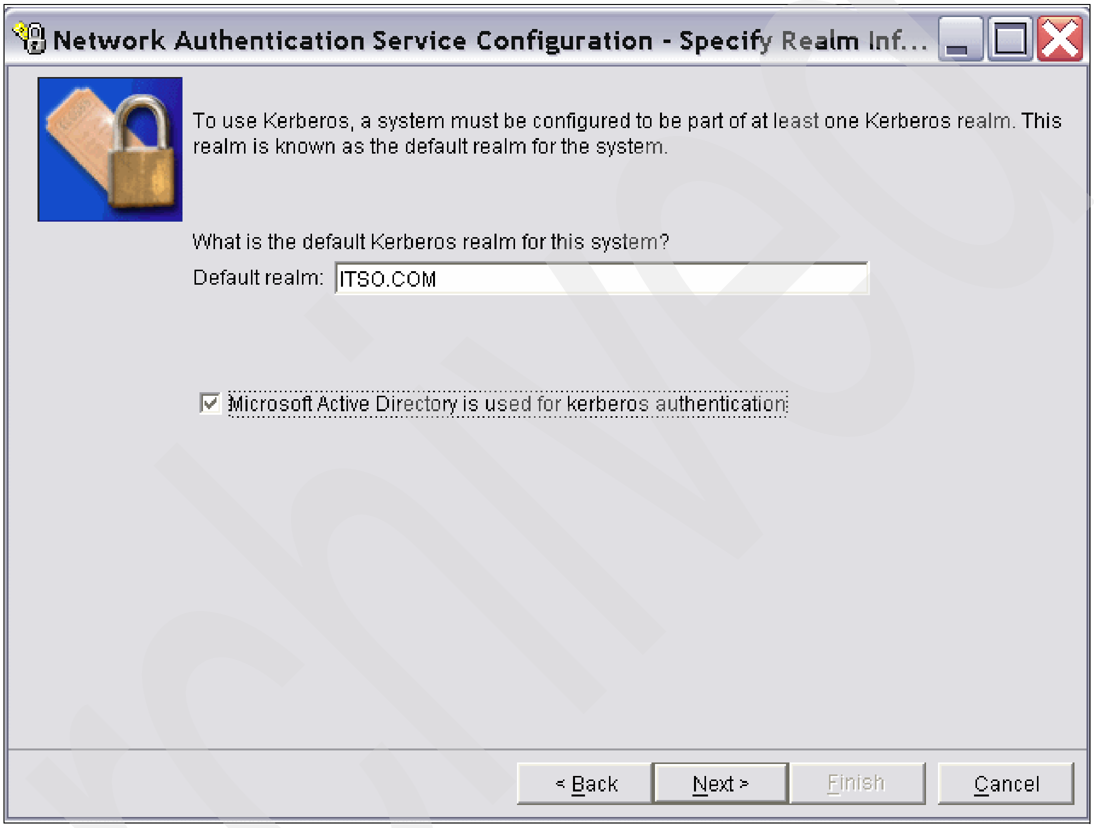
1. In an iSeries Navigator session, expand ***your system connection*** → **Security**. Right-click **Network Authentication Service** and select **Configure**.

   If you see the **Reconfigure** option instead of **Configure**, it indicates that the Network Authentication Service has already been configured. You can either reconfigure it (the reconfiguration proceeds in a similar way to configuration), or you can right-click **Network Authentication Service** and select **Properties** to verify that the current configuration is appropriate for your network.

2. The Network Authentication Service configuration wizard welcome window opens. Read the information and click **Next**.

3. In the Specify Realm Information window, as shown in Figure 6-8, enter the name of the realm that serves as your default Kerberos realm, parameter A. In this scenario, it is ITSO.COM. Select **Microsoft Active Directory is used for Kerberos authentication** because it reflects the implementation in this scenario. Click **Next**.

Note: The Windows 2000 KDC is case-sensitive and the name of the realm is always in uppercase. Under standard conventions, the name of the realm is the domain name, which is converted to uppercase.



Network Authentication Service Configuration - Specify Realm Inf...

To use Kerberos, a system must be configured to be part of at least one Kerberos realm. This realm is known as the default realm for the system.

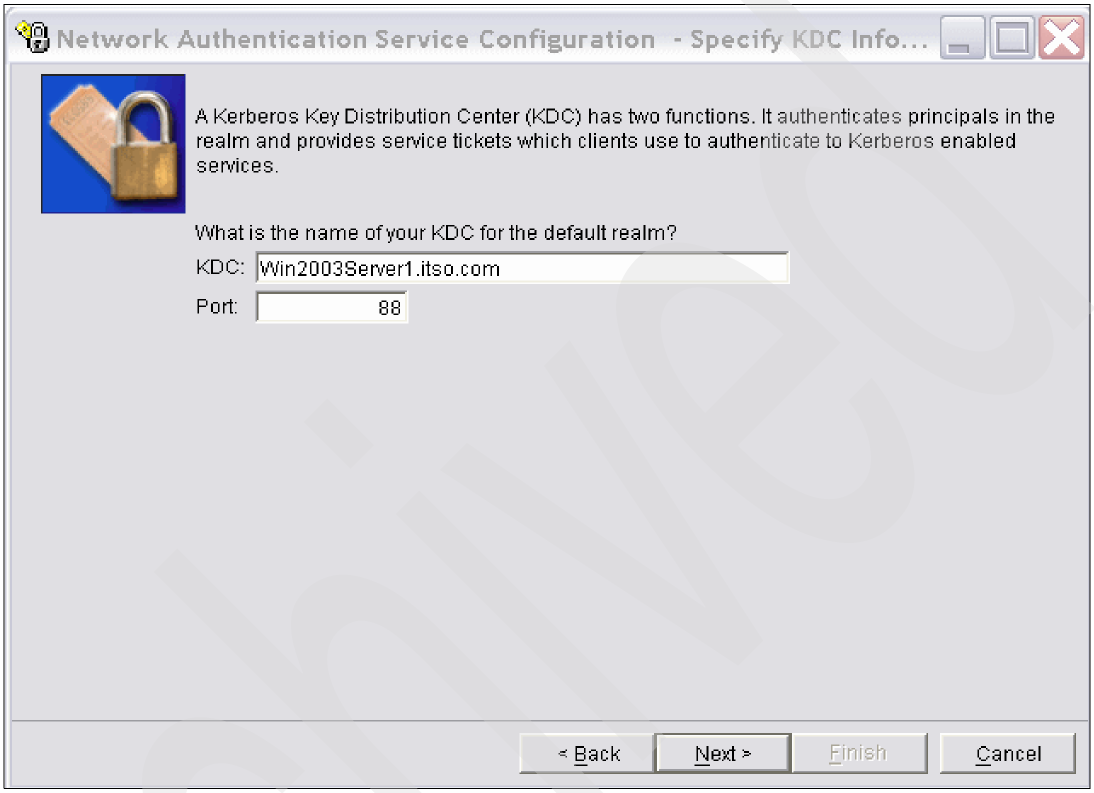
What is the default Kerberos realm for this system?

Default realm: ITSO.COM

☑ Microsoft Active Directory is used for kerberos authentication

Figure 6-8 NAS wizard configuration - Specify realm information

4. In the Specify KDC Information window, shown in Figure 6-9, enter the fully qualified host and domain name of your Active Directory server that acts also as the Kerberos Key Distribution Center (KDC), parameter C. Win2003Server1.itso.com is the domain name in our scenario. Enter the port number, parameter D. The default port for Kerberos is 88. Unless your KDC has been configured to listen on a port other than the default, you do not need to change this parameter. Click **Next**.


Network Authentication Service Configuration - Specify KDC Info...

A Kerberos Key Distribution Center (KDC) has two functions. It authenticates principals in the realm and provides service tickets which clients use to authenticate to Kerberos enabled services.

What is the name of your KDC for the default realm?

KDC: Win2003Server1.itso.com

Port: 88

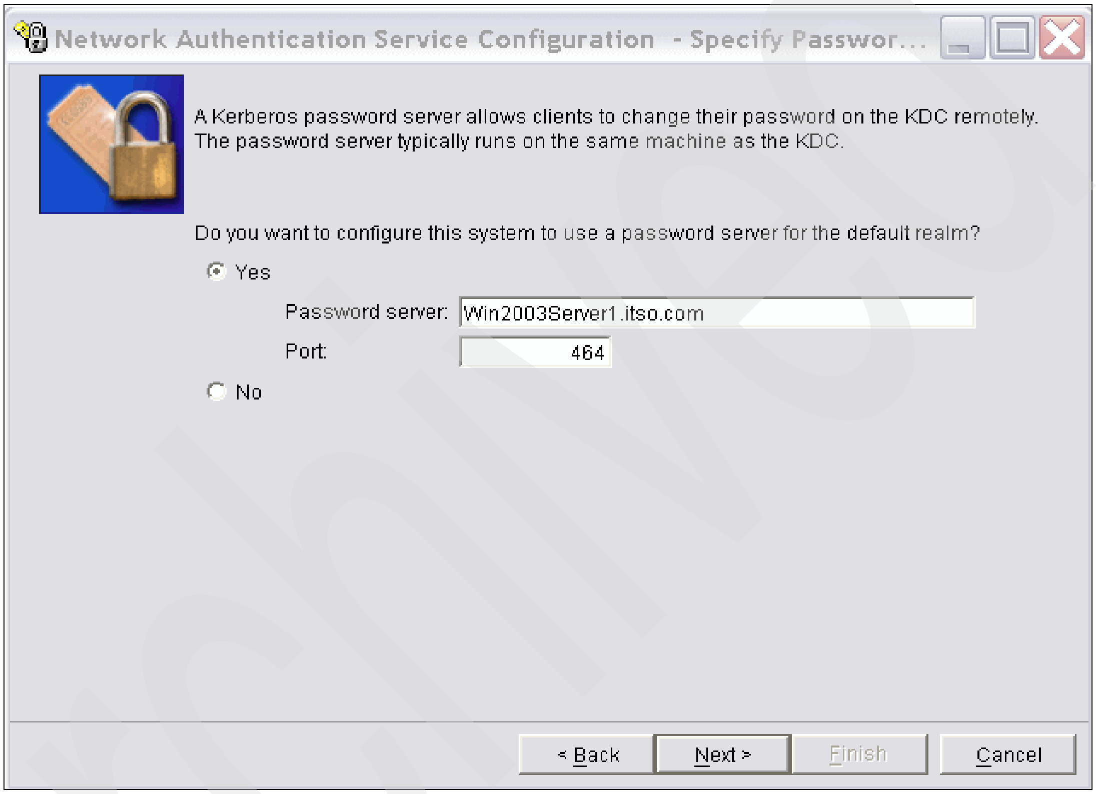
< Back
Next >
Finish
Cancel

Figure 6-9 NAS configuration wizard - Specify KDC information

5. The next window, shown as Figure 6-10, gives you the option to allow principals to change the Kerberos passwords remotely. If you want to allow clients to change passwords, select **Yes** in the Specify Password Server Information window.

   The window fields appear already filled in with the default values and with **Yes** already selected. The configuration wizard also keeps valid the KDC server name for the password server and leaves 464 as the default port.

   Check the information collected in the table“Gathering information” on page 144, parameters E and F, if password server name or port is different than the ones proposed. Modify the necessary fields. Click **Next**.



Network Authentication Service Configuration - Specify Passwor...

A Kerberos password server allows clients to change their password on the KDC remotely. The password server typically runs on the same machine as the KDC.

Do you want to configure this system to use a password server for the default realm?

● Yes

Password server: Win2003Server1.itso.com

Port: 464

○ No

Figure 6-10 NAS configuration wizard - Specify password server information

6. The Select Keytab Entry window lets you select which services on your i5/OS the wizard enables for Kerberos authentication, parameter F. A keytab file is populated with the name of the principals selected and their passwords are required in the next window. Read this wizard window text for the keytab file definition.

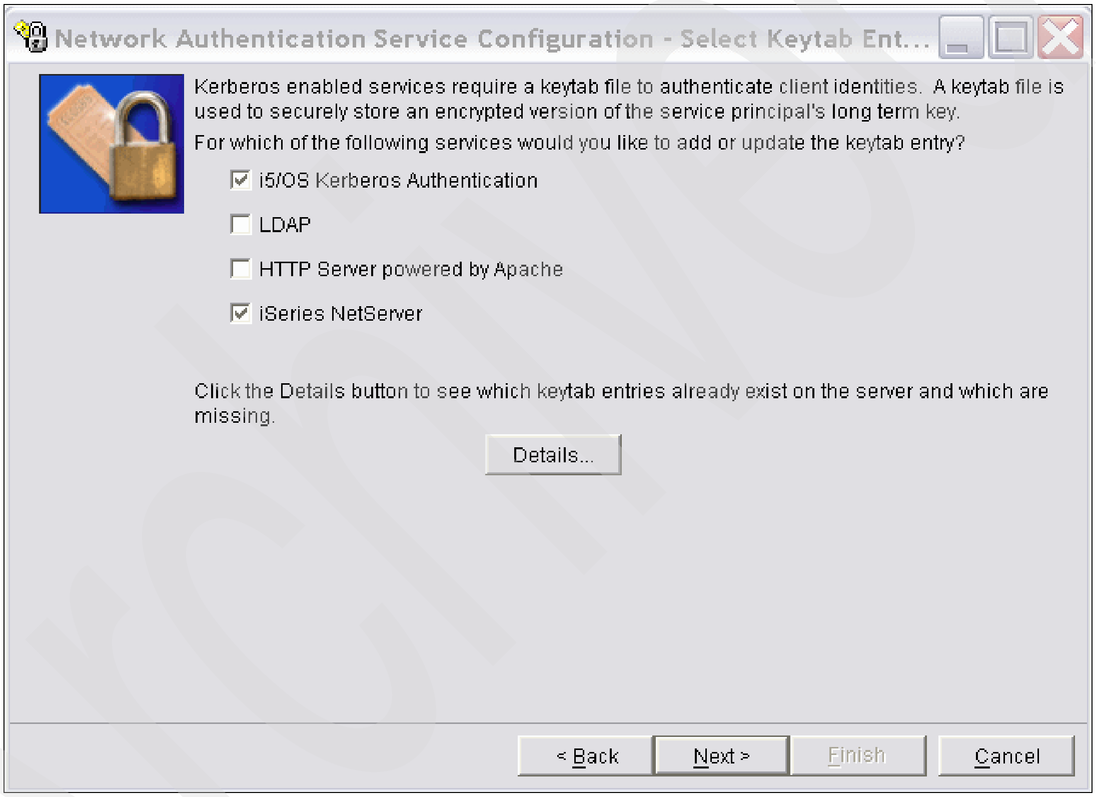
In our scenario, we only enable the iSeries Kerberos Authentication and the iSeries NetServer as shown in Figure 6-11.

Also, LDAP and HTTP servers that are powered by Apache can use Kerberos tickets to authenticate. If your current plans are to enable those services for Kerberos authentication, it might save you time to check the boxes in this step.

We do not follow that path for these two “additional services” in this chapter. However, if you checked LDAP and HTTP server powered by Apache, you see two additional windows that prompt you for the passwords for those two principals.

For the principals that you want to select, ensure that you document those passwords because you need to supply them in the KDC configurations.

In our example, select only the **iSeries Kerberos Authentication** and the **iSeries NetServer** check boxes, then click **Next**.



Network Authentication Service Configuration - Select Keytab Ent...

Kerberos enabled services require a keytab file to authenticate client identities. A keytab file is used to securely store an encrypted version of the service principal's long term key.

For which of the following services would you like to add or update the keytab entry?

☑ i5/OS Kerberos Authentication

□ LDAP

□ HTTP Server powered by Apache

☑ iSeries NetServer

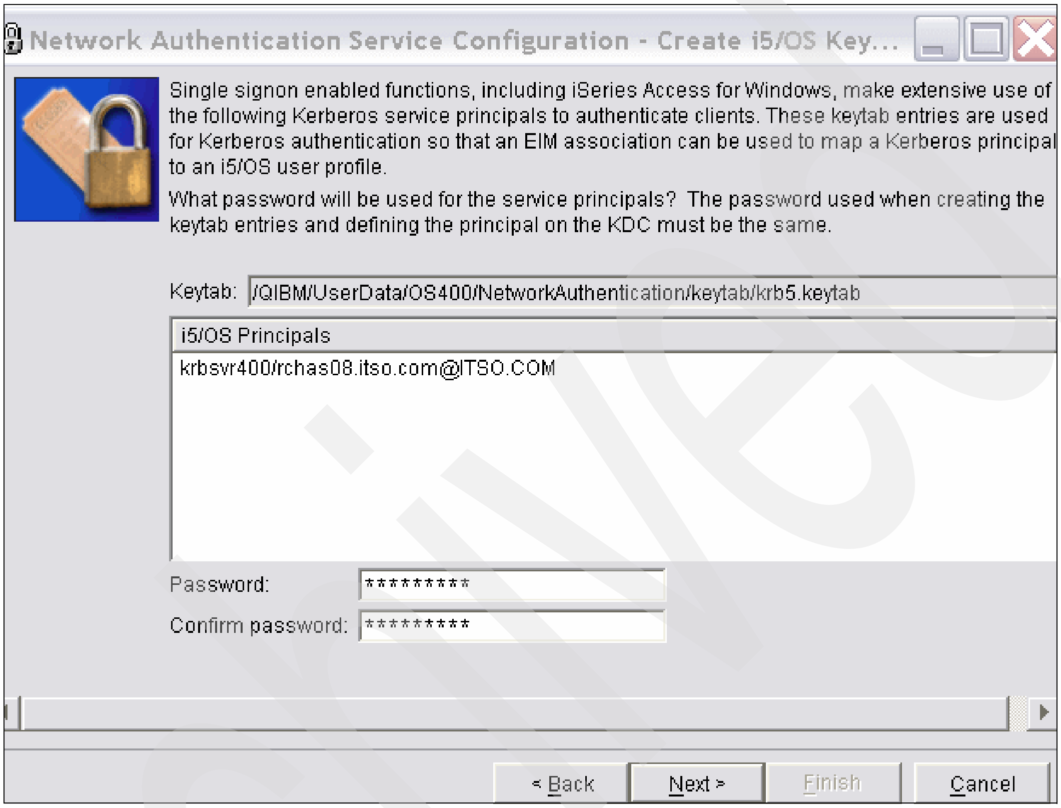
Click the Details button to see which keytab entries already exist on the server and which are missing.

Figure 6-11   NAS configuration wizard - Select keytab entries

7. In the Create iSeries Keytab Entry window, shown in Figure 6-12, specify the password for the corresponding Kerberos principal displayed. That is, its shared secret.

   Note that the Keytab field in the Create iSeries Keytab Entry window shows the path to the keytab file that the wizard will generate.

   Enter the password twice for verification because it is not displayed. Click **Next**.



Network Authentication Service Configuration - Create i5/OS Key...

Single signon enabled functions, including iSeries Access for Windows, make extensive use of the following Kerberos service principals to authenticate clients. These keytab entries are used for Kerberos authentication so that an EIM association can be used to map a Kerberos principal to an i5/OS user profile.

What password will be used for the service principals? The password used when creating the keytab entries and defining the principal on the KDC must be the same.

Keytab: /QIBM/UserData/OS400/NetworkAuthentication/keytab/krb5.keytab

i5/OS Principals

krbsvr400/rchas08.itso.com@ITSO.COM

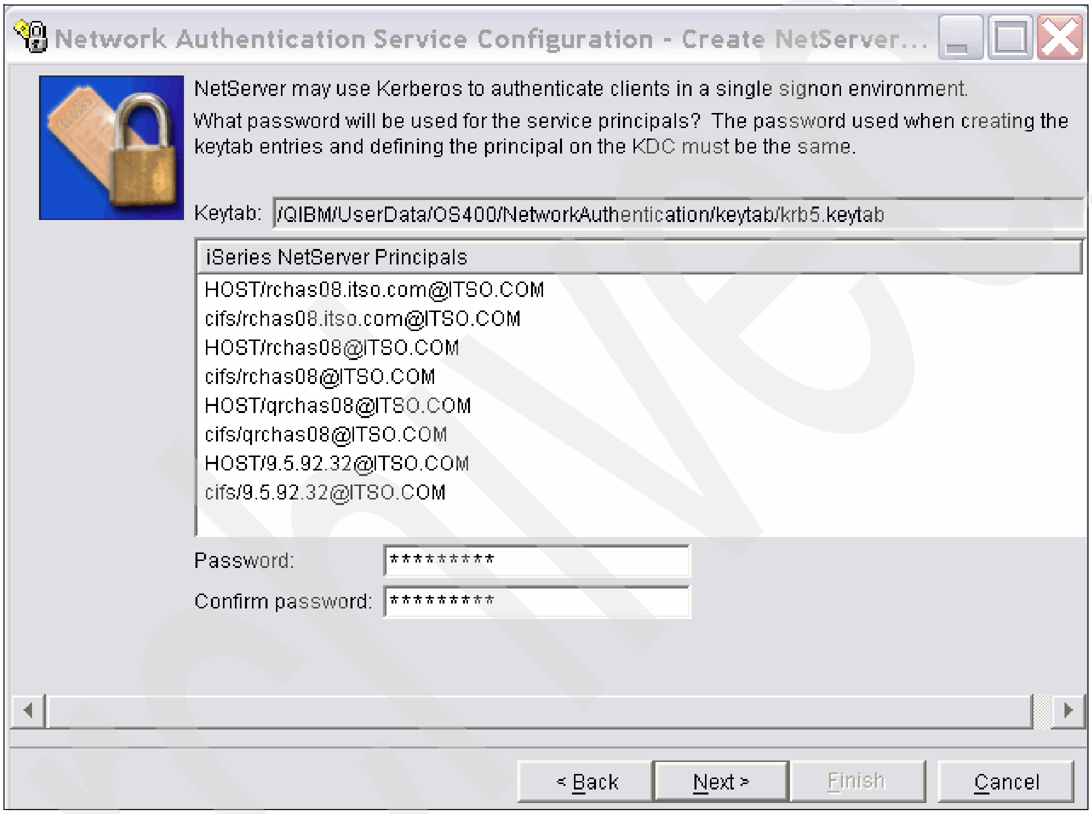
Password: *********

Confirm password: *********

Figure 6-12 NAS configuration wizard - Create i5/OS keytab entry

8. A similar window asks you to enter the password for the iSeries NetServer principal, as you can see in Figure 6-13. Notice that the wizard automatically adds the i5/OS name, fully qualified name, and IP address, both for host and Common Integrated File System (CIFS) entries. This is because both Windows 2000 and Windows XP support Kerberos V5, but they require different user names to be defined for the principals to create. Windows 2000 systems look for a service principal that the user name portion of the principal has defined as the host. Clients running the XP operating system look for user names with CIFS.

   Enter the password twice for verification and click **Next**.



Network Authentication Service Configuration - Create NetServer...

NetServer may use Kerberos to authenticate clients in a single signon environment.

What password will be used for the service principals? The password used when creating the keytab entries and defining the principal on the KDC must be the same.

Keytab: /QIBM/UserData/OS400/NetworkAuthentication/keytab/krb5.keytab

iSeries NetServer Principals
HOST/rchas08.itso.com@ITSO.COM
cifs/rchas08.itso.com@ITSO.COM
HOST/rchas08@ITSO.COM
cifs/rchas08@ITSO.COM
HOST/qrchas08@ITSO.COM
cifs/qrchas08@ITSO.COM
HOST/9.5.92.32@ITSO.COM
cifs/9.5.92.32@ITSO.COM

Password: *********

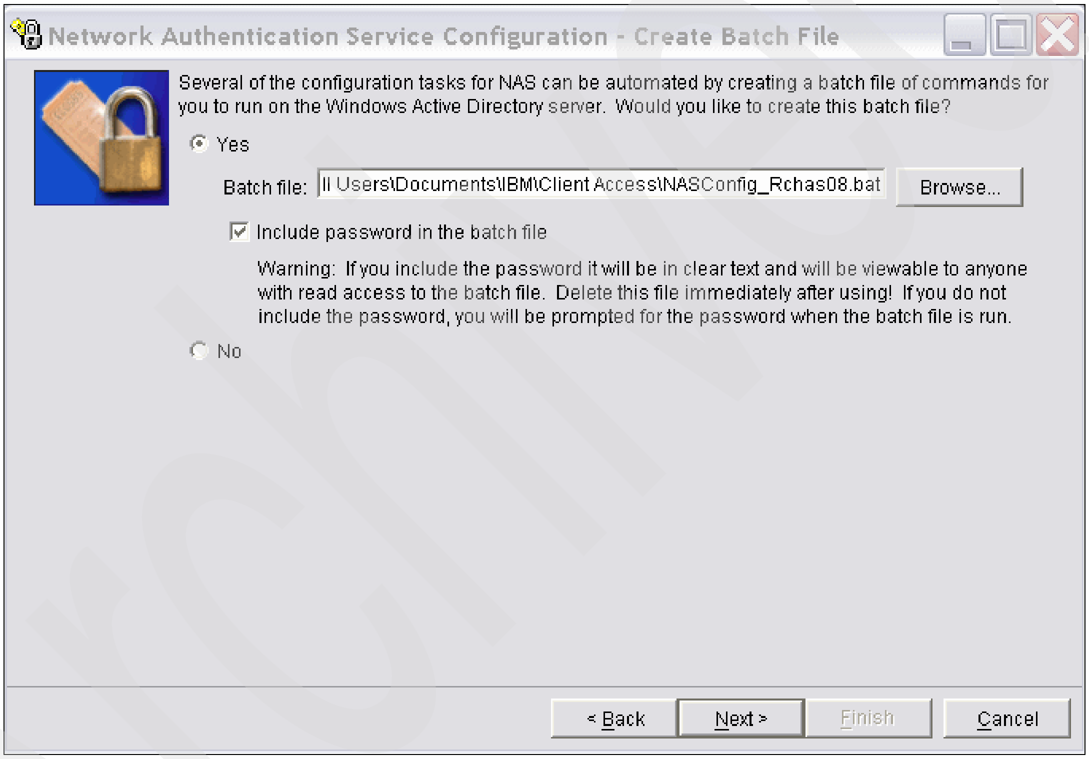
Confirm password: *********

Figure 6-13 NAS configuration wizard - Create NetServer keytab entry

9. The default is shown in the next window in Figure 6-14, with the **Yes** option selected. The NAS configuration wizard allows you to create a batch file. If you execute that file on the Windows KDC server, it adds the iSeries applications as Active Directory accounts. It creates the associated Kerberos principal entries.

   The default batch file is C:\Documents and Settings\All Users\Documents\IBM\Client Access\NASConfig_Rchas08.bat, but you can modify the path or the name file. **Include password in the batch file** is also checked as the default. Notice that the passwords are in clear text in the batch file. Thus, we recommend to delete the batch file from the Kerberos server and your PC right after you use it. If you do not include the password in the batch file, a prompt for inserting the password appears when you run the batch file on the Kerberos server.

   You can select **No** and do it manually, but it requires configuration on the Active Directory and manual operations to add i5/OS service principals to the Kerberos server.



Network Authentication Service Configuration - Create Batch File

Several of the configuration tasks for NAS can be automated by creating a batch file of commands for you to run on the Windows Active Directory server. Would you like to create this batch file?

● Yes

Batch file: ll Users\Documents\IBM\Client Access\NASConfig_Rchas08.bat

☑ Include password in the batch file

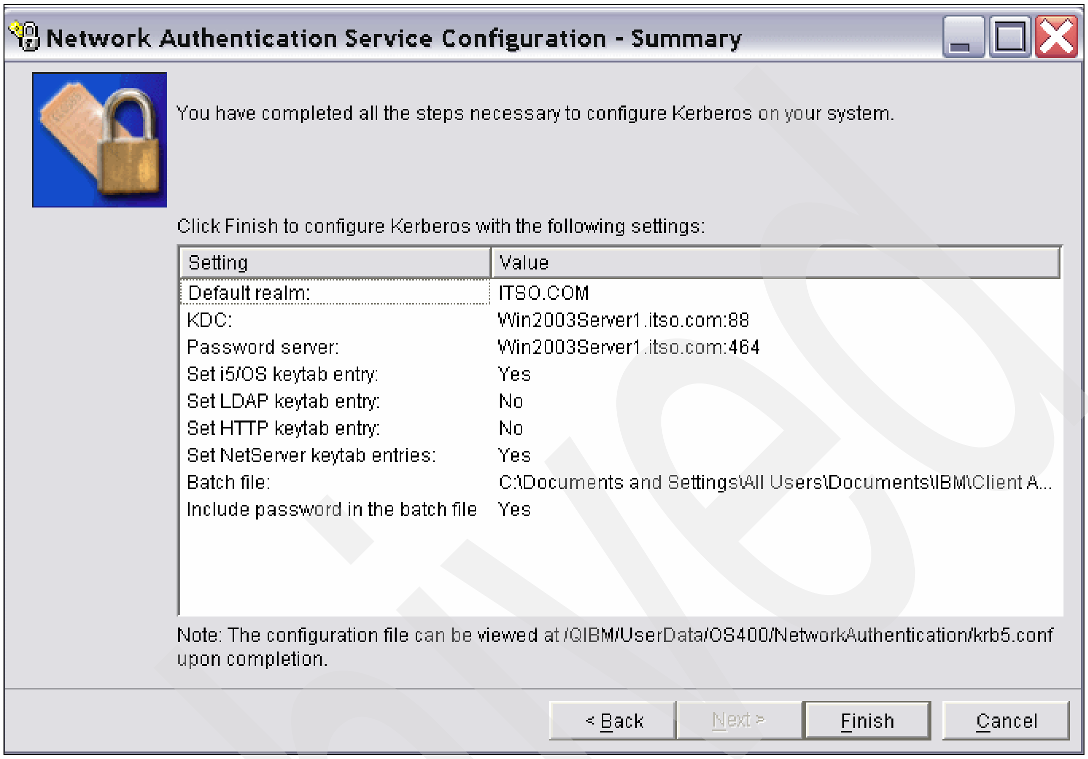
Warning: If you include the password it will be in clear text and will be viewable to anyone with read access to the batch file. Delete this file immediately after using! If you do not include the password, you will be prompted for the password when the batch file is run.

○ No

Figure 6-14 NAS configuration wizard - Create batch file

10. Click **Next**.

11.The final step is to verify the entries in the Configuration Summary window (Figure 6-15). Review the setting values. Use **Back** if you need to go back and make changes. When satisfied with all the setting values, click **Finish**.



You have completed all the steps necessary to configure Kerberos on your system.

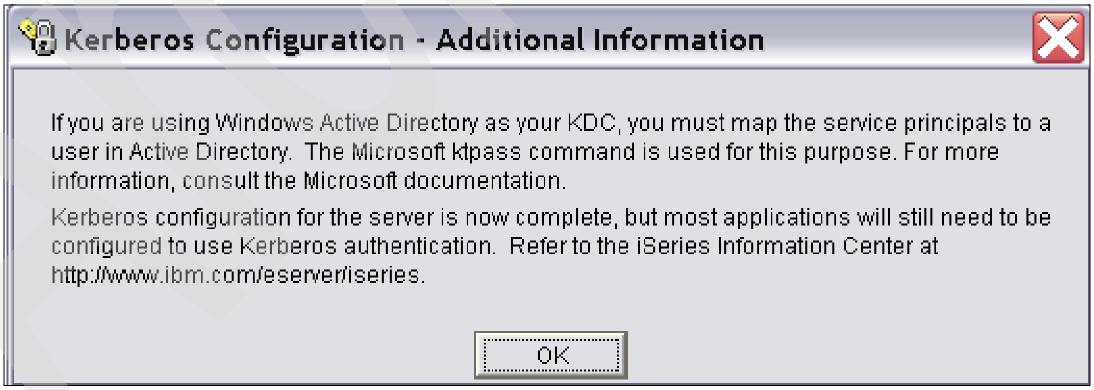
Click Finish to configure Kerberos with the following settings:

Setting	Value
Default realm:	ITSO.COM
KDC:	Win2003Server1.itso.com:88
Password server:	Win2003Server1.itso.com:464
Set i5/OS keytab entry:	Yes
Set LDAP keytab entry:	No
Set HTTP keytab entry:	No
Set NetServer keytab entries:	Yes
Batch file:	C:\Documents and Settings\All Users\Documents\IBM\Client A...
Include password in the batch file	Yes

Note: The configuration file can be viewed at /QIBM/UserData/OS400/NetworkAuthentication/krb5.conf upon completion.

Figure 6-15 NAS configuration wizard - Summary window

12.The messages shown in Figure 6-16 remind you of activities to be performed on the Windows Kerberos server to complete the Kerberos setup. Click **OK** and the NAS configuration wizard is completed.

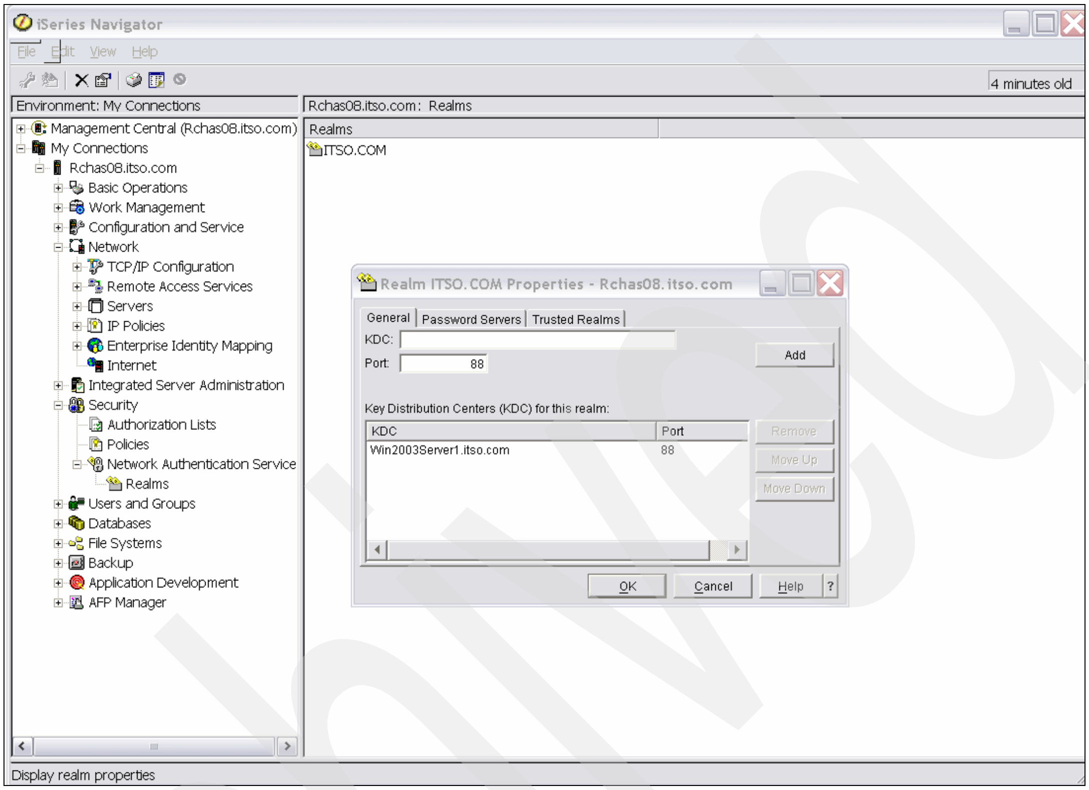


If you are using Windows Active Directory as your KDC, you must map the service principals to a user in Active Directory. The Microsoft ktpass command is used for this purpose. For more information, consult the Microsoft documentation.

Kerberos configuration for the server is now complete, but most applications will still need to be configured to use Kerberos authentication. Refer to the iSeries Information Center at http://www.ibm.com/eserver/iseries.

Figure 6-16 NAS configuration wizard message

To verify the ITSO.COM realm settings you just created, expand ***your system connection*** → **Security**. Right-click **Network Authentication Service** and click **Realms** and the ITSO.COM realm appears in the right pane. By right-clicking on it and selecting **Properties**, you can review the values input in the configuration wizard as shown in Figure 6-17.



KDC:

Port: 88

Key Distribution Centers (KDC) for this realm:

KDC	Port
Win2003Server1.itso.com	88

Figure 6-17 Realm properties

All these settings are stored in the Integrated File System in the file /QIBM/UserData/OS400/NetworkAuthentication/krb5.conf.

Enrolling the i5/OS services on the KDC

To complete the enrollment of the i5/OS services to the Windows domain and to take advantage of the ticket authentication of the Kerberos server, there are two methods. You can manually add the service principals, or as this scenario illustrates, you can launch the batch file of the windows KDC server as mentioned in Step 9 on page 152.

In this scenario the batch file is C:\Documents and Settings\All Users\Documents\IBM\Client Access\NASConfig_Rchas08.bat. In Example 6-1, you can see the details of the file.

Notice that the passwords of the service principals are in plain text.

Example 6-1 NASConfig_Rchas08.bat file

```
@ECHO OFF
ECHO  IBM grants you a nonexclusive copyright license to use all
ECHO  programming code examples from which you can generate similar
ECHO  function tailored to your own specific needs.
ECHO.
ECHO  All sample code is provided by IBM for illustrative purposes
ECHO  only.  These examples have not been thoroughly tested under all
ECHO  conditions.  IBM, therefore, cannot guarantee or imply
ECHO  reliability, serviceability, or function of these programs.
```

```
ECHO.
ECHO  All programs contained herein are provided to you "AS IS"
ECHO  without any warranties of any kind. The implied warranties
ECHO  of non-infringement, merchantability and fitness for a
ECHO  particular purpose are expressly disclaimed.
ECHO.
ECHO.
ECHO  NOTE:  If any of the commands fail, such as KTPASS or SETSPN,
ECHO         make sure that the directories that contain these commands
ECHO         are included in the user's PATH statement on the KDC server.
ECHO.
ECHO.
ECHO.
@ECHO ON


setlocal
set WINVER=2003
ver | find "2000" >nul
if not errorlevel 1 set WINVER=2000
if %WINVER%==2000 (

NET USER rchas08_1_krbsvr400 navigator /ADD /workstations:none /DOMAIN
KTPASS -MAPUSER rchas08_1_krbsvr400 -PRINC krbsvr400/rchas08.itso.com@ITSO.COM -PASS
navigator -mapop set

NET USER rchas08_2_HOST netserver /ADD /workstations:none /DOMAIN
KTPASS -MAPUSER rchas08_2_HOST -PRINC HOST/rchas08.itso.com@ITSO.COM -PASS netserver -mapop
set

NET USER rchas08_3_cifs netserver /ADD /workstations:none /DOMAIN
KTPASS -MAPUSER rchas08_3_cifs -PRINC cifs/rchas08.itso.com@ITSO.COM -PASS netserver -mapop
set

NET USER rchas08_4_HOST netserver /ADD /workstations:none /DOMAIN
KTPASS -MAPUSER rchas08_4_HOST -PRINC HOST/rchas08@ITSO.COM -PASS netserver -mapop set

NET USER rchas08_5_cifs netserver /ADD /workstations:none /DOMAIN
KTPASS -MAPUSER rchas08_5_cifs -PRINC cifs/rchas08@ITSO.COM -PASS netserver -mapop set

NET USER rchas08_6_HOST netserver /ADD /workstations:none /DOMAIN
KTPASS -MAPUSER rchas08_6_HOST -PRINC HOST/qrchas08@ITSO.COM -PASS netserver -mapop set

NET USER rchas08_7_cifs netserver /ADD /workstations:none /DOMAIN
KTPASS -MAPUSER rchas08_7_cifs -PRINC cifs/qrchas08@ITSO.COM -PASS netserver -mapop set

NET USER rchas08_8_HOST netserver /ADD /workstations:none /DOMAIN
KTPASS -MAPUSER rchas08_8_HOST -PRINC HOST/9.5.92.32@ITSO.COM -PASS netserver -mapop set

NET USER rchas08_9_cifs netserver /ADD /workstations:none /DOMAIN
KTPASS -MAPUSER rchas08_9_cifs -PRINC cifs/9.5.92.32@ITSO.COM -PASS netserver -mapop set


) else (

DSADD user cn=rchas08_1_krbsvr400,cn=users,dc=ITSO,dc=COM -pwd navigator -display
rchas08_1_krbsvr400
KTPASS -MAPUSER rchas08_1_krbsvr400 -PRINC krbsvr400/rchas08.itso.com@ITSO.COM -PASS
navigator -mapop set
DSADD user cn=rchas08_2_HOST,cn=users,dc=ITSO,dc=COM -pwd netserver -display rchas08_2_HOST
KTPASS -MAPUSER rchas08_2_HOST -PRINC HOST/rchas08.itso.com@ITSO.COM -PASS netserver -mapop
set

DSADD user cn=rchas08_3_cifs,cn=users,dc=ITSO,dc=COM -pwd netserver -display rchas08_3_cifs
KTPASS -MAPUSER rchas08_3_cifs -PRINC cifs/rchas08.itso.com@ITSO.COM -PASS netserver -mapop
set

DSADD user cn=rchas08_4_HOST,cn=users,dc=ITSO,dc=COM -pwd netserver -display rchas08_4_HOST
KTPASS -MAPUSER rchas08_4_HOST -PRINC HOST/rchas08@ITSO.COM -PASS netserver -mapop set

DSADD user cn=rchas08_5_cifs,cn=users,dc=ITSO,dc=COM -pwd netserver -display rchas08_5_cifs
KTPASS -MAPUSER rchas08_5_cifs -PRINC cifs/rchas08@ITSO.COM -PASS netserver -mapop set

DSADD user cn=rchas08_6_HOST,cn=users,dc=ITSO,dc=COM -pwd netserver -display rchas08_6_HOST
KTPASS -MAPUSER rchas08_6_HOST -PRINC HOST/qrchas08@ITSO.COM -PASS netserver -mapop set

DSADD user cn=rchas08_7_cifs,cn=users,dc=ITSO,dc=COM -pwd netserver -display rchas08_7_cifs
KTPASS -MAPUSER rchas08_7_cifs -PRINC cifs/qrchas08@ITSO.COM -PASS netserver -mapop set

DSADD user cn=rchas08_8_HOST,cn=users,dc=ITSO,dc=COM -pwd netserver -display rchas08_8_HOST
KTPASS -MAPUSER rchas08_8_HOST -PRINC HOST/9.5.92.32@ITSO.COM -PASS netserver -mapop set

DSADD user cn=rchas08_9_cifs,cn=users,dc=ITSO,dc=COM -pwd netserver -display rchas08_9_cifs
KTPASS -MAPUSER rchas08_9_cifs -PRINC cifs/9.5.92.32@ITSO.COM -PASS netserver -mapop set


)
endlocal


@ECHO OFF
ECHO.
ECHO.
ECHO  ************************   WARNING   **************************
ECHO  This batch files contains passwords!  Make sure to delete this
ECHO  file from both the Windows KDC server AND from your PC!!!
ECHO  ***************************************************************
ECHO.
@ECHO ON


@ECHO OFF
ECHO.
ECHO  ---------------------
ECHO  Batch file completed.
ECHO  ---------------------
ECHO.
PAUSE
@ECHO ON
```

To use this file, copy the file to the Kerberos server and run it. You can share the directory of your PC workstation where the file is located, or you can use File Transfer Protocol (FTP) to move it, as we have done in this scenario.

Follow these steps to use the batch file to add the principal names to the Kerberos server:

1. Use FTP batch files created by the wizard:

   a. On the Windows workstation that the administrator used to configure network authentication service, in the Windows bottom bar, select **Start** → **Run**. Enter `cmd` in the Run pop-up window to bring up a DOS command prompt.

   b. In the DOS window, type the following command: `ftp MSKerberosServer`. In this scenario, the server is Win2003Server1.itso.com. This starts an FTP session on your PC. You are prompted for the administrator's user name and password.

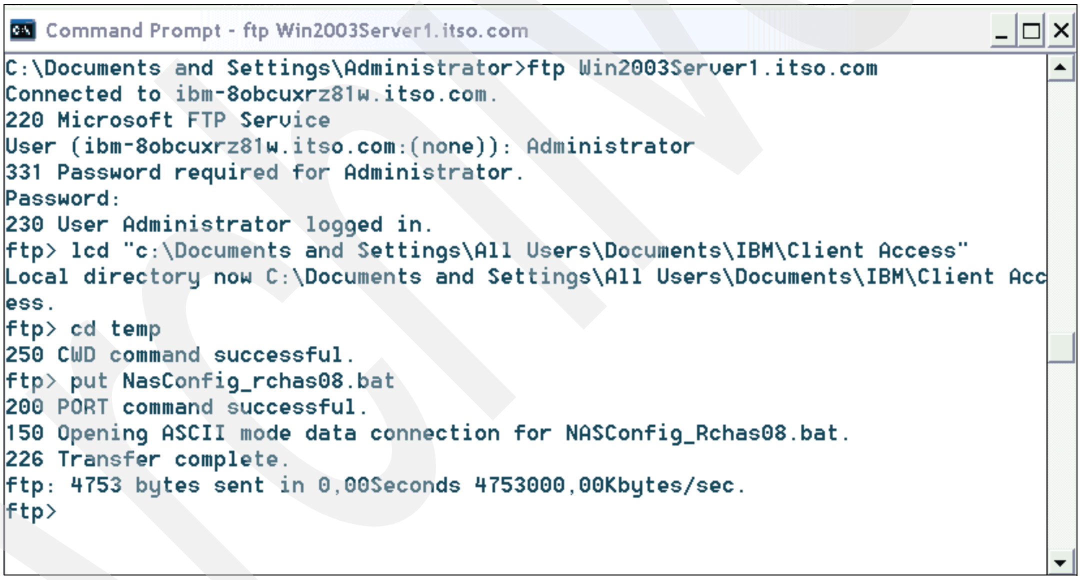
   c. On the FTP prompt, type `lcd C:\Documents and Settings\All Users\Documents\IBM\Client Access`. Press the Enter key. This changes the working local directory on your PC.

   d. On the FTP prompt, type `cd \`*`mydirectory`*, where *mydirectory* is a directory located on the Kerberos server where you want to store the batch file.

   e. On the FTP prompt, type `put NASConfig_`*`yoursystem`*`.bat`. In our case, the file is NasConfig_Rochas08.bat.

   f. Type `quit` to exit the FTP session.

   The file is transferred from the PC workstation to the Microsoft Kerberos server as you can see in Figure 6-18.



```
C:\Documents and Settings\Administrator>ftp Win2003Server1.itso.com
Connected to ibm-8obcuxrz81w.itso.com.
220 Microsoft FTP Service
User (ibm-8obcuxrz81w.itso.com:(none)): Administrator
331 Password required for Administrator.
Password:
230 User Administrator logged in.
ftp> lcd "c:\Documents and Settings\All Users\Documents\IBM\Client Access"
Local directory now C:\Documents and Settings\All Users\Documents\IBM\Client Acc
ess.
ftp> cd temp
250 CWD command successful.
ftp> put NasConfig_rchas08.bat
200 PORT command successful.
150 Opening ASCII mode data connection for NASConfig_Rchas08.bat.
226 Transfer complete.
ftp: 4753 bytes sent in 0,00Seconds 4753000,00Kbytes/sec.
ftp>
```

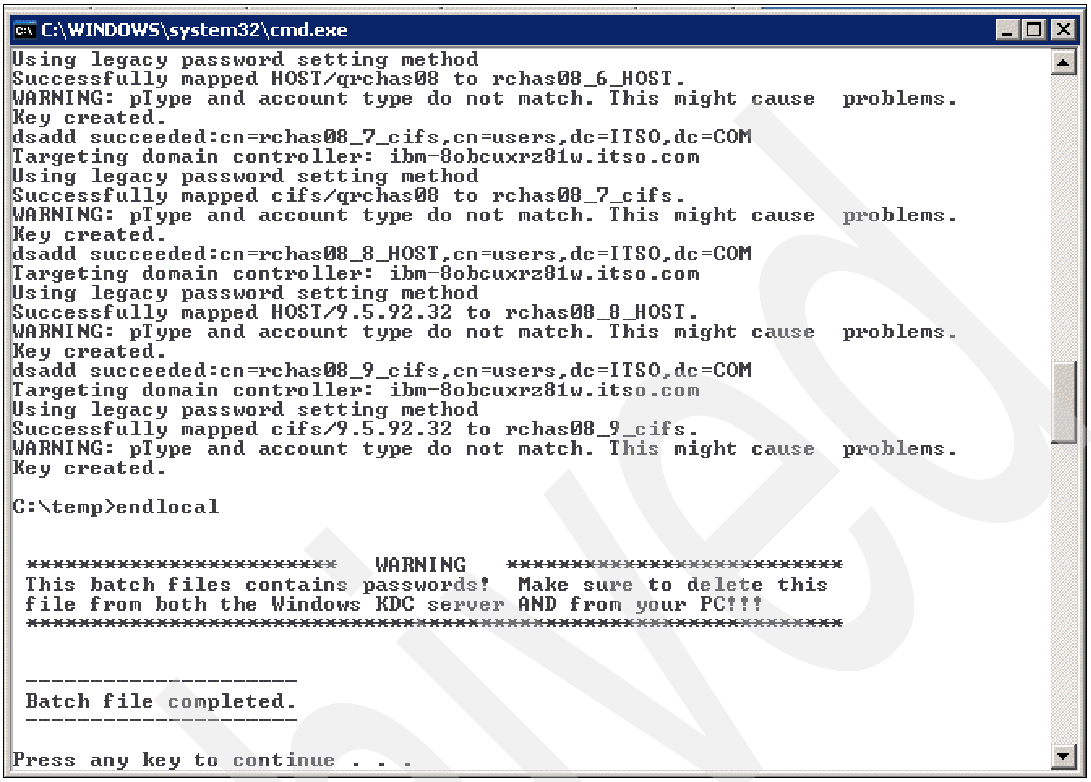
Figure 6-18 FTP session to transfer the batch file to the MS Kerberos server

2. Run both batch files on kdc1.myco.com:

   a. On your Windows 2003 server, open the directory where you transferred the batch file.

   b. Find the NASConfig_*yoursystem*.bat file and double-click the file to run it. In this scenario, the file is NASConfig_Rochas08.bat.

c. After execution, verify that the i5/OS principals have been added to the Kerberos server by checking the log as shown in Figure 6-19.



```
Using legacy password setting method
Successfully mapped HOST/qrchas08 to rchas08_6_HOST.
WARNING: pType and account type do not match. This might cause  problems.
Key created.
dsadd succeeded:cn=rchas08_7_cifs,cn=users,dc=ITSO,dc=COM
Targeting domain controller: ibm-8obcuxrz81w.itso.com
Using legacy password setting method
Successfully mapped cifs/qrchas08 to rchas08_7_cifs.
WARNING: pType and account type do not match. This might cause  problems.
Key created.
dsadd succeeded:cn=rchas08_8_HOST,cn=users,dc=ITSO,dc=COM
Targeting domain controller: ibm-8obcuxrz81w.itso.com
Using legacy password setting method
Successfully mapped HOST/9.5.92.32 to rchas08_8_HOST.
WARNING: pType and account type do not match. This might cause  problems.
Key created.
dsadd succeeded:cn=rchas08_9_cifs,cn=users,dc=ITSO,dc=COM
Targeting domain controller: ibm-8obcuxrz81w.itso.com
Using legacy password setting method
Successfully mapped cifs/9.5.92.32 to rchas08_9_cifs.
WARNING: pType and account type do not match. This might cause  problems.
Key created.

C:\temp>endlocal


 **************************   WARNING   **************************
 This batch files contains passwords!  Make sure to delete this
 file from both the Windows KDC server AND from your PC!!!
 *****************************************************************


 ---------------------
 Batch file completed.
 ---------------------

Press any key to continue . . .
```

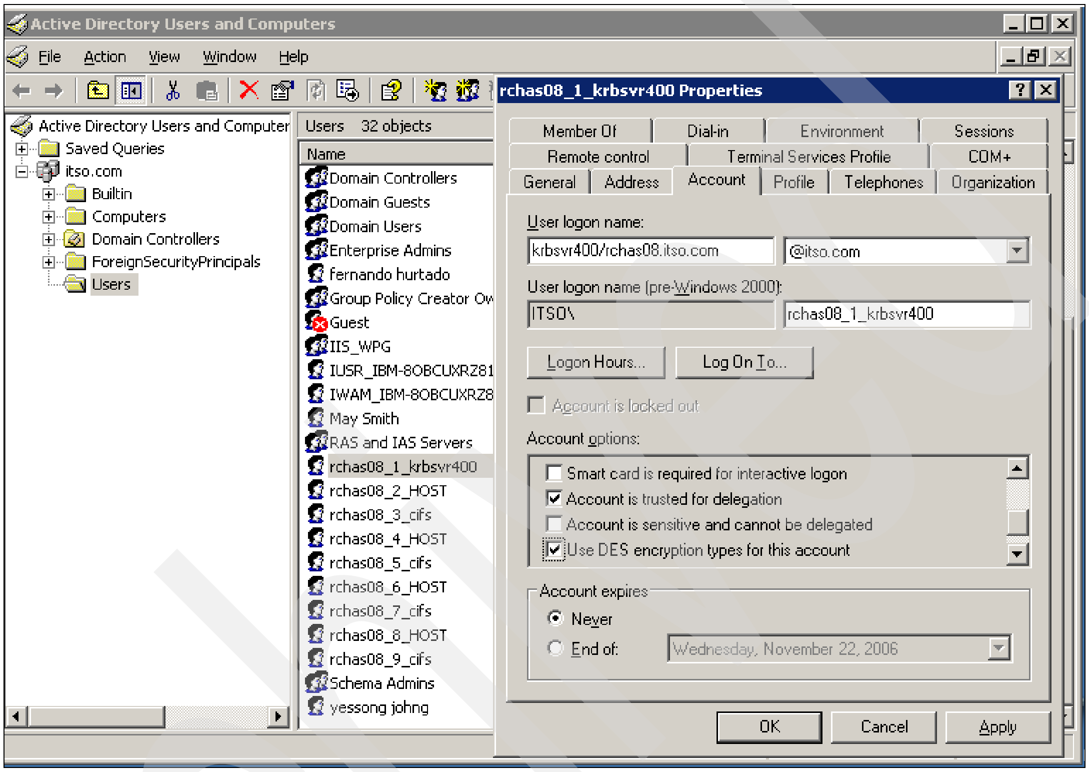
Figure 6-19 Log of the NasConfig_Rchas08.bat execution

3. On your Windows 2003 server, expand **Administrative Tools** → **Active Directory Users and Computers** → **Users**.

4. Verify the iSeries has a user account by selecting the appropriate Windows 2003 domain. Notice that this Windows 2003 domain is the same as the default realm name that you specified in the network authentication service configuration.

5. In the list of users that is displayed, find *yoursystem*_1_krbsvr400. This is the user account generated for the i5/OS principal name. In our scenario, it is rchas08_1_krbsvr400.

6. Access the properties on your Active Directory users as shown in Figure 6-20. From the **Account** tab, in the account options window, scroll down and select **Account is trusted for delegation**. Note: This optional step enables your system to delegate, or forward, a user's credentials to other systems. As a result, the i5/OS service principal can access services on multiple systems on behalf of the user. Verify that **Use DES encryption types for this account** is also selected. Click **OK**.



User logon name: krbsvr400/rchas08.itso.com @itso.com

User logon name (pre-Windows 2000): ITSO\ rchas08_1_krbsvr400

□ Account is locked out

Account options:

□ Smart card is required for interactive logon
☑ Account is trusted for delegation
□ Account is sensitive and cannot be delegated
☑ Use DES encryption types for this account

Account expires

● Never
○ End of: Wednesday, November 22, 2006

Figure 6-20 *i5/OS Kerberos Account property*

You have now completed the Windows portion of the setup.

Kerberos verification

You have completed the necessary steps to implement Network Authentication Service authentication of users on your iSeries system:

- Network Authentication Service is now set up on the i5/OS.
- Kerberos principal is created for your iSeries system in the KDC of your Windows 2003 server.

Now check that these two components cooperate. The steps described here are not required for the Network Authentication Service to work. However, by performing these steps, you confirm that the Kerberos environment is working correctly.

To verify the configuration, you need to create a home directory on the i5/OS with user profiles who will do a Kerberos verification as listed below. On the iSeries command line, issue the following command:

```
crtdir '/home/krbsvr400'
```

This directory is used to store the Kerberos credentials after the kinit command is complete.

Note: A home directory for i5/OS user profiles is necessary for those users that manually request a Kerberos ticket by the kinit command. However, if you intend to only access the iSeries using PC5250, you do not need to create an iSeries user profile home directory.

Other services might require a home directory for i5/OS user profile. For example, the Distributed Data Management (DDM) service will most likely request it.

1. Start the Qshell interpreter in an 5250 session for your i5/OS by entering the following command:

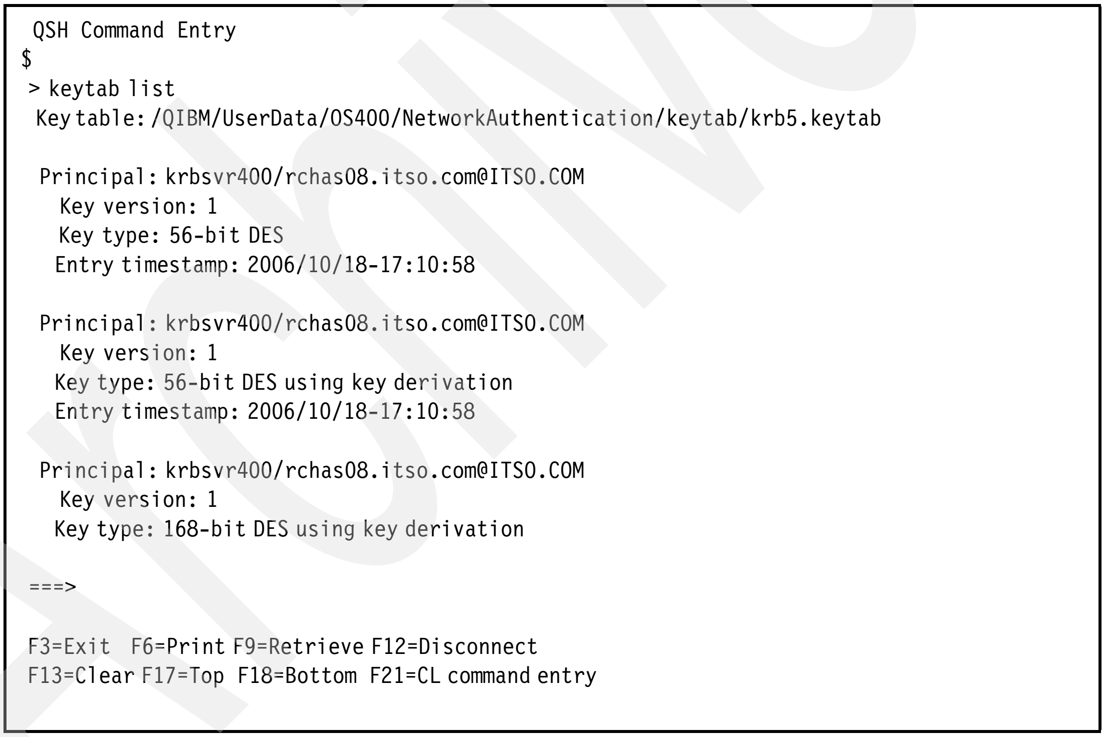
   ```
   QSH
   ```

2. Use the following Qshell command to list the current keys in the Kerberos key table:

   ```
   keytab list
   ```

An example of the output is shown in Figure 6-21.

If the wizard completed correctly and made contact with the KDC, the key table contains three entries for the krbsvr400 principal (at different encryption levels) and similarly for the iSeries NetServer principal.



```
 QSH Command Entry
$
 > keytab list
  Key table: /QIBM/UserData/OS400/NetworkAuthentication/keytab/krb5.keytab

  Principal: krbsvr400/rchas08.itso.com@ITSO.COM
    Key version: 1
    Key type: 56-bit DES
   Entry timestamp: 2006/10/18-17:10:58

  Principal: krbsvr400/rchas08.itso.com@ITSO.COM
    Key version: 1
   Key type: 56-bit DES using key derivation
   Entry timestamp: 2006/10/18-17:10:58

  Principal: krbsvr400/rchas08.itso.com@ITSO.COM
    Key version: 1
   Key type: 168-bit DES using key derivation

 ===>

 F3=Exit  F6=Print F9=Retrieve F12=Disconnect
 F13=Clear F17=Top  F18=Bottom  F21=CL command entry
```

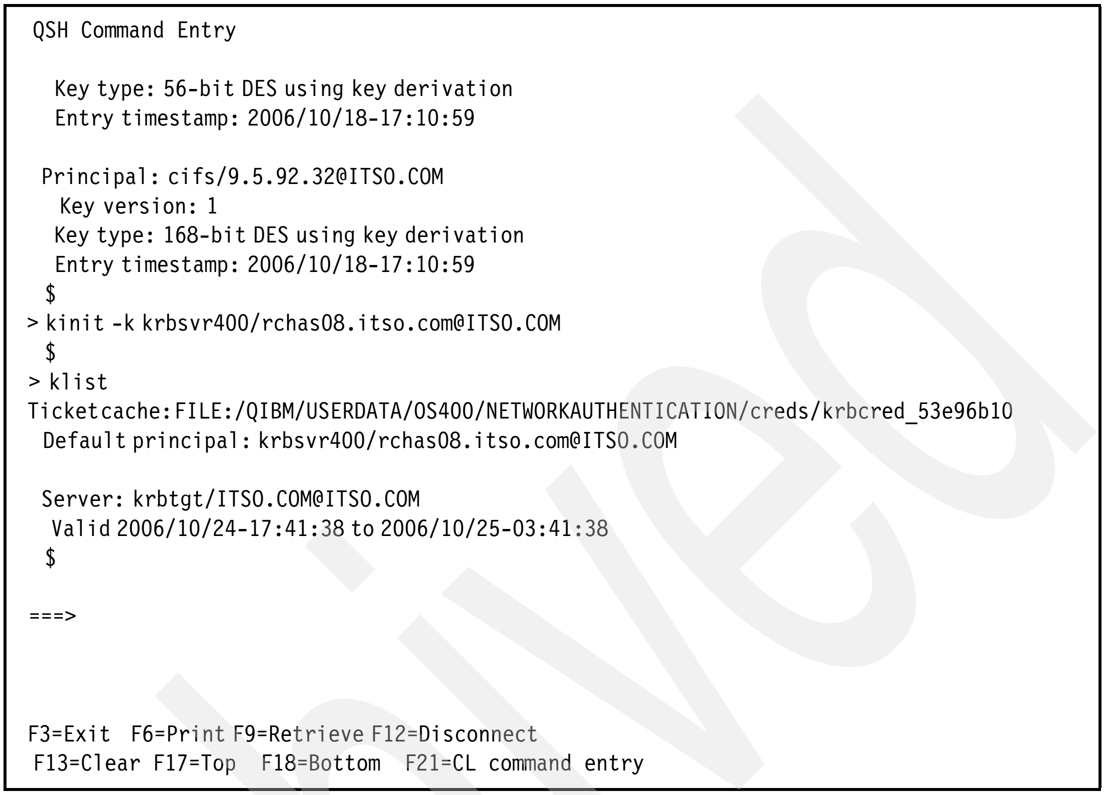
Figure 6-21 Keytab list output

3. When the key table is verified, the next step is to request a ticket granting ticket (TGT) from the KDC. Use the kinit command from a Qshell command line as shown in Figure 6-22 on page 161.

   Enter all components of the principal name in the correct case. If possible, you can copy and paste to avoid typos in the i5/OS principal name.

   The kinit command completes without any messages and the command prompt appears.

4. List the TGT using the klist command from Qshell as shown in the lower part of Figure 6-22.



```
 QSH Command Entry

   Key type: 56-bit DES using key derivation
   Entry timestamp: 2006/10/18-17:10:59

  Principal: cifs/9.5.92.32@ITSO.COM
    Key version: 1
   Key type: 168-bit DES using key derivation
   Entry timestamp: 2006/10/18-17:10:59
  $
> kinit -k krbsvr400/rchas08.itso.com@ITSO.COM
  $
> klist
Ticketcache:FILE:/QIBM/USERDATA/OS400/NETWORKAUTHENTICATION/creds/krbcred_53e96b10
  Default principal: krbsvr400/rchas08.itso.com@ITSO.COM

  Server: krbtgt/ITSO.COM@ITSO.COM
   Valid 2006/10/24-17:41:38 to 2006/10/25-03:41:38
  $

===>



F3=Exit  F6=Print F9=Retrieve F12=Disconnect
 F13=Clear F17=Top  F18=Bottom  F21=CL command entry
```

Figure 6-22 TGT request

This completes the verification of the Network Authentication Service setup.

6.4.2 Enabling EIM

The following steps enable Enterprise Identity Mapping (EIM):

- Configure EIM domain and EIM domain controller using the EIM configuration wizard.
- Use iSeries navigator to add a few users to the domain and associate them with their identities in user registries.

EIM domains are maintained in a LDAP directory, specifically IBM’s implementation called the *IBM Directory Server*. You can host it on various platforms. On i5/OS, AIX and z/OS® are already included in the operating system, but they are available free of charge on other operating systems, such as Windows, Unix, and Linux. To be an EIM controller, you must support and implement EIM APIs or Pluggable Authentication Module (PAM) on those platforms.

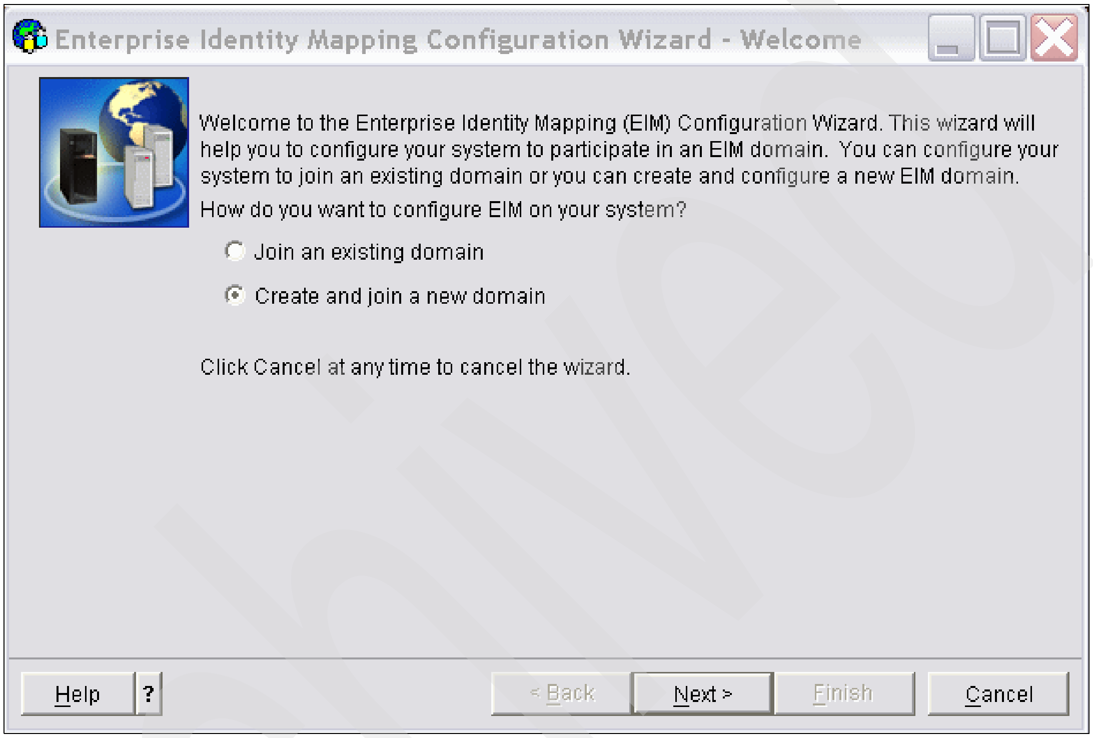
The iSeries Navigator offers a wizard to configure the EIM domain, but it works only if the IBM Directory Server is on i5/OS, or if it is implemented on an IBM Tivoli® Directory Server.

Configuring EIM domain with the wizard

1. In an iSeries Navigator session, expand ***your system connection*** → **Network** → **Enterprise Identity Mapping**. Right-click **Configuration** and select **Configure**.

If you see the **Reconfigure** option instead of **Configure**, it indicates that the Enterprise Identity Mapping has already been configured. You can either reconfigure it (the reconfiguration proceeds in a similar way to configuration), or you can right-click **Configuration** and select **Properties** to verify that the current configuration is appropriate for your network and to eventually check that the EIM domain is already configured.

2. The Enterprise Identity Mapping configuration wizard welcome window opens as shown in Figure 6-23. Select **Create and join a new domain** and click **Next**.



Welcome to the Enterprise Identity Mapping (EIM) Configuration Wizard. This wizard will help you to configure your system to participate in an EIM domain. You can configure your system to join an existing domain or you can create and configure a new EIM domain.

How do you want to configure EIM on your system?

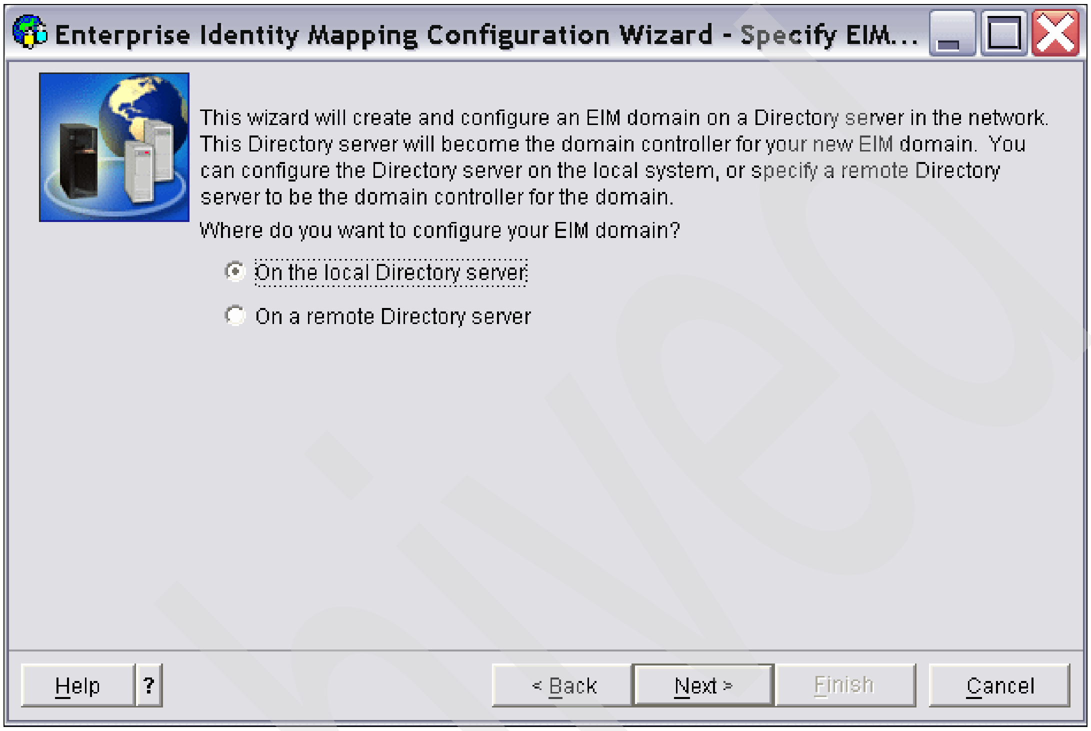
○ Join an existing domain

● Create and join a new domain

Click Cancel at any time to cancel the wizard.

Figure 6-23 EIM configuration wizard - Welcome window

3. In the window shown in Figure 6-24, specify the location of the directory server that acts as the EIM domain controller for the new EIM domain. When you create a new EIM domain, you configure a directory server to act as the EIM domain controller for the new EIM domain. You can specify if the directory server is located locally on this system, or remotely on another one.


Enterprise Identity Mapping Configuration Wizard - Specify EIM...

This wizard will create and configure an EIM domain on a Directory server in the network. This Directory server will become the domain controller for your new EIM domain. You can configure the Directory server on the local system, or specify a remote Directory server to be the domain controller for the domain.

Where do you want to configure your EIM domain?

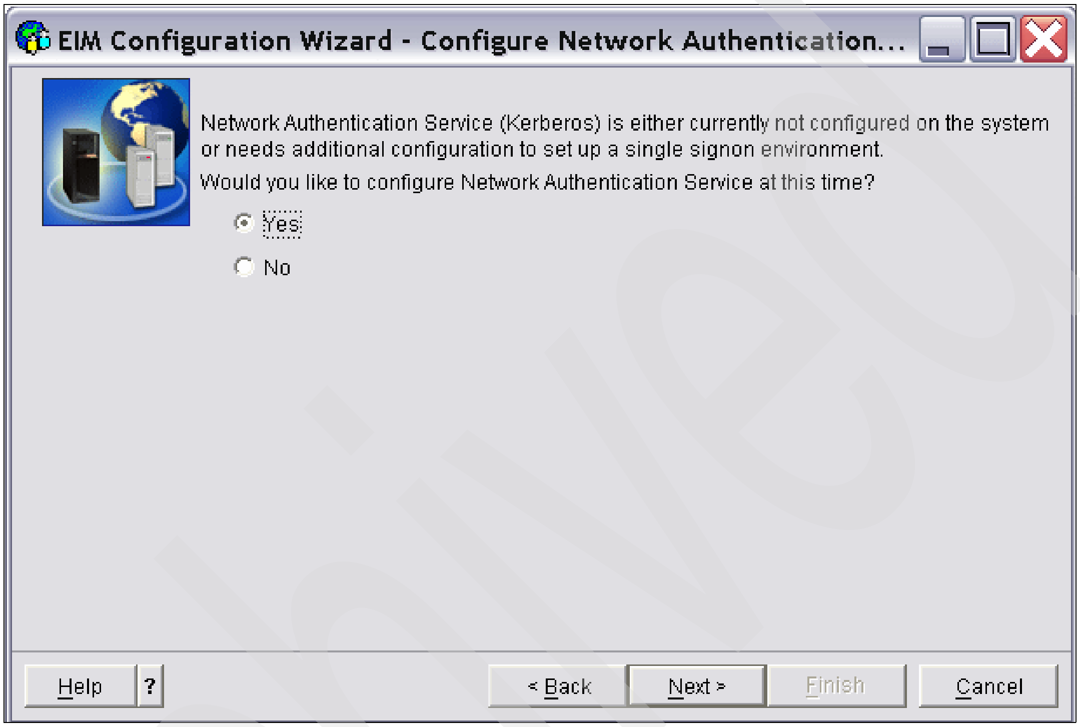
● On the local Directory server

○ On a remote Directory server

Figure 6-24 EIM configuration wizard - Specify EIM domain location

4. The wizard (Figure 6-25) gives you the option to configure NAS in case it is not currently configured on your system, or when you need to perform additional NAS configuration. You are not required to configure NAS to configure EIM. We prefer to keep the two configurations tasks separated for clarity.

   Because this scenario has already gone through the NAS configuration, select **No** and click **Next**.



EIM Configuration Wizard - Configure Network Authentication...

Network Authentication Service (Kerberos) is either currently not configured on the system or needs additional configuration to set up a single signon environment.

Would you like to configure Network Authentication Service at this time?

● Yes

○ No

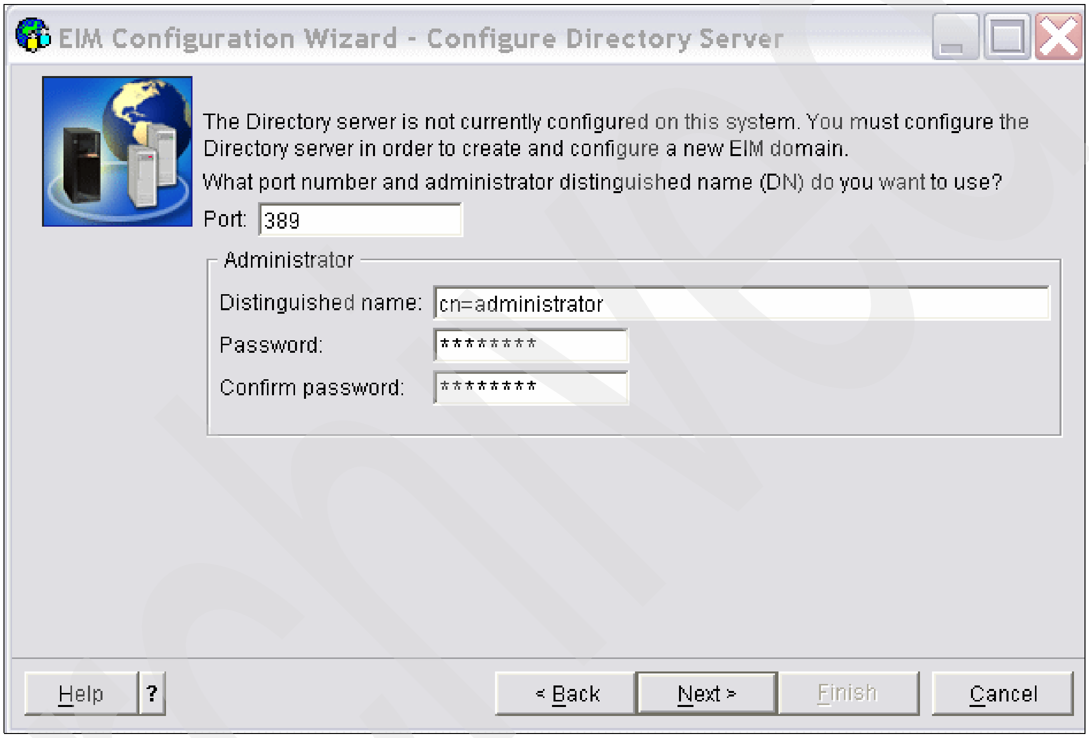
Figure 6-25 EIM configuration wizard - Configure NAS

5. If your LDAP server is running while you are using the wizard, a warning window appears to inform you that the wizard needs to stop and restart the LDAP server. Click **Yes** and skip to Step 6 on page 148.

Otherwise, you see the window shown in Figure 6-26. The EIM wizard detects that the TCP/IP Directory Server is not currently configured on this system. In Step 2 on page 145, we choose to use the a local Directory Server to store the EIM Domain controller and table, so now you must configure it before proceeding with the EIM configuration. To create the Directory Server, the wizard asks to set up a port where the server will listen to, an administrator distinguish name, and a relative password.

The default values, 389 for the port and dn=Administrator for the administrator user, are proposed. You can change or keep them and set the password value for the Directory Server administrator user.

Click **Next** to continue.



The Directory server is not currently configured on this system. You must configure the Directory server in order to create and configure a new EIM domain.

What port number and administrator distinguished name (DN) do you want to use?

Port: 389

Administrator

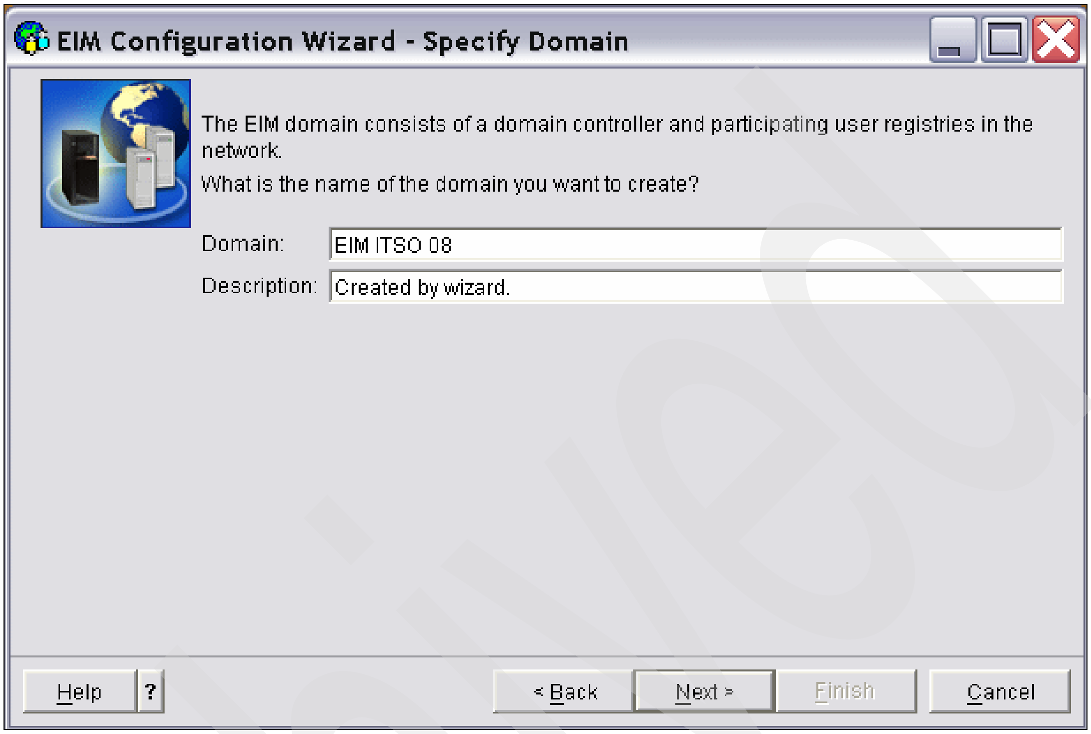
Distinguished name: cn=administrator

Password: ********

Confirm password: ********

Figure 6-26 EIM configuration wizard - Configure the Directory server

6. The wizard now asks you to choose a name for the EIM domain name you are creating, as shown in Figure 6-27. Fill in the Domain and Description fields, or leave the default EIM value for the Domain and click **Next**. In this scenario, we name it ITSO.COM EIM.



EIM Configuration Wizard - Specify Domain

The EIM domain consists of a domain controller and participating user registries in the network.

What is the name of the domain you want to create?

Domain: EIM ITSO 08

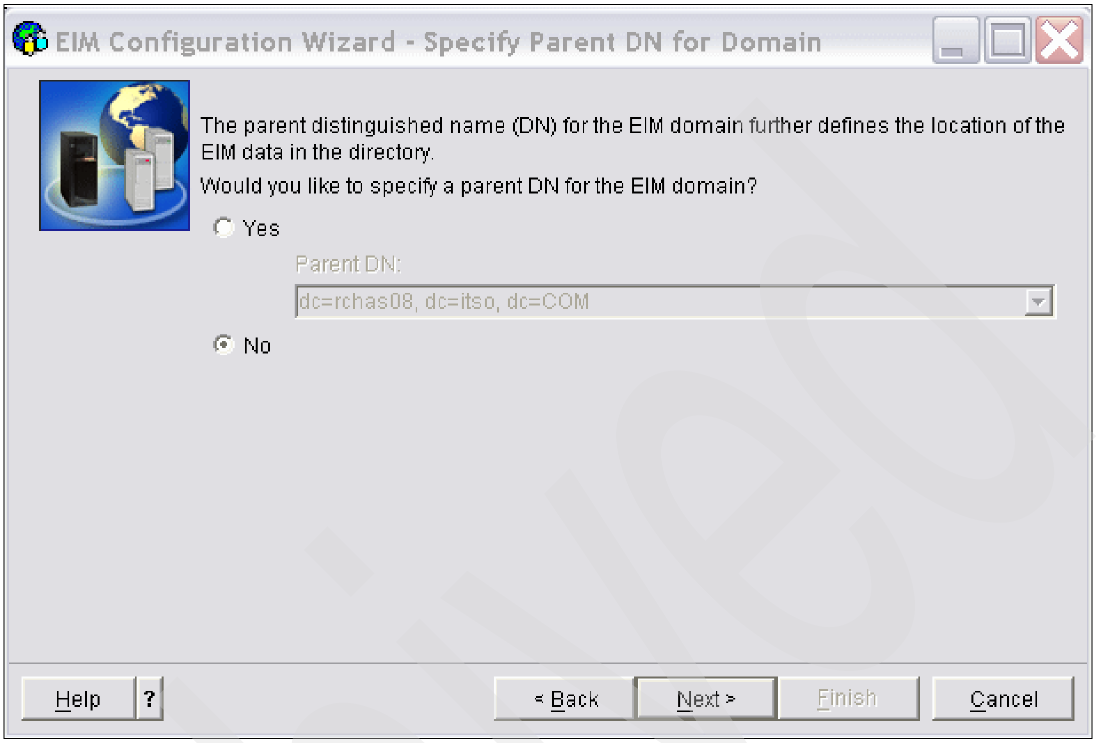
Description: Created by wizard.

Figure 6-27 EIM configuration wizard - Specify domain name

7. Specify the parent DN the wizard to use for the location of the EIM domain. This is the DN that represents the entry immediately above your domain name entry in the directory information tree hierarchy.

   When you create a domain on a local directory server, a parent DN is optional. If you do not specify a parent DN and you are configuring a domain on a local directory server, the wizard creates a directory location with a suffix it derives from the EIM domain name to store the EIM directory data.

In you do not have specific request regarding this directory location, leave the default value **No** as shown in Figure 6-28 and click **Next**.



The parent distinguished name (DN) for the EIM domain further defines the location of the EIM data in the directory.

Would you like to specify a parent DN for the EIM domain?

○ Yes

Parent DN: dc=rchas08, dc=itso, dc=COM

● No

Figure 6-28 EIM configuration wizard - Specify parent DN for domain

8. In the Registry Information window (Figure 6-29), you can request two user registries to automatically add them to your domain. Only user identities (IDs) from user registries that are participating in an EIM domain can have associations defined for them. To have a user registry participate in an EIM domain, you must create an EIM registry definition for it and add it to the domain.

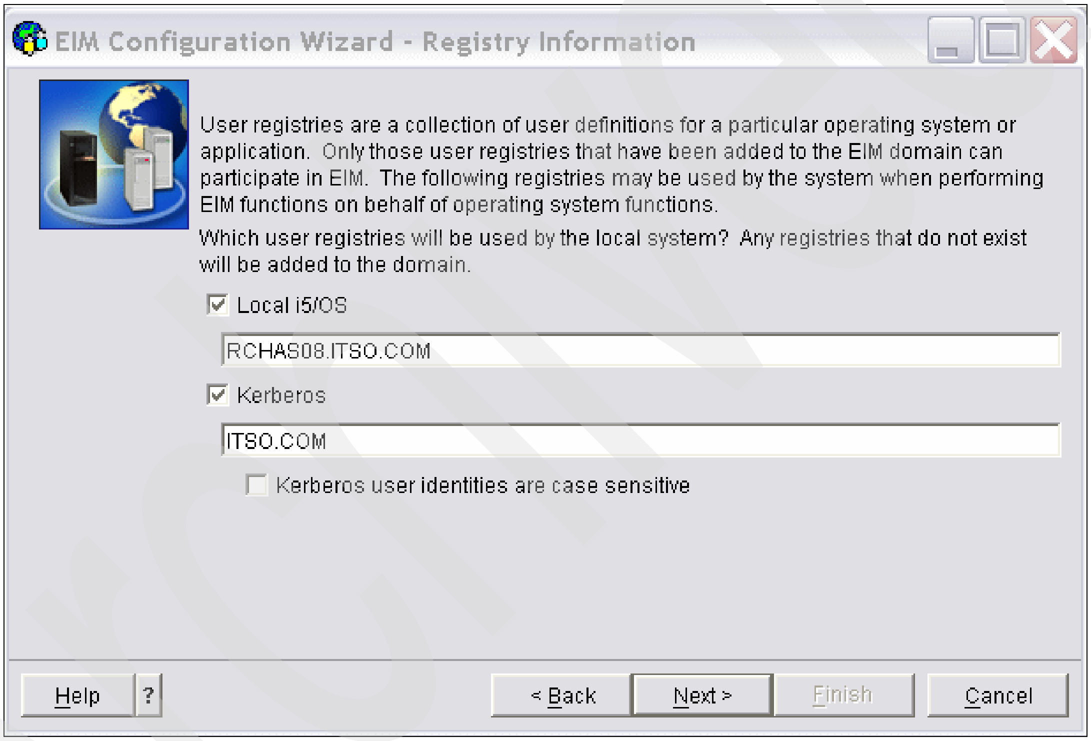
   Check for both of them on:

   – Local i5/OS registry for your iSeries system, hosting the EIM domain controller
   – Kerberos registry - in our case, located on the Windows 2000 server

   Click **Next** to proceed.

> **Tip:** You can simplify your configuration, and consequently any potential debugging, if you de-select the Kerberos user identities are case-sensitive check box.

ì



EIM Configuration Wizard - Registry Information

User registries are a collection of user definitions for a particular operating system or application. Only those user registries that have been added to the EIM domain can participate in EIM. The following registries may be used by the system when performing EIM functions on behalf of operating system functions.

Which user registries will be used by the local system? Any registries that do not exist will be added to the domain.

☑ Local i5/OS

RCHAS08.ITSO.COM

☑ Kerberos

ITSO.COM

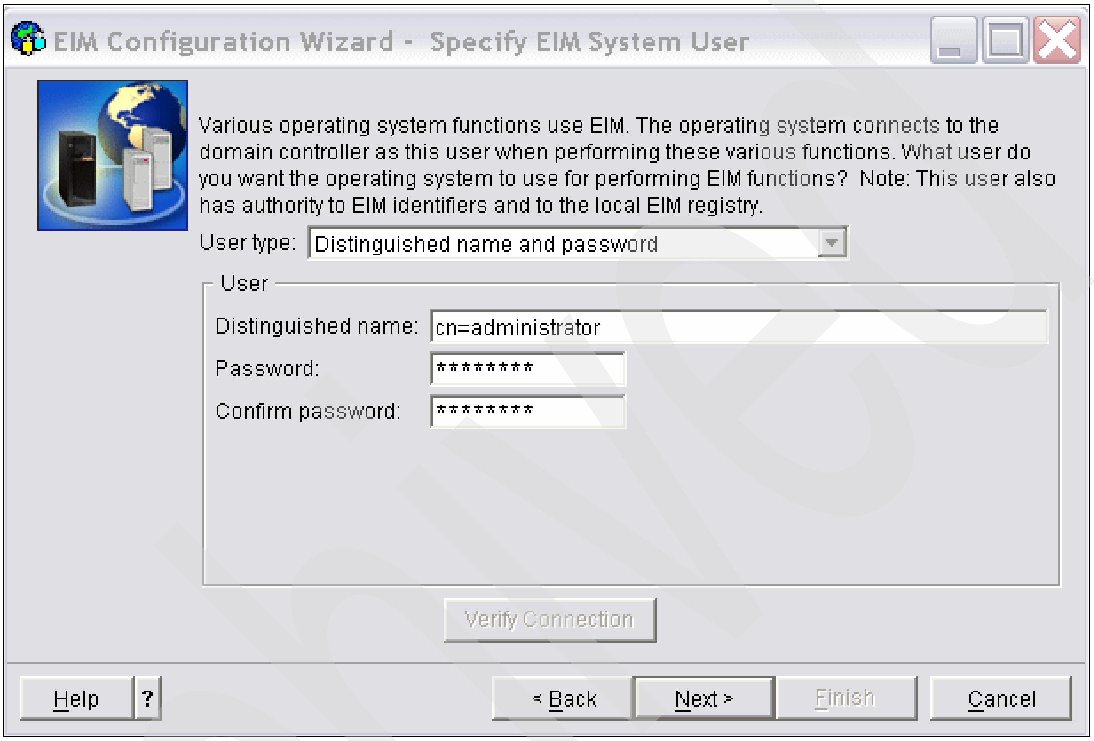
□ Kerberos user identities are case sensitive

Figure 6-29 EIM configuration wizard - Registry information

9. In Figure 6-30, specify the EIM System User whose account is used to connect to the EIM domain controller by various operating system functions.

   Specify a user that is currently defined in the Directory server that is hosting the EIM domain controller.

   As default, the wizard proposes the administrator distinguish name and password we specified in Step 5 on page 148. Modify those values if required, or click **Next**.



EIM Configuration Wizard - Specify EIM System User

Various operating system functions use EIM. The operating system connects to the domain controller as this user when performing these various functions. What user do you want the operating system to use for performing EIM functions? Note: This user also has authority to EIM identifiers and to the local EIM registry.

User type: Distinguished name and password

User

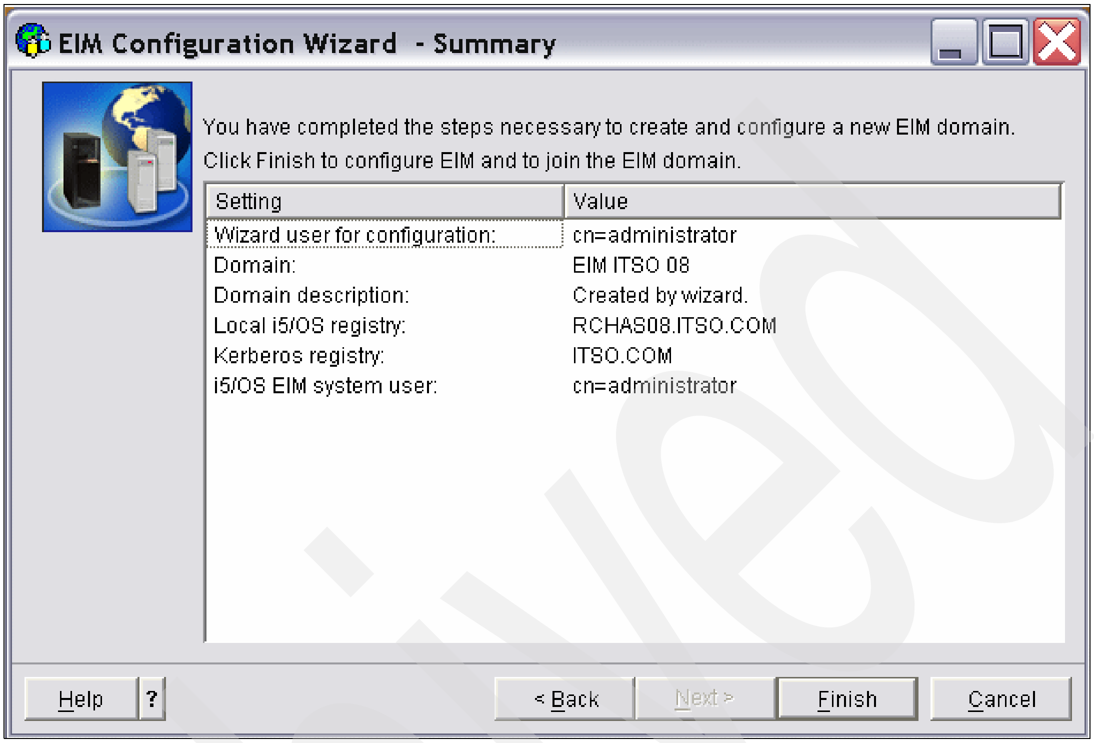
Distinguished name: cn=administrator

Password: ********

Confirm password: ********

Figure 6-30 EIM configuration wizard - specify EIM system user

10. The Summary window shown in Figure 6-31 recaps the settings you have specified. Verify that they are accurate and click **Finish**.

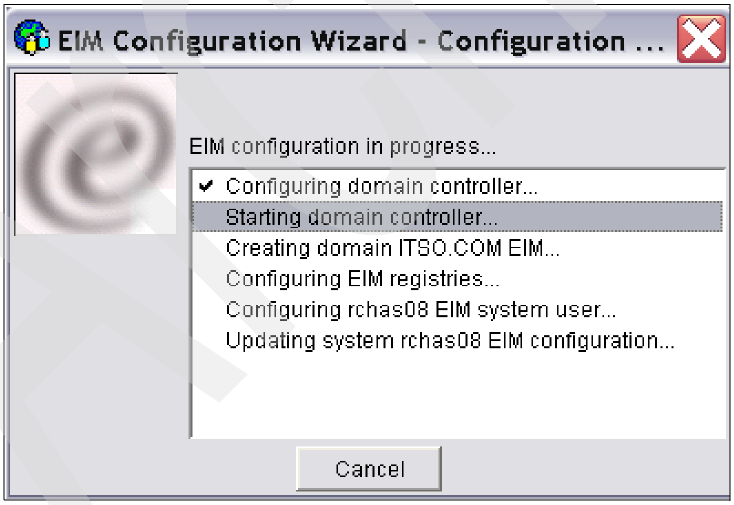

EIM Configuration Wizard - Summary

You have completed the steps necessary to create and configure a new EIM domain. Click Finish to configure EIM and to join the EIM domain.

Setting	Value
Wizard user for configuration:	cn=administrator
Domain:	EIM ITSO 08
Domain description:	Created by wizard.
Local i5/OS registry:	RCHAS08.ITSO.COM
Kerberos registry:	ITSO.COM
i5/OS EIM system user:	cn=administrator

Figure 6-31 Eim configuration wizard - Summary

Now the EIM configuration wizard is proceeding with the configuration. The window shown in Figure 6-32 shows all the steps the wizard has to go through. It can take a few minutes.


EIM Configuration Wizard - Configuration ...

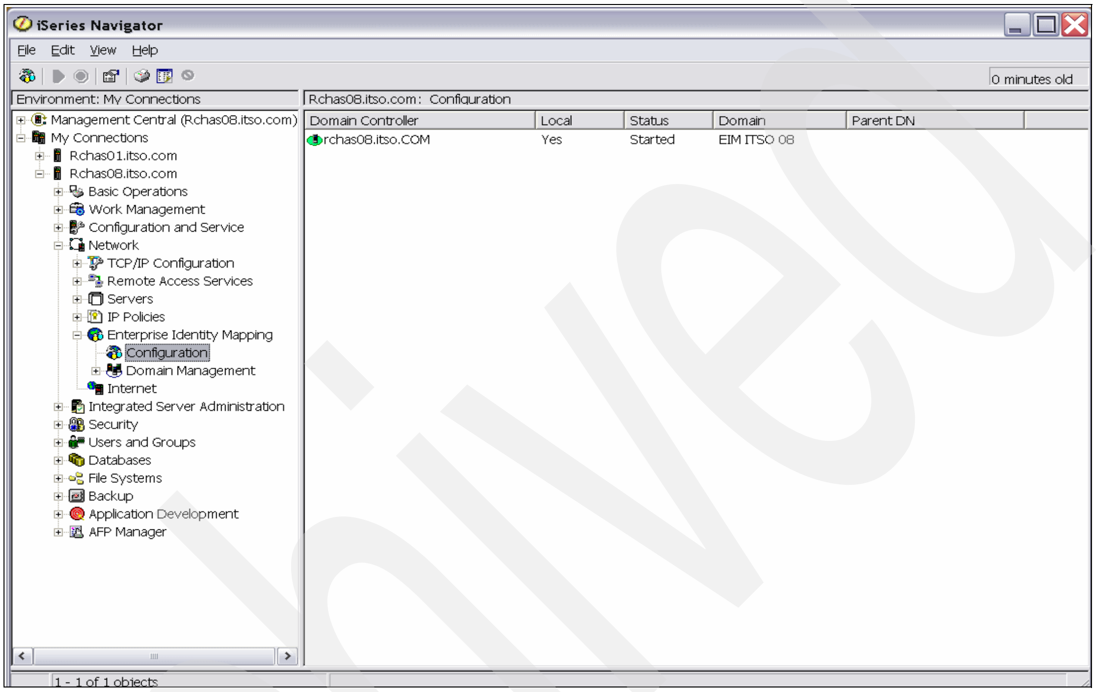
EIM configuration in progress...

- ✓ Configuring domain controller...
- Starting domain controller...
- Creating domain ITSO.COM EIM...
- Configuring EIM registries...
- Configuring rchas08 EIM system user...
- Updating system rchas08 EIM configuration...

Figure 6-32 EIM configuration in progress

When the wizard has finished the configuration, expand ***your system connection*** → **Network** → **Enterprise Identity Mapping**, click **Configuration** in the left pane. In the right pane, you can see what was created as shown in Figure 6-33.

The ITSO.COM EIM Domain configuration is stored in the local Directory Server structure. You see the Domain Controller has started if the TCP/IP Directory Server is activate. With a right-click *our Domain Controller*, you can stop or start it, but be *careful* because that operation directly impacts the whole system Directory Server.



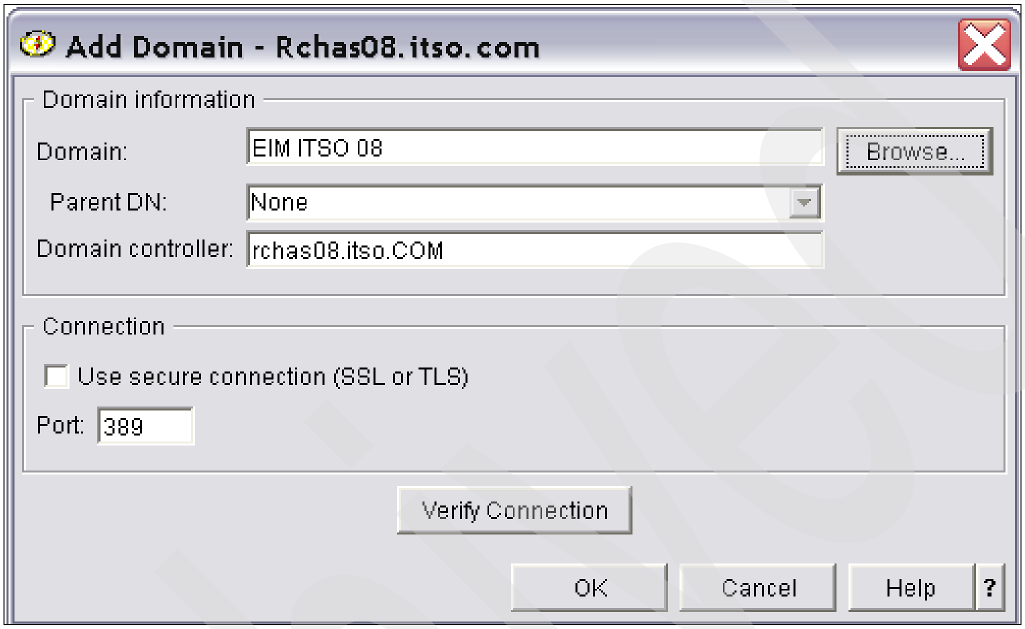
Domain Controller	Local	Status	Domain	Parent DN
rchas08.itso.COM	Yes	Started	EIM ITSO 08	

Figure 6-33 EIM Domain Controller status

What you see in the right pane, you can see on all the iSeries Navigator by clicking **Configuration**. Instead, the ITSO.COM EIM and its entries below that you see by expanding **Domain Management** on the left pane, are shown in your iSeries Navigator because you had run the EIM configuration wizard on it.

Attention: The domain management information is stored locally on the client. If you use iSeries Navigator on another PC, you need to add the domain for management again. When the domain is added for the particular client, it appears in its domain management.

To add an EIM domain for management on another PC, in the iSeries Navigator session, expand ***your system connection*** → **Network** → **Enterprise Identity Mapping.** Right-click **Domain Management** and click **Add Domain** in the local menu. As shown in Figure 6-34, in the Add Domain window, all the fields might already be filled in. If not, click **Browse** and a list of configured domains are presented. Select your EIM domain and click **OK**. You obtain the same situation shown in Figure 6-33 on page 171.


Add Domain - Rchas08.itso.com

Domain information

Domain: EIM ITSO 08

Parent DN: None

Domain controller: rchas08.itso.COM

Connection

□ Use secure connection (SSL or TLS)

Port: 389

Figure 6-34 Add the EIM Domain under the Domain Management on your PC

The options Add domain and Remove domain, available from the Domain Management local menu, act only locally on the client. You can run them any time without having any effect on the operation of the EIM domain or domain controller.

On the other hand, the option Delete available from the local menu of the particular domain deletes the domain from the domain controller.

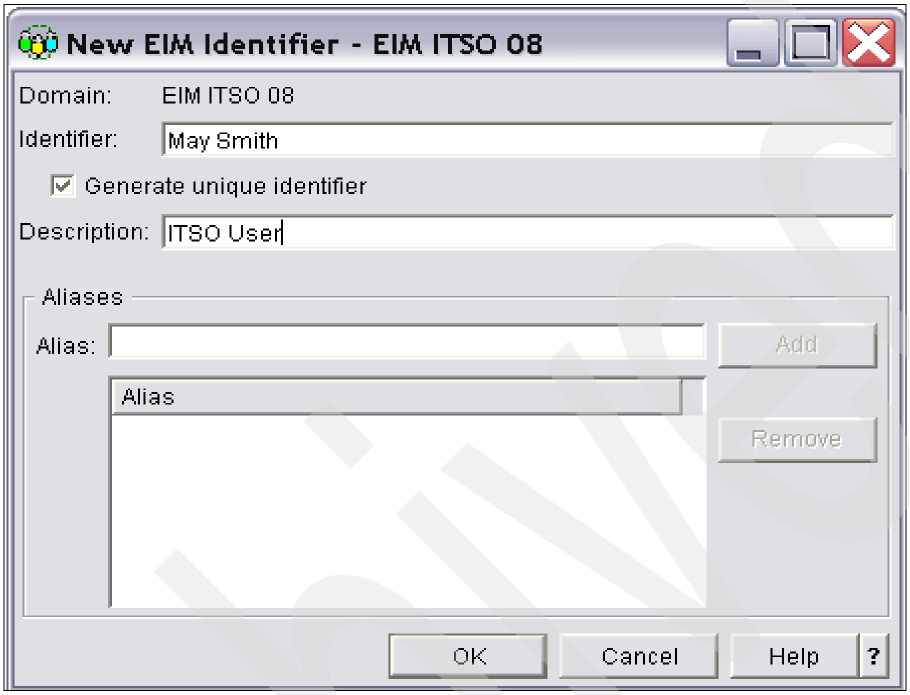
Populating the EIM table with identifiers and associations

Prior to testing your EIM configuration, you need to create at least one user in your EIM domain. You can use the iSeries Navigator to manage a small number of users in EIM. However, in iSeries Navigator you cannot browse the user profiles or accounts in the user registries, you have to key in all the user IDs.

Perform the following three steps to add a user (an EIM ID) to the EIM domain:

1. In the iSeries Navigator, expand ***your system connection*** → **Network** → **Enterprise Identity Mapping**. If you have not connected to the EIM domain controller previously, you are prompted to enter the distinguished name and its password set in Step 9 on page 152. Expand ***your EIM Domain***.
2. Right-click **User Registries** and you see two user registries that the wizard has added in Step 8 on page 151. You can optionally right-click at the registries in the panel on the right and select **Properties** in the local menu. In the Properties window, you can change the description set by the wizard.
3. Right-click **Identifiers** in the left panel of the iSeries navigator and select **New Identifier** in the local menu.

4. The New EIM Identifier window appears as shown in Figure 6-35. Enter the EIM Identifier of the new user you are going to add to the EIM domain. The EIM identifier needs to be unique within the EIM domain. iSeries Navigator issues an error message that indicates an identifier by this name already exists when you try to create a duplicate ID. You can choose to select the Generate Unique Identifier box. If you add a duplicate EIM ID, the system appends a number to the end of the ID. Click **OK**.



New EIM Identifier - EIM ITSO 08

Domain: EIM ITSO 08

Identifier: May Smith

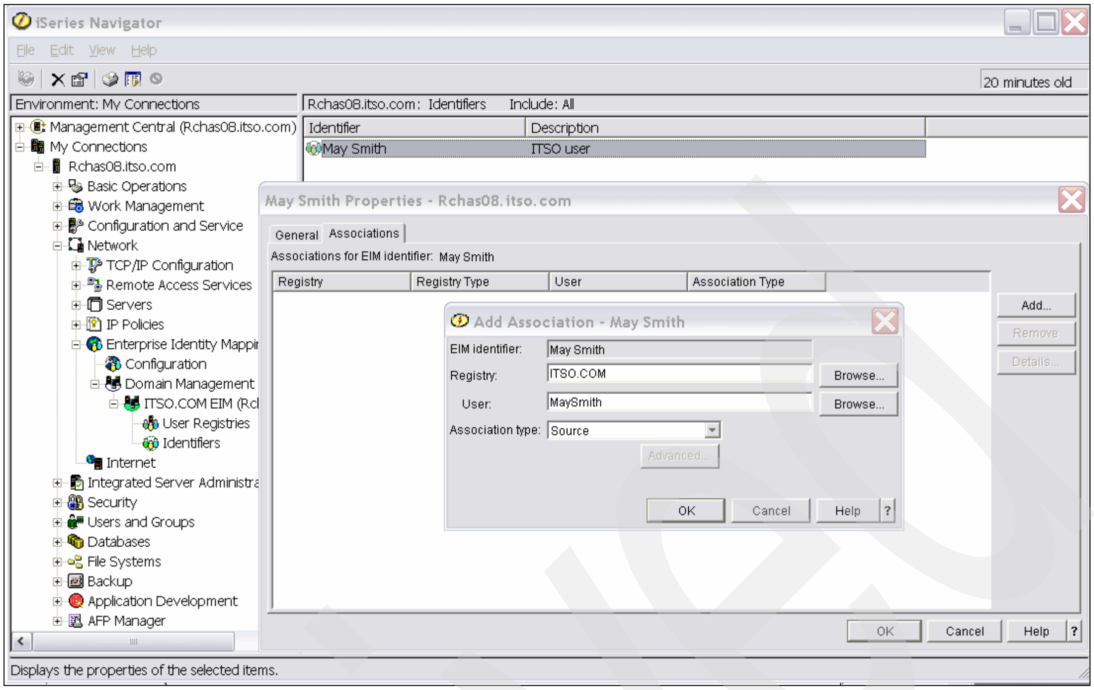
☑ Generate unique identifier

Description: ITSO User

Figure 6-35 Creating a new EIM Identifier

You have added the EIM Identifier of the user in the EIM domain. Now you have to associate this identifier with the user it represents in the various user registries.

5. In the left pane under your EIM domain, click **Identifiers**. A list of identifiers come up in the right pane of the iSeries Navigator. Right-click the user you added and select **Properties** from the menu.
6. The Properties window of the selected EIM ID appears. Select the **Associations** tab and click **Add**.
7. The details of the identifier selected comes up. Click the **Associations** tab to add the association to the Kerberos registry. In the Add Association window, shown in Figure 6-36 on page 174, click **Browse** for a list of the available registries.



Identifier	Description
May Smith	ITSO user

Associations for EIM identifier: May Smith

EIM identifier: May Smith

Registry: ITSO.COM

User: MaySmith

Association type: Source

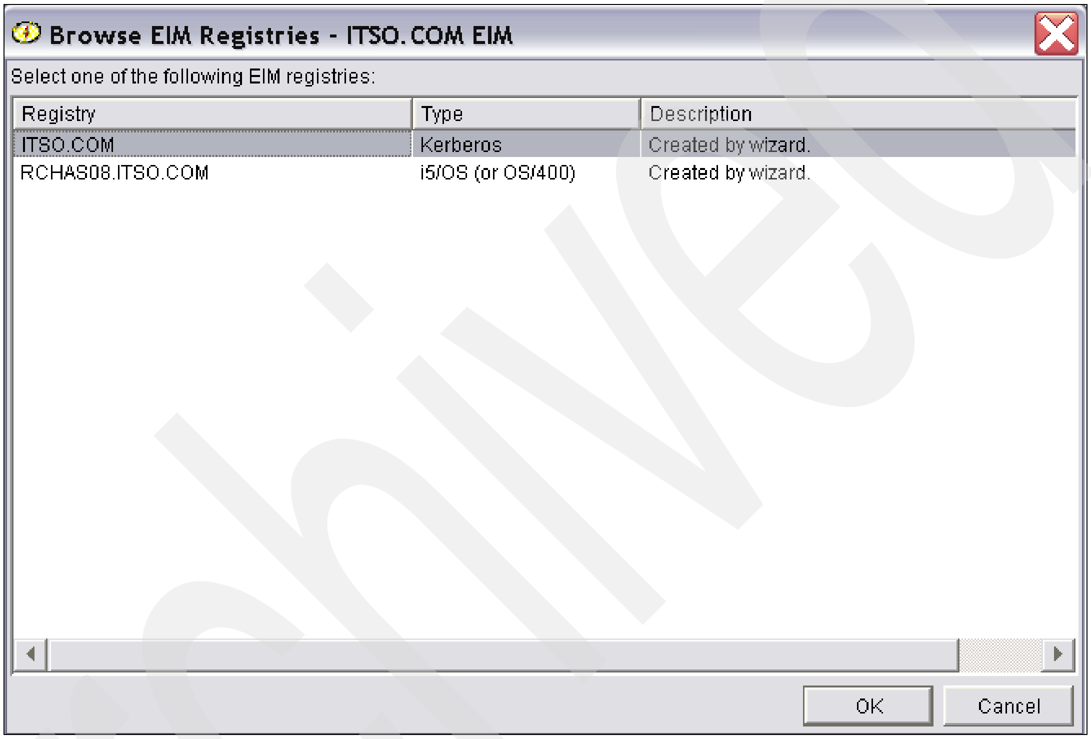
Figure 6-36 Adding a source EIM association

8. The Browse EIM registries window (Figure 6-37) shows the two user registry definitions that are added to the EIM domain by the EIM wizard in Step 8 on page 151 of section Configuring EIM domain with the wizard.

   – The local i5/OS registry for your iSeries system, hosting the EIM domain controller, is represented here by its fully qualified host name, RCHAS08.ITSO.COM, in our example.

   – The Kerberos registry on the Windows 2003 server, represented here by the Kerberos realm, is ITSO.IBM.COM in our example.

   Select the **Kerberos** registry and click **OK**.



Browse EIM Registries - ITSO.COM EIM

Select one of the following EIM registries:

Registry	Type	Description
ITSO.COM	Kerberos	Created by wizard.
RCHAS08.ITSO.COM	i5/OS (or OS/400)	Created by wizard.

Figure 6-37 Select EIM Registries window

9. Clicking **OK** takes you back to the Add Association window. Complete it as shown in Figure 6-36 on page 174:

   a. Fill in the User field with the user ID that the user used to sign on to the Windows domain. `MaySmith` is our example.

   b. Select **Source** in the Association type combo box. Click **OK**.

10. Add the i5/OS registry:

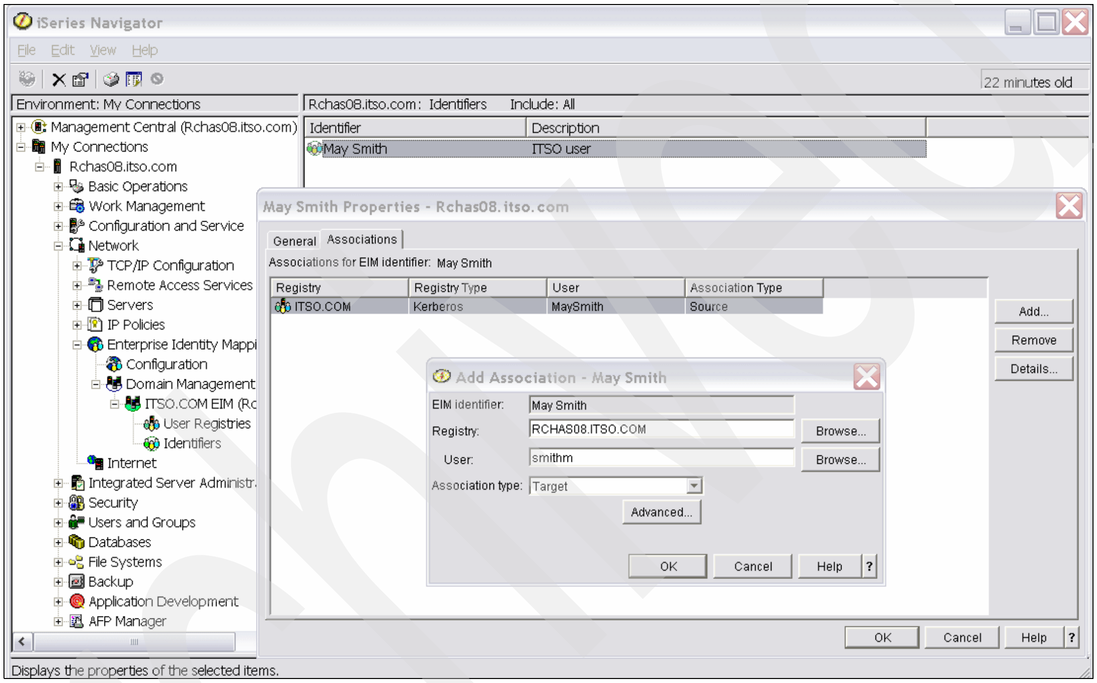
  a. Click **Add** again.

  b. In the Add Association window, shown in Figure 6-38, click **Browse**.

  c. In the Browse EIM registries window, select the i5/OS registry, as shown in Figure 6-37 on page 175. We use RCHAS08.ITSO.COM.

  d. Back in the Add Association window, fill in the User field with the name of the user profile of the user in i5/OS. `smithm` is our example.

  e. Select **Target** in the Association type combo box. Click **OK** in to Add this second association.



Identifier	Description
May Smith	ITSO user

Associations for EIM identifier: May Smith

Registry	Registry Type	User	Association Type
ITSO.COM	Kerberos	MaySmith	Source

EIM identifier: May Smith

Registry: RCHAS08.ITSO.COM

User: smithm

Association type: Target

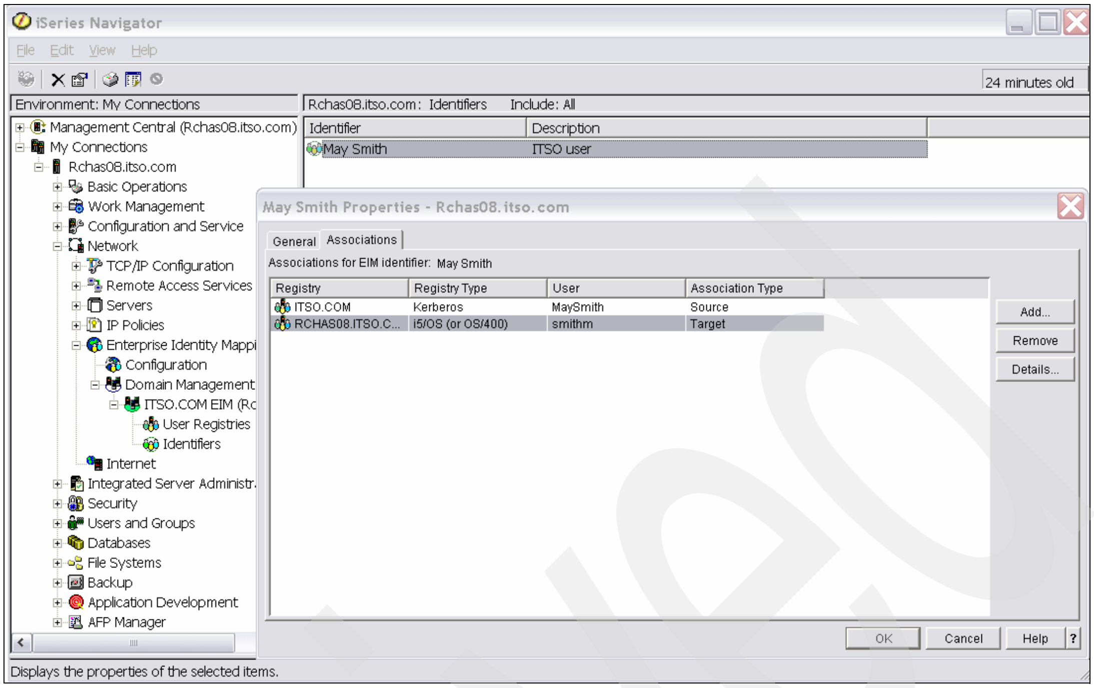
Displays the properties of the selected items.

Figure 6-38 Adding a target EIM association

11. In the Properties window for the selected EIM ID (Figure 6-39 on page 177), you can see both associations:

  – The i5/OS registry with the Target association. RCHAS08.ITSO.COM is our example.

  – The Windows 2003 Kerberos registry with the Source association. ITSO.COM is our example.



Identifier	Description
May Smith	ITSO user

Associations for EIM identifier: May Smith

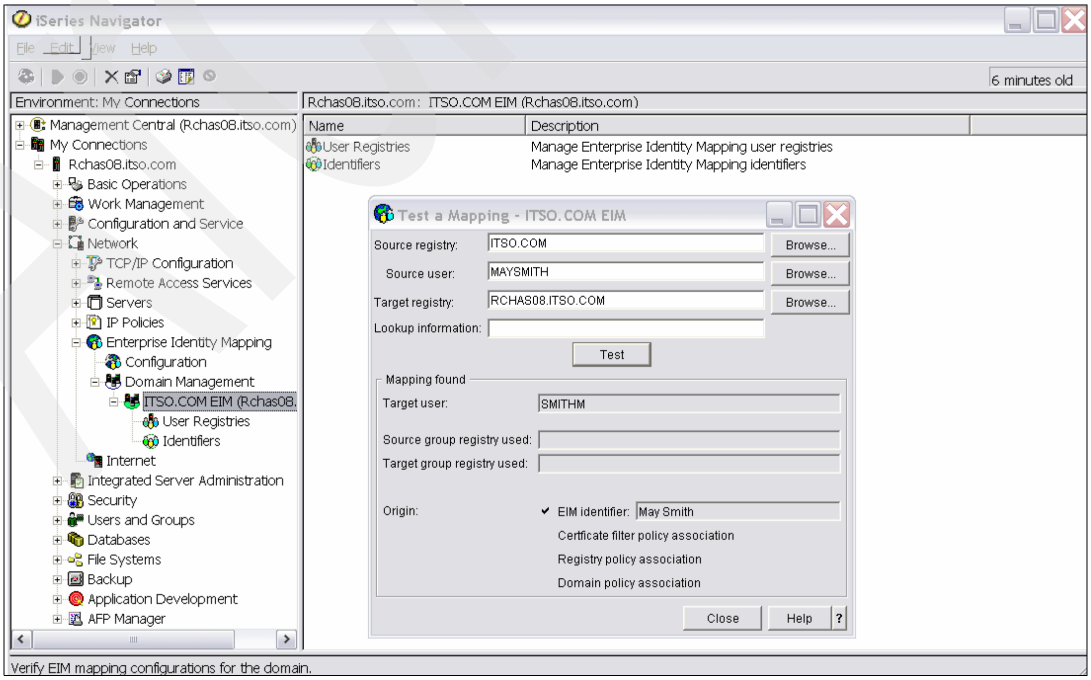
Registry	Registry Type	User	Association Type
ITSO.COM	Kerberos	MaySmith	Source
RCHAS08.ITSO.C...	i5/OS (or OS/400)	smithm	Target

Figure 6-39 Identify associations list

12. Verify the associations are correct and click **OK**.

This completes adding the user and the user's associations in the EIM domain. Repeat the steps for additional users.

The association that you added is basic and simple. However, you can always verify the associations, which is helpful in a complex implementation. Right-click your EIM Domain and click **Test a Mapping**. The toolbox appears as shown in Figure 6-40.



Name	Description
User Registries	Manage Enterprise Identity Mapping user registries
Identifiers	Manage Enterprise Identity Mapping identifiers

Source registry: ITSO.COM
Source user: MAYSMITH
Target registry: RCHAS08.ITSO.COM
Lookup information:

Mapping found
Target user: SMITHM
Source group registry used:
Target group registry used:
Origin: ✓ EIM identifier: May Smith
Certficate filter policy association
Registry policy association
Domain policy association

Figure 6-40 EIM domain - Testing a mapping

You can perform a mapping lookup operation test that uses the source registry, source user, target registry, and any lookup information (we do not have any of those in our example). When the lookup operation completes, the results display under the mapping found.

6.4.3 SSO

Now that you have completed the setup of the components needed for the single sign-on, verify the setup by enabling two widely-used IBM client applications to access the iSeries server:

- 5250 Telnet and iSeries Navigator
- iSeries NetServer

Before enabling these two applications, first ensure that to enable the 5250 emulation for single sign-on, the system value QRMTSIGN is set to *VERIFY (recommended) or *SAMEPRF (less secure environment). To check or change the QRMTSIGN system value:

1. Sign on to i5/OS as a user with *ALLOBJ and *SECADM authorities.
2. Enter the Display System Value (DSPSYSVAL) i5/OS command:

   ```
   DSPSYSVAL SYSVAL(QRMTSIGN)
   ```

3. If the value shown is *FRCSIGNON or *REJECT, use the Change System Value (CHGSYSVAL) i5/OS command to change the setting:

   ```
   CHGSYSVAL SYSVAL(QRMTSIGN) VALUE(*VERIFY)
   ```

Change the i5/OS profile of the test user to PASSWORD(*NONE) to demonstrate the full strength of this single sign-on solution:

1. Sign on to i5/OS as a user with *ALLOBJ and *SECADM authorities.
2. Enter the Change User Profile (CHGUSRPRF) i5/OS command, for example:

   ```
   CHGUSRPRF USRPRF(SMITHM) PASSWORD(*NONE)
   ```

Enabling 5250 Telnet and iSeries Navigator for the single sign-on

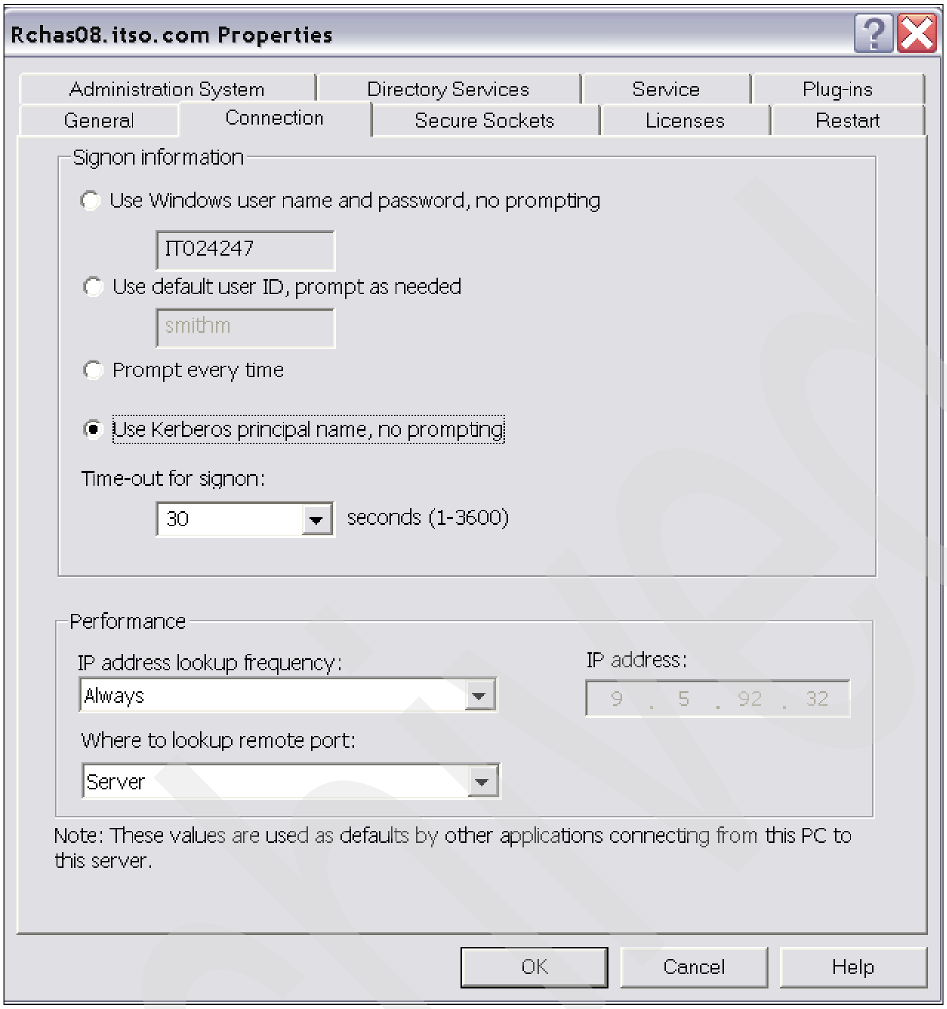
Perform the following steps to enable single sign-on for the iSeries Navigator:

1. In iSeries Navigator, right-click your iSeries server. In the local menu, select **Properties**.

   If you have not been connected to the iSeries server, the connection is attempted and one of the Sign-on to iSeries windows might appear. Cancel the connection attempt by clicking **Cancel** or **No**.

2. In the iSeries server Properties window shown in Figure 6-41 on page 179, select the **Connection** tab. In the Sign-on information section, select the option **Use Kerberos principal name, no prompting** and click **OK**.

Single sign-on for the iSeries Navigator is now enabled.



Signon information

○ Use Windows user name and password, no prompting

IT024247

○ Use default user ID, prompt as needed

smithm

○ Prompt every time

● Use Kerberos principal name, no prompting

Time-out for signon:

30 seconds (1-3600)

Performance

IP address lookup frequency: Always

IP address: 9 . 5 . 92 . 32

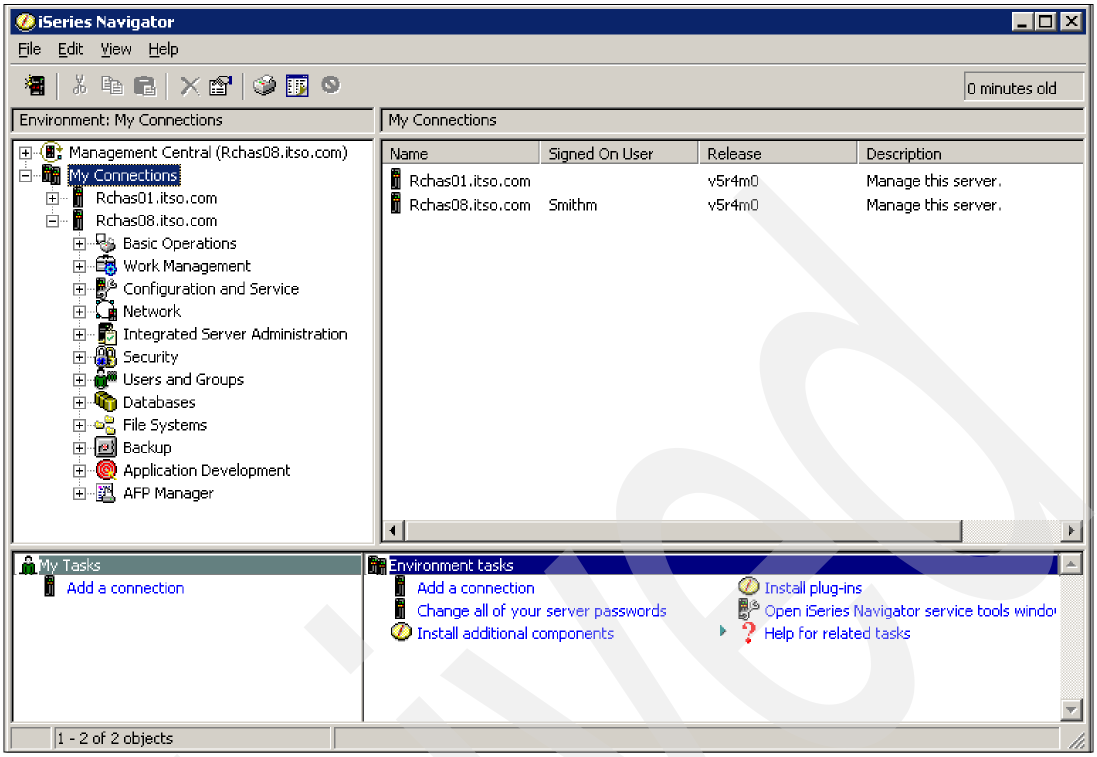
Where to lookup remote port: Server

Note: These values are used as defaults by other applications connecting from this PC to this server.

Figure 6-41 iSeries Navigator Connection properties

To verify the settings, in the left panel of the iSeries Navigator window, expand *your system connection* if the list of selections appears. The connections started. Note that the sign-on does not appear.

To find which user ID is used by the connection, click the environment in the left panel (its default name is My Connections) and press the F5 key to refresh the window content. The user ID now appears next to the connection name in the Signed On User column, as shown in Figure 6-42 on page 180.



Name	Signed On User	Release	Description
Rchas01.itso.com		v5r4m0	Manage this server.
Rchas08.itso.com	Smithm	v5r4m0	Manage this server.

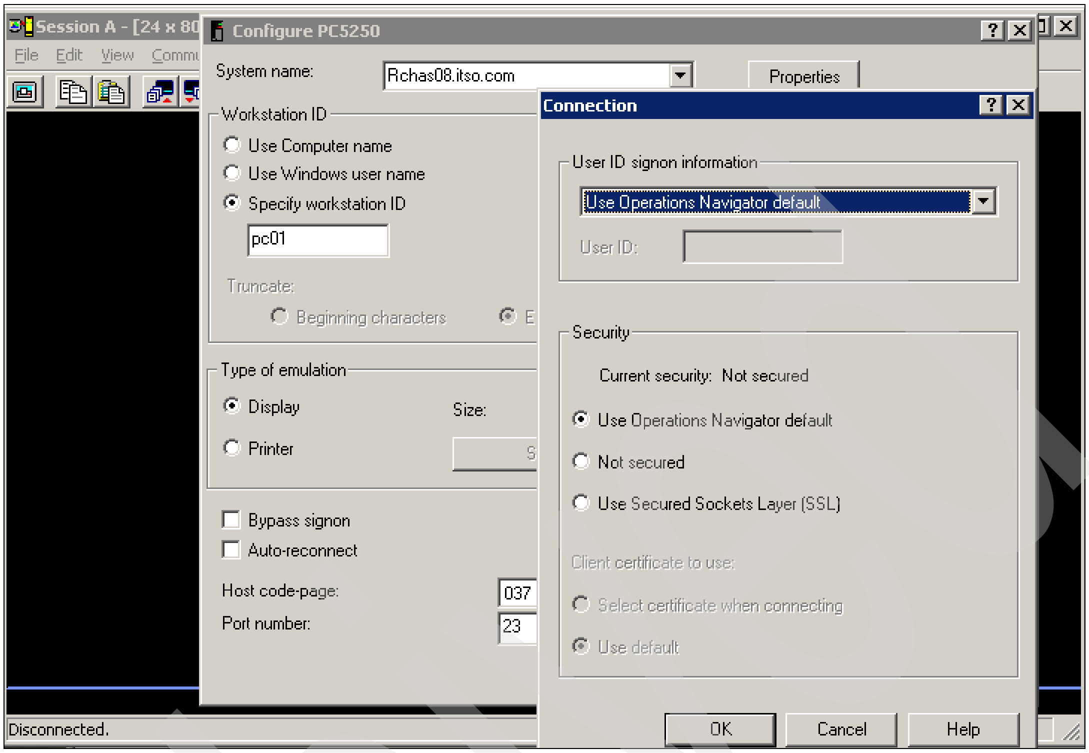
Figure 6-42 iseries Navigator connection - Signed on user

To enable and then verify single sign-on for the iSeries Access 5250 emulation:

3. Open the iSeries Access 5250 emulation session for your iSeries server. If the session is connected to the server, disconnect it by selecting **Communication** → **Disconnect** in the menu.

4. Select **Communication** → **Configure** in the session menu.

5. In the Configure PC5250 window, as shown in Figure 6-43, click **Properties**.



System name: Rchas08.itso.com

Workstation ID
○ Use Computer name
○ Use Windows user name
● Specify workstation ID
pc01

Truncate:
○ Beginning characters
● E

Type of emulation
● Display
○ Printer
Size:

□ Bypass signon
□ Auto-reconnect

Host code-page: 037
Port number: 23

User ID signon information
Use Operations Navigator default
User ID:

Security
Current security: Not secured
● Use Operations Navigator default
○ Not secured
○ Use Secured Sockets Layer (SSL)

Client certificate to use:
○ Select certificate when connecting
● Use default

Figure 6-43 PC5250 connection properties

6. When the Connection window displays, go to the combo box in the section labeled User ID signon information. Scroll the combo box to the bottom and select the option **Use Kerberos principal name, no prompting**. Alternatively, you can select the option **Use Operation navigator default** as you see in Figure 6-43. This option allows you to control all connections to a particular iSeries server from one place. Click **OK**.

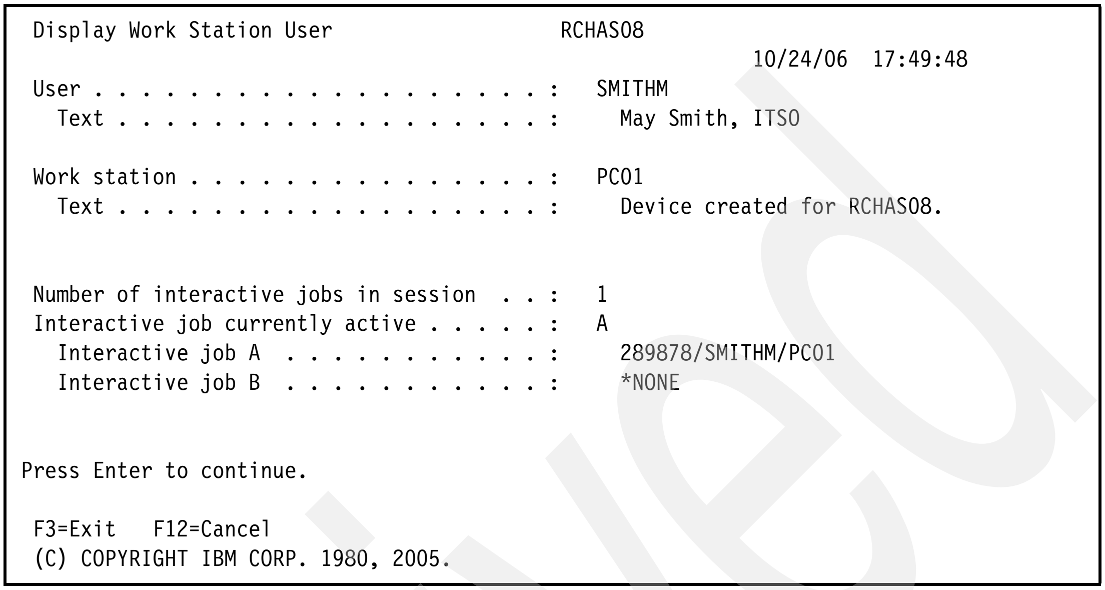
7. To save the session set-up, select **File** → **Save** from the 5250 session window menu. Single sign-on for the iSeries Access 5250 emulation is now enabled.

To verify that single sign-on works for the iSeries Access 5250 emulation:

1. Select **Communication** → **Connect** from the menu of the 5250 session window.

2. The session connects to the iSeries server and you are signed on. Note that the sign-on does not appear.

3. To obtain which user profile the session is using, issue the i5/OS command Display Workstation User (DSPWSUSR). No parameters are required. The results look similar to Figure 6-44.



```
 Display Work Station User                  RCHAS08
                                                            10/24/06  17:49:48
 User . . . . . . . . . . . . . . . . . . . :   SMITHM
   Text . . . . . . . . . . . . . . . . . . :     May Smith, ITSO

 Work station . . . . . . . . . . . . . . . :   PC01
   Text . . . . . . . . . . . . . . . . . . :     Device created for RCHAS08.


 Number of interactive jobs in session  . . :   1
 Interactive job currently active . . . . . :   A
   Interactive job A  . . . . . . . . . . . :     289878/SMITHM/PC01
   Interactive job B  . . . . . . . . . . . :     *NONE


Press Enter to continue.

 F3=Exit   F12=Cancel
 (C) COPYRIGHT IBM CORP. 1980, 2005.
```

Figure 6-44   DSPWSUSR results

You have completed the verification of the iSeries Access 5250 emulation single sign-on.

Enabling NetServer for single sign-on

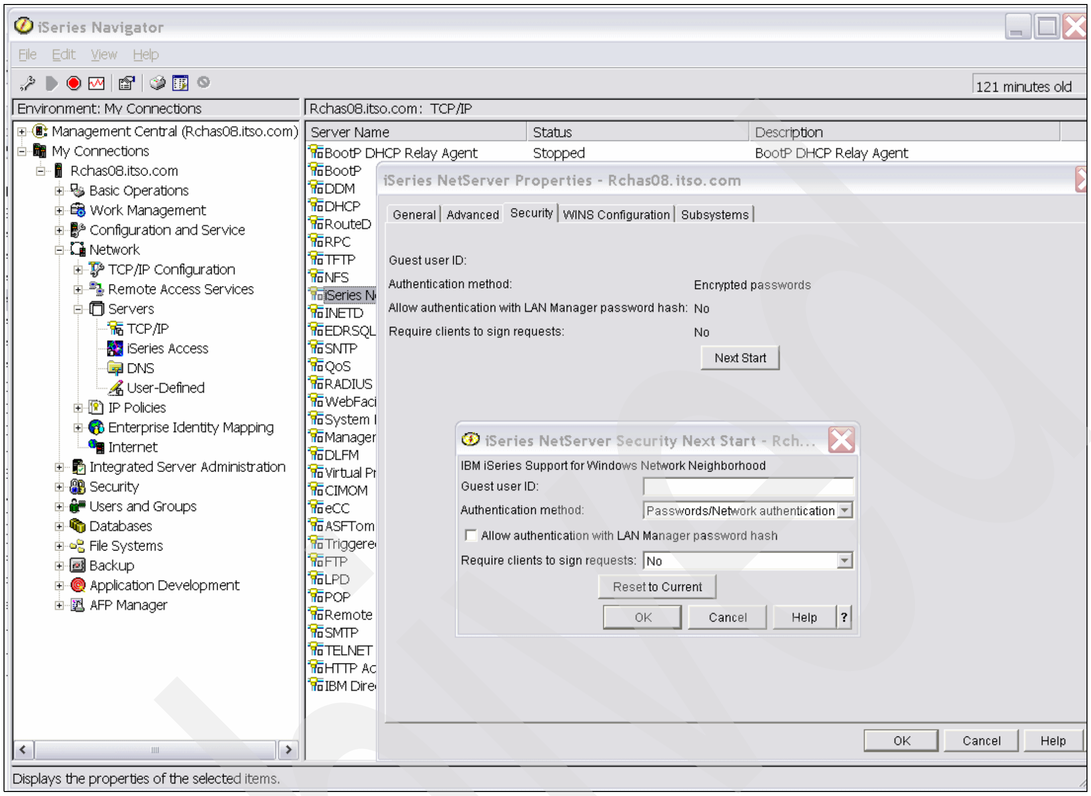
The goal is to smoothly transition NetServer to SSO in your production environment. Like any change to a network function, it is best to implement a test environment first. If no test server is available, you might need to test on your production server. While you might smoothly roll out SSO for the terminal emulation and iSeries Navigator functions on your production environment without first configuring a test environment, attempting the same with NetServer is *disastrous*. You might lose the ability for any client to connect to NetServer. A possible solution is to only enable SSO for NetServer names that are not currently in use on your network. The setup for this scenario is simple:

- Ensure that the ktpass command is not used to create a service principal for the names that will continue to use passwords.
- Enable NetServer to accept both passwords and tickets.

If you do not have an unused name, you can use a DNS alias to point to your iSeries family server's TCP/IP address. You must then create your own keytab entries on the System i system through Qshell and use the ktpass command to map the service principal name over a new Active Directory user. After you create the principal and enable Encrypted passwords/Kerberos v5 authentication for NetServer, you can use Kerberos to access NetServer using the DNS alias with your test profile. Your users will continue to use encrypted passwords to connect to the other server names.

1. In iSeries Navigator session, expand ***your system connection*** → **Network** → **Servers** → **TCP/IP**.
2. From the list of all the TCP/IP Severs available, right-click **iSeries NetServer** and select **Properties**.

3. Click the **Security** tab and click **Next Start**. The Properties window appears as shown in Figure 6-45,



Guest user ID:

Authentication method: Encrypted passwords

Allow authentication with LAN Manager password hash: No

Require clients to sign requests: No

IBM iSeries Support for Windows Network Neighborhood

Guest user ID:

Authentication method: Passwords/Network authentication

☐ Allow authentication with LAN Manager password hash

Require clients to sign requests: No

Figure 6-45 NetServer Properties

4. On the Security Next Start dialog box, select one of the following authentication methods:

- If you select **Passwords/Network authentication**, clients that do not support Kerberos, or clients that do support Kerberos but are not currently participating in a Kerberos realm, use encrypted passwords to authenticate.
- If you select **Network authentication**, all clients must use Kerberos to authenticate with the server. Therefore, only clients that support Kerberos v5 can connect to iSeries NetServer when this support is enabled.

  The following Windows clients do *not* support Kerberos v5:

  – Windows 95
  – Windows 98
  – Windows NT®
  – Windows Me

5. Click **OK**.

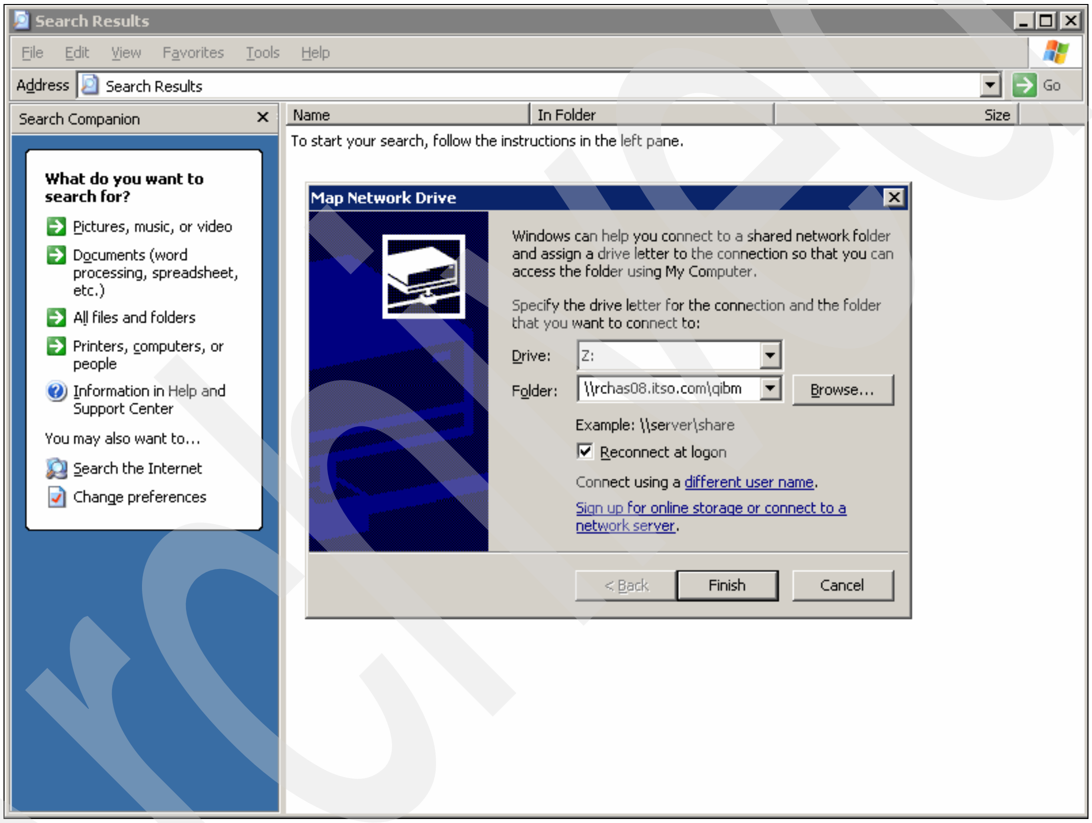
6. Changes to NetServer require a server restart to be activated. If you are ready to proceed:

   a. In right panel of the iSeries Navigator, right-click **iSeries NetServer** and select **Stop**.
   b. Verify that the server has stopped by refreshing the window with the F5 key.
   c. Right-click **iSeries NetServer** again and select **Start**.

The NetServer is ready to accept the Kerberos tickets authentication instead of the password.

To verify that you have connected to the Netserver and your user has been mapped to an i5/OS profile, follow these steps on your Windows XP client:

7. Sign on to the Windows domain as the test user. In our scenario, it is MaySmith.
8. Start Windows Explorer and in its menu, select **Tools** → **Map Network Drive**.
9. In the Map Network Drive window (Figure 6-46), fill in the folder name:
   - Server: Specify a fully qualified name of your iSeries server - \\rchas08.itso.com in our example.
   - Share: Specify the name of a share, accessible for your test user as defined in the NetServer file shares - \qibm in our example.
10. Click **Finish**.



Search Results
File Edit View Favorites Tools Help
Address Search Results
Go
Search Companion
Name
In Folder
Size
What do you want to search for?
Pictures, music, or video
Documents (word processing, spreadsheet, etc.)
All files and folders
Printers, computers, or people
Information in Help and Support Center
You may also want to...
Search the Internet
Change preferences
Map Network Drive
Browse...
< Back
Finish
Cancel

To start your search, follow the instructions in the left pane.

Windows can help you connect to a shared network folder and assign a drive letter to the connection so that you can access the folder using My Computer.

Specify the drive letter for the connection and the folder that you want to connect to:

Drive: Z:

Folder: \\rchas08.itso.com\qibm

Example: \\server\share

☑ Reconnect at logon

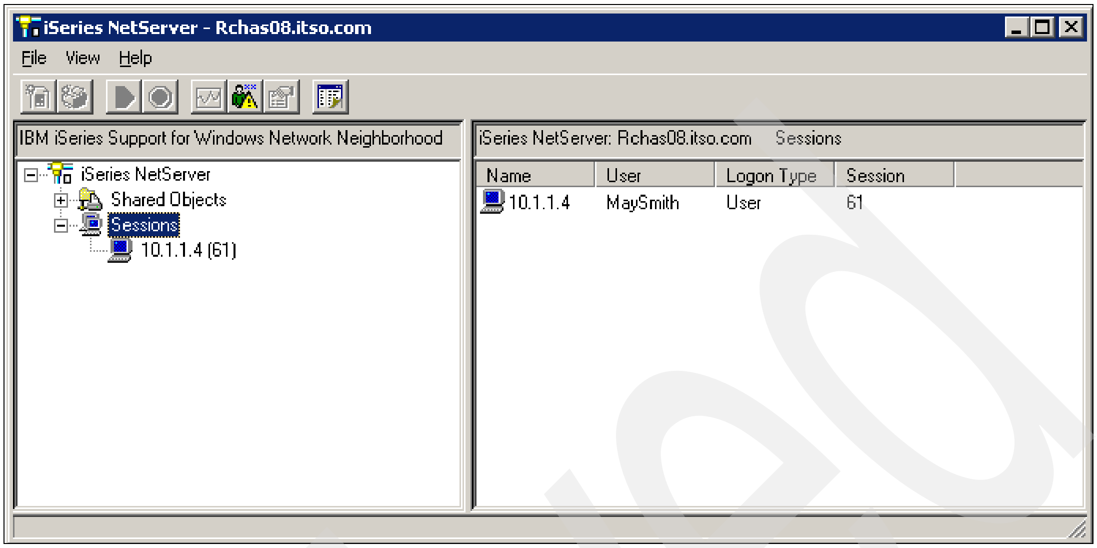
Connect using a different user name.

Sign up for online storage or connect to a network server.

Figure 6-46 Map Network drive

11. Note that you are not challenged for a sign-on and a window opens with the contents of the mapped drive.
12. To verify which user ID was used to connect:
    a. In the iSeries Navigator session, open ***your system connection*** with QSECOFR authorities.
    b. Expand **Network** → **Servers** → **TCP/IP**.
    c. Double-click **iSeries NetServer**.

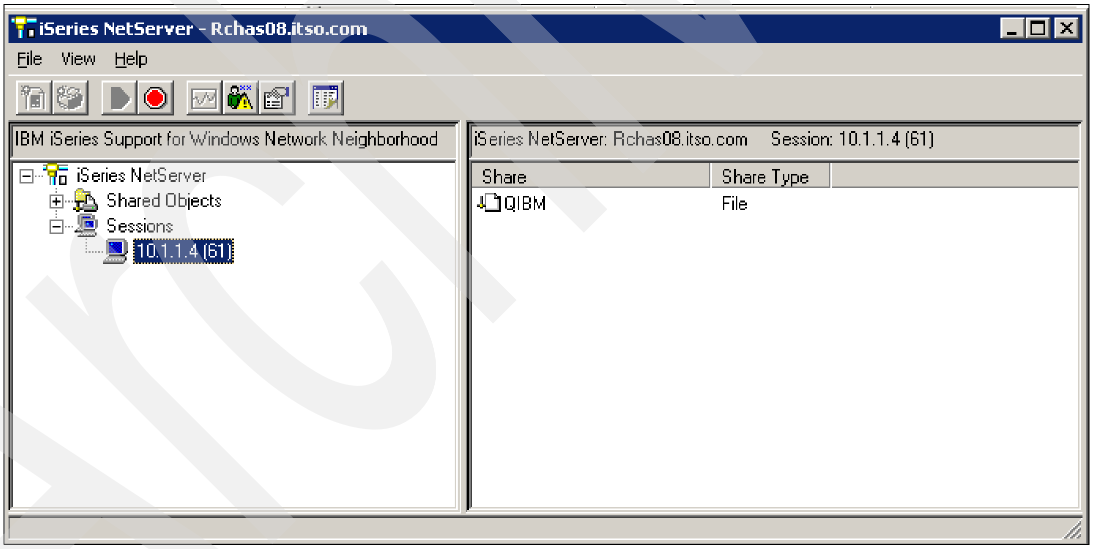
d. In the left panel of the iSeries NetServer window, expand **Sessions**. You see the sessions in right panel, as shown in Figure 6-47.


iSeries NetServer - Rchas08.itso.com
File View Help
IBM iSeries Support for Windows Network Neighborhood
iSeries NetServer
Shared Objects
Sessions
10.1.1.4 (61)
iSeries NetServer: Rchas08.itso.com Sessions

Name	User	Logon Type	Session
10.1.1.4	MaySmith	User	61

Figure 6-47 NetServer sessions

13. Select the session in the left panel. You see the shares used in this session in right panel, as shown in Figure 6-48.

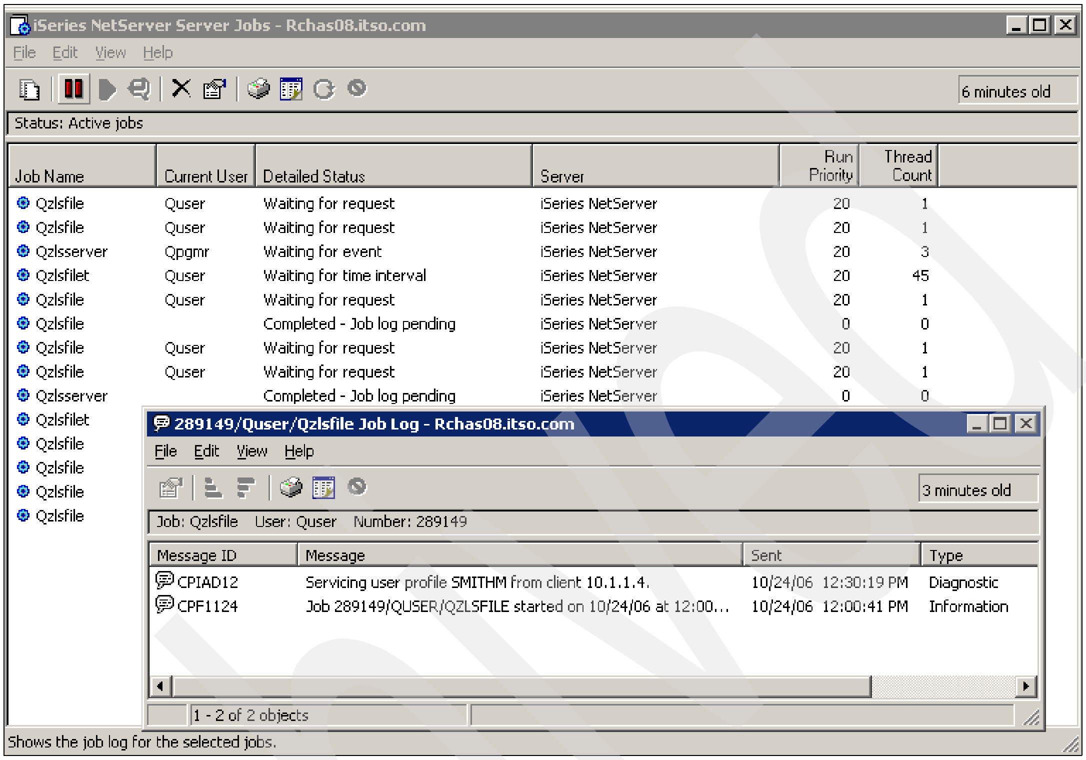

iSeries NetServer - Rchas08.itso.com
File View Help
IBM iSeries Support for Windows Network Neighborhood
iSeries NetServer
Shared Objects
Sessions
10.1.1.4 (61)
iSeries NetServer: Rchas08.itso.com Session: 10.1.1.4 (61)

Share	Share Type
QIBM	File

Figure 6-48 Shares for a session

14. You can repeat the verification for the other two Kerberos principals.

15. Notice in Figure 6-47 on page 185 that the user name is MaySmith, which is May's Windows user ID. To verify which user profile that job is running under on the iSeries, go to the iSeries Navigator and expand ***your system connection*** → **Network** → **Servers** → **TCP/IP**. In the right panel, right-click **iSeries NetServer** and select **Server Jobs**.



Status: Active jobs

Job Name	Current User	Detailed Status	Server	Run Priority	Thread Count
Qzlsfile	Quser	Waiting for request	iSeries NetServer	20	1
Qzlsfile	Quser	Waiting for request	iSeries NetServer	20	1
Qzlsserver	Qpgmr	Waiting for event	iSeries NetServer	20	3
Qzlsfilet	Quser	Waiting for time interval	iSeries NetServer	20	45
Qzlsfile	Quser	Waiting for request	iSeries NetServer	20	1
Qzlsfile		Completed - Job log pending	iSeries NetServer	0	0
Qzlsfile	Quser	Waiting for request	iSeries NetServer	20	1
Qzlsfile	Quser	Waiting for request	iSeries NetServer	20	1
Qzlsserver		Completed - Job log pending	iSeries NetServer	0	0
Qzlsfilet					
Qzlsfile					
Qzlsfile					
Qzlsfile					
Qzlsfile					

Job: Qzlsfile User: Quser Number: 289149

Message ID	Message	Sent	Type
CPIAD12	Servicing user profile SMITHM from client 10.1.1.4.	10/24/06 12:30:19 PM	Diagnostic
CPF1124	Job 289149/QUSER/QZLSFILE started on 10/24/06 at 12:00...	10/24/06 12:00:41 PM	Information

1 - 2 of 2 objects

Shows the job log for the selected jobs.

Figure 6-49 Mapped NetServer job

16. To complete the verification, double-click one of the **Qzlsfile** jobs to obtain which job is taking care of the May's request. When you find it, in its job logs, you can see a window similar to Figure 6-49. In the window, you see that the client IP address, the same as the address listed in the session in Figure 6-47 on page 185, such as 10.1.1.4 in our scenario, and that the served user profile is SMITHM.

This completes enabling the NetServer for single sign-on.

6.5 EIM high availability

When implemented, the Network Authentication Service (NAS) and Enterprise Identity Mapping (EIM) configurations need a backup and recovery plan. You can save and restore them on the same i5/OS, or on the one that takes over the role of the original one. In that case, see Appendix A of *Windows-based Single Signon and EIM Framework on the IBM @server iSeries Server,* SG24-6975, where you can find the objects that you need to back up to avoid losing your configurations and data.

However, many applications can use single sign-on solution that do not necessarily belong to the i5/OS, where the EIM has been implemented. Consider how you can assure high availability of the EIM data. You do not want to compromise those applications that use a SSO solution in case problems affect the Directory Server that hosts the EIM domain controller. In addition to the save/restore of your EIM domain data method, you can configure and use a replica of the directory server. In that case, all changes to EIM domain data are automatically forwarded to the replica directory server so that if the directory server that hosts the domain controller fails or loses EIM data, you can retrieve the data from the replica server. The Directory Server replication provides redundancy of information and replicas back up the content of their supplier servers.

How you configure and use a replica directory server vary depending on the type of replication model that you choose to use. For information about all the possible replications and how to configure the directory server in various replication scenarios, see the iSeries V5R4 Information Center at:

http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/index.jsp?topic=/rzahy/rzahyreplication-c.htm

Referring to our scenario in 6.2, "Scenario description" on page 135, we want to create a Directory Server replication master-master between the two i5/OS.

Here are a few definitions before we start the implementation:

- The master server contains the master directory information from where updates are propagated to the replicas. All changes are made and occur on the master server, and the master is responsible for propagating these changes to the replicas.
- The replica is an additional server that contains a copy of directory information. The replicas are copies of the master (or the subtree that it is a replica). The replica provides a backup of the replicated subtree.
- Master-replica replication is when the master is responsible to propagate the updates to the replica servers. The replica can only publish the subtree, but not update it.
- Master-master replication is when there are several servers acting as masters for directory information, with each master responsible for updating other master servers and replica servers.

In our case, having a master- to-master replication means that both i5/OS Directory Servers refer to the same subtree. Both of them can update it and the update is a propagate to the other peer.

We have configured the production system to participate in the Kerberbos realm. We have set on its directory server the EIM domain to assure an SSO implementation, even if user IDs on the different platforms are not the same. Now, we configure the directory server of both `production` and *test* systems to implement a master-master replication. We also configure the EIM on the test system to join to an existing EIM domain to update the EIM data itself and to take full advantage of the directory server replication set up.

6.5.1 Creating a master-master configuration

In our scenario, rchas08 is the production system where we have configured the EIM. For simplicity, we refer to it as a *master server*. Rchas01 is the test system we want to use as an EIM domain control backup and to distinguish it from the other one. We refer to it as a *replica server*. Even if the final goal is to implement a master-master replication, it is also a master.

Note that the directory servers have to be running during these tasks.

We assume that the Directory Server Web Administration Tool is already set up on one of the system. In our case, it is the production one, Rchas08. Otherwise, see the Web administration topic in the iSeries V5R4 Information Center at:

http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/index.jsp?topic=/rzahy/rzahywebadmin.htm

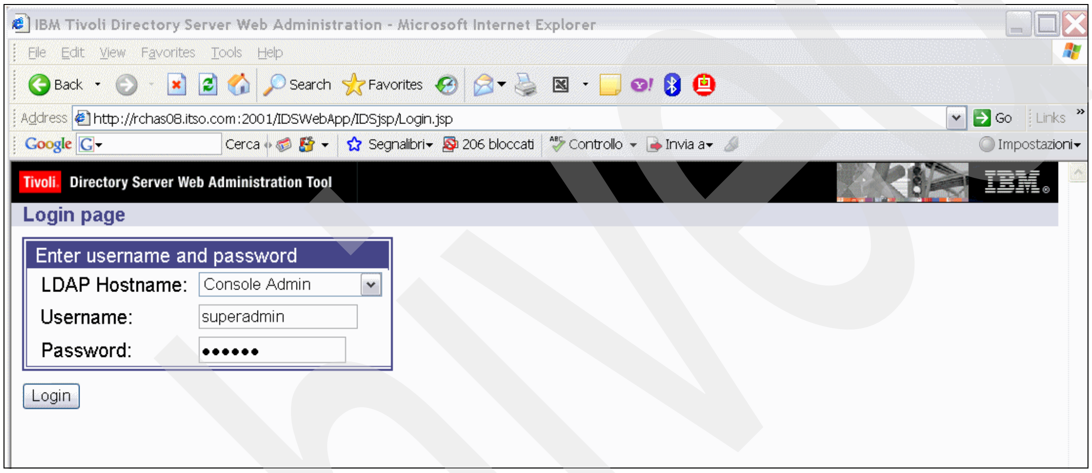
1. Start the Directory Server Web administration by doing one of the following steps:

   a. From the iSeries Navigator, select ***your system connection*** → **Network** → **Servers** → **TCP/IP**, right click **IBM Directory Server**, and click **Server Administration**.

   b. From the i5/OS Tasks page (http://*your system*:2001), click **IBM Directory Server for i5/OS**.

2. The page shown in Figure 6-50 appears. To administer a directory server, enroll it in the directory servers list managed by this Web Administration Tool. First, access the console settings to modify them.

   Leave `Console Admin` in LDAP Hostname field, than insert `superadmin` as the Username and `secret` as the Password, unless you have changed the defaults. Click **Login**.


IBM Tivoli Directory Server Web Administration - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Search
Favorites
Address
Go
Links
Google
Cerca
Segnalibri
206 bloccati
Controllo
Invia a
Impostazioni
Tivoli. Directory Server Web Administration Tool
IBM
Login

Address: http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/Login.jsp

Login page

Enter username and password

LDAP Hostname: Console Admin

Username: superadmin

Password: ••••••

Figure 6-50 Web Administration Tool - Login in Console Administrator

3. As shown in Figure 6-51, expand **Console Administration** in the left pane and click **Manage console servers**. In the right pane, click **Add**.

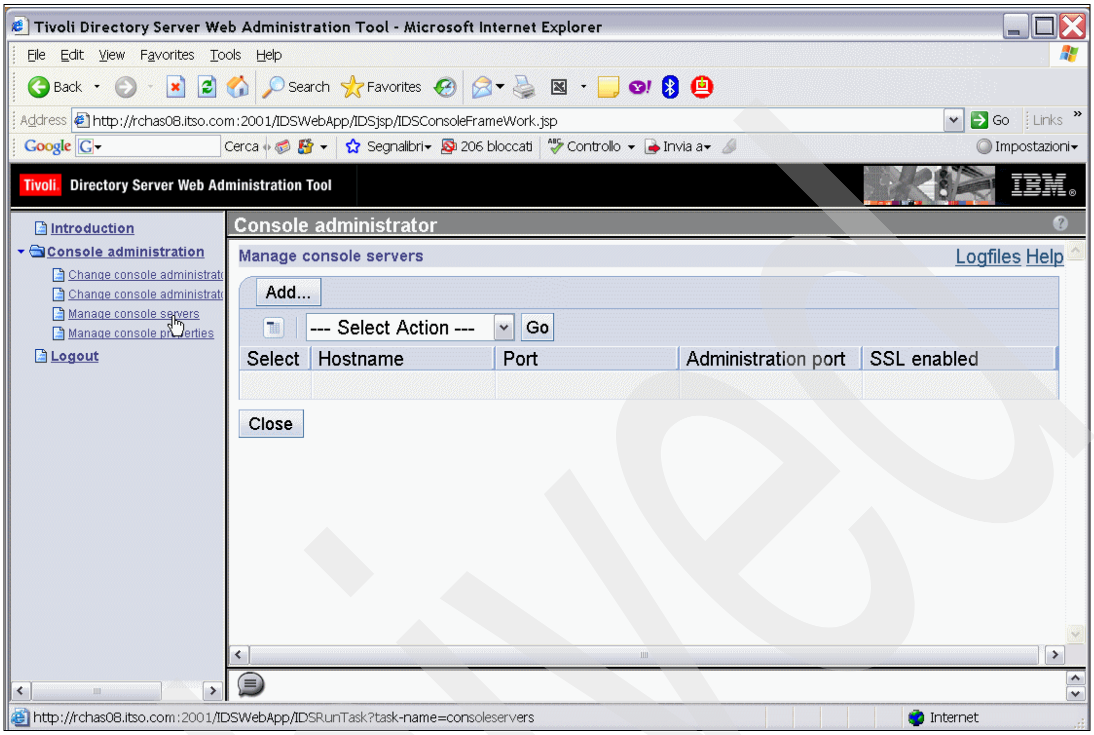
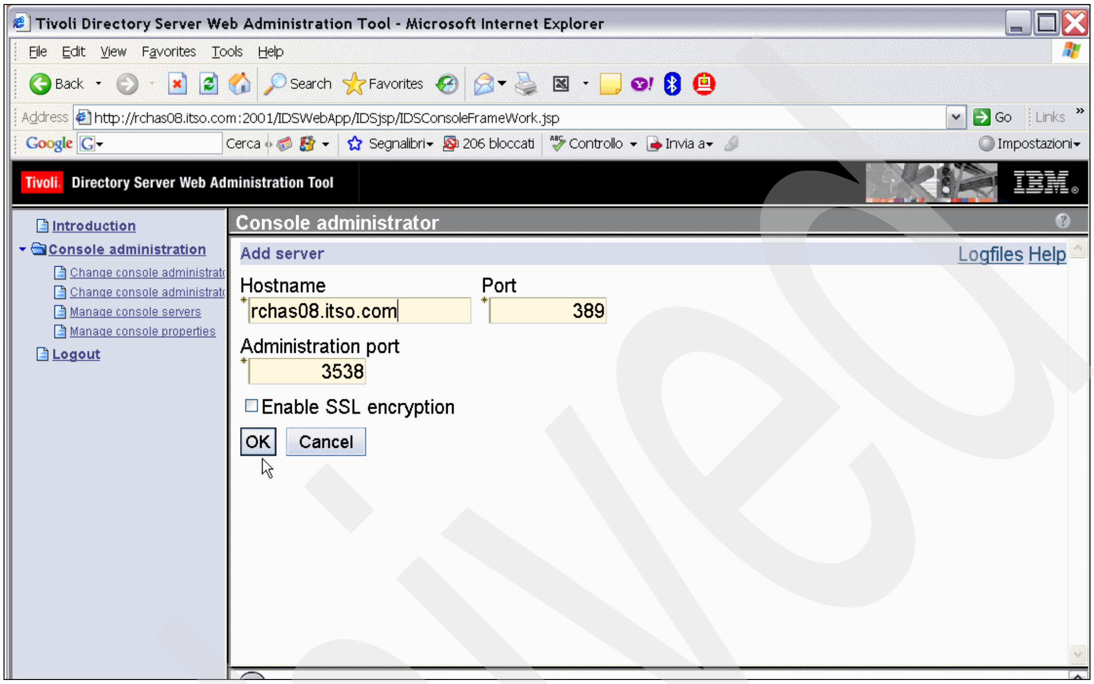

Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Search
Favorites
Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp
Go
Links
Tivoli. Directory Server Web Administration Tool
IBM.
Introduction
Console administration
Change console administrat
Change console administrat
Manage console servers
Manage console properties
Logout
Console administrator
Manage console servers
Logfiles Help
Add...
--- Select Action ---
Go
Select
Hostname
Port
Administration port
SSL enabled
Close
http://rchas08.itso.com:2001/IDSWebApp/IDSRunTask?task-name=consoleservers
Internet

Figure 6-51 Console administrator - Manage console server

4. As shown in Figure 6-52, fill in the Hostname field with the i5/OS name or address of one of the two systems you are going to manage from the Directory Server Administration Tool. Leave the values as defaults unless you have changed them during the directory server configuration. Click **OK**.


Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Search
Favorites
Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp
Go
Links
Tivoli Directory Server Web Administration Tool
IBM
Introduction
Console administration
Change console administrat
Change console administrat
Manage console servers
Manage console properties
Logout
Console administrator
Add server
Logfiles Help

Hostname: rchas08.itso.com

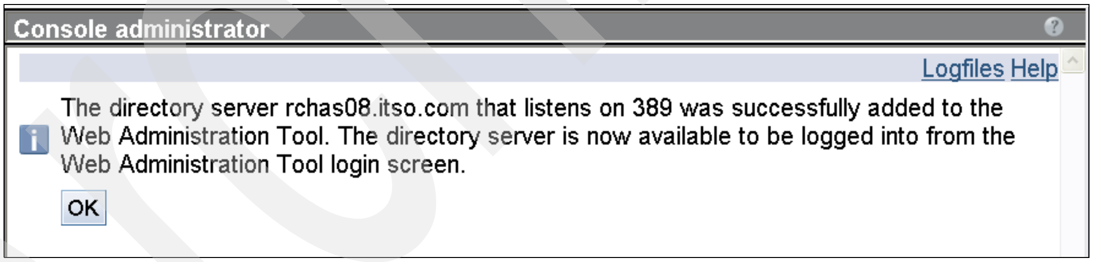
Port: 389

Administration port: 3538

□ Enable SSL encryption

Figure 6-52 Console administrator - Add server

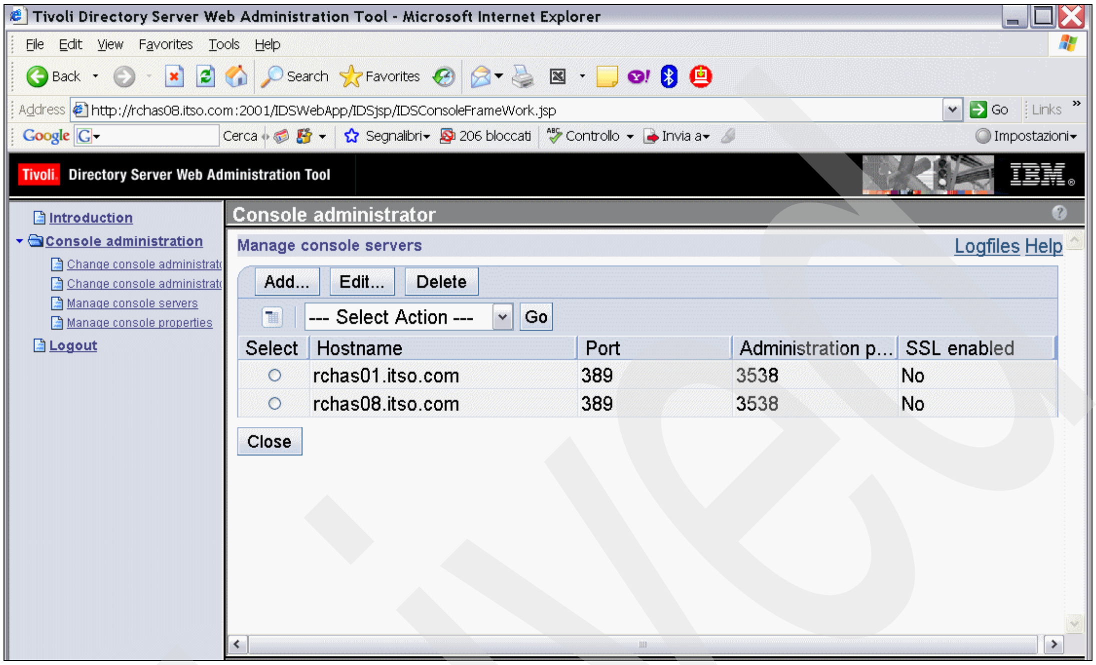
5. The message shown in Figure 6-53 appears if the operation was done correctly. Click **OK**.



The directory server rchas08.itso.com that listens on 389 was successfully added to the Web Administration Tool. The directory server is now available to be logged into from the Web Administration Tool login screen.

Figure 6-53 Console administrator - Confirmation message for adding a server

6. Repeat Steps 4 and 5 for the other system. At the end, you see the Manage console servers page updated as shown in Figure 6-54. Click **Close** to end this task and then **Logout** in the left pane to exit from the Console administrator page.



Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp
Go Links
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IBM
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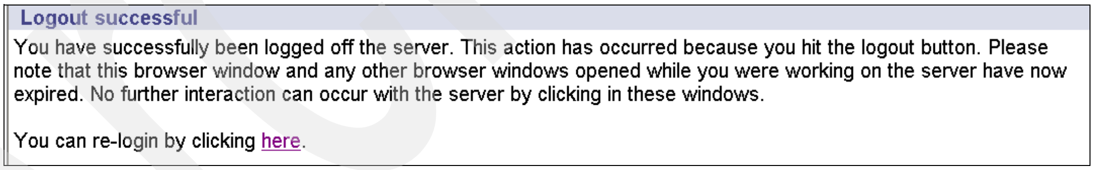
Change console administrat
Change console administrat
Manage console servers
Manage console properties
Logout
Console administrator
Manage console servers
Logfiles Help
Add... Edit... Delete
--- Select Action --- Go
Close

Select	Hostname	Port	Administration p...	SSL enabled
○	rchas01.itso.com	389	3538	No
○	rchas08.itso.com	389	3538	No

Figure 6-54 Console administrator - Manage console servers page updated with list of servers

7. Each time that you log out from a Web Administrator page, the tool shows you the page that you see in Figure 6-55. Notice the opportunity to reload the initial page for a new login.

   Now that you have added the two directory servers to manage, proceed with the configuration of the replication. Click **here**.



Logout successful

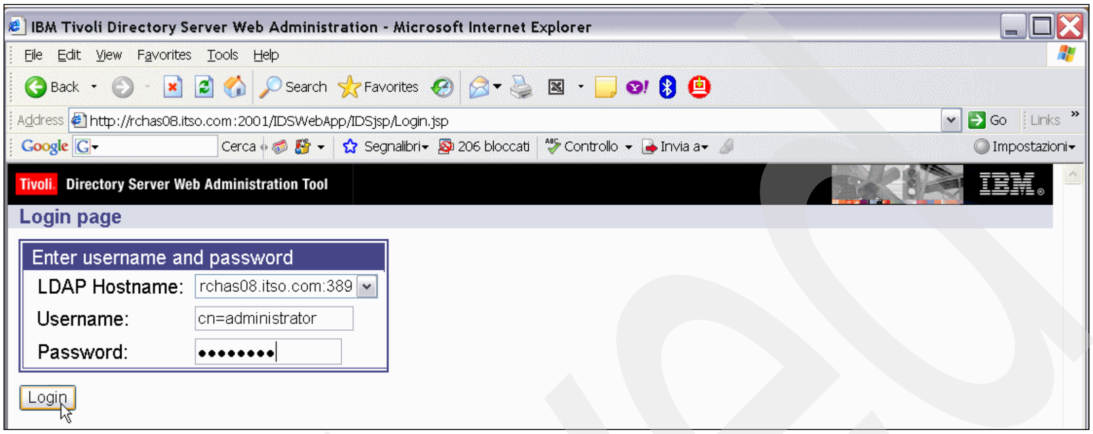
You have successfully been logged off the server. This action has occurred because you hit the logout button. Please note that this browser window and any other browser windows opened while you were working on the server have now expired. No further interaction can occur with the server by clicking in these windows.

You can re-login by clicking here.

Figure 6-55 Logout message

8. Start with the configuration of the directory server that hosts the EIM domain control as a master to synchronize the EIM subtree data with the Directory server of the other i5/OS that will become one of its replica.

In the Web Administrator Tool Login page, as shown in Figure 6-56, select the directory server that you want to administer in the LDAP Hostname field, **rchas08.itso.com:389**. Enter the administrator login DN that you use to bind to the directory server and `cn=Administrator` in the Username field. Enter the administrator password in the Password field. Click **Login**.


IBM Tivoli Directory Server Web Administration - Microsoft Internet Explorer
File Edit View Favorites Tools Help
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Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/Login.jsp
Go Links
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IBM
Login page
Enter username and password
Login

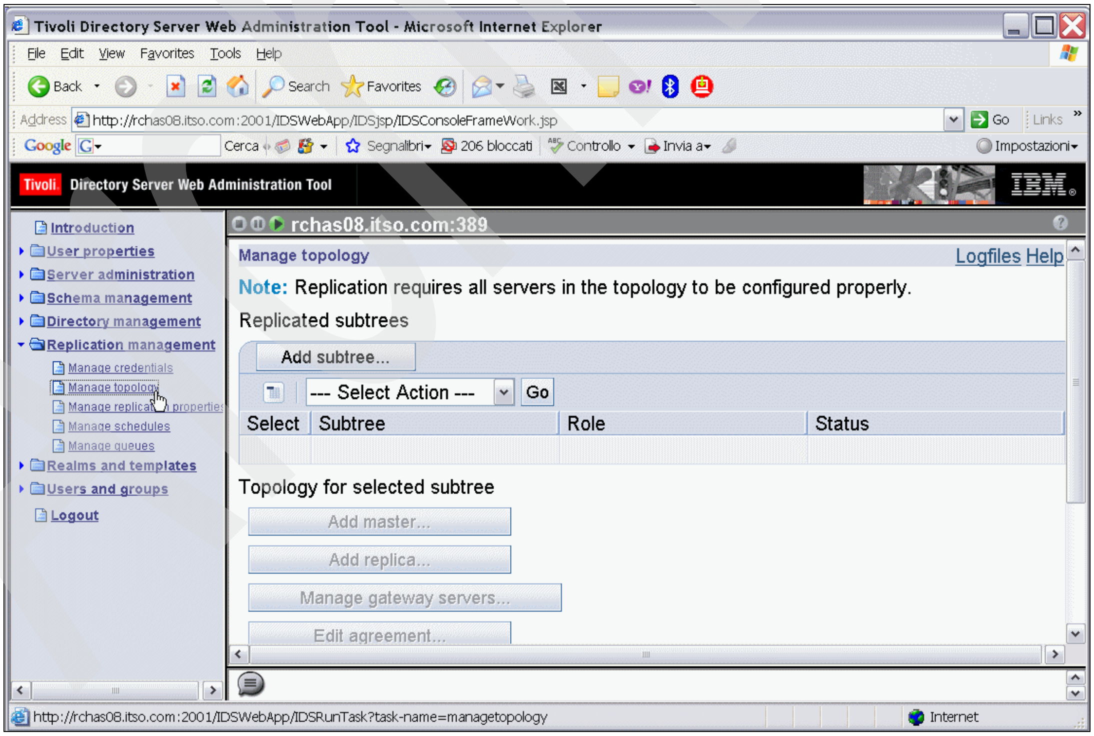
LDAP Hostname: rchas08.itso.com:389

Username: cn=administrator

Password: ••••••••

Figure 6-56 Web Administration Tool - Login in Master Directory Server

9. In this step, create a master server and define which of its subtrees to replicate. In the Directory Server Web Administration Tool page for the selected server, expand **Replication management** in the left pane and click **Manage topology** as shown in Figure 6-57. To specify the subtree that we want to replicate, click **Add subtree**.


Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer
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Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp
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Manage queues
Realms and templates
Users and groups
Logout
rchas08.itso.com:389
Manage topology
Logfiles Help
Add subtree...
--- Select Action ---
Go
Add master...
Add replica...
Manage gateway servers...
Edit agreement...
http://rchas08.itso.com:2001/IDSWebApp/IDSRunTask?task-name=managetopology
Internet

Note: Replication requires all servers in the topology to be configured properly.

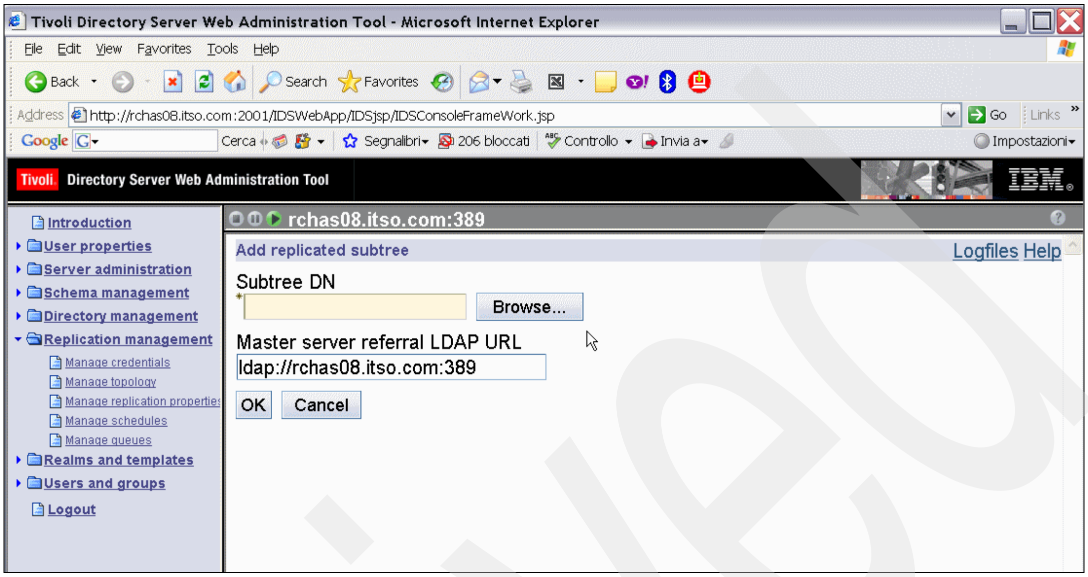
Replicated subtrees

Select	Subtree	Role	Status

Topology for selected subtree

Figure 6-57 Directory Server Web Administration - Manage topology

10.In the Figure 6-58, you can directly enter the DN of the root entry of the EIM subtree that you want to replicate. If you are not familiar with the LDAP syntax, browse to the list of available ones. Click **Browse** to expand the entries.



Add replicated subtree

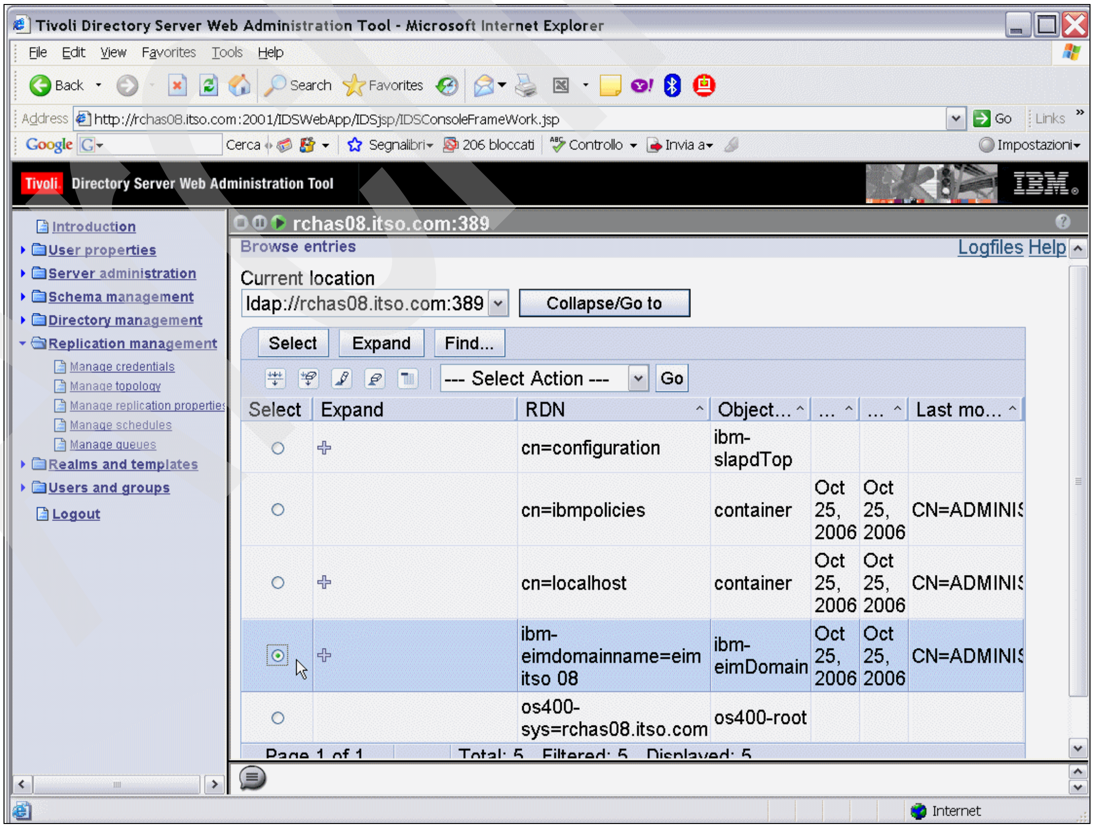
Subtree DN

Master server referral LDAP URL

ldap://rchas08.itso.com:389

Figure 6-58 Directory Server Web Administration - Add replica subtree

11.A list of subtrees is shown in Figure 6-59. Select the EIM entry, in our case it is **ibm-eimdomainname=eim itso 08.** This is the root of the subtree to replicate. Click **Select**.



Browse entries

Current location

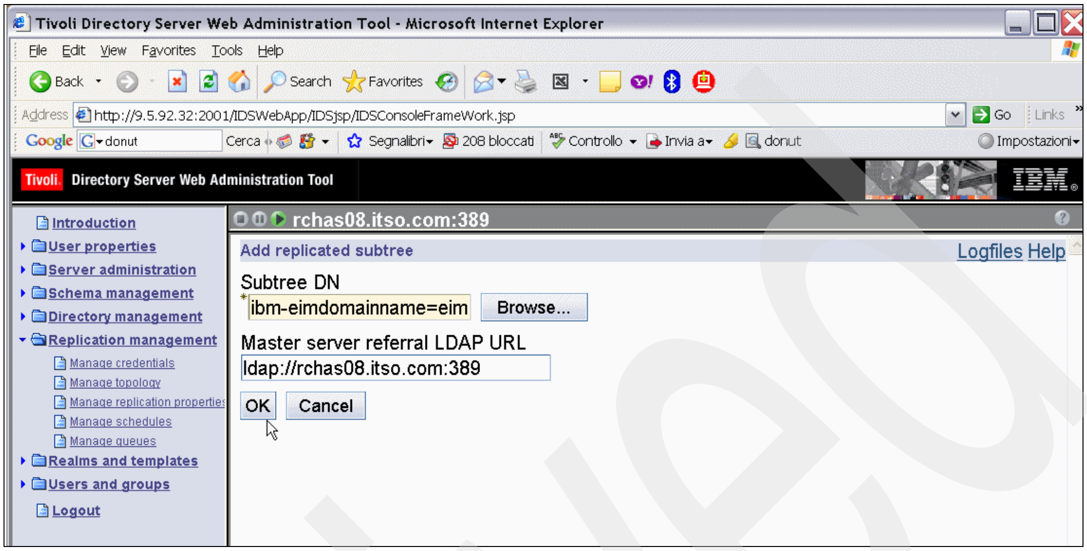
ldap://rchas08.itso.com:389

Select	Expand	RDN	Object...	...	...	Last mo...
○	✚	cn=configuration	ibm-slapdTop			
○		cn=ibmpolicies	container	Oct 25, 2006	Oct 25, 2006	CN=ADMINIS
○	✚	cn=localhost	container	Oct 25, 2006	Oct 25, 2006	CN=ADMINIS
●	✚	ibm-eimdomainname=eim itso 08	ibm-eimDomain	Oct 25, 2006	Oct 25, 2006	CN=ADMINIS
○		os400-sys=rchas08.itso.com	os400-root			

Page 1 of 1 Total: 5 Filtered: 5 Displayed: 5

Figure 6-59 Directory Server Web Administration - Browse subtree entries

12.The **Subtree DN** field, as shown in Figure 6-60, is filled in with the root of the EIM subtree you want to replicate. The **Master server referal LDAP URL** is optional, but the default is the name of the local Directory Server. Click **OK**.


Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://9.5.92.32:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp
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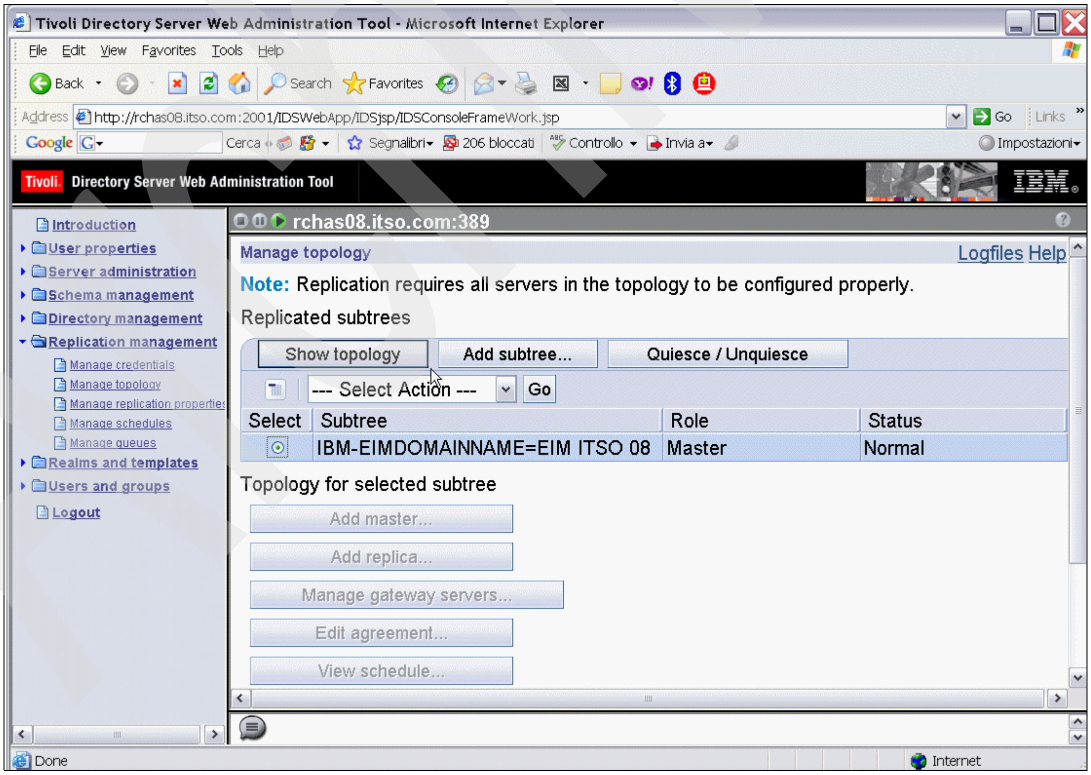
Users and groups
Logout
rchas08.itso.com:389
Add replicated subtree
Logfiles Help
Browse...
OK
Cancel

Subtree DN
ibm-eimdomainname=eim

Master server referral LDAP URL
ldap://rchas08.itso.com:389

Figure 6-60 Directory Server Web Administration - Add replicated subtree page filled in

The root of the EIM subtree is now in the list of subtrees to be replicated, as shown in Figure 6-61. Notice the directory server you are connected to acts as a master role.



Note: Replication requires all servers in the topology to be configured properly.

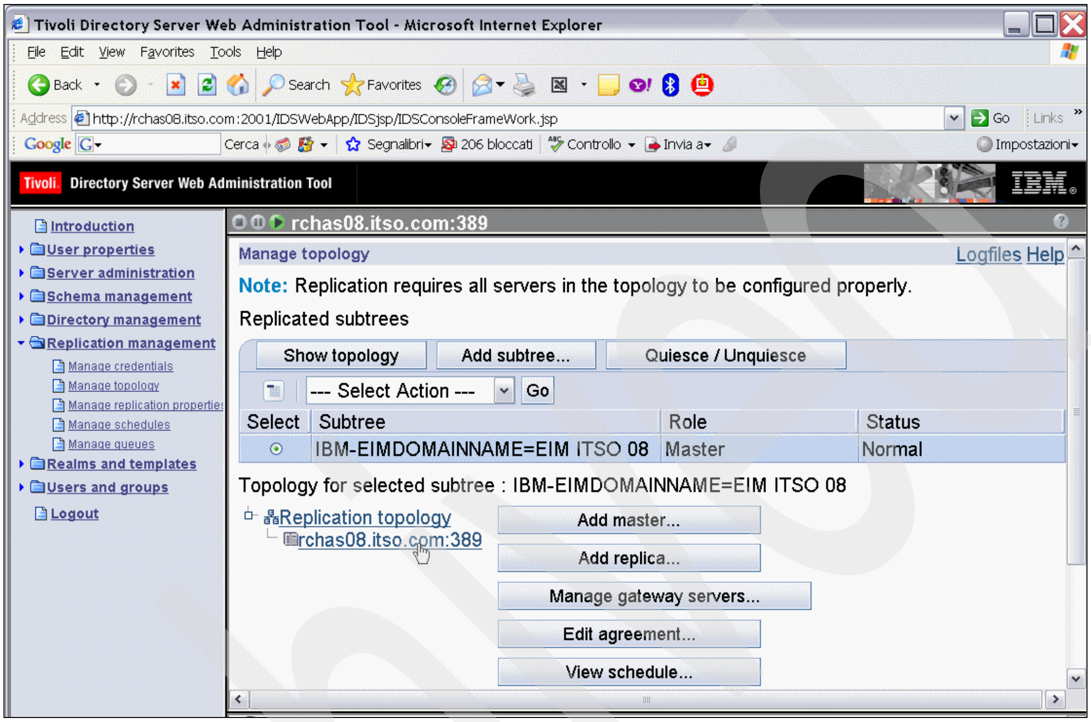
Replicated subtrees

Select	Subtree	Role	Status
○	IBM-EIMDOMAINNAME=EIM ITSO 08	Master	Normal

Topology for selected subtree

Figure 6-61 Directory Server Web Administration - Replicated subtree list

13. You can select the EIM subtree and click **Show topology** to see its topology. As you can see in Figure 6-62, at this step of the configuration, there is only the directory server that acts as a master. At this point of the configuration, this step is done only to get familiar with the subtree topology. Click **Close** to complete this task and in the left pane, click **Manage credentials**.



Note: Replication requires all servers in the topology to be configured properly.

Replicated subtrees

Select	Subtree	Role	Status
◉	IBM-EIMDOMAINNAME=EIM ITSO 08	Master	Normal

Topology for selected subtree : IBM-EIMDOMAINNAME=EIM ITSO 08

Replication topology
- rchas08.itso.com:389

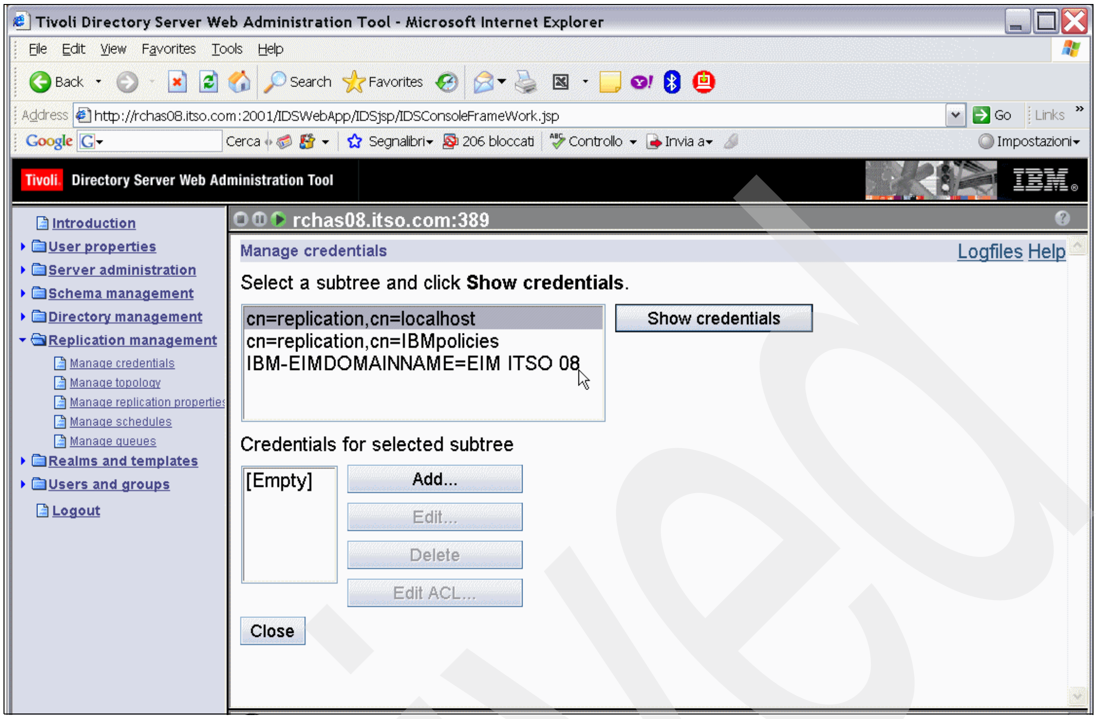
Figure 6-62 Directory Server Web Administration - EIM subtree topology

14. Now create the credential to be used by the master to send changes of the replicated subtree to another server. The credentials identify the method and required information that the supplier uses in binding to the consumer. The supplier is the server that sends changes to another server, the consumer. The credentials are stored in an entry of the DN, which is specified in the replication agreement.

    As you can see in Figure 6-63 on page 196, the Web Administration Tool allows you to define credentials in various locations. We are not explaining the replica theory in this scenario. For more information, see the iSeries V5R4 Information Center at:

    `http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/index.jsp?topic=/rzahy/rzahyreplication-c.htm`

    If you select to store the credential in the cn=replication and cn=localhost subtree, the directory servers keep the credentials only on the current server. This is more secure, but it presents limitations in certain situations. Because of that, we suggest that you store the credentials within the replicated subtree, in which case the credentials are replicated with the rest of the subtree. In our scenario, the replicated subtree is ibm-eimdomaninname= eim itso 08. Select it and click **Add** to add the credentials within it.


Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer
File Edit View Favorites Tools Help
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Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp
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rchas08.itso.com:389
Logfiles Help
Show credentials
Add...
Edit...
Delete
Edit ACL...
Close

Manage credentials

Select a subtree and click **Show credentials**.

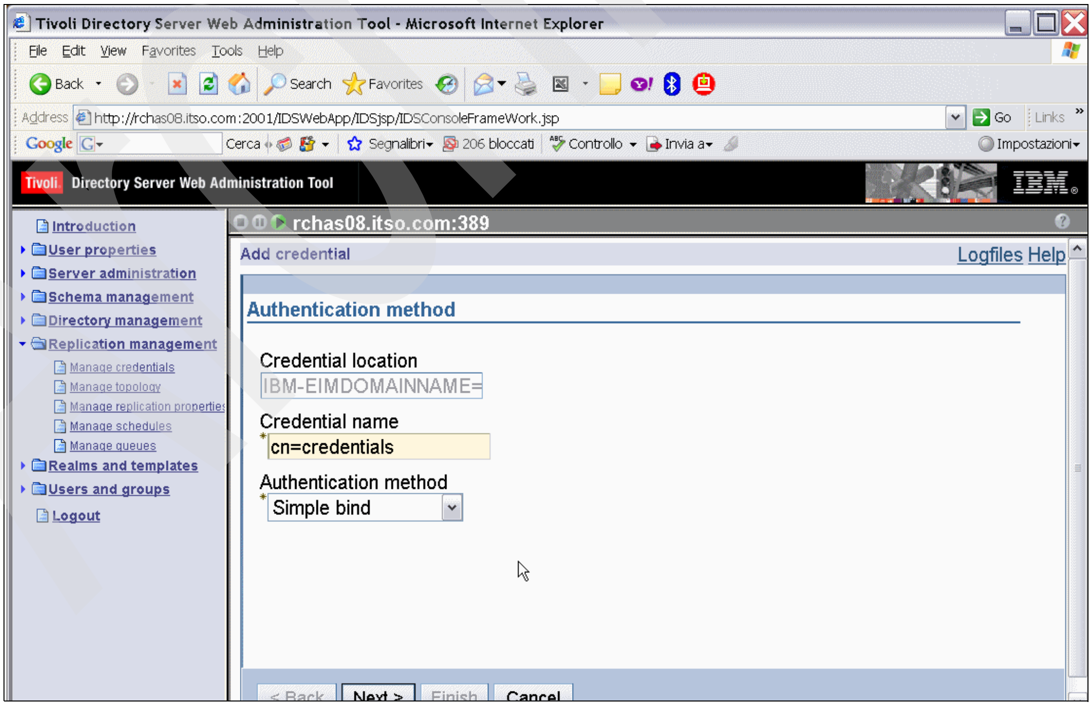
cn=replication,cn=localhost
cn=replication,cn=IBMpolicies
IBM-EIMDOMAINNAME=EIM ITSO 08

Credentials for selected subtree

[Empty]

Figure 6-63 Directory Server Web Administration - Manage credentials

15.As you can see in Figure 6-64, enter the name for the credentials you are creating. In our scenario, cn=credentials and the Authentication method. The default is Simple bind, which includes the DN and password authentication. Click **Next**.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Users and groups
Logout
rchas08.itso.com:389
Logfiles Help
< Back
Next >
Finish
Cancel

Add credential

Authentication method

Credential location
IBM-EIMDOMAINNAME=

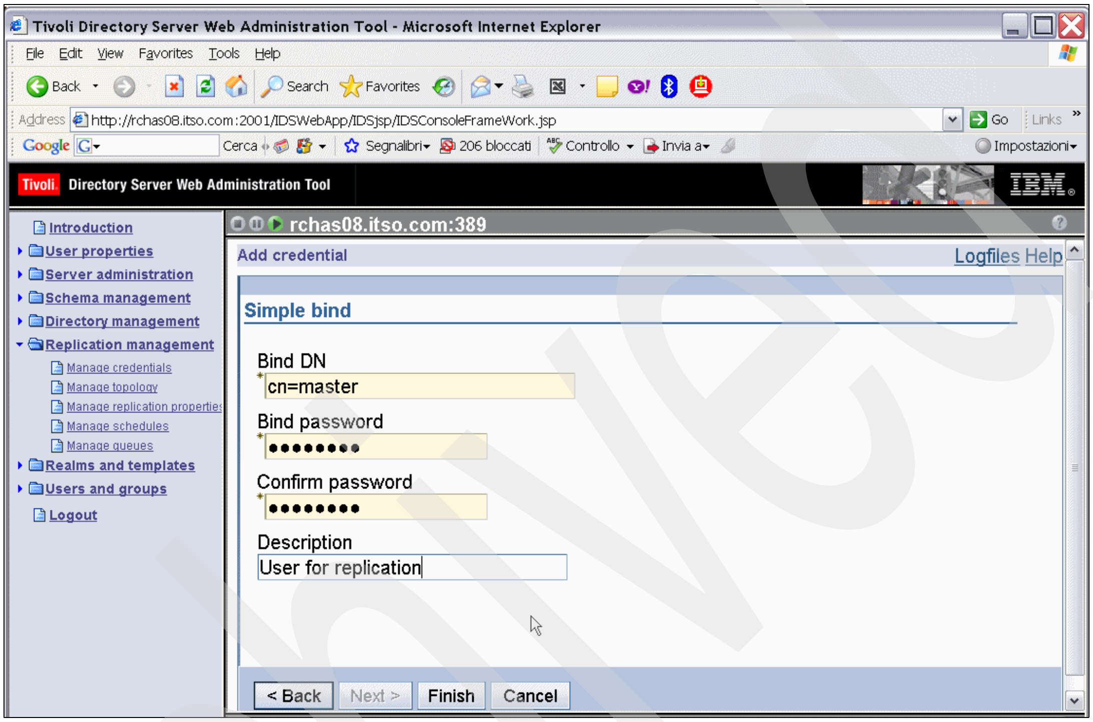
Credential name
*cn=credentials

Authentication method
*Simple bind

Figure 6-64 Directory Server Web Administration - Add credential name and method

16.Because we have selected the Simple bind as the authentication method, as shown in Figure 6-65 on page 197, specify the bind DN name and password. To supply the replicated subtree changes to the master, do not use the cn=Administrator DN to bind to the other server. Therefore, create a DN and password ad hoc for the replication.

Enter the DN that the server uses to bind to the replica, enter the same password in the Bind password and Confirmation password field, and a brief description if you want. In our scenario, we specify `cn=master` as the Bind DN. Click **Finish** to confirm the data input or click **Back** if you want to modify previous settings.



Bind DN: cn=master

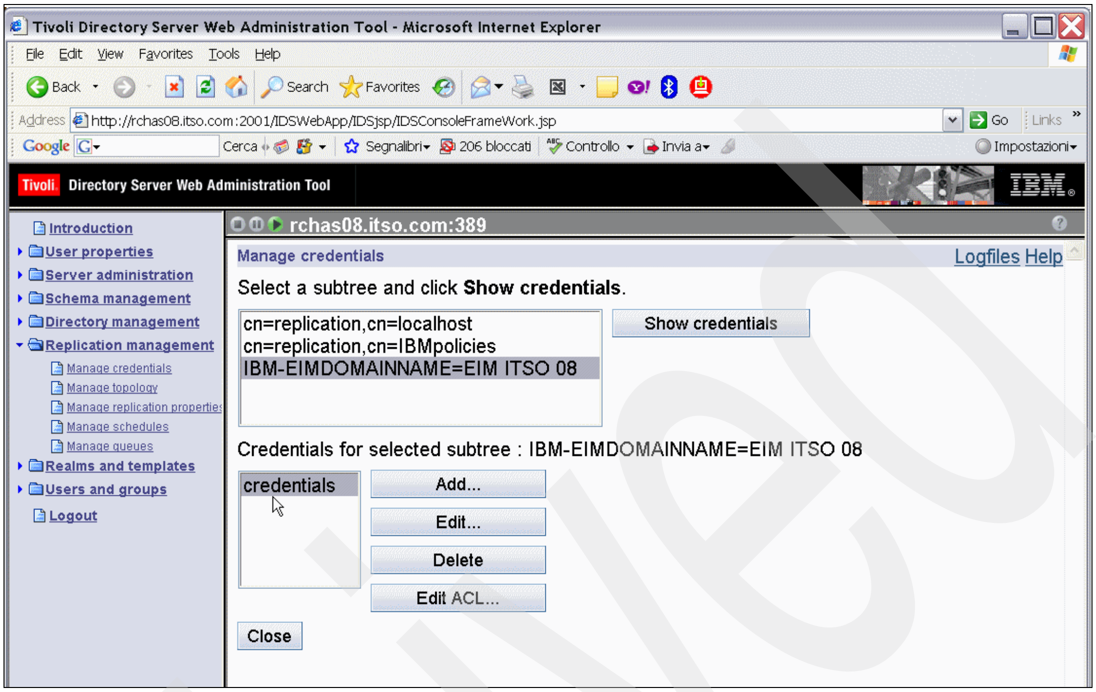
Bind password: ••••••••

Confirm password: ••••••••

Description: User for replication

Figure 6-65 Directory Server Web Administration - Add credential simple bind information

When you select **Finish**, you see the window shown in Figure 6-66. For our selected subtree, credentials is shown in the Credentials field. Click **Close** to end this task.



Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer
File Edit View Favorites Tools Help
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Logout
rchas08.itso.com:389
Manage credentials
Logfiles Help

Select a subtree and click **Show credentials**.

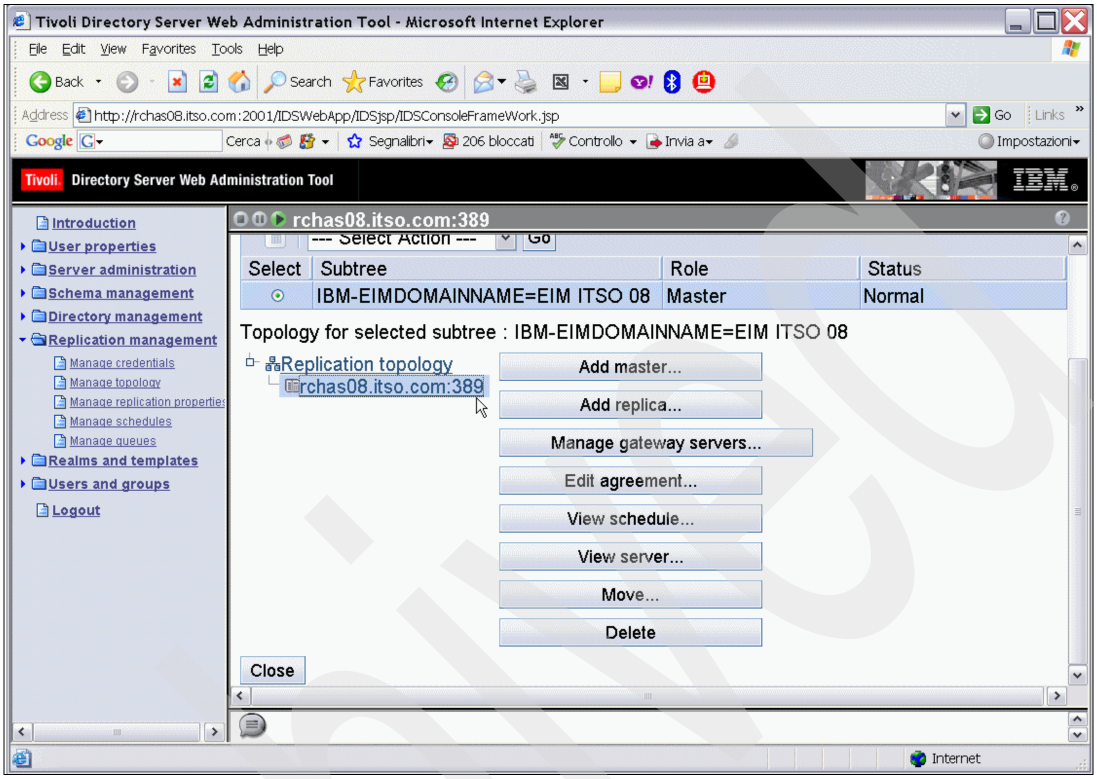
cn=replication,cn=localhost
cn=replication,cn=IBMpolicies
IBM-EIMDOMAINNAME=EIM ITSO 08

Credentials for selected subtree : IBM-EIMDOMAINNAME=EIM ITSO 08

credentials

Figure 6-66 Directory Server Web Administration - credentials for selected subtree

17.Select **Manage topology** again in the left pane. Select the **IBM-EIMDOMAINNAME=EIM ITSO 08** subtree and click **Show topology** as in Step 13 on page 195. As shown in Figure 6-67, select the master server and click **Add replica**.



Select	Subtree	Role	Status
●	IBM-EIMDOMAINNAME=EIM ITSO 08	Master	Normal

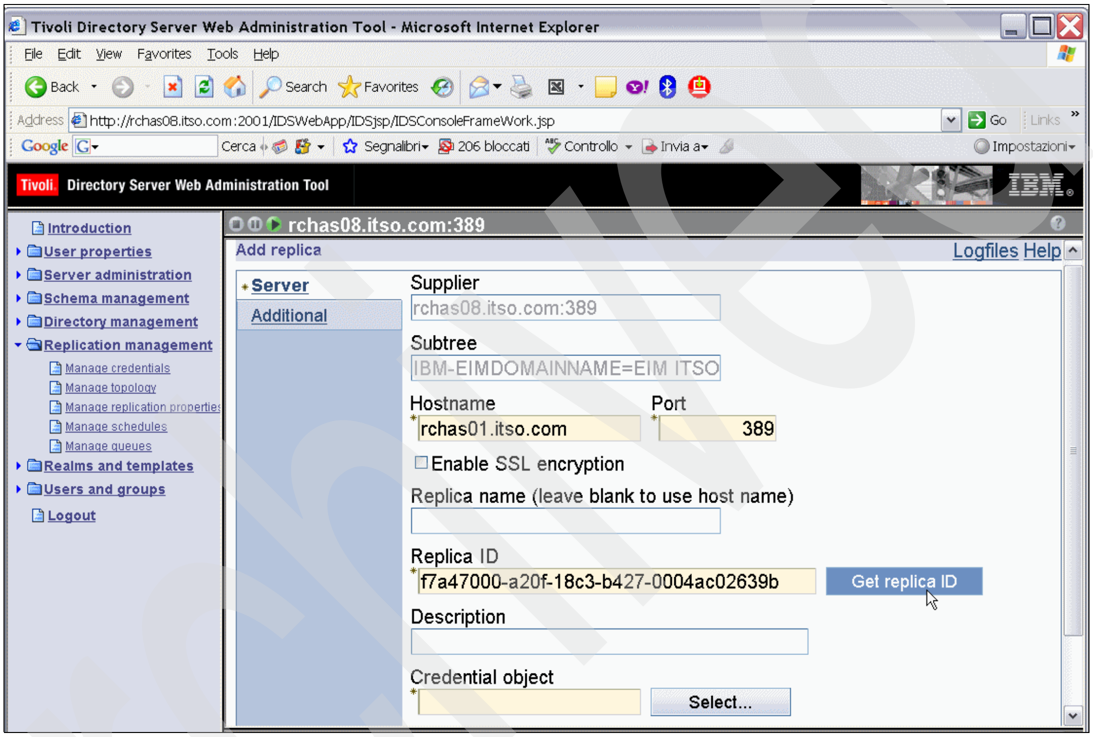
Topology for selected subtree : IBM-EIMDOMAINNAME=EIM ITSO 08

Figure 6-67 Directory Server Web Administration - Manage topology

18. You have already selected the subtree to replicate and the directory server master for that replication. Now identify which server is the replica in this scenario, the Supplier field in Figure 6-68.

Enter the name or the IP address of the replica server in the Hostname field and the port number. In our scenario, the replica server is rchas01.itso.com and port 389 is the default. Click **Get replica ID** and the master retrieves this information automatically from the replica host name to establish a connection.

When identifying the replica server, complete this task by setting an agreement to decide how the master opens a connection to the server to replicate the changes of the replicated subtree. For that reason, select a Credential object by clicking **Select** next to this field.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Additional

Add replica

Supplier
rchas08.itso.com:389

Subtree
IBM-EIMDOMAINNAME=EIM ITSO

Hostname
rchas01.itso.com

Port
389

□ Enable SSL encryption

Replica name (leave blank to use host name)

Replica ID
f7a47000-a20f-18c3-b427-0004ac02639b

Get replica ID

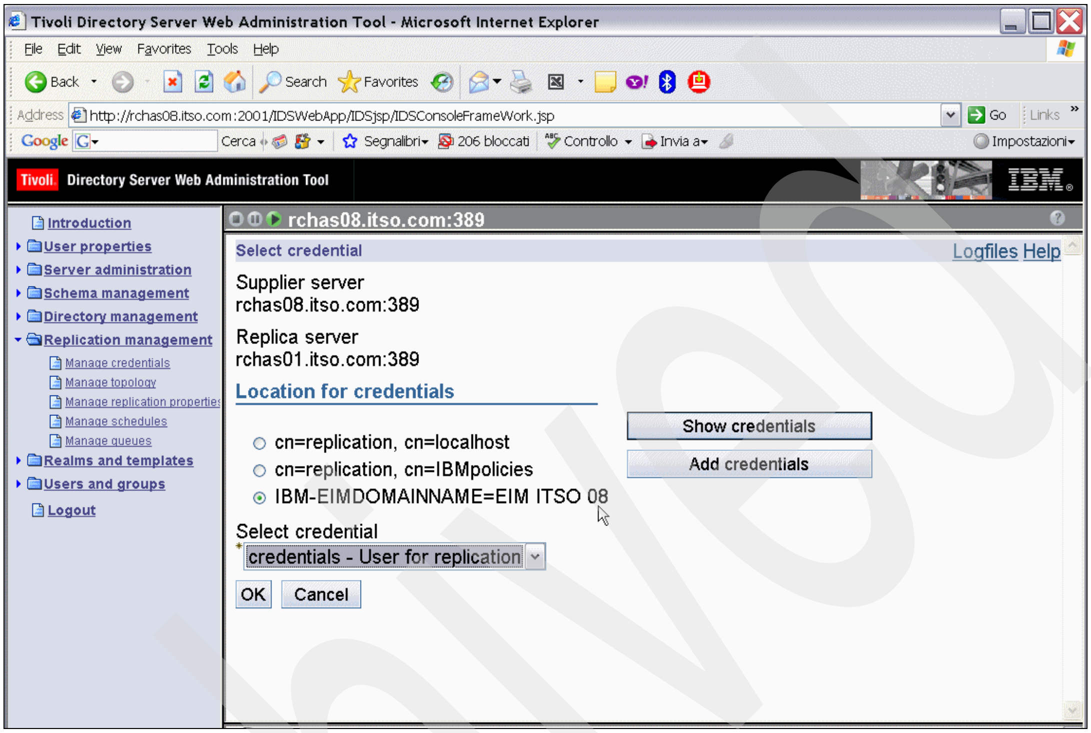
Description

Credential object

Select...

Figure 6-68 Directory Server Web Administration, Add replica

19. In the window shown in Figure 6-69, select the location where the credentials are stored. In our scenario, it is IBM-EIMDOMAINNAME=EIM ITSO 08 and click **Show credentials**. The credentials you created in Step on page 198 appear in the Select credential window. Highlight those credentials and click **OK**.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Manage queues
Realms and templates
Users and groups
Logout
rchas08.itso.com:389
Logfiles Help
Show credentials
Add credentials
OK
Cancel

Select credential

Supplier server
rchas08.itso.com:389

Replica server
rchas01.itso.com:389

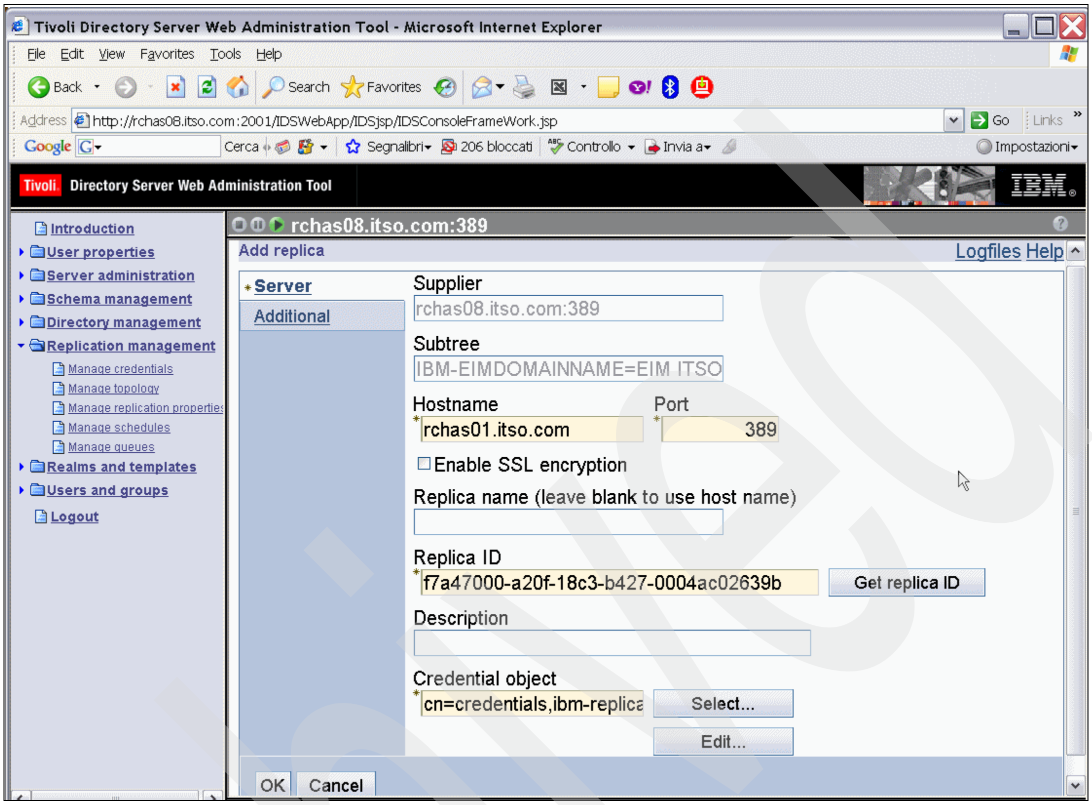
Location for credentials

○ cn=replication, cn=localhost
○ cn=replication, cn=IBMpolicies
● IBM-EIMDOMAINNAME=EIM ITSO 08

Select credential
credentials - User for replication

Figure 6-69 Directory Server Web Administration - Select credentials to replicate updates

20. As you can see in Figure 6-70, the Add replica form is completed. Click **OK** at the bottom of the page.



Supplier
rchas08.itso.com:389

Subtree
IBM-EIMDOMAINNAME=EIM ITSO

Hostname: *rchas01.itso.com
Port: *389

□ Enable SSL encryption

Replica name (leave blank to use host name)

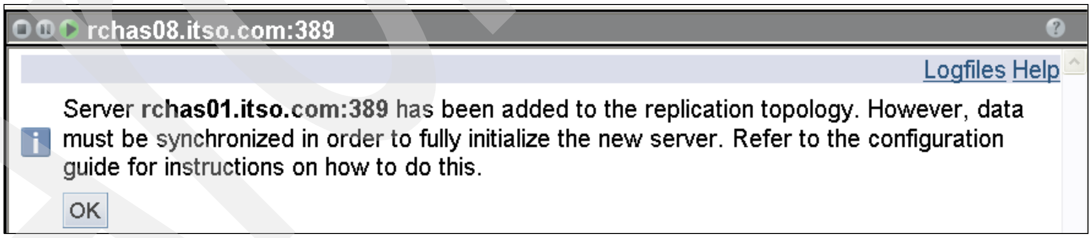
Replica ID
*f7a47000-a20f-18c3-b427-0004ac02639b

Description

Credential object
*cn=credentials,ibm-replica

Figure 6-70 Directory Server Web Administration - Add replica completed

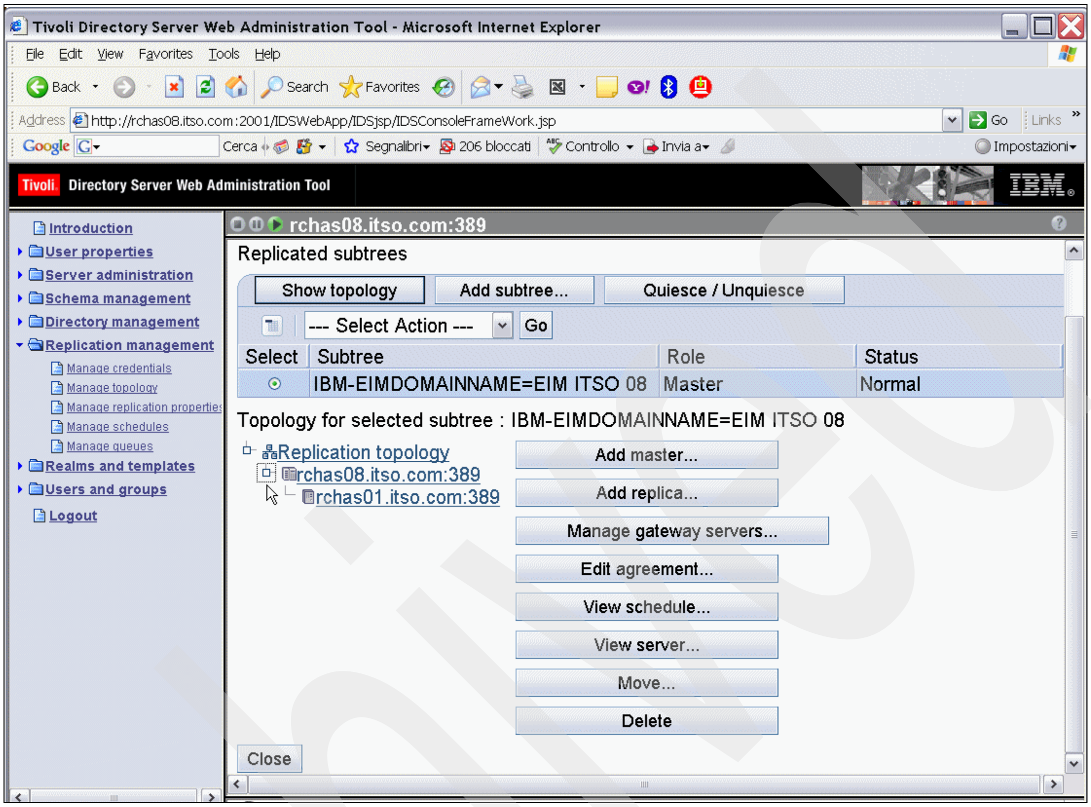
21. As you can see in Figure 6-71, a message confirms that the replica server has been successfully added and that you must synchronize the data to start the replication. Click **OK** to complete the add replica task.



Server **rchas01.itso.com:389** has been added to the replication topology. However, data must be synchronized in order to fully initialize the new server. Refer to the configuration guide for instructions on how to do this.

Figure 6-71 Directory Server Web Administration - Add replica message completed

22. As shown in Figure 6-72, the subtree topology has been updated. If you expand the master server, now in one step below, you can see the replica server. Click **Close** to complete the manage topology task.



Address: http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp

Replicated subtrees

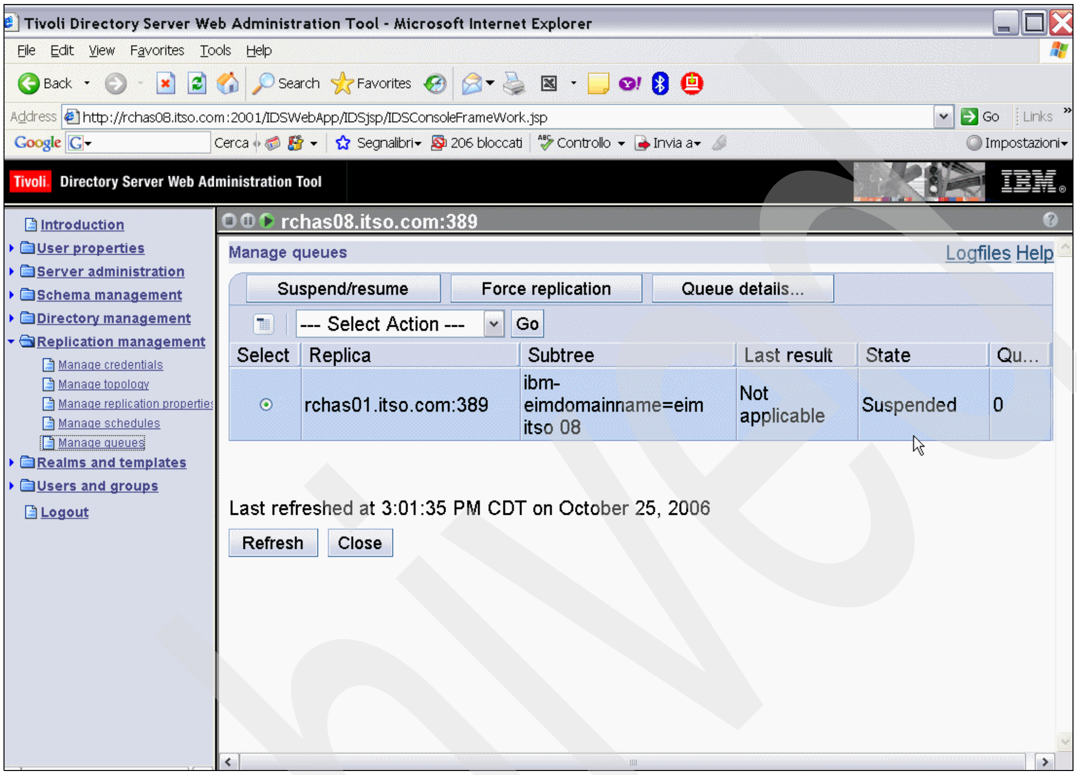
Select	Subtree	Role	Status
●	IBM-EIMDOMAINNAME=EIM ITSO 08	Master	Normal

Topology for selected subtree : IBM-EIMDOMAINNAME=EIM ITSO 08

- Replication topology
  - rchas08.itso.com:389
    - rchas01.itso.com:389

Figure 6-72 Directory Server Web Administration - Manage topology updated

23. To see if the replication is still not active, select **Manage queues** in the left pane. Figure 6-73 shows the status of the queue that sends data to the replica as Suspended. Click **Close** to complete the task and **Logout** on the left pane to exit from the Web Administration tool.



Select	Replica	Subtree	Last result	State	Qu...
⦿	rchas01.itso.com:389	ibm-eimdomainname=eim itso 08	Not applicable	Suspended	0

Last refreshed at 3:01:35 PM CDT on October 25, 2006

Figure 6-73 Directory Server Web Administration- Manage queues

24. When the replication is configured and enabled, all the updates done on the replicated subtree are sent from the master to the other servers. However, at the first time, to initialize the replication, you manually copy the data to the replica server exporting the topology from the master.

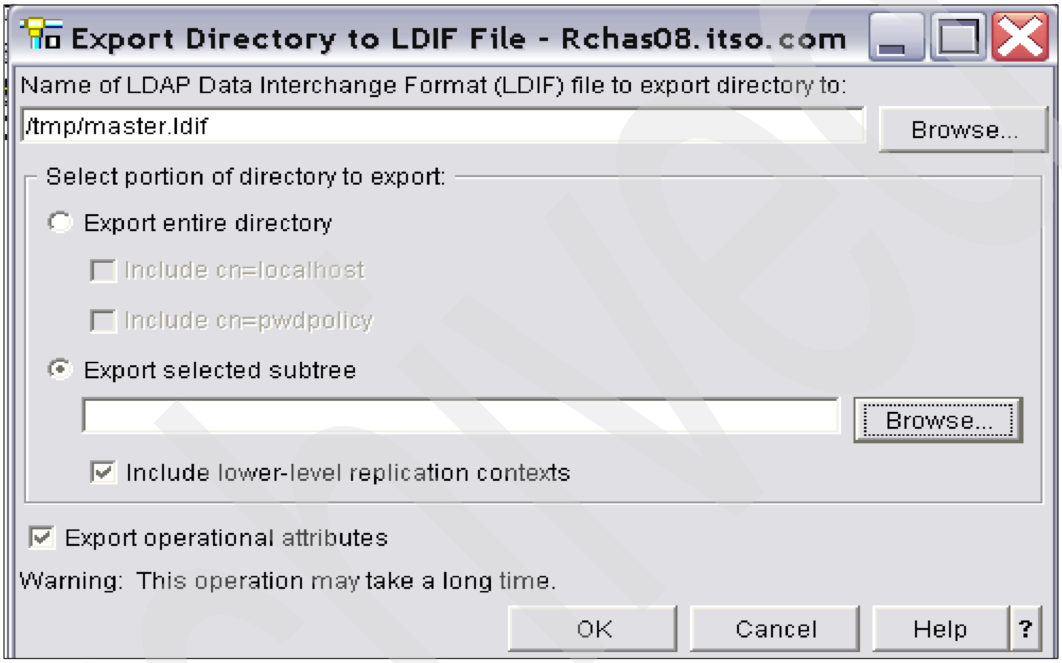
To export the topology data on the master server, create an LDAP Data Interchange Format (LDIF) file:

a. Open an iSeries Navigator session, expand ***your master system connection*** → **Network** → **Servers** → **TCP/IP**, right-click **IBM Directory Server**, select **Tools**, and then select **Export file**. The wizard appears as shown in Figure 6-74.

b. Enter the fully qualified path (starting with the root) and the name of the LDIF file.

c. Select **Export selected subtree**.

d. Ensure that **Include lower-level replication context** and **Export operational attributes** are selected and click **Browse** next to this field.



Export Directory to LDIF File - Rchas08.itso.com

Name of LDAP Data Interchange Format (LDIF) file to export directory to: /tmp/master.ldif

Select portion of directory to export:

○ Export entire directory

□ Include cn=localhost

□ Include cn=pwdpolicy

● Export selected subtree

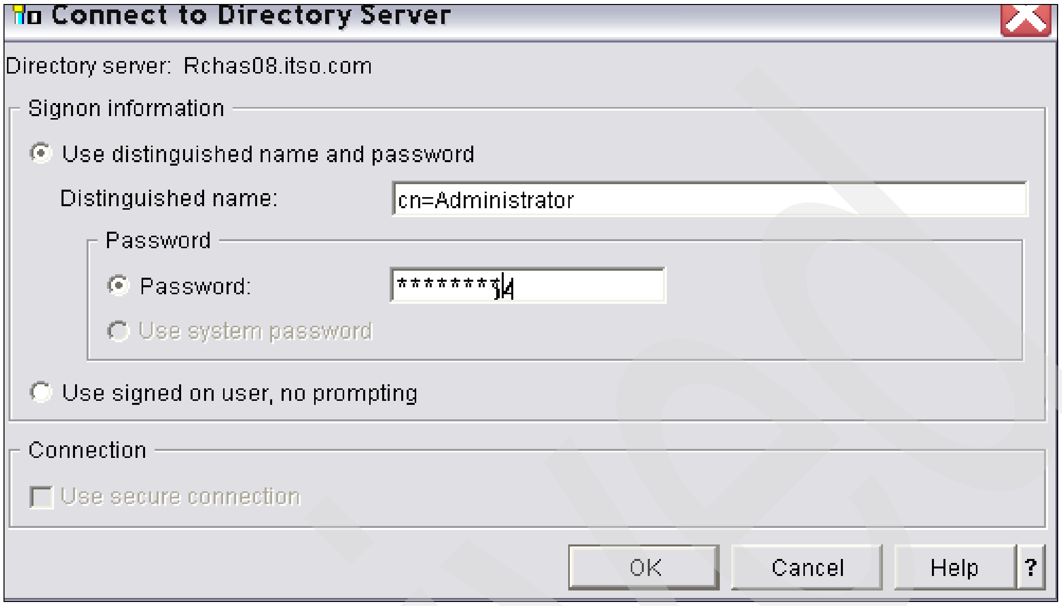
☑ Include lower-level replication contexts

☑ Export operational attributes

Warning: This operation may take a long time.

Figure 6-74 iSeries Navigation - Export an LDIF file

25. To retrieve the subtree information about your Directory Server, you need to connect and authenticate, as you can see in Figure 6-75. Select **Use distinguished name and password** and enter `cn=Administrator` as the DN and its relative password. Click **OK**.



Connect to Directory Server

Directory server: Rchas08.itso.com

Signon information

● Use distinguished name and password

Distinguished name: cn=Administrator

Password

● Password: ********

○ Use system password

○ Use signed on user, no prompting

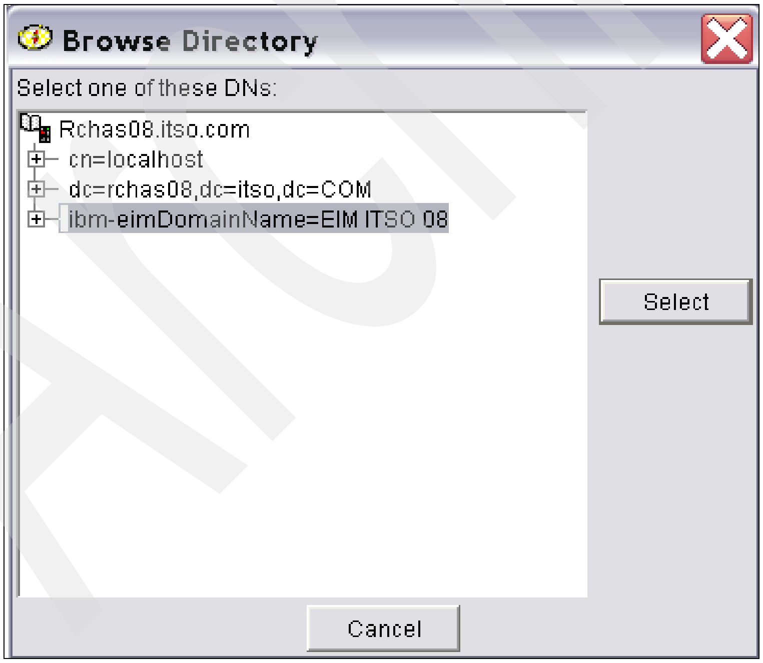
Connection

□ Use secure connection

Figure 6-75 iSeries Navigator - Connect to master Directory server

26. From the tree, shown in Figure 6-76, select the **IBM-EIMDOMAINNAME=EIM ITSO 08** subtree that you want to export in the LDIF file and click **Select**.

.



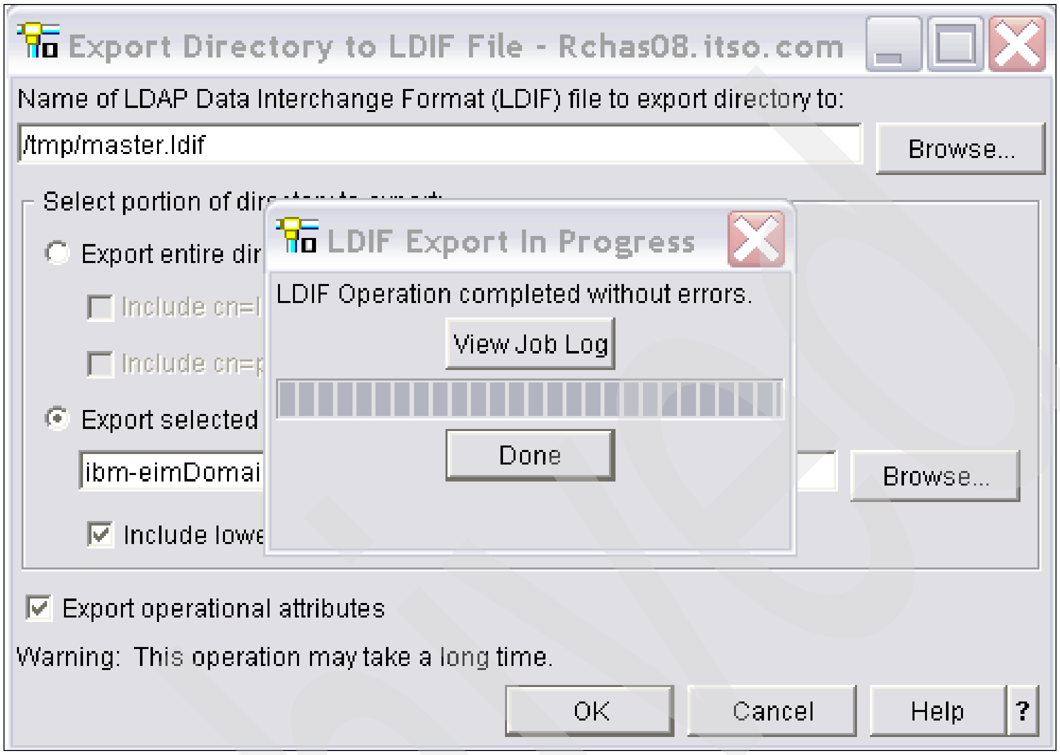
Browse Directory

Select one of these DNs:

Rchas08.itso.com
- cn=localhost
- dc=rchas08,dc=itso,dc=COM
- ibm-eimDomainName=EIM ITSO 08

Figure 6-76 iSeries Navigator - Select a subtree to export

27.Because the Export Directory to LDIF file wizard is completed, click **OK** and the window with a completion bar appears. When the operation is completed without errors, as shown in Figure 6-77, you can click **Done** to close the wizard.



Export Directory to LDIF File - Rchas08.itso.com

Name of LDAP Data Interchange Format (LDIF) file to export directory to:

/tmp/master.ldif

Select portion of dir

○ Export entire dir

□ Include cn=l

□ Include cn=p

● Export selected

ibm-eimDomai

☑ Include lowe

LDIF Export In Progress

LDIF Operation completed without errors.

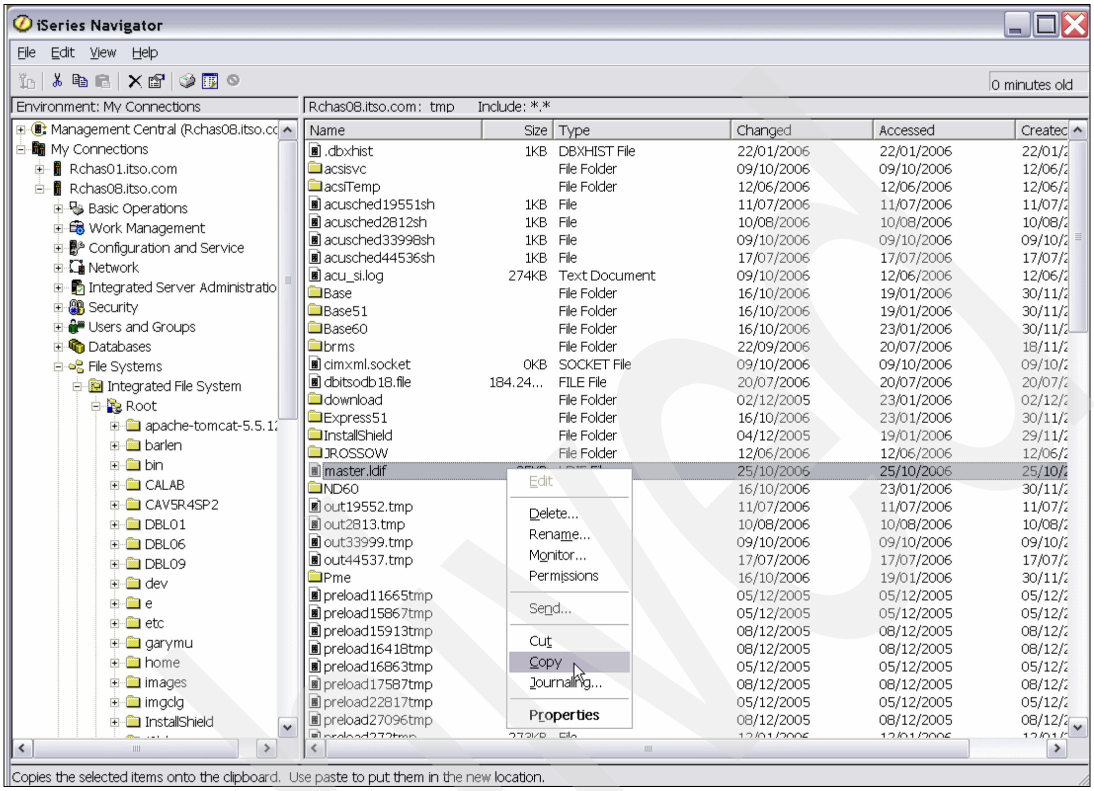
☑ Export operational attributes

Warning: This operation may take a long time.

Figure 6-77 iSeries Navigator - LDIF Export completed

28.The LDIF file is now in /tmp/master.ldif in the Integrated File System of the master server. Copy this file on the replica server to import the subtree data exported. To do this operation, you can use an FTP session, for example. Here, we document this step using the iSeries Navigator session that we are already using.

As shown in Figure 6-78, expand ***your master system connection*** → **File Systems** → **Integrated File Systems** → **Root**, click **tmp**, then in the right pane, right-click **master.ldif** and select **Copy**. The LDIF file is copied in the clipboard.



Rchas08.itso.com: tmp   Include: *.*

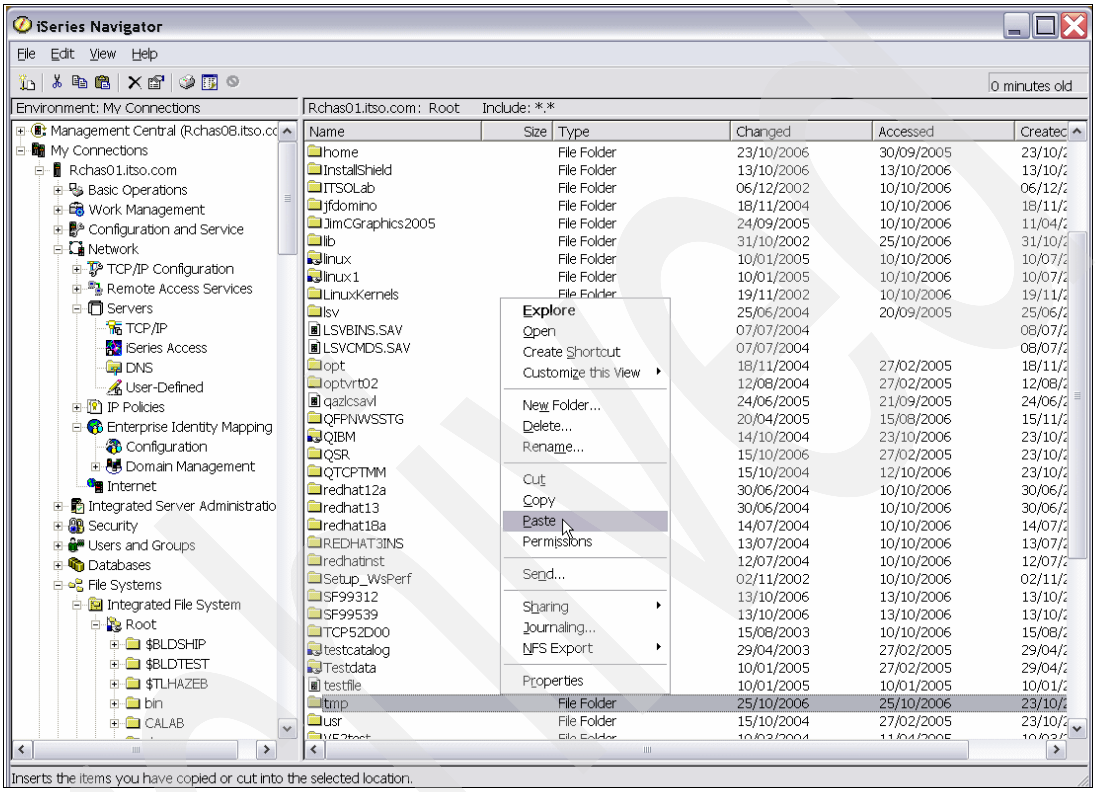
Name	Size	Type	Changed	Accessed	Createc
.dbxhist	1KB	DBXHIST File	22/01/2006	22/01/2006	22/01/2
acsisvc		File Folder	09/10/2006	09/10/2006	12/06/2
acsiTemp		File Folder	12/06/2006	12/06/2006	12/06/2
acusched19551sh	1KB	File	11/07/2006	11/07/2006	11/07/2
acusched2812sh	1KB	File	10/08/2006	10/08/2006	10/08/2
acusched33998sh	1KB	File	09/10/2006	09/10/2006	09/10/2
acusched44536sh	1KB	File	17/07/2006	17/07/2006	17/07/2
acu_si.log	274KB	Text Document	09/10/2006	12/06/2006	12/06/2
Base		File Folder	16/10/2006	19/01/2006	30/11/2
Base51		File Folder	16/10/2006	19/01/2006	30/11/2
Base60		File Folder	16/10/2006	23/01/2006	30/11/2
brms		File Folder	22/09/2006	20/07/2006	18/11/2
cimxml.socket	0KB	SOCKET File	09/10/2006	09/10/2006	09/10/2
dbitsodb18.file	184.24...	FILE File	20/07/2006	20/07/2006	20/07/2
download		File Folder	02/12/2005	23/01/2006	02/12/2
Express51		File Folder	16/10/2006	23/01/2006	30/11/2
InstallShield		File Folder	04/12/2005	19/01/2006	29/11/2
JROSSOW		File Folder	12/06/2006	12/06/2006	12/06/2
master.ldif			25/10/2006	25/10/2006	25/10/2
ND60			16/10/2006	23/01/2006	30/11/2
out19552.tmp			11/07/2006	11/07/2006	11/07/2
out2813.tmp			10/08/2006	10/08/2006	10/08/2
out33999.tmp			09/10/2006	09/10/2006	09/10/2
out44537.tmp			17/07/2006	17/07/2006	17/07/2
Pme			16/10/2006	19/01/2006	30/11/2
preload11665tmp			05/12/2005	05/12/2005	05/12/2
preload15867tmp			05/12/2005	05/12/2005	05/12/2
preload15913tmp			08/12/2005	08/12/2005	08/12/2
preload16418tmp			08/12/2005	08/12/2005	08/12/2
preload16863tmp			05/12/2005	05/12/2005	05/12/2
preload17587tmp			08/12/2005	08/12/2005	08/12/2
preload22817tmp			05/12/2005	05/12/2005	05/12/2
preload27096tmp			08/12/2005	08/12/2005	08/12/2

Copies the selected items onto the clipboard. Use paste to put them in the new location.

Figure 6-78 iSeries Navigator - Copy the LDIF file on the master system

29. Now pass the file to the replica. In the iSeries Navigator Session, expand ***your replica system connection*** → **File Systems** → **Integrated File Systems** → **Root**, right-click **tmp**, and select **Paste** to detach the LDIF file from the clipboard to the replica /tmp directory (Figure 6-79).

    Do not import the LDIF file now because you need to stop the directory server. You still have changes to the replica directory server settings that require a restart of the server. You will import the LDIF file later.



Rchas01.itso.com: Root   Include: *.*

Name	Size	Type	Changed	Accessed	Createc
home		File Folder	23/10/2006	30/09/2005	23/10/2
InstallShield		File Folder	13/10/2006	13/10/2006	13/10/2
ITSOLab		File Folder	06/12/2002	10/10/2006	06/12/2
jfdomino		File Folder	18/11/2004	10/10/2006	18/11/2
JimCGraphics2005		File Folder	24/09/2005	10/10/2006	11/04/2
lib		File Folder	31/10/2002	25/10/2006	31/10/2
linux		File Folder	10/01/2005	10/10/2006	10/07/2
linux1		File Folder	10/01/2005	10/10/2006	10/07/2
LinuxKernels		File Folder	19/11/2002	10/10/2006	19/11/2
lsv			25/06/2004	20/09/2005	25/06/2
LSVBINS.SAV			07/07/2004		08/07/2
LSVCMDS.SAV			07/07/2004		08/07/2
opt			18/11/2004	27/02/2005	18/11/2
optvrt02			12/08/2004	27/02/2005	12/08/2
qazlcsavl			24/06/2005	21/09/2005	24/06/2
QFPNWSSTG			20/04/2005	15/08/2006	15/11/2
QIBM			14/10/2004	23/10/2006	23/10/2
QSR			15/10/2006	27/02/2005	23/10/2
QTCPTMM			15/10/2004	12/10/2006	23/10/2
redhat12a			30/06/2004	10/10/2006	30/06/2
redhat13			30/06/2004	10/10/2006	30/06/2
redhat18a			14/07/2004	10/10/2006	14/07/2
REDHAT3INS			13/07/2004	10/10/2006	13/07/2
redhatinst			12/07/2004	10/10/2006	12/07/2
Setup_WsPerf			02/11/2002	10/10/2006	02/11/2
SF99312			13/10/2006	13/10/2006	13/10/2
SF99539			13/10/2006	13/10/2006	13/10/2
TCP52D00			15/08/2003	10/10/2006	15/08/2
testcatalog			29/04/2003	27/02/2005	29/04/2
Testdata			10/01/2005	27/02/2005	29/04/2
testfile			10/01/2005	10/01/2005	10/01/2
tmp		File Folder	25/10/2006	25/10/2006	23/10/2
usr		File Folder	15/10/2004	27/02/2005	23/10/2

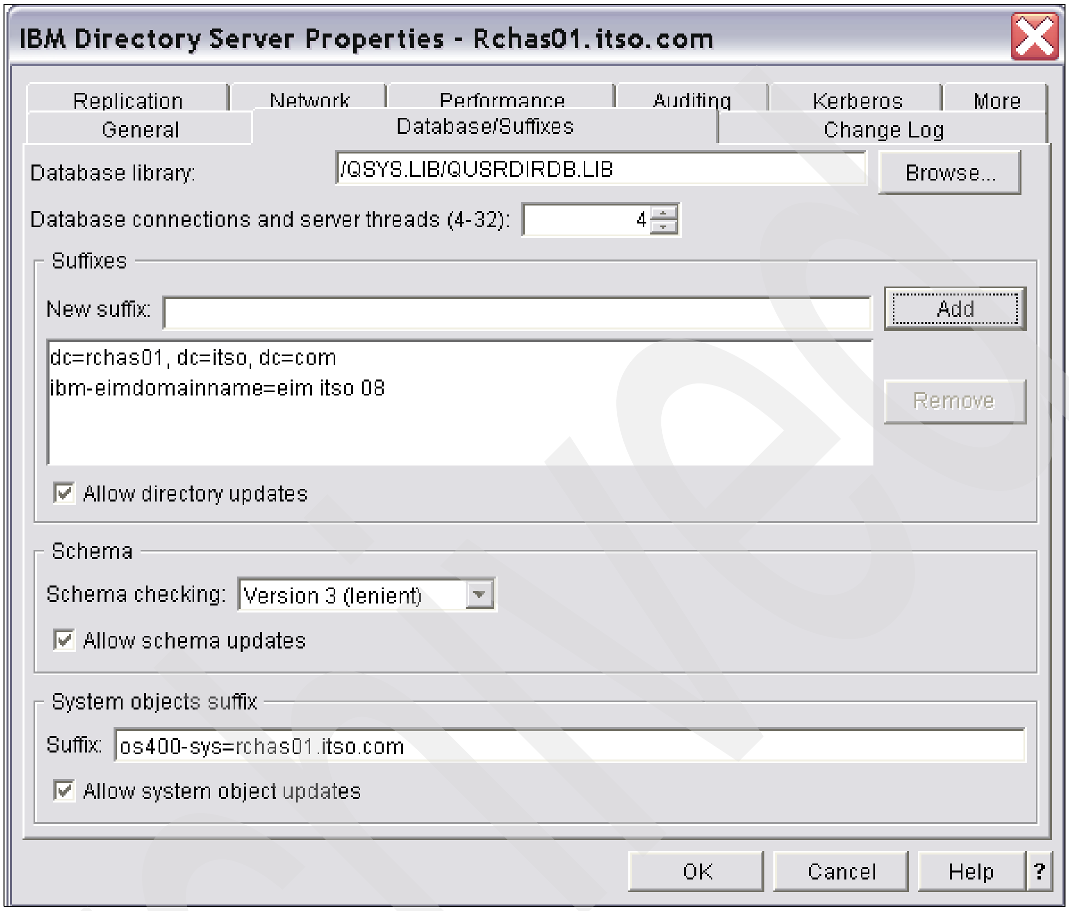
Inserts the items you have copied or cut into the selected location.

Figure 6-79 iSeries Navigator - Paste the LDIF file on the replica system

30. The directory server that will be the replica of a particular subtree needs the same structure as the replicated subtree. Thus, before you import the LDIF file, add the root of the replicated subtree in the suffix list known by the directory server.

    To do this, in your iSeries Navigator session, expand ***your replica system connection*** → **Network** → **Servers** → **TCP/IP**, right-click **IBM Directory Server**, and select **Properties.**

As shown in Figure 6-80, go to the **Database/Suffixes** tag. Enter the name of the EIM replicated subtree. In our scenario, it is `ibm-eimdomainname= eim itso 08.` Click **Add**. Make sure that **Allow directory updates** is checked and click **OK**.



Database library: /QSYS.LIB/QUSRDIRDB.LIB

Database connections and server threads (4-32): 4

New suffix:

dc=rchas01, dc=itso, dc=com
ibm-eimdomainname=eim itso 08

☑ Allow directory updates

Schema checking: Version 3 (lenient)

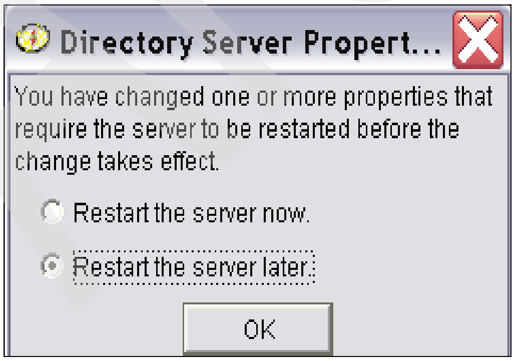
☑ Allow schema updates

Suffix: os400-sys=rchas01.itso.com

☑ Allow system object updates

Figure 6-80 iSeries Navigator - Add a new suffix in IBM Directory Server properties

31. In the window, as shown in Figure 6-81, select **Restart the Server later** and click **OK**. You still have another change to do in the replica server before you stop and start the Directory Server.



You have changed one or more properties that require the server to be restarted before the change takes effect.

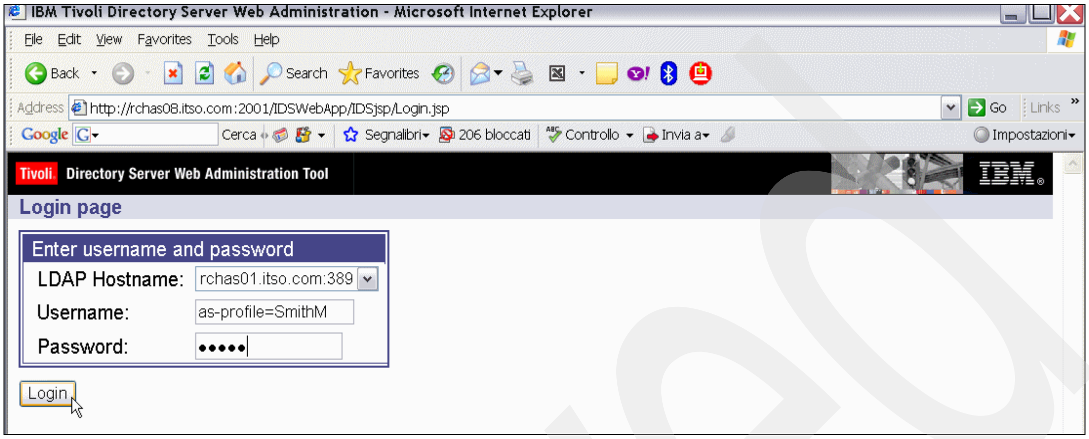
○ Restart the server now.

● Restart the server later.

Figure 6-81 ISeries Navigator - Pop-up window

32. Back in the Directory Server Web Administration Tool, log on to the replica Directory Server to add the master supplier information. To perform this task, you need to logon with a i5/OS system user that must have *ALLOBJ and *IOSYSCFG special authorities to

change the settings in the replication properties panels. In our scenario, as shown in Figure 6-82, select **rchas01.itso.com:389** as the LDAP Hostname, enter `os400-profile=smithm` as the Username, and her relative password in the Password field. Click **Login**.



IBM Tivoli Directory Server Web Administration - Microsoft Internet Explorer

Address: http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/Login.jsp

Tivoli Directory Server Web Administration Tool

Login page

Enter username and password

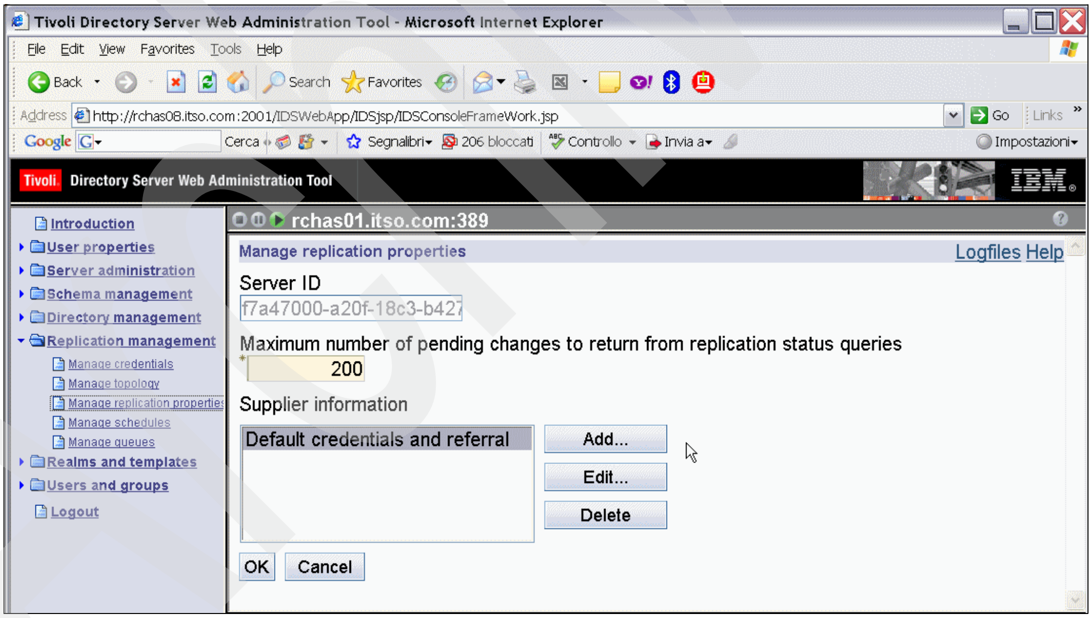
LDAP Hostname: rchas01.itso.com:389

Username: as-profile=SmithM

Password: •••••

Figure 6-82 Directory Server Web Administration - Login to replica Directory Server

33.As shown in Figure 6-83, expand the **Replication Management** in the left pane and click **Manage replication properties**. Then in the right pane, select **Default credentials and referral** in the Supplier information list and click **Add**.



Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer

Address: http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp

Tivoli Directory Server Web Administration Tool

rchas01.itso.com:389

Manage replication properties

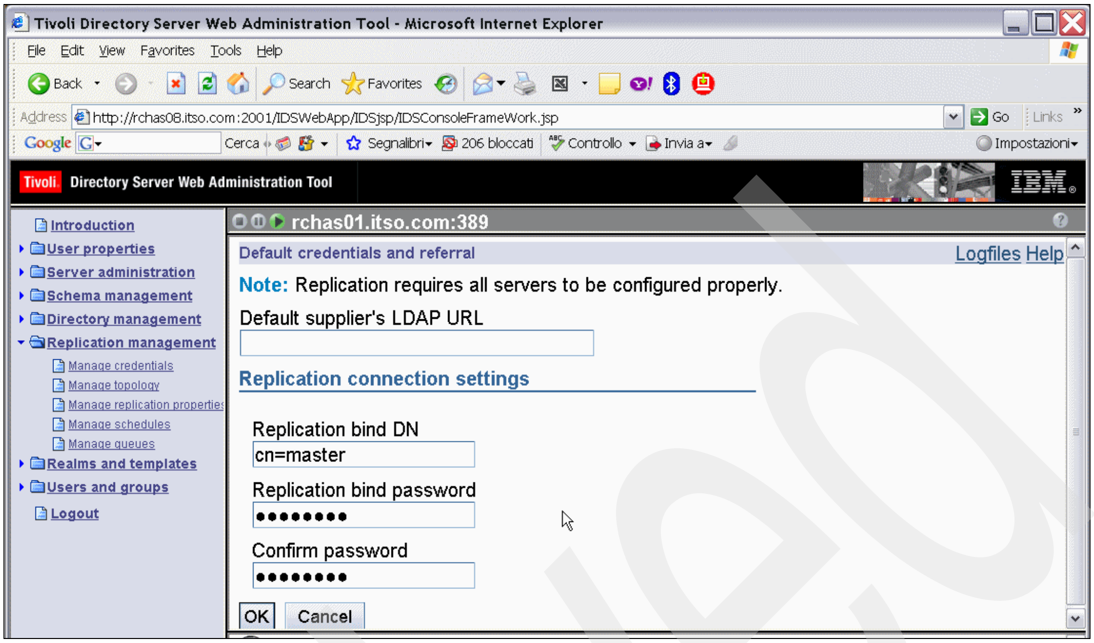
Server ID: f7a47000-a20f-18c3-b427

Maximum number of pending changes to return from replication status queries: 200

Supplier information: Default credentials and referral

Figure 6-83 Directory Server Web Administration - Manage replication properties

34.The values that you input as replication connection settings (Figure 6-84 on page 212) are valid for all subtrees replicated using the default credentials and referral. You also use Replication bind DN of cn=master and enter the same password in the Replication bind password and Confirmation password fields as in Step 16 on page 196. Click **OK**. The window shown in Figure 6-83 appears again, click **OK** to close the task, and click **Logout** in the left pane to close the Web Administration Tool session.


Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp Go Links
Google Cerca Segnalibri 206 bloccati Controllo Invia a Impostazioni
Tivoli Directory Server Web Administration Tool IBM.
Introduction
User properties
Server administration
Schema management
Directory management
Replication management
Manage credentials
Manage topology
Manage replication properties
Manage schedules
Manage queues
Realms and templates
Users and groups
Logout
rchas01.itso.com:389
Default credentials and referral
Logfiles Help
OK Cancel

Note: Replication requires all servers to be configured properly.

Default supplier's LDAP URL

Replication connection settings

Replication bind DN: cn=master

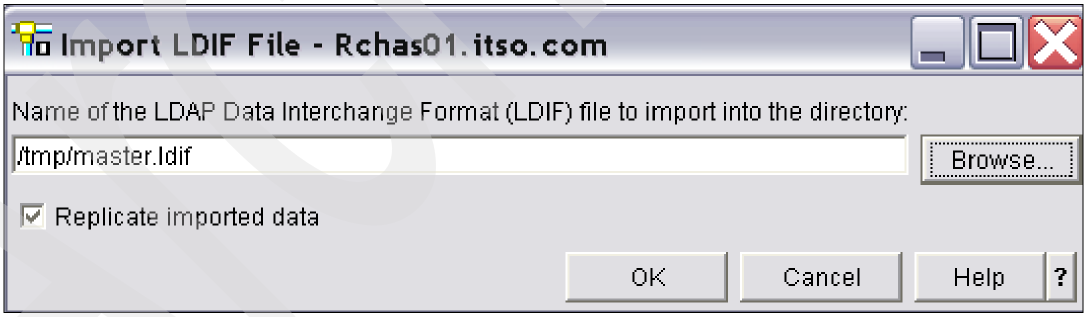
Replication bind password: ●●●●●●●●

Confirm password: ●●●●●●●●

Figure 6-84 Directory Server Web Administration - Replication connection settings

35. Now you can finally stop the replica Directory Server to take effect with the next start of the updates you have completed and to import the LDIF file.

    In the iSeries Navigation Session, expand ***your replica system connection*** → **Network** → **Servers** → **TCP/IP**, right-click **IBM Directory Server**, and select **Stop**. When the directory server is stopped, right-click again **IBM Directory Server**, expand **Tools**, and then select **Import File**. In the window shown in Figure 6-85, enter the fully qualified path and name of the LDIF file. In our scenario, enter `/tmp/master.ldif` and click **OK**.



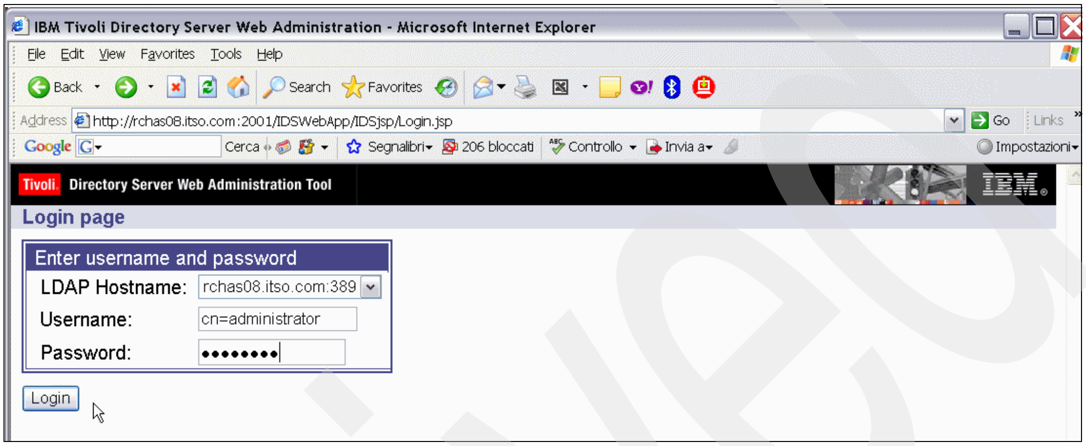
Name of the LDAP Data Interchange Format (LDIF) file to import into the directory: /tmp/master.ldif

☑ Replicate imported data

Figure 6-85 iSeries Navigator - Import LDIF file

When the confirmation message indicates that the import operation is completed, click **Done**. You can restart the replica Directory Server. Right-click **IBM Directory Server** and select **Start**.

36. The replica Directory Server is synchronized with the subtree data replicated on the master server, and both servers are using the same credentials. You have completed the setup of the master-replica topology. In the Directory Server Web Administration Tool, log on to the master Directory Server to release the replica queue. This time, as shown in Figure 6-86, log on with cn=Aministrator. Select **rchas08.itso.com:389** as the LDAP Hostname, enter `cn=Administrator` as the Username, and its relative password in the Password field. Click **Login**.


IBM Tivoli Directory Server Web Administration - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/Login.jsp
Go Links
Google Cerca Segnalibri 206 bloccati Controllo Invia a Impostazioni
Tivoli Directory Server Web Administration Tool
IBM
Login page
Enter username and password
Login

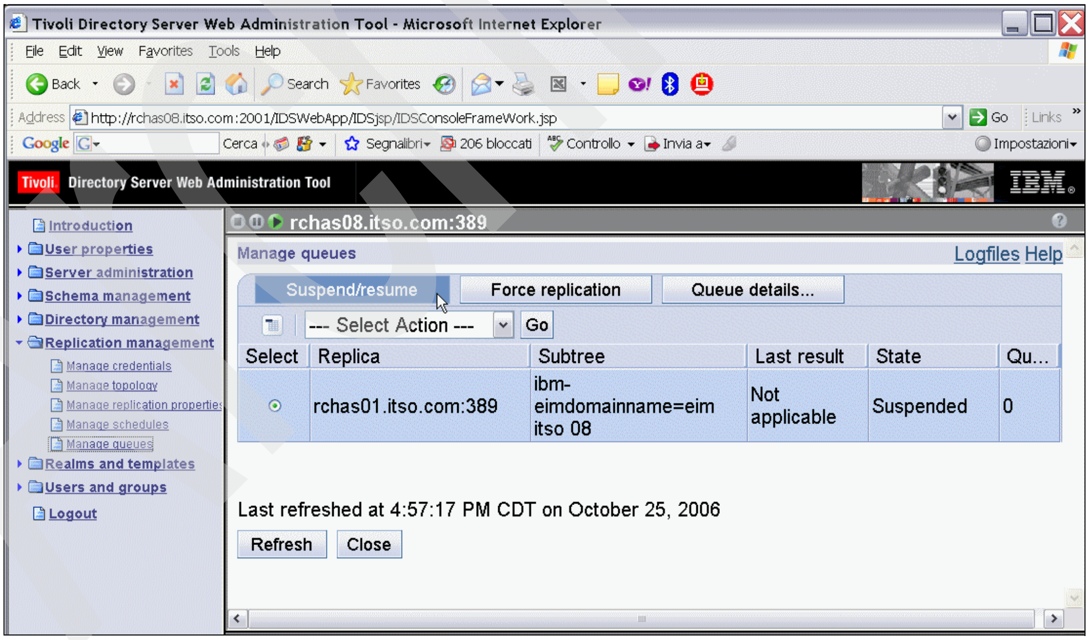
LDAP Hostname: rchas08.itso.com:389

Username: cn=administrator

Password: ••••••••

Figure 6-86 Directory Server Web Administration - Login to master Directory Server

37. As shown in Figure 6-87, when logged in, expand **Replication management** in the left pane and click **Managed queues**. In the right pane, you see that the replica state is **Suspended**. Select the replica server **rchas01.itso.com:389** and click **Suspend/resume**.

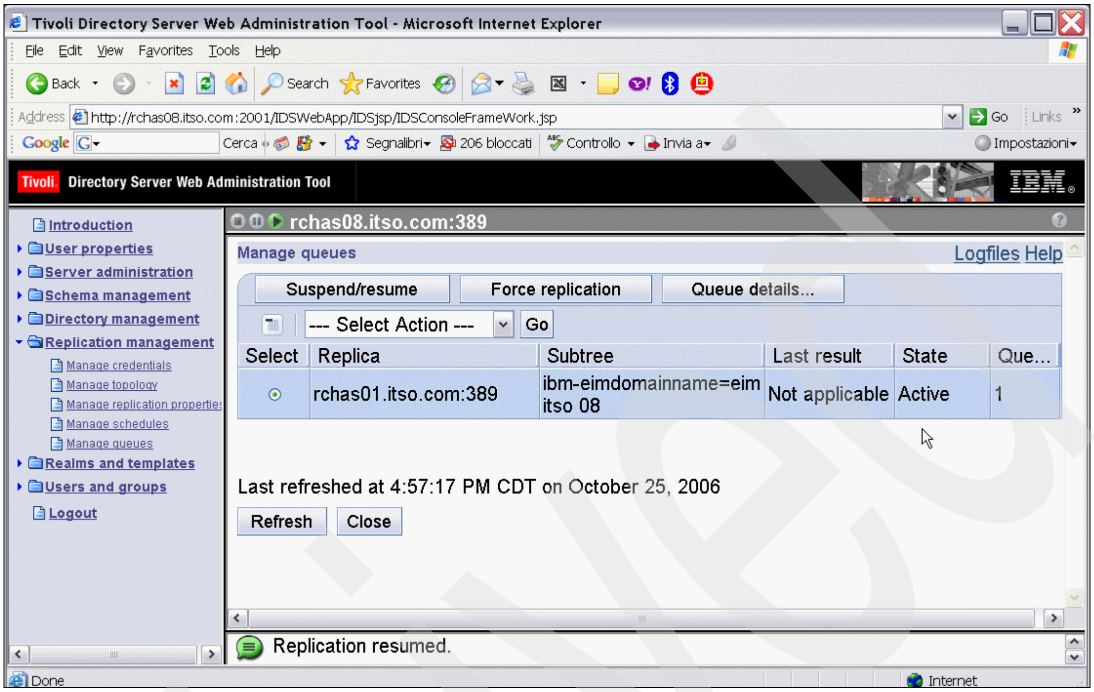


Select	Replica	Subtree	Last result	State	Qu...
●	rchas01.itso.com:389	ibm-eimdomainname=eim itso 08	Not applicable	Suspended	0

Last refreshed at 4:57:17 PM CDT on October 25, 2006

Figure 6-87 Directory Server Web Administration - Manage queues

38. As Figure 6-88 shows, the replica state in now **Active**. Notice the message at the bottom of the right pane that tells you the replication is being resumed. Click **Refresh**.



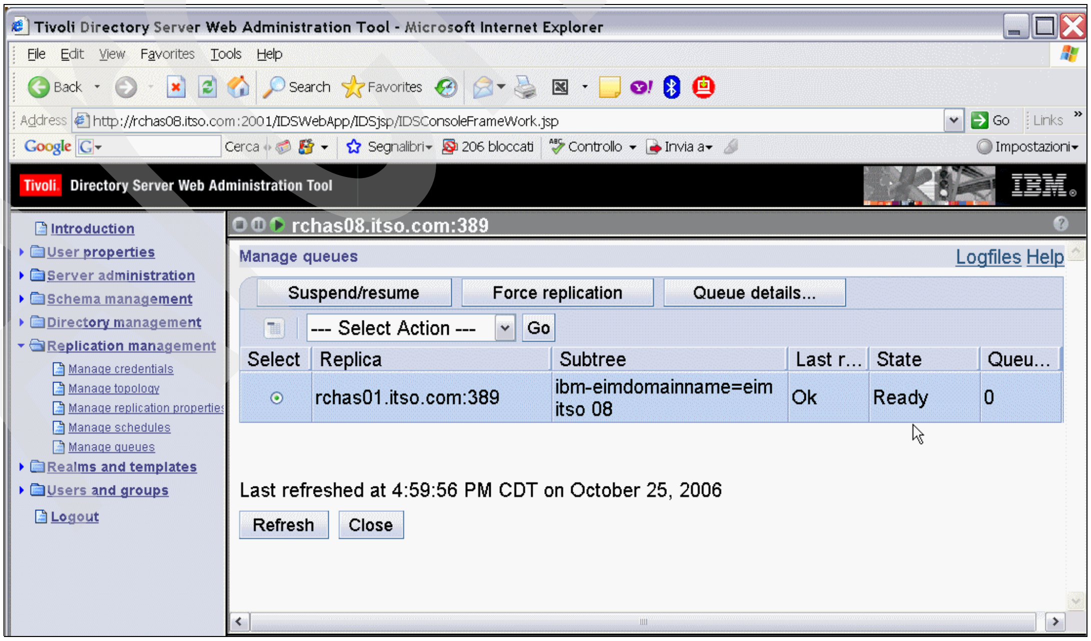
Select	Replica	Subtree	Last result	State	Que...
⊙	rchas01.itso.com:389	ibm-eimdomainname=eim itso 08	Not applicable	Active	1

Last refreshed at 4:57:17 PM CDT on October 25, 2006

Replication resumed.

Figure 6-88 Directory Server Web Administration - Replica queue state is now active

39. Notice the state of replica queue is now **Ready** (Figure 6-89). This is the correct state when a queue is active without any pending updates, shown as 0 in the Queue column. Click **Close** to complete the task and **Logout** in the left pane. You have now completed the master-replica settings and activated the replication successfully.

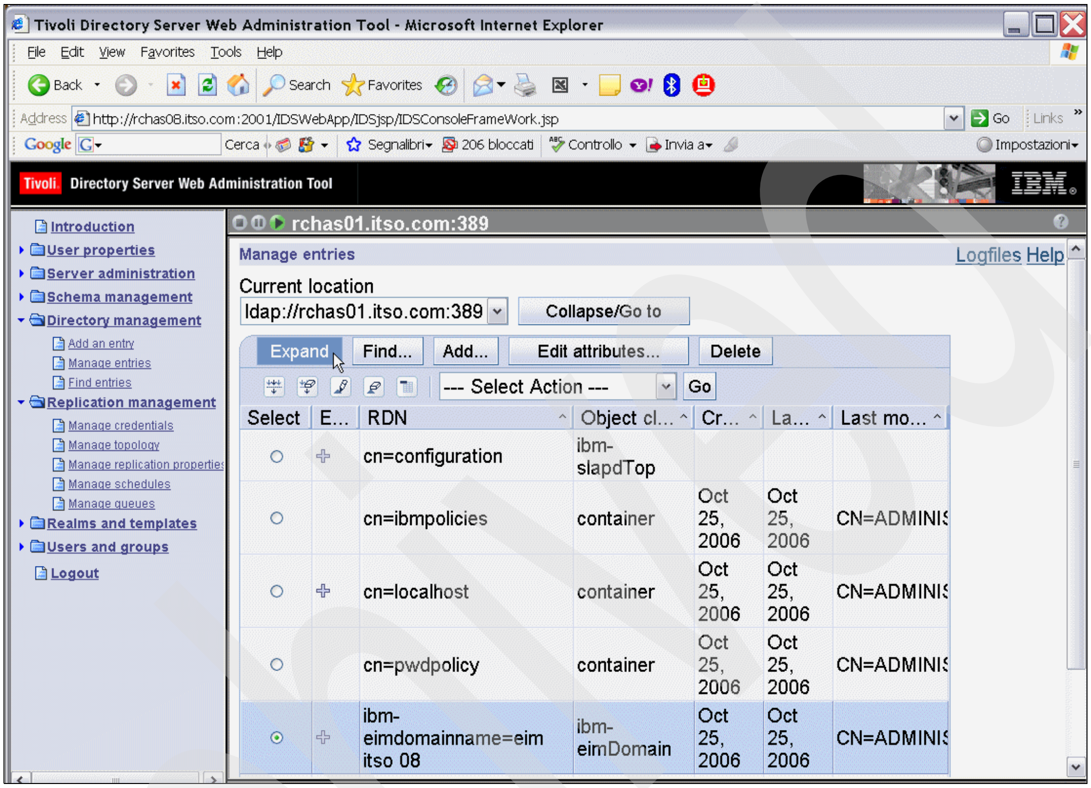


Select	Replica	Subtree	Last r...	State	Queu...
⊙	rchas01.itso.com:389	ibm-eimdomainname=eim itso 08	Ok	Ready	0

Last refreshed at 4:59:56 PM CDT on October 25, 2006

Figure 6-89 Directory Server Web Administration - Replica queue state is ready

To verify that the subtree data is synchronized on both master and replica servers, you can logon in the replica Directory Server using Web Administration Tool with cn=Administrator and its relative password. Then expand **Directory management** as shown in Figure 6-90 and click **Manage entries**. Select the EIM subtree replicated. In our scenario, it is ibm-eimdomainname=eim itso 08 and click **Expand**.



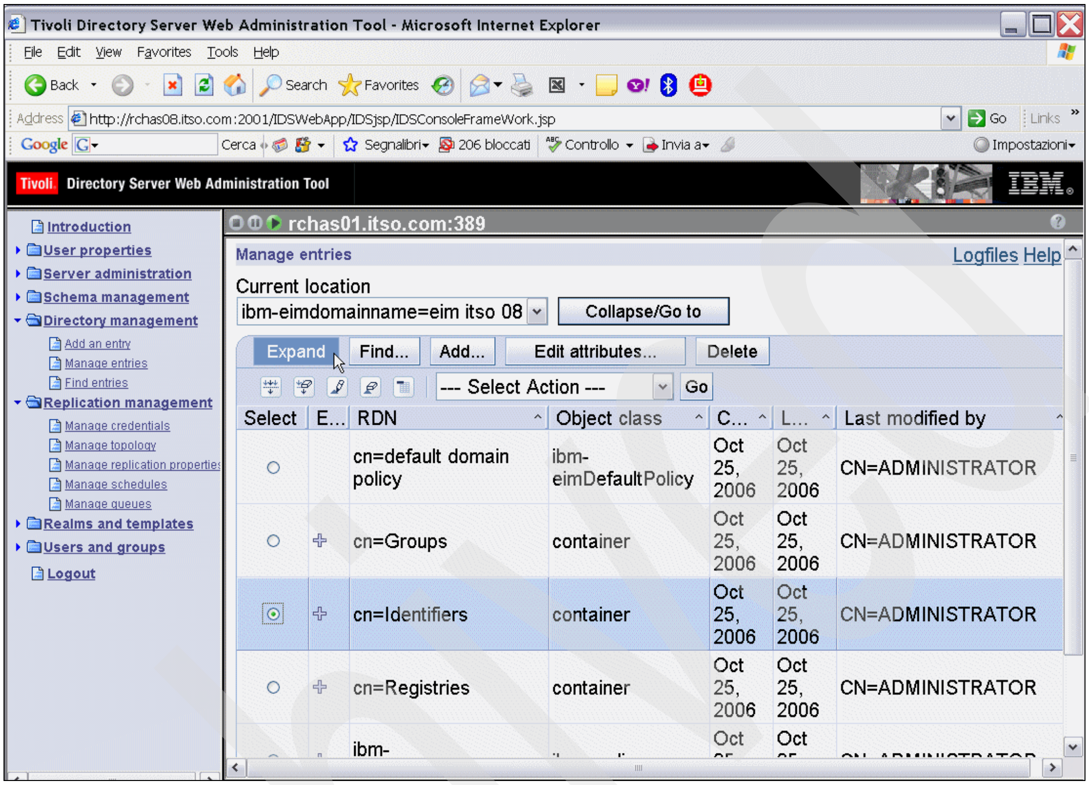
Current location

ldap://rchas01.itso.com:389

Select	E...	RDN	Object cl...	Cr...	La...	Last mo...
○	✚	cn=configuration	ibm-slapdTop			
○		cn=ibmpolicies	container	Oct 25, 2006	Oct 25, 2006	CN=ADMINIS
○	✚	cn=localhost	container	Oct 25, 2006	Oct 25, 2006	CN=ADMINIS
○		cn=pwdpolicy	container	Oct 25, 2006	Oct 25, 2006	CN=ADMINIS
●	✚	ibm-eimdomainname=eim itso 08	ibm-eimDomain	Oct 25, 2006	Oct 25, 2006	CN=ADMINIS

Figure 6-90 Directory Server Web Administration - Manage entries on replica server

As shown in Figure 6-91, you can see the subtree data that you have populated with the EIM configuration wizard on the master system. You can see details of the other subtree entries by selecting them and clicking **Expand** again.



Current location

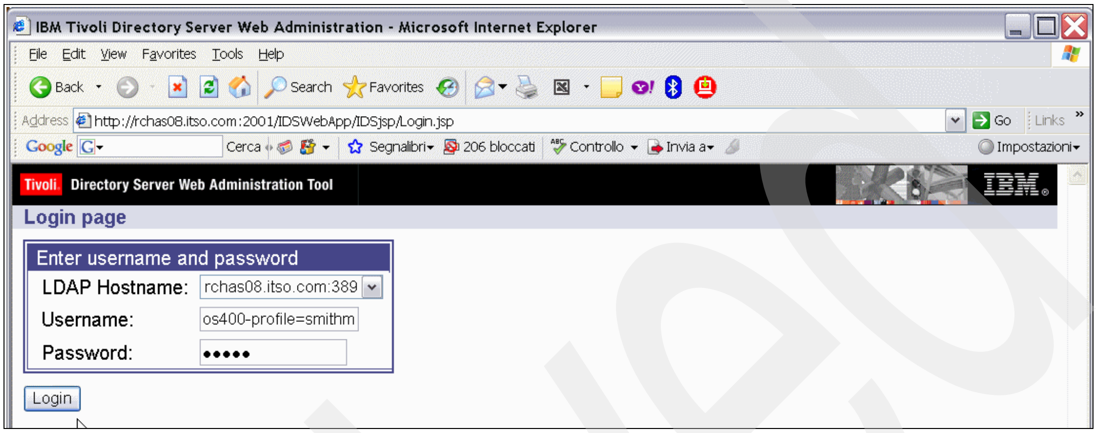
ibm-eimdomainname=eim itso 08

Select	E...	RDN	Object class	C...	L...	Last modified by
○		cn=default domain policy	ibm-eimDefaultPolicy	Oct 25, 2006	Oct 25, 2006	CN=ADMINISTRATOR
○	+	cn=Groups	container	Oct 25, 2006	Oct 25, 2006	CN=ADMINISTRATOR
●	+	cn=Identifiers	container	Oct 25, 2006	Oct 25, 2006	CN=ADMINISTRATOR
○	+	cn=Registries	container	Oct 25, 2006	Oct 25, 2006	CN=ADMINISTRATOR
		ibm-		Oct	Oct	

Figure 6-91 Directory Server Web Administration - Manage entries on replica server for replicated data

40. All the changes done on the replicated subtree in the master server are sent automatically to the replica server. With this replication topology, the replica cannot update the replicated subtree, the replica can only publish it. To reach complete high availability of the EIM structure, you must also enable the replica server to update the replicated subtree. In this case, you have a master-master replication topology.

In the Directory Server Web Administration Tool login page, log on in the master Directory Server to modify the replication properties. Notice that to perform this task, you need to log on with a i5/OS system user that must have *ALLOBJ and *IOSYSCFG special authorities to change settings in the replication properties panels, as shown in Figure 6-92. Select **rchas08.itso.com:389** as the LDAP Hostname. Enter `os400-profile=smithm` in the Username field and the relative password in the Password field. Click **Login**.



IBM Tivoli Directory Server Web Administration - Microsoft Internet Explorer

Address: http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/Login.jsp

Tivoli Directory Server Web Administration Tool

Login page

Enter username and password

LDAP Hostname: rchas08.itso.com:389

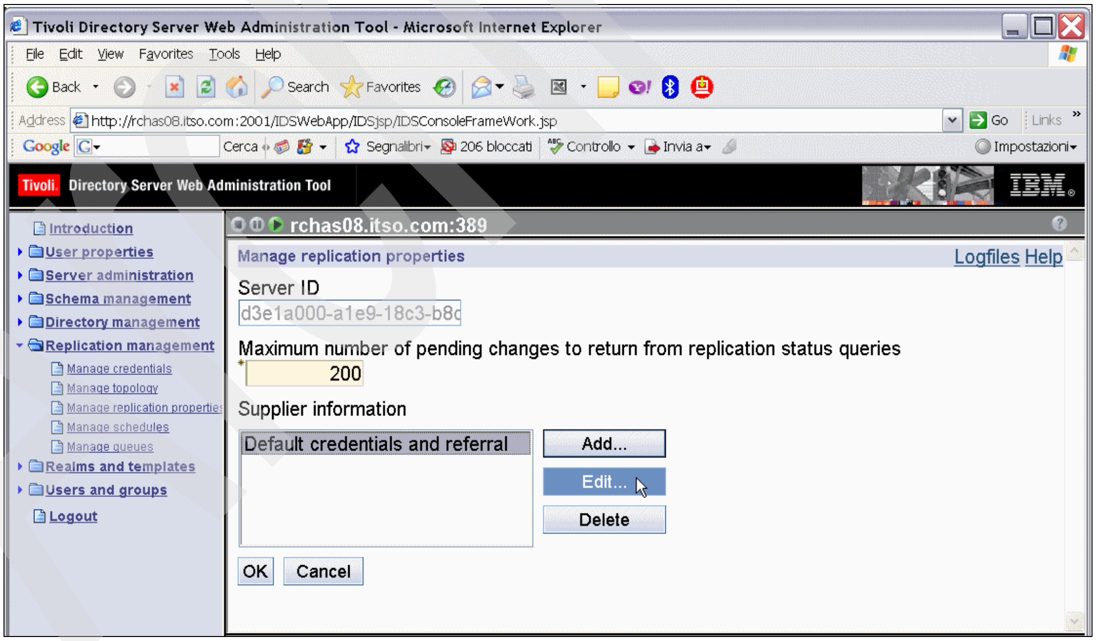
Username: os400-profile=smithm

Password: •••••

Login

Figure 6-92 Directory Server Web Administration - Login on master server

41. As you did on the replica server, set the master server to accept updates from other servers. As shown in Figure 6-93, expand **Replication Management** in the left pane and click **Manage replication properties**. In the right pane, select **Default credentials and referral** in the Supplier information list and click **Add**.



Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer

Address: http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp

Tivoli Directory Server Web Administration Tool

rchas08.itso.com:389

Manage replication properties

Server ID: d3e1a000-a1e9-18c3-b8c

Maximum number of pending changes to return from replication status queries: 200

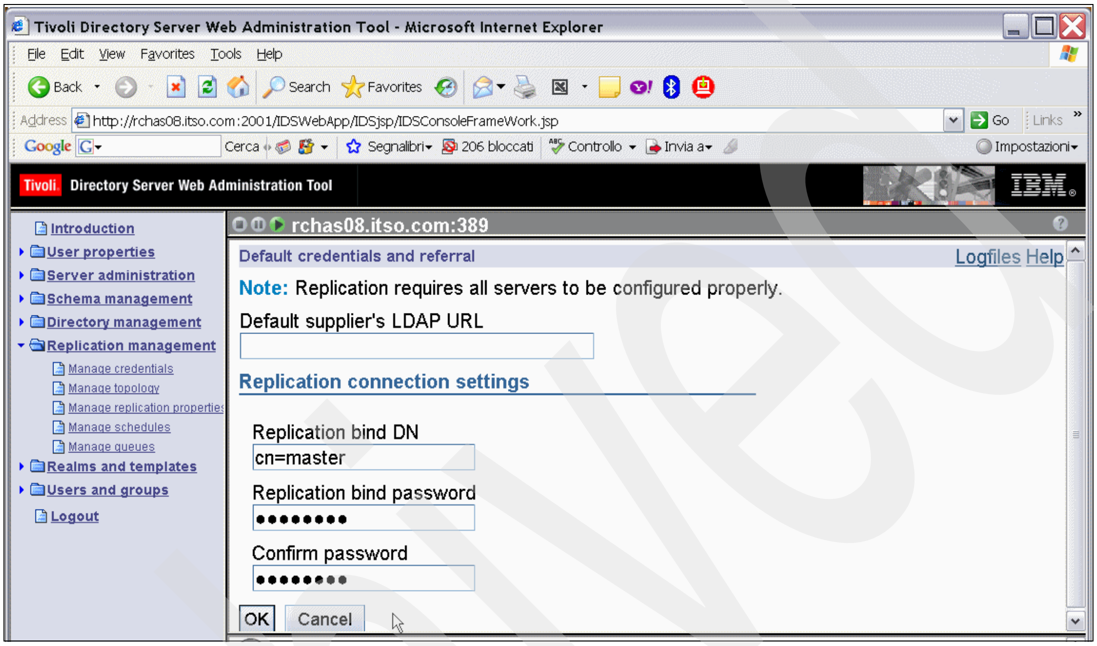
Supplier information: Default credentials and referral

Add... | Edit... | Delete

OK | Cancel

Figure 6-93 Directory Server Web Administration - Manage replication properties

42. The values for the Replication connection settings (Figure 6-94) are valid for all the subtrees replicated using the **Default credentials and referral**. You are also using cn=master as the Replication bind DN and entering the same password in the Replication bind password and Confirmation password fields as in Step 16 on page 196. Click **OK**. The window shown in Figure 6-93 on page 217 appears again. Click **OK** to close the task and **Logout** in the left pane to close the Web Administration Tool session.


Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/IDSConsoleFrameWork.jsp
Go Links
Google Cerca Segnalibri 206 bloccati Controllo Invia a Impostazioni
Tivoli Directory Server Web Administration Tool
IBM
Introduction
User properties
Server administration
Schema management
Directory management
Replication management
Manage credentials
Manage topology
Manage replication properties
Manage schedules
Manage queues
Realms and templates
Users and groups
Logout
rchas08.itso.com:389
Default credentials and referral
Logfiles Help
OK
Cancel

Note: Replication requires all servers to be configured properly.

Default supplier's LDAP URL:

Replication connection settings

Replication bind DN: cn=master

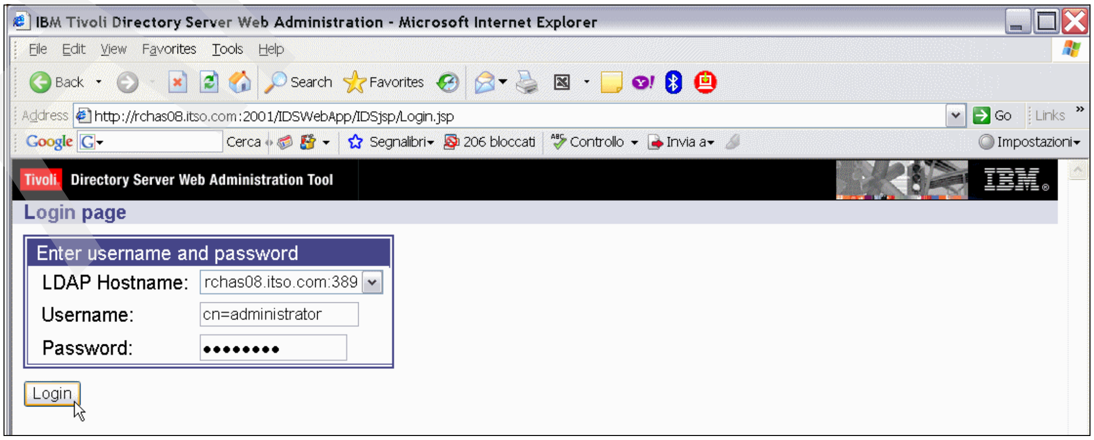
Replication bind password: ••••••••

Confirm password: ••••••••

Figure 6-94 Directory Server Web Administration - Replication connection settings

43. Stop and start the master Directory Server to let that the changes take effect with the next start. In the iSeries Navigation Session, expand ***your master system connection*** → **Network** → **Servers** → **TCP/IP**, right-click **IBM Directory Server**, and select **Stop**. When the status is stopped, right-click **IBM Directory Server** and select **Start**.

44. Back to Directory Server Web Administration Tool login page, log on in the master Directory Server to modify the replication topology, which is needed for the cn=administrator. As shown in Figure 6-95, select **rchas08.itso.com:389** as the LDAP Hostname, enter `cn=administrator` in the Username field, and its relative password in the Password field. Click **Login**.


IBM Tivoli Directory Server Web Administration - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/Login.jsp
Go Links
Google Cerca Segnalibri 206 bloccati Controllo Invia a Impostazioni
Tivoli Directory Server Web Administration Tool
IBM
Login page
Login

Enter username and password

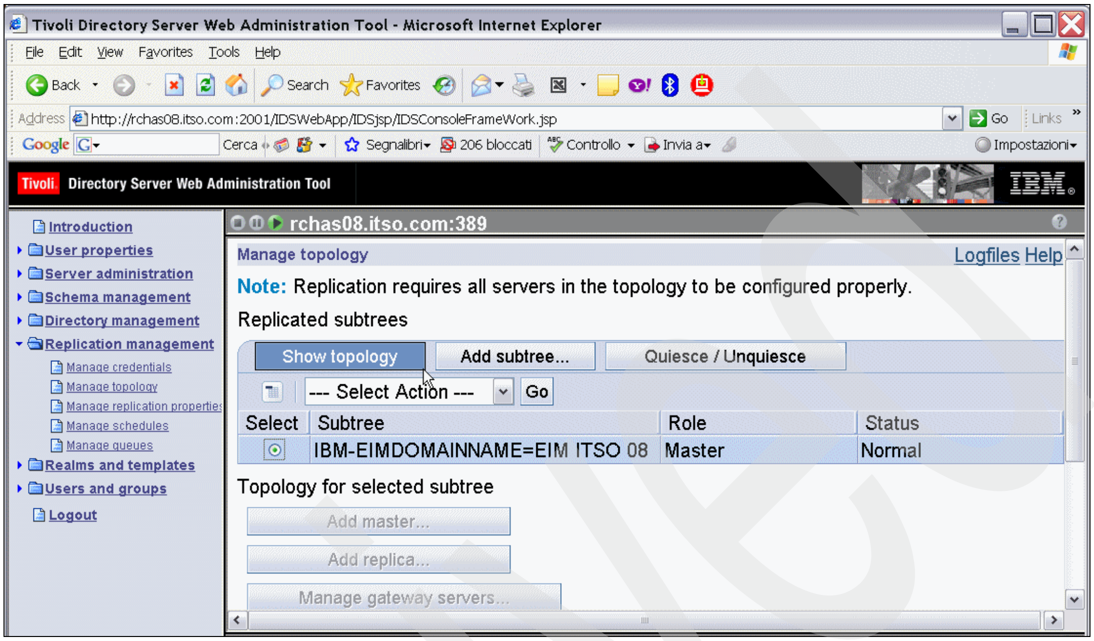
LDAP Hostname: rchas08.itso.com:389

Username: cn=administrator

Password: ••••••••

Figure 6-95 Directory Server Web Administration - Login into master Directory Server

45. Expand **Replication management** in the left pane and click **Manage topology**. As shown in Figure 6-96, select the replicated subtree. In this scenario, it is IBM-EIMDOMAINNAME=EIM ITSO 08 and click **Show topology**.



Note: Replication requires all servers in the topology to be configured properly.

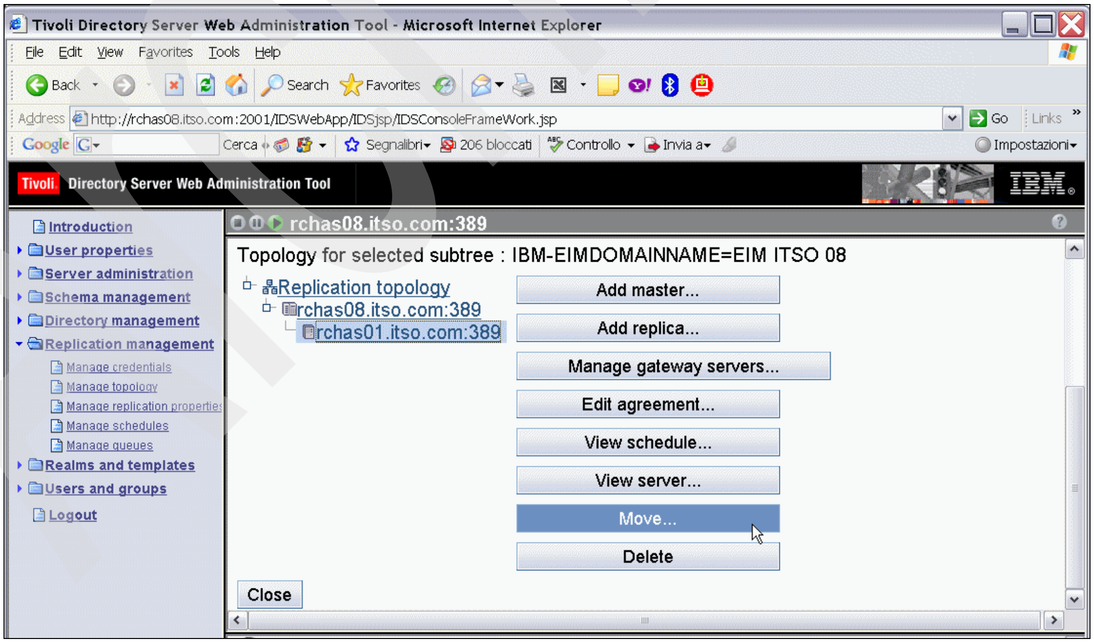
Replicated subtrees

Select	Subtree	Role	Status
●	IBM-EIMDOMAINNAME=EIM ITSO 08	Master	Normal

Topology for selected subtree

Figure 6-96 Directory Server Web Administration - Manage topology

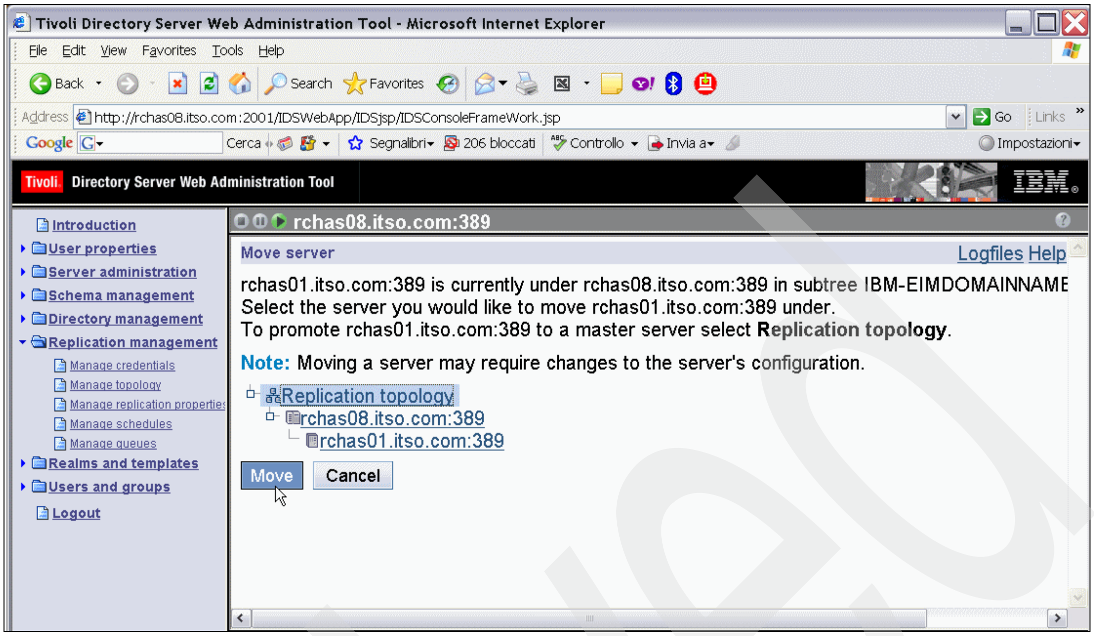
46. In the replication topology tree, expand the master server entry. In our scenario, it is rchas08.itso.com:389. Select its replica server. In our scenario, it is rchas01.itso.com:389, as shown in Figure 6-97, and click **Move**.



Topology for selected subtree : IBM-EIMDOMAINNAME=EIM ITSO 08

Figure 6-97 Directory Server Web Administration - Replication topology

47. You want that replica server to become a master server too in the replication subtree IBM-EIMDOMANNAME=EIM ITSO 08 topology. To do that, select **Replication topology** and click **Move** as shown in Figure 6-98 on page 220.



Move server

rchas01.itso.com:389 is currently under rchas08.itso.com:389 in subtree IBM-EIMDOMAINNAME
Select the server you would like to move rchas01.itso.com:389 under.
To promote rchas01.itso.com:389 to a master server select **Replication topology**.

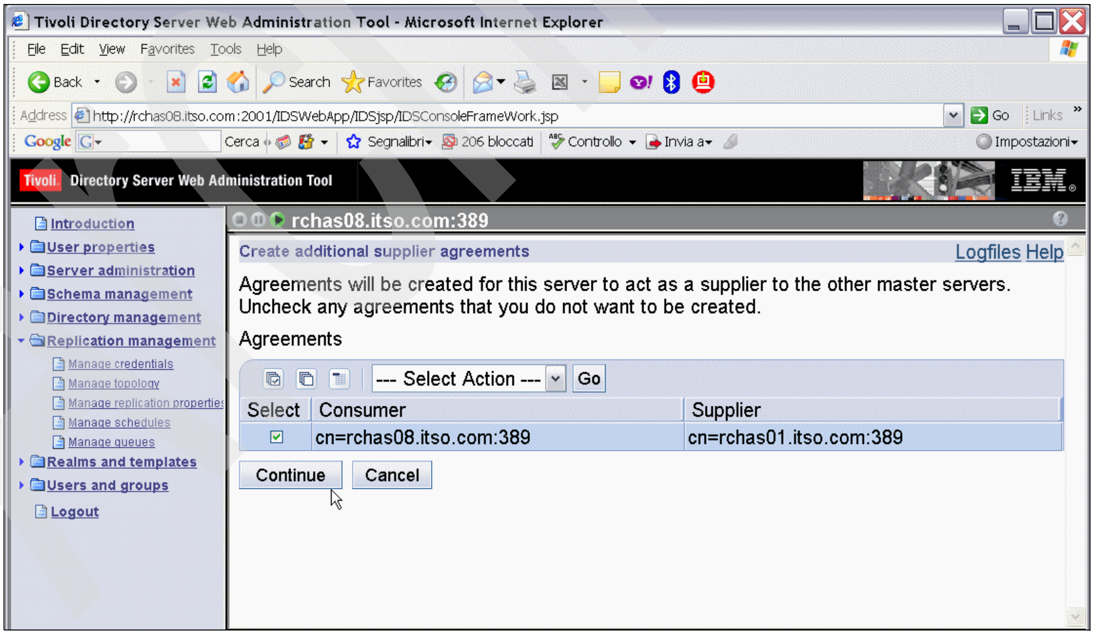
Note: Moving a server may require changes to the server's configuration.

- Replication topology
  - rchas08.itso.com:389
    - rchas01.itso.com:389

Figure 6-98 Directory Server Web Administration - Move server

48. The Web Administration Tool guides you through the steps to set up the necessary agreement in this new replication topology.

    As you can see in the Figure 6-99, the original master server is the consumer of the information supplied by the new master. In this scenario, it is cn=rchas01.itso.com:389. Select the entry and click **Continue**.



Create additional supplier agreements

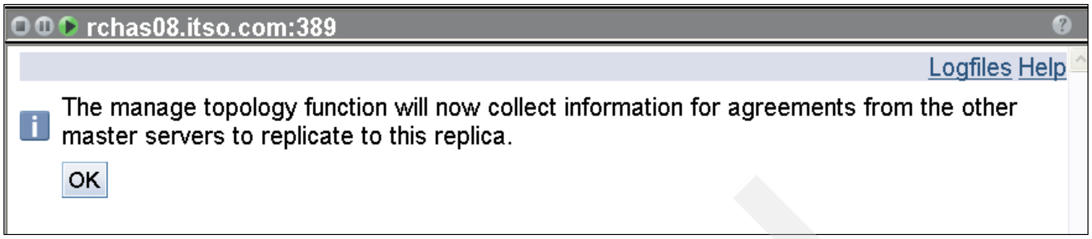
Agreements will be created for this server to act as a supplier to the other master servers.
Uncheck any agreements that you do not want to be created.

Agreements

Select	Consumer	Supplier
☑	cn=rchas08.itso.com:389	cn=rchas01.itso.com:389

Figure 6-99 Directory Server Web Administration - Create additional supplier agreement.

49. The message that you see in Figure 6-100 on page 221 indicates that the Web Administration Tool is retrieving the information required to establish an agreement from the new master server. In our scenario, it is rchas01.itso.com:389. Click **OK**.

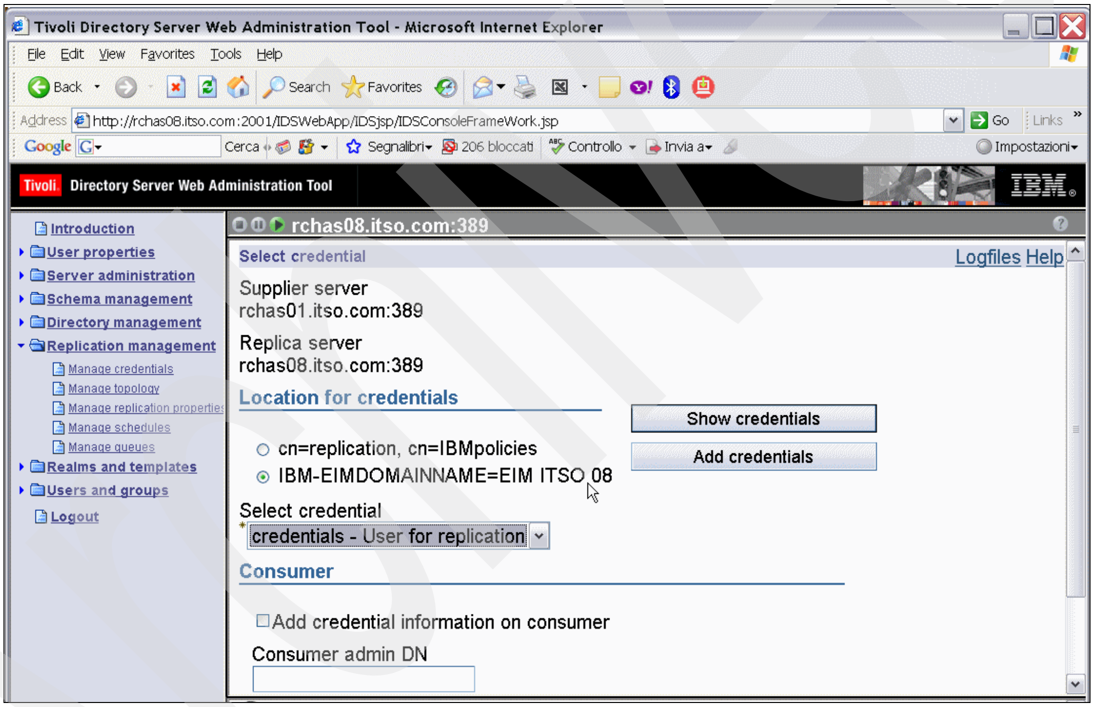

rchas08.itso.com:389

The manage topology function will now collect information for agreements from the other master servers to replicate to this replica.

Figure 6-100 Directory Server Web Administration - Message

50. Because you created the credentials in Step 14 on page 195, store them in the replicated subtree IBM-EIMDOMAINNAME=EIM ITSO 08. They are available also on the replica server, which is becoming a supplier (another master) in the same replication topology.

    Thus, select the replicated subtree **IBM-EIMDOMAINNAME=EIM ITSO 08** and click **Show credentials**. As shown in Figure 6-101 in the navigation menu, select **credentials** and click **OK** at the bottom of the page.


Tivoli Directory Server Web Administration Tool - Microsoft Internet Explorer

rchas08.itso.com:389

Select credential

Supplier server
rchas01.itso.com:389

Replica server
rchas08.itso.com:389

Location for credentials

○ cn=replication, cn=IBMpolicies
● IBM-EIMDOMAINNAME=EIM ITSO 08

Select credential
credentials - User for replication

Consumer

□ Add credential information on consumer

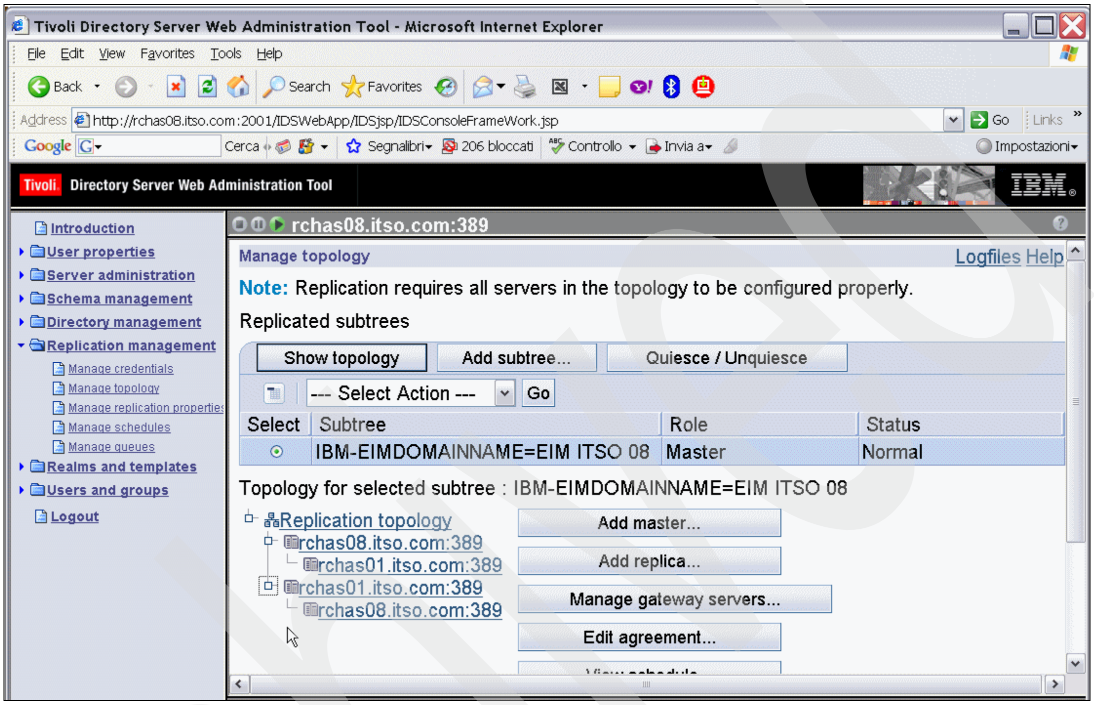
Consumer admin DN

Figure 6-101 Directory Server Web Administration - Select credential

51. You have completed the configuration of the master-master replication.

As you can see in Figure 6-102, in the IBM-EIMDOMAINNAME=EIM ITSO 08 replication topology, rchas08.itso.com:389 is a master server of rchas01.itso.com:389, which is the replica. Note that because rchas01.itso.com:389 is also a master server, rchas08.itso.com:389 is its replica.

Click **Close** at the bottom of the page to close the manage topology task and then click **Logout** in the left pane.



Manage topology

Note: Replication requires all servers in the topology to be configured properly.

Replicated subtrees

Select	Subtree	Role	Status
●	IBM-EIMDOMAINNAME=EIM ITSO 08	Master	Normal

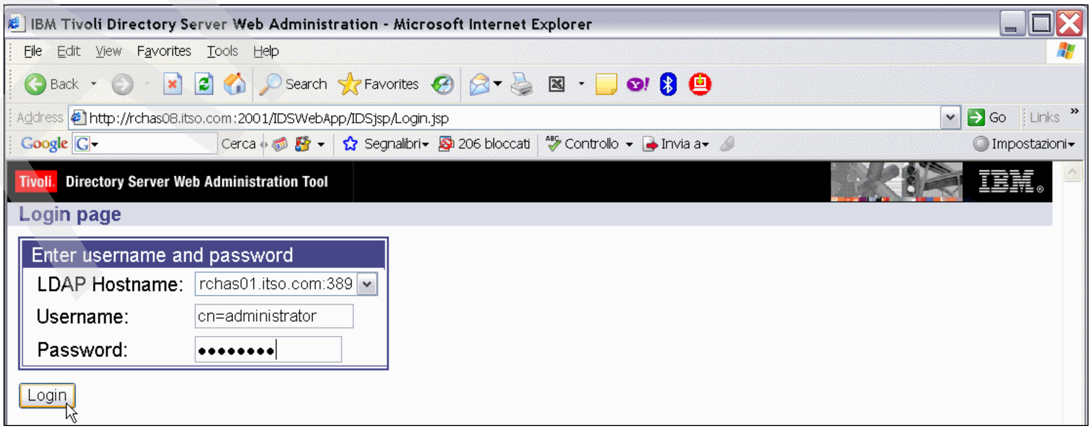
Topology for selected subtree : IBM-EIMDOMAINNAME=EIM ITSO 08

- Replication topology
  - rchas08.itso.com:389
    - rchas01.itso.com:389
  - rchas01.itso.com:389
    - rchas08.itso.com:389

Figure 6-102 Directory Server Web Administration - Manage topology updated

52.The master-master topology is now set up. Start the replication as in Step 37 on page 213 to resume the replica queue on the new master.

In the Directory Server Web Administration Tool, as shown in Figure 6-103, log on with cn=Aministrator. Select **rchas01.itso.com:389** as the LDAP Hostname, enter `cn=Administrator` as the Username, and its relative password in the Password field. Click **Login**.


IBM Tivoli Directory Server Web Administration - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://rchas08.itso.com:2001/IDSWebApp/IDSjsp/Login.jsp
Go Links
Google Cerca Segnalibri 206 bloccati Controllo Invia a Impostazioni
Tivoli Directory Server Web Administration Tool
IBM
Login

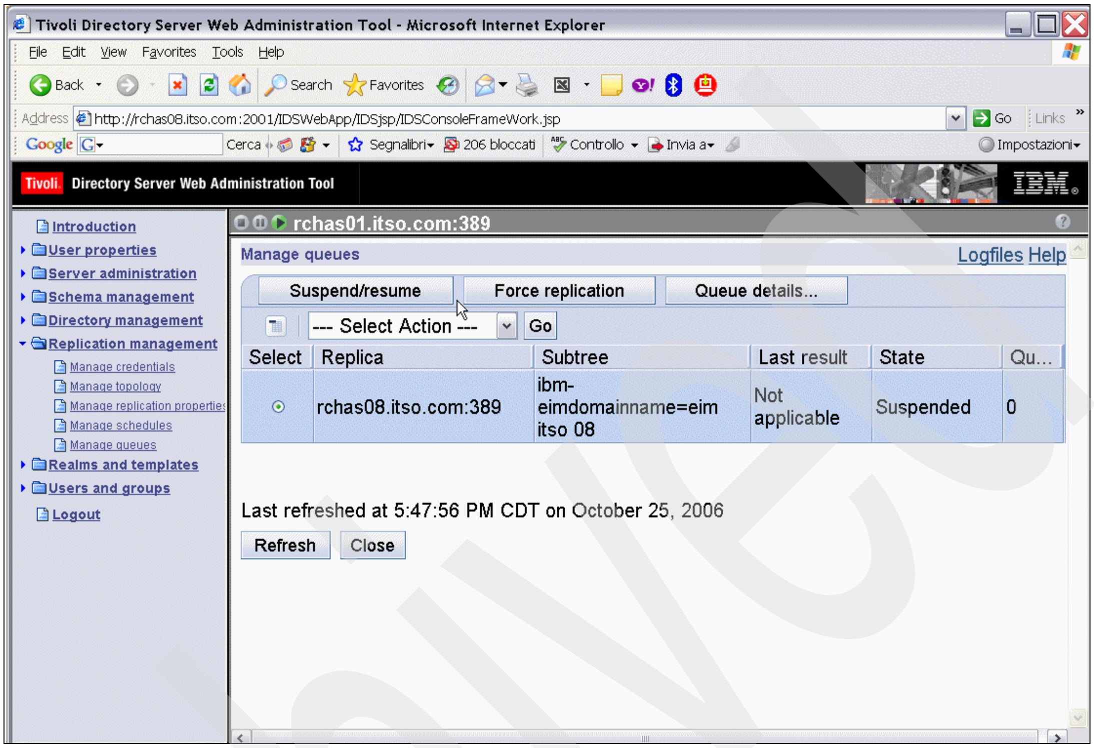
Login page

Enter username and password

LDAP Hostname:	rchas01.itso.com:389
Username:	cn=administrator
Password:	••••••••

Figure 6-103 Directory Server Web Administration - Login on rchas01.itso.com:389 server

53. As shown in Figure 6-104, when you log in, expand **Replication management** in the left pane and click **Managed queues**. In the right pane, you can see that the replica state is **Suspended**. Select the replica server **rchas08.itso.com:389** and click **Suspend/resume**.

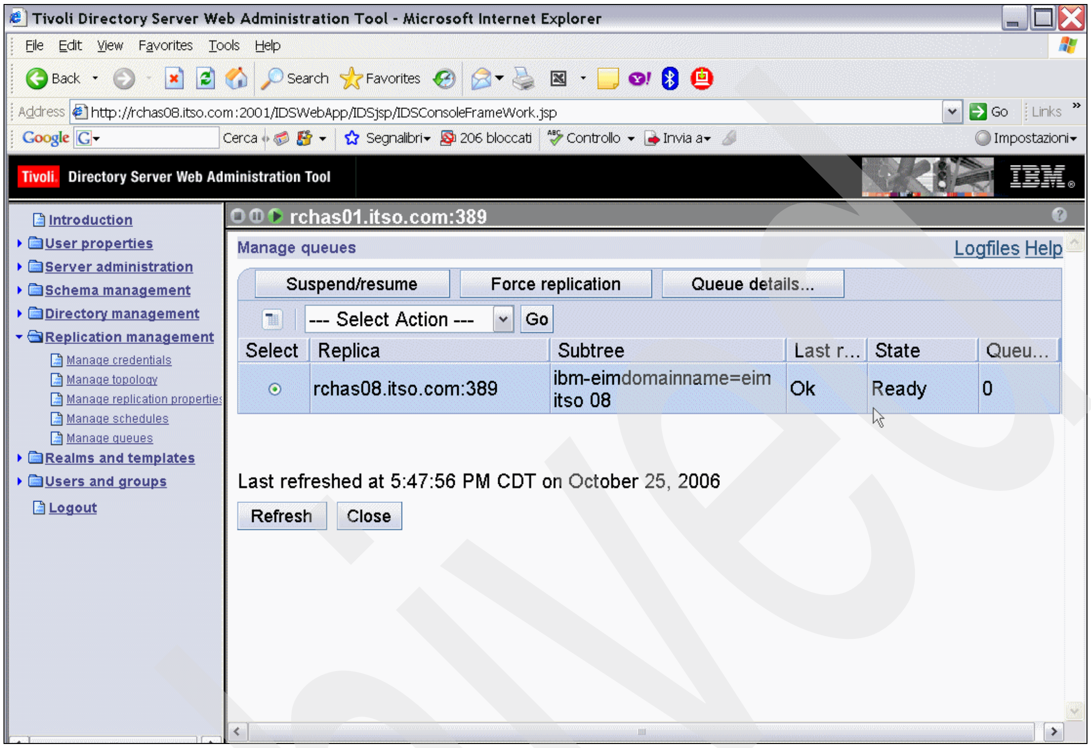


Select	Replica	Subtree	Last result	State	Qu...
⦿	rchas08.itso.com:389	ibm-eimdomainname=eim itso 08	Not applicable	Suspended	0

Last refreshed at 5:47:56 PM CDT on October 25, 2006

Figure 6-104 Directory Server Web Administration - Manage queues

54. The state of the replica queue is now **Ready** (Figure 6-105). Click **Close** to complete the task and **Logout** in the left pane. You have now successfully completed the master-master settings and activated the replication.



Select	Replica	Subtree	Last r...	State	Queu...
●	rchas08.itso.com:389	ibm-eimdomainname=eim itso 08	Ok	Ready	0

Last refreshed at 5:47:56 PM CDT on October 25, 2006

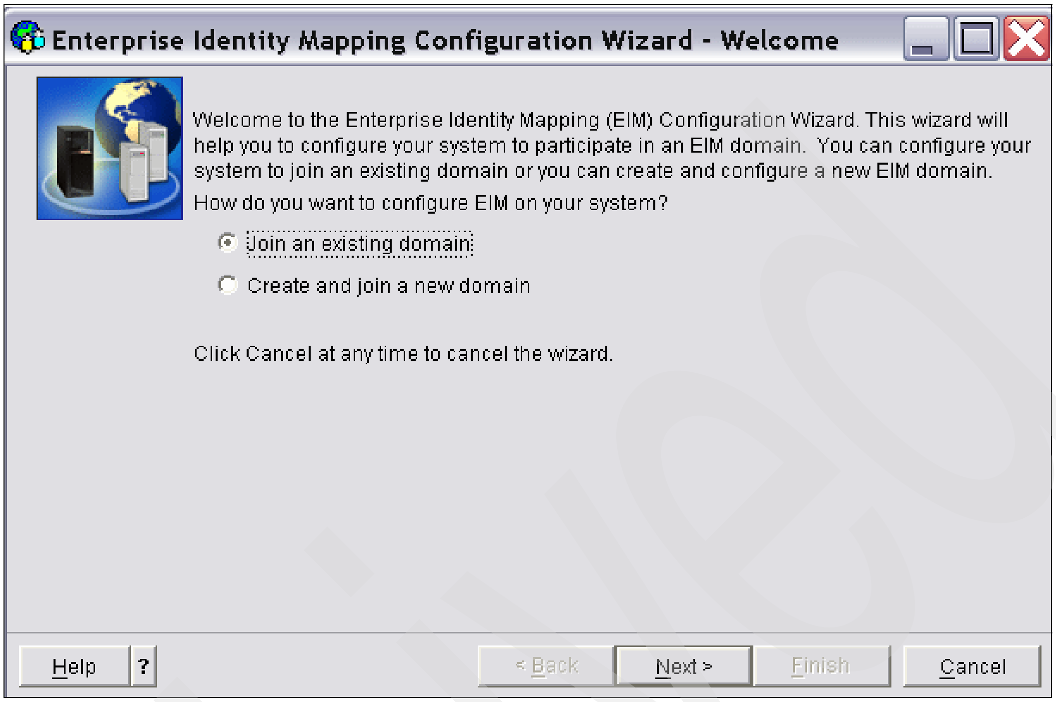
Figure 6-105 Directory Server Web Administration, Resumed replica queue

55. Back to the goal of our scenario, we wanted to set up the master-master replica to assure high availability of the EIM domain server. At this point, the replication subtree IBM-EIMDOMAINNAME=EIM ITSO 08 is replicated on both the production and test system directory servers. However, the EIM on the test system is not configured yet to update the existing EIM domain with the iSeries Navigator EIM wizard. We refer to the production system as rchas08 and the test system as rchas01.

To do that, in an iSeries Navigator session, expand ***your test system connection*** → **Network** → **Enterprise Identity Mapping**. Right-click **Configuration** and select **Configure**.

If you see the **Reconfigure** option instead of **Configure**, it indicates that the EIM has already been configured. You can either reconfigure it (the reconfiguration proceeds in a similar way to the configuration), or you can right-click **Configuration** and select **Properties** to verify that the current configuration is appropriate for your network. You also need to check if the EIM domain is already configured.

56. The Enterprise Identity Mapping configuration wizard welcome window opens as shown in Figure 6-106. Select **Join an existing domain** and click **Next**.



Enterprise Identity Mapping Configuration Wizard - Welcome

Welcome to the Enterprise Identity Mapping (EIM) Configuration Wizard. This wizard will help you to configure your system to participate in an EIM domain. You can configure your system to join an existing domain or you can create and configure a new EIM domain.

How do you want to configure EIM on your system?

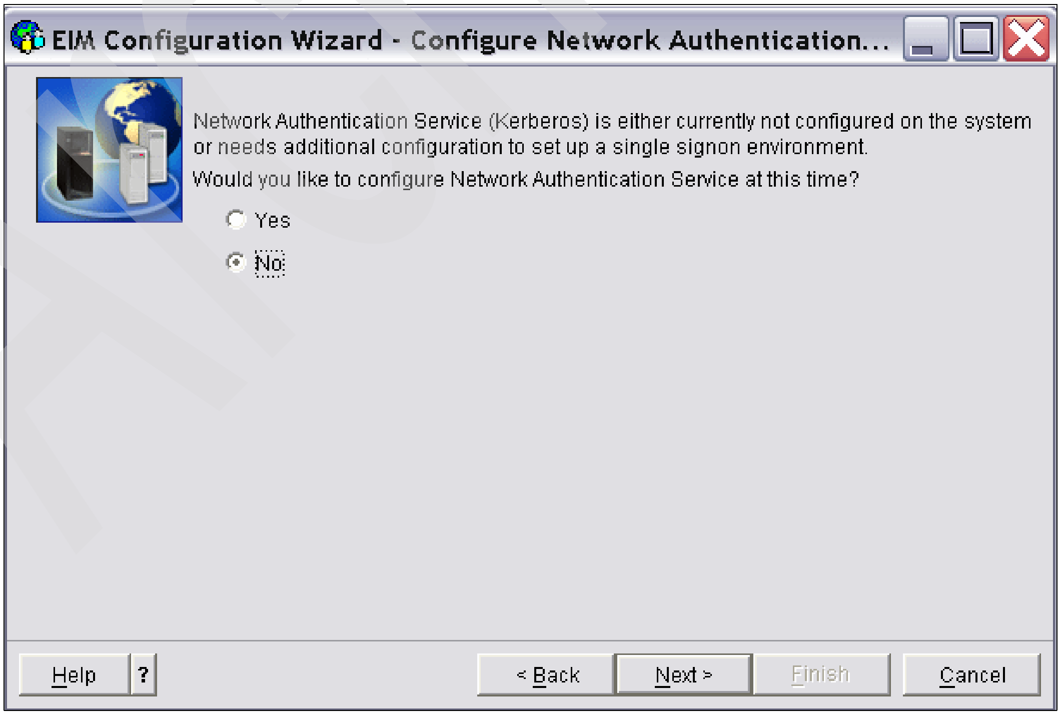
● Join an existing domain

○ Create and join a new domain

Click Cancel at any time to cancel the wizard.

Figure 6-106 ISeries Navigator - EIM Configuration Wizard

57. We assume that the Network Authentication Service is already configured on this system. If not, you can configure it later using the instructions in 6.4.1, “Configuring NAS” on page 145. As shown in Figure 6-107, select **No** and click **Next**.



EIM Configuration Wizard - Configure Network Authentication...

Network Authentication Service (Kerberos) is either currently not configured on the system or needs additional configuration to set up a single signon environment.

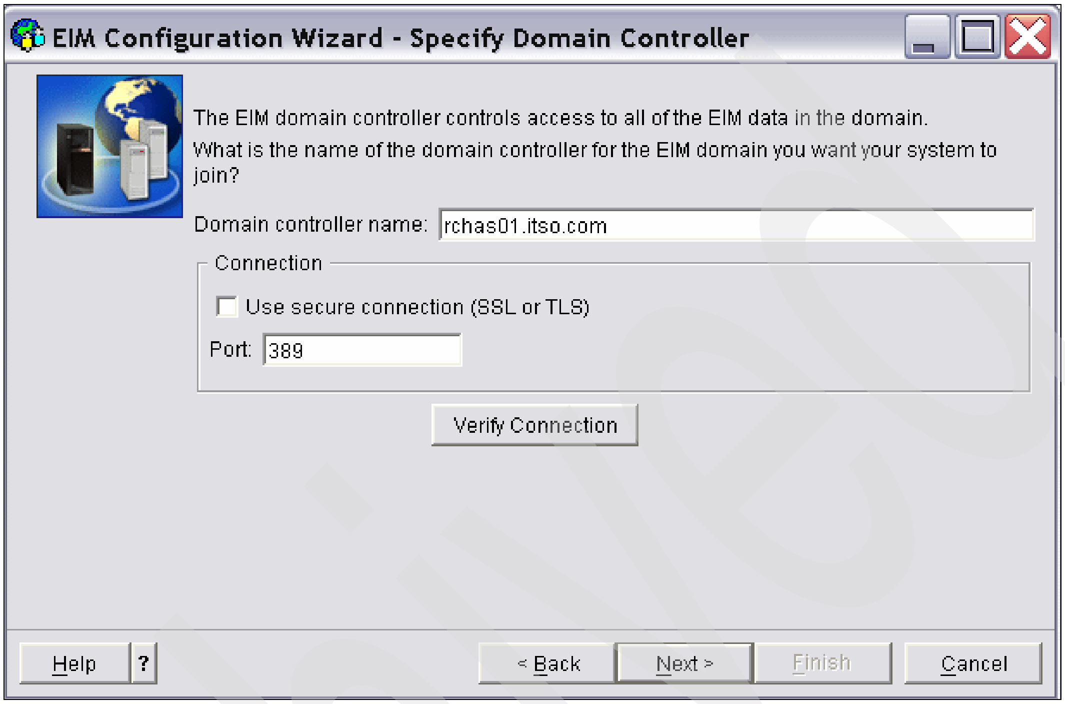
Would you like to configure Network Authentication Service at this time?

○ Yes

● No

Figure 6-107 EIM Configuration Wizard - Configure NAS

58. Enter the IP address or the name of the test system, and the port number. As you can see in Figure 6-108, the test system accesses the replicated EIM domain on the local directory server. In our scenario, rchas01.itso.com is the domain controller name and 389 is the port. Click **Next**.



EIM Configuration Wizard - Specify Domain Controller

The EIM domain controller controls access to all of the EIM data in the domain.

What is the name of the domain controller for the EIM domain you want your system to join?

Domain controller name: rchas01.itso.com

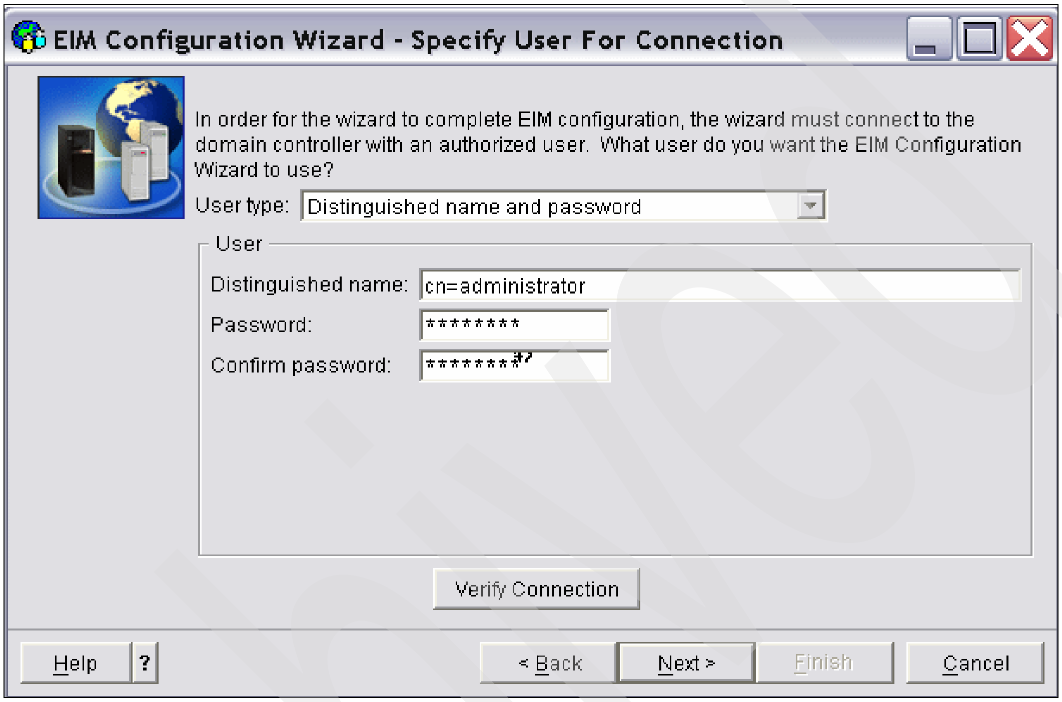
Connection

☐ Use secure connection (SSL or TLS)

Port: 389

Figure 6-108 EIM Configuration Wizard, Specify Domain Controller

59. As shown in Figure 6-109, enter the DN and password to access the domain controller specified. Enter `cn=administrator` as the DN and its relative password in the Password and Confirmation password fields. Click **Verify Connection** if you want to verify the connection with the directory server before proceeding with the rest of the EIM configuration and to see if the DN and password specified are correct. Otherwise, when your are done with the verification, click **Next**.



EIM Configuration Wizard - Specify User For Connection

In order for the wizard to complete EIM configuration, the wizard must connect to the domain controller with an authorized user. What user do you want the EIM Configuration Wizard to use?

User type: Distinguished name and password

User

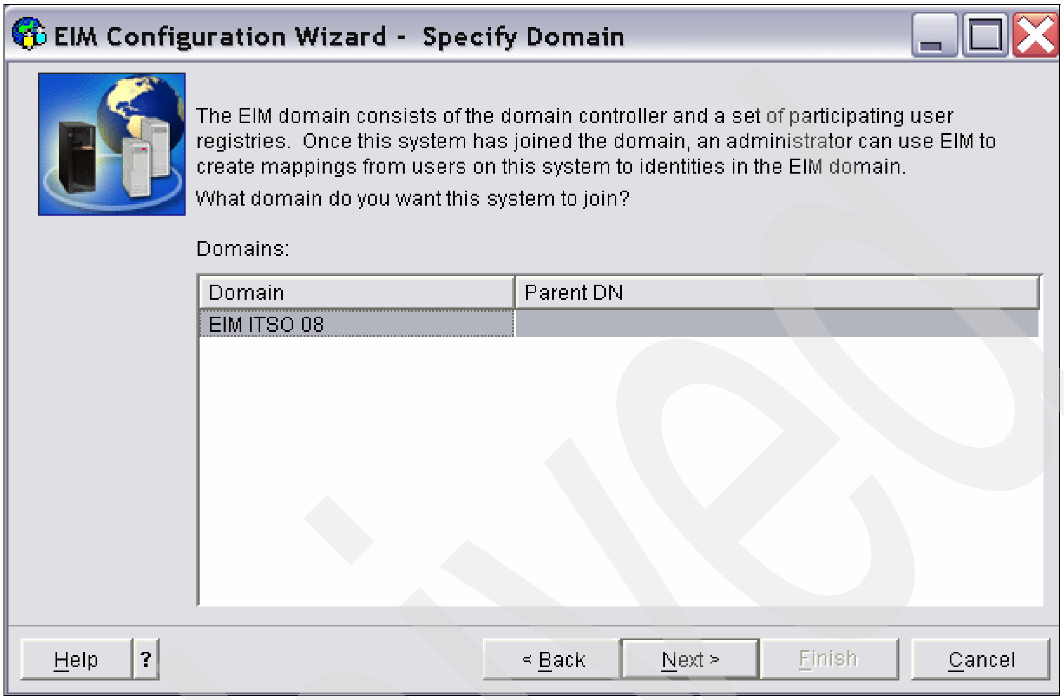
Distinguished name: cn=administrator

Password: ********

Confirm password: ********

Figure 6-109 EIM Configuration Wizard - Specify User for Connection

60. The EIM Configuration wizard retrieves the available EIM domain present on the test system's directory server. As you can see in Figure 6-110, the EIM ITSO 08 domain is shown. Select it and click **Next**.



EIM Configuration Wizard - Specify Domain

The EIM domain consists of the domain controller and a set of participating user registries. Once this system has joined the domain, an administrator can use EIM to create mappings from users on this system to identities in the EIM domain.

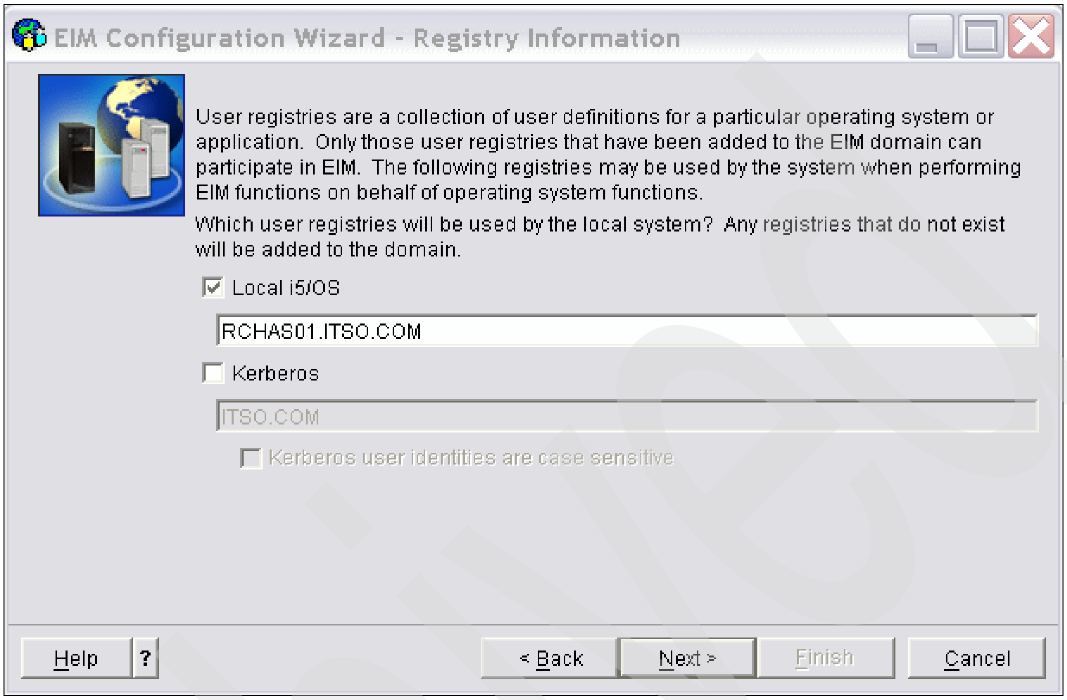
What domain do you want this system to join?

Domains:

Domain	Parent DN
EIM ITSO 08	

Figure 6-110 EIM Configuration Wizard - Specify Domain

61. In the Registry Information window (Figure 6-111), check **Local i5/OS** to automatically add it to the EIM domain. Because we are joining the existing domain, the Kerberos realm is already known. Click **Next** to proceed.



EIM Configuration Wizard - Registry Information

User registries are a collection of user definitions for a particular operating system or application. Only those user registries that have been added to the EIM domain can participate in EIM. The following registries may be used by the system when performing EIM functions on behalf of operating system functions.

Which user registries will be used by the local system? Any registries that do not exist will be added to the domain.

☑ Local i5/OS

RCHAS01.ITSO.COM

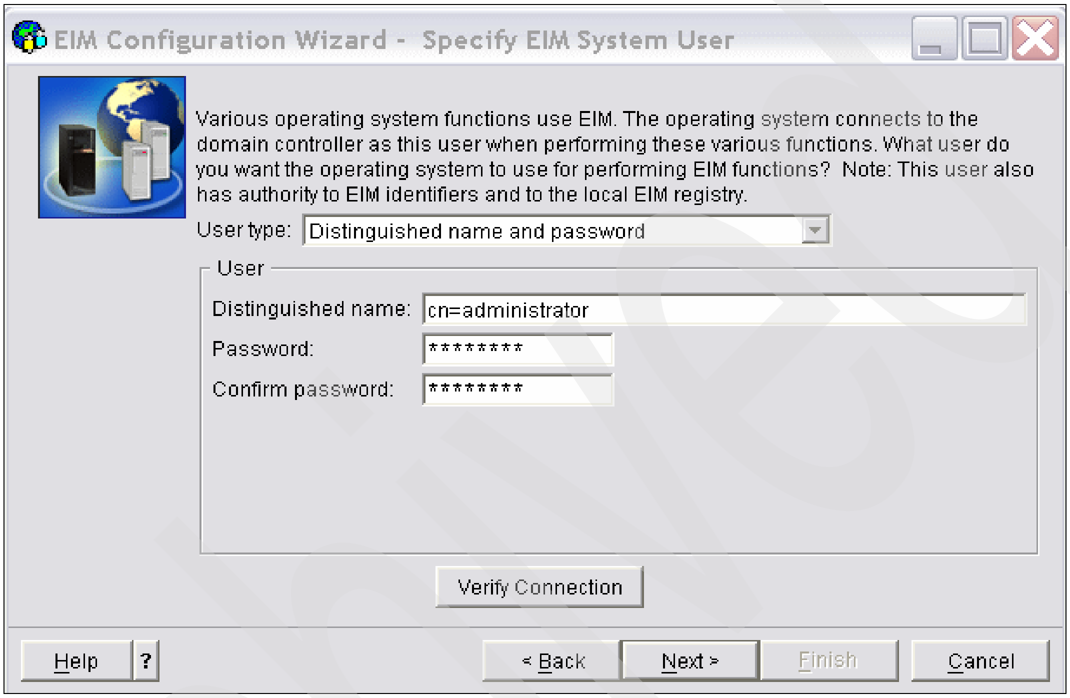
☐ Kerberos

ITSO.COM

☐ Kerberos user identities are case sensitive

Figure 6-111 EIM Configuration Wizard - Registry Information

62. Specify the DN and password that the iSeries Navigator EIM wizard will use to access the domain controller to perform various EIM functions. As shown in Figure 6-112, enter `cn=administrator` in the Distinguished name field and its relative password in the Password and Confirmation password fields. Click **Verify Connection** if you want to verify the connection with the directory Server before proceeding with the rest of EIM configuration and to see if the DN and password specified are correct. Otherwise, when you are done with the verification, click **Next**.



EIM Configuration Wizard - Specify EIM System User

Various operating system functions use EIM. The operating system connects to the domain controller as this user when performing these various functions. What user do you want the operating system to use for performing EIM functions? Note: This user also has authority to EIM identifiers and to the local EIM registry.

User type: Distinguished name and password

User

Distinguished name: cn=administrator

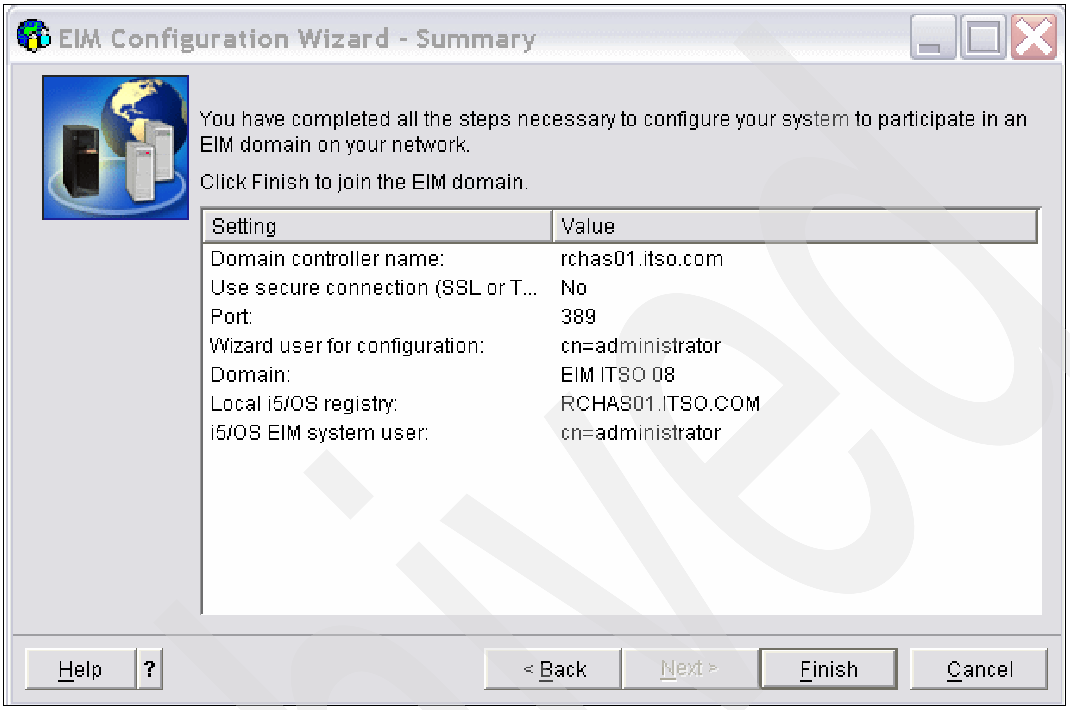
Password: ********

Confirm password: ********

Figure 6-112 EIM Configuration Wizard - Specify EIM System User

63. The Summary window (Figure 6-113) recaps the settings you have specified. Verify that they are accurate and click **Finish**.

The EIM configuration wizard proceeds with the configuration, it can take a few minutes. A window informs you on the status for each configuration step.



EIM Configuration Wizard - Summary

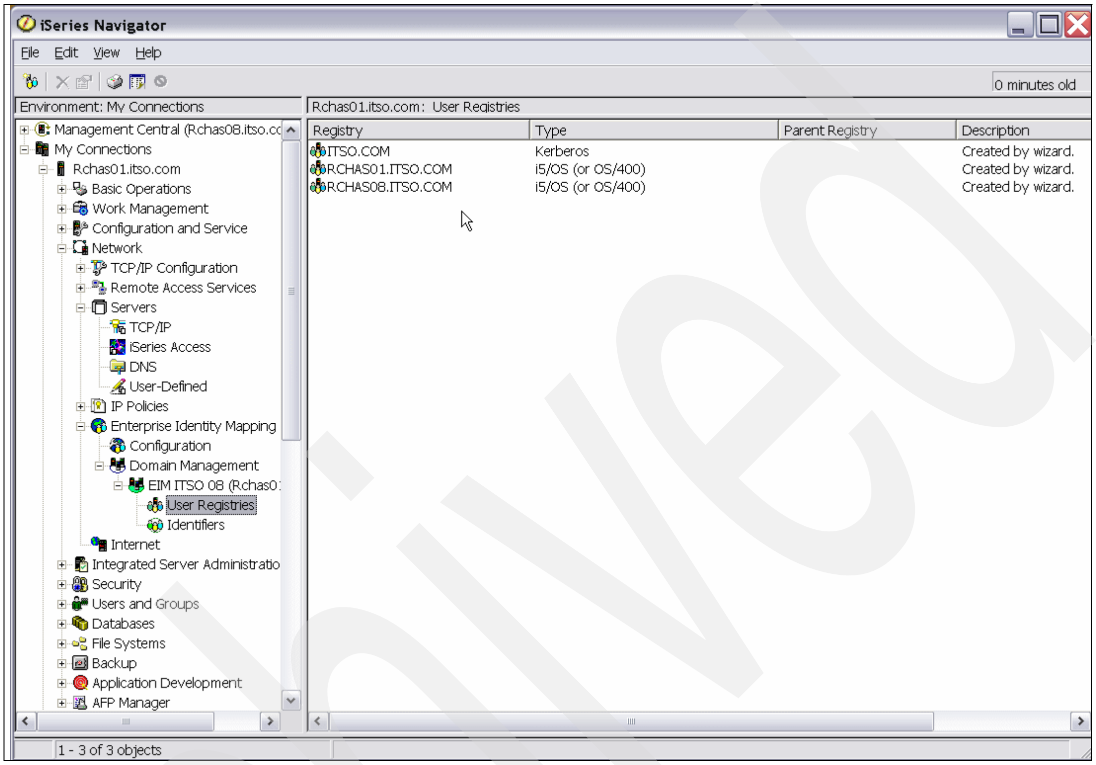
You have completed all the steps necessary to configure your system to participate in an EIM domain on your network.

Click Finish to join the EIM domain.

Setting	Value
Domain controller name:	rchas01.itso.com
Use secure connection (SSL or T...	No
Port:	389
Wizard user for configuration:	cn=administrator
Domain:	EIM ITSO 08
Local i5/OS registry:	RCHAS01.ITSO.COM
i5/OS EIM system user:	cn=administrator

Figure 6-113 EIM Configuration Wizard - Summary window

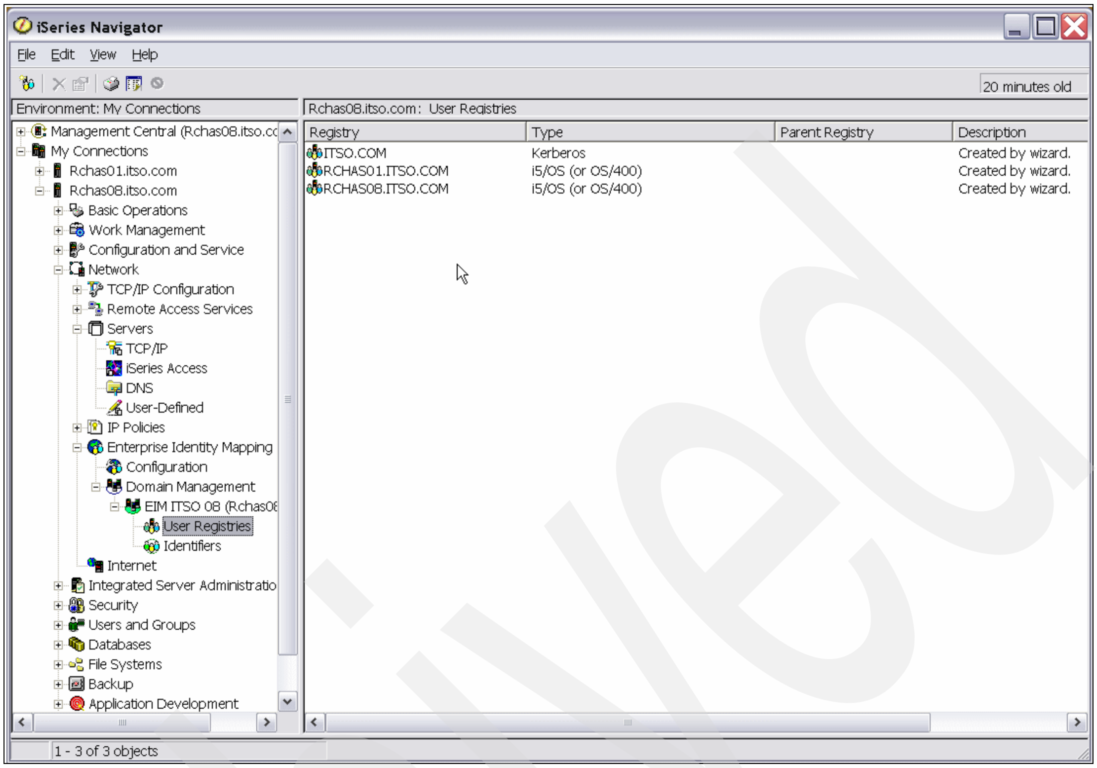
When the wizard has finished, verify that the new updates and the previous data are present. Expand ***your test system connection*** → **Network** → **Enterprise Identity Mapping** → **Domain Management** → ***your eim domain*** and right-click **User Registries**. As shown in Figure 6-114, the user registries list shows both i5/OS systems and the Kerberos realm.



Registry	Type	Parent Registry	Description
ITSO.COM	Kerberos		Created by wizard.
RCHAS01.ITSO.COM	i5/OS (or OS/400)		Created by wizard.
RCHAS08.ITSO.COM	i5/OS (or OS/400)		Created by wizard.

Figure 6-114 ISeries Navigator - User registries list on test system

Similarly, you can see the same result on the production system, as shown in Figure 6-115.



Registry	Type	Parent Registry	Description
ITSO.COM	Kerberos		Created by wizard.
RCHAS01.ITSO.COM	i5/OS (or OS/400)		Created by wizard.
RCHAS08.ITSO.COM	i5/OS (or OS/400)		Created by wizard.

Figure 6-115 ISeries Navigator - User registries list on production system

The EIM domain is now backed up. If there is a problem with the directory server on the production system, the directory server on the test one can completely take over of its role in the EIM domain. So far, we have walked through all the necessary steps to set up the replica. However, high availability is a complex topic that you need to consider for all the system applications and services. Thus, the EIM fail-over plan needs to follow the company fail-over policies. This chapter does not cover such a complex topic, but here are a few examples of how to implement it:

- You can use a *network dispatcher* in your network that routes the LDAP client requests to the preferred and available directory server. The dispatcher can route the new LDAP connections to the highest priority active server based on the rules that give different priorities, and on the advisor monitor's setting that provides the status connection feedback. You can also use this implementation for faster searches. LDAP requests can spread among several different servers, all having the same content, instead of a single server. This improves the response time for the request completion.
- You can use *virtual IP address takeover*. You can bind directory servers to the same virtual IP address on each system with "proxy Address Resolution Protocol (ARP)" enabled, but only the virtual IP on the preferred directory server system is active. Then, creating a heartbeat program, you can monitor the directory server, or the virtual IP to check its availability. When it goes down, the program starts the virtual IP on the backup system and the proxy ARP routes the new LDAP connections to it.

As mentioned, the goal is to provide an opportunity to include the EIM domain in your high availability policy. The examples above are two of several ways for a failure takeover plan. The main goals are awareness of possible problems related to the unavailability of data in your business and how to reduce or avoid those problems.

6.6 Single sign-on tips

The following applications can take advantage of the password elimination single sign-on solution on i5/OS:

- i5/OS V5R2 and later
- PC5250 and Telnet
- iSeries Access for Windows and i5/OS Host Servers
- IBM WebSphere Host On-Demand V8.0.2 (IP22808) and later
- iSeries NetServer
- Structured Query Language (SQL)/Distributed Relational Database Architecture™ (DRDA®)
- Distributed Data Management (DDM)
- QFileSvr.400
- Apache Web server, available at r520 with additional PTFs
- LDAP
- iSeries Access for Web
- WebFacing
- WebSphere Development Studio Client Web tools

When users implement password elimination SSO, they can access i5/OS with an expired password because Kerberos tickets, and not passwords, are used for authentication. However, this does not work if their corresponding user profiles are disabled.

Domino has multiple SSO options that include:

- SSO for Lotus® Notes® client
- Lotus Instant Messaging and Web Conferencing (Sametime®) SSO
- Web-based SSO

For more detail, see *Security Considerations in Lotus Notes and Domino 7: Making Great Security Easier to Implement,* SG24-7256.

Let us a look at other platforms rather than the i5/OS-enabled for password elimination SS0 solution:

- Windows 2000 and 2003 server
- Windows 2000 and XP Professional client
- AIX
- Linux (You can download for free native on Red Hat Linux while on SuSE and most other non-USA Linux that implement the Heimdal version.)
- z/OS

By implementing password elimination SSO, users will have less downtime organizing and managing passwords. Ongoing administration costs are reduced because the overhead of password related Help Desk calls and the number of user registries decrease. An additional benefit is added security on your network. From a business view, you have a more secure network that costs less to maintain. Implementing password elimination reduces the risk to lose or compromise passwords to only one.

Users need to remember one password only. This might avoid a security hazard, such as writing down several passwords on paper.

The network administrator can also improve desktop security by implementing the Windows group policy. Group policies are powerful. The administrator can enable the group policy at the domain level and control these settings so that users cannot change them. The administrator can control the desktop screen saver settings on the users' computers by using the wait time before the screen saver starts and on the "On resume, password protect" check box.

7

Securing Telnet for iSeries access using SSL

The *Transport Layer Security* (TLS) and its predecessor *Secure Socket Layer* (SSL) are widely known and used protocols that assure an end-to-end encrypted communication session based on the certificates exchange. For simplicity, we refer to them as SSL. By activating an SSL session, you also achieve data integrity and authentication of the server and, optionally, of the client.

This chapter provides a practical scenario on how to protect your iSeries access connections over the network, and eventually how to control accesses into the i5/OS server with the SSL client authentication.

Here, you can find the list of ports that iSeries access requires. This list might be necessary to open if your i5/OS server is protected by a firewall or any other mechanism.

For information about the theory of SSL protocol, see *TCP/IP Tutorial and Technical Overview*, SG24-7287.

7.1 Scenario description

Here we have a company that produces DVDs and deals with the shops rather than direy selling to the consumers. Figure 7-1 shows their network layout.

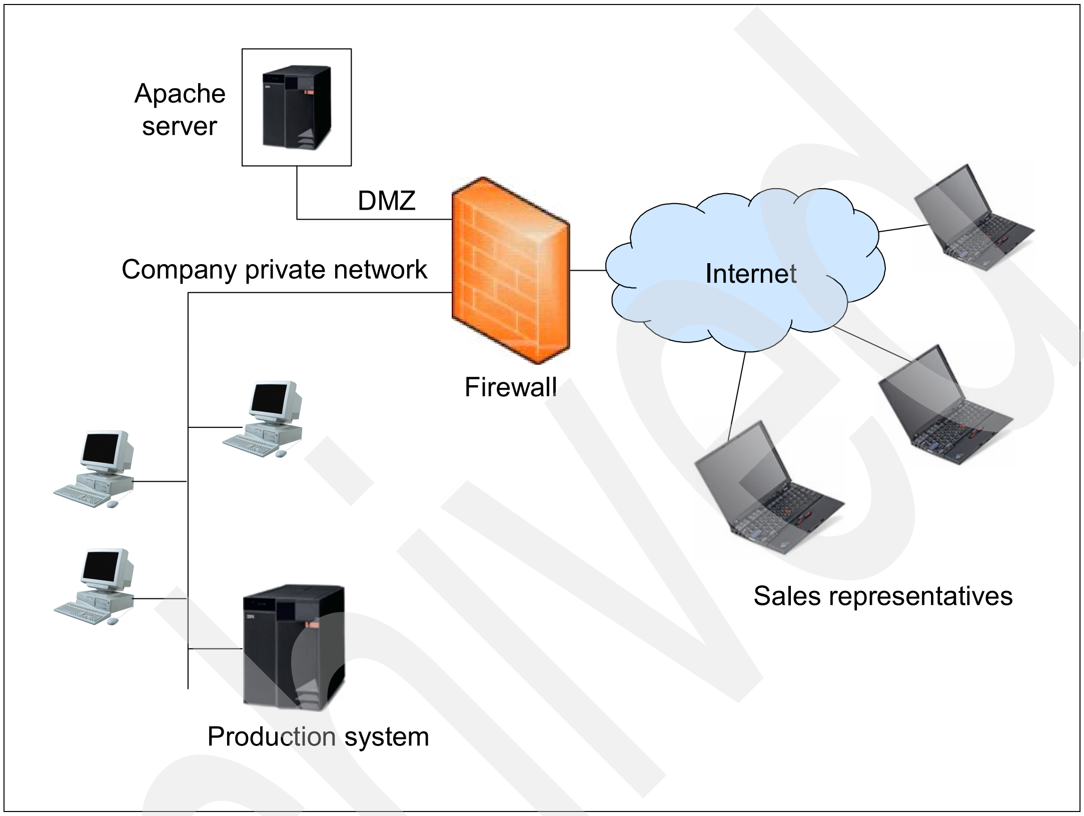


Figure 7-1 Company network layout

The shops can always consult, via the browser, the online catalog on a Web site hosted on an i5/OS server. However, there are sales representatives who visit the point of sales to collect their orders. The sales representatives travel all day long, many are far from their headquarter. Therefore, they input the orders and check for product availability with the i5/OS server using iSeries access connected via Internet.

The production system i5/OS server and all the PCs network in the headquarter are connected to Internet via a secure gateway. A firewall protects the company private network.

The other i5/OS server with the Apache server that serves the products catalog in a graphical frame is in a DMZ. See Chapter 2, “Building a DMZ with i5/OS” on page 15 for details and implications related to security aspects of the DMZ.

The name of that server is well-known and published in the public DNS. On the other hand, the production i5/OS server has a private IP address, The firewall masquerades it with a public one, which is not solved by the public DNS server.

> **Tip:** Not publishing the i5/OS server’s IP address in the public DNS server does not mean that the i5/OS server in the private network is safe. You can always scan it to see the open ports, but at least it is not under the reflectors.

The data transmitted by or to the sales representatives are sensitive. Therefore, the company decided to protect those transmissions via SSL and to authenticate the clients before accepting the Telnet requests.

Notice that, according to this company’s security policy, it is not enough to activate only the basic SSL. Basic SSL provides only the data encryption, the data integrity, and the server authentication, but not on the client side. Without the client authentication function enabled, the System i server accepts all the Telnet requests coming from the 992 port. In that case, the safety of the system is demanded only to the sign-on window with user and password authentication. This is good protection, but you need to consider multiple windows to protect the core of the business data. To ensure that only their sales representatives can access the database to order or query the stock information, they decide to activate the SSL client authentication option. The i5/OS server validates and eventually accepts the client requests before serving the sign-on window (only if they are trusted).

On the local network, users can still work with the non-secure iSeries access connection. However, on the firewall, the only required SSL ports are open. See 7.2.2, “SSL port required for iSeries access” on page 239 for the list of ports for applications. This way, privacy is guaranteed for the transmitted data and validation is guaranteed for incoming requests.

Tip: It is a good security policy to control which ports are open on the i5/OS server itself, not just on the firewall, for listen status.

7.2 SSL implementation and iSeries access configuration

If you want to enable SSL on your iSeries access connections, see *iSeries Access for Windows V5R2 Hot Topics: Tailored Images, Application Administration, SSL, and Kerberos,* SG24-6939. This book implemented the scenario at V5R2. All the considerations and the windows involved are valid for V5R4, except for the prerequisites.

7.2.1 SSL prerequisites

Licensed products are now included in the base code at V5R4. For this version, the prerequisites are:

- IBM Digital Certificate Manager (DCM), option 34 of i5/OS (5722-SS1)
- TCP/IP Connectivity Utilities for iSeries (5722-TC1)
- IBM HTTP Server for iSeries (5722-DG1)
- IBM Developer Kit for Java™ (5722–JV1)
- IBM eServer iSeries Access for Windows, 5722-XE1

Note: At V5R4, license program products 5722AC3, Cryptographic Access Provider and 5722-CE3, and SSL Client Encryption at 128 bit are no longer required. The function of the first one is now integrated into the operating system, while the function of the second one is now integrated into the 5722-XE1, iSeries Access for Windows.

7.2.2 SSL port required for iSeries access

Table 7-1 on page 240 lists servers and ports used by iSeries access and their corresponding SSL ports.

Table 7-1 Client Access Express servers and port numbers

Server	Port	SSL port	Description
Port Mapper as-svrmap	449	N/A	Returns the port number for the requested server.
Central as-central as-central-s	8470	9470	Used when a client access license is required, and also for downloading translation tables.
Database as-database as-database-s	8471	9471	Used for accessing the AS/400 database.
Data Queue as-dtaq as-dtaq-s	8472	9472	Allows access to the AS/400 data queues, used for passing data between applications.
File Server as-file as-file-s	8473	9473	Used for accessing any part of the AS/400 file system.
Print as-netprt as-netprt-s	8474	9474	Used to access printers known to the AS/400 system.
Remote Command as-rmtcmd as-rmtcmd-s	8475	9475	Used to send commands from a PC to an AS/400 system and for program calls.
Sign-on as-signon as-signon-s	8476	9476	Used for every Client Access connection to authenticate users and to change passwords.
Web Admin as-admin-http as-admin-http-s	2001	2010	Used to access Web applications served by the AS/400 system.
MAPI as-pop3	5110		Used by the Mail APIs.
DDM ddm ddm-ssl	446	448	Used to access data via Distributed Relational Database Architect (DRDA) and for record level access.
Telnet Telnet Telnet-SSL	23	992	Used to access 5250 emulation.
USF as-usf as-usf-s	8480	N/A	Used for multimedia data.
LDAP	389	636	Provides network directory services.
Mgmt Central as-mgtctrl as-mgtctrl-ss as-mgtctrl-cs	5555	5566 5577	Used to manage multiple AS/400 systems in a network.

Server	Port	SSL port	Description
NetServer	137, 138, 139, 8474[1]	N/A	Allows access to the AS/400 file system from Windows PCs.

[1] The print server on port 8474 is used internally only. Therefore, you do not need to set it in your IP packet filtering rules. However, you must start the print server for NetServer to work properly.

8

Securing FTP using SSL

The *File Transfer Protocol* (FTP) is used mainly to send and receive files in the network. You can also use FTP to rename or delete files and to launch programs or commands on the remote system.

Note that FTP does not encrypt the logon information, thus the user profiles and the passwords exchanged are in plain text in the network.

You might need to protect the data that you want to move because it contains sensitive information. Even if the transmitted data is not sensitive, you need to protect the connection, or at least the login phase. Otherwise, hackers can sniff the data and use it to penetrate a secure network.

This chapter provides a step-by-step configuration for activating a secure FTP either on the client or server side and gives you tips to protect the logging phase only.

For information about FTP, such as the anonymous FTP or the control of operations that a specific user can operate, see the *File Transfer Protocol* topic in the iSeries V5R4 Information Center at:

http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/topic/rzaiq/rzaiqrzairqgetstart.htm

8.1 Scenario description

Here we have the same company that was mentioned in Chapter 7, “Securing Telnet for iSeries access using SSL” on page 237. Now, they need to transfer data to their i5/OS server in a secure way from their software house, which periodically updates their programs. Figure 8-1 illustrates this scenario.

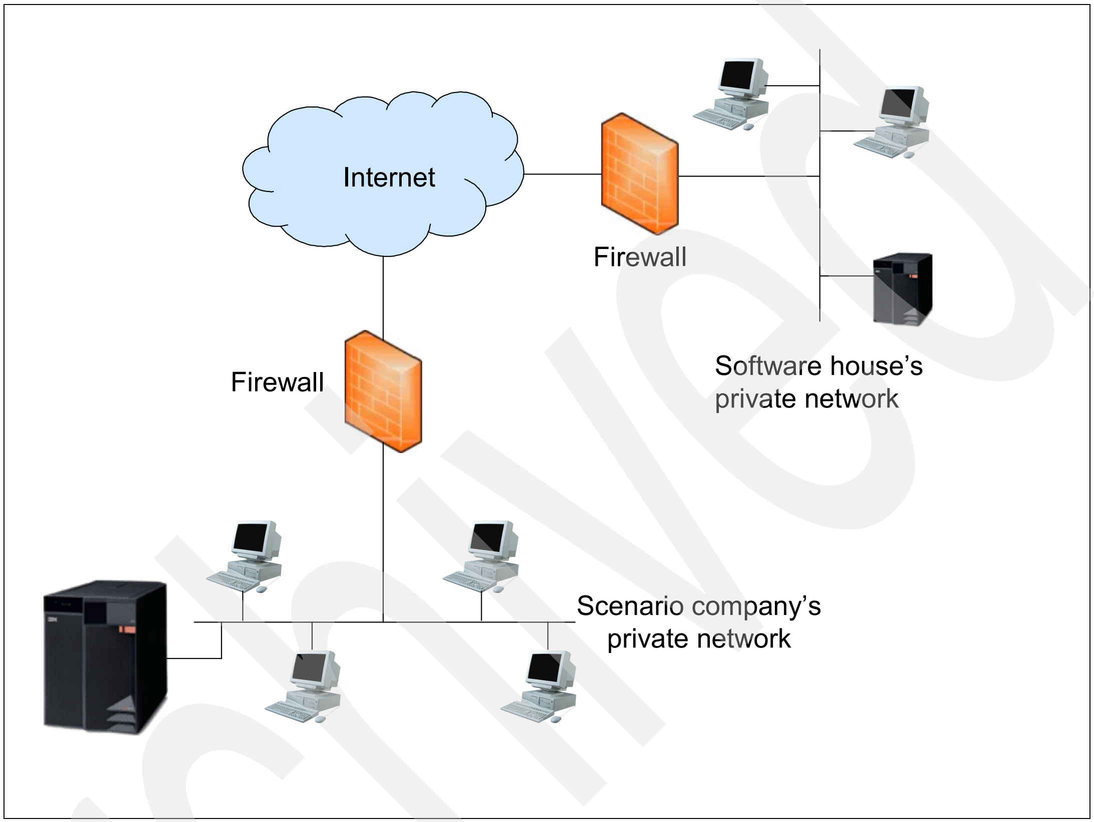

Internet
Firewall
Firewall
Software house’s private network
Scenario company’s private network

Figure 8-1 The company and the software house using Internet accesses to transfer data

The goal is to protect data confidentially during the transmission between the company and their software house. They know each other, so they do not need a public or well-known Certificate Authority (CA). This is a central administrative entity that can issue digital certificates to users and servers, such as VeriSign, to validate their authenticity. For this reason, they decide to use self-signed certificates.

The firewall configurations need to be set up to permit the FTP connection from the software house’s i5/OS server to the company’s i5/OS server. You can find considerations about the necessary ports in Section 8.6, “Tips and techniques” on page 278.

8.2 Planning for a secure FTP implementation

We do not describe in details the Digital Certificate Manager (DCM) parameters. For such information, see *iSeries Security OS/400 DCM and Cryptografic Enhancements*, SG24-6168.

In this scenario, we assume that both the company’s and software house’s i5/OS servers are running V5R4 i5/OS and that they have never configured the systems to use the certificates.

8.2.1 Prerequisites

The SSL prerequisites are valid for both the client and server sides.

Before you configure FTP to use SSL, you must have installed the following prerequisite programs:

- IBM Digital Certificate Manager (DCM), option 34 of i5/OS (5722-SS1)
- TCP/IP Connectivity Utilities for iSeries (5722-TC1)
- IBM HTTP Server for iSeries (5722-DG1)
- IBM Developer Kit for Java (5722–JV1)

1. On an i5/OS command line, type the following command to start the server instance:

   ```
   STRTCPSVR SERVER(*HTTP) HTTPSVR(*ADMIN)
   ```

2. Ensure that the ADMIN server instance is up and running under the QHTTPSVR subsystem. Use the following command to verify that port 2001 is in listen status:

   ```
   NETSTAT *CNN
   ```

For good security, activate the ADMIN instance for maintenance purposes only.

8.3 Step-by-step set up guide for FTP server

To enable the SSL on the FTP server, go through the Digital Certificate Manager (DCM) tasks. In this chapter, we use Microsoft Internet Explorer® v6.0 to run our processes.

1. Start a Web browser. Enter the following URL:

   ```
   http://servername:2001
   ```

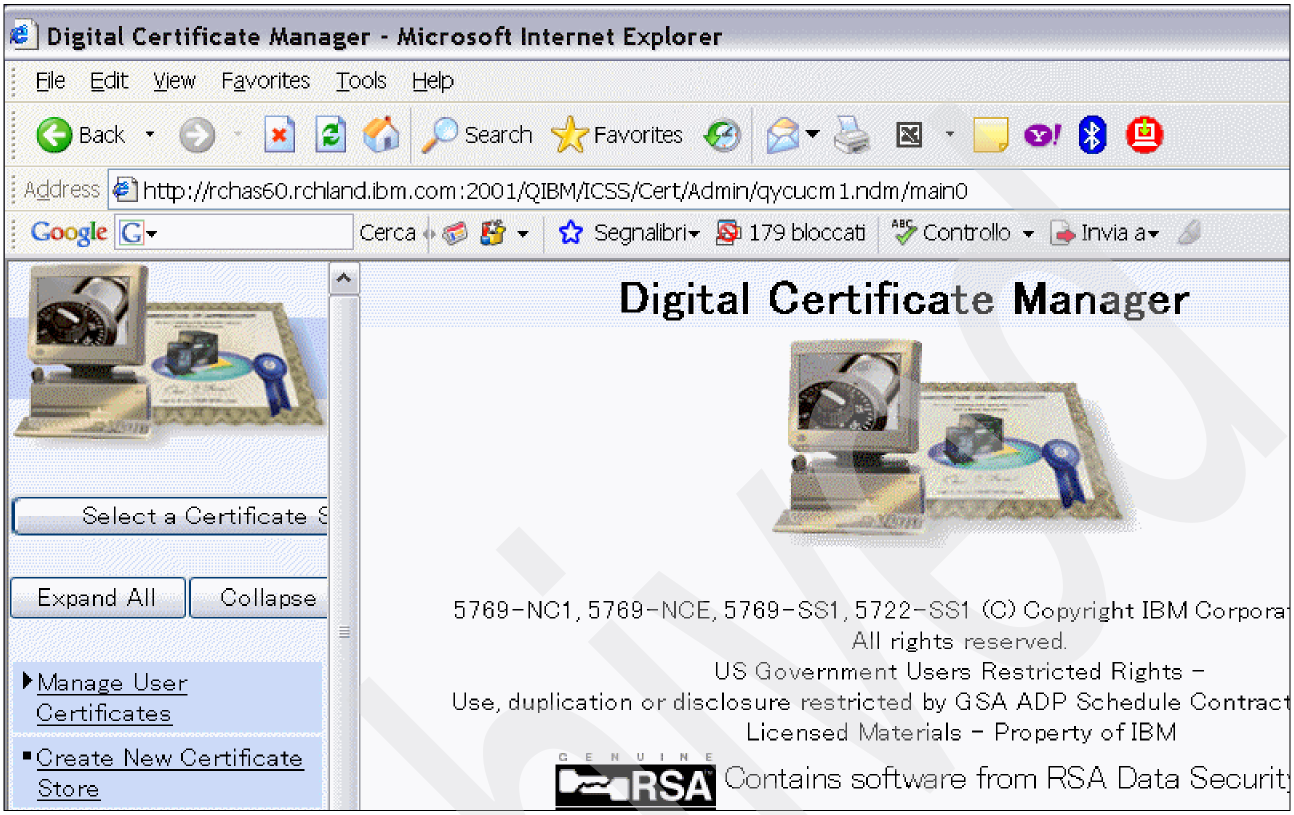
   The URL value *servername* represents the host name or IP address of the company's i5/OS server, which is the FTP server.

2. Sign on to the i5/OS Tasks pop-up using your user profile and password.

> **Note:** To have a fully operational DCM, sign on with a user profile with *ALLOBJ and *SECADM special authorities.

3. Click **Digital Certificate Manager**.

Figure 8-2 shows the page that appears when you select the **Digital Certificate Manager** from the i5/OS Tasks page in a brand new environment.

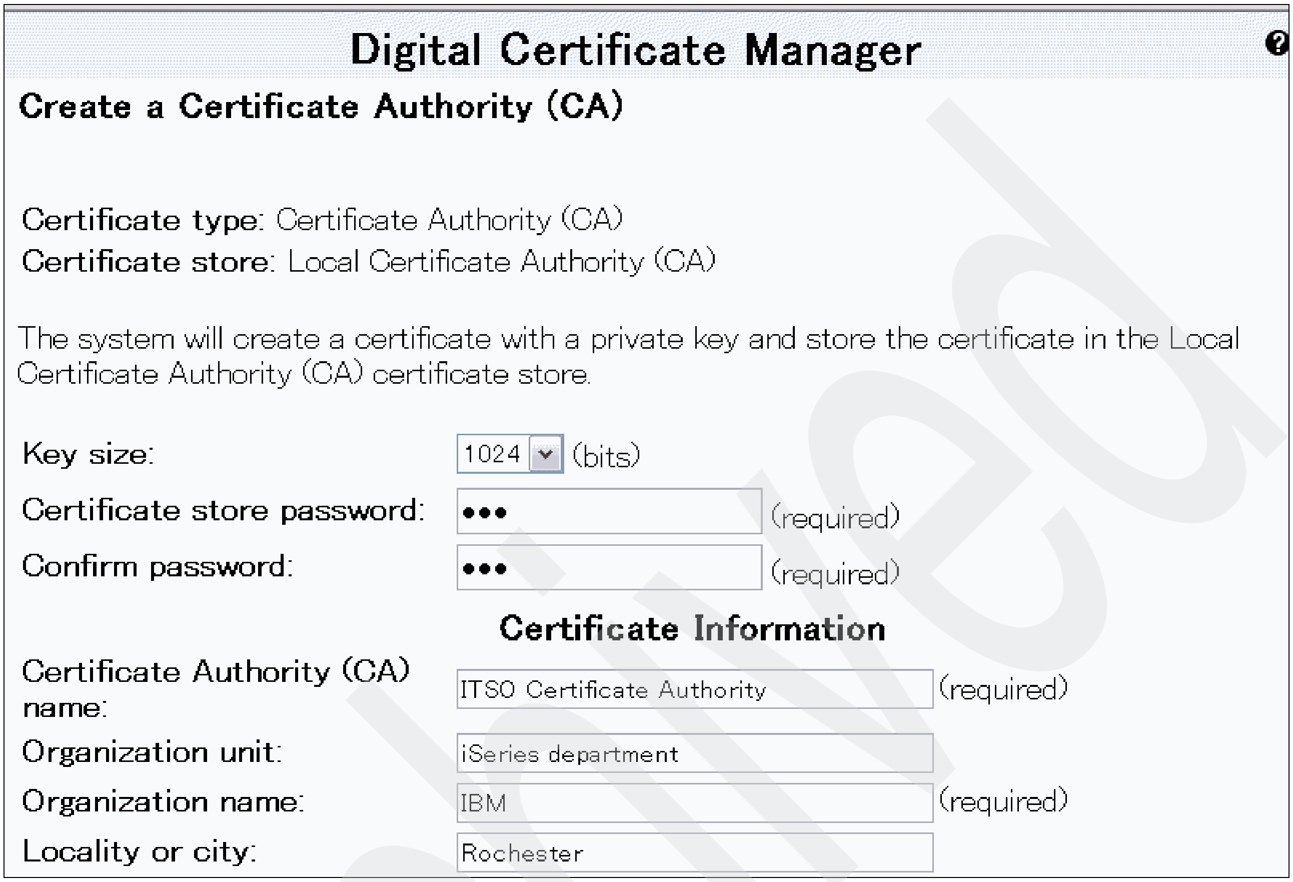

Digital Certificate Manager - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Search
Favorites
Address http://rchas60.rchland.ibm.com:2001/QIBM/ICSS/Cert/Admin/qycucm1.ndm/main0
Google
Cerca
Segnalibri
179 bloccati
Controllo
Invia a
Select a Certificate S
Expand All
Collapse
Manage User Certificates
Create New Certificate Store
Digital Certificate Manager
GENUINE RSA

5769-NC1, 5769-NCE, 5769-SS1, 5722-SS1 (C) Copyright IBM Corporat
All rights reserved.
US Government Users Restricted Rights -
Use, duplication or disclosure restricted by GSA ADP Schedule Contract
Licensed Materials - Property of IBM
Contains software from RSA Data Securit

Figure 8-2 Digital Certificate Manager main page

4. Click **Create a Certificate Authority (CA)** in the left navigation.

The page shown in Figure 8-3 appears. You see parameters requested and values used in this scenario to create the Certificate Authority certificate.



Create a Certificate Authority (CA)

Certificate type: Certificate Authority (CA)
Certificate store: Local Certificate Authority (CA)

The system will create a certificate with a private key and store the certificate in the Local Certificate Authority (CA) certificate store.

Key size: 1024 (bits)
Certificate store password: ••• (required)
Confirm password: ••• (required)

Certificate Information

Certificate Authority (CA) name: ITSO Certificate Authority (required)
Organization unit: iSeries department
Organization name: IBM (required)
Locality or city: Rochester

Figure 8-3 Create a Certificate Authority page

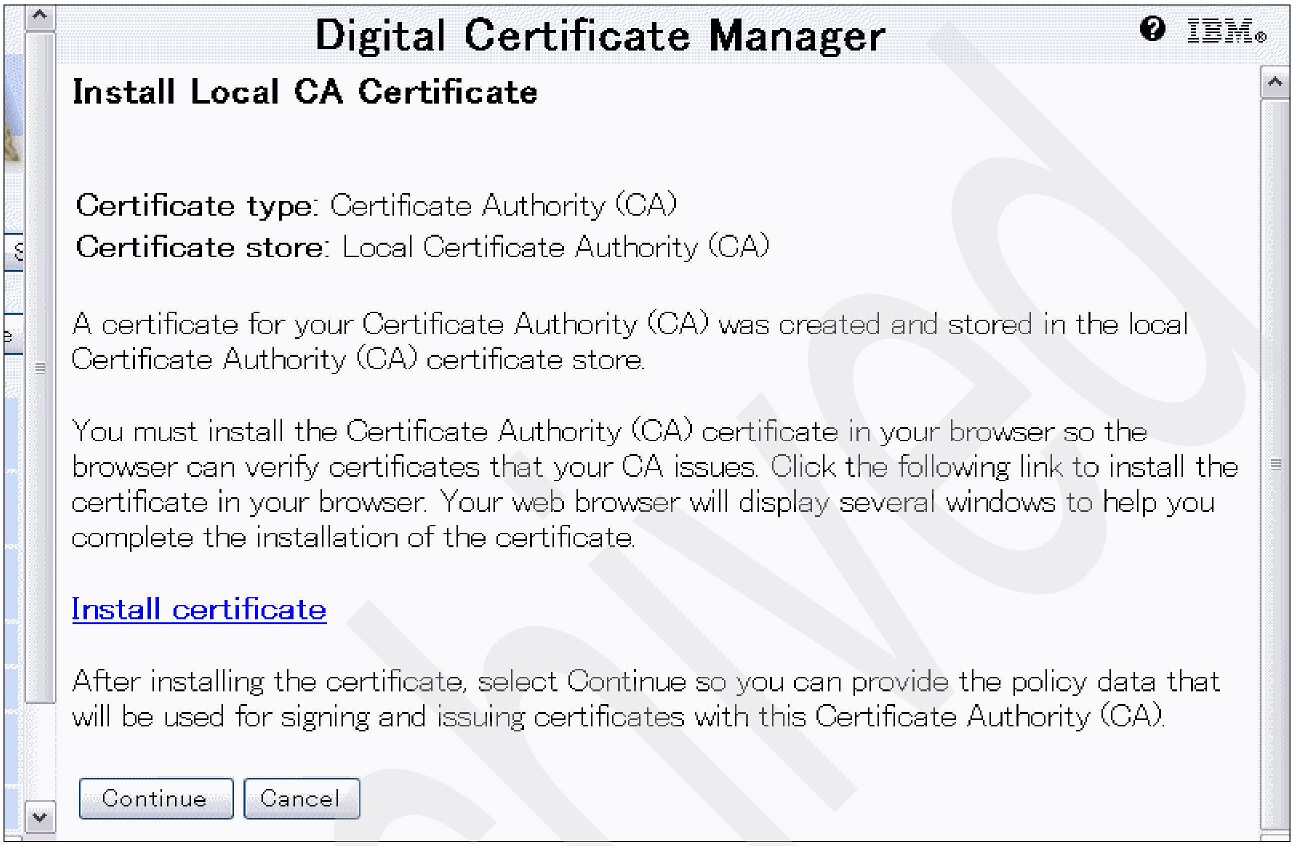
Table 8-1 shows all the parameters requested to create a Certificate Authority and the values used in this scenario.

Table 8-1 Parameters required to create a Certificate Authority

Parameter	Value
Key size	1024
Certificate Store password	Password
Confirmation password	Same password as above
Certificate Authority name	ITSO Certificate Authority
Organization Unit	iSeries department
Organization name	IBM
Locality or city	Rochester
Stare or province	Minnesota
Country	US
Validity period of Certificate Authority	1095

5. Fill in all the requested fields in the Create A Certificate Authority (CA) page and click **Continue**.

   The Digital Certificate Manager process the form and creates the certificate for the Certificate Authority as shown in Figure 8-4.



Install Local CA Certificate

Certificate type: Certificate Authority (CA)
Certificate store: Local Certificate Authority (CA)

A certificate for your Certificate Authority (CA) was created and stored in the local Certificate Authority (CA) certificate store.

You must install the Certificate Authority (CA) certificate in your browser so the browser can verify certificates that your CA issues. Click the following link to install the certificate in your browser. Your web browser will display several windows to help you complete the installation of the certificate.

Install certificate

After installing the certificate, select Continue so you can provide the policy data that will be used for signing and issuing certificates with this Certificate Authority (CA).

Figure 8-4 Certificate Authority created

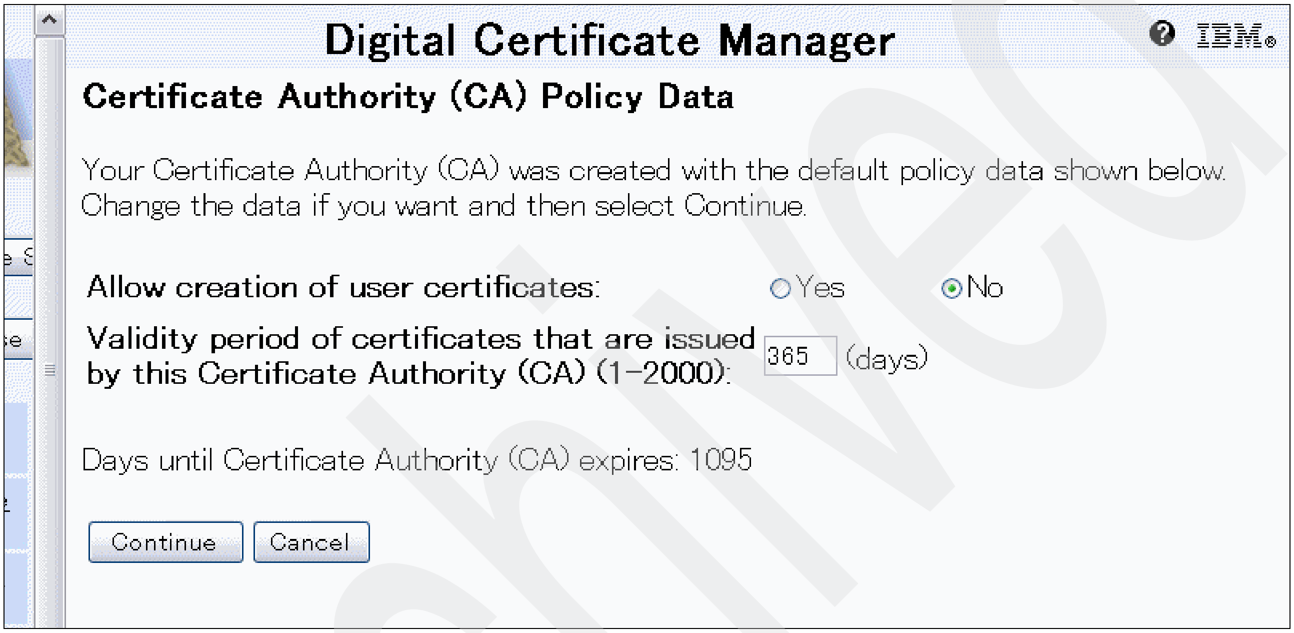
   You can also choose to install the CA certificate created in your browser, but if you do not want to do it now or if you do not need the CA certificate on the PC where you are performing the configuration, the Digital Certification manager lets you do it later.

6. Click **Continue**.

You can change the Certificate Authority policy data as you see in Figure 8-5. The policy data determines whether the CA can issue and sign user certificates or not, and how long the certificates are valid.

Because this scenario uses the secure FTP client as an i5/OS server that does not support the Client Authentication, you do not have to select **Yes** in the Allow creation of user certificates field. The Digital Certificate Manager lets you modify the Certificate Authority policy data later when it is required.

Notice the Validity period of certificates issued value is also valid for the Server Certificate that will be applied on the FTP server application. By leaving the value as 365 days, you can renew it in a year.



Digital Certificate Manager

Certificate Authority (CA) Policy Data

Your Certificate Authority (CA) was created with the default policy data shown below. Change the data if you want and then select Continue.

Allow creation of user certificates: ○ Yes ● No

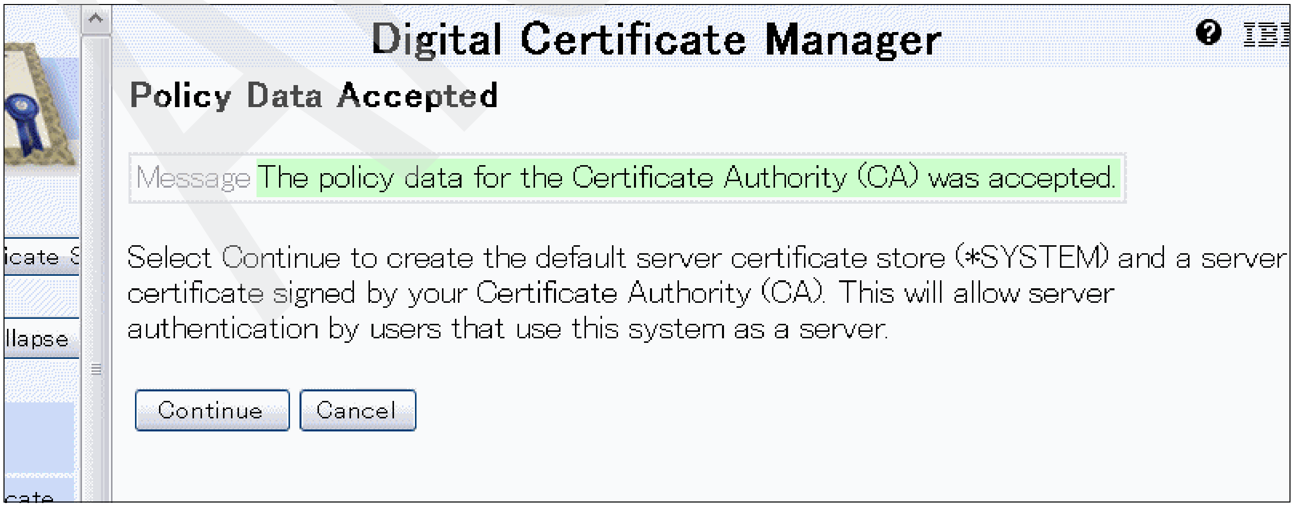
Validity period of certificates that are issued by this Certificate Authority (CA) (1-2000): 365 (days)

Days until Certificate Authority (CA) expires: 1095

Figure 8-5 Certificate Authority Policy Data page

7. Click **Continue**.

   A confirmation message appears showing that the policy data was accepted, as shown in Figure 8-6.



Digital Certificate Manager

Policy Data Accepted

Message The policy data for the Certificate Authority (CA) was accepted.

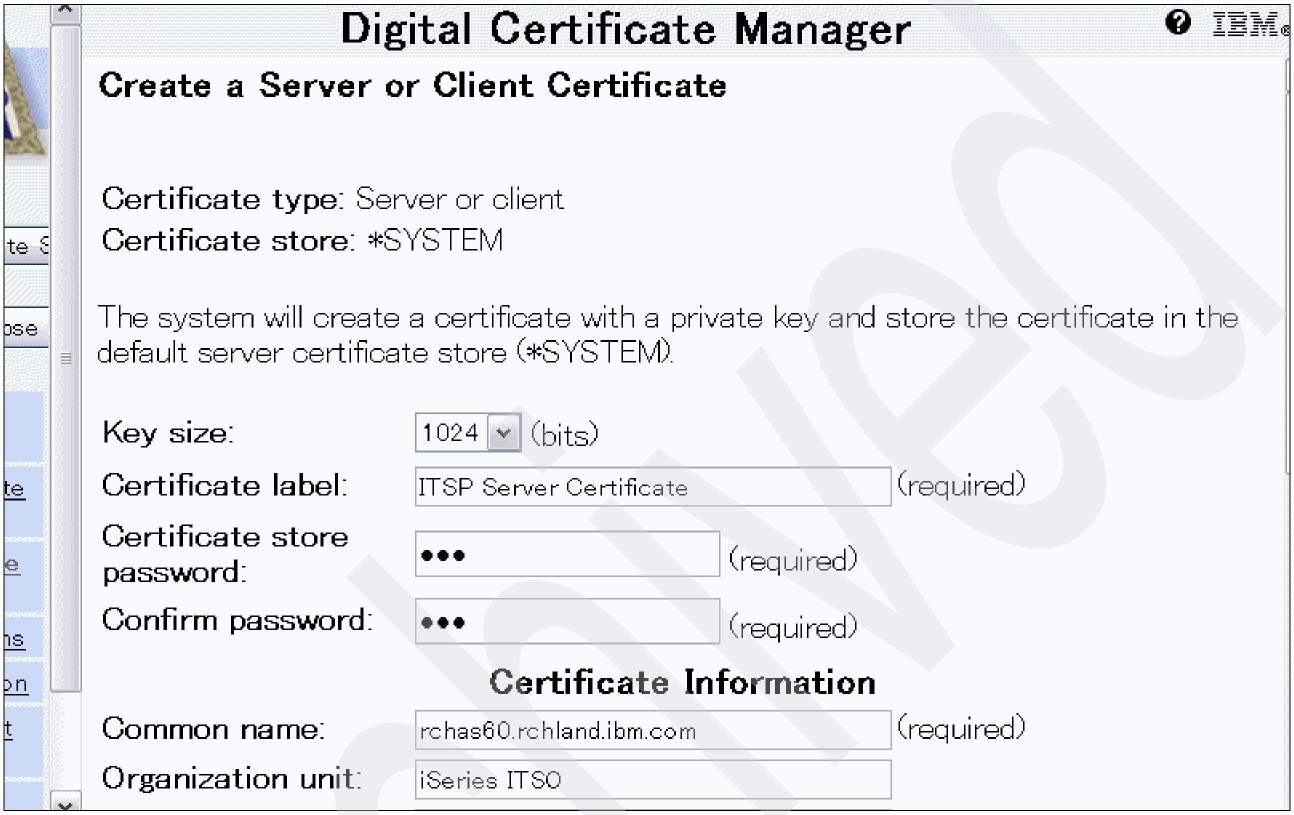
Select Continue to create the default server certificate store (*SYSTEM) and a server certificate signed by your Certificate Authority (CA). This will allow server authentication by users that use this system as a server.

Figure 8-6 Policy Data Accepted page

8. Click **Continue**.

   The next step is to create a server certificate that secure server and client applications can use during the SSL handshake.

   The page shown in Figure 8-7 appears. You see parameters requested and values used in this scenario to create a server or client certificate.



Digital Certificate Manager

Create a Server or Client Certificate

Certificate type: Server or client
Certificate store: *SYSTEM

The system will create a certificate with a private key and store the certificate in the default server certificate store (*SYSTEM).

Key size:	1024 (bits)
Certificate label:	ITSP Server Certificate (required)
Certificate store password:	••• (required)
Confirm password:	••• (required)

Certificate Information

Common name:	rchas60.rchland.ibm.com (required)
Organization unit:	iSeries ITSO

Figure 8-7 Create a Server or Client Certificate

Table 8-2 shows all the parameters requested to create a server or client certificate and the values used in this scenario.

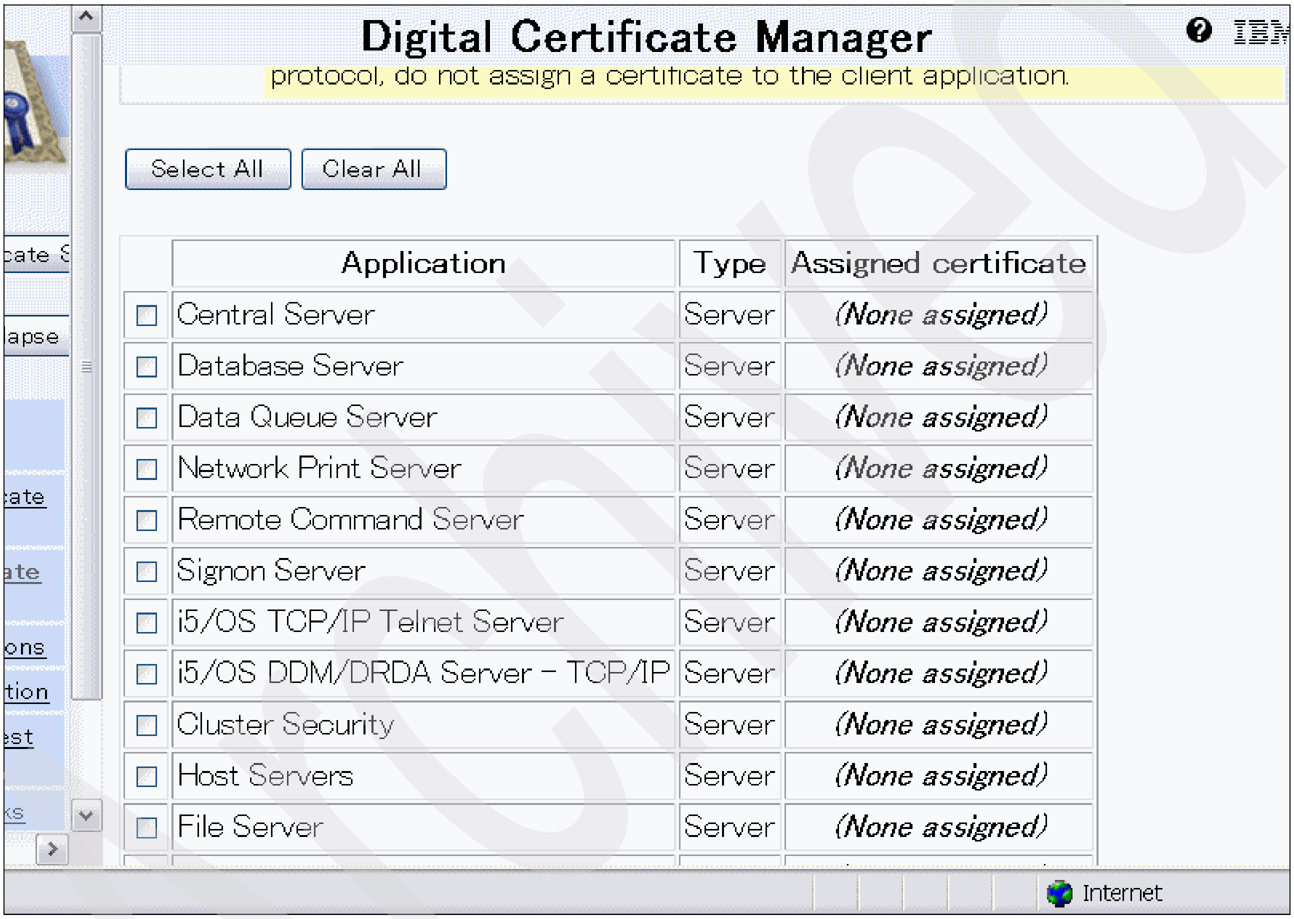
Table 8-2 Parameters required to create a server or client certificate

Parameter	Value
Key size	1024
Certificate label	ITSO Server Certificate
Certificate store password	Password
Confirmation password	Same password as above
Common name	rchas60.rchland.ibm.com
Organization unit	iSeries ITSO
Organization name	IBM
Locality or city	Rochester
State or province	Minnesota

Parameter	Value
Country	US
Subject Alternative Name fields	blank

9. Fill in all the requested fields on the Create A Server or Client Certificate page and click **Continue**.

   A confirmation message shows that the Server Certificate was created. Select applications that will use the server certificate you created, as shown in Figure 8-8.



Digital Certificate Manager

protocol, do not assign a certificate to the client application.

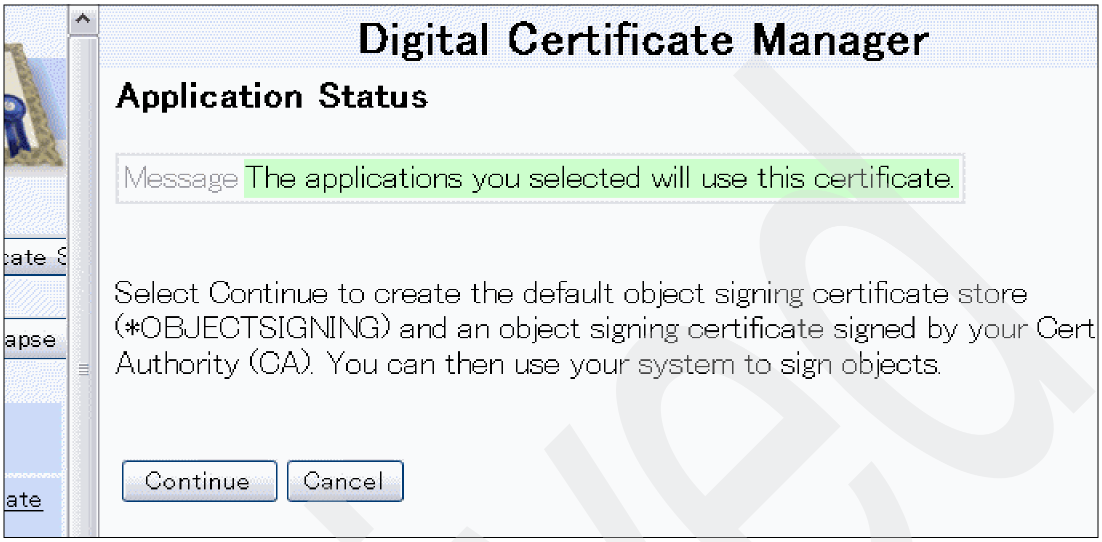
	Application	Type	Assigned certificate
□	Central Server	Server	*(None assigned)*
□	Database Server	Server	*(None assigned)*
□	Data Queue Server	Server	*(None assigned)*
□	Network Print Server	Server	*(None assigned)*
□	Remote Command Server	Server	*(None assigned)*
□	Signon Server	Server	*(None assigned)*
□	i5/OS TCP/IP Telnet Server	Server	*(None assigned)*
□	i5/OS DDM/DRDA Server - TCP/IP	Server	*(None assigned)*
□	Cluster Security	Server	*(None assigned)*
□	Host Servers	Server	*(None assigned)*
□	File Server	Server	*(None assigned)*

Figure 8-8 Select Application page

10. Select the **i5/OS TCP/IP FTP Server** application and click **Continue** at the bottom of the window.

A confirmation message confirms that the certificate was correctly applied to the application (Figure 8-9).

11.Because Object Signing is not covered in this scenario, click **Continue** to end this task.



Digital Certificate Manager

Application Status

Message The applications you selected will use this certificate.

Select Continue to create the default object signing certificate store (*OBJECTSIGNING) and an object signing certificate signed by your Cert Authority (CA). You can then use your system to sign objects.

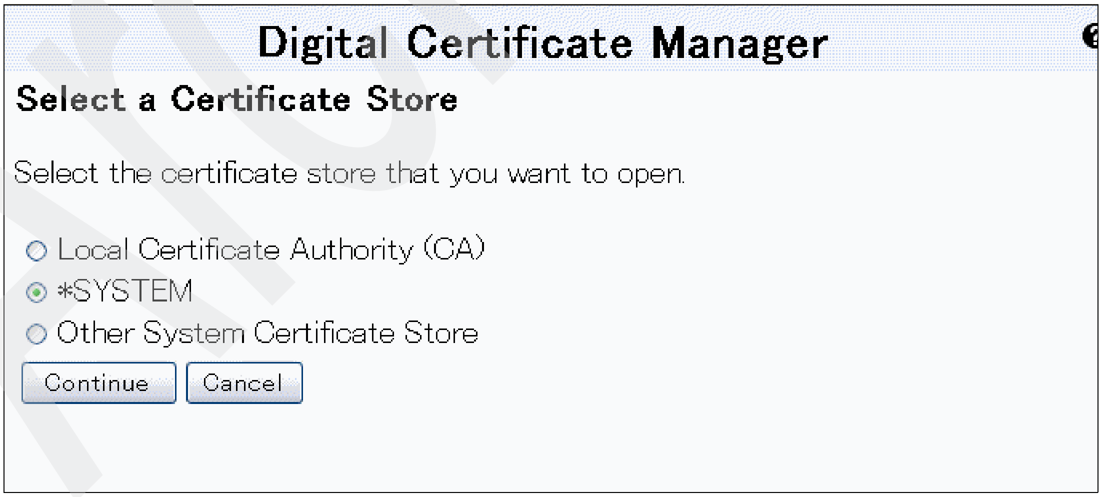
Figure 8-9 Confirmation message for the application status

The main Digital Certificate Manager Task page, as shown in Figure 8-2 on page 246, appears.

To complete the setup of the secure FTP server, modify the FTP server application and apply the Server Certificate on it.

12.Click **Select a Certificate Store** in the navigation pane on the left.

The Digital Certificate Manager lists all the certificate stores that you can select, as shown in Figure 8-10.



Digital Certificate Manager

Select a Certificate Store

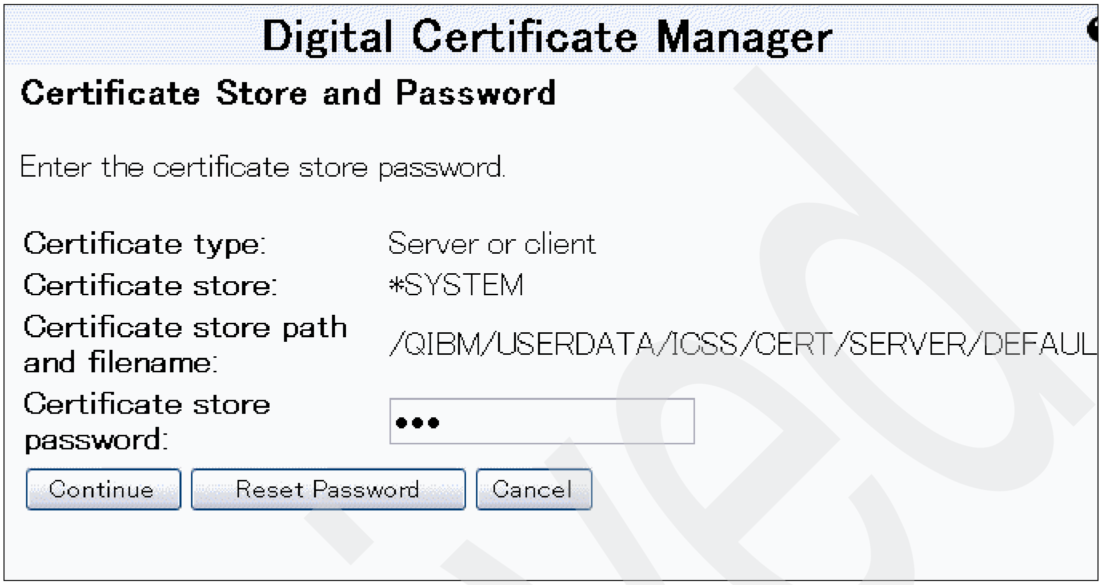
Select the certificate store that you want to open.

○ Local Certificate Authority (CA)
● *SYSTEM
○ Other System Certificate Store

Figure 8-10 List of selectable certificate stores

13.Select ***SYSTEM** and click **Continue**.

The page shown in Figure 8-11 appears. To log into the *SYSTEM Certificate Store, provide the same password input in the Certificate store password field in the form shown in Figure 8-3 on page 247.



Digital Certificate Manager

Certificate Store and Password

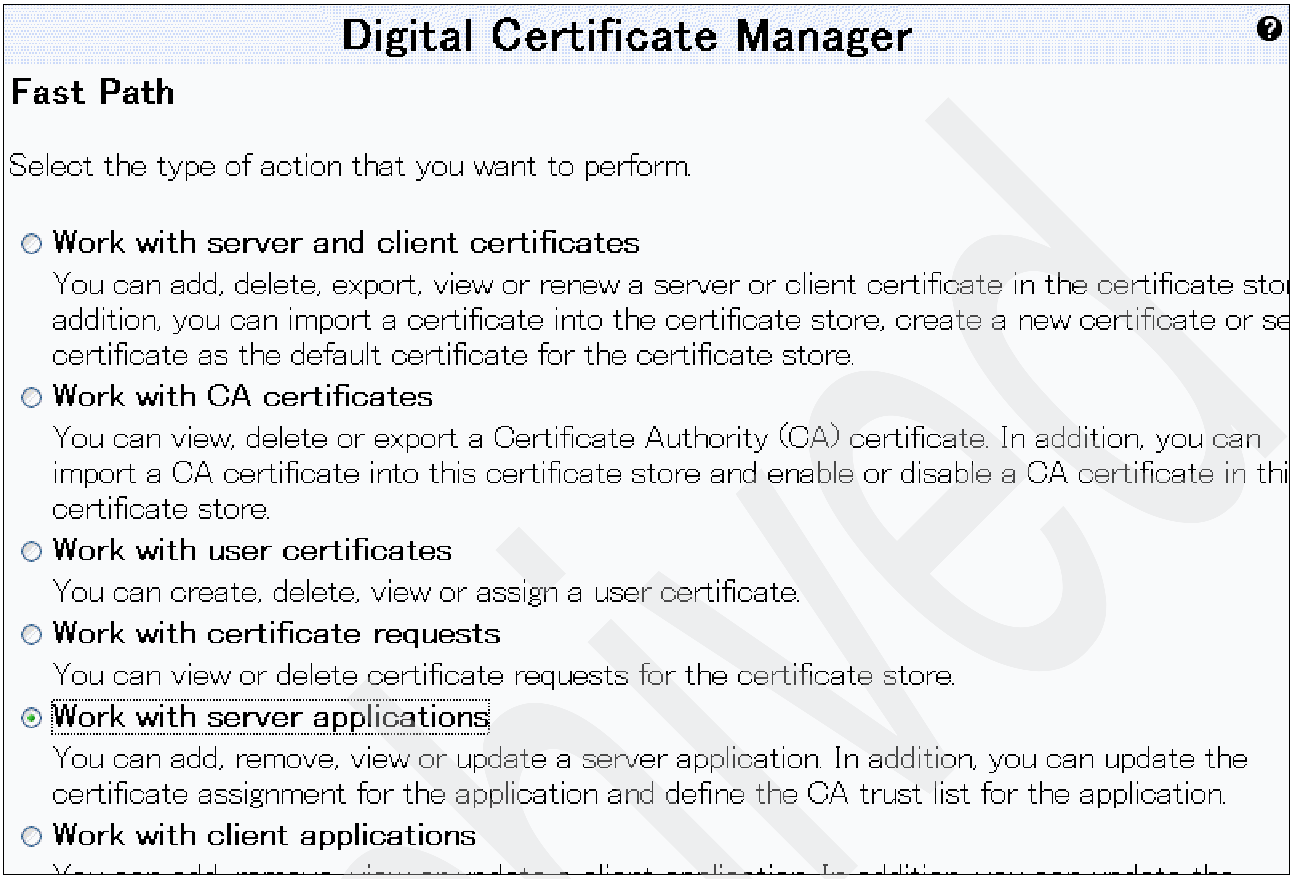
Enter the certificate store password.

Certificate type:	Server or client
Certificate store:	*SYSTEM
Certificate store path and filename:	/QIBM/USERDATA/ICSS/CERT/SERVER/DEFAUL
Certificate store password:	●●●

Figure 8-11 Certificate Store and Password page

14. Enter the password and click **Continue**.

15. In the left navigation, expand the **Fast Path** task as shown in Figure 8-12. Select **Work with server applications** and click **Continue**.



Digital Certificate Manager

Fast Path

Select the type of action that you want to perform.

○ Work with server and client certificates

You can add, delete, export, view or renew a server or client certificate in the certificate sto addition, you can import a certificate into the certificate store, create a new certificate or se certificate as the default certificate for the certificate store.

○ Work with CA certificates

You can view, delete or export a Certificate Authority (CA) certificate. In addition, you can import a CA certificate into this certificate store and enable or disable a CA certificate in thi certificate store.

○ Work with user certificates

You can create, delete, view or assign a user certificate.

○ Work with certificate requests

You can view or delete certificate requests for the certificate store.

● Work with server applications

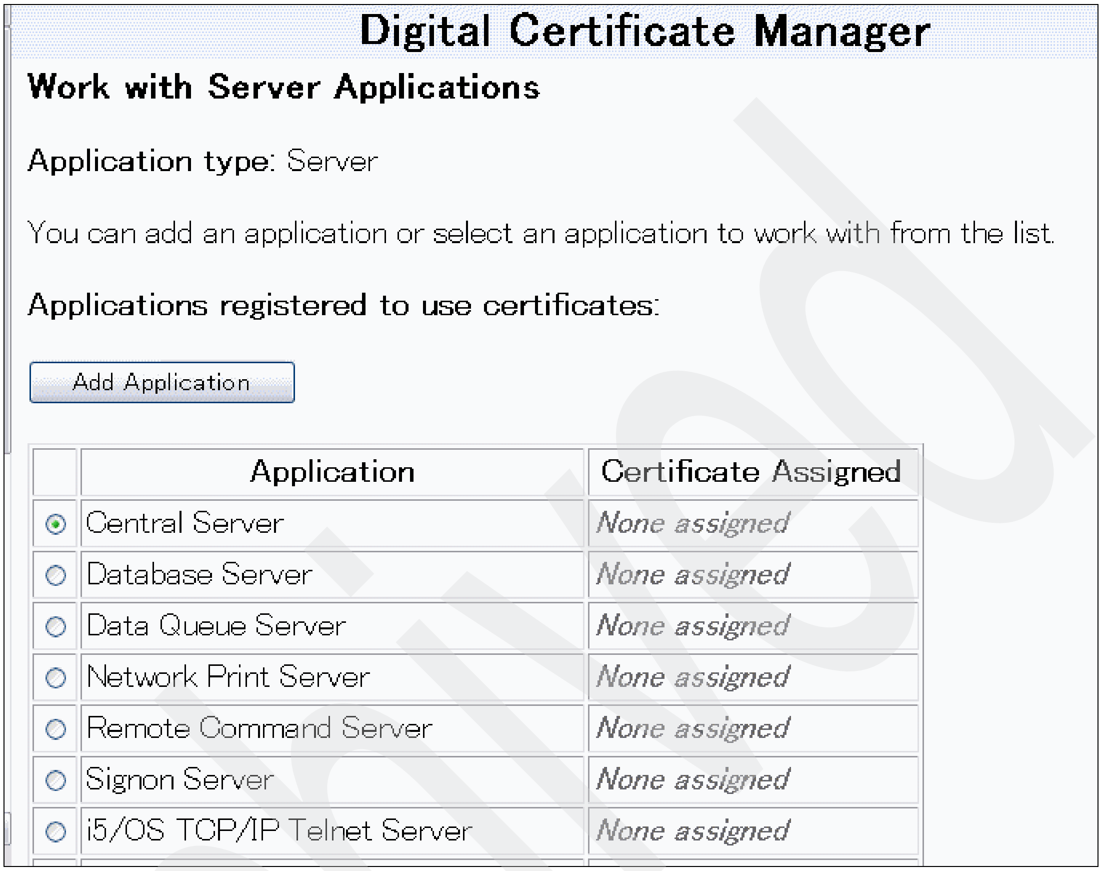
You can add, remove, view or update a server application. In addition, you can update the certificate assignment for the application and define the CA trust list for the application.

○ Work with client applications

You can add, remove, view or update a client application. In addition, you can update the

Figure 8-12 Fast Path page

16. A list of server applications appears as shown in Figure 8-13. Select the **i5/OS TCP/IP FTP Server** application and click **Work with Application** at the bottom of the page.



Digital Certificate Manager

Work with Server Applications

Application type: Server

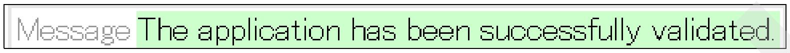
You can add an application or select an application to work with from the list.

Applications registered to use certificates:

	Application	Certificate Assigned
●	Central Server	*None assigned*
○	Database Server	*None assigned*
○	Data Queue Server	*None assigned*
○	Network Print Server	*None assigned*
○	Remote Command Server	*None assigned*
○	Signon Server	*None assigned*
○	i5/OS TCP/IP Telnet Server	*None assigned*

Figure 8-13 Work with Application page

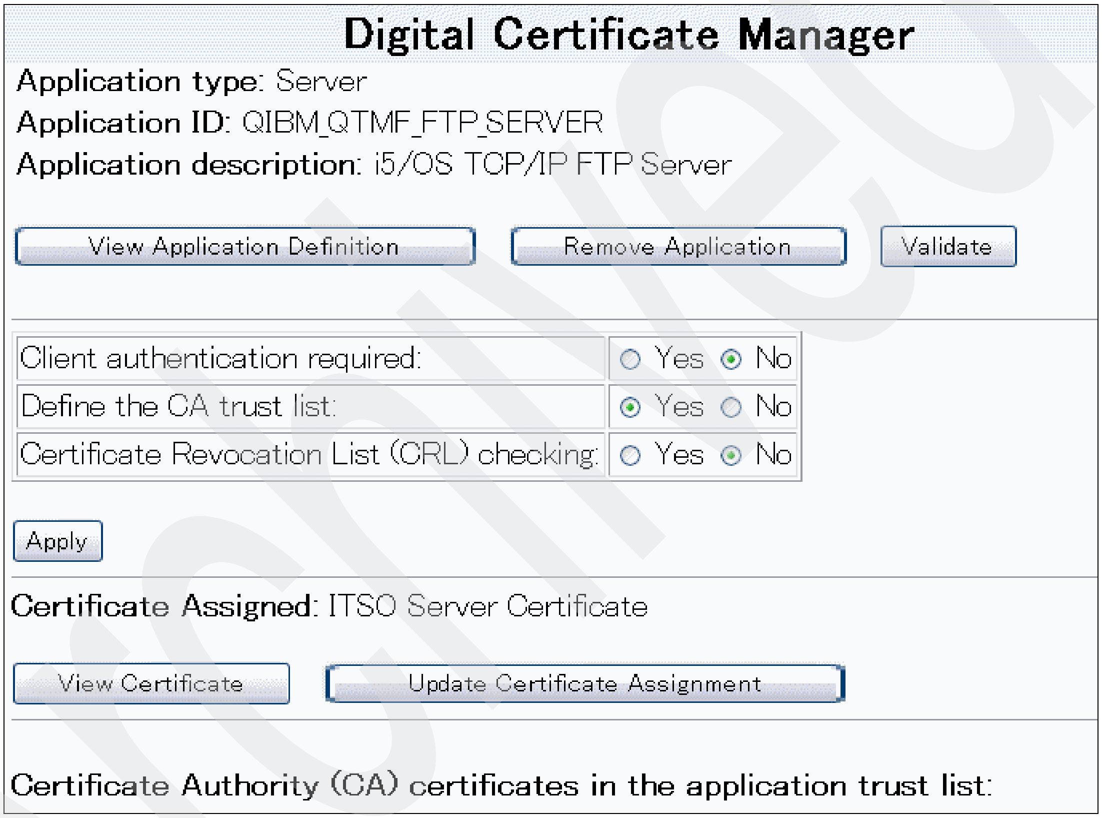
Details of the FTP Server application appear (Figure 8-15). If **Yes** is selected in the Define the CA trust list and CA Certificates are not listed in the Certificate Authority (CA) certificates in the application trust list (as in this case), then define a CA Trust list. Otherwise, you can verify the configuration by clicking **Validate** and the message, shown in Figure 8-14, appears.



Message The application has been successfully validated.

Figure 8-14 Confirmation message of a correct Application validation

The validation of an application certificate is not a required operation, but it is useful to see if all was done correctly.



Digital Certificate Manager

Application type: Server

Application ID: QIBM_QTMF_FTP_SERVER

Application description: i5/OS TCP/IP FTP Server

Client authentication required:	○ Yes ● No
Define the CA trust list:	● Yes ○ No
Certificate Revocation List (CRL) checking:	○ Yes ● No

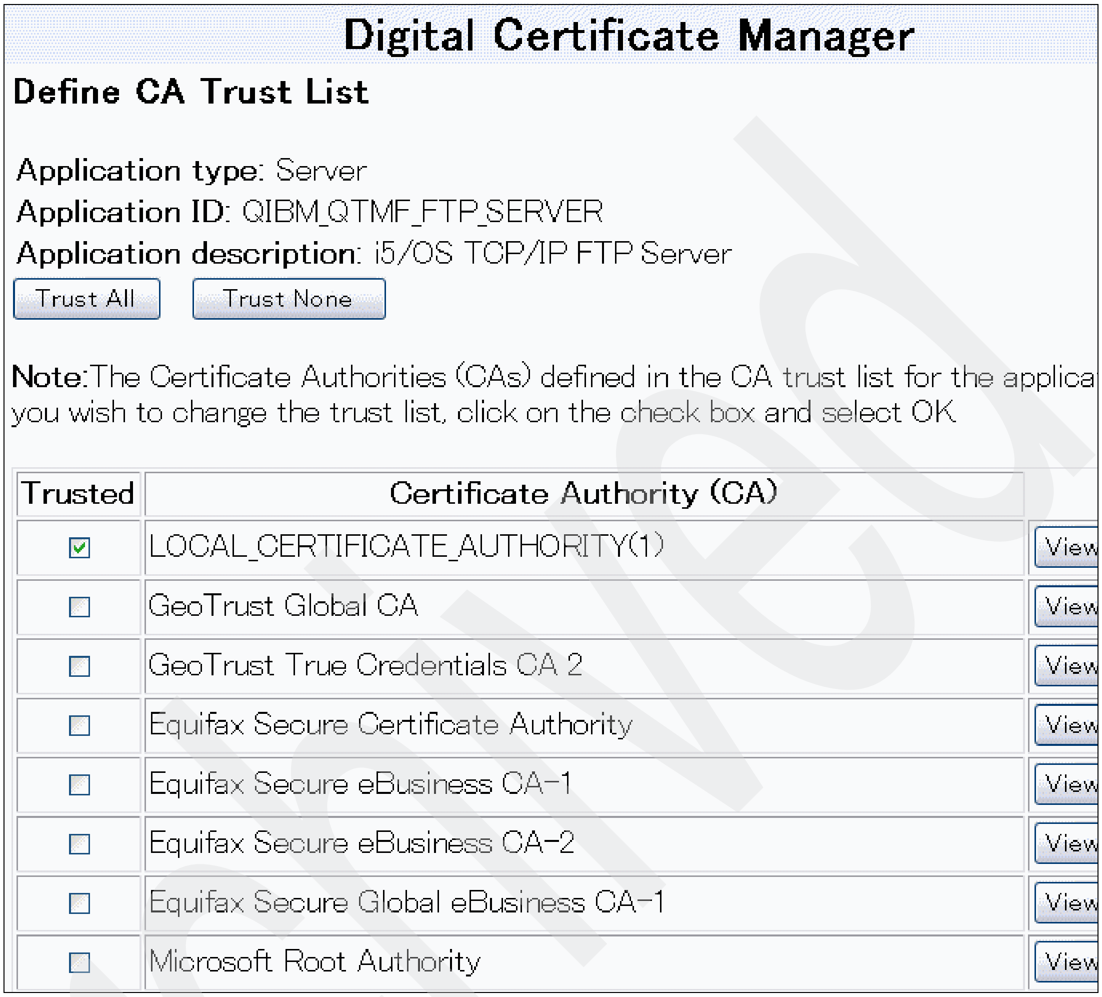
Certificate Assigned: ITSO Server Certificate

Certificate Authority (CA) certificates in the application trust list:

Figure 8-15 FTP Server Application information

17.Select Yes for **Define CA Trust List**.

A list of all the CA Certificate known by the system appears as shown in Figure 8-16.



Digital Certificate Manager

Define CA Trust List

Application type: Server
Application ID: QIBM_QTMF_FTP_SERVER
Application description: i5/OS TCP/IP FTP Server

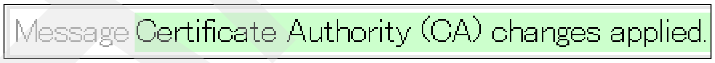
Note:The Certificate Authorities (CAs) defined in the CA trust list for the applica
you wish to change the trust list, click on the check box and select OK.

Trusted	Certificate Authority (CA)	
☑	LOCAL_CERTIFICATE_AUTHORITY(1)	View
□	GeoTrust Global CA	View
□	GeoTrust True Credentials CA 2	View
□	Equifax Secure Certificate Authority	View
□	Equifax Secure eBusiness CA-1	View
□	Equifax Secure eBusiness CA-2	View
□	Equifax Secure Global eBusiness CA-1	View
□	Microsoft Root Authority	View

Figure 8-16 Define Trust List page

18.Select the **LOCAL_CERTIFICATE_AUTHORITY(1)**, the CA certificate that was created. Click **OK** at the bottom of the page.

The message shown in Figure 8-17 appears at the top the Define CA Trust List page.

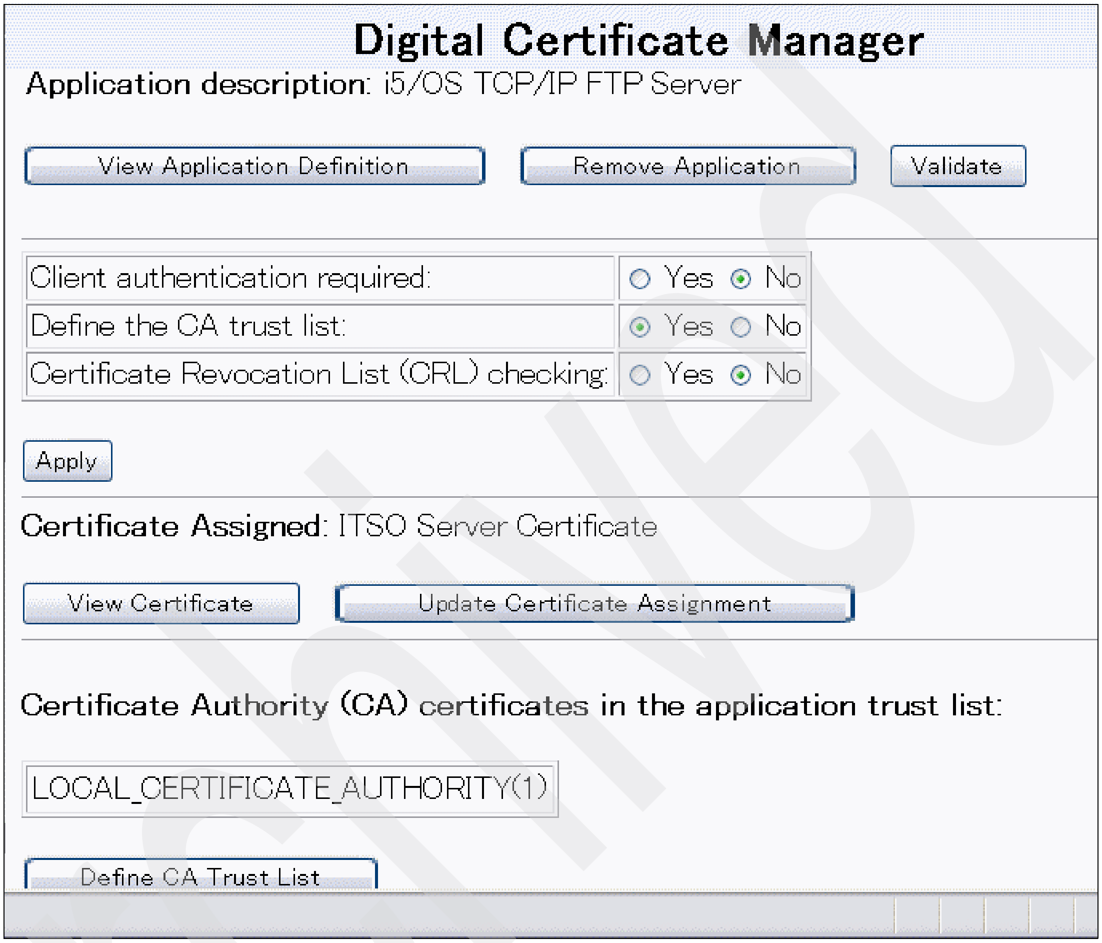


Message Certificate Authority (CA) changes applied.

Figure 8-17 Define Trust List confirmation message

19. Select **Cancel** to return to the FTP Server Application information page shown in Figure 8-15 on page 256.

    Notice that the CA certificates in the application trust list was updated with the Local Certificate Authority entry (Figure 8-18).



Digital Certificate Manager

Application description: i5/OS TCP/IP FTP Server

Client authentication required:	○ Yes ● No
Define the CA trust list:	● Yes ○ No
Certificate Revocation List (CRL) checking:	○ Yes ● No

Certificate Assigned: ITSO Server Certificate

Certificate Authority (CA) certificates in the application trust list:

LOCAL_CERTIFICATE_AUTHORITY(1)

Figure 8-18 Updated information in CA certificates in the application trust list

Now you can verify the DCM configuration for this application.

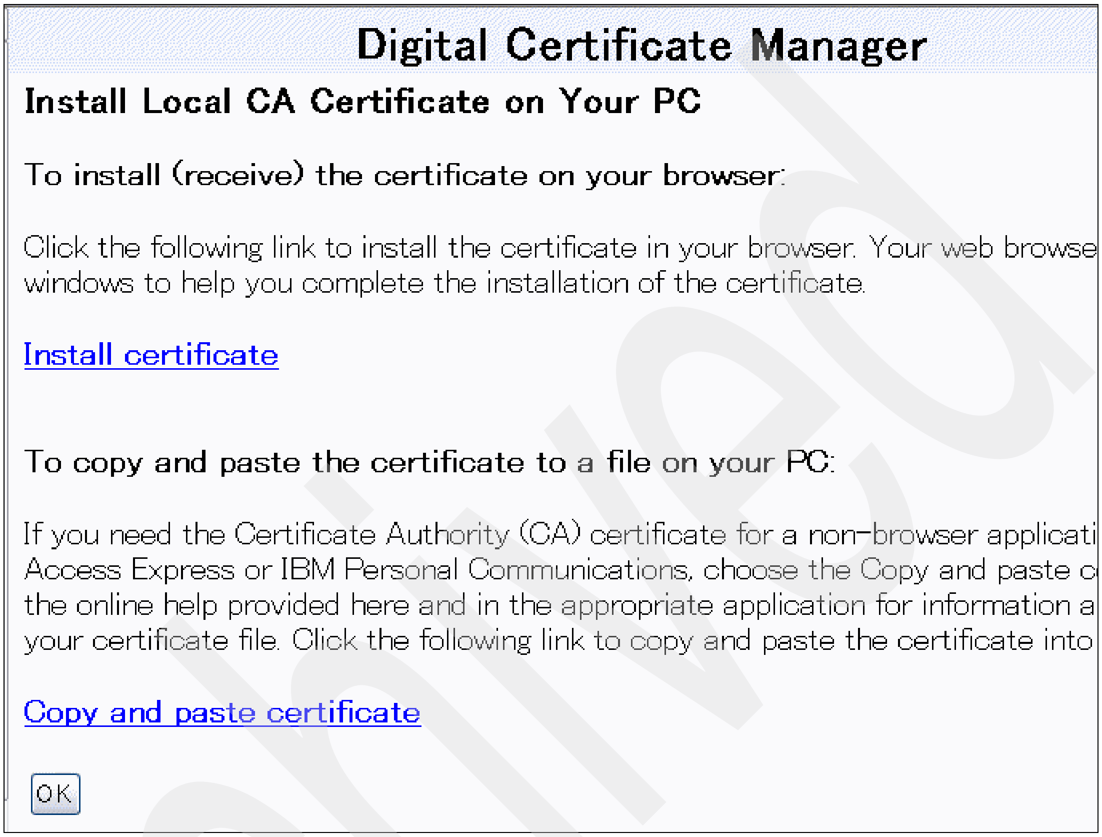
20. Click **Validate** and the message shown in Figure 8-14 on page 256 appears.

21. Close this task. Click **Cancel** until you reach the main Digital Certificate Manager tasks page, as shown in Figure 8-2 on page 246.

    As the last action in the DCM tasks, obtain the CA certificate on your PC to send it to the system that will be the secure FTP client.

22. Select **Install Local CA Certificate on Your PC** in the left navigation page.

In the window shown in Figure 8-19, click **Install certificate** to install the CA certificate in your PC browser, or click **Copy and paste Certificate** to save the CA certificate into a file. Because you need to send the CA certificate to the remote i5/OS server and you do not have to use it on your browser, choose the second option.



Digital Certificate Manager

Install Local CA Certificate on Your PC

To install (receive) the certificate on your browser:

Click the following link to install the certificate in your browser. Your web browse windows to help you complete the installation of the certificate.

Install certificate

To copy and paste the certificate to a file on your PC:

If you need the Certificate Authority (CA) certificate for a non-browser applicati Access Express or IBM Personal Communications, choose the Copy and paste c the online help provided here and in the appropriate application for information a your certificate file. Click the following link to copy and paste the certificate into

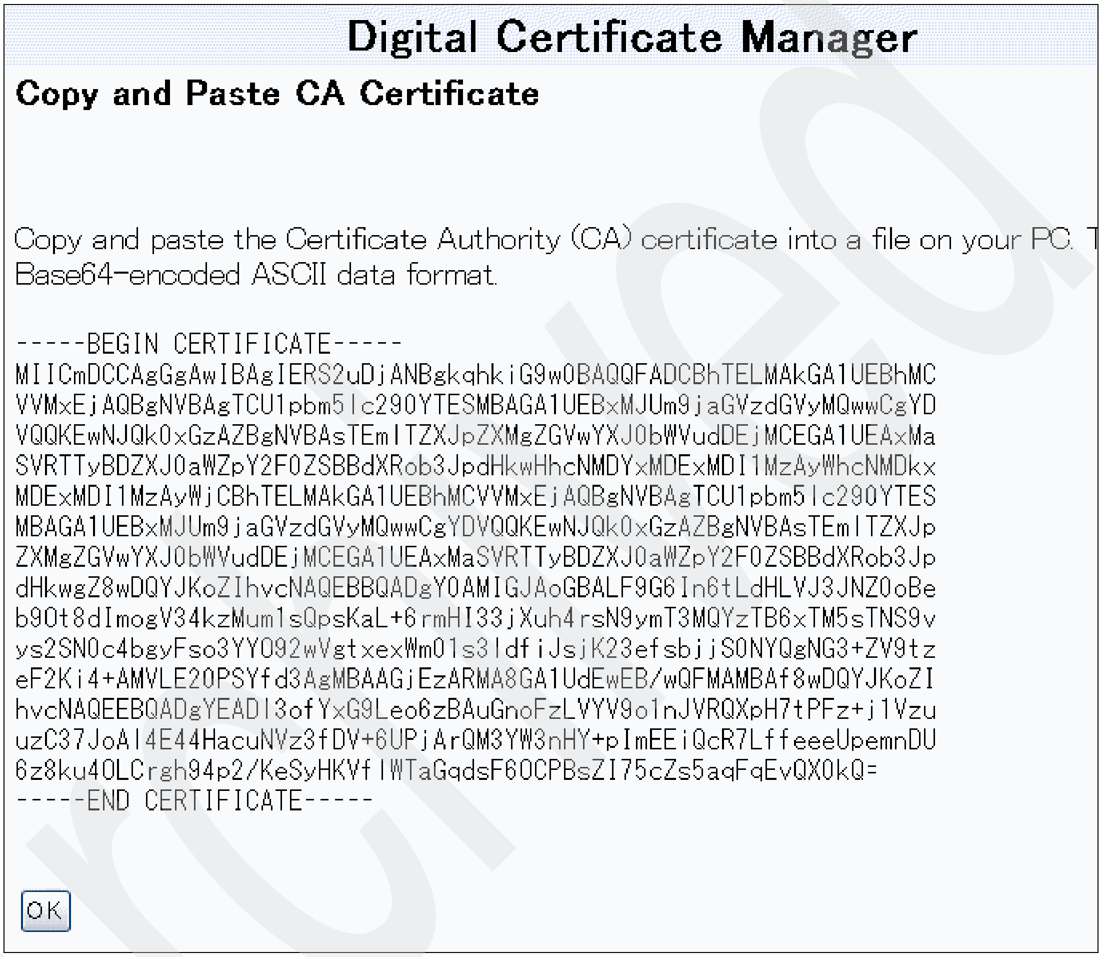
Copy and paste certificate

Figure 8-19 Install Local CA Certificate on your PC page

23. Click **Copy and paste certificate.**

Follow the instructions mentioned in Figure 8-20 to copy the CA certificate.

24. Select the area starting from -----BEGIN CERTIFICATE----- until the -----END CERTIFICATE-----, including all the dashes.
25. Copy and paste it into a Notepad and save it as `rchas60CA.txt` in a working directory.
26. Send this file as an attachment in a mail to someone who belongs in the remote enterprise.



Digital Certificate Manager

Copy and Paste CA Certificate

Copy and paste the Certificate Authority (CA) certificate into a file on your PC. T
Base64-encoded ASCII data format.

```
-----BEGIN CERTIFICATE-----
MIICmDCCAgGgAwIBAgIERS2uDjANBgkqhkiG9w0BAQQFADCBhTELMAkGA1UEBhMC
VVMxEjAQBgNVBAgTCU1pbm5lc290YTESMBAGA1UEBxMJUm9jaGVzdGVyMQwwCgYD
VQQKEwNJQk0xGzAZBgNVBAsTEmlTZXJpZXMgZGVwYXJ0bWVudDEjMCEGA1UEAxMa
SVRTTyBDZXJ0aWZpY2F0ZSBBdXRob3JpdHkwHhcNMDYxMDExMDI1MzAyWhcNMDkx
MDExMDI1MzAyWjCBhTELMAkGA1UEBhMCVVMxEjAQBgNVBAgTCU1pbm5lc290YTES
MBAGA1UEBxMJUm9jaGVzdGVyMQwwCgYDVQQKEwNJQk0xGzAZBgNVBAsTEmlTZXJp
ZXMgZGVwYXJ0bWVudDEjMCEGA1UEAxMaSVRTTyBDZXJ0aWZpY2F0ZSBBdXRob3Jp
dHkwgZ8wDQYJKoZIhvcNAQEBBQADgY0AMIGJAoGBALF9G6In6tLdHLVJ3JNZ0oBe
b9Ot8dImogV34kzMum1sQpsKaL+6rmHI33jXuh4rsN9ymT3MQYzTB6xTM5sTNS9v
ys2SN0c4bgyFso3YY092wVgtxexWm01s3ldfiJsjK23efsbjjS0NYQgNG3+ZV9tz
eF2Ki4+AMVLE20PSYfd3AgMBAAGjEzARMA8GA1UdEwEB/wQFMAMBAf8wDQYJKoZI
hvcNAQEEBQADgYEADl3ofYxG9Leo6zBAuGnoFzLVYV9o1nJVRQXpH7tPFz+j1Vzu
uzC37JoAl4E44HacuNVz3fDV+6UPjArQM3YW3nHY+pImEEiQcR7LffeeeUpemnDU
6z8ku4OLCrgh94p2/KeSyHKVflWTaGqdsF6OCPBsZI75cZs5aqFqEvQX0kQ=
-----END CERTIFICATE-----
```

Figure 8-20 Public CA certificate

27. At the end of the operation, click **OK** to end the task.

Now, you have completed all the DCM tasks. To use SSL to secure your FTP server, verify and modify the FTP server attribute.

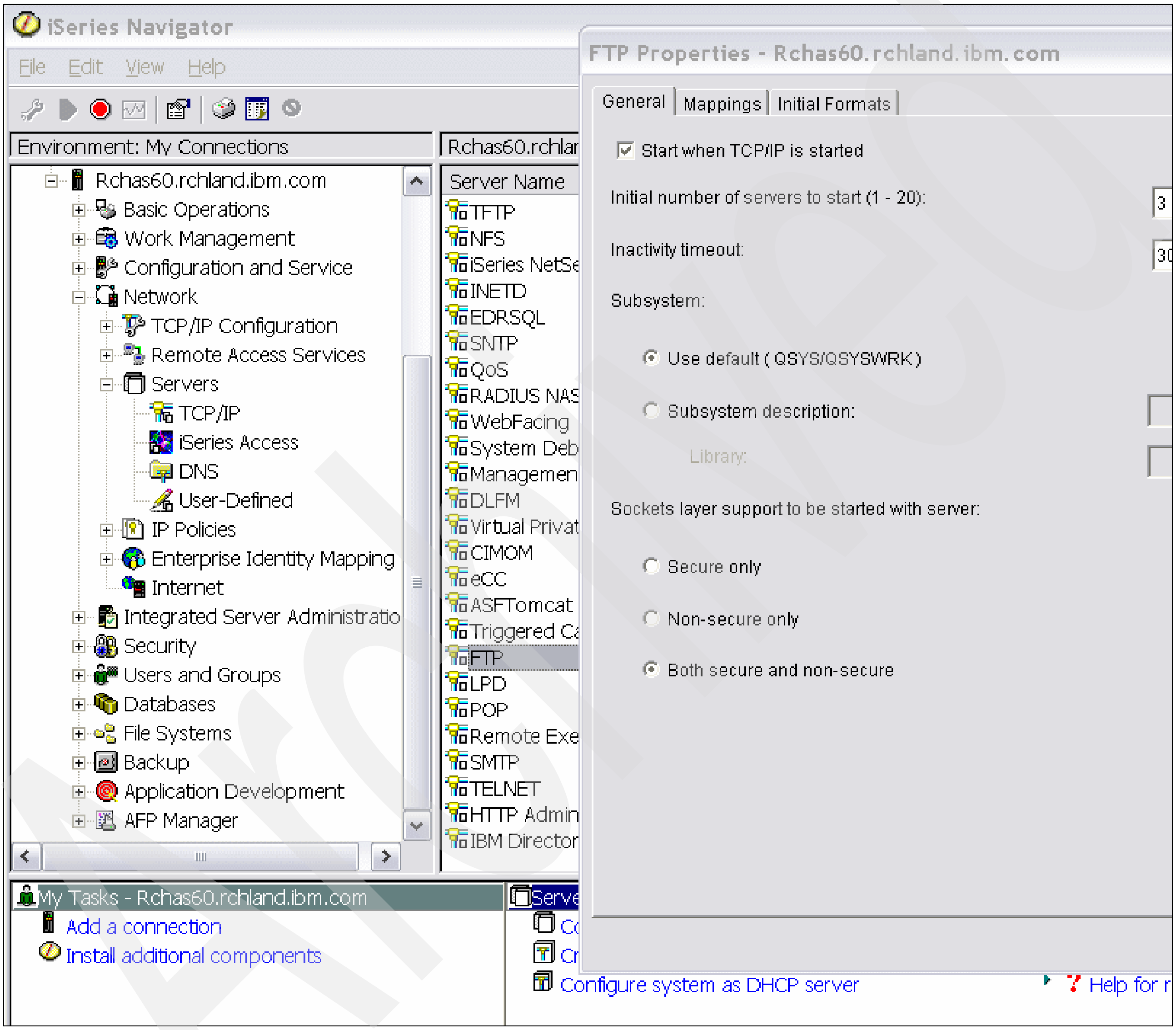
Perform the following steps to enable the secure FTP server:

1. In the iSeries Navigator, expand ***servername*** → **Network** → **Servers** → **TCP/IP**, where *servername* is the name of the connection.

2. Right-click **FTP** and select **Properties.** Figure 8-21 shows the FTP properties.
3. Select the **General** tab.
4. Choose one of these options in the SSL to be started with the server section:

- **Secure only**: Allow only SSL sessions.
- **Both secure and non-secure**: Allow both secure and non-secure sessions.

5. Click **OK** to save the changes and complete the task.



FTP Properties - Rchas60.rchland.ibm.com

General | Mappings | Initial Formats

☑ Start when TCP/IP is started

Initial number of servers to start (1 - 20): 3

Inactivity timeout: 30

Subsystem:

● Use default (QSYS/QSYSWRK)

○ Subsystem description:

Library:

Sockets layer support to be started with server:

○ Secure only

○ Non-secure only

● Both secure and non-secure

Figure 8-21 FTP server attributes via iSeries Navigator

Now, restart the FTP server to apply all the changes you have done, assigning the certificate and modifying the FTP attributes.

6. To verify that the Secure FTP server in listening status, use the following command to verify that both the ports 21 and 990 are in Listen status:

```
NETSTAT *CNN
```

As mentioned in the Admin instance, it is a good security policy to activate the FTP server when necessary and to keep it stopped when not necessary.

8.4 Step-by-step set up guide for FTP client

The CA certificate in Step 26 on page 260 needs to be delivered to the receiver.

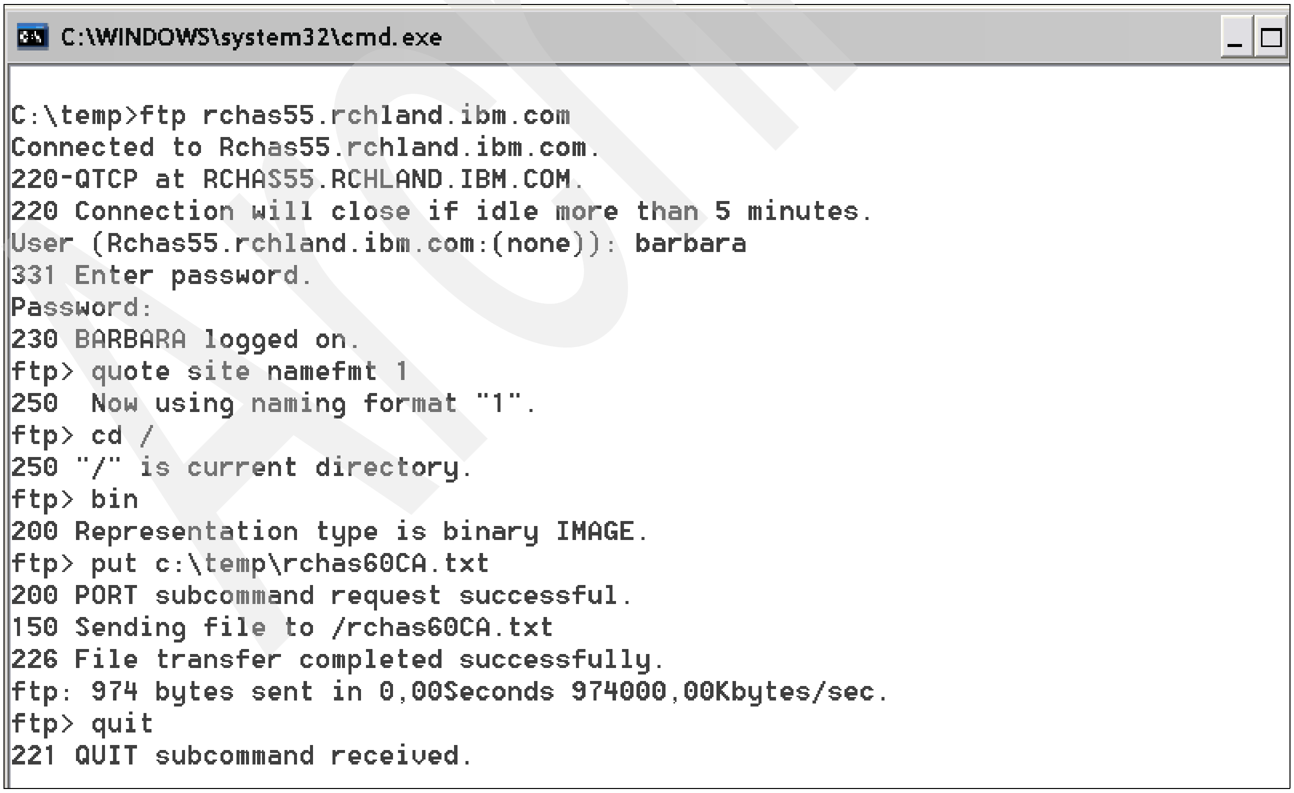
Follow these steps to configure an SSL or to secure an FTP client:

1. Detach the CA certificate to your PC in a working directory. As mentioned in “Step-by-step set up guide for FTP server” on page 245 in Step 25 on page 260, the file name is `rchas60CA.txt`. For example, in this scenario, the file is detached into the directory C:\temp.
2. In the Windows bottom bar, select **Start** → **Run.** Specify `cmd` in the Run pop-up window to bring up a DOS command prompt.
3. In the DOS window, type the following command:

   ```
   ftp servername1
   ```

   Servername1 is the name of your iSeries, acting as a secure FTP client.
4. Sign on with your user profile and password.
5. At the FTP prompt, run the `quote site namefmt 1` subcommand to set the path name format.
6. Enter `cd /` to change the current working directory on the i5/OS server side.
7. Enter `bin` to turn the transfer type to a binary image.
8. Enter the subcommand `put c:\temp\rchas60CA.txt`.
9. Enter `quit` to close the FTP session.

   The file is transferred from the PC to the i5/OS server as shown in Figure 8-22.



```
C:\temp>ftp rchas55.rchland.ibm.com
Connected to Rchas55.rchland.ibm.com.
220-QTCP at RCHAS55.RCHLAND.IBM.COM.
220 Connection will close if idle more than 5 minutes.
User (Rchas55.rchland.ibm.com:(none)): barbara
331 Enter password.
Password:
230 BARBARA logged on.
ftp> quote site namefmt 1
250  Now using naming format "1".
ftp> cd /
250 "/" is current directory.
ftp> bin
200 Representation type is binary IMAGE.
ftp> put c:\temp\rchas60CA.txt
200 PORT subcommand request successful.
150 Sending file to /rchas60CA.txt
226 File transfer completed successfully.
ftp: 974 bytes sent in 0,00Seconds 974000,00Kbytes/sec.
ftp> quit
221 QUIT subcommand received.
```

Figure 8-22 FTP session to transfer the CA certificate from the PC to the iSeries

The CA certificate file is in the i5/OS server Integrated File System, but to enable the SSL on the FTP Client, you have to go through the Digital Certificate Manager (DCM) tasks to configure the trusted certificate authorities list for the FTP client application. You must add any certificate authorities that were used to create certificates assigned to the servers that you want to connect.

We use Microsoft Internet Explorer 6.0 to run our processes.

1. Start a Web browser. Enter the URL:

   `http://servername1:2001`

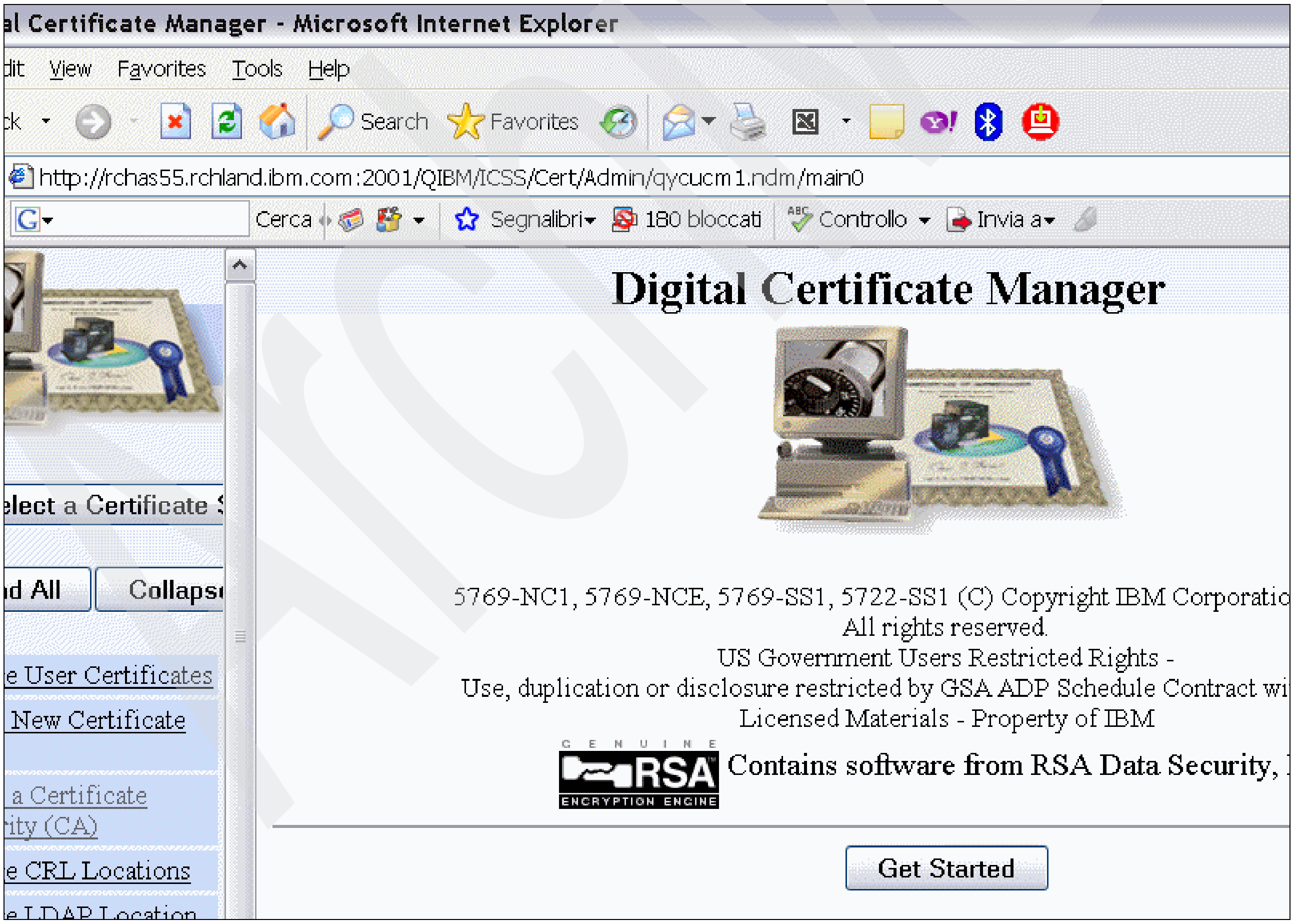
   Servername1 represents the host name or IP address of iSeries. In this case, it is the SSL FTP client i5/OS server system.

2. Sign on to the i5/OS Tasks pop-up, using your user profile and password.

> **Note:** To have a fully operational DCM, sign on with a user profile with *ALLOBJ and *SECADM special authorities.

3. Click **Digital Certificate Manager**.

   Figure 8-23 shows the page that appears when you select the **Digital Certificate Manager** from the i5/OS Tasks page in a brand new environment.


al Certificate Manager - Microsoft Internet Explorer
dit View Favorites Tools Help
ck Search Favorites
http://rchas55.rchland.ibm.com:2001/QIBM/ICSS/Cert/Admin/qycucm1.ndm/main0
Cerca Segnalibri 180 bloccati Controllo Invia a
elect a Certificate S
d All
Collaps
e User Certificates
New Certificate
a Certificate
ity (CA)
e CRL Locations
e LDAP Location
Digital Certificate Manager
GENUINE RSA ENCRYPTION ENGINE
Get Started

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All rights reserved.
US Government Users Restricted Rights -
Use, duplication or disclosure restricted by GSA ADP Schedule Contract wi
Licensed Materials - Property of IBM
Contains software from RSA Data Security, I

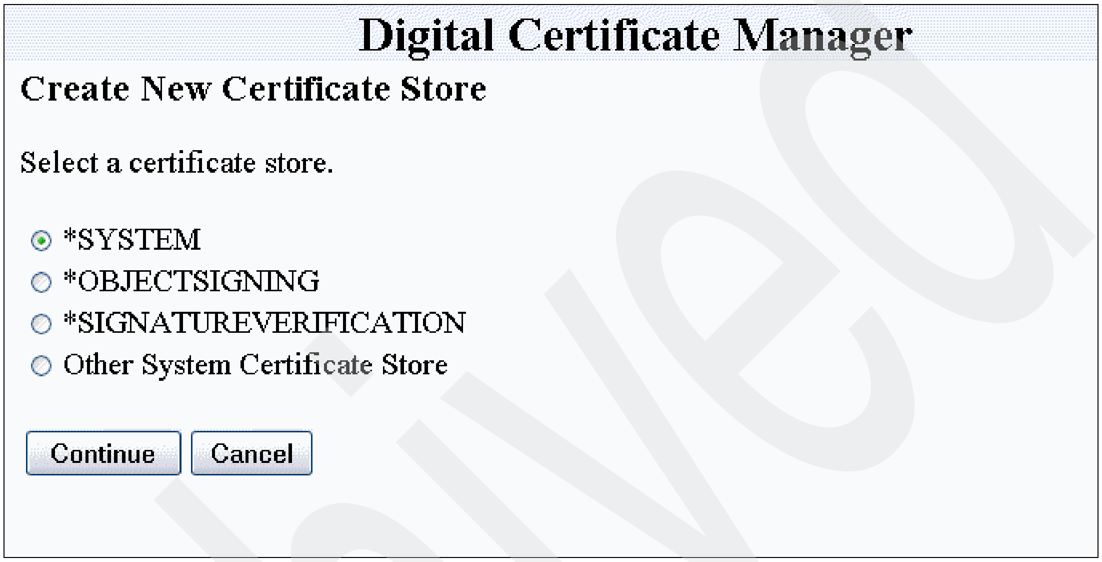
Figure 8-23 Main Digital Certificate Manager task page

You do not need to create a Local Certificate Authority in this scenario. In the SSL handshake, it is the server that provides proof that confirms its identity. This proof is the CA certificate signature that validates the Server Certificate. The client recognizes the Certification Authority and trusts it to verify and eventually accepts the server identity.

For these reasons, create a container to save the remote CA certificate.

4. Click **Create New Certificate Store** in the left navigation.

   Figure 8-24 shows all the possible Certificate Stores that are not created yet.



Digital Certificate Manager

Create New Certificate Store

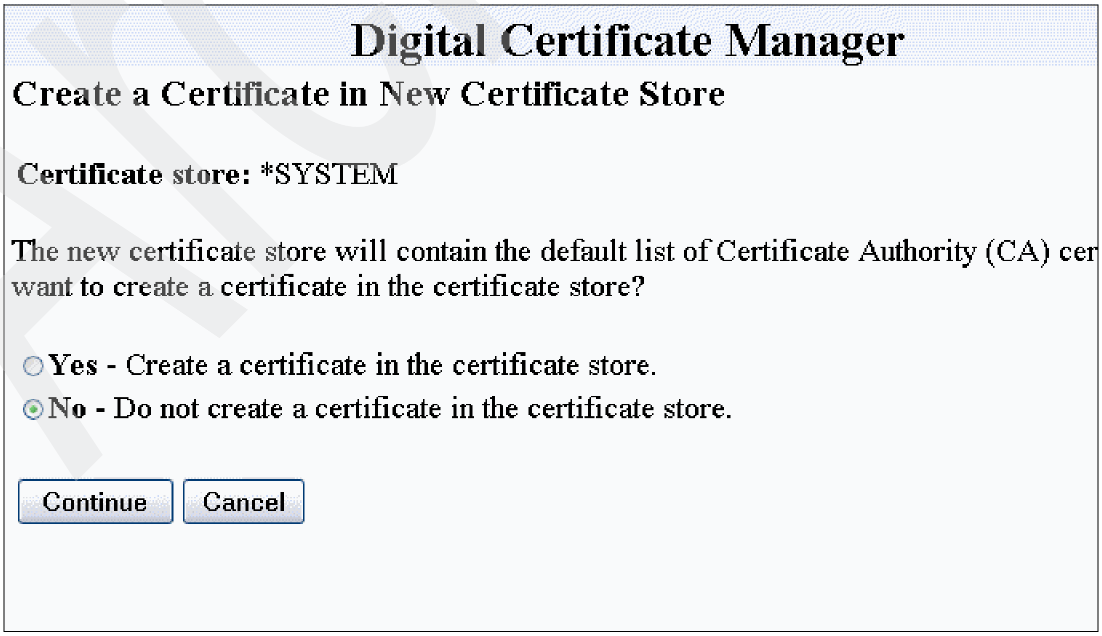
Select a certificate store.

● *SYSTEM
○ *OBJECTSIGNING
○ *SIGNATUREVERIFICATION
○ Other System Certificate Store

Figure 8-24 Create New Certificate Store page

5. Select ***SYSTEM** and then click **Continue**.

   The Digital Certificate Manager allows you to create a server or client certificate, as Figure 8-25 shows, but this is not required for our scenario.



Digital Certificate Manager

Create a Certificate in New Certificate Store

Certificate store: *SYSTEM

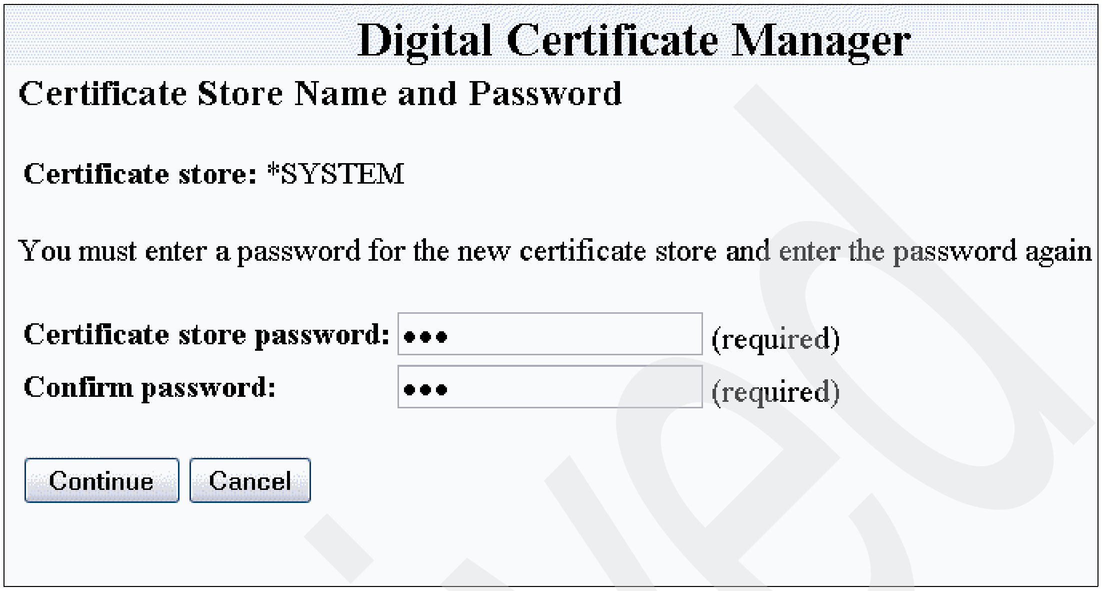
The new certificate store will contain the default list of Certificate Authority (CA) cer
want to create a certificate in the certificate store?

○ **Yes** - Create a certificate in the certificate store.
● **No** - Do not create a certificate in the certificate store.

Figure 8-25 Choose to create or not a Certificate in a New Certificate Store

6. Select **No** and click **Continue**.

   As shown in Figure 8-26, set a password that protects the *SYSTEM Certificate Store.



Digital Certificate Manager

Certificate Store Name and Password

Certificate store: *SYSTEM

You must enter a password for the new certificate store and enter the password again

Certificate store password: ••• (required)

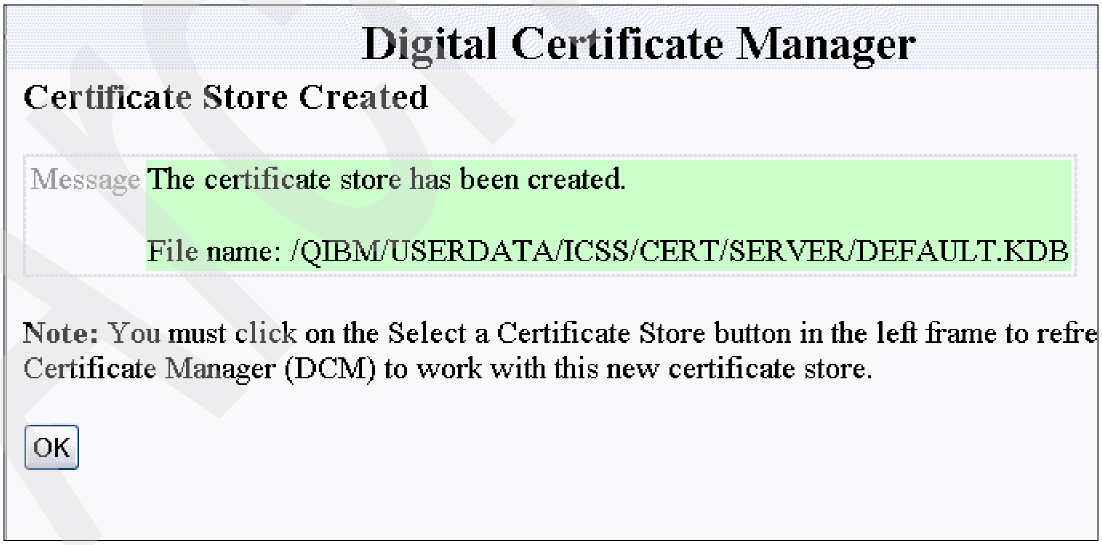
Confirm password: ••• (required)

Figure 8-26 Set the password for the New Certificate Store

7. Insert a password in the Certificate store password field, confirm it in the Confirm password field, and click **Continue**.

   The message shown in Figure 8-27 tells you that the *SYSTEM Certificate Store was created correctly.

8. Click **OK** to complete the task.



Digital Certificate Manager

Certificate Store Created

Message The certificate store has been created.

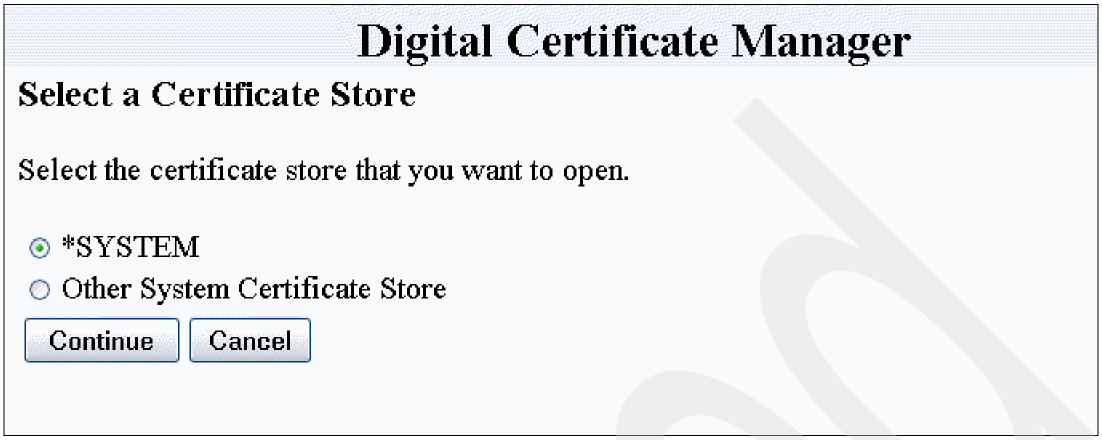
File name: /QIBM/USERDATA/ICSS/CERT/SERVER/DEFAULT.KDB

Note: You must click on the Select a Certificate Store button in the left frame to refre Certificate Manager (DCM) to work with this new certificate store.

Figure 8-27 Certificate Store Created confirmation message

The window shown in Figure 8-24 on page 264 appears again. Because you are not creating other certificate stores in this scenario, click **Cancel** to go back to the main Digital Certificate Manager task page.

9. Click **Select a Certificate Store** in the left navigation. Figure 8-28 shows the Certificate Store available to open.



Digital Certificate Manager

Select a Certificate Store

Select the certificate store that you want to open.

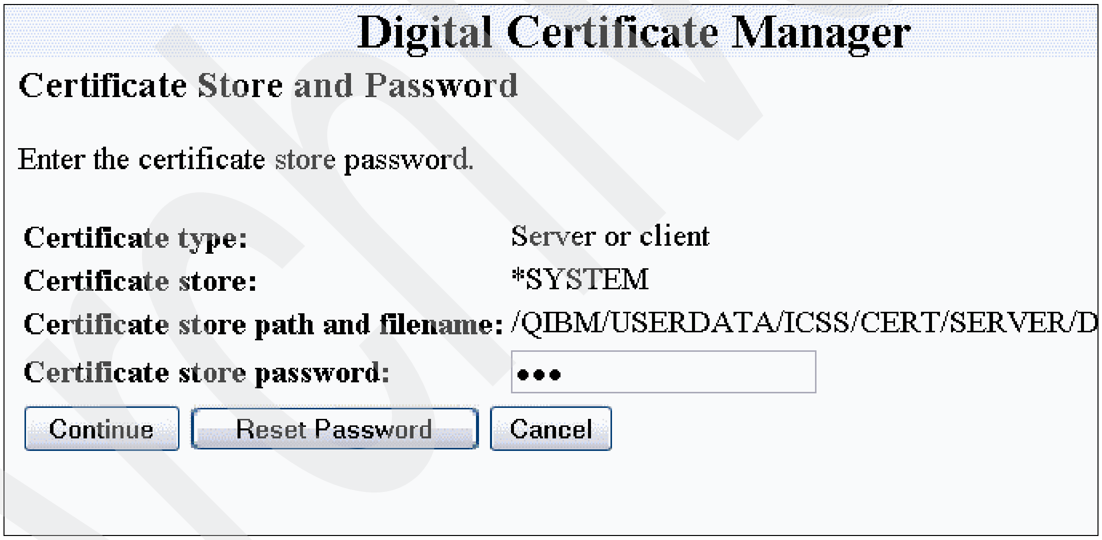
● *SYSTEM

○ Other System Certificate Store

Figure 8-28 Select a Certificate Store page

10. Select ***SYSTEM** and click **Continue**.

To open the *SYSTEM Certificate Store, as shown in Figure 8-29, provide the same password that you had set in Step 7 on page 265.



Digital Certificate Manager

Certificate Store and Password

Enter the certificate store password.

Certificate type: Server or client

Certificate store: *SYSTEM

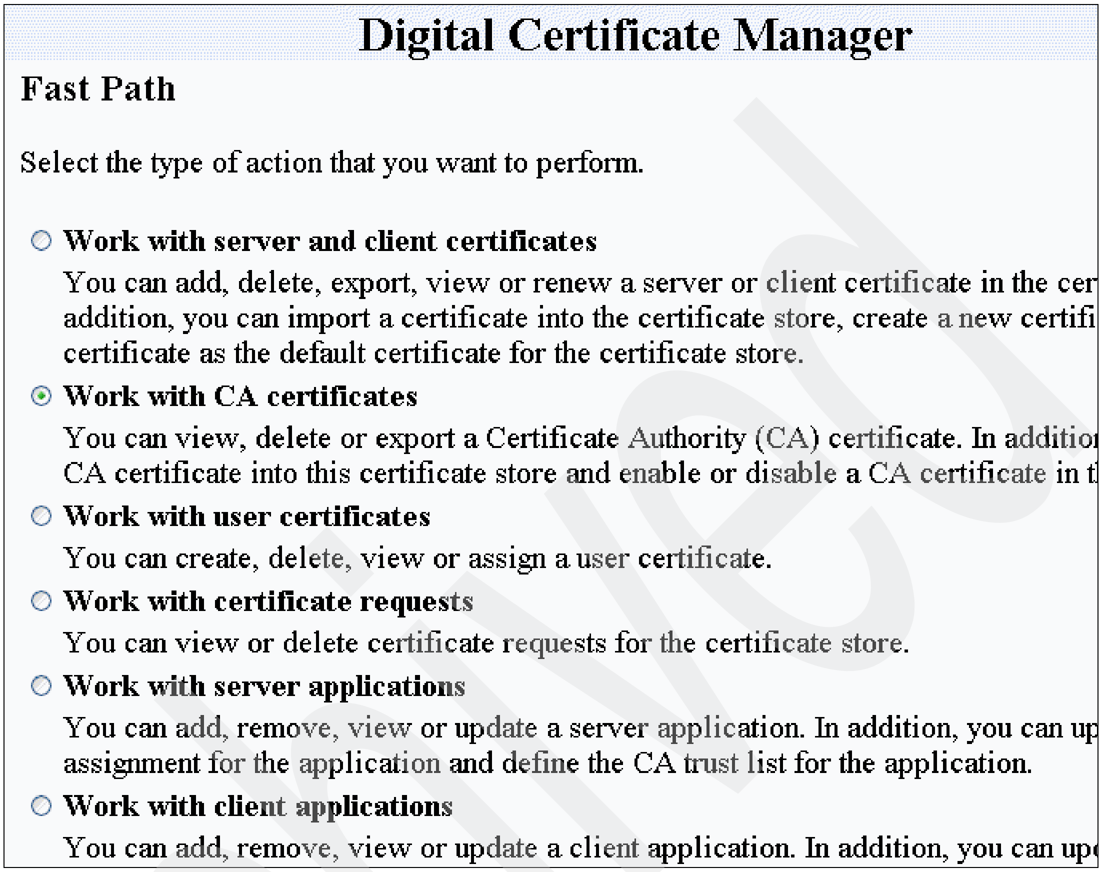
Certificate store path and filename: /QIBM/USERDATA/ICSS/CERT/SERVER/D

Certificate store password: •••

Figure 8-29 Certificate Store and Password page

11. Enter the correct password in the Certificate store password field and click **Continue**.

12. In the left navigation, expand **Fast Path** as shown in Figure 8-30. Select **Work with CA certificates** and click **Continue**.



Digital Certificate Manager

Fast Path

Select the type of action that you want to perform.

○ **Work with server and client certificates**
You can add, delete, export, view or renew a server or client certificate in the cer
addition, you can import a certificate into the certificate store, create a new certifi
certificate as the default certificate for the certificate store.

● **Work with CA certificates**
You can view, delete or export a Certificate Authority (CA) certificate. In additio
CA certificate into this certificate store and enable or disable a CA certificate in t

○ **Work with user certificates**
You can create, delete, view or assign a user certificate.

○ **Work with certificate requests**
You can view or delete certificate requests for the certificate store.

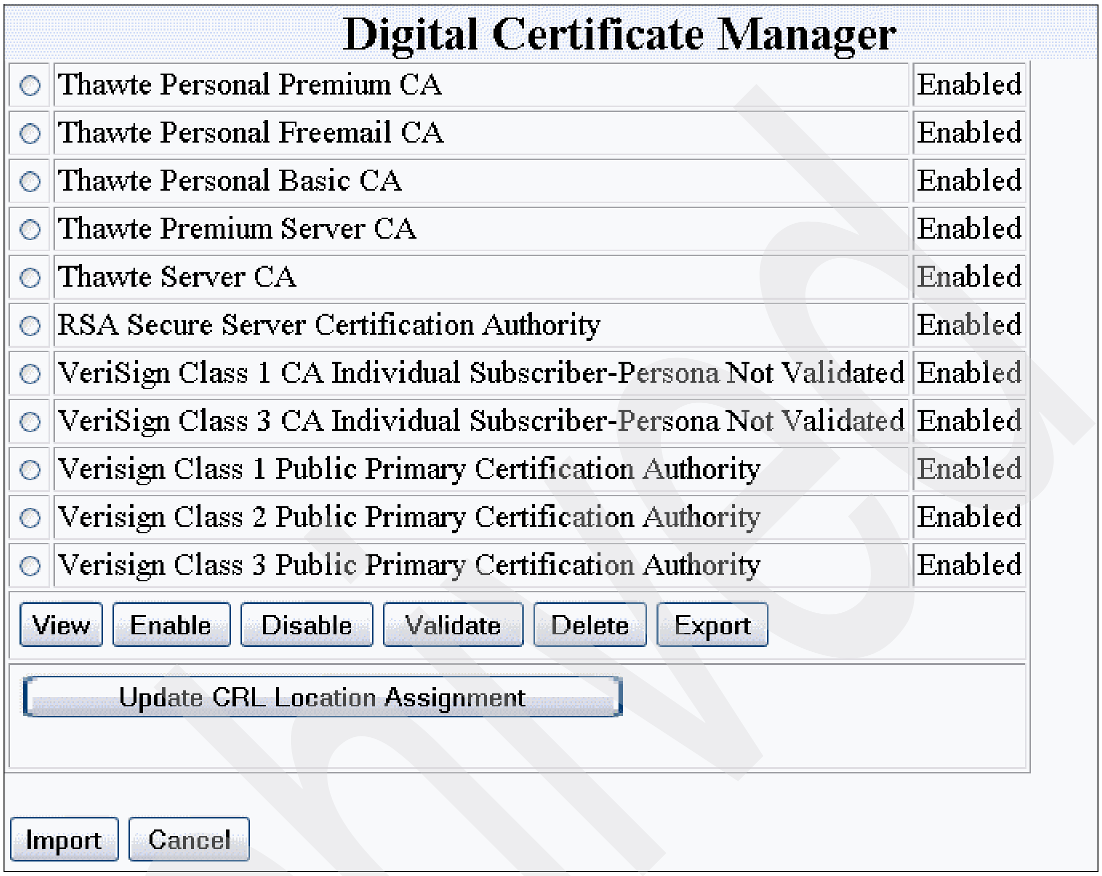
○ **Work with server applications**
You can add, remove, view or update a server application. In addition, you can up
assignment for the application and define the CA trust list for the application.

○ **Work with client applications**
You can add, remove, view or update a client application. In addition, you can up

Figure 8-30 Fast Path page

The list of all current certificate authorities known by the system is shown in Figure 8-31.

13.Click **Import** at the bottom of the page.

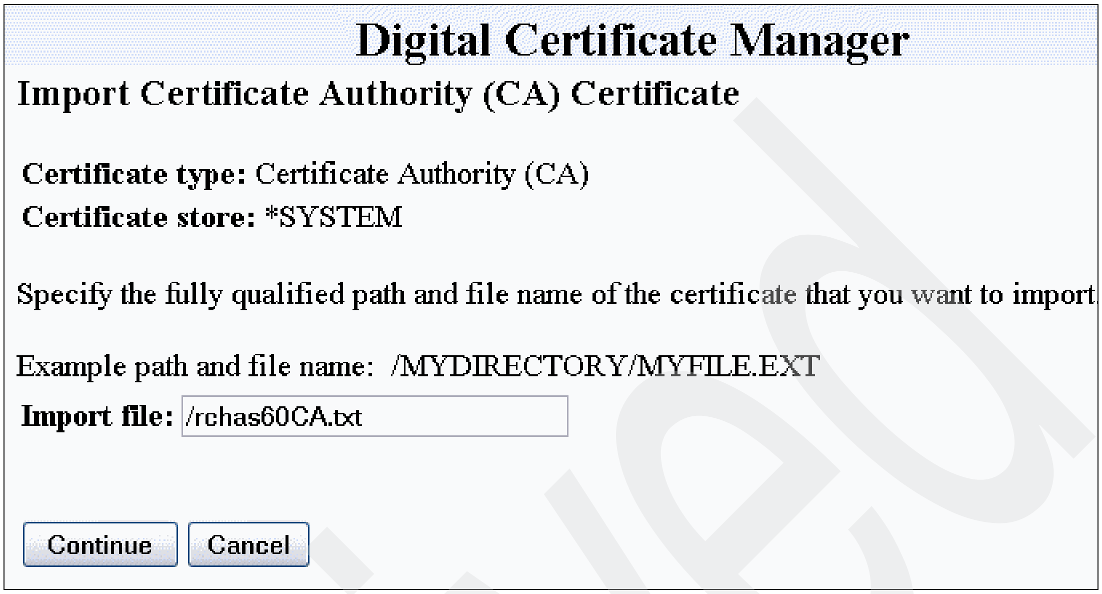


Digital Certificate Manager

○	Thawte Personal Premium CA	Enabled
○	Thawte Personal Freemail CA	Enabled
○	Thawte Personal Basic CA	Enabled
○	Thawte Premium Server CA	Enabled
○	Thawte Server CA	Enabled
○	RSA Secure Server Certification Authority	Enabled
○	VeriSign Class 1 CA Individual Subscriber-Persona Not Validated	Enabled
○	VeriSign Class 3 CA Individual Subscriber-Persona Not Validated	Enabled
○	Verisign Class 1 Public Primary Certification Authority	Enabled
○	Verisign Class 2 Public Primary Certification Authority	Enabled
○	Verisign Class 3 Public Primary Certification Authority	Enabled

Figure 8-31 Work with Certificate Authority page

In the page shown in Figure 8-32, specify the full path of the file that you transferred via FTP into the i5/OS Integrated File System in Step 8 on page 250.



Digital Certificate Manager

Import Certificate Authority (CA) Certificate

Certificate type: Certificate Authority (CA)

Certificate store: *SYSTEM

Specify the fully qualified path and file name of the certificate that you want to import

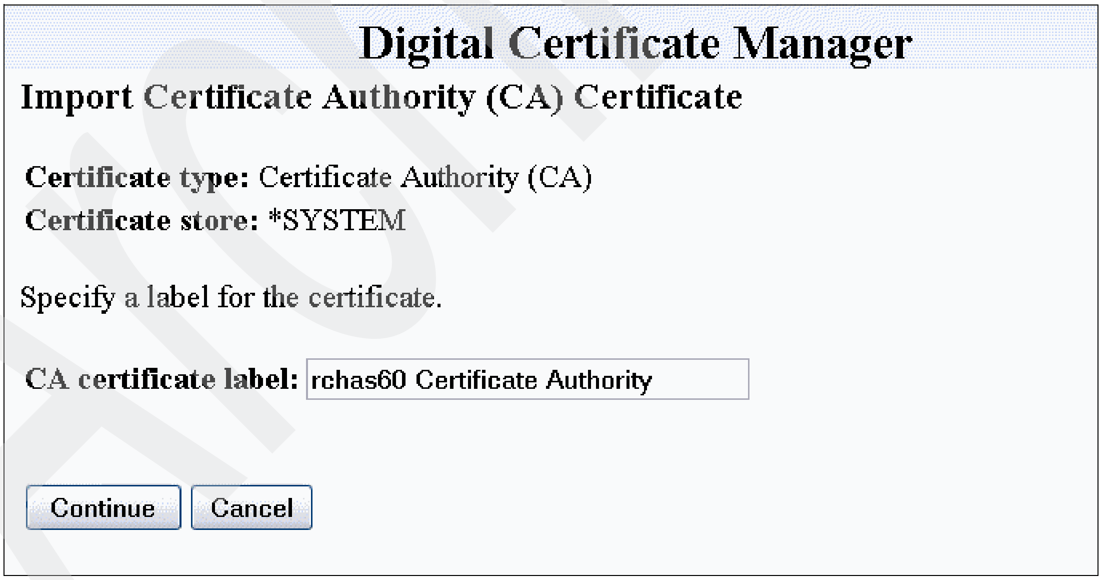
Example path and file name: /MYDIRECTORY/MYFILE.EXT

Import file: /rchas60CA.txt

Figure 8-32 Specify the CA Certifier file path

14. Enter the fully qualified path of the certificate file. In this scenario, it is c:/rchas60CA.txt and click **Continue**.

    As shown in Figure 8-33, insert a unique CA certificate label.



Digital Certificate Manager

Import Certificate Authority (CA) Certificate

Certificate type: Certificate Authority (CA)

Certificate store: *SYSTEM

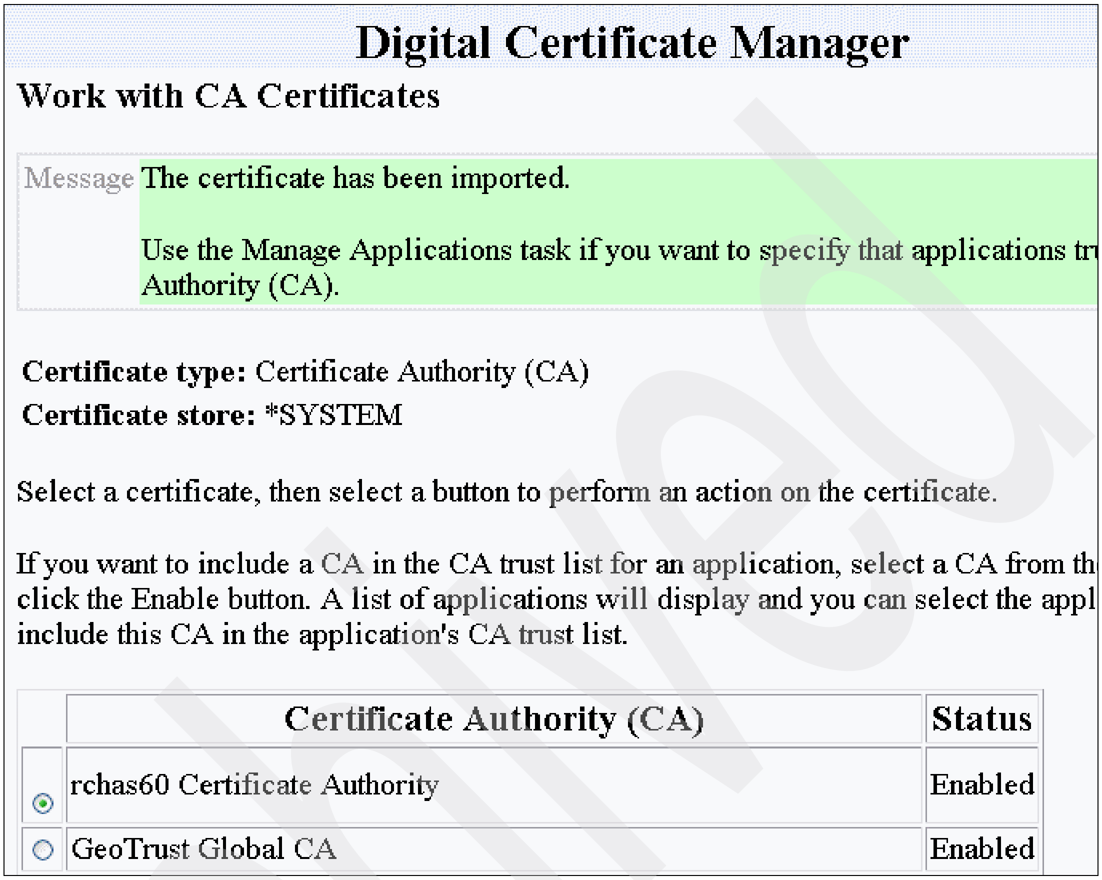
Specify a label for the certificate.

CA certificate label: rchas60 Certificate Authority

Figure 8-33 Insert the CA certificate label

15. Enter `rchas60 Certificate Authority` as the CA certificate label and click **Continue**,

As shown in Figure 8-34, a confirmation message informs you that the CA certificate was imported correctly.



Digital Certificate Manager

Work with CA Certificates

Message The certificate has been imported.

Use the Manage Applications task if you want to specify that applications tr
Authority (CA).

Certificate type: Certificate Authority (CA)

Certificate store: *SYSTEM

Select a certificate, then select a button to perform an action on the certificate.

If you want to include a CA in the CA trust list for an application, select a CA from th
click the Enable button. A list of applications will display and you can select the appl
include this CA in the application's CA trust list.

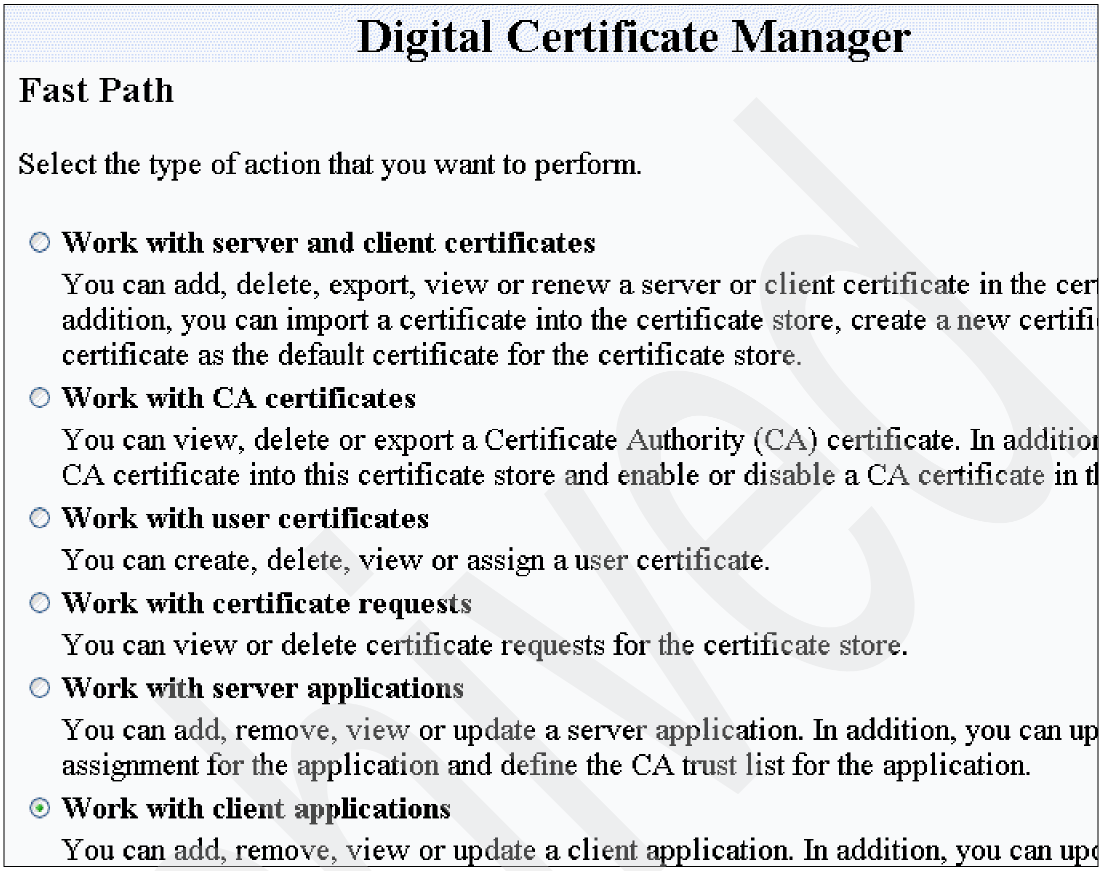
	Certificate Authority (CA)	Status
●	rchas60 Certificate Authority	Enabled
○	GeoTrust Global CA	Enabled

Figure 8-34 CA certificate successfully imported

16. Click **Cancel** to complete the task and go back to the main Digital Certificate Store task page in the *SYSTEM Certificate Store.

Next, set the SSL FTP client to trust the Certificate Authority that you imported.

17. Expand again **Fast Path** in the left navigation, but this time select **Work with client applications**, as shown in Figure 8-35, and click **Continue.**



Digital Certificate Manager

Fast Path

Select the type of action that you want to perform.

○ **Work with server and client certificates**
You can add, delete, export, view or renew a server or client certificate in the cer
addition, you can import a certificate into the certificate store, create a new certifi
certificate as the default certificate for the certificate store.

○ **Work with CA certificates**
You can view, delete or export a Certificate Authority (CA) certificate. In additio
CA certificate into this certificate store and enable or disable a CA certificate in t

○ **Work with user certificates**
You can create, delete, view or assign a user certificate.

○ **Work with certificate requests**
You can view or delete certificate requests for the certificate store.

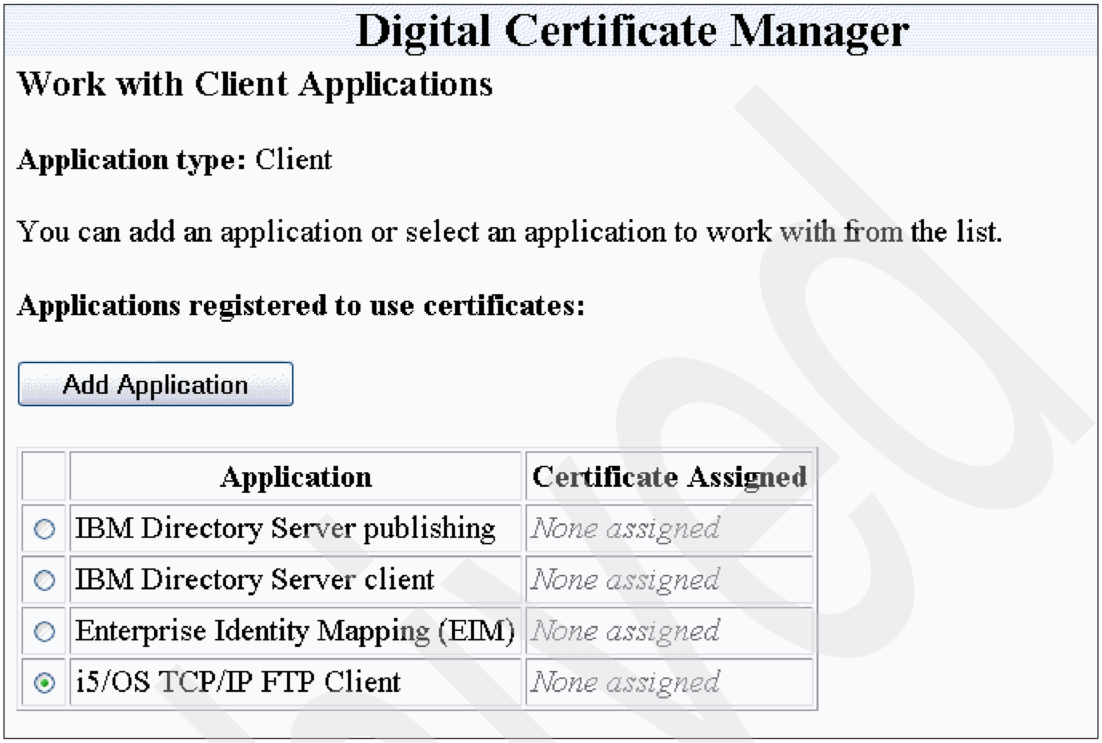
○ **Work with server applications**
You can add, remove, view or update a server application. In addition, you can up
assignment for the application and define the CA trust list for the application.

● **Work with client applications**
You can add, remove, view or update a client application. In addition, you can up

Figure 8-35 In Fast path page - Select Work with client applications

Figure 8-36 shows the list of SSL Client applications available on the system.

18. Select **i5/OS TCP/IP FTP Client** and click **Work with Application**.



Digital Certificate Manager

Work with Client Applications

Application type: Client

You can add an application or select an application to work with from the list.

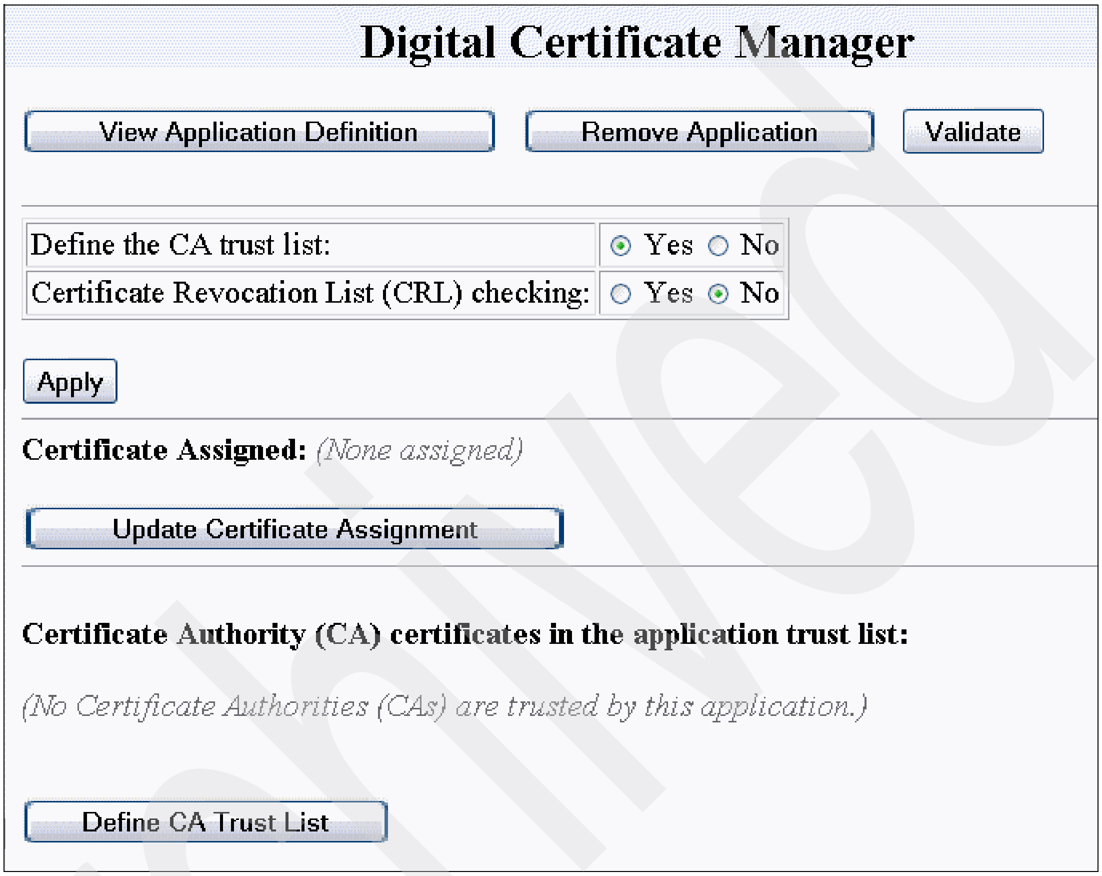
Applications registered to use certificates:

	Application	Certificate Assigned
○	IBM Directory Server publishing	*None assigned*
○	IBM Directory Server client	*None assigned*
○	Enterprise Identity Mapping (EIM)	*None assigned*
●	i5/OS TCP/IP FTP Client	*None assigned*

Figure 8-36 Work with Client Application

Figure 8-37 shows that the FTP client application does not trust any CA certificate. It implements this type of checking because there is a **Yes** in the Define the CA trust list option.

19.Click **Define CA Trust list**.



Digital Certificate Manager
View Application Definition
Remove Application
Validate
Apply
Update Certificate Assignment
Define CA Trust List

Define the CA trust list:	● Yes ○ No
Certificate Revocation List (CRL) checking:	○ Yes ● No

Certificate Assigned: *(None assigned)*

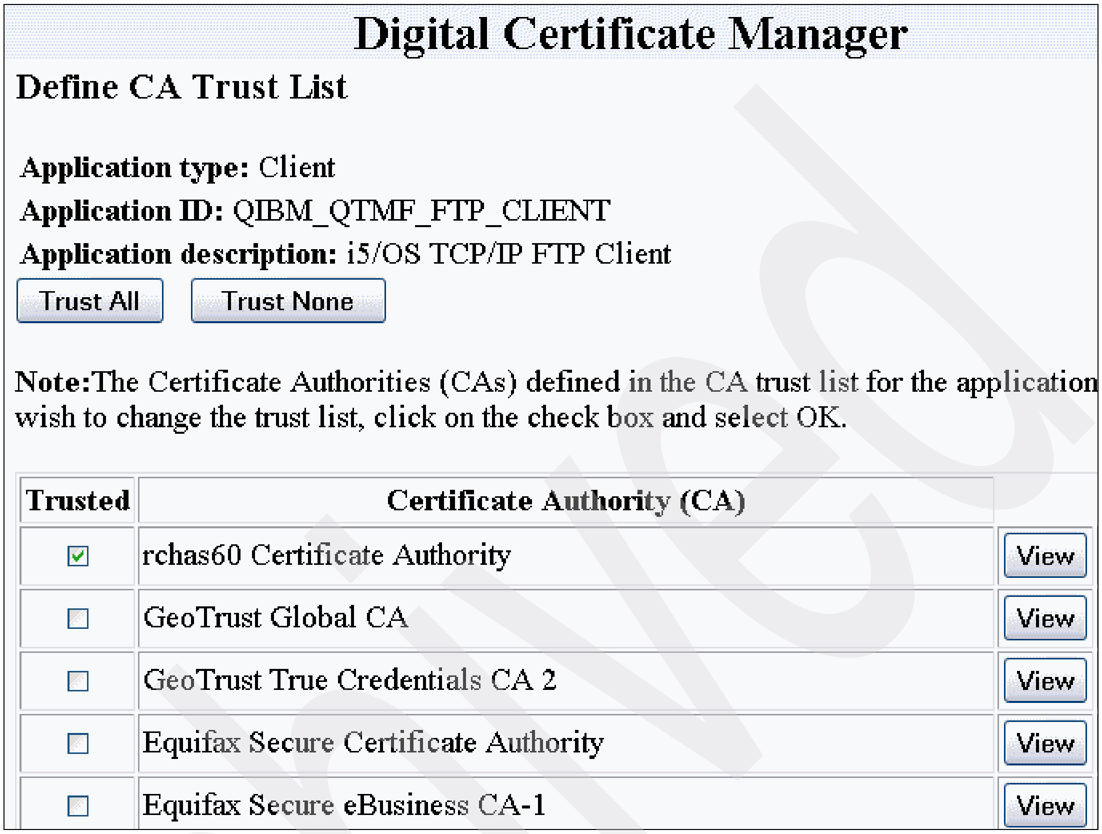
Certificate Authority (CA) certificates in the application trust list:

(No Certificate Authorities (CAs) are trusted by this application.)

Figure 8-37 FTP Client Application details

Figure 8-38 shows all the certificate authorities known by the system.

20. Select **rchas60 Certificate Authority** and click **OK**.



Digital Certificate Manager

Define CA Trust List

Application type: Client

Application ID: QIBM_QTMF_FTP_CLIENT

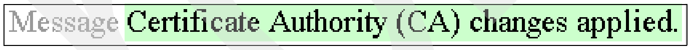
Application description: i5/OS TCP/IP FTP Client

Note: The Certificate Authorities (CAs) defined in the CA trust list for the application wish to change the trust list, click on the check box and select OK.

Trusted	Certificate Authority (CA)	
☑	rchas60 Certificate Authority	View
□	GeoTrust Global CA	View
□	GeoTrust True Credentials CA 2	View
□	Equifax Secure Certificate Authority	View
□	Equifax Secure eBusiness CA-1	View

Figure 8-38 Select the Certificate Authority you want to trust

The message shown in Figure 8-39 confirms you that the changes made on the Certificate Authority were applied.

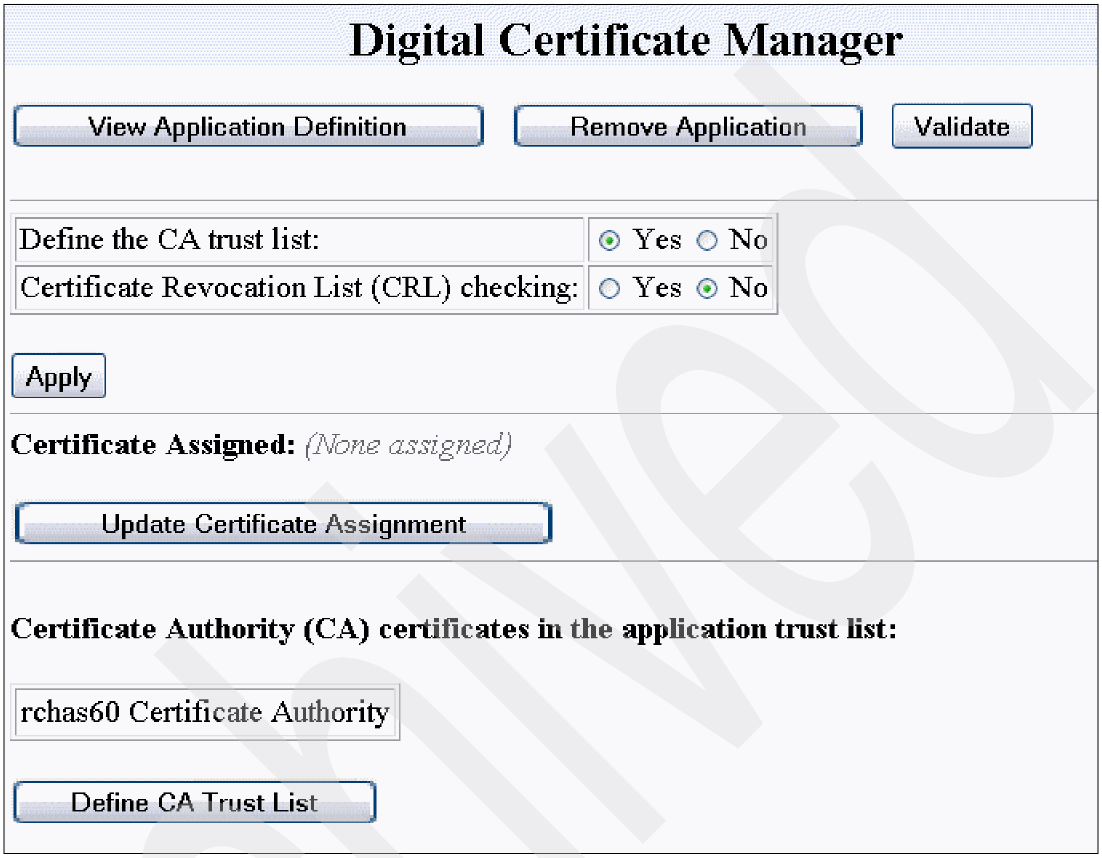


Message Certificate Authority (CA) changes applied.

Figure 8-39 Confirmation message

21. In Figure 8-38 on page 274, click **Cancel** to complete the task.

Figure 8-40 shows that the SSL FTP client can now trust the rchas60CA Certificate Authority.


Digital Certificate Manager
View Application Definition
Remove Application
Validate
Apply
Update Certificate Assignment
Define CA Trust List

Define the CA trust list:	● Yes ○ No
Certificate Revocation List (CRL) checking:	○ Yes ● No

Certificate Assigned: *(None assigned)*

Certificate Authority (CA) certificates in the application trust list:

rchas60 Certificate Authority

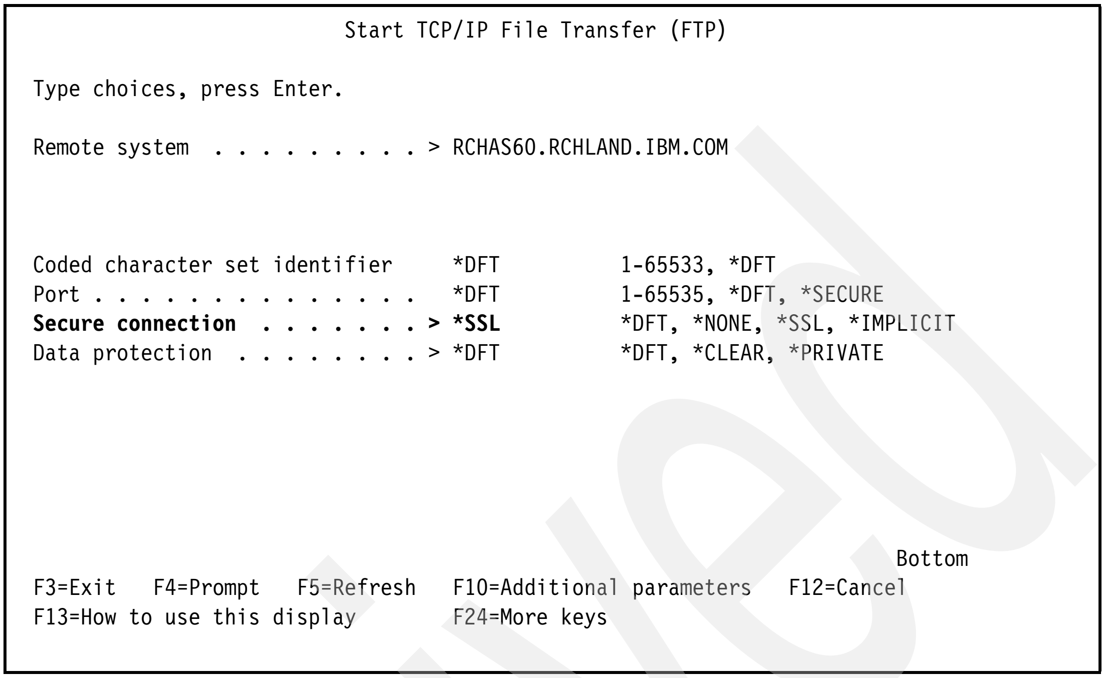
Figure 8-40 FTP Client Application information updated

The configuration is completed and the FTP client is enabled to use the SSL. Eventually, you can validate the application to check if the steps are correct.

8.5 Verifying the Secure FTP

You have enabled SSL on the FTP client and server sides to establish a secure FTP connection. Even if both parts are configured to use SSL, the request to open an SSL FTP session starts always from the client side.

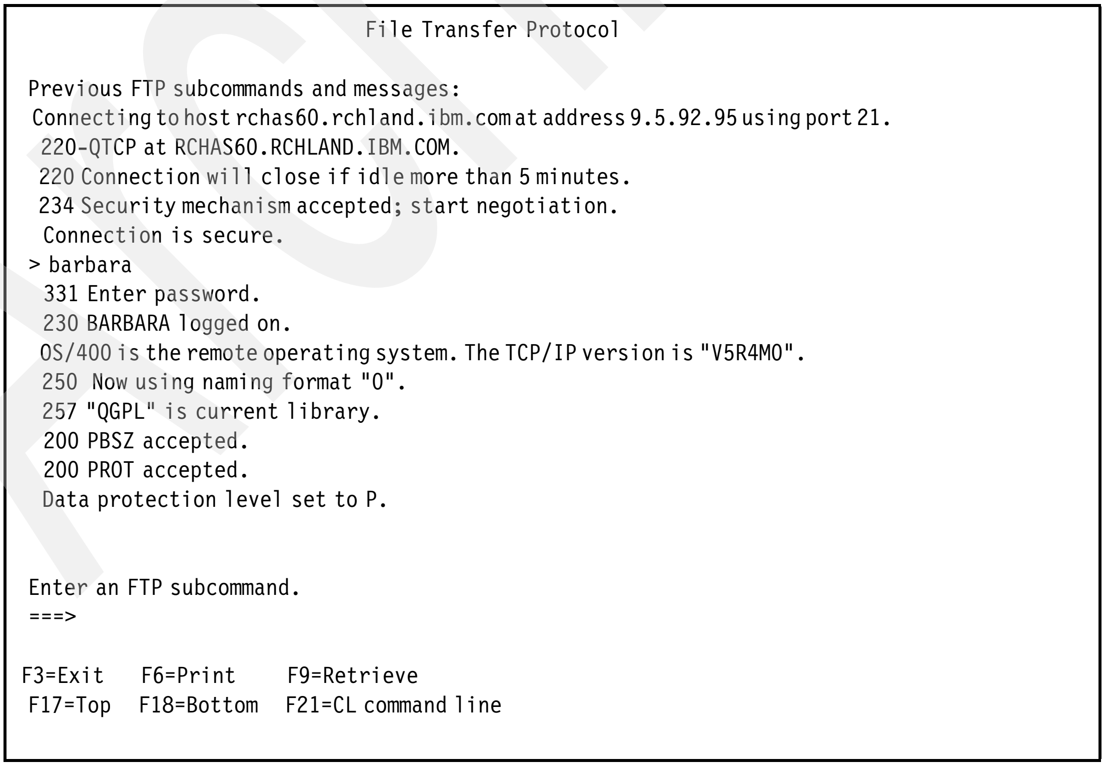
Figure 8-41 shows an example of this request.



```
                               Start TCP/IP File Transfer (FTP)

 Type choices, press Enter.

 Remote system  . . . . . . . . . > RCHAS60.RCHLAND.IBM.COM



 Coded character set identifier     *DFT          1-65533, *DFT
 Port . . . . . . . . . . . . . .   *DFT          1-65535, *DFT, *SECURE
 Secure connection  . . . . . . . > *SSL          *DFT, *NONE, *SSL, *IMPLICIT
 Data protection  . . . . . . . . > *DFT          *DFT, *CLEAR, *PRIVATE






                                                                      Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F10=Additional parameters   F12=Cancel
 F13=How to use this display        F24=More keys
```

Figure 8-41 FTP command prompt

Specifying *SSL in the Secure connection (SECCNN) parameter, the FTP client starts the negotiation for a secure connection in the control session opened on port 21(Figure 8-42). Later on, all the data transmitted between those systems are encrypted.



```
                                 File Transfer Protocol

 Previous FTP subcommands and messages:
  Connecting to host rchas60.rchland.ibm.com at address 9.5.92.95 using port 21.
   220-QTCP at RCHAS60.RCHLAND.IBM.COM.
   220 Connection will close if idle more than 5 minutes.
   234 Security mechanism accepted; start negotiation.
    Connection is secure.
 > barbara
    331 Enter password.
    230 BARBARA logged on.
   OS/400 is the remote operating system. The TCP/IP version is "V5R4M0".
    250  Now using naming format "0".
    257 "QGPL" is current library.
    200 PBSZ accepted.
    200 PROT accepted.
    Data protection level set to P.


 Enter an FTP subcommand.
 ===>

F3=Exit    F6=Print     F9=Retrieve
 F17=Top   F18=Bottom   F21=CL command line
```

Figure 8-42 Sample FTP session

The following three parameters are involved in the Secure FTP connection opening. Different combinations of these parameters have different results.

- Secure connection (SECCNN):

  This specifies the security mechanism to use for protecting information transferred on the FTP control connection (which includes the password used to authenticate the session with the FTP server). The values are:

  - *DFT: If the PORT parameter specifies *SECURE or 990, *IMPLICIT is used. Otherwise, *NONE is used.
  - *IMPLICIT: The FTP client immediately attempts to use TLS/SSL when connecting to the specified FTP server (without sending an AUTH subcommand to the server). If the server does not support implicit TLS/SSL on the specified port, or the TLS/SSL negotiation fails for any reason, the connection is closed.
  - *SSL: After connecting to the specified FTP server, the FTP client sends an AUTH (authorization) subcommand requesting a TLS/SSL protected session. If the server supports TLS/SSL, a TLS/SSL negotiation is performed. If the server does not support TLS/SSL or the TLS/SSL negotiation fails, the connection closes.
  - *NONE: The FTP client does not use encryption when connecting to the specified FTP server.

- Port (PORT):

  This specifies the port number to use for connecting to the FTP server. Normally, the “well-known” port value of 21 is used to connect to the FTP server. The values are:

  - *DFT: The value 00021 is used.
  - *SECURE: The value 00990 is used. Port 990 is reserved for secure FTP servers that immediately use Transport Layer Security (TLS) or SSL protocols to encrypt data.
  - 1-65535: The requested port value is used. This value is validated to ensure it is in the proper range.

    Note: If you specify 990, the FTP client performs the same functions as *SECURE.

- Data protection (DTAPROT):

  This specifies the type of data protection to use for information transferred on the FTP data connection. Use this connection to transfer file data and directory listings. The FTP protocol does not allow protection of the data connection if the control connection is not protected. The values are:

  - *DFT: If the SECCNN parameter specifies a protected control connection, *PRIVATE is used. Otherwise, *CLEAR is used.
  - *PRIVATE: Information sent on the FTP data connection is encrypted.

    Note: If the SECCNN parameter specifies that the FTP control connection is not encrypted, then you cannot specify *PRIVATE.

  - *CLEAR: Information sent on the FTP data connection is not encrypted.

Table 8-3 shows a schema of the possible combinations of SECCNN and PORT values.

Table 8-3 Possible combination and relatives results of SECCNN and PORT parameters

SECCNN value	PORT value	Control connection result
*DFT or *IMPLICIT	*SECURE or 990	It works. Control session crypted and opened directly on secure port.
*IMPLICIT	*DFT or 21	It does not work.
*SSL	*SECURE or 990	It does not work.
*SSL	*DFT or 21	It works. Control session opened on non-secure port and then switched on the secure one to be crypted.
*DFT	*DFT	It works. Control session opened on non secure port.

Note that as soon as a secure FTP connection is established, the data protection (DTAPROT) parameter is either *CLEAR and *PRIVATE. When *CLEAR is specified, only the information exchanged in the control session is crypted. The user profile and the password have this information. When *PRIVATE is specified, all the data exchanged is protected by the SSL.

Encryption can have a significant performance cost and can be bypassed on the data connection. This allows you to transfer non-sensitive files without decreasing performance and still protect the system's security by not exporting the password. However, if the SSL traffic is considerable, then you can order and install a 2058 Cryptographic Accelerator; that is, a Peripheral Component Interconnect (PCI) card. This card is specially designed to accelerate the computer intensive processing required when establishing a SSL/TLS session. For details about its configuration, see the *2058 Cryptographic Accelerator* topic in the iSeries V4R4 Information Center at:

http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/index.jsp?topic=/rzajc/rzajcaccel2058.htm

When the session is established, there are many subcommands that can enable a SSL session or disable it and change the results of the initial FTP client requests. Those subcommands include SECOPEN, SECData, PROT, and CCC. For more information, see the *File Transfer Protocol* topic in the iSeries V5R4 Information Center at:

http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/index.jsp?topic=/rzaiq/rzaiqrzairqgetstart.htm

8.6 Tips and techniques

A good security policy is in layers; one level is not enough to consider it as a safe solution. Keep in mind that "Security is only as strong as the weakest link in the chain".

Network security is implemented to protect two objects: the data that is transmitted on the network and the computers that are connected to the network. Network security cannot replace physical site security, host security on the connected systems, application security, and user security education. It can only act as a first layer of defense.

SSL is not the only solution that you can implement to secure your i5/OS server FTP Server system. If you choose this solution, then enable the client authentication function.

Other actions that you can take to protect your FTP server are:

- Control FTP access: If you are using FTP, control users to protect your data and network.
- Manage access using FTP exit programs: Use FTP exit points or the Application Administration in iSeries Navigator to protect the iSeries.
- Monitor incoming FTP users: Monitor who is logging in to your FTP server.

Those are some examples that you can implement. There is no solution that fits all situations, it always depends on what you want to protect, which effort is required to protect your goals, and your enterprise security policies.

If there is a firewall installed and when possible, open only the port 990 used by the secure FTP control session and not port 21. If the client authentication function is enabled on the SSL FTP server application, then this provides good protection. To open a Secure FTP control session directly to port 990, check Table 8-3 on page 278 for the option to specify to input the FTP client request. There are no specific considerations related to the SSL FTP data connections. The same rules apply for non-secure FTP data connections.

For more information about FTP and security, see *System i Security Guide for IBM i5/OS Version 5 Release 4,* SG24-6668. For implementation details, see the *File Transfer Protocol* topic in the iSeries V5R4 Information Center at:

http://publib.boulder.ibm.com/infocenter/systems/scope/i5os/index.jsp?topic=/rzaiq/rzaiqrzairqgetstart.htm

OpenSSH and Open SSL

Note: Since V5R3, the free-of-charge Licensed Product Offering (LPO) IBM Portable Utilities, 5733-SC1, has been available. The 5733-SC1 LPO contains the OpenSSH, OpenSSL and zlib open source packages ported to i5/OS using the i5/OS PASE runtime environment, and i5/OS Option 33 (i5/OS PASE - Portable Solutions Application Environment).

The SSH protocol suite is a software solution that provides secure alternatives for Telnet and FTP. SSH verifies the authenticity of both the client and server, and all of the data (including user IDs and passwords) encrypted as it travels in the network. This encryption is done transparently to the user.

Because it is a UNIX® standard, SSH presents limitations in the i5/OS environment. It does *not* support character conversion. Only binary transfer mode is supported, which operates only with the Integrated File System (namefmt 1), even if it can reach the library system through the use of a path.

See Chapter 12, “Using file transfer and public key authentication with OpenSSH” on page 301 on how to install, configure, and use SSH with i5/OS.

9

Introduction to OpenSSH for i5/OS

The *Secure Shell* (SSH) was originally designed to provide mainly a secure remote login to and a file transfer utility between remote computers. The communication protocol is an SSH protocol that runs on top of *Transmission Control Protocol* (TCP). Currently, two protocols are supported, SSH1 and SSH2. These two protocols are entirely different. and therefore, are not compatible. Today, a company named SSH Communications Security, the original developer of SSH, maintains these protocols. The SSH *transport layer protocol* is described in draft form on the Web at:

`http://www.ietf.org/html.charters/secsh-charter.html`

This chapter explains the tools and files that are provided with OpenSSH, the implementation of OpenSSH on i5/OS, and the installation of the IBM Portable Utilities for i5/OS licensed program. It also presents an overview of the environment used in this book.

9.1 OpenSSH tools and files

OpenSSH is the open source version of SSH and provides a set of tools that allows secure communications between two communication partners using the SSH protocol. The following tools and files are provided with OpenSSH:

- ssh client utility (basic rlogin or rsh-type client program):

  The ssh client utility is a program for logging into a remote system and for performing commands on a remote system. It is intended to replace the rsh and rlogin utilities, which do not provide a secure connection. It also provides secure encrypted communications between two systems over an untrusted network. You can also forward X11 connections and arbitrary TCP/IP ports over the secure channel.

  In the UNIX and Linux world, ssh is a common utility to securely communicate to a remote system. You also use it as a client to establish an SSH connection to the Hardware Management Console (HMC) with the IBM POWER5™ technology-based IBM System i5™ and System p5™ platforms. The SSH connection with the HMC provides administrators with a command line interface.

  ssh connects and logs into the specified host name (with optional user name). The user must prove their identity to the remote system using one of several authentication methods, depending on the protocol version that is used.

  A popular graphical ssh client is the PuTTY client. You can download it freely from the Internet at:

  http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html

  That site takes you to the same page of the PuTTY programmer. This ssh client is published under the MIT license, which is compatible with the GNU GPL license. It allows both individuals and companies to use the client without restriction.

- sshd daemon (permits you to login):

  The ssh daemon (sshd) is the daemon (server) program for ssh. Together, these programs replace rlogin and rsh and provide a secure encrypted communications link between two untrusted hosts over a non-secure connection.

  The sshd daemon listens by default on port 22 for connections from clients. It is normally started at IPL time. It spawns a new daemon process for each incoming connection. This implementation of the sshd daemon supports both SSH protocol versions 1 and 2, simultaneously.

- ssh_config client configuration file:

  This is the system wide configuration file for ssh client settings. These settings are used for every ssh, sftp, and scp client request. The system-wide configuration file, with the name ssh_config, is stored in the /QOpenSys/QIBM/UserData/SC1/OpenSSH/openssh-3.5p1/ etc directory.

- sshd_config daemon configuration file:

  Customizing the sshd configuration file is optional. It is required only when the default values meet your requirements. The configuration file is in the integrated file system directory /QOpenSys/QIBM/UserData/SC1/OpenSSH/openssh-3.5p1/etc. The configuration file name is sshd_config. By default, it has all configuration directives as comments listed. The values shown represent the default settings.

  Important: Use care when selecting the sshd_config file. There are two files, one for the server named sshd_config and one for the client named ssh_config.

- ssh-agent authentication agent (stores private keys):

  ssh-agent is an authentication agent that can store private keys for use with public key authentication. This agent allows a user to load their private key into memory to avoid retyping the pass phrase each time an SSH connection is started. It is typically started at the beginning of one session, and subsequent program calls are started as clients to the ssh-agent process.

- ssh-add (adds keys to the ssh-agent):

  ssh-add tries to load private keys from private key files in a user's ~/.ssh directory. The file names that ssh-add is looking for are defined in the ssh_config file.

- sftp (FTP-like program that works over the SSH1 and SSH2 protocol):

  sftp is a secure FTP replacement. As with all implementations of sftp on other platforms, sftp can only transfer data in binary format. sftp does not provide the enhanced functions that are available in the i5/OS FTP utility when transferring files in the QSYS.LIB file system. It does not provide the CCSID data conversion options available in the i5/OS FTP utility.

- scp file copy program:

  scp is a secure file copy program and an alternative to sftp for copying a single file in the integrated file system. It is the OpenSSH version of rcp.

- ssh-keygen key generation tool:

  ssh-keygen is a public and private key generation and management tool. ssh allows users to authenticate using these public and private keys as an alternative to using their operating system sign-on password. As the key names suggest, you can freely distribute public keys, but also protect private keys.

  - Client side:

    You can distribute the public key to the server, where the client connects. The corresponding private key stays on the client and is typically stored encrypted via a pass-phrase key. When the client user wants to use the private key for authentication, the user must enter the pass phrase to unlock the key.

  - Server side:

    You can distribute the public key to any client that connects to this server. The private key is stored in a file on the server. Protect this file via object authorities. Usually, private key files on the server side are not encrypted using a pass phrase. If this is the case, the user must enter the pass phrase every time the server daemon starts.

    Under i5/OS, the keys are stored in files in the integrated file system and private key files provide no public access.

In addition to these utilities, such as ssh, sftp, and so forth, OpenSSH provides the following functions:

- X11 forwarding: Provides encryption of remote X Window System network traffic.
- Port forwarding: Allows forwarding of TCP/IP connections to a remote system over an encrypted channel. This function is useful for applications that do not support SSL encryption, such as Post Office Protocol (POP) or Simple Network Management Protocol (SNMP).
- Data compression: OpenSSH compresses data before it encrypts data using zlib for compression, which can improve the overall performance.
- Kerberos and AFS® Ticket Passing: Passes on tickets for Kerberos and AFS to the remote system. A user can access all Kerberos and AFS services without entering a password again.

- Cryptographic functions: Uses the OpenSSL cryptographic library.

9.2 i5/OS implementation

IBM Portable Utilities for i5/OS, License Program Option (LPO) 5733-SC1, is available since February 2005 for V5R3, and now also V5R4. This LPO contains the OpenSSH, OpenSSL, and zlib open source packages ported to i5/OS using the i5/OS PASE (Portable Solutions Application Environment) runtime environment. The LPO requires a minimum of i5/OS V5R3 and requires that i5/OS Option 33 (i5/OS PASE) is installed.

Only a single English build is available. However, this single build includes the following translations of the OpenSSH messages, which are based on the LANG and NLSPATH environment variable settings:

- CA_ES and ca_ES (Catalan)
- CS_CZ and cs_CZ (Czech)
- DE_DE and de_DE (German)
- EN_US and en_US (English)
- ES_ES and es_ES (Spanish)
- FR_FR and fr_FR (French)
- HU_HU and hu_HU (Hungarian)
- IT_IT and it_IT (Italian)
- JA_JP and ja_JP and Ja_JP (Japanese)
- KO_KR and ko_KR (Korean)
- PL_PL and pl_PL (Polish)
- PT_BR and pt_BR (Portuguese)
- RU_RU and ru_RU (Russian)
- SK_SK and sk_SK (Slovak)
- ZH_CN and Zh_CN and zh_CN (Simplified Chinese)
- ZH_TW and Zh_TW and zh_TW (Traditional Chinese)

The versions and installation directories for the products are:

- The OpenSSH version is 3.5p1 and located in the /QOpenSys/QIBM/ProdData/SC1/OpenSSH/openssh-3.5p1/ directory.
- The OpenSSL version is 0.9.7d and located in the /QOpenSys/QIBM/ProdData/SC1/OpenSSL/openssl-0.9.7d/ directory.
- The zlib version is 1.1.4 and located in the /QOpenSys/QIBM/ProdData/SC1/zlib/zlib-1.1.4/ directory.

System-wide configuration settings

The sshd daemon (sshd_config file) and ssh client (ssh_config file) system-wide settings are stored in the integrated file system in directory /QOpenSys/QIBM/UserData/SC1/OpenSSH/openssh-3.5p1/etc.

User-specific configuration settings

You can override or define certain ssh client settings defined by the individual user. Each user who uses SSH must have a home directory, such as /home/barlen. Under this home directory, there is a hidden directory with the name .ssh, for example, /home/barlen/.ssh. This directory can contain a user's public/private key pairs, a config file, a known_hosts file, and an authorized_keys file.

9.3 Installing the IBM Portable Utilities for i5/OS license program

IBM Portable Utilities for i5/OS contains the OpenSSH, OpenSSL, and zlib open source products. The license program option number for Portable Utilities for i5/OS is 5733-SC1. Because the license program option is available in U.S. English only, you must restore the product as shown in the following two commands:

```
RSTLICPGM LICPGM(5733SC1) DEV(OPTxx) OPTION(*BASE) RSTOBJ(*ALL) LNG(2924)
RSTLICPGM LICPGM(5733SC1) DEV(OPTxx) OPTION(1) RSTOBJ(*PGM)
```

Note: Option 1 only contains program objects. In addition to product 5733-SC1, you must install i5/OS PASE, which is shipped as i5/OS option 33.

9.4 Example environment

Throughout the chapters of this book, the examples shown are based on the following scenario characteristics:

- The SSHD daemon is running on two i5/OS partitions with host names of i5OSP4 and i5OSP2.
- SSH connections are established between the previously mentioned partitions.
- SSH connections are also established from i5/OS to an HMC.
- The user profiles are BARLEN2 for the i5OSP2 system and BARLEN4 for the i5OSP4 system.
- Both i5/OS operating systems are at software level Version 5 Release 3 Modification 0.

Figure 9-1 illustrates our environment.

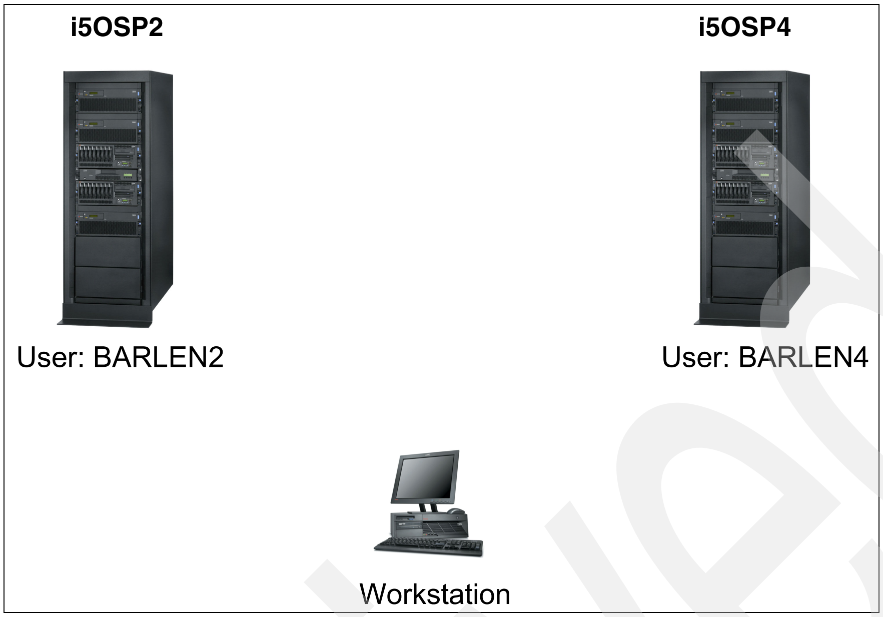


Figure 9-1 Example environment

9.5 Additional information

You can find additional information about SSH and Portable Utilities for i5/OS at the following Web addresses:

- OpenSSH:

  `http://www.openssh.org/`

- IBM Portable Utilities for i5/OS:

  `http://www.ibm.com/servers/enable/site/porting/tools/openssh.html`

10

Setting up and running the sshd daemon

This chapter explains how you set up the Secure Shell (SSH) server (sshd daemon). You *must* perform these same steps on every system that runs an sshd daemon.

For a client to establish an SSH connection to a server, such as the IBM eServer iSeries server, the sshd daemon must run on the server side. Before you can start the sshd daemon, you must perform the following initial setup tasks:

- Set up public and private keys for SSH protocol 1 (rsa1 key).
- Set up public and private keys for SSH protocol 2 (rsa and dsa keys).
- If changes are required, modify the sshd configuration file.
- Start sshd or schedule autostart of sshd.

Prior to performing the setup explained in this chapter, you *must* install:

- The license program option IBM Portable Utilities for i5/OS (5733-SC1)
- i5/OS Portable Solutions Application Environment (PASE) option 33

10.1 Setting up the sshd daemon

Public key authentication is used when establishing an SSH session. At least the sshd daemon requires one or more public key pairs to support public key authentication. Different key types are used for the SSH1 and SSH2 protocols. Perform the following steps to generate the required key pairs for both SSH protocol types:

1. Sign on to your System i platform with a user profile that has *ALLOBJ special authority.
2. From the command line, enter the following command to start an i5/OS PASE shell session:

   ```
   CALL QP2TERM
   ```

3. In the i5/OS PASE shell session, run the following commands in the order shown:

   ```
   cd /QOpenSys/QIBM/UserData/SC1/OpenSSH/openssh-3.5p1/etc
   ssh-keygen -t rsa1 -b 2048 -f ssh_host_key -N ''
   ssh-keygen -t dsa -b 2048 -f ssh_host_dsa_key -N ''
   ssh-keygen -t rsa -b 2048 -f ssh_host_rsa_key -N ''
   ```

   These commands generate public and private key pairs for the SSH1 and SSH2 protocols. They are stored in the /QOpenSys/QIBM/UserData/SC1/OpenSSH/openssh-3.5p1/etc directory. The -N parameter specifies the passphrase that is used to protect the private keys. The passphrase is used as a password to unlock the keys.

   For a server, we recommend that you do *not* specify a passphrase, because the server usually starts in unattended mode. If a passphrase is specified, the server prompts the user to enter the passphrase. Therefore, an empty passphrase is specified.

Note: For our scenario, we set up the sshd daemon environment on both the i5OSP4 and i5OSP2 systems.

10.1.1 Modifying the sshd daemon system configuration

The /QOpenSys/QIBM/UserData/SC1/OpenSSH/openssh-3.5p1/etc directory also contains a configuration file for the server (sshd_config) and the client (ssh_config). Customizing the sshd configuration file is optional. It is only required when the default values do not meet your requirements. As shown in Figure 10-1, the provided sshd_config file contains all possible configuration directives. By default, these directives are commented out with the number sign (#).

```
#Port 22
#Protocol 2,1
#ListenAddress 0.0.0.0
#ListenAddress ::

# HostKey for protocol version 1
#HostKey /QOpenSys/QIBM/ProdData/SC1/OpenSSH/openssh-3.5p1/etc/ssh_host_key
# HostKeys for protocol version 2
#HostKey /QOpenSys/QIBM/ProdData/SC1/OpenSSH/openssh-3.5p1/etc/ssh_host_rsa_key
#HostKey /QOpenSys/QIBM/ProdData/SC1/OpenSSH/openssh-3.5p1/etc/ssh_host_dsa_key

# Lifetime and size of ephemeral version 1 server key
#KeyRegenerationInterval 3600
#ServerKeyBits 768
```

Figure 10-1 The sshd_config file

The values behind the keywords are the default values that the sshd daemon uses when the configuration file is not changed. You can edit the configuration file with this command:

```
EDTF ’/QOpenSys/QIBM/UserData/SC1/OpenSSH/openssh-3.5p1/etc/sshd_config’
```

For more information about the configuration file and its directives, see the OpenSSH Web site at:

http://www.openssh.org

10.2 Starting the sshd daemon with Submit Job (SBMJOB)

Eventually, you must start the sshd daemon with the sshd shell command. You can also submit the job as a batch job as shown in the following example:

```
SBMJOB CMD(CALL PGM(QP2SHELL) PARM('/QOpenSys/usr/sbin/sshd'))
```

After you finish the configuration, you can start the sshd daemon. You can either start the daemon manually, or put it into the startup program to start the daemon automatically when the system starts. The user, under which the sshd daemon runs, must have *ALLOBJ special authority to login users via ssh. We recommend that you create a separate user for running the sshd daemon. The user profile name is eight characters or less.

10.3 Starting the sshd daemon in a dedicated subsystem environment

To better control the environment and resources that are used by SSH jobs, we recommend that you run SSH jobs in a dedicated subsystem. This becomes more obvious when we discuss how the sshd environment works. When you start the sshd daemon in i5/OS, a single job for the daemon is started. When a client establishes an SSH session to the daemon, the daemon spawns a new job for this particular client. When a user is authenticated for this client session, another job is spawned. In addition, if the user runs a command or job, another job is started, which means, that you might end up with *three* jobs for a single client user. Therefore, we recommend that you run all SSH jobs in a separate subsystem.

To set up the required subsystem environment, you must have at least the following i5/OS objects:

- Subsystem description (SBSD) with routing and memory entries and an autostart job entry
- Job queue (JOBQ)
- Job description (JOBD)
- User profile (USRPRF). This object is recommended to run **sshd** under a dedicated user profile.

The following steps show an example of starting the **sshd** daemon in a simple subsystem environment:

1. Create a subsystem description using the following CL command:

   ```
   CRTSBSD SBSD(SSHLIB/SSHSBS) POOLS((1 *BASE)) TEXT('SSH jobs subsystem')
   ```

   This command creates a subsystem description SSHSBS in the SSHLIB library and a single memory pool is assigned. You might want to create a dedicated memory pool in your environment instead of using the system’s base pool.

2. Create a job queue for submitting the job to the subsystem:

```
CRTJOBQ JOBQ(SSHLIB/SSHJOBQ) TEXT('SSH job queue')
```

3. Create a user profile for the daemon job:

```
CRTUSRPRF USRPRF(SSHDUSR) PASSWORD(*NONE) INLMNU(*SIGNOFF) LMTCPB(*YES) SPCAUT(*ALLOBJ)
TEXT('SSHD Daemon user profile')
```

   This user profile runs the sshd daemon, and therefore, so do not use it to sign on to the system. To ensure this, create the profile without a password and specify *SIGNOFF for the initial menu. In addition, set limited capabilities for the user profile to *YES.

4. Create a job description for the subsystem autostart job entry:

```
CRTJOBD JOBD(SSHLIB/SSHJOBD) JOBQ(SSHLIB/SSHJOBQ)
TEXT('Job description for SSHD autostart') USER(SSHDUSR)
RQSDTA('CALL PGM(QP2SHELL) PARM(''/QOpenSys/usr/sbin/sshd'')')
```

5. Create a class for the subsystem. The class defines the run priority of the ssh jobs and other resource related parameters.

```
CRTCLS CLS(SSHLIB/SSHCLS) TEXT('SSH job class')
```

6. Add a routing entry to the subsystem:

```
ADDRTGE SBSD(SSHLIB/SSHSBS) SEQNBR(1) CMPVAL(*ANY) PGM(QCMD) CLS(SSHLIB/SSHCLS)
```

   For the autostart job entry to start the sshd daemon job, a routing entry is required in the job in the subsystem.

7. Add the job queue that you previously created to the subsystem description:

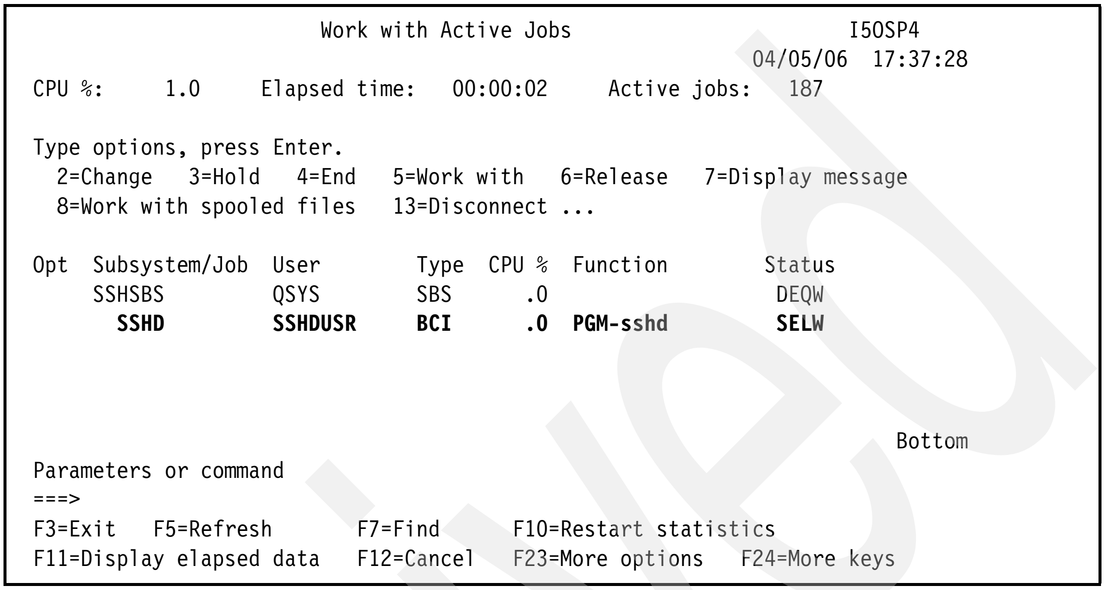
```
ADDJOBQE SBSD(SSHLIB/SSHSBS) JOBQ(SSHLIB/SSHJOBQ) MAXACT(*NOMAX) SEQNBR(10)
```

8. Add the autostart job entry to the subsystem description:

```
ADDAJE SBSD(SSHLIB/SSHSBS) JOB(SSHD) JOBD(SSHLIB/SSHJOBD)
```

   When the subsystem is started, the job, as specified in the autostart job entry through the job description, is started. It runs with the priority defined in the SSHCLS class. It also runs under the SSHDUSR user profile.

To fully automate the startup of the sshd daemon at IPL time, change your startup program to include the STRSBS SSHLIB/SSHSBS command. When the subsystem is started with the previously created subsystem environment and no SSH connection is established, you see one job running as shown in Figure 10-2.



```
                          Work with Active Jobs                        I50SP4
                                                               04/05/06  17:37:28
CPU %:     1.0     Elapsed time:   00:00:02     Active jobs:   187

Type options, press Enter.
  2=Change   3=Hold   4=End   5=Work with   6=Release   7=Display message
  8=Work with spooled files   13=Disconnect ...

Opt  Subsystem/Job  User        Type  CPU %  Function        Status
     SSHSBS         QSYS        SBS      .0                   DEQW
       SSHD         SSHDUSR     BCI      .0  PGM-sshd         SELW




                                                                          Bottom
Parameters or command
===>
F3=Exit   F5=Refresh       F7=Find      F10=Restart statistics
F11=Display elapsed data   F12=Cancel   F23=More options   F24=More keys
```

Figure 10-2 SSH subsystem job

For more information about subsystems and work management, see the iSeries V5R4 Information Center at:

http://publib.boulder.ibm.com/infocenter/iseries/v5r3/index.jsp

11

Establishing an SSH session

This chapters explains how to set up a user environment on i5/OS and how to establish a Secure Shell (SSH) session between two i5/OS partitions or systems.

11.1 Preparing the user environment

You must perform certain one-time setup tasks for every user who uses SSH, regardless of whether the user establishes a session to i5/OS or initiates a session from an i5/OS Portable Solutions Application Environment (PASE) session. The major prerequisites for each user who uses SSH are summarized as follows:

- The user profile name is a maximum of eight characters long. Therefore, you cannot use the i5/OS supported maximum length of ten characters for a user who uses SSH.
- Each user needs a home directory in the integrated file system.
- Set certain authorities for the home directory.

11.1.1 Creating the home directory

Each user profile that authenticates to the sshd daemon when establishing a session to i5/OS or initiating a session from within i5/OS to another system’s sshd daemon, must have a home directory in the integrated file system. By default, when you create a user profile in i5/OS, the home directory /home/*usrprf* is set in the user profile. However, because it is not automatically created, create the directory manually as shown in the following example, where *usrprf* is the user profile name:

```
MKDIR ’/home/usrprf’
```

In the scenario described in 9.4, “Example environment” on page 285, the user profile on the i5OSP4 system is BARLEN4. Therefore, the command to create the home directory is:

```
MKDIR ’/home/barlen4’
```

We also create the home directory for user BARLEN2 on the i5OSP2 system.

11.1.2 Setting the home directory permissions

It is a good practice to limit access permissions to any object in i5/OS to what a user or the public really needs. In a default environment, as shipped with i5/OS, the integrated file system root directory and the /home directory have *RWX public authorities. This means when you create a home directory without specifying the public authority settings, every user’s home directory also has a public *RWX (equivalent to *ALL) authority. Change this for SSH, especially when using public key authentication.

```
CHGAUT OBJ('/home/barlen4’) USER(*PUBLIC) DTAAUT(*EXCLUDE) OBJAUT(*NONE)
```

You also need to change the authority settings for the primary group. This also applies when you do not have a primary group assigned yet. The reason is that integrated file system keeps the default primary group authorities in the background.You can display them in the Qshell or i5/OS PASE shell with the command `ls -la /home/barlen4`. In this case, run the following CL command to set the permissions correctly:

```
CHGPGP OBJ('/home/barlen4') NEWPGP(*NONE) DTAAUT(*RX)
```

> **Note:** The equivalent shell (Qshell or i5/OS PASE shell) command to set the public (other) and group authorities is:
>
> ```
> chmod 750 /home/barlen4
> ```

We also set the permissions for the home directory for user BARLEN2 on the i5OSP2 system.

11.2 Using SSH between i5/OS environments

As mentioned in 9.1, “OpenSSH tools and files” on page 282, the ssh utility is a client utility that provides access to a remote system’s UNIX-type shell. In the case of an i5/OS environment, an SSH session is established to the i5/OS PASE shell environment. i5/OS PASE is the AIX runtime environment on i5/OS. There are special considerations when initiating an SSH session from the i5/OS PASE shell. In this section, you learn how to establish an SSH session between the i5OSP4 (client) system and the i5OSP2 (sshd) system.

The special program switches that you use in the following steps only apply when you initiate an SSH session from the i5/OS PASE shell environment. If you establish a session from Linux or Windows to the i5/OS PASE environment, the special parameter is not required.

Perform the following steps to establish an SSH session from the i5OSP4 system to the i5OSP2 system:

1. Start an i5/OS PASE shell session by entering the following command:

   ```
   CALL  QP2TERM
   ```

   > **Tip:** Familiarize yourself with the ssh shell command and its various parameters. There is a significant number of parameters to choose from. You can override most of the system-wide settings for the ssh client environment, such as the protocol version. Use the following command to see all parameter options for the ssh program:
   >
   > ```
   > ssh -?
   > ```

2. Establish an SSH session to the i5OSP2 system by entering the following command:

   ```
   ssh -T barlen2@i5OSP2
   ```

   This command establishes an SSH session and tries to sign on with user BARLEN2 to the i5OSP2 system. The -T switch is important when you initiate a session from the i5/OS PASE shell. It causes the ssh program to not allocate a TTY device. This is special to the i5/OS PASE environment. Without specifying the switch (parameter), you receive an error message that the system call received a parameter that is not valid and the connection is closed. The reason is that an i5/OS terminal session does not represent a true TTY terminal as all UNIX-type terminals do.

   > **Note:** You do not have to specify a user profile name with the ssh command. If omitted, the ssh command tries to log in with the user profile name that is used on the source system.

> **Important:** If you set up the sshd (server) environment and establish an SSH session with your user profile for the first time, you see the following message indicating that the host key verification failed. The remote system's public key is not known on the source system.
>
> ```
> ssh i5OSP2
> The authenticity of host 'i5osp2 (172.17.17.29)' can't be established.
>  . key fingerprint is RSA.
>  Are you sure you want to continue connecting (yes/no)?
> no
> Host key verification failed.
> $
> ```
>
> When you answer "yes", the remote systems public key is permanently added to your known_hosts file on the source system in the .ssh directory of the user's home directory. When the remote system's public key is in your known_hosts file, subsequent ssh requests from the same source user to the same target system no longer issue the message.

When asked whether you want to continue connecting, answer "Yes" to add the remote host's public key to the known_hosts file.

3. When prompted to enter your password, enter the password of user BARLEN2 on the i5OSP2 system. You authenticate successfully and end up in the i5/OS PASE shell of the i5OSP2 system. Like in any other UNIX-type environment, you do not see any messages when a command completes successfully, but only when an error occurs.

   You can now issue any shell command. This command runs on the i5OSP2 system. In Figure 11-1, the pwd (display the current directory) and hostname (display the IP host name) commands are issued after they are successfully authenticated.

```
$
 > ssh -T barlen2@i5OSP2
   The authenticity of host 'i5osp2 (172.17.17.29)' can't be established.
   . key fingerprint is RSA.
   Are you sure you want to continue connecting (yes/no)?
 > yes
   Warning: Permanently added 'i5osp2,172.17.17.29' (RSA) to the list of known hosts.
   barlen2@i5osp2's password:
 > pwd
   /home/barlen2
 > hostname
   i5osp2.stgt.spc.ihost.com
```

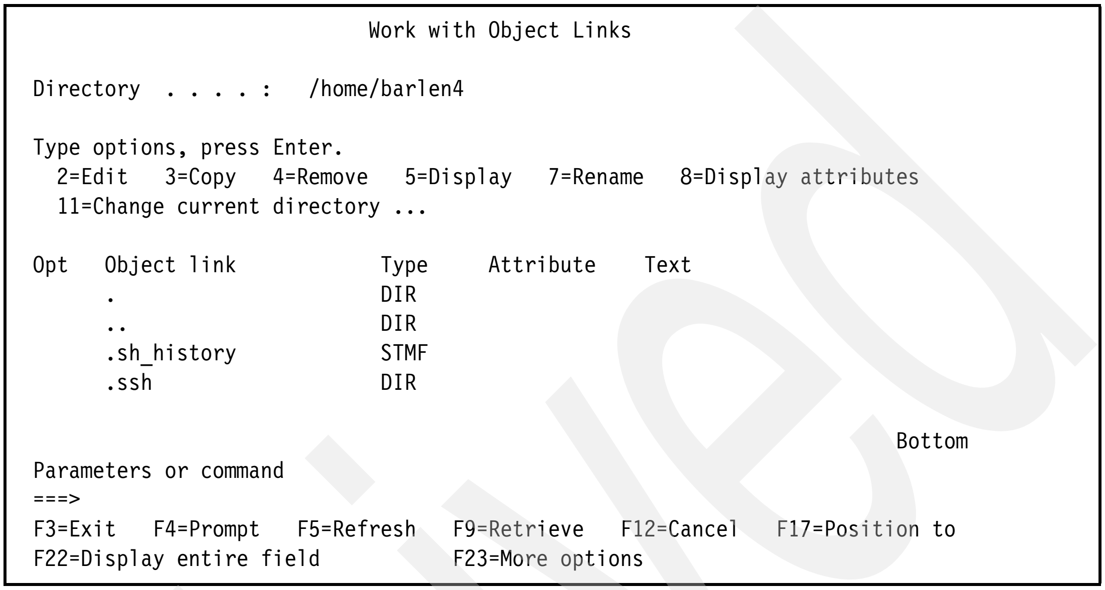
Figure 11-1 Running the pwd and hostname commands on the i5OSP2 system

4. Enter the exit command to return to your source system (i5OSP4) and close the SSH connection.
5. As mentioned previously, the sshd daemon's public key of the target system is stored in the known_hosts file on the source system. This allows the client to verify the public key of the target server the next time the client establishes the connection. The known_hosts file is stored in the client's user home directory in the subdirectory .ssh. The .ssh directory is, by default, a hidden directory. When using the Work with Object Links (WRKLNK) CL command to display the contents of the user's home directory, it appears to be empty, but that is not true.

You can enter the following CL command to display the hidden files and directories in a 5250 session:

```
WRKLNK OBJ('/home/barlen4/*') DSPOPT(*ALL)
```

As shown in Figure 11-2, DSPOPT *ALL also shows the hidden .ssh directory.



```
                              Work with Object Links

 Directory  . . . . :   /home/barlen4

 Type options, press Enter.
   2=Edit   3=Copy   4=Remove   5=Display   7=Rename   8=Display attributes
   11=Change current directory ...

 Opt   Object link           Type     Attribute    Text
       .                     DIR
       ..                    DIR
       .sh_history           STMF
       .ssh                  DIR

                                                                       Bottom
 Parameters or command
 ===>
 F3=Exit   F4=Prompt   F5=Refresh   F9=Retrieve   F12=Cancel   F17=Position to
 F22=Display entire field          F23=More options
```

*Figure 11-2   WRKLNK command output with the DSPOPT set to *ALL*

When using option 5 to go into the .ssh subdirectory, you see the known_hosts file.

Tip: In a perfect world, every function that you perform on a system runs without any problems and always completes successfully. Unfortunately, this is not always the case. Therefore, it is important to know where a problem might come from. The ssh program includes a switch to provide extensive logging, which you can specify when starting an SSH session. Enter the following command to enable debug logging for ssh.

```
ssh -Tv barlen2@i5osp2
```

The -v switch enables logging. You can specify up to three v characters to increase verbosity.

11.2.1 Using the ssh utility to run commands remotely

The ssh utility has several switches and parameters that allow you to run a shell command remotely, without first entering the remote shell. The following examples show different ways to use this function:

- The following command establishes an SSH session under the user profile BARLEN2 to the i5OSP2 system and submits a backup job in i5/OS:

  ```
  ssh -T barlen2@i5osp2 'system "SBMJOB CMD(CALL PGM(TOOLS/BACKUPLIBS) PARM(*ALL))
  JOB(BACKUP)" '
  ```

  As a result of this command, the shell displays the following i5/OS message that was issued on the remote system:

  ```
  CPC1221: Job 015242/BARLEN2/BACKUP submitted to job queue QBATCH in library QGPL.
  ```

  The system command is used in the i5/OS PASE shell to run i5/OS commands.

- In this example, the Display Message (DSPMSG) command for displaying the QSYSOPR message queue is run:

  ```
  ssh -T barlen2@i5osp2 'system "DSPMSG QSYSOPR" '
  ```

  As opposed to the first example where you received the message about the submission of the job, the DSPMSG command returns the output to the source systems's i5/OS PASE shell.

  ```
  CPC9802: Printer output created.
   5722SS1 V5R3M0 040528                Messages in queue - QSYSOPR
  Page  0001
  MSGID   SEV MSG TYPE
  CPI1E23  00  COMPLETION  Cleanup has started.
    QSYSSCD   QPGMR    012895 QEZEVTHL    0000 01/05/06 23:00:21.246696 QPGMR
  CPI1E88 00 INFO    Cleanup of OfficeVision/400 calendar items started.
     QCLNCALITM QPGMR    014930 QEZCLOFC    0000 01/05/06 23:00:21.273736 QPGMR
  ```

Note: These two examples always require you to enter a password when connecting to the remote system. In many cases, this is not desirable because certain commands need to run in unattended or batch mode. You can achieve automatic sign-on with ssh by using public key authentication as described in 12.2.1, “Running the scp command in batch mode” on page 307.

11.3 Using SSH from other platforms to i5/OS

Because OpenSSH is available for different system platforms, you can establish an ssh, scp, or sftp session between other systems and i5/OS. In Linux, AIX, or other UNIX-type platform, the standard commands (ssh, scp, sftp) are available. On a Windows platform, you can use a free ssh utility called PuTTY, which you can download from the Internet at:

http://www.putty.nl/download.html

In the following section, you establish a basic SSH connection from a PuTTY ssh client to the i5/OS sshd daemon.

11.3.1 Using PuTTY to establish an SSH connection to i5/OS

The PuTTY program is an ssh client with a graphical user interface (GUI) that is used often in a Windows environment. In addition to the PuTTY ssh client program, other utilities are used together with PuTTY (for example, pageant and puttygen), or use the SSH protocol for file transfer with PSCP or PSFTP.

The following steps show you how to establish an SSH session with PuTTY to the i5/OS SSHD daemon. These steps presume that you have installed PuTTY on your workstation.

Note: Remember to set up the i5/OS user environment as described in 11.1, “Preparing the user environment” on page 294, before you continue with the following steps.

1. Start the PuTTY client. When you start it without parameters, the GUI starts.
2. Enter the following connection information:

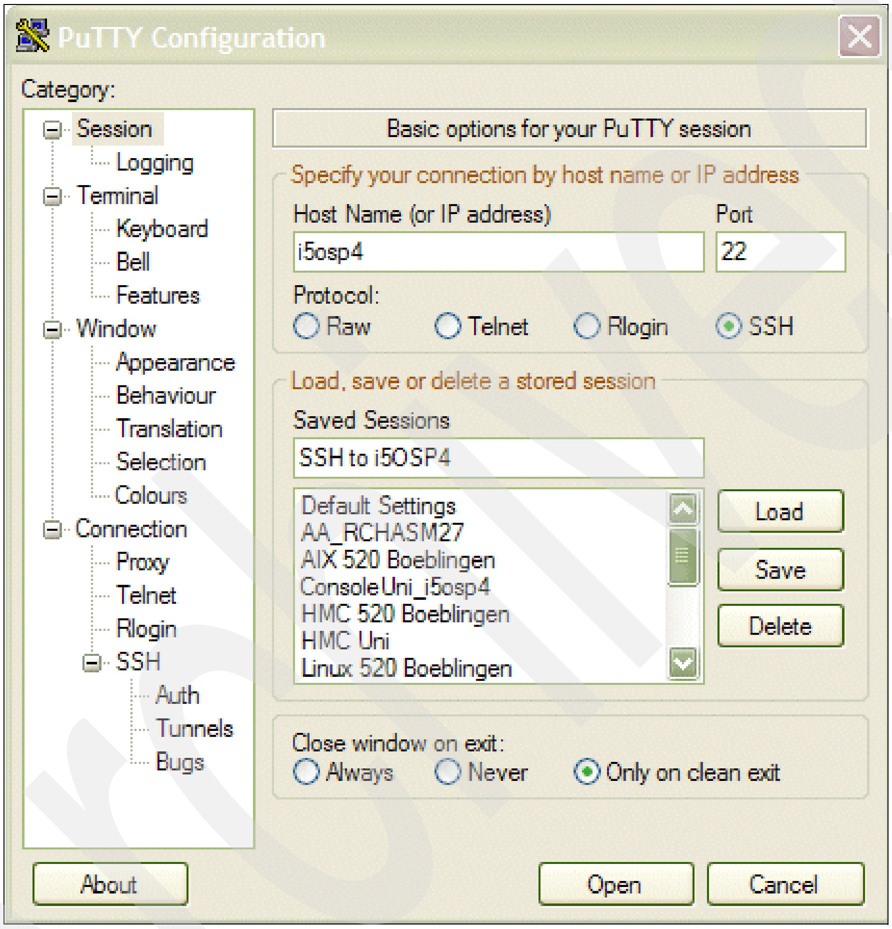
   a. For Host Name (or IP address), type `i5OSP4`.
   b. For Port, type `22`.
   c. For Protocol, select **SSH**.

   These are the only parameters that you need to connect via ssh to an sshd daemon.

3. In the Category pane, click **Connection** → **SSH**. Familiarize yourself with the connection options for the SSH protocol. In the SSH properties section, define the SSH protocol that you want the client to use and the encryption algorithms. You can also select whether to use zlib compression.

4. In the Category pane, click **Session** to return to the session definition section.

5. To reuse the connection information for later use, you can save the settings under profile. In the Saved Sessions field, enter the profile description `SSH to i5OSP4` (Figure 11-3). Click **Save** to save your session connection details.



Host Name (or IP address): i5osp4

Port: 22

Protocol: ○ Raw ○ Telnet ○ Rlogin ● SSH

Saved Sessions: SSH to i5OSP4

Default Settings
AA_RCHASM27
AIX 520 Boeblingen
ConsoleUni_i5osp4
HMC 520 Boeblingen
HMC Uni
Linux 520 Boeblingen

Close window on exit: ○ Always ○ Never ● Only on clean exit

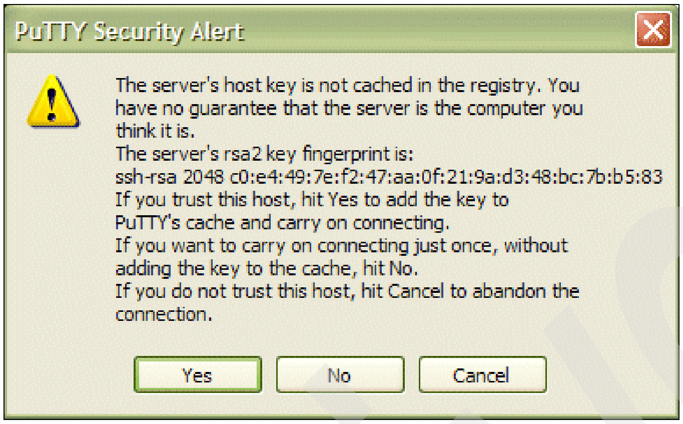
Figure 11-3 PuTTY session details i5OSP4

6. Leave the PuTTY client open.

Establishing an SSH session

Now test the SSH connection. Since ssh is a Secure Shell that originated from the UNIX environment, an SSH session to i5/OS takes you into an i5/OS PASE shell.

1. In the open PuTTY client, click **Open**. The ssh client connects to the sshd server.
2. When you connect the first time to the sshd server, a warning message is displayed as shown in Figure 11-4.



The server's host key is not cached in the registry. You have no guarantee that the server is the computer you think it is.
The server's rsa2 key fingerprint is:
ssh-rsa 2048 c0:e4:49:7e:f2:47:aa:0f:21:9a:d3:48:bc:7b:b5:83
If you trust this host, hit Yes to add the key to PuTTY's cache and carry on connecting.
If you want to carry on connecting just once, without adding the key to the cache, hit No.
If you do not trust this host, hit Cancel to abandon the connection.

Figure 11-4 The ssh client warning message

ssh uses public key authentication during session establishment. Initially, only server authentication is performed. That is, the client authenticates the server. This involves the server sending its public key to the client. If you connect the first time, the client does not know anything about the server's public key. Therefore, it displays a message indicating that the client is not aware of this server. You choose to trust the presented key and continue without (select No) storing the key for future sessions, or select Yes to store the key on the client. When you select Yes and establish in the future another session to the server, the client already has the key and trusts the server connection and no longer displays any message.

> **Note:** When you change the server's public and private key pair for sshd, you see the warning message again.

Select **Yes** to store the server's public key the client. With PuTTY, the key is stored in the Windows registry.

3. At the login prompt, log in with your i5/OS user credentials. In this example, we login as `barlen4` (Figure 11-5). You are prompted for your i5/OS user profile password. You are then connected to the i5/OS PASE shell on the i5OSP4 system.

```
login as: barlen4
barlen4@i5osp4's password:
$
```

Figure 11-5 The ssh shell session

4. In the SSH session, enter the `pwd` command to check your current directory settings. You are now in your /home/barlen4 directory.
5. To perform another test, you might want to run a command, such as `system dspneta,pwd`, to display the i5/OS network attributes in your shell session.

12

Using file transfer and public key authentication with OpenSSH

In addition to an interactive ssh shell session, there are two programs for transferring files. The first one is the scp program, which allows you transfer a single file from the command line to another system. The second program is called sftp, which is similar to regular File Transfer Protocol (FTP). It starts a shell where you can enter FTP subcommands.

You can use the scp and sftp programs from any system that supports Secure Shell (SSH). However, when you use these programs from the i5/OS (Portable Solutions Application Environment (PASE) shell, you run into the same problem as with ssh, namely that the i5/OS PASE shell session does not represent a true TTY terminal.

The major difference between ssh and scp and sftp is that the scp and sftp programs do not support the -T switch (do not allocate a TTY terminal). The only way to use scp and sftp from an i5/OS PASE shell session is by using public key authentication instead of password authentication. This has a significant advantage. In many System i accounts, batch FTP is used to transfer files from one System i platform to another one in unattended mode. This requires that the FTP commands are provided in a source file, which includes the password in clear text. Now, with scp and public key authentication, you can transfer files without potentially exposing passwords.

12.1 Setting up public key authentication

An alternative to password authentication is public key authentication. This type of authentication involves the use of a private and public key pair. You can distribute the public key freely, but the private key is always protected by the owner of the key.

The setup for public key authentication requires the following steps:

1. Create a private and public key pair on the source system for your user profile.
2. Transfer the public key to the destination system. This is the system to which you want to establish an scp or sftp connection. If you establish ssh (including scp and sftp) sessions to multiple systems, transfer the key to every destination system to which you want to connect.
3. Append the public key to the authorized_keys file on the destination system or systems. The authorized_keys file resides in the /home/~user/.ssh directory on the destination system. Only source users whose public key is stored in the authorized_keys file on the destination system can use public key authentication. The public key must correspond to the appropriate private key.

> **Note:** You can store a source user's public key in multiple authorized_keys files on the target system for different target user profiles. This allows a source user to establish a session to a target system by using several different user profiles on the target system.

In this scenario, you set up the following environment:

- You create a public and private key pair for user BARLEN4 on the source system i5OSP4.
- You transfer the public key file of user BARLEN4 from the i5OSP4 system to the i5OSP2 system and append the public key in the BARLEN2 user profile's authorized_keys file.
- You enable source user BARLEN4 to establish an scp session from the i5OSP4 system to the i5OSP2 system by using user profile BARLEN2 on the target system.

Perform the steps in the following sections to set up public key authentication for the scenario environment.

Generating the key pair

To generate the key pair, follow these steps:

1. If you have not already done so, sign on to the i5OSP4 system with the user BARLEN4.
2. Enter the i5/OS PASE shell with the command:

   ```
   CALL QP2TERM
   ```

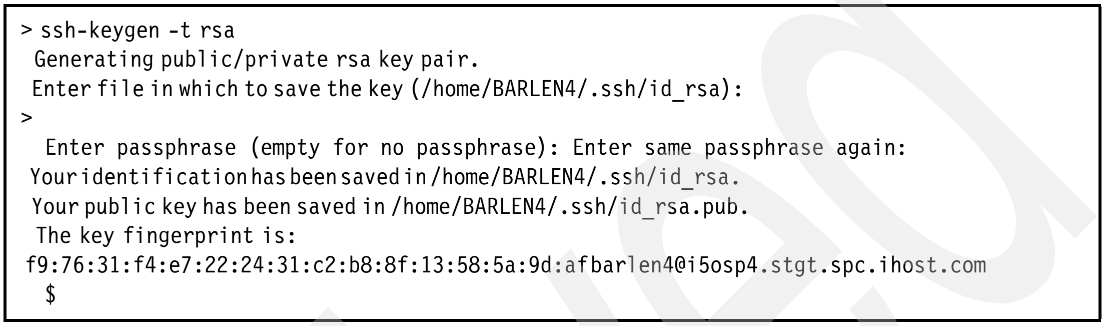
3. The user who wants to create the key pair must be in the user's home directory. You can check this by entering the pwd command:

   ```
   > pwd
     /home/BARLEN4
     $
   ```

4. In the i5/OS PASE shell, enter the following command to create a private and public key pair for the SSH1 protocol.

   ```
   ssh-keygen -t rsa
   ```

   As shown in the command output (Figure 12-1), when prompted to enter a file name for the key, press Enter to accept the default location. The command generates the key pair and then asks for a passphrase to protect the key. Enter a passphrase and press Enter. The private key is stored in the id_rsa file. To use this key at a later time, provide the passphrase to decrypt the key file.



```
> ssh-keygen -t rsa
 Generating public/private rsa key pair.
 Enter file in which to save the key (/home/BARLEN4/.ssh/id_rsa):
>
  Enter passphrase (empty for no passphrase): Enter same passphrase again:
 Your identification has been saved in /home/BARLEN4/.ssh/id_rsa.
 Your public key has been saved in /home/BARLEN4/.ssh/id_rsa.pub.
 The key fingerprint is:
f9:76:31:f4:e7:22:24:31:c2:b8:8f:13:58:5a:9d:afbarlen4@i5osp4.stgt.spc.ihost.com
  $
```

Figure 12-1 The ssh-keygen command output

The command creates two files in the .ssh directory:

- id_rsa: This file contains the private key.
- id_rsa.pub: This file contains the corresponding public key.

> **Note:** If you want to use ssh, scp, or sftp in unattended mode, for example in a batch job, we recommend that you do not use a passphrase, especially when running that job in the night when nobody is available to enter the passphrase. In this case, press Enter without typing a passphrase. Without a passphrase, the only protection of the private key is the object level permission to the file itself. By default, the private key file is created with an object level permission of *EXCLUDE for group and public authorities.

5. Press **F3** to exit the i5/OS PASE shell session.

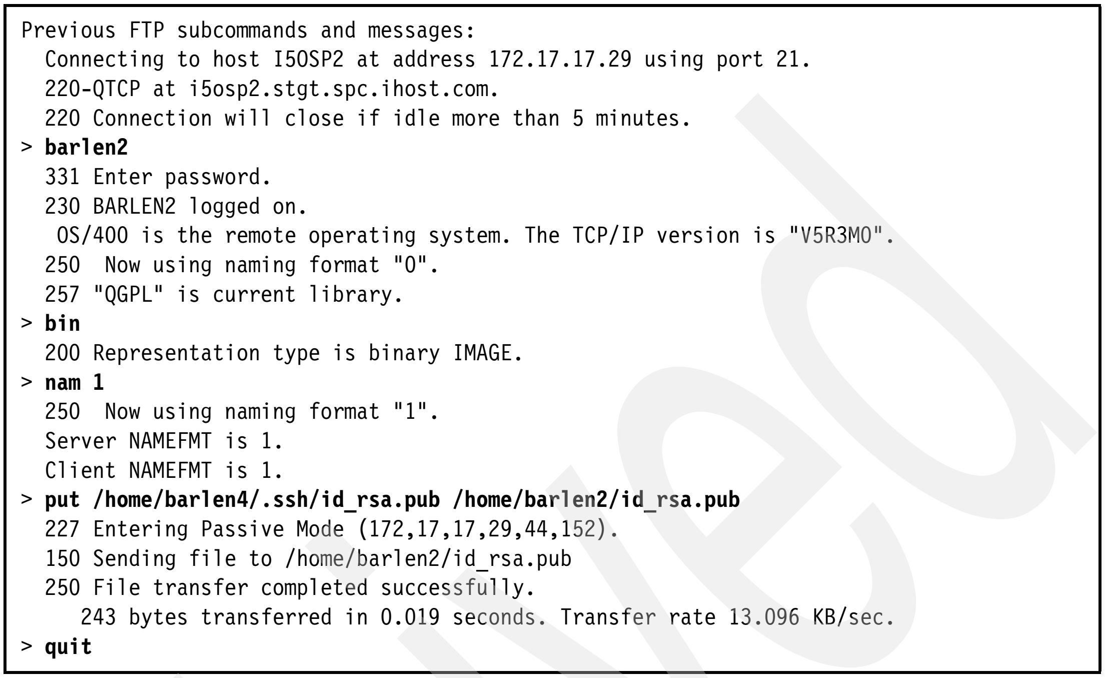
Transferring the public key

Now that the key pair is created, in the next steps, you transfer the public key file to the remote system where you want to connect to via ssh, scp, or sftp.

1. Send the id_rsa.pub file to the remote i5OSP2 system using your user credentials on i5OSP2 (BARLEN2). Enter the following FTP command to start a sub-shell FTP window:

   ```
   FTP RMTSYS(i5OSP2)
   ```

2. Use the FTP session commands as shown in Figure 12-2. After the transfer is completed successfully, exit the FTP session by entering the `quit` command.



```
Previous FTP subcommands and messages:
  Connecting to host I5OSP2 at address 172.17.17.29 using port 21.
  220-QTCP at i5osp2.stgt.spc.ihost.com.
  220 Connection will close if idle more than 5 minutes.
> barlen2
  331 Enter password.
  230 BARLEN2 logged on.
   OS/400 is the remote operating system. The TCP/IP version is "V5R3M0".
  250  Now using naming format "0".
  257 "QGPL" is current library.
> bin
  200 Representation type is binary IMAGE.
> nam 1
  250  Now using naming format "1".
  Server NAMEFMT is 1.
  Client NAMEFMT is 1.
> put /home/barlen4/.ssh/id_rsa.pub /home/barlen2/id_rsa.pub
  227 Entering Passive Mode (172,17,17,29,44,152).
  150 Sending file to /home/barlen2/id_rsa.pub
  250 File transfer completed successfully.
     243 bytes transferred in 0.019 seconds. Transfer rate 13.096 KB/sec.
> quit
```

Figure 12-2 FTP subcommands to transfer id_rsa.pub from i5OSP4 to i5OSP2

3. Keep the 5250 session on i5OSP4 open.

Adding the public key to the authorized_keys file

As mentioned in the introduction of this chapter, the authorized_keys file resides in the user's .ssh directory under the user's home directory. By default, the .ssh directory does not exist until you create it manually or start an SSH session from the i5/OS PASE shell to another system. In this scenario, you create the directory structure and set the necessary permissions manually. This time, all the steps are performed with i5/OS PASE shell commands instead of i5/OS CL commands.

1. Using a 5250 session, sign on to i5OSP2 (your target system) with the user profile BARLEN2.
2. Enter the i5/OS PASE shell with the following command:

   ```
   CALL QP2TERM
   ```

3. Enter the following command to create the .ssh subdirectory. The home directory, along with the required authorities, was created previously.

   ```
   mkdir /home/barlen2/.ssh
   ```

4. Set the required authorities for the .ssh directory:

   ```
   chmod 700 /home/barlen2/.ssh
   ```

   The numbers that follow the chmod command represent the authority bits in a UNIX-type file system. In this example, the value 700 indicates:

   – The owner of the directory has Read, Write, and Execute permissions.
   – The primary group of the directory has no access permissions.
   – Other users have no access permissions for this directory.

> **Note:** It is not required to remove the read (R) and execute (X) permission for Other and Group. The only requirement is to remove the write (W) authority. However, it is always good to restrict access to security-sensitive information.

5. Enter the following shell command to verify the existence of the .ssh directory and the authority settings:

   ```
   ls -al /home/barlen2
   ```

   Figure 12-3 shows the output of the command.

```
> ls -al /home/barlen2
  total 80
  drwxr-s---   3 barlen2  0            8192 May 05 15:38 .
  drwxrwsrwx   3 qsys     0            8192 May 05 10:01 ..
  -rw-------   1 barlen2  0             132 May 05 15:49 .sh_history
  drwx--S---   2 barlen2  0            8192 May 05 15:38 .ssh
  -rwxr-x---   1 barlen2  0             243 May 05 15:29 id_rsa.pub
 $
```

Figure 12-3 The output of the ls -la command

6. In the i5/OS PASE shell, change the current directory to the .ssh directory with the following command:

   ```
   cd /home/barlen2/.ssh
   ```

7. Append the public key file that you transferred to the i5OSP2 system to the authorized_keys file. Enter the following command to append the public key file:

   ```
   cat /home/barlen2/id_rsa.pub >> authorized_keys
   ```

   This command outputs the contents of the id_rsa.pub file and appends them to the existing authorized_keys file, or creates a new authorized_keys file if it does not exist. Do *not* attempt to use the Edit File (EDTF) command or another editor to do this. The key in the file is long, and control characters or typos render the authorized_keys file useless.

8. Enter the command `ls -l` again to display the permissions of the authorized_keys file (Figure 12-4).

```
-rw-rw-rw-   1 barlen2  0              243 May 05 15:53 authorized_keys
```

Figure 12-4 The authorized_keys file permissions after creation

   The authorized_keys file must also have the write authorities removed. Otherwise, public key authentication fails.

9. The authorized_keys file is a sensitive file. You do not want anyone to add their own keys to your file. Even better, you do not want anyone to see which keys you have in there. Therefore, set permissions accordingly with the following command:

   ```
   chmod go-rwx authorized_keys
   ```

   The command removes the read, write, and execute permissions from the group and other users. Figure 12-5 shows the result.

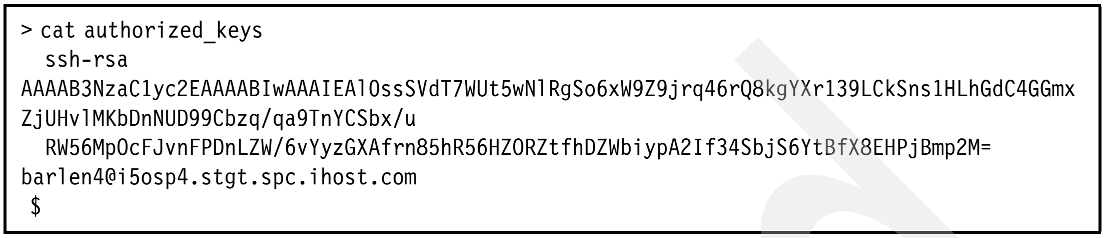
```
-rw-------   1 barlen2  0              243 May 05 15:53 authorized_keys
```

Figure 12-5 The authorized_keys file permissions after permission change

10. You can display the contents of the authorized_keys file with the following command:

```
cat authorized_keys
```

Figure 12-6 shows the output.



```
> cat authorized_keys
  ssh-rsa
AAAAB3NzaC1yc2EAAAABIwAAAIEAlOssSVdT7WUt5wNlRgSo6xW9Z9jrq46rQ8kgYXr139LCkSns1HLhGdC4GGmx
ZjUHvlMKbDnNUD99Cbzq/qa9TnYCSbx/u
  RW56MpOcFJvnFPDnLZW/6vYyzGXAfrn85hR56HZORZtfhDZWbiypA2If34SbjS6YtBfX8EHPjBmp2M=
barlen4@i5osp4.stgt.spc.ihost.com
 $
```

Figure 12-6 The authorized_keys file after import of public key

For every source user who wants to authenticate with public key authentication using this target system's user profile, import (append) the corresponding public key.

> **Note:** Permissions for your home directory, the .ssh directory, and the authorized_keys files are not group writable.

12.2 Using public key authentication with scp to transfer files

Now that you have created your key pair for key authentication, test to see if you did everything correctly. If you want to use the same i5/OS PASE shell session for transferring multiple files with scp, you can store the private key in memory before using scp. To place the private key in memory, you must run the ssh-agent and ssh-add programs. The ssh-agent program allows you to have private keys stored in memory. The ssh-add utility is the actual tool that adds the keys to the agent.

First, let us work with the ssh-agent and ssh-add utilities.

1. In this scenario environment, as described in 9.4, "Example environment" on page 285, the 5250 session on i5OSP4 is still open with the user BARLEN4 signed on.
2. Start an i5/OS PASE shell session with the following CL command:

   ```
   CALL QP2TERM
   ```

3. Enter the following command to start the ssh-agent program:

   ```
   ssh-agent $SHELL
   ```

   The parameter $SHELL refers to an environment variable that contains the path and name of the current shell (/QOpenSys/usr/bin/sh). The agent then runs in a new shell. Note that the $SHELL value is case-sensitive. If the start of the agent is successful, you do not see any messages and no command prompt character is displayed.
4. Enter the following command to add your private key to the agent's memory:

   ```
   ssh-add
   ```

   The ssh-add command tries to read all private key files from the user's .ssh directory.

> **Note:** The default file names that ssh-add is looking for are defined in the system-wide ssh client configuration file /QOpenSys/QIBM/UserData/SC1/OpenSSH/openssh-3.5p1/etc/ssh_config. This file contains the following directives:
>
> ```
> #   IdentityFile ~/.ssh/identity
> #   IdentityFile ~/.ssh/id_rsa
> #   IdentityFile ~/.ssh/id_dsa
> ```
>
> The number sign (#) means that the directives show the default values that the system uses unless otherwise specified. If you want to override the values with your own values, remove the # sign.

The ssh-add program asks you for the passphrase that you used to protect the private key file. This is the passphrase that you entered when you created the key pair in Step 4 on page 303. Enter the passphrase. You see a result similar to the one in Figure 12-7.

```
 $
> ssh-agent $SHELL
> ssh-add
  Enter passphrase for /home/BARLEN4/.ssh/id_rsa:
Identity added: /home/BARLEN4/.ssh/id_rsa (/home/BARLEN4/.ssh/id_rsa)
```

Figure 12-7 The ssh-add command

You are ready to use scp with public key authentication.

5. Let us assume that you want to transfer the ssh_config file from the /home/sshdusr directory on the i5OSP4 system to the home directory of user BARLEN2 on the i5OSP2 system.

   ```
   scp /home/sshdusr/ssh_config barlen2@i5OSP2:/home/barlen2/ssh_config
   ```

   Notice the syntax of the scp command. The first parameter identifies the source file followed by a remote user at a specific system followed by the remote file name. In the case of a successful completion, the scp command, as all other commands, does not return any success messages. Only error messages are shown if an error occurs. If you omit the target user name, scp tries to use the same user profile as on the source system.

12.2.1 Running the scp command in batch mode

The steps in the previous section work fine in an interactive session mode. A user can enter several scp commands after loading the private key into the user environment with the ssh-agent and ssh-add utilities. However, this process does not work well in a batch environment. Suppose you start a CL program in batch that transfers three files during the night. The program must submit an i5/OS PASE shell batch job with the program QP2SHELL. However, in a batch environment, a user who enters the passphrase cannot use the private key.

The answer to this problem might be to use an i5/OS PASE shell script that is started from a CL batch job or a CL program that calls the scp utility. The following section shows how to set up an environment to transfer files with public key authentication in batch mode. The characteristics of the scenario are:

- The user BARLEN4 is signed on to the source system i5OSP4.
- The user BARLEN2 is signed on to the target system i5OSP2.

- A file test1 is transferred via scp from the source to the target system. The file is stored in the /home/barlen4 directory on the source system and is transferred to the /home/barlen2 directory on the target system.
- Public key authentication is used for the file transfer.
- The transfer starts in CL batch job on the source system.

The following steps guide you through the process of creating the previously described environment.

Setting up the public and private keys

The public and private key pair that was created in Section 12.1, “Setting up public key authentication” on page 302 uses a passphrase to protect the private key file. When a user or job wants to use public key authentication and accesses the private key file, someone must enter the passphrase to *unlock* the key. This is not usable in a batch environment where no one is available to enter a passphrase.

You can solve this problem by creating the private key without a passphrase. That way, the private key is stored in cleartext in the key file and used by any user or program that has access to the private key file. Therefore, it is *important* to properly secure your private key file. In the batch file transfer scenario, only the user profile, under which the batch job runs, has read access to the key file. Public authority is set to *EXCLUDE.

> **Tip:** Using public key authentication with scp in a batch environment has a significant advantage over traditional batch FTP in i5/OS. You do not need to hardcode passwords in cleartext in programs or files.

To create the key pair for the batch environment:

1. On the source system i5OSP4, sign on via a 5250 session under user BARLEN4.
2. Start an i5/OS PASE shell session with the CL command:

   ```
   CALL QP2TERM
   ```

3. The user who wants to create the key pair needs to be in the user’s home directory. Check by entering the pwd command.

   ```
   > pwd
     /home/BARLEN4
     $
   ```

4. Change to the directory .ssh:

   ```
   cd .ssh
   ```

5. In the i5/OS PASE shell, enter the following command to create a private and public key pair for the SSH1 protocol. This time, the file name (-f) and passphrase (-N) parameters are specified as parameters on the ssh-keygen command. Also, an RSA key is used for protocol SSH2.

   ```
   ssh-keygen -t rsa -f id_rsa -N ''
   ```

The private key is stored in the id_rsa file without passphrase protection. If a key already exists, you are prompted to override the existing key. In our scenario, the private key file already existed from the previous setup as shown in Figure 12-8.

```
> ssh-keygen -t rsa1 -f id_rsa -N ''
  Generating public/private rsa1 key pair.
  id_rsa already exists.
  Overwrite (yes/no)?
> yes
  Your identification has been saved in id_rsa.
  Your public key has been saved in id_rsa.pub.
  The key fingerprint is:
 d5:5e:06:c0:4c:db:2f:d3:f5:37:d2:e5:8c:34:77:46 barlen4@i5osp4.stgt.spc.ihost.com
  $
```

Figure 12-8   Key generation without passphrase protection

6. Transfer the id_rsa.pub public key file to the target system as described in “Transferring the public key” on page 303. You must also add this file to the target user’s authorized keys file as explained in “Adding the public key to the authorized_keys file” on page 304.

Creating the CL batch program

You can run the scp file transfer from a CL program. The CL source shown in Figure 12-9 calls the i5/OS PASE shell batch environment and copies the /home/barlen4/test1 file, on the i5OSP4 system, to the /home/barlen2/test1 file on the i5OSP2 system.

```
/* ********************************************************************** */
/* XFER - CL program to transfer file test1 from one system to another    */
/*        system using the OpenSSH utility scp.                           */
/*                                                                        */
/* Written by: Thomas Barlen, IBM Germany, May 2006                       */
/* ********************************************************************** */
             PGM
             CALL       PGM(QP2SHELL) +
                          PARM('/QOpenSys/QIBM/ProdData/SC1/OpenSSH/o+
                          penssh-3.5p1/bin/scp' '-B' +
                          '-i /home/barlen4/.ssh/id_rsa'  +
                          '/home/barlen4/test1' +
                          'barlen2@i5osp2:/home/barlen2/test1')
             ENDPGM
```

Figure 12-9   CL source for calling scp from CL

You can also pass the parameters for scp as variables to the CL program. In the example shown in Figure 12-9, the scp utility is called through the QP2SHELL program from the integrated file system directory /QOpenSys/QIBM/ProdData/SC1/OpenSSH/openssh-3.5p1/bin. The -B parameter tells scp not to prompt for any user input. The name of the private key file to be used for authentication is defined on the -i parameter. The two parameters that follow define the source file and the target file preceded with the target system’s user and system name.

You can then submit this program to batch by using the Submit Job (SBMJOB) CL command.

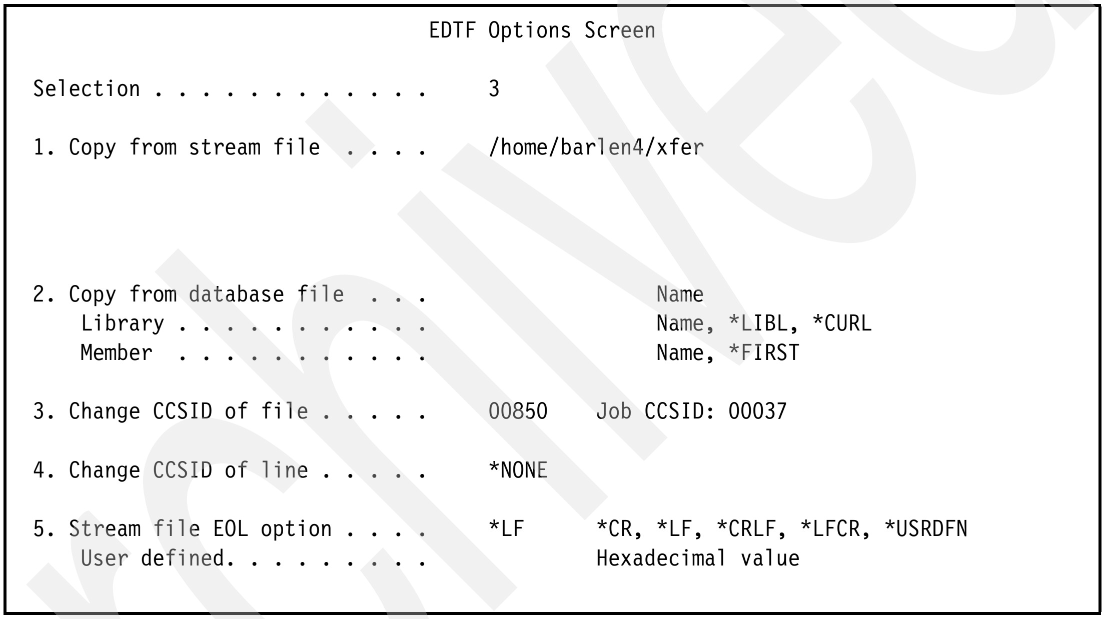
Creating the i5/OS PASE shell script

Submitting several i5/OS PASE shell commands in a CL program will run each shell command in a different shell environment. To run several shell commands in one i5/OS PASE shell environment, use a shell script. In this example, a shell script with the name xfer is created in the user's home directory of /home/barlen4.

1. Sign on with user BARLEN4 on the i5OSP4 system.
2. Enter the following command to edit the file xfer in the user's home directory:

   ```
   edtf '/home/barlen4/xfer'
   ```

3. In the editor window, press F15 to open the Editor Options Screen.
4. In the EDTF Options Screen (Figure 12-10), select option **3** and specify an ASCII code page, such as `850`, for the CCSID of the file and press Enter. Then enter option `5` and specify `*LF` as the end of line (EOL) option. Finally, press F12 to return to the editor window.



```
                                EDTF Options Screen

 Selection . . . . . . . . . . .     3

 1. Copy from stream file  . . . .     /home/barlen4/xfer




 2. Copy from database file  . . .                  Name
     Library . . . . . . . . . .                    Name, *LIBL, *CURL
     Member  . . . . . . . . . .                    Name, *FIRST

 3. Change CCSID of file . . . . .     00850    Job CCSID: 00037

 4. Change CCSID of line . . . . .     *NONE

 5. Stream file EOL option . . . .     *LF      *CR, *LF, *CRLF, *LFCR, *USRDFN
     User defined. . . . . . . . .              Hexadecimal value
```

Figure 12-10 EDTF Options Screen

5. Create a shell script, starting with the shell script header as shown in Figure 12-11:

```
#!/bin/ksh
# Written by: Thomas Barlen, IBM Germany, May 2006
#
# ABSTRACT: Transfer files via scp using public key authentication
#
# Export the path where the OpenSSH utilities are stored:
export PATH=$PATH:/QOpenSys/QIBM/ProdData/SC1/OpenSSH/openssh-3.5p1/bin
# Run the scp commands:
scp -B -i /home/barlen4/.ssh/id_rsa /home/barlen4/test1
  barlen2@i5osp2:/home/barlen2/test1
scp -B -i /home/barlen4/.ssh/id_rsa /home/barlen4/test2
  barlen2@i5osp2:/home/barlen2/test2
scp -B -i /home/barlen4/.ssh/id_rsa /home/barlen4/test3
  barlen2@i5osp2:/home/barlen2/test3
```

Figure 12-11 Creating a shell script

These shell script commands copy three files via scp from the source to the target system. All three commands run in the same shell session.

6. Set the authorities to the shell script to only allow authorized users to execute it. Enter the following commands in the order shown:

```
CHGAUT OBJ('/home/barlen4/xfer') USER(*PUBLIC) DTAAUT(*EXCLUDE) OBJAUT(*NONE)
CHGPGP OBJ('/home/barlen4/xfer') NEWPGP(*NONE) DTAAUT(*EXCLUDE) OBJAUT(*NONE)
```

7. Make sure that the Execute bit is set for the shell script. You can set it for user BARLEN4 with the following command:

```
CHGAUT OBJ('/home/barlen4/xfer') USER(BARLEN4) DTAAUT(*RWX)
```

8. You can call this shell script from a CL program by using the following CL command:

```
CALL       PGM(QP2SHELL) PARM('/home/barlen4/xfer')
```

You can also pass the file names and other values as parameters or environment variables to the shell script.

12.3 Exploiting public key authentication with ssh

You can sue public key authentication with more than just scp or sftp. You can also use them with ssh. It allows you, for example, to submit remote commands through ssh. You can use the ssh-agent and ssh-add utilities and specify the private key file with the -i parameter on the ssh command to use public key authentication with ssh.

13

Protecting traffic with SSH tunnels

A powerful function with ssh is t*unneling* or forwarding Internet Protocol (IP) traffic in a secure tunnel. This is useful for applications that do not support Secure Sockets Layer (SSL) or Transport Layer Security (TLS). An example of using a Secure Shell (SSH) tunnel is a user wants to use Telnet from one i5/OS to another i5/OS. Although the Telnet server in i5/OS supports SSL, the client does not. As an alternative to using virtual private network (VPN), you can establish an SSH tunnel between the two systems and then tunnel the Telnet traffic through the secure connection. Tunnels are established on a per port basis. That means, if you want to securely tunnel Post Office Protocol (POP) and Simple Mail Transfer Protocol (SMTP) traffic, you need two tunnels: one for port 110 and one for port 25.

In this chapter, you set up SSH tunnels between two i5/OS environments and between a PC workstation and an i5/OS environment.

13.1 Setting up an SSH tunnel between i5/OS environments

In this section, you use public key authentication to establish a secure SSH tunnel between i5OSP4 and i5OSP2. The tunnel is used to establish secure 5250 Telnet sessions. Figure 13-1 illustrates the environment.

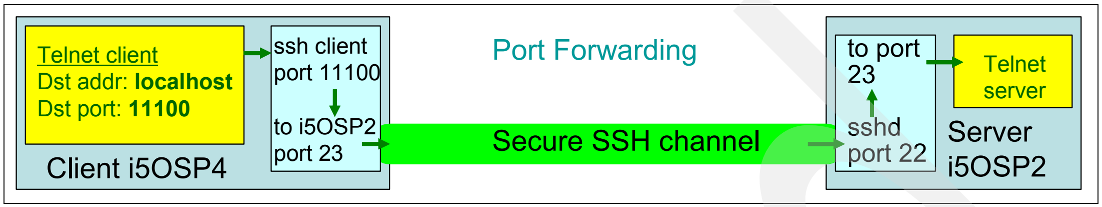


Figure 13-1 i5/OS SSH tunnel environment

A tunnel is set up on the client system. The *tunnel* is a server process that listens on a port. In this scenario, you use a port that is not being used by another job. We choose port number 11100 on the client side of the tunnel. The tunnel listens on the local host address and ends at the remote systems sshd daemon. The daemon routes the traffic to port 23 on the remote system. This allows you to tunnel an otherwise unprotected 5250 session securely through an SSH tunnel. The only change that is required from a client user perspective is that the user needs to specify as the remote address on the Telnet command the localhost address and the remote port 11100.

The scenario consists of the following subtasks:

1. Start an i5/OS Portable Solutions Application Environment (PASE) shell session on the client side (i5OSP4) and prepare the session for public key authentication using the ssh-agent and ssh-add programs.
2. Establish an SSH tunnel between the i5OSP4 and i5OSP2 systems.
3. Start a Telnet session from the i5OSP4 system to the i5OSP2 system using the SSH tunnel.

Perform the following steps to establish and use the SSH tunnel:

1. If you have not already done so, establish a 5250 session from your workstation to the i5OSP4 system and sign on, in our scenario, with user BARLEN4.
2. Enter the i5/OS PASE shell with the command:

   ```
   CALL QP2TERM
   ```

3. Enter the following command to start the ssh-agent program:

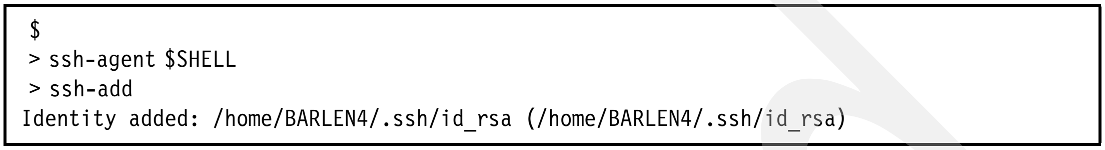
   ```
   ssh-agent $SHELL
   ```

   Tip: You do not receive any messages if the agent starts successfully.

4. Add your private key to the agent’s memory by using the following command (Figure 13-2):

   ```
   ssh-add
   ```

   The ssh-add command tries to read all private key files from the user’s .ssh directory. For passphrase protected key files, the ssh-add program asks you for the passphrase that you used to protect the private key file. In this case, use the private key file that was created in “Setting up the public and private keys” on page 308.



```
 $
 > ssh-agent $SHELL
 > ssh-add
Identity added: /home/BARLEN4/.ssh/id_rsa (/home/BARLEN4/.ssh/id_rsa)
```

Figure 13-2 Output of running the ssh-add command

5. Start the SSH tunnel by using the following command:

   ```
   ssh –T –L 11100:localhost:23 barlen2@i5OSP2
   ```

   This command starts an SSH tunnel from port 11100 on the local host address. The tunnel ends on port 23 on the i5OSP2 system and is authenticated as user BARLEN2.

6. From another 5250 session to the i5OSP4 system, enter the following command:

   ```
   netstat *cnn
   ```

   Find the job that is listening on port 11100. This is the local tunnel end on the i5OSP4 system.

7. Test the tunnel. Start a Telnet session using the following command:

   ```
   TELNET RMTSYS(LOCALHOST) PORT(11100)
   ```

   Notice that the sign-on display is the one for the remote system, even though you did a Telnet to the localhost. This is proof that the connection uses your SSH tunnel.

Important: When using the previous command from an i5/OS PASE shell session, keep the shell session with the SSH tunnel active at all times to allow any user on system i5OSP4 to establish a Telnet session via the tunnel. Although the previous approach does everything we want, it is cumbersome to have somebody start a tunnel after each initial program load (IPL) and then keep the session with the tunnel up all the time. The following method allows you to automatically start SSH tunnels and keep them active at all times:

```
SBMJOB CMD(CALL PGM(QP2SHELL) PARM('/QOpenSys/usr/bin/ssh' '-T' '-N'
'-L 11100:localhost:23' 'i5OSP2')) JOB(SSHTUN23) JOBQ(SSHJOBQ)
```

In this case, the SSH tunnel session is established via a batch job. You can then submit this job in the system startup program or a subsystem autostart job. It is a complex call than entering the ssh command in an interactive shell. Use a separate job queue as shown in the previous command to separate ssh-related work from other batch jobs. For this, use the environment as documented in Section 10.3, “Starting the sshd daemon in a dedicated subsystem environment” on page 289.

You must separately specify each parameter to the ssh command in the program call. The –N parameter causes the program to not submit any command to the sshd. It only establishes a forwarding tunnel that runs in the background.

The user that submits the job or the user that is specified for the USER parameter of the Submit Job (SBMJOB) command must use public key authentication. Password authentication does not work because in a batch job, there is no one who can enter the password. You must generate the keys with an empty passphrase, so that the ssh client can automatically open the private key file without prompting for a passphrase. As with other key files too, protect the private key file for the tunnel user. That means there is no public authority to the key files at all.

13.2 Setting up an SSH tunnel between a workstation and i5/OS

You can also use an SSH tunnel from a PC workstation to i5/OS. In this section, you establish an SSH tunnel for port 23 (Telnet). Authentication is performed through public keys to avoid user ID and password prompting when the tunnel is established. PuTTY is used as the ssh client. At the end, you establish a 5250 session across the tunnel.

Prerequisites

You must install utilities to use public key authentication with PuTTY. You can download these utilities from the Internet at:

http://www.putty.nl/download.html

The following utilities provide the equivalent support that you get in i5/OS with the ssh, ssh-keygen, ssh-agent, and ssh-add utilities:

- PuTTY: The equivalent of the ssh utility.
- PuTTYgen: Corresponds to the ssh-keygen utility.
- Pageant: Provides the functions of ssh-agent and ssh-add.

Important: In the steps in the following sections, we presume that you have installed the previously mentioned utilities in the c:\ssh directory on your workstation.

Setting up the tunnel with PuTTY

To set up the tunnel with PuTTY:

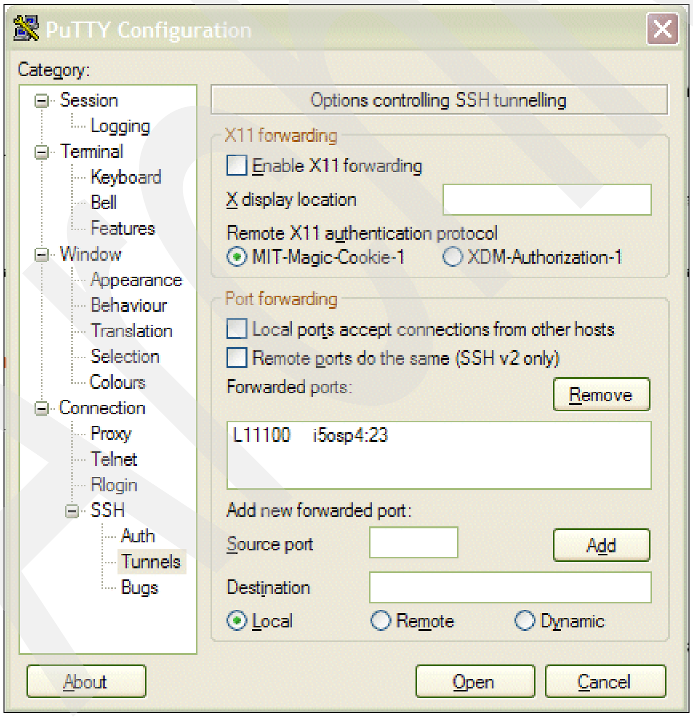
1. From your Windows workstation, start the PuTTY client.
2. Enter the following connection information:
   - Host Name (or IP address): `i5OSP4`
   - Port: `22`
   - Protocol: `SSH`

   These are the only parameters that you must specify to connect via ssh to an sshd daemon.
3. In the Saved sessions parameter, enter a name for this connection (for example, `SSH Telnet Tunnel`), and click **Save**.
4. Under Category, select **Connection** → **SSH** → **Tunnels**.
5. In the Options controlling SSH tunneling panel (Figure 13-3), enter the following tunnel configuration information:

   a. For Source port, type `11100`.
   b. For Destination, type `i5OSP4:23`.
   c. Select **Local**.

   This tunnel has the same characteristics as the one created in 13.1, “Setting up an SSH tunnel between i5/OS environments” on page 314. The tunnel listens on your PC on port 11100, but ends on system i5OSP4 on port 23.

   d. Click **Add** to add the tunnel configuration to the profile.



□ Enable X11 forwarding

X display location

Remote X11 authentication protocol
● MIT-Magic-Cookie-1 ○ XDM-Authorization-1

□ Local ports accept connections from other hosts
□ Remote ports do the same (SSH v2 only)

Forwarded ports:
L11100 i5osp4:23

Add new forwarded port:
Source port
Destination
● Local ○ Remote ○ Dynamic

Figure 13-3 PuTTY tunnel settings

Attention: Use care with the PuTTY tunnel option, Local ports accept connections from other hosts. This option enables your workstation to be a gateway for other computers. The local port, in our scenario port 11100, accepts Telnet connections from other systems and tunnels the connections to your tunnel. This is a potential security risk. This option corresponds to the ssh option -g.

6. You must tunnel additional ports when using the IBM iSeries Access for Windows PC5250 emulation. This emulation uses iSeries Access sign-on services, the port mapping service, and the remote command service when establishing a session.
   a. Enter the following additional port to the configuration.
      i. For Source port, type `449`.
      ii. For Destination, type `i5OSP4:449`.
   b. Select **Local**.
   c. Click **Add**.
   d. Enter the following port:
      i. For Source port, type `8470`.
      ii. For Destination, type `i5OSP4:8470`.
   e. Select **Local**.
   f. Click **Add**.
   g. Enter the following port:
      i. For Source port, type `8475`.
      ii. For Destination, type `i5OSP4:8475`.
   h. Select **Local**.
   i. Click **Add**.
   j. Enter the following port:
      i. For Source port, type `8476`.
      ii. For Destination, type `i5OSP4:8476`.
   k. Select **Local**.
   l. Click **Add**.
7. Keep the PuTTY window open.

In the next steps, prepare the client to perform public key authentication. Use the private key that you created in “Setting up the public and private keys” on page 308.

Preparing the environment to use the keys

As previously mentioned, use the private and public key pair that you already used with public key authentication between two i5/OS environments. To use these keys with PuTTY, prepare the environment:

1. Establish a 5250 session from your Windows desktop to the i5OSP4 system and sign on. In this scenario, we signed on with user BARLEN4. This was the user that already created a key pair in its .ssh directory.
2. Enter the i5/OS PASE shell with the following command:

   ```
   CALL QP2TERM
   ```

3. Change to your user’s .ssh directory:

   ```
   cd /home/barlen4/.ssh
   ```

4. For the PuTTY client to authenticate under the BARLEN4 user profile with public key authentication, place the public key into the authorized_keys file. Remember that you performed this step on the i5OSP2 system when setting up public key authentication between i5OSP4 and i5OSP2, but not on the i5OSP4 system. To do this, enter the following command in your i5/OS PASE shell:

   ```
   cat id_rsa.pub > authorized_keys
   ```

   This command creates the authorized_keys file and stores the public key in there.

5. Change the file and directory permissions as follows:

   ```
   chmod go-w authorized_keys
   chmod g-w /home/barlen4
   chmod g-w /home/barlen4/.ssh
   ```

   This command removes the w(rite) permissions from the primary group and from other users. The settings of the home and .ssh directory might have already shown the proper authority bit settings from the steps performed in 11.1, "Preparing the user environment" on page 294.

6. Press F3 to exit the i5/OS PASE shell session.

You have completed the server side setup for public key authentication. In the remaining steps, you install the private key on your workstation. Remember that you use the same keys for authentication between i5/OS environments and from your workstation to i5/OS, because you are working under one user only. You can also generate another key pair on the client and then import its public key into the authorized_keys file on the server. That way, you manage two different key pairs.

1. Open a command prompt on your Windows workstation.

2. Change to the ssh directory.

   ```
   cd c:\ssh
   ```

3. Transfer your private key file from system i5OSP4 to the ssh directory using the FTP commands as shown in Figure 13-4.

```
C:\ssh>ftp i5osp4
Connected to i5osp4.stgt.spc.ihost.com.
220-QTCP at i5osp4.stgt.spc.ihost.com.
220 Connection will close if idle more than 5 minutes.
User (i5osp4.stgt.spc.ihost.com:(none)): barlen4
331 Enter password.
Password:
230 BARLEN4 logged on.
ftp> ascii
200 Representation type is ASCII nonprint.
ftp> quote site nam 1
250  Now using naming format "1".
ftp> get /home/barlen4/.ssh/id_rsa id_rsa
200 PORT subcommand request successful.
150 Retrieving file /home/barlen4/.ssh/id_rsa
250 File transfer completed successfully.
ftp: 883 bytes received in 0.05Seconds 17.66Kbytes/sec.
ftp> quit
221 QUIT subcommand received.
```

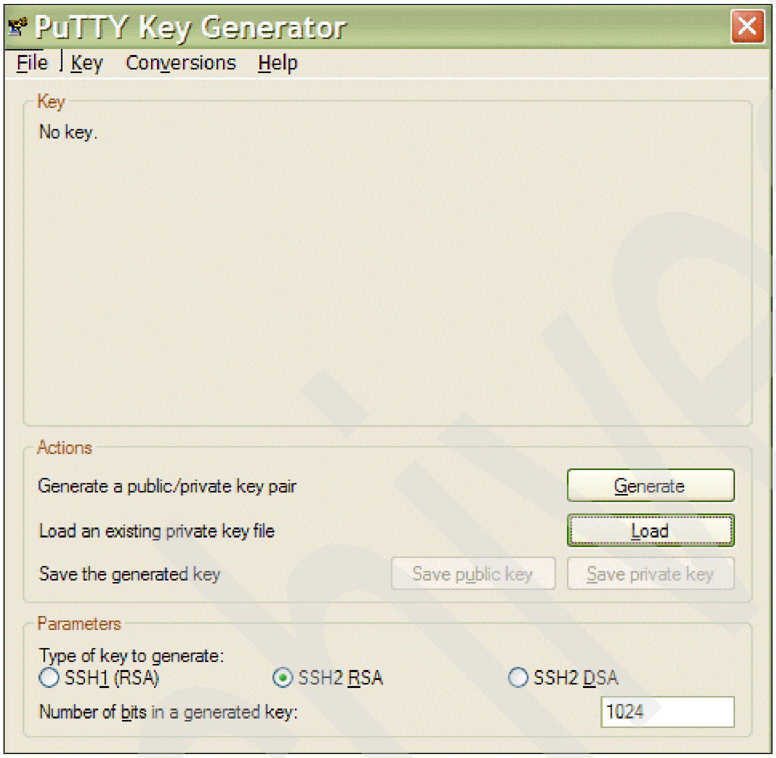
Figure 13-4 FTP session

4. While in the ssh directory, enter the puttygen command to start the key management tool for PuTTY. This tool generates key pairs and imports keys that were generated on another

platform, such as the key that you just transferred to the workstation. The window changes as shown in Figure 13-5.

5. In the PuTTY Key Generator window (Figure 13-5), click **Load** to import your existing key and select the private key file **c:\ssh\id_rsa**.

   Keep in mind that you must select the **All Files** (*.*) file type to select the file. Click **Open** to select the file.



Key

No key.

Actions

Generate a public/private key pair

Load an existing private key file

Save the generated key

Parameters

Type of key to generate:

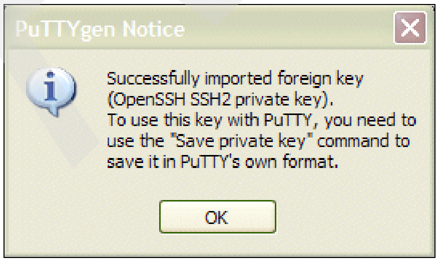
○ SSH1 (RSA) ● SSH2 RSA ○ SSH2 DSA

Number of bits in a generated key: 1024

Figure 13-5 PuTTY Key Generator window

> **Note:** Because the private key file was created without passphrase protection, the puttygen utility imported the key without prompting for a passphrase. If you created the private key file with passphrase protection, you see a prompt to enter the passphrase first, before puttygen can successfully import the key.

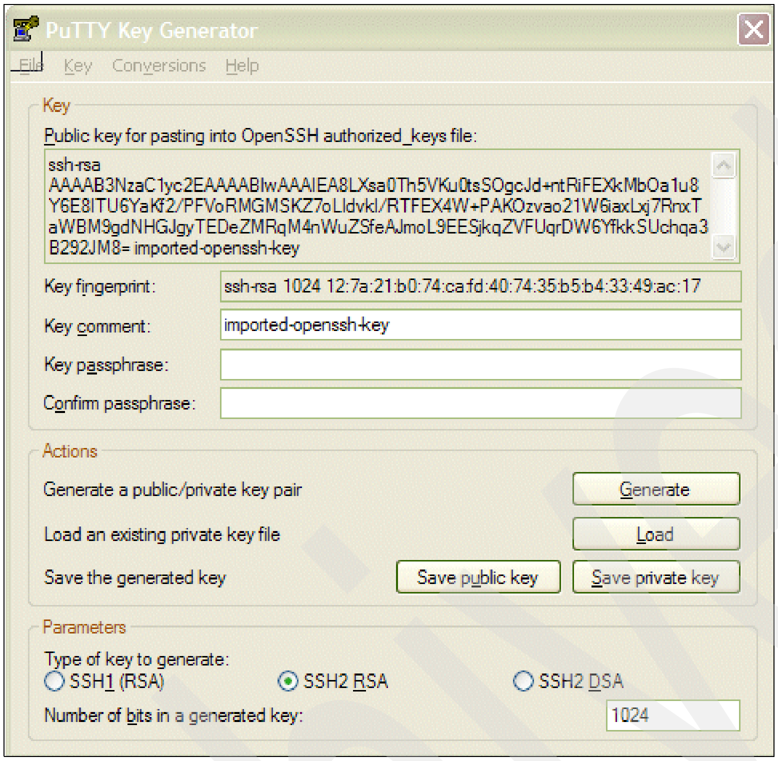
6. A confirmation message displays as shown in Figure 13-6. Click **OK** to close the message window.



Successfully imported foreign key (OpenSSH SSH2 private key).
To use this key with PuTTY, you need to use the "Save private key" command to save it in PuTTY's own format.

Figure 13-6 Key import confirmation message

7. The PuTTY Key Generator changes as shown in Figure 13-7. Click **Save private key** to save the key to the \ssh directory.



Public key for pasting into OpenSSH authorized_keys file:

```
ssh-rsa
AAAAB3NzaC1yc2EAAAABIwAAAIEA8LXsa0Th5VKu0tsSOgcJd+ntRiFEXkMbOa1u8
Y6E8ITU6YaKf2/PFVoRMGMSKZ7oLldvkl/RTFEX4W+PAKOzvao21W6iaxLxj7RnxT
aWBM9gdNHGJgyTEDeZMRqM4nWuZSfeAJmoL9EESjkqZVFUqrDW6YfkkSUchqa3
B292JM8= imported-openssh-key
```

Key fingerprint: ssh-rsa 1024 12:7a:21:b0:74:ca:fd:40:74:35:b5:b4:33:49:ac:17

Key comment: imported-openssh-key

Key passphrase:

Confirm passphrase:

Generate a public/private key pair

Load an existing private key file

Save the generated key

Type of key to generate:
○ SSH1 (RSA) ● SSH2 RSA ○ SSH2 DSA

Number of bits in a generated key: 1024

Figure 13-7 PuTTY Key Generator: Import complete

8. Save the key into a new file because PuTTY uses its own key file format. The utility warns you when you try to save the key without passphrase protection. Click **Yes** to the message to continue.

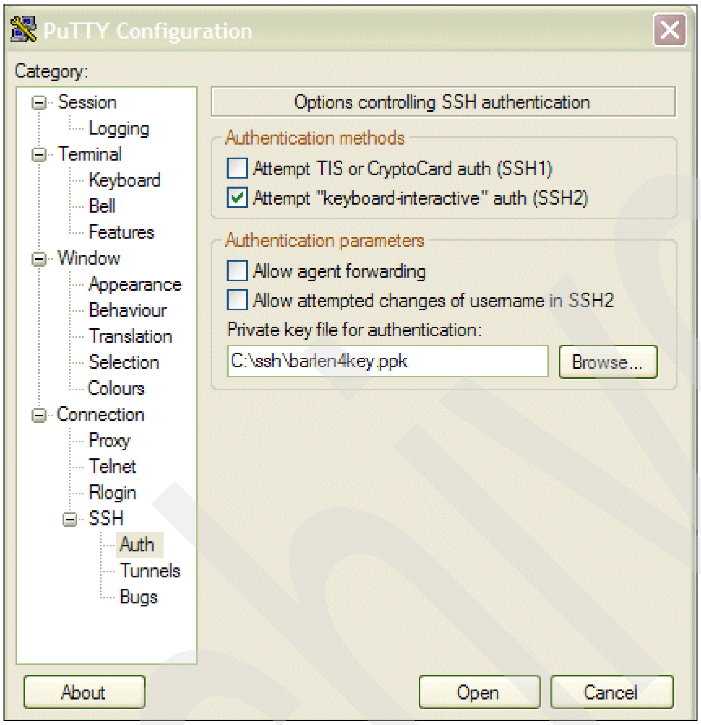
9. Enter the file name `barlen4key.ppk` and make sure the store path is still \ssh.

10. Close the PuTTY Key Generator window.

Defining the PuTTY public key authentication settings

Now modify the PuTTY settings to allow public key authentication.

1. Maximize the PuTTY window again and under Category, click **Connection** → **SSH** → **Auth**.
2. In the Options for controlling SSH configuration panel on the right (Figure 13-8), enter the path and file name of the private key file that you created in the Private key file for authentication field. In this example, enter `C:\ssh\barlen4key.ppk`.



Authentication methods

☐ Attempt TIS or CryptoCard auth (SSH1)

☑ Attempt "keyboard-interactive" auth (SSH2)

Authentication parameters

☐ Allow agent forwarding

☐ Allow attempted changes of username in SSH2

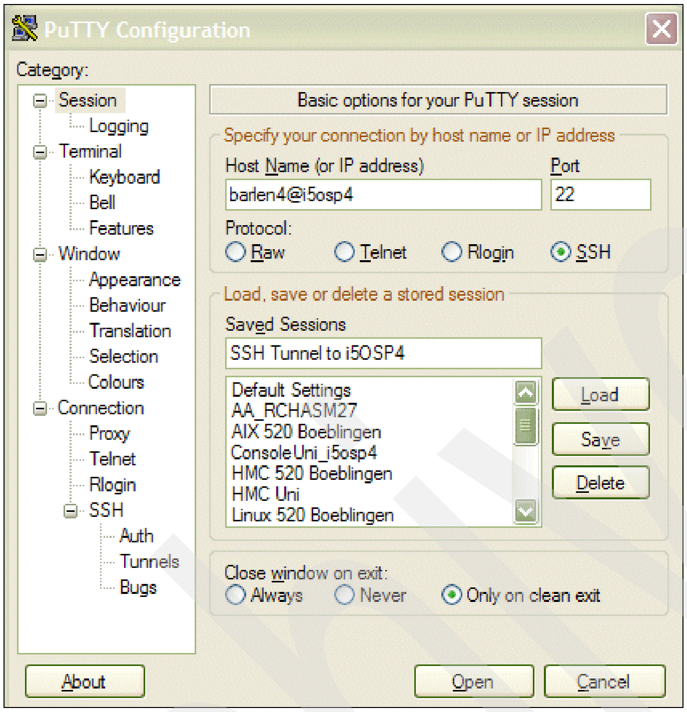
Private key file for authentication: C:\ssh\barlen4key.ppk

Figure 13-8 PuTTY authentication settings

3. Under Category, click **Session**.

4. To automate as much as possible, especially when establishing a tunnel, specify the user ID that belongs to the private key file. In the Basic options for your PuTTY session panel (Figure 13-9), enter the following information:

   – Host name (or IP address): `barlen4@i5OSP4`
   – Saved Sessions: `SSH Tunnel to i5OSP4`



PuTTY Configuration

Category:

Basic options for your PuTTY session

Specify your connection by host name or IP address

Host Name (or IP address): barlen4@i5osp4

Port: 22

Protocol: ○ Raw ○ Telnet ○ Rlogin ● SSH

Load, save or delete a stored session

Saved Sessions: SSH Tunnel to i5OSP4

Default Settings
AA_RCHASM27
AIX 520 Boeblingen
ConsoleUni_i5osp4
HMC 520 Boeblingen
HMC Uni
Linux 520 Boeblingen

Close window on exit: ○ Always ○ Never ● Only on clean exit

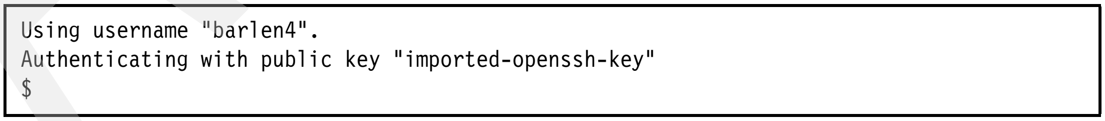
Figure 13-9 PuTTY session page

When using these settings, the PuTTY client tries to automatically authenticate the SSH session under the user name barlen4 on system i5OSP4.

5. Click **Save** to save the profile.

Establishing the tunnel

In the PuTTY client, click **Open** to start the connection. As shown in Figure 13-10, you see that the client automatically tries to authenticate with barlen4. It also opens the private key file that you configured in the session profile. When passphrase protection is active, you are prompted to enter the passphrase.



```
Using username "barlen4".
Authenticating with public key "imported-openssh-key"
$
```

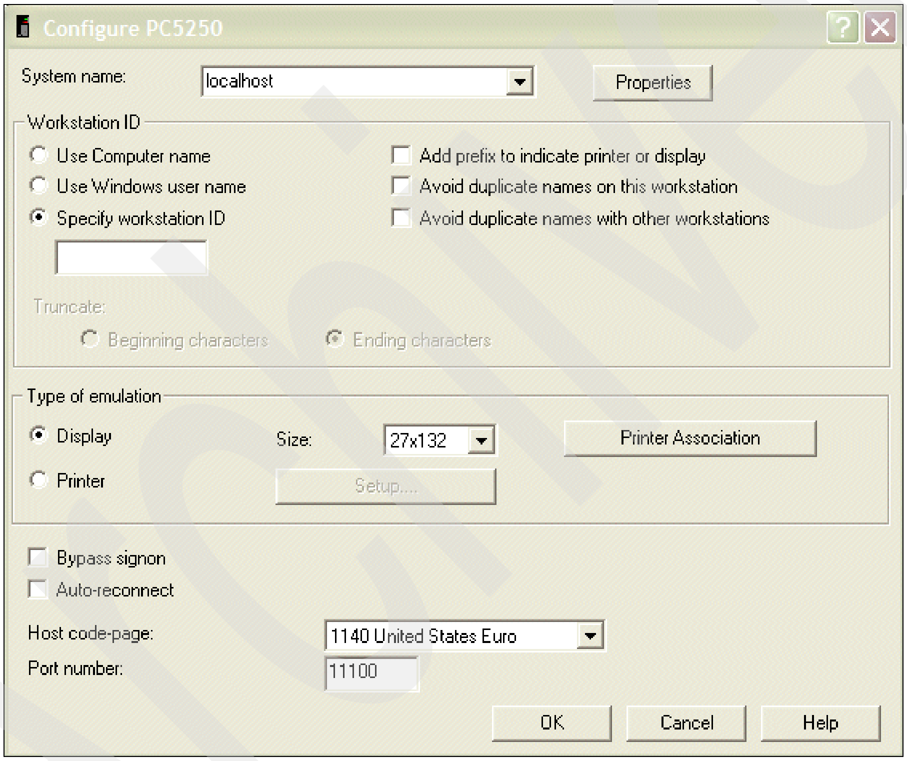
Figure 13-10 PuTTY login prompt

You have now established the tunnel and can use it for Telnet traffic.

Starting a secure 5250 Telnet session

Now test your secure tunnel:

1. Right-click the Windows desktop and select **New** → **iSeries Desktop Icon**.
2. Select **PC5250 Emulator** as the application and click **Next**.
3. For the iSeries system, enter `localhost` and click **Next**.
4. For the icon text, enter `Tunnel to i5OSP4`, click **Next,** and then click **Finish**.
5. On the Windows desktop, double-click the **Tunnel to i5OSP4** () icon. The PC5250 properties page opens.
6. Verify that the following connection settings are specified as shown in Figure 13-11:
   a. For System name, select **localhost**.
   b. For Port number, type `11100`. The connection is established to the local host (your PC workstation) to port 11100 (the beginning of the tunnel).
   c. Click **OK** to start the session.



Configure PC5250

System name: localhost

Workstation ID
○ Use Computer name
○ Use Windows user name
● Specify workstation ID
□ Add prefix to indicate printer or display
□ Avoid duplicate names on this workstation
□ Avoid duplicate names with other workstations

Truncate:
○ Beginning characters
● Ending characters

Type of emulation
● Display
○ Printer
Size: 27x132

□ Bypass signon
□ Auto-reconnect

Host code-page: 1140 United States Euro
Port number: 11100

Figure 13-11 PC5250 connection settings

7. You can sign on to i5/OS and use the NETSTAT *CNN command to check the ports and addresses that are used for your connection. Notice that the remote IP address is the address of the iSeries system rather than the remote PC workstation.
8. Sign off and close your 5250 session.
9. In the open PuTTY window, enter `Exit` to end the session.

13.3 Automating the tunnel session start

As you have seen in the previous task, you open the PuTTY graphical interface, load the profile, and start it. When passphrase protection is active for the private key file, you are also prompted to enter the passphrase that protects the private key file. The next steps show another way to establish the tunnel through the command line interface.

Perform the following steps to meet the previously stated goals:

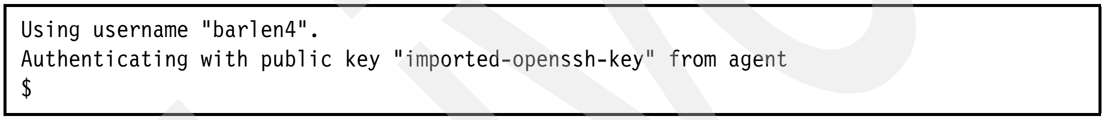
1. Using the Windows command prompt, change to the \ssh directory:

   ```
   cd c:\ssh
   ```

2. From the command prompt in the \ssh directory, enter the following command to start the tunnel:

   ```
   putty -load "SSH Tunnel to i5OSP4"
   ```

   This command loads the configuration profile that you created in the PuTTY graphical interface. It opens the ssh command prompt. When passphrase protection is defined for the private key file, you can use the pageant utility to preload private keys into memory before establishing the tunnel as described in "Automatic setup of tunnels with private key file passphrase protection" on page 325.



```
Using username "barlen4".
Authenticating with public key "imported-openssh-key" from agent
$
```

Figure 13-12 SSH tunnel start messages

3. In the PuTTY command window, right-click the upper left corner of the window and select **Event Log** to display the ports that are tunneled with this connection.
4. Close the Event Log window.
5. In the PuTTY command prompt, enter the `exit` command to stop the tunnel and exit the SSH session.

Automatic setup of tunnels with private key file passphrase protection

For better security, we recommend that you protect your private key file with a passphrase. This is especially recommended when using a Windows operating system and no proper resource protection for the private key file is defined. In this case, you can load the private key into memory before starting the tunnel by using the pageant utility. The following steps show how to use the pageant tool to load a private key that is passphrase-protected.

1. Using the Windows command prompt, change to the \ssh directory:

   ```
   cd c:\ssh
   ```

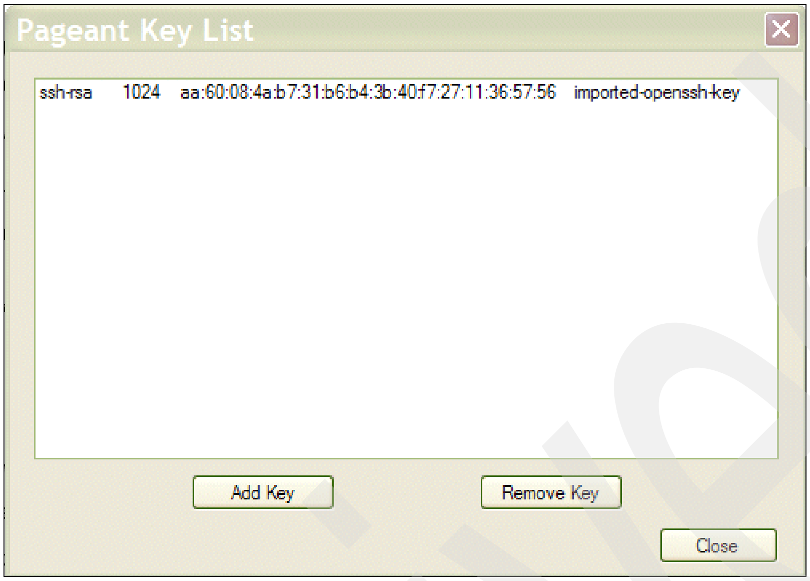
2. Enter the pageant command to start the PuTTY key agent. The program starts in the background and places an icon in the active program tasks bar.
3. Right-click the **pageant icon** (🖥) and select **Add Key** from the menu.
4. Select the **\ssh\barlen4key.ppk** private key file and click **Open**.

   You can also load keys from the command line when starting the pageant tool. To load your private key file with the command line options, enter the following command string:

   ```
   \ssh\pageant \ssh\barlen4key.ppk
   ```

   Remember that the key file in this scenario is not passphrase-protected.

5. When prompted to enter the passphrase, enter the passphrase that is used to protect the private key.
6. Double-click the **pageant** icon and verify that the key was added (Figure 13-13).



```
ssh-rsa    1024    aa:60:08:4a:b7:31:b6:b4:3b:40:f7:27:11:36:57:56    imported-openssh-key
```

Figure 13-13 The pageant key list

7. From the command prompt in the \ssh directory, enter the following command to start the tunnel:

   ```
   putty -load "SSH Tunnel to i5OSP4"
   ```

   This command loads the configuration profile that you created in the PuTTY graphical interface. It opens the ssh command prompt. As you can see in Figure 13-14, the authentication takes place without entering a passphrase when PuTTY starts.

```
Using username "barlen4".
Authenticating with public key "imported-openssh-key" from agent
$
```

Figure 13-14 SSH tunnel start messages

8. In the PuTTY command prompt, enter the `exit` command to stop the tunnel and exit the SSH session.

14

Using SSH to control your HMC

The *Hardware Management Console* (HMC) tool manages logical partitions (LPAR) in an IBM System i5 environment. Traditionally, the HMC is operated through a graphical interface. The graphical interface provides the following options:

- Define and manage partitions
- Define and manage partition profiles
- Operate managed systems
- Perform dynamic LPAR operations, such as moving processor and memory resources

You can perform these functions that are available through the graphical interface through commands. These commands are entered via an SSH session. This support opens a wide range of possibilities for automating system tasks, such as initiating the move of memory from one partition to another partition through a command sent from i5/OS via ssh to the HMC. Another example is to move a tape controller from one partition to another partition to make the tape available to all partitions for backup operations.

This chapter covers the following topics:

14.1 Setting up SSH on the HMC

To allow SSH connections and remote command execution on a HMC, you must perform initial setup steps on the HMC itself. These steps are also explained in the IBM Systems Hardware Information Center at the following Web address:

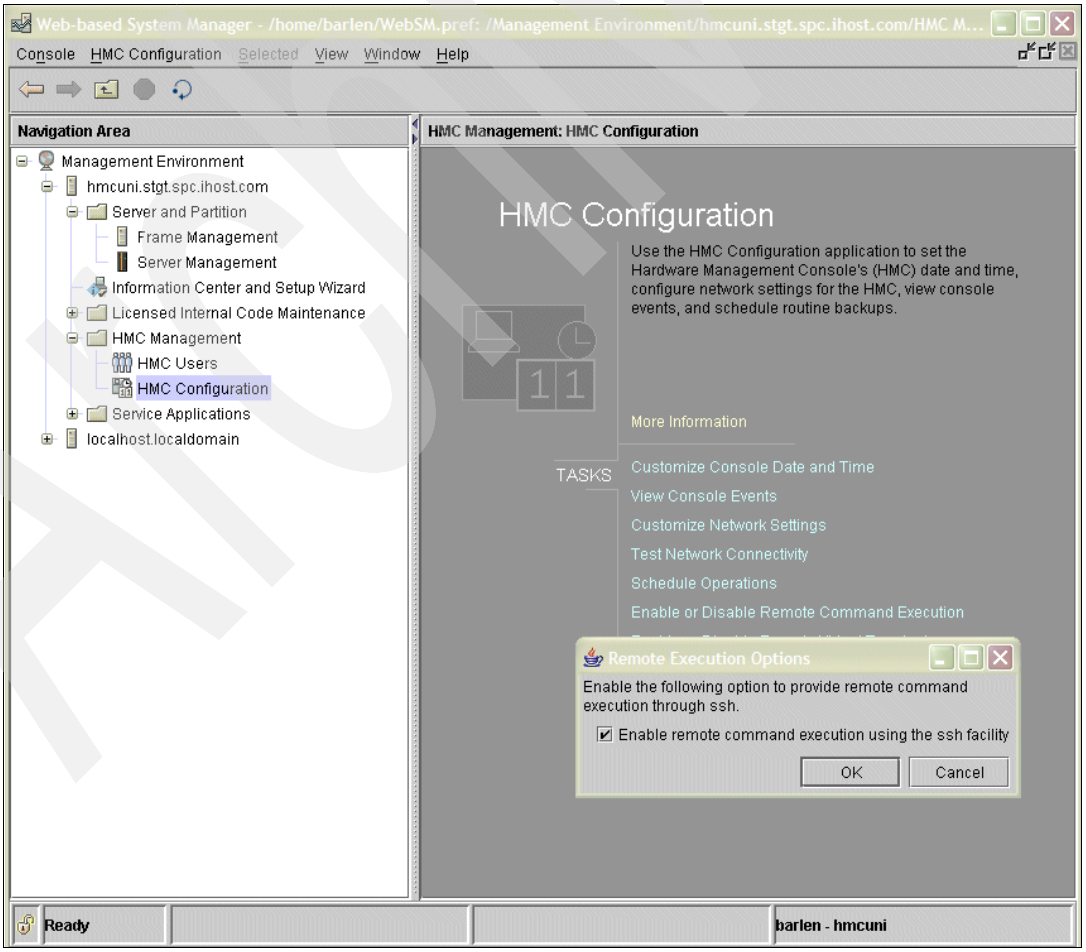
```
http://publib.boulder.ibm.com/infocenter/eserver/v1r3s/index.jsp?topic=/iphai/settingupsecurescriptexecutionsbetweensshclientsandthehmc.htm
```

Perform the steps in the following sections to enable the HMC to allow remote command execution through SSH.

Enabling SSH on the HMC

To enable SSH on the HMC:

1. At the HMC or through the WebSM interface, sign on to the HMC with a profile that has the authority to manage the HMC configuration.
2. In the Navigation area, expand **HMC Management** and click **HMC Configuration**.
3. In the Contents area on the right, click **Enable or Disable Remote Command Execution**.
4. When the Remote Execution Options window opens, select the **Enable remote command execution using the ssh facility** check box as shown in Figure 14-1.
5. Click **OK** to save the settings.


Web-based System Manager - /home/barlen/WebSM.pref: /Management Environment/hmcuni.stgt.spc.ihost.com/HMC M...
Console
HMC Configuration
Selected
View
Window
Help
Navigation Area
Management Environment
hmcuni.stgt.spc.ihost.com
Server and Partition
Frame Management
Server Management
Information Center and Setup Wizard
Licensed Internal Code Maintenance
HMC Management
HMC Users
HMC Configuration
Service Applications
localhost.localdomain
HMC Management: HMC Configuration
HMC Configuration
More Information
TASKS
Customize Console Date and Time
View Console Events
Customize Network Settings
Test Network Connectivity
Schedule Operations
Enable or Disable Remote Command Execution
Remote Execution Options
OK
Cancel
Ready
barlen - hmcuni

Use the HMC Configuration application to set the Hardware Management Console's (HMC) date and time, configure network settings for the HMC, view console events, and schedule routine backups.

Enable the following option to provide remote command execution through ssh.

☑ Enable remote command execution using the ssh facility

Figure 14-1 Enabling remote command execution on the HMC

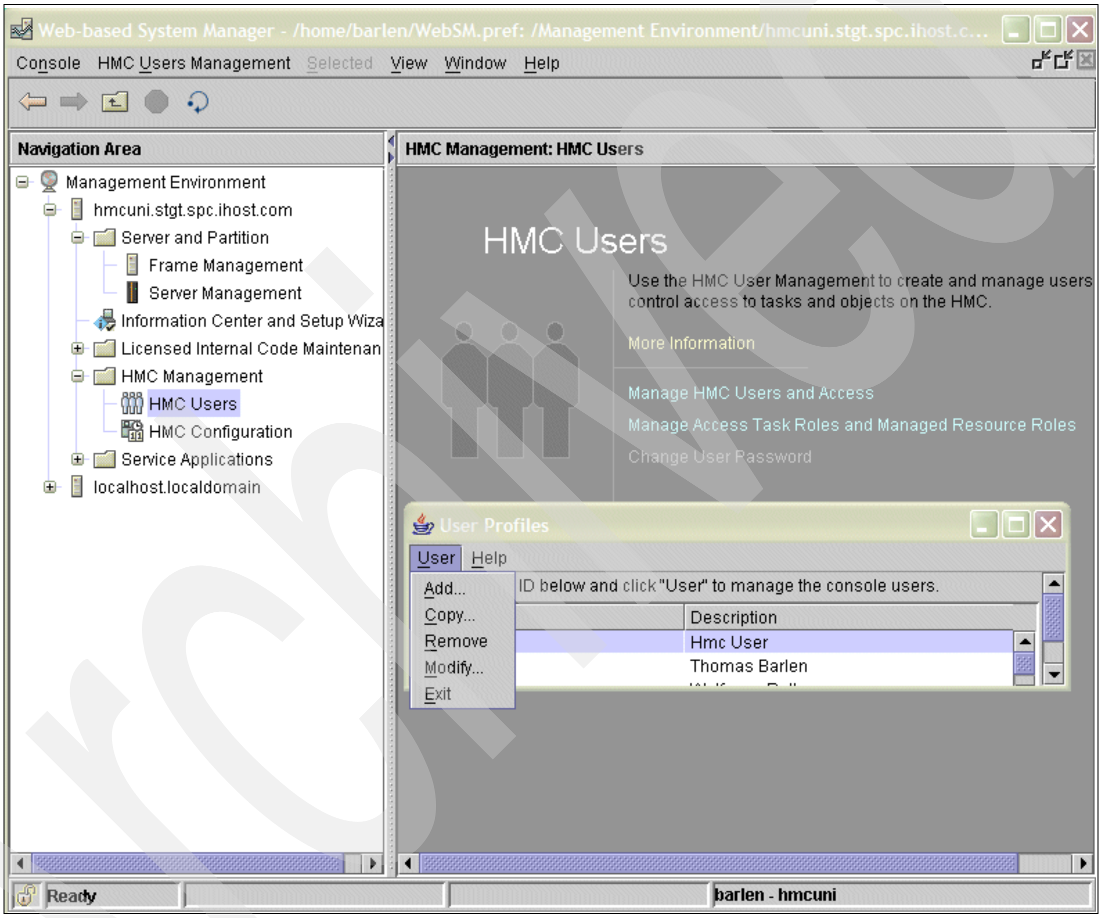
Creating a user account on the HMC

Create an HMC user with one of the following roles:

- Super administrator
- Service representative

Follow these steps:

1. In the navigation area, under HMC Management, click **HMC Users**.
2. In the HMC Users content pane, click **Manage HMC Users and Access**.
3. In the User Profiles window, select **User** → **Add** to add a new user account (Figure 14-2).



Use the HMC User Management to create and manage users control access to tasks and objects on the HMC.

ID below and click "User" to manage the console users.

Description
Hmc User
Thomas Barlen

Figure 14-2 User Profiles window

4. In the Add User window (Figure 14-3), for the new user account, specify the information using the following parameters. The values provided for each option are ones that we used in this book. You might want to use different names.

   a. For User ID, type `HMCSSH`. Note that user ID names are case-sensitive.

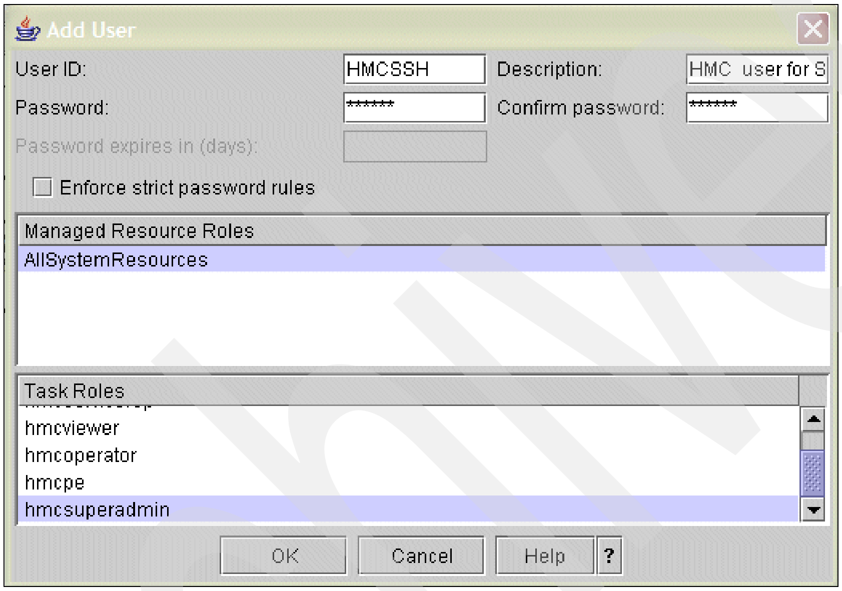
   b. For Description, type `HMC User for SSH`.

   c. For Password, enter a password that you can remember.

   d. For Managed Resource Roles, select **AllSystemResources**.

   e. For Task Roles, select **hmcsuperadmin**. You can also use a service representative, but this user might not perform all the functions that you want to run via SSH.

   f. Click **OK** to create the new user account.



Add User

User ID: HMCSSH

Description: HMC user for S

Password: ******

Confirm password: ******

Password expires in (days):

□ Enforce strict password rules

Managed Resource Roles

AllSystemResources

Task Roles

hmcviewer

hmcoperator

hmcpe

hmcsuperadmin

Figure 14-3 Add User window

5. In the User Profiles window, select **User** → **Exit** to close the window.

14.2 Setting up public key authentication

To submit an HMC command via SSH in unattended mode, you must set up public key authentication between the **`ssh`** client, in this case the i5/OS environment, and the HMC. Perform the following steps to set up public key authentication for the i5/OS user BARLEN4 on the i5OSP4 system to the HMC, with the host name HMCUNI and the user profile HMCSSH. After the setup is complete, user BARLEN4 on system i5OSP4 can run HMC commands under user HMCSSH on the HMC.

1. User BARLEN4 on the i5OSP4 system needs a public key pair. Perform the steps described in “Setting up the public and private keys” on page 308 to create a public key pair for user BARLEN4 without private key passphrase protection.

2. Using an i5/OS Portable Solutions Application Environment (PASE) shell session on system i5OSP4, set the correct integrated file system permissions as follows:

```
chmod 700 /home/barlen4
chmod 700 /home/barlen4/.ssh
```

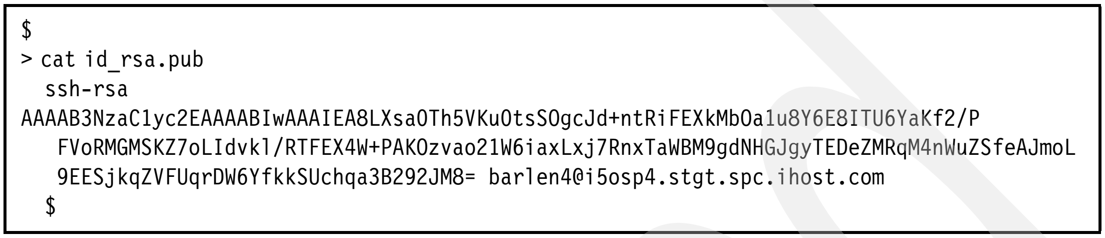
3. If you are not already in the .ssh directory, change to it via the shell command:

   ```
   cd /home/barlen4/.ssh
   ```

4. Display the public key file by using the following command:

   ```
   cat id_rsa.pub
   ```

   The public key displays as shown in Figure 14-4.



```
$
> cat id_rsa.pub
  ssh-rsa
AAAAB3NzaC1yc2EAAAABIwAAAIEA8LXsaOTh5VKuOtsSOgcJd+ntRiFEXkMbOa1u8Y6E8ITU6YaKf2/P
   FVoRMGMSKZ7oLIdvkl/RTFEX4W+PAKOzvao21W6iaxLxj7RnxTaWBM9gdNHGJgyTEDeZMRqM4nWuZSfeAJmoL
   9EESjkqZVFUqrDW6YfkkSUchqa3B292JM8= barlen4@i5osp4.stgt.spc.ihost.com
  $
```

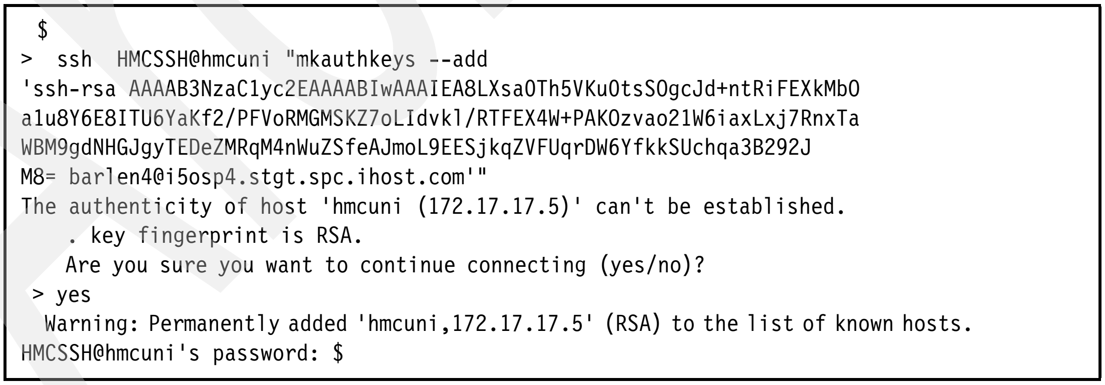
Figure 14-4 Public key

5. Add the public key to the authorized_keys2 file on the HMC:

   ```
   ssh  HMCSSH@hmcuni "mkauthkeys --add
   'ssh-rsa AAAAB3NzaC1yc2EAAAABIwAAAIEA8LXsaOTh5VKuOtsSOgcJd+ntRiFEXkMbO
   a1u8Y6E8ITU6YaKf2/PFVoRMGMSKZ7oLIdvkl/RTFEX4W+PAKOzvao21W6iaxLxj7RnxTa
   WBM9gdNHGJgyTEDeZMRqM4nWuZSfeAJmoL9EESjkqZVFUqrDW6YfkkSUchqa3B292J
   M8= barlen4@i5osp4.stgt.spc.ihost.com'"
   ```

   > **Note:** You must enter the public key exactly as it was displayed with the cat id_rsa.pub command. This includes spaces and in one string. The previous command establishes an SSH session to the HMC and signs on as user HMCSSH (case-sensitive). This was the user that was created previously in “Creating a user account on the HMC” on page 329. On the HMC, the mkauthkeys command is run with the -add parameter. This causes the key that is specified to be added to the authorized_keys2 file on the HMC. Adding the key is required for public authentication.

   Figure 14-5 shows the command processing output.



```
 $
>  ssh  HMCSSH@hmcuni "mkauthkeys --add
'ssh-rsa AAAAB3NzaC1yc2EAAAABIwAAAIEA8LXsaOTh5VKuOtsSOgcJd+ntRiFEXkMbO
a1u8Y6E8ITU6YaKf2/PFVoRMGMSKZ7oLIdvkl/RTFEX4W+PAKOzvao21W6iaxLxj7RnxTa
WBM9gdNHGJgyTEDeZMRqM4nWuZSfeAJmoL9EESjkqZVFUqrDW6YfkkSUchqa3B292J
M8= barlen4@i5osp4.stgt.spc.ihost.com'"
The authenticity of host 'hmcuni (172.17.17.5)' can't be established.
    . key fingerprint is RSA.
    Are you sure you want to continue connecting (yes/no)?
 > yes
  Warning: Permanently added 'hmcuni,172.17.17.5' (RSA) to the list of known hosts.
HMCSSH@hmcuni's password: $
```

Figure 14-5 Command output for adding a public key

> **Note:** When you establish an SSH session to the HMC for the first time, you are prompted to accept the host key from the HMC. When you answer “Yes” to the question, the host key is added to the known_hosts file of user BARLEN4 on the i5OSP4 system.

6. When prompted, enter the password of user HMCSSH.

The public key authentication setup is now complete, and you can continue running HMC commands.

14.3 Moving resources between partitions using SSH in i5/OS

Let us look closer at how you can use the ssh utility to move hardware resources in a dynamic logical partitioning (DLPAR) environment. The intent of this chapter is not to show you the HMC commands that are available and how to use all of them. Instead, it is to demonstrate how to use HMC commands in an i5/OS or any other environment that supports the SSH client. For more information about LPAR and HMC commands, see *Logical Partitions on System i5: A Guide to Planning and Configuring LPAR with HMC on System i*, SG24-8000.

The commands shown in this chapter are based on the LPAR environment shown in Figure 14-6.

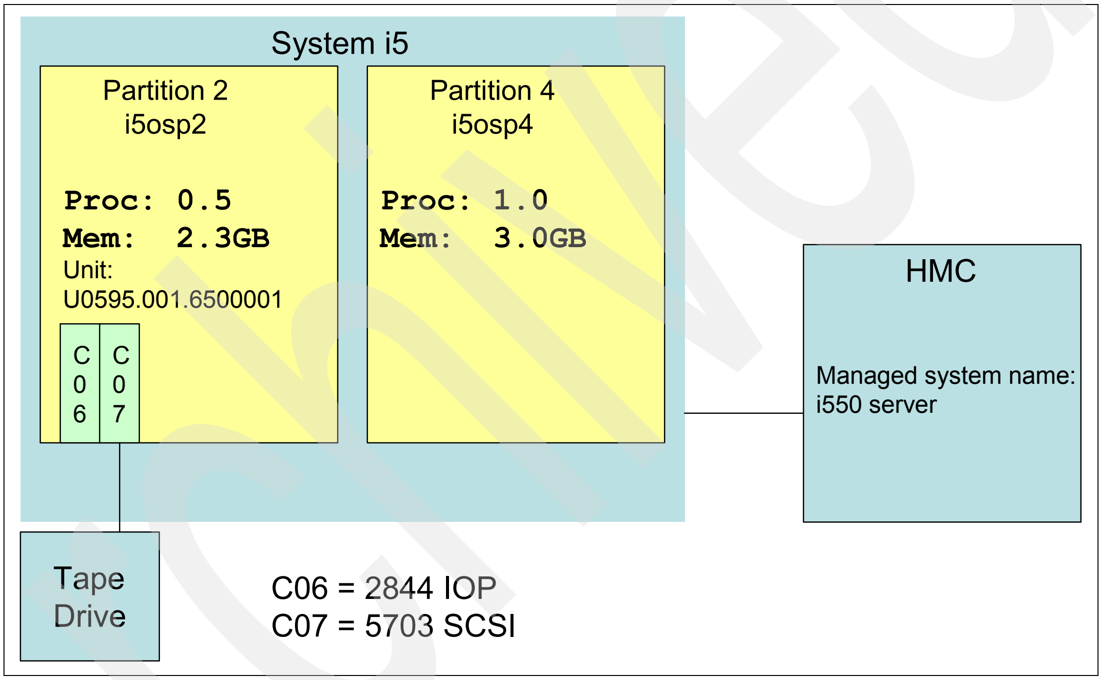


Figure 14-6 LPAR environment

Moving processor units between partitions

In the first example, the 0.3 processing units are moved via DLPAR from partition 4 (i5OSP4) to partition 2 (i5OSP2). The move is initiated from i5/OS.

1. Sign on to system i5OSP4 with user BARLEN4. This is the user profile that is set up for public key authentication with the HMC.
2. Start an i5/OS PASE shell session by entering the CL command:

```
CALL QP2TERM
```

3. Move the processing units from partition 4 to partition 2:

```
ssh HMCSSH@hmcuni “chhwres -r proc  -m ’i550 server’ -o m  -p I5OSP4  -t I5OSP2
--procunits 0.3”
```

You can use the chhwres command to add, move, or remove resources, such as input/output resources, virtual resources, processor, and memory. The meaning of the specified parameters is as follows:

-r Specifies the type of resource to be processed. In this example, processor resources are moved.

-m Defines the name of the managed system.

> **Tip:** The HMC command to determine the name of the managed system or systems is:
>
> ```
> lssyscfg -r sys -F name
> ```

-o The action to be performed for the resource. In this case it is m (move).

-p The name of the partition a resource is moved from.

> **Tip:** You can use the following command to list all partition names for a managed system:
>
> ```
> lssyscfg -r lpar -m 'i550 server' -F name
> ```

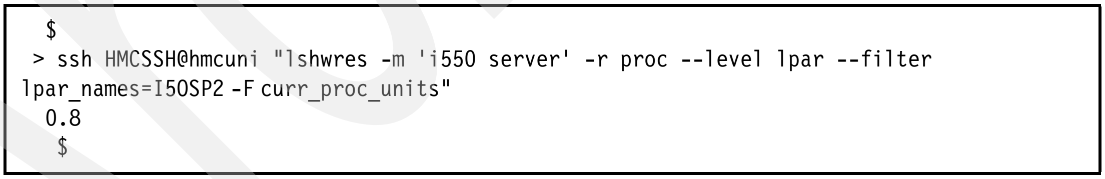
-t The target partition name.

--procunits The number of processing units to be processed.

The HMC commands are similar to other kinds of Linux or UNIX-type commands. They do not issue any success messages when they complete successfully. Therefore, we recommend that you verify the result of the HMC command after its completion. For example, if you want to verify that the processing units were moved successfully to a partition, you can use the following command:

```
ssh HMCSSH@hmcuni "lshwres -m 'i550 server' -r proc --level lpar --filter lpar_names=I5OSP2
-F curr_proc_units"
```

Figure 14-7 shows the complete command output.



```
  $
 > ssh HMCSSH@hmcuni "lshwres -m 'i550 server' -r proc --level lpar --filter
lpar_names=I5OSP2 -F curr_proc_units"
  0.8
   $
```

Figure 14-7 Command output

Moving adapter resources

You can submit HMC commands from an i5/OS environment to move resources, such as a SCSI adapter from one partition to another partition. That way, you can have one tape drive installed on your system and use it from multiple partitions. You can organize a backup process as follows:

1. Partition 4 has a tape drive allocated and varied on. A backup batch job runs.
2. At the end of the backup job in partition A, the job varies off the tape drive and sends via the ssh utility a command to the HMC to move the tape adapter and controller to partition 2. When the move has completed successfully, the job starts a backup job in partition 2 by issuing the corresponding command through the Run Remote Command (RUNRMTCMD) CL command.

3. The backup job in partition 2 starts and varies on the tape drive. Afterwards it performs the backup operation. When finished, it varies off the tape drive and, via an ssh command, moves the controlling adapter back to partition 4.

You can imagine all different kinds of uses for moving resources based on events that are occurring in a partition. Based on the LPAR environment described in Figure 14-6 on page 332, the following example shows you how to move the adapter resource in slot C07 in unit U0595.001.6500001 from partition i5OSP4 to partition i5OSP2:

1. Sign on to partition i5OSP4 with user BARLEN4.
2. Start an i5/OS PASE shell session.
3. Enter the following command to move the adapter. Remember to vary off resources before trying to move resources through DLPAR.

```
ssh HMCSSH@hmcuni  “chhwres  -r io --rsubtype slot  -m 'i550 server' -o m
-p I5OSP4 -t I5OSP2 -l 2102000A”
```

This command moves the resource in slot C07 from partition i5OSP4 to partition i5OSP2. As you can see, there is no parameter to specify a slot number. I/O slots are addressed by a DRC index number. Before you see how to determine the DRC index number, review the following explanation of the parameters:

-r Specifies the type of resource to be processed. In this example, I/O resources are moved.

--rsubtype When io is specified for the resource type parameter -r, provide more specific information about the type of I/O resource to be processed. In this case, the rsubtype is an adapter slot.

-m Defines the name of the managed system.

-o The action to be performed for the resource. In this case it is m (move).

-p The name of the partition from which a resource is moved.

-t The target partition name of the partition to which a resource is moved.

-l Specifies the DRC index number. Each resource has a unique DRC index number. This is *important,* because you might have several I/O expansion units, such as a 0595, installed, and in each unit, you have an adapter in slot C07. One way to address the correct resource is by unit name and slot number, but the current implementation performs the addressing by a DRC index number.

Determining the DRC index number

To find a DRC index number for a resource, you must know the unit (system or expansion units) where the resource is located. There are always several ways to reach the same result. The following method is one example to determine the DRC index number for the adapter in slot C07 in unit U595.001.6500001.

Enter the following HMC command to list all physical resources including the DRC index number in unit U595.001.6500001:

```
ssh HMCSSH@hmcuni “lshwres -r io --rsubtype slot -m 'i550 server'
-F phys_loc,drc_index   --header  --filter units=U0595.001.6500001”
```

This command displays only the physical location (phys_loc) and DRC index (drc_index) attributes as specified in the -F parameter. It lists all physical I/O resources of type slot that are installed in unit U0595.001.6500001 as defined in the filter parameter. The output also includes a header.

Figure 14-8 shows an example of the command output.

```
> sssh HMCSSH@hmcuni “lshwres -r io --rsubtype slot -m 'i550 server'
-F phys_loc,drc_index   --header  --filter units=U0595.001.6500001”
  phys_loc,drc_index
  C06,2101000A
  C07,2102000A
  C08,2103000A
  C01,2101000B
  C02,2102000B
  C03,2103000B
  C04,2104000B
  $
```

Figure 14-8 HMC command output

In this case, the resource in slot C07 has the DRC index number of 2102000A.

> **Tip:** If you do not know the slot number and unit for the installed adapter, you can always use the Work with Hardware Resources (WRKHDWRSC) CL command in the partition where the adapter is installed to display the resource details.

In the previous example, the SCSI adapter with the attached tape drive was moved from partition i5OSP4 to partition i5OSP2. To use the tape drive in partition i5OSP2, you must also move the controlling input/output processor (IOP) in position C06.

Related publications

The publications listed in this section are particularly suitable for a more detailed discussion of the topics covered in this book.

IBM Redbooks publications

For information about ordering these publications, see “How to get IBM Redbooks publications” on page 339. Note that some of the documents referenced here might be available in softcopy only.

- *IBM AS/400 Printing V*, SG24-2160
- *Linux on the IBM @server iSeries Server: An Implementation Guide*, SG24-6232
- *Logical Partitions on IBM PowerPC: A Guide to Working with LPAR on POWER5 for IBM @server i5 Servers*, SG24-8000
- *V5 TCP/IP Applications on the* IBM @server *iSeries Server,* SG24-6321
- *Virtual Partition Manager A Guide to Planning and Implementation*, REDP-4013
- *Windows-based Single Signon and the EIM Framework on the IBM* IBM @server *iSeries Server*, SG24-6975

Other publications

The following publication is also relevant as an information source:

- *Backup and Recovery V5R3,* SC41-5304

Online resources

These Web sites and URLs are also relevant as information sources:

- *The Book of Webmin Or: How I Learned to Stop Worrying and Love UNIX*:

  `http://www.swelltech.com/support/pdfs/webminguide.pdf`
- Downloading and installing Webmin:

  `http://www.webmin.com/download.html`
- General discussion of Webmin:

  `http://www.webmin.com`
- Gentoo Linux home page:

  `http://www.gentoo.org`
- Gentoo Linux Projects: Gentoo Linux PPC64 Development:

  `http://ppc64.gentoo.org`
- Heimdal Kerberos 5:

  `http://www.pdc.kth.se/heimdal`

- IBM @server Hardware Information Center:

  http://publib.boulder.ibm.com/infocenter/iseries/v1r2s/en_US/index.htm
- IBM @server i5 and iSeries System Handbook for i5/OS V5R3:

  http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/ga195486.html?Open
- IBM @server iSeries ODBC Driver for Linux: Connection String Keywords and Values:

  http://www.ibm.com/servers/eserver/iseries/linux/odbc/guide/odbcproperties.html
- IBM Resource Link:

  http://www.ibm.com/servers/resourcelink
- IBM Systems Information Centers:

  http://publib.boulder.ibm.com/iseries/
- iSeries Access for Linux:

  http://www.ibm.com/servers/eserver/iseries/access/linux
- iSeries ODBC Driver for Linux: PHP examples:

  http://www-1.ibm.com/servers/eserver/iseries/linux/odbc/guide/demoindex.html
- Kerberos: The Network Authentication Protocol:

  http://web.mit.edu/kerberos/www
- The Linux Documentation Project:

  http://www.tldp.org
- The Linux Home Page at Linux Online:

  http://www.linux.org
- LPAR Overview:

  http://www.iseries.ibm.com/lpar
  http://www-1.ibm.com/servers/eserver/iseries/lpar
- Novell: SUSE Linux:

  http://www.suse.com
- Novell: SUSE Linux Enterprise Server 9:

  http://www.suse.com/sles/documentation/samba
- Novell: Why Choose Novell for Linux?:

  http://www.novell.com/linux
- OpenOffice.org:

  http://www.openoffice.org
- OpenPKG: OpenPGP Key Server:

  http://pgp.openpkg.org
- PuTTY: A Free Telnet/SSH Client:

  http://www.chiark.greenend.org.uk/~sgtatham/putty
- RealVNC:

  http://www.realvnc.com
- Red Hat Linux home page:

  http://www.redhat.com
- Service and productivity tools for Linux on POWER:

  http://techsupport.services.ibm.com/server/lopdiags

- Standalone Diagnostics CD-ROM:

  http://techsupport.services.ibm.com/server/mdownload/diags
- Third-party modules for Webmin:

  http://webadminmodules.sourceforge.net
- The unixODBC Project home page:

  http://www.unixodbc.org
- V5R3 Information Center:

  http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/index.htm
- Various Linux related information about i5 is available at:

  http://www.ibm.com/servers/eserver/iseries/linux
- WinSCP: Freeware SFTP and SCP client for Windows:

  http://winscp.sourceforge.net/eng
- Workload Estimator (WLE):

  http://www-912.ibm.com/wle/EstimatorServlet

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- Introduction to OpenSSH for i5/OS
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