

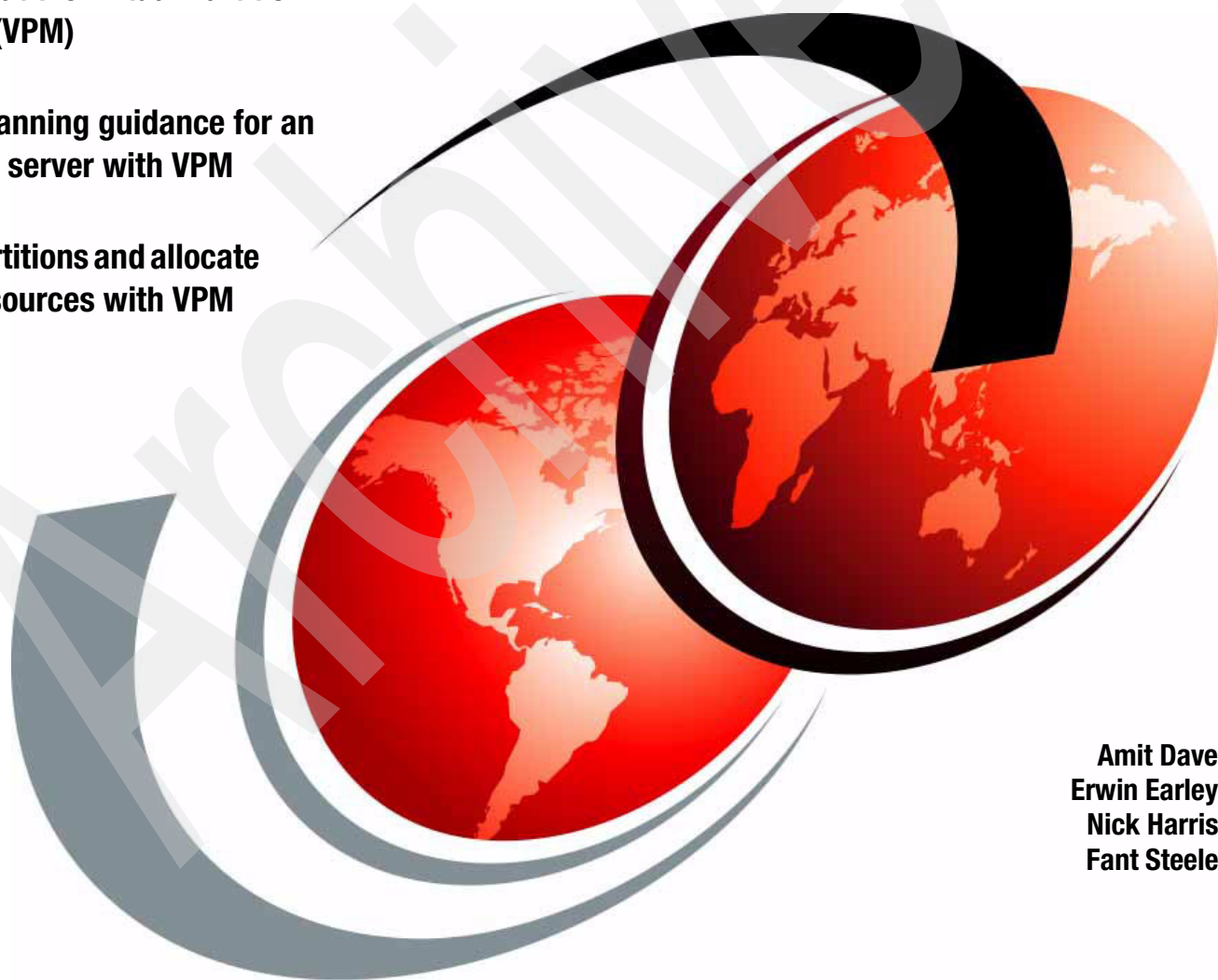
# Virtual Partition Manager

## A Guide to Planning and Implementation

Learn about the Virtual Partition Manager (VPM)

Review planning guidance for an eServer i5 server with VPM

Create partitions and allocate virtual resources with VPM



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International Technical Support Organization

**Virtual Partition Manager  
A Guide to Planning and Implementation**

April 2005

Archived

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

## **First Edition (April 2005)**

This edition applies to eServer i5 and i5/OS Version 5, Release 3.

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# Preface

With the recently announced POWER5™ processor based eServer™ i5 systems, IBM® is delivering the 3<sup>rd</sup> generation of logical partitioning for the iSeries™ family of servers. The new partitioning capabilities enable clients to further simplify their infrastructures.

The IBM Virtualization Engine™, which provides support for logical partitioning and resource virtualization through i5/OS™, is included with eServer i5 servers.

The Virtual Partition Manager (VPM) introduces the capability to create and manage Linux® partitions without the use of the Hardware Management Console (HMC). The Virtual Partition Manager supports the needs of small and medium customers that want to add simple Linux workloads to their eServer i5 server. The Virtual Partition Manager is included with i5/OS V5R3.

The Virtual Partition Manager supports environments with one i5/OS partition and up to four Linux partitions. In addition, the single i5/OS partition must own and manage all of the I/O resources.

This document is intended to assist IBM Business Partners and clients that are planning to deploy Linux partitions on eServer i5 servers using the Virtual Partition Manager.

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# Introduction to Virtual Partition Manager for eServer i5 Servers

With the recently announced POWER5 processor based eServer i5 systems, IBM is delivering the 3<sup>rd</sup> generation of logical partitioning for the iSeries family of servers. The new partitioning capabilities enable clients to further simplify their infrastructures.

The IBM Virtualization Engine, which provides support for logical partitioning and resource virtualization through i5/OS, is included with eServer i5 servers.

The Virtual Partition Manager (VPM) introduces the capability to create and manage Linux partitions without the use of the Hardware Management Console (HMC). The Virtual Partition Manager supports the needs of small and medium customers that want to add simple Linux workloads to their eServer i5 server. The Virtual Partition Manager is included with i5/OS V5R3, as illustrated in Figure 1-1.



Figure 1-1 The Virtual Partition Manager

The Virtual Partition Manager supports environments with one i5/OS partition and up to four Linux partitions. In addition, the single i5/OS partition must own and manage all of the I/O resources.

This document is intended to assist IBM Business Partners and clients that are planning to deploy Linux partitions on eServer i5 servers using the Virtual Partition Manager.

The HMC remains the premier management tool for logical partitioning on the eServer i5 server. It is required to support more robust configurations: multiple i5/OS partitions, AIX® 5L™ partitions, flexible hardware resource assignments, and dynamic resource movement.

The key differences between the Virtual Partition Manager and the HMC are highlighted in Table 1-1.

*Table 1-1 Differences between VPM and HMC*

	<b>Virtual Partition Manager</b>	<b>Hardware Management Console</b>
Operating Systems supported	i5/OS and Linux	i5/OS, Linux, and AIX
Maximum number of partitions	5 (1 i5/OS and 4 Linux)	254
Uncapped Partition support	Yes	Yes
Dynamic Resource Movement	No	Yes
I/O Support for Linux	Virtual	Virtual and Direct
Maximum # of Virtual Ethernet connections	4	4096
Maximum Virtual Disk per Partition	64TB	64TB

This document is intended to assist users who plan to deploy Linux partitions on eServer i5 servers using the Virtual Partition Manager.

## Planning for Virtual Partition Manager

Virtual Partition Manager is enabled by enhancing the partition management tasks in the Dedicated Service Tools (DST) and System Service Tools (SST) for i5/OS V5R3. This capability is enabled only for eServer i5 systems allowing you to create up to a maximum of four Linux partitions in addition to the one i5/OS partition that owns all of the I/O resources for the Linux partitions.

Keep in mind that the intended use of Virtual Partition Manager allows deployment of a limited number of Linux partitions on eServer i5 systems without requiring an HMC, where the entire I/O is hosted by a single i5/OS partition.

## 2.1 Planning Considerations

It is strongly recommended that you fully understand the planning considerations required to enable Virtual Partition Manager on your eServer i5 system. Following are the planning considerations:

- ▶ You need a minimum of an eServer i5 server with i5/OS V5R3, and PTF MF34753 (or its supersede) applied to enable Virtual Partition Manager.

**Important:** Prerequisite PTFs MF34946 and MF34962 must be permanently applied before doing a SAVSYS of the i5/OS partition. A D-mode IPL of the Virtual Partition Manager activated i5/OS partition will fail with an SRC of A6005001 with media that does not have these PTFs permanently applied.

- ▶ An IPL is required to apply MF34753 (or its supersedes).
- ▶ Ensure that you have the latest firmware level (SF230\_113 [PTF MH00265] or above) downloaded for the eServer i5 server.
- ▶ A maximum of 4 Linux partitions are supported.
- ▶ I/O for all Linux partitions must be managed by a single i5/OS instance.
- ▶ Linux uses virtual I/O to access disk, tape, DVD, and Ethernet resources owned by the i5/OS partition.
- ▶ Up to a maximum of 4 Virtual Ethernet connections may be configured for each Linux partition or for the i5/OS partition.
- ▶ Direct attach I/O cannot be installed in any Linux partition, including any additional Ethernet Adapters for a Firewall gateway.
- ▶ Only a single i5/OS instance can exist on eServer i5. If you need more than one i5/OS instance on your eServer i5, use a Hardware Management Console (HMC).
- ▶ Linux partition creation and management can only be performed through DST or SST tasks. iSeries Navigator does not support Virtual Partition Manager.
- ▶ Automatic processor balancing between Linux and i5/OS partitions is supported through uncapped processor pool. Dynamic movement of resources such as processor, memory, and I/O is not supported. Restart the Linux partition for the changes to take effect.
- ▶ HMC functionality, such as Capacity Upgrade on Demand (On/Off CoD, and Reserve CoD) is not enabled through DST or SST tasks. Only permanently activated processors may be allocated to any of the partitions.
- ▶ Partition configuration data cannot be saved through DST or SST tasks. Ensure that hardcopy prints are kept with configuration screens should you need to recreate the partitions.
- ▶ Migration of partition configuration data to HMC is not available. If HMC is deployed at a future stage, you need to recreate the Linux partitions. The data stored through virtual I/O on i5/OS remains unaffected.
- ▶ Initially, the Virtual Partition Manager configuration screens are only available in English and are not translated.
- ▶ Virtual Partition Manager cannot be managed through services offerings such as LPAR Toolkit or similar LPAR management tools provided by various IBM business partners. Likewise, there are no Application Programming Interfaces (API) or SSH capabilities enabled for such management tools.

- You cannot use Virtual Partition Manager on an eServer i5 server that is configured using an HMC.

**Note:** An IPL of eServer i5 system may be required for partition creation.

Once you understand the above planning considerations, you can start planning for your eServer i5 server with Linux partitions using Virtual Partition Manager.

## 2.2 Planning for Linux Logical Partitions

The IBM eServer Hardware Information Center contains important information that you need to understand as you start your preparations for deploying Linux partitions. Begin with the Partitioning for Linux section.

[http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en\\_US/index.htm?info/iphae/linuxpartitions.htm](http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm?info/iphae/linuxpartitions.htm)

This section provides information about hardware requirements, logical partition planning tasks, and details on how to create a Linux logical partition using i5/OS virtual I/O resources. Some of the important planning steps are documented in the next section.

## 2.3 Performing capacity planning

Sizing guidelines for partitions with Linux workloads can be derived through using the IBM Workload Estimator (WLE).

<http://www-912.ibm.com/supporthome.nsf/document/16533356>

WLE is a tool that runs in a Browser or on a personal computer (PC). It estimates the computer resources required for traditional workloads as core applications and new workloads, as Linux, WebSphere® and Lotus® workloads. For Linux, partition sizing information is available for file serving, web serving, and network application workloads.

### 2.3.1 Designing and validating your Partition Configuration

Use the Logical Partition Validation Tool (LVT) to help you design a partitioned system. You can download a copy from the following Web address:

[http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en\\_US/index.htm?info/iphat/iphatlvt.htm](http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm?info/iphat/iphatlvt.htm)

The LVT provides you with a validation report that reflects your system requirements while not exceeding logical partition recommendations. Keep in mind that you can only define hosted Linux partitions using the Virtual Partition Manager. It is also important to understand and plan for the Hypervisor™ Memory requirements.

### 2.3.2 Understanding use of Virtual Resources for Linux Partitions

To learn how your Linux logical partitions can communicate with other devices through virtual I/O, see the Virtual I/O devices topic in the Information Center at the following Web address:

[http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en\\_US/index.htm?info/iphbi/iphbivirtualnative.htm](http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm?info/iphbi/iphbivirtualnative.htm)

## 2.4 Ordering the eServer i5 System

To simplify the implementation of your eServer i5 server, we recommend that you order the Novell or Red Hat Linux distribution with your eServer i5 server: order feature code #0142 Linux specify, and order feature code #0496 Force i5/OS Preload.

Beginning May 2005, the IBM configuration tool (eConfig) is enhanced to support the preload of i5/OS on your eServer i5 server, even when you elect to configure Linux partitions. Prior to this, when you ordered your eServer i5 and specified a Linux partition, the IBM manufacturing plant did not preload i5/OS and only installed i5/OS microcode on the load source disk unit. The remaining disk configuration and i5/OS installation tasks were then performed at the client location after the partitions were defined.

The #0496 FORCE i5/OS PRELOAD feature code preloads i5/OS on a new server across all disk units, even though logical partitioning was specified. You cannot use this feature code if the Linux partition has dedicated disk controllers and drives included in the ordered configuration.

We recommend that you include this new feature code to preload i5/OS when you order the Linux distributions from Red Hat or Novell with the eServer i5 server and virtual storage.

In the case of Virtual Partition Manager, since all of the Linux partitions use virtual I/O, it is important that you take advantage of this IBM configuration support enhancement so that your new eServer i5 system comes fully loaded with i5/OS, ready for you to start deploying your Linux partitions.



## Getting Started with Virtual Partition Manager

In this section, we review the pre-requisites that you need to plan for and implement before defining your Linux partitions using Virtual Partition Manager. We recommend that you study the concepts for Partitioning for Linux for eServer i5 systems, documented in the eServer Information at the following Web address:

[http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en\\_US/index.htm?info/iphbi/iphbikickoff.htm](http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm?info/iphbi/iphbikickoff.htm)

## 3.1 Minimum Configuration Requirements

The following requirements apply for Linux partitions created on eServer i5 systems. Each partition requires the following:

- ▶ Processor unit
  - 0.10 processing units allocated out of a shared processing pool
- ▶ Memory
  - Minimum of 128MB of memory or region size (whichever is largest)
  - Hypervisor memory set aside from your total memory capacity—available for managing logical partitions. Your Logical Partition Validation Tool (LVT) gives you an indication of this memory requirement. For more information, see the memory section in the Information Center at the following Web address.

[http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en\\_US/index.htm?info/iphathat/iphathatparmemory](http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm?info/iphathat/iphathatparmemory)

- ▶ Disk Storage
  - 1GB served through Virtual I/O by i5/OS
- ▶ Network Interface
  - One virtual Ethernet adapter for communicating to i5/OS or other Linux partitions
- ▶ Partition Management Console
  - iSeries Operations Console, LAN Console or 5250 (TwinAx) Console for partition creation and management
- ▶ Software Requirements
  - i5/OS V5R3 or above
  - Minimum of 2.3.0 version firmware applied. For information about minimum software requirements, and download instructions, visit the IBM eServer Prerequisite Web-site at:

[http://www-912.ibm.com/E\\_DIR/ESERVERPREREQ.NSF](http://www-912.ibm.com/E_DIR/ESERVERPREREQ.NSF)

Select the **Software** tab with the options shown as follows.

# IBM eServer Prerequisite

Feature Prerequisites

Hardware

Software

Search for software/firmware functions by selecting an operating system/firmware, a product, and a release from the lists provided.

Operating System/  
Firmware:

Product:

Function:

Figure 3-1 Prerequisite tool selections

- Ensure that you have a minimum of PTF MF34753 (or its supersede) applied to enable Virtual Partition Manager. If this PTF is not already installed, download and apply them before starting your partition setup.
- Permanently apply prerequisite PTFs MF34946 and MF34962 before doing a SAVSYS of the i5/OS partition. A D-mode IPL of the Virtual Partition Manager activated i5/OS partition will fail with an SRC of A6005001 with media that does not have these PTFs permanently applied.

**Note:** These minimum configurations may vary significantly depending on the workload enabled for each of the Linux partitions, and based on the Linux distribution and version that you install. Please refer to a specific Linux distribution's guideline for the actual values.

## 3.2 Complete Initial Setup of Your eServer i5

Before you define Linux partitions and load Linux distribution, you need to complete the Initial Server Setup tasks using either the predefined or customized setup checklists. You can find the checklists at the following Web address:

[http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en\\_US/index.htm?info/initialserversetup](http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm?info/initialserversetup)

Use the checklists initially for standalone servers, without specifying logical partitioning. Even though you will create Linux partitions at a later stage, for the purposes of setting up your server, you want to complete the installation so that it does not require a Hardware Management Console (HMC).

With your new eServer i5 server, i5/OS currently owns all of the processor, memory, and I/O resources. The next few chapters provide step-by-step instructions for the basic configuration tasks required to remove resources from i5/OS and set up Linux partitions using Virtual Partition Manager. We will also discuss how to define the Network Server Storage Space

(NWSSTG), and Network Server Storage Description (NWSD) for virtual storage and enable virtual Ethernet for network communications between multiple partitions.

## Preparing Your System for Virtual Partition Manager

This chapter provides step-by-step instructions on how you can remove logical resources from i5/OS using the Virtual Partition Manager, in preparation for defining new Linux partitions. With your new eServer i5 system, by default, the i5/OS partition currently owns all of the processor, memory, and I/O resources.

You can invoke the Virtual Partition Manager either through Dedicated Service Tools (DST) or System Service Tools (SST) tasks. The advantage of using SST is that you can bring your eServer i5 system to full operational mode rather than having to do your partition definitions in a restricted state where the rest of the operating system has not started, and users are not able to use the system.

We recommend that you manage your Linux partition, creation, and management through SST tasks, which enables you to use your i5/OS environment concurrently. After you define the partitions, a system IPL is required to complete the removal of resources from i5/OS.

## 4.1 Removing Resources from i5/OS

1. From the Main menu or the i5/OS command line, start the System Service tools by typing **STRSST**, as seen in Figure 4-1.

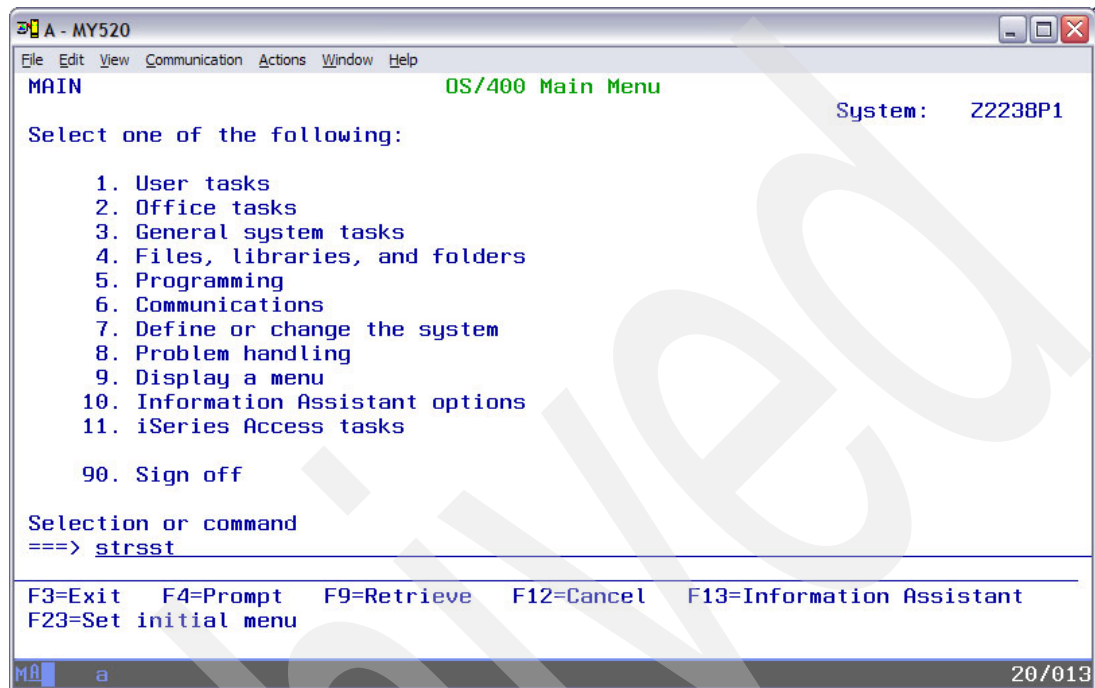


Figure 4-1 Main menu

2. Enter your user ID and a password as seen in *Figure 4-2 on page 13*. This assumes that your Security Officer already created a DST/SST user profile for you to use, and provided adequate privileges to allow you to perform partition creation and management tasks.

For information about how to create DST user profiles, refer to the InfoCenter article on Managing service tools user ID and passwords at the following Web address:

<http://publib.boulder.ibm.com/infocenter/iseries/v5r3/ic2924/index.htm?info/rzamlh/rzamlhmanagst>

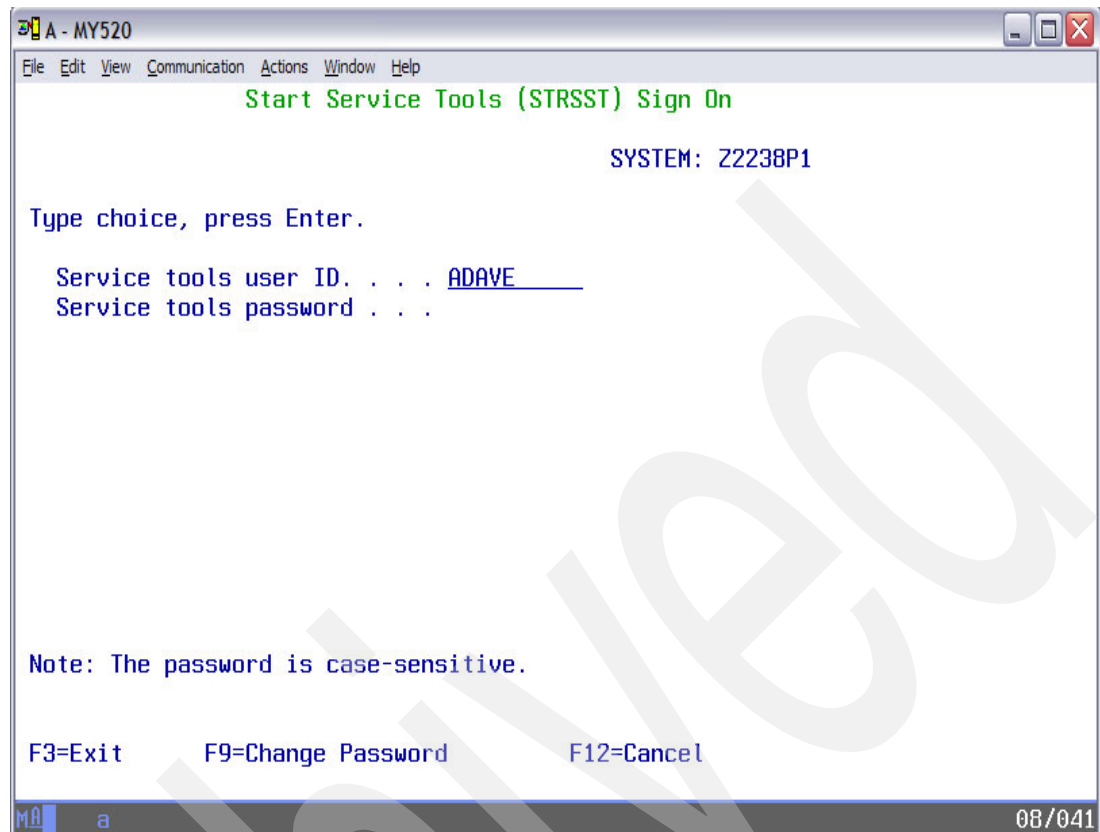


Figure 4-2 Start Service Tools sign-on screen

3. From the Start Service Tools (SST) menu as seen below, select option **5 Work with system partitions**.

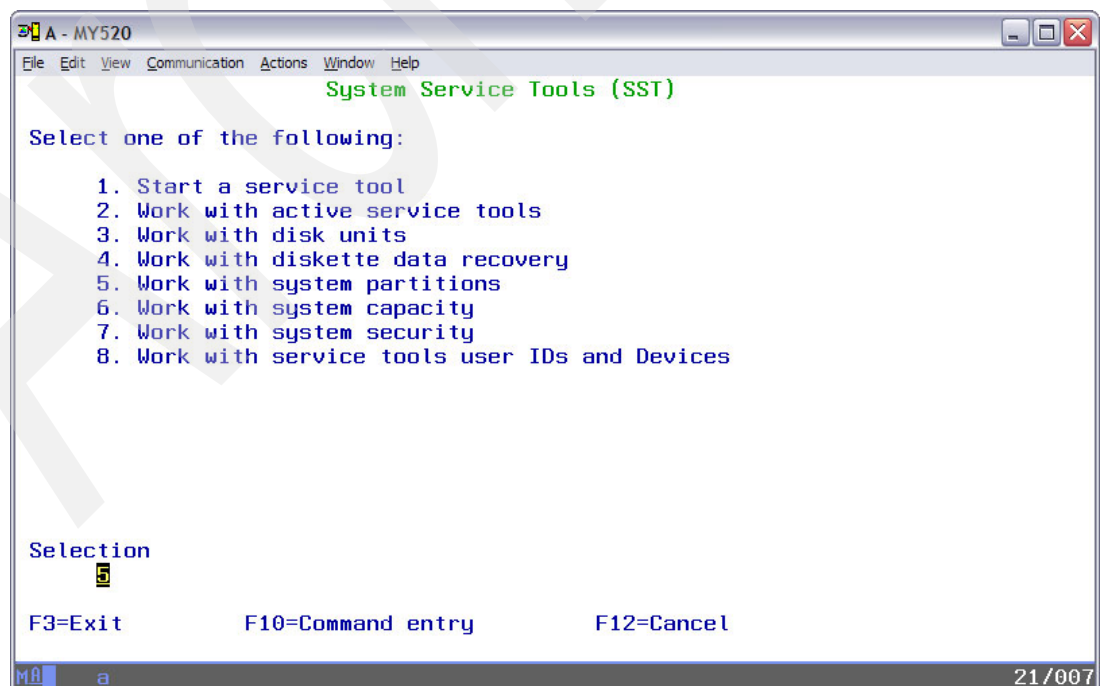


Figure 4-3 System Service Tools

An informational message appears as shown in Figure 4-4. This message appears when you enter the option to Work with System Partitions for the first time, or when you clear all partition configuration data.

**Note:** If another session is currently using the Virtual Partition Manager, an error dialog appears indicating that the tool is already in use.

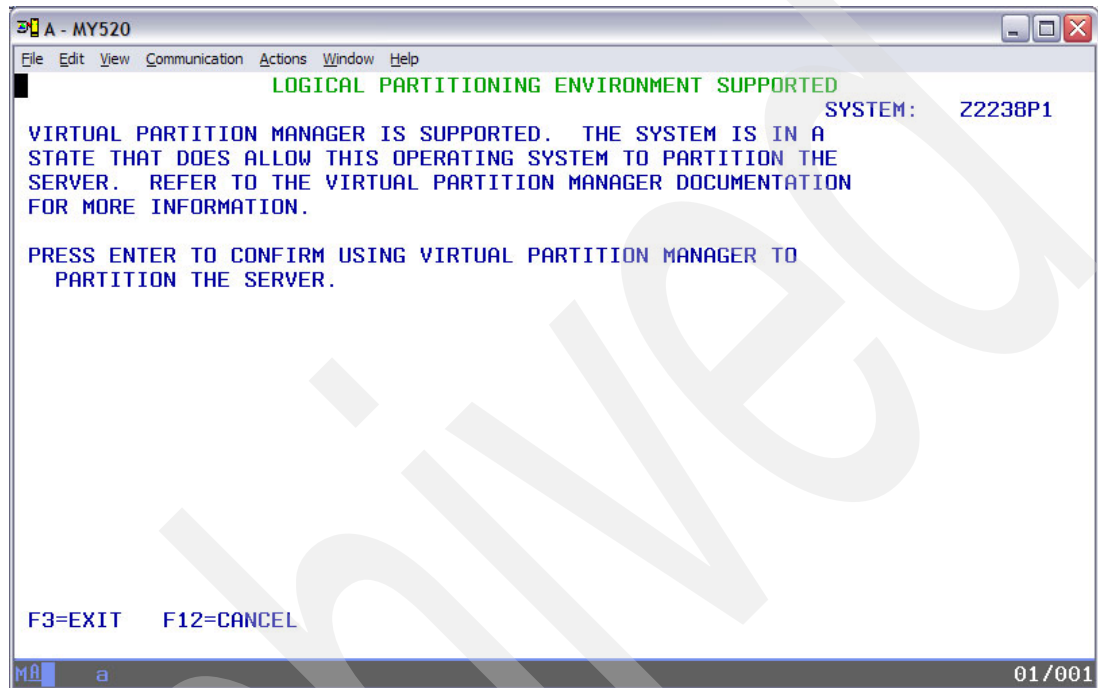


Figure 4-4 Initial Information display

4. Press Enter at the message. The Logical Partition management tasks appear, as seen in Figure 4-5 on page 15.



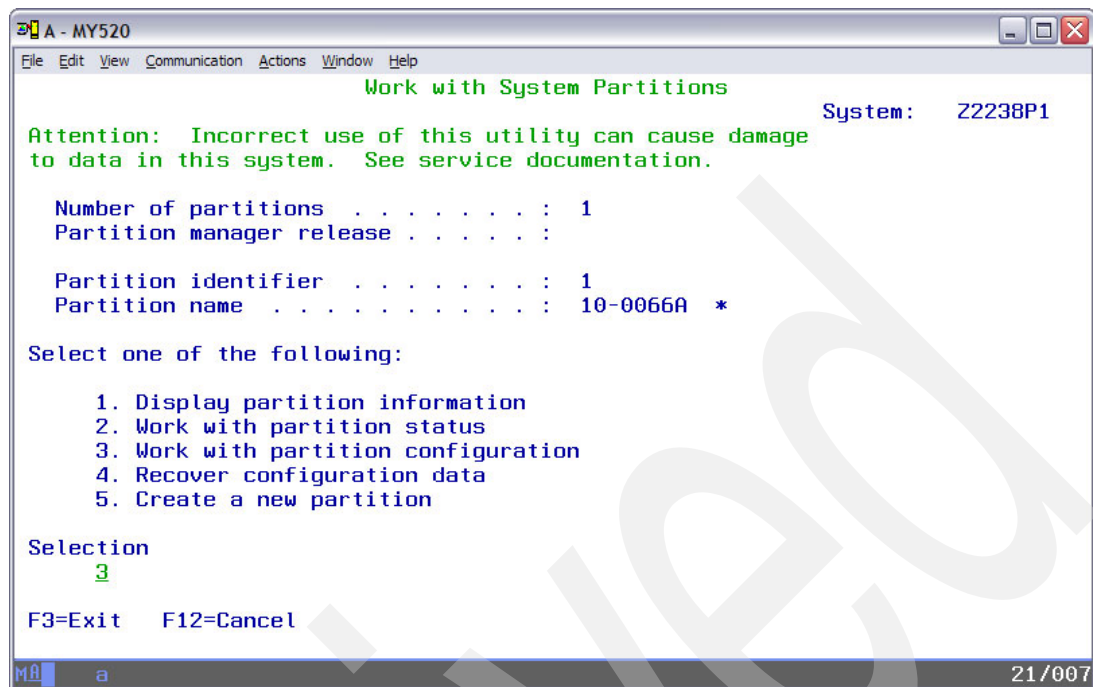


Figure 4-5 Work with System Partitions

5. Select option 3 Work with partition configuration, as shown in Figure 4-5.

The objective of the next few steps is to ensure that we remove processing and memory resources from the i5/OS partition so that we can create Linux partitions. It is important that you complete the sizing exercise for your overall CPU and memory utilization for your i5/OS workloads to account for removal of such resources. Also take into account the overheads associated with micro-partition processor allocation. For more information, see the whitepaper on i5/OS LPAR performance on POWER4™ and POWER5 systems.

**Note:** Option 1: Display Partition Information is not enabled for Virtual Partition Manager. Instead, use Option 2: Work with Partition Status, or use Option 3: Work with Partition Configuration to manage logical partitions using Virtual Partition Manager.

6. From the Work with Partition Configuration menu, select option 2 to Change partition configuration for your i5/OS instance as shown in Figure 4-6 on page 16.

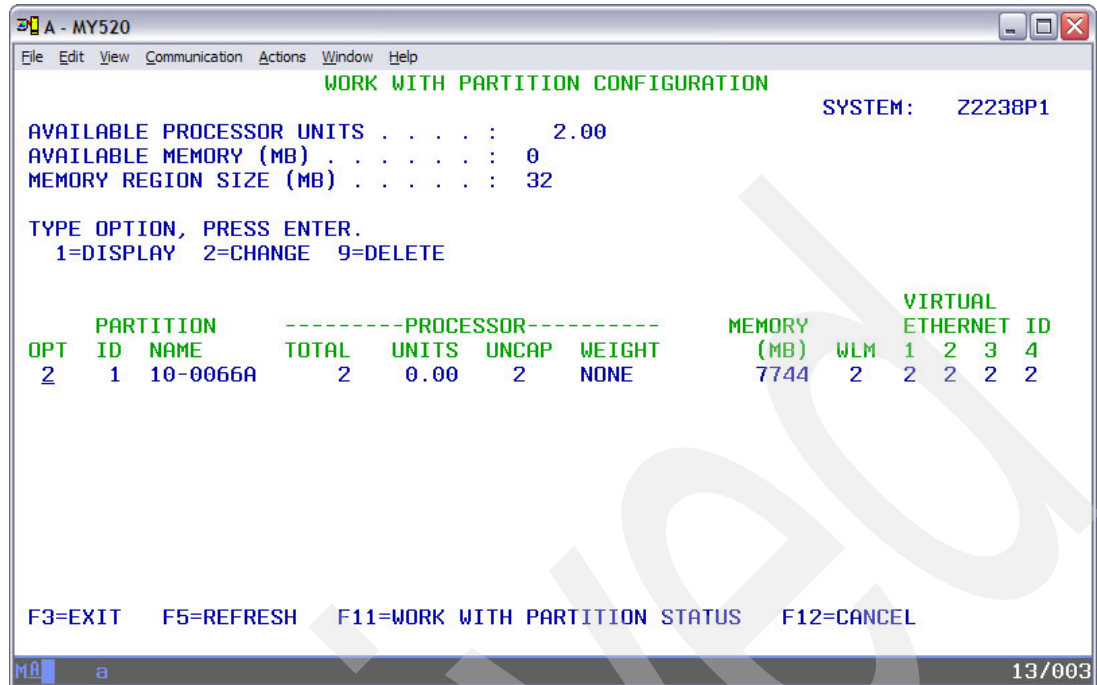


Figure 4-6 Work with Partition Configuration

With a new system, one i5/OS partition is defined and the Change Partition Configuration display shows the defaults as shown in Figure 4-7. This is where we remove resources from your i5/OS instance so that additional Linux partitions are created.

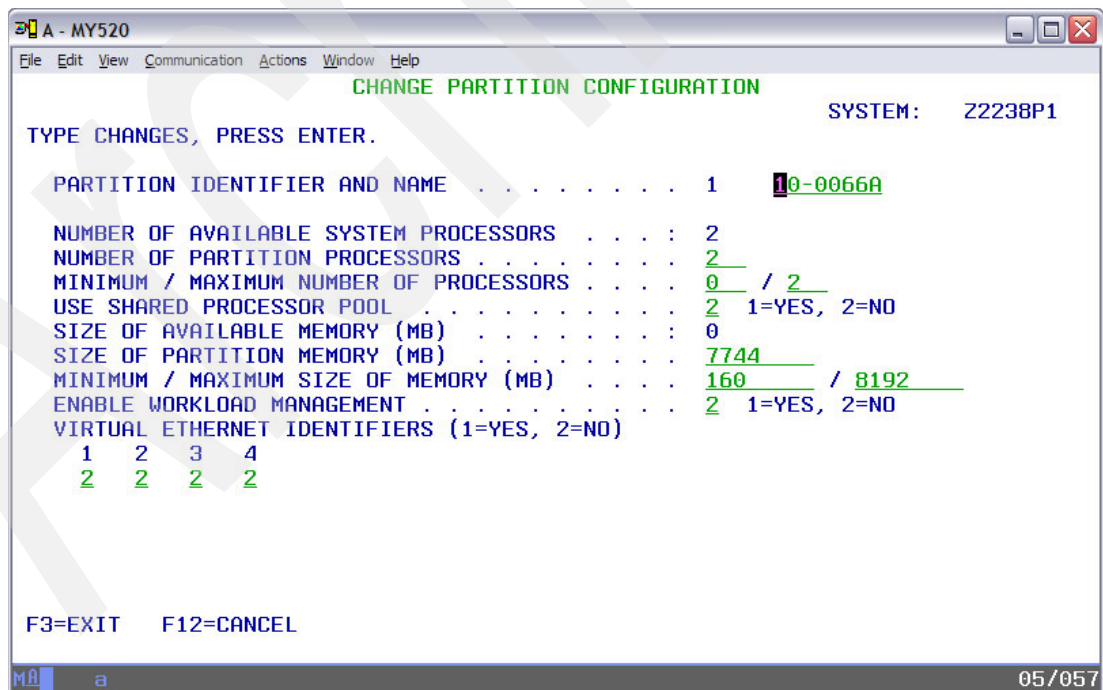


Figure 4-7 Change Partition Configuration

7. Make several changes here, based on the resources you want to set for the i5/OS partition. You need to assign the CPU and memory allocation according to the planning

you completed with the Logical Partitioning Validation Tool (LVT). We examine all of the changes step-by-step as highlighted in Figure 4-8.

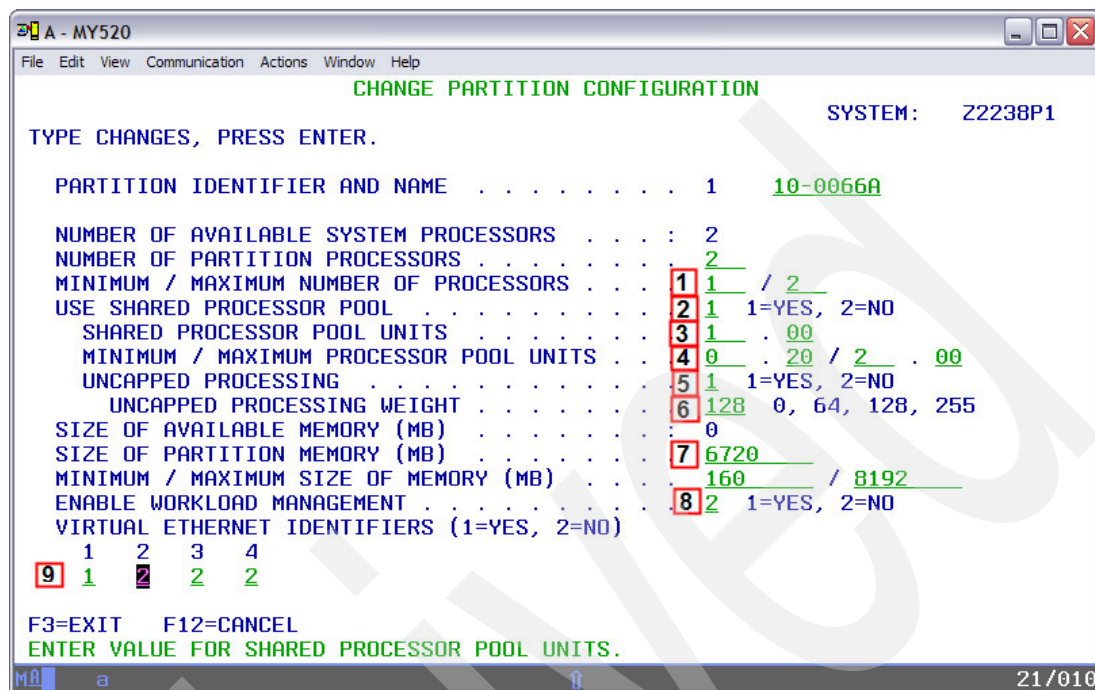


Figure 4-8 Change Partition Configuration Options

- **1 Minimum / Maximum Number of Processors:** Enter the value for the minimum number of processors you anticipate needing for your i5/OS environment, and the maximum number of processors available for i5/OS. In our sample environment, we had two processors and we left the maximum value at 2—enabling i5/OS to utilize all of the processors if the Linux partitions are not being used.
- **2 Use Shared Processor Pool:** The shared processor pool is a group of physical processors that provide processing capacity that can be shared among multiple logical partitions. The shared processor pool allows you to assign partial processors to a logical partition. In our example, since we are going to create four additional Linux partitions, we do not have sufficient resources to allocate a full processor for every partition. Another advantage for changing the partition configuration to use the shared processor pool is that the partition has the capability to use processor resources unused by other partitions.

**Note:** When the current value of 2 is changed to 1, indicating shared processor pool is desired, the system prompts for new shared processor pool values **once the Enter key is pressed**.

- **3 Shared Processor Pool Units:** Specifies the total number of processing units that are available to the partition after the resources are removed. In this example, the i5/OS partition is left with 100 processing units, or a full processor after we remove the CPU resources.
- **4 Minimum / Maximum Shared Processor Pool Units:** A minimum of 0.10 processing units is required for every full processor that may be utilized for the given partition. In our example, since we have a maximum of 2 processors that the i5/OS

partition can utilize, the minimum value is therefore required to be set to 0.20 processing units with a maximum of 200 processing units, or 2 processors.

- **5 Uncapped processing:** By changing the value from 2= NO, to 1=YES, the partition may utilize excess shared processor cycles. The quantity assigned is dependent on the setting of the uncapped processing weight field that follows. If the value is 2=NO, then this partition is not assigned excess shared processor cycles and is a capped partition.

A capped partition indicates that the logical partition will never exceed its assigned processing capacity. You can use the capped mode if you know that a software application would never require more than a certain amount of processing power. Any unused processing resources are used only by the uncapped partitions in the shared processor pool.

A partition using the uncapped mode indicates that the partition's assigned current processing capacity can be exceeded up to the partition's current virtual processor setting when the shared process or pool has any unused processing power.

**Note:** Considering that Virtual Partition Manager does not support dynamic movement of resources, you might want to define your partitions as uncapped partitions to automatically assign unused processing units to a partition that needs the resources.

- **6 Uncapped Processing Weight:** With Virtual Partition Manager, since you can only create four additional Linux partitions, this range is restricted to a set of predefined values: 0=None, 64=Low, 128=Medium, and 255=High. By setting the uncapped weight (255 being the highest weight), any available unused capacity is distributed to contending logical partitions in proportion to the established value of the uncapped weight. The default uncapped weight value is 128. For example, if partition 2 had an uncapped weight of 64 and partition 3 had an uncapped weight of 255, partition 3 would get up to four times the unused processing resources that partition 2 received. A value of zero is required to be set for partitions that are capped.
- **7 Size of Partition Memory:** Linux partitions require a minimum of 128 megabytes. In this example, the value indicates the amount of main storage that remains with i5/OS partition. Make the new value multiples of the value set as the LMB size during your initial set up using ASMI. For example, you cannot set a value of 6700 because it gives an error message, like the one shown in Figure 4-10 on page 20. See the memory section, at the following Web address, in eServer Information Center for additional details.

[http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en\\_US/index.htm?info/iphatlparmmemory](http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm?info/iphatlparmmemory)

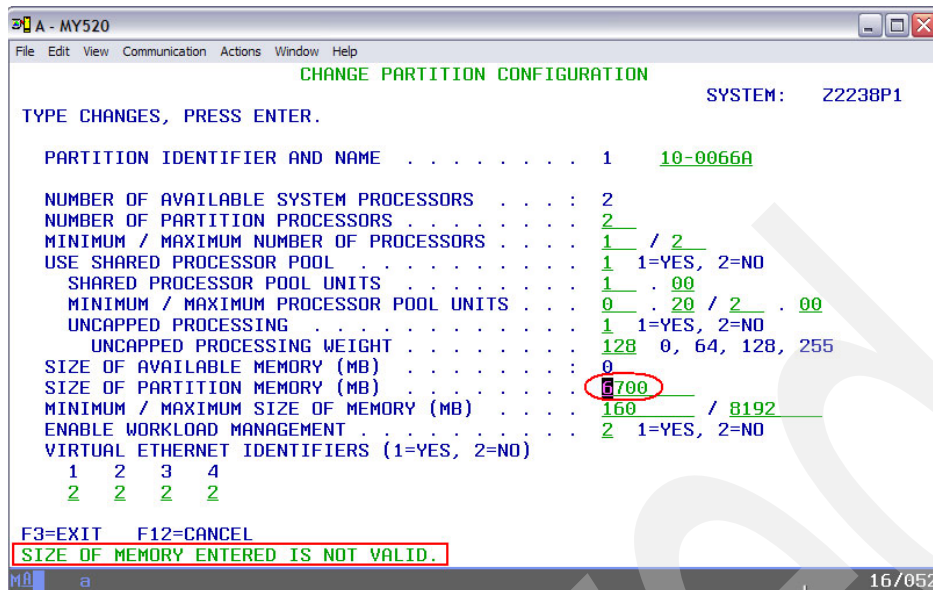


Figure 4-9 Figure 9: Change Partition Configuration Memory Error

- **8 Enable Workload Manager:** The default value for Virtual Partition Manager is set to 2=No, meaning that the partition is not allowed to use the future workload management tool within the partition to automatically adjust resource assignments, such as the IBM Enterprise Workload Manager.
  - **9 Virtual Ethernet Identifiers:** A value of 1 indicates you enabled one of the virtual Ethernet communications ports for inter-partition communications between Linux or i5/OS partitions. In this example, we changed the value for one of the ports to 1, which creates a virtual Ethernet adapter under i5/OS with a resource type of 268C and an associated resource name that is used during the set up of Ethernet line description.
8. Remove CPU and memory resources, enable the i5/OS partition to take advantage of shared processor pool and uncapped processors, and enable a virtual Ethernet port for inter-partition communications. Press Enter. The message screen shown in Figure 4-10 on page 20 appears.



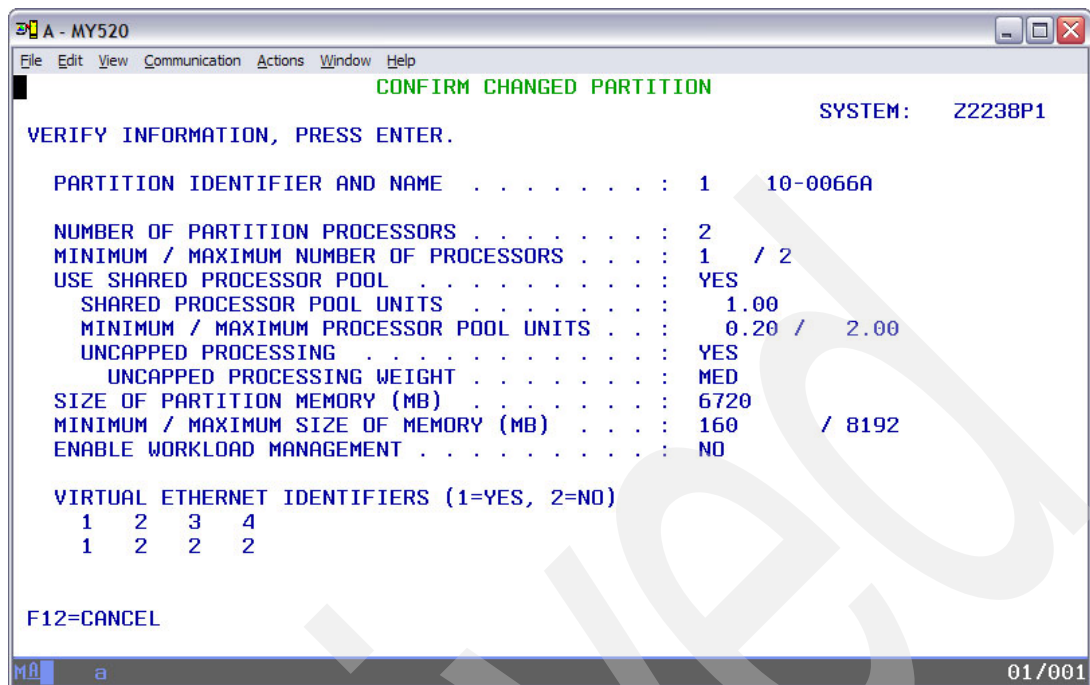


Figure 4-10 Confirm Changed Partition

9. Press Enter again on the Confirm Changed Partition screen. This completes the changes required on the i5/OS partition.

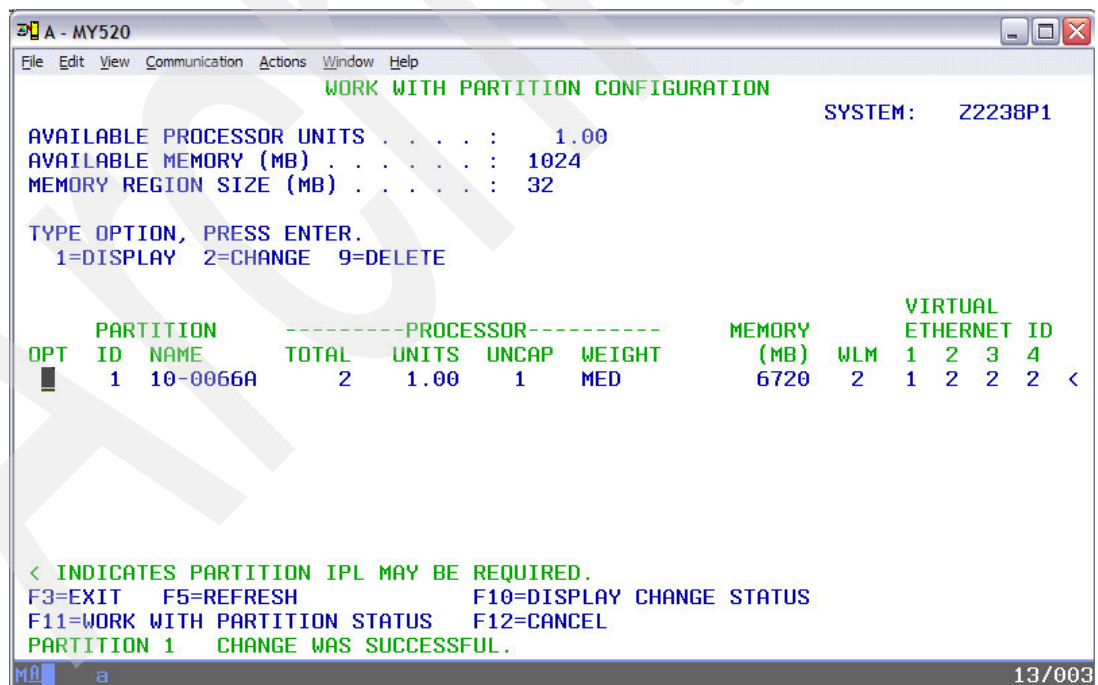


Figure 4-11 Partition change successful

Notice that the changes made to i5/OS resources requires an IPL of the system, as indicated by the "<" in Figure 4-11. There is no need to perform this task at present, you can perform the IPL once you define all of the Linux partitions.

Also notice that changes to memory allocation in i5/OS partition are not immediate.

10. Use option 1 against the new partition you created, and then function F9 to toggle between CURRENT and PENDING values. You will see that the memory is gradually removed from the owning partition. When you remove large amounts of main storage from the owning partition, the removal may take a considerable time.

**Note:** Notice that memory is released quicker if you define your partitions when the system is in a restricted state through DST.

11. Figure 4-12 shows the available CPU and memory resources for creating new partitions. In the next section, we use these resources to define new Linux partitions.

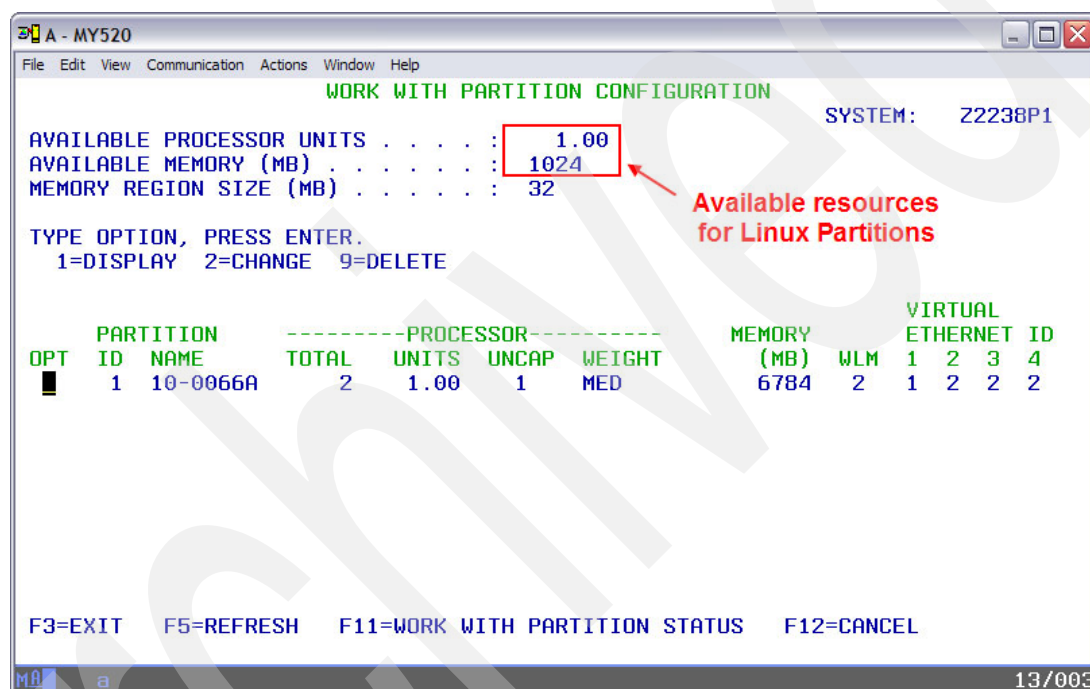


Figure 4-12 Available resources for Creating New Partitions

12. You are now ready to create Linux partitions using Virtual Partition Manager, and the resources that you removed from i5/OS partition. Even though the Work with System Partitions display shows that you may require a System IPL, you should wait until all of the new Linux partitions are defined. The next chapter provides step-by-step instructions on how to define a Linux partition using Virtual Partition Manager.

## 4.2 Understanding Virtual I/O Slots and Requirement for IPLs

When defining Linux partitions using Virtual Partition Manager, you must think in terms of setting up a brand new server—except that it does not have its own hardware. However the requirement still remains. Resources such as memory, CPU, serial SCSI, Ethernet LAN, and serial client adapter are just some of the resources you need on your computer. In the case of eServer i5, the partition hypervisor virtualizes all of these resources through enabling virtual I/O slots.

Depending on the number of Linux partitions you define and on the number of virtual I/O slots you enable (such as virtual SCSI, virtual Ethernet LANs), you may or may not notice that an IPL is required.

By default, the i5/OS partition is enabled with 8 virtual I/O slots. Internally, two of these virtual slots are taken up by virtual serial, and one for virtual management device. This leaves five free slots. When you create a partition, it takes up to 2 virtual I/O in the i5/OS partition: one for the virtual SCSI server adapter, and one for the virtual serial client adapter. When you add the i5/OS partition to a virtual Ethernet LAN, it uses one additional virtual slot.

When you exceed the allocation of five virtual I/O slots, the partition hypervisor sends a command to allocate more virtual I/O slots. At this point, it just gets everything it will ever need. Therefore, once you go beyond the eight available virtual I/O slots, the system sets itself up to use all of the available virtual I/O slots and enables them during the next IPL. Hence, notice that when you define more than one Linux partition—and enable a couple of virtual Ethernet LANs—the Partition Configuration Screen shows you that you need to IPL your system to implement the changes.

Note that once you get all of the allocations you need, even if you remove the LPARs or delete them, the system does not reset the virtual I/O slot count.

In summary, notice that during Linux partition creation, you need an IPL of the system to activate the changes in virtual I/O slots. This is only required once, and its best to perform it during the initial set up of your LPARs.





## Creating Linux Partitions using Virtual Partition Manager

This chapter provides step-by-step instructions for creating a Linux Partition on eServer i5 system using the Virtual Partition Manager; however, you must first remove resources from the i5/OS partition.

## 5.1 Defining new Linux Partitions

1. From the Work with System Partitions display, take option 5 to Create a new partition as shown below in *Figure 5-1*.

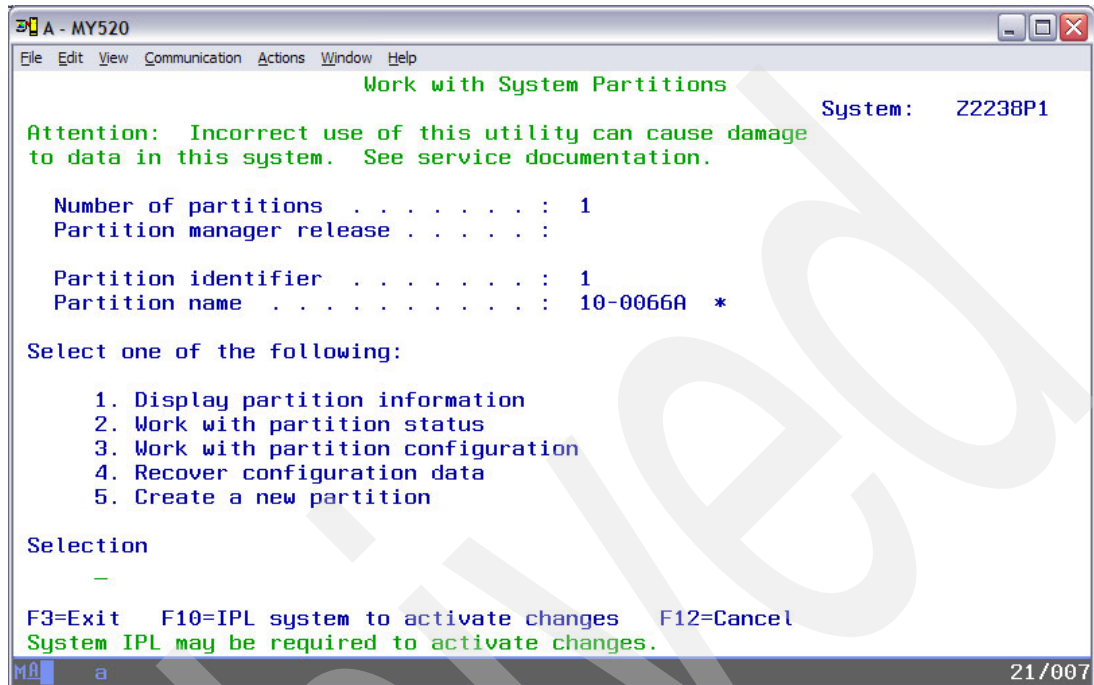


Figure 5-1 Work with System Partitions

2. Assign the values for creating the new Linux partition as per your Logical Partitioning Validation Tool (LVT) output, as shown in Figure 5-2 on page 25. Following is a brief explanation of each value:
  - **1 Partition Identifier and Name:** Enter the partition name for your Linux partition. You can also change the partition identifier if you choose to. In this example, the default given (next partition identifier number) by the system is selected.
  - **2 Number of Partition Processors:** If you are defining a Linux partition with dedicated processors, then enter the value of the processors that are dedicated to that partition. For partitions utilizing shared processor pool, you can enter the value of the number of virtual processors that you plan to utilize in your applications. This value also affects how you set up your Min/Max number of processors, and also how you set up your Min/Max shared processor pool units later. For example, if you set a value of 4, then set the maximum number of processors in the next field (as shown in **3** below) to 4; likewise, you need at least 0.40 processing units specified in step 4.
  - **3 Minimum / Maximum number of Processors:** Enter the value for minimum number of processors that you need for your Linux environment, and the maximum number of processors that are available for Linux.
  - **4 Shared Processor Pool Units:** Assuming that you are going to use shared processor pool, you now need to specify the total number of processing units available to the partition during start up. In our example, since we are going to create four additional Linux partitions, we would not have sufficient resources to allocate a full processor for every partition to be set up as having a dedicated CPU.

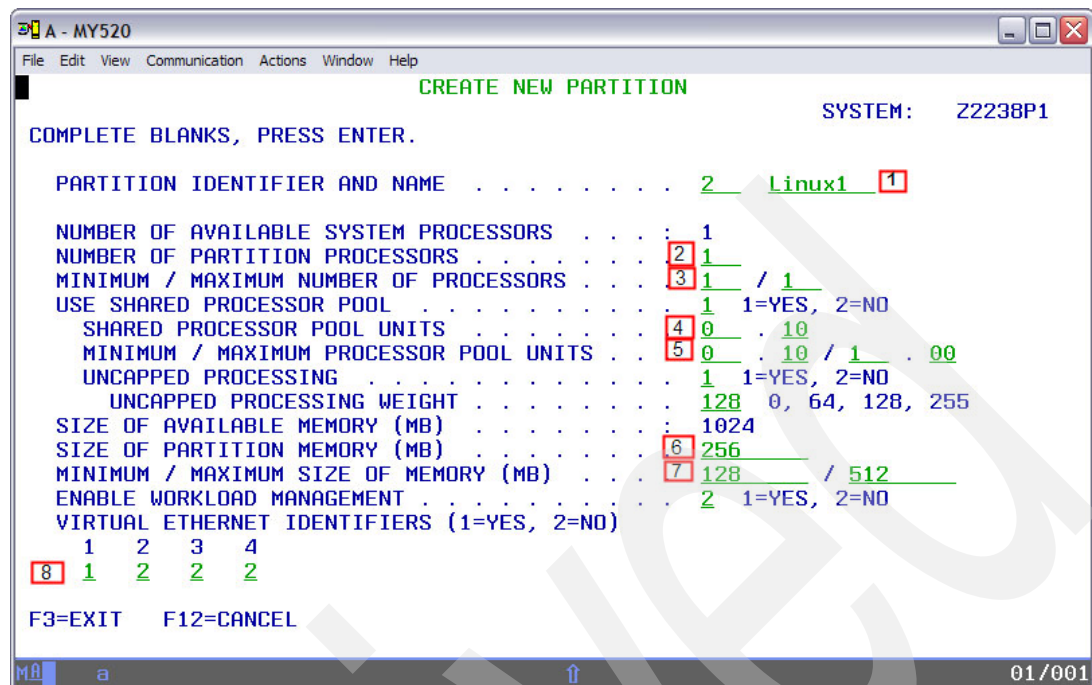


Figure 5-2 Create new Linux partition

- **5 Minimum / Maximum Shared Processor Pool Units:** A minimum of 0.10 processing units is required for every full processor that may be utilized for the given partition. Assign the values appropriately based on the range that you want your partitions to utilize unused processing cycles.
- **6 Uncapped processing:** You have the option to have your Linux partition shared capped, or shared uncapped. See the shared processor section in the IBM Information Center for more information about capped and uncapped processors.

<http://www-1.ibm.com/servers/eserver/series/perfmgmt/pdf/lparperf.pdf>

By default, an uncapped processing weight of 128 (medium) is assigned. A value of 255 indicates that the partition has a higher priority to utilize idle CPU cycles compared to a partition with 128 (medium) or 64 (low). For example, if partition 3 had an uncapped weight of 64 and partition 4 had an uncapped weight of 255, partition 4 gets up to four times the unused processing resources that partition 3 received. A value of zero is required to be set for partitions that are capped.

**Note:** Considering that Virtual Partition Manager does not support dynamic movement of resources, you might want to define your partitions as uncapped partitions to automatically assign unused processing units to a partition that needs the resources.

- **7 Size of Partition Memory:** The minimum memory requirement for Linux partition is 128 megabytes. At the following Web address, see the memory section in IBM eServer Information Center for additional details.

[http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en\\_US/index.htm?info/iphathat1parmemory](http://publib.boulder.ibm.com/infocenter/eserver/v1r2s/en_US/index.htm?info/iphathat1parmemory)

Set the appropriate values based on your planning done with Logical Partitioning Validation Tool (LVT).

**8 Virtual Ethernet Identifiers:** A value of 1 indicates that you are enabling one of the virtual Ethernet communications ports for inter-partition communications between Linux or i5/OS partitions. You can select up to four virtual Ethernet communications links.

Once these values are set, you get a confirmation display, as shown below in Figure 5-3.

3. Press **Enter**. You are returned back to the Work with System Partitions display. You can repeat the above steps to define another Linux partition, if necessary.

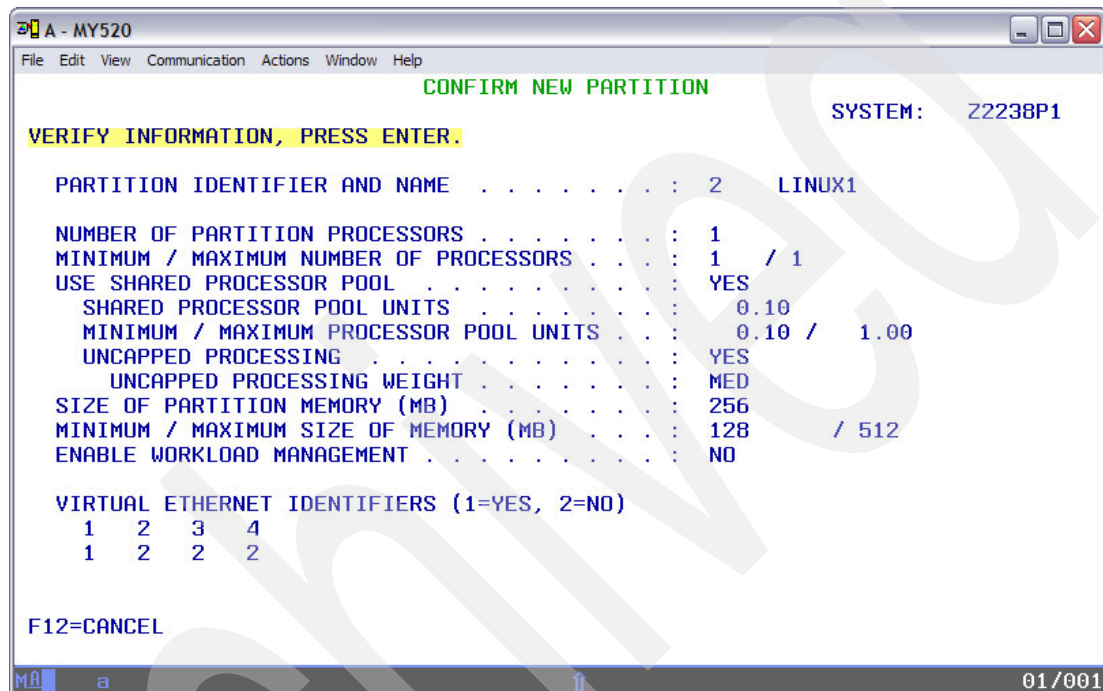


Figure 5-3 Confirm new partition

4. Once you define all of your partitions, you can view them using Option 3 from Work with System Partitions as shown in Figure 5-4 on page 27. In this example, Linux4 was defined as capped processor partition.

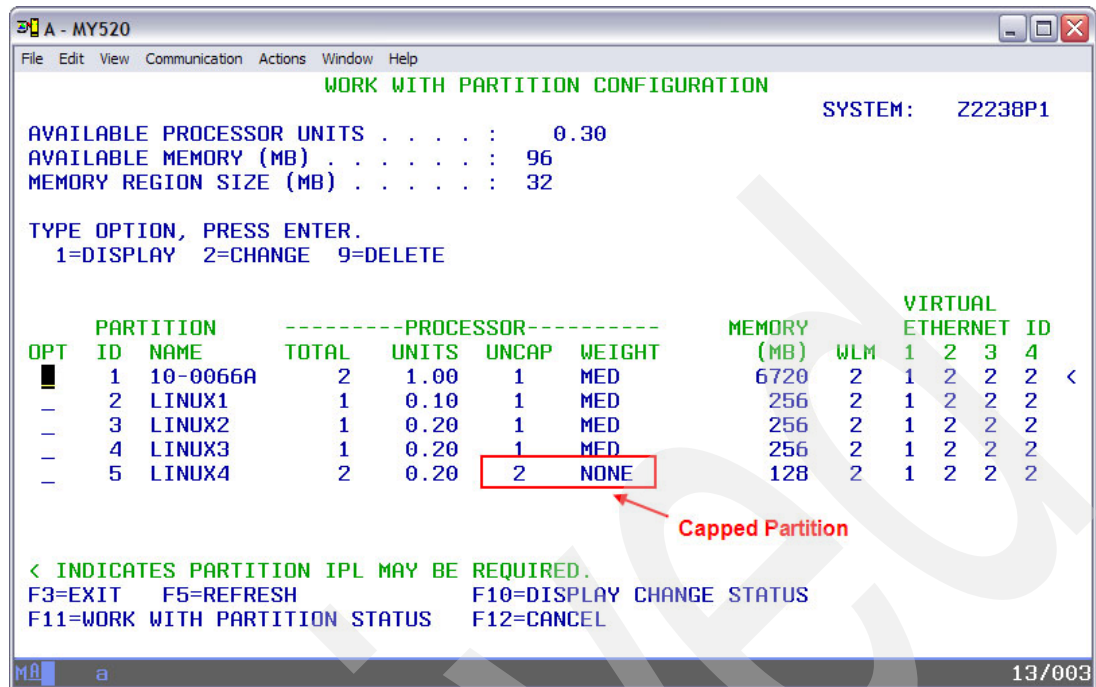


Figure 5-4 View of all newly defined partitions

5. You can either update the partitions to change any resource configurations, or delete them and recreate them. Keep in mind that you can only change or delete one partition at a time. If you wanted to start all over again and clean up all of the configuration information, you can use the option to Clear Partition Configuration Data as discussed in the 5.1.1, "Recover Configuration Data" on page 28 section.
6. Exit out of the Work with Partition Configuration display to return back to the Work with System Partitions. You can now start the system IPL to finish the updates required to the hypervisor for enabling the new Linux partitions.
7. Select F10 function key as shown in Figure 5-5 on page 28.

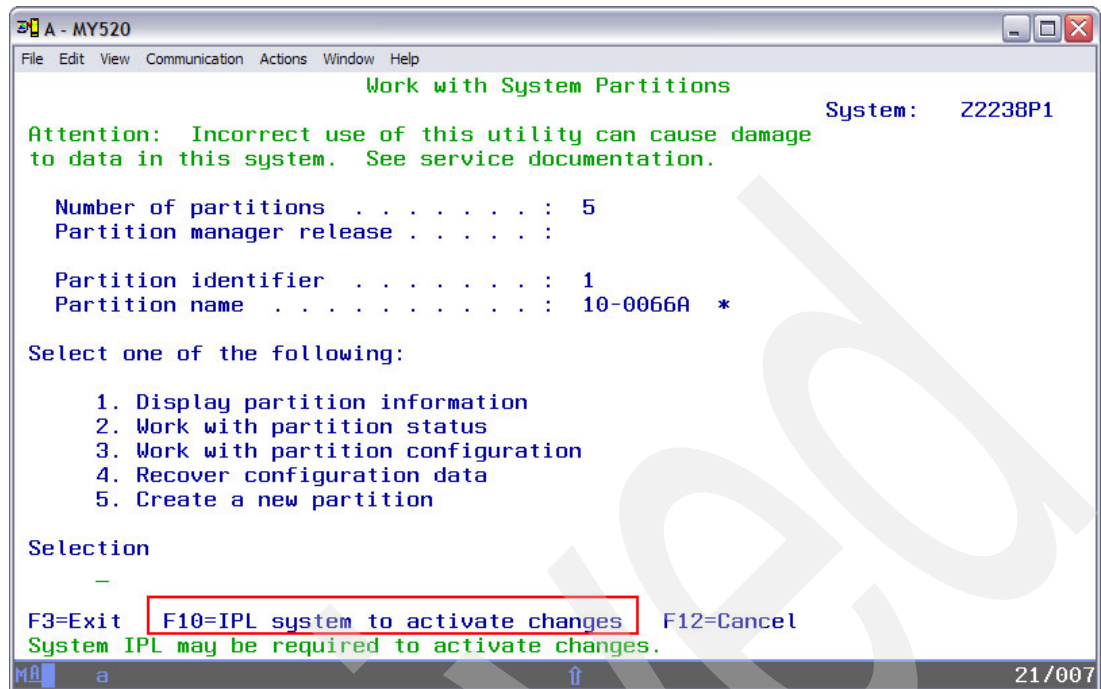


Figure 5-5 Ready to IPL with Work with System Profiles

### 5.1.1 Recover Configuration Data

If for some reason you want to restart from the very beginning by deleting all of the partitions, you may want to do so by taking option 5 from the Work with System Partitions display, and then selecting Option 7 to Clear configuration data, as shown in Figure 5-6 on page 29.



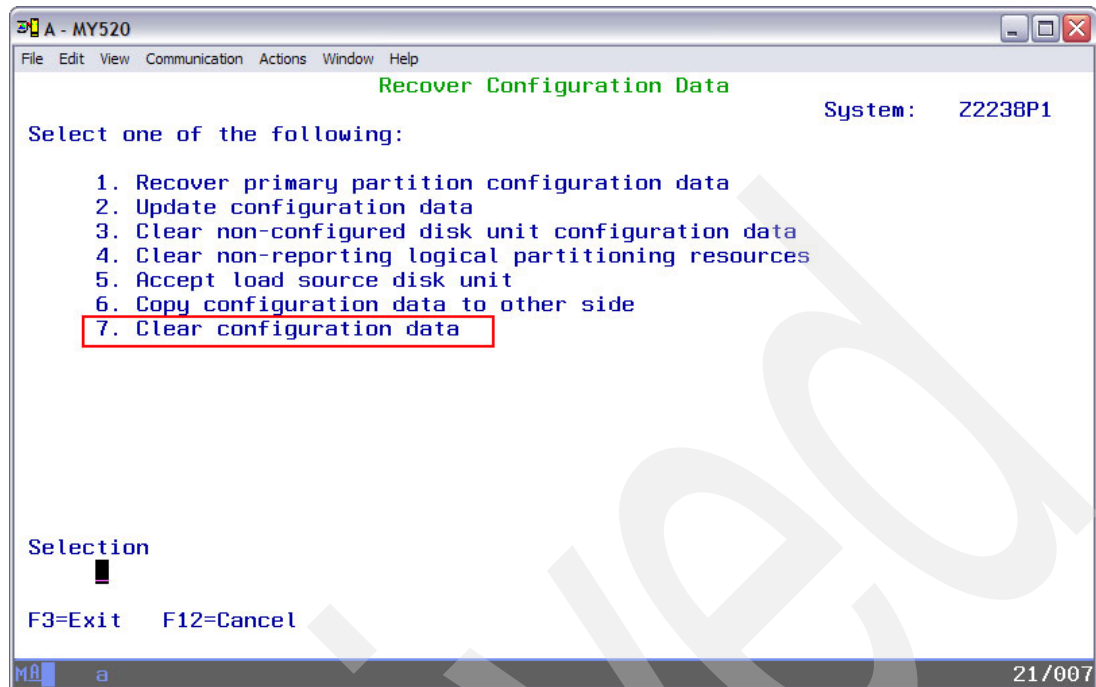


Figure 5-6 Clear configuration data

Take care when taking this option, as it completely removes all Linux partition configurations. You also need to take this action when migrating from Virtual Partition Manager to HMC managed Linux partitions.

### 5.1.2 Migration Considerations when moving to HMC

The following steps outline some of the planning considerations for migrating off of the Virtual Partition Manager to HMC managed Linux partitions. Please note that you cannot save and restore partition configuration data; instead, you must create them in their entirety. However, you do not need to recreate your data saved in Linux partitions through the Network Server Storage Space. Point to the same virtual SCSI and virtual I/O resources when partitions are defined through HMC.

1. Power off all of the Linux partitions.
2. Start SST or DST, and select the option to Work with system partitions.  
If you do not already have your LVT prints, you may want to take note of the resource allocations you have for each of your Linux partitions such as CPU, memory, Min/Max values, number of virtual Ethernet LANs, and the eWLM settings. Keep in mind that you cannot print the configuration data through any report from the Virtual Partition Manager displays.
3. Clear the Linux partition configurations using option 4 from the Work with System Partitions display. The Recovery Partition Configuration screen appears.
4. Select Option 7 to Clear partition configuration data.
5. IPL your server after clearing the partition configuration data.
6. Connect HMC to your server.
7. Create a new profile for the Linux partition that contains the physical I/O, memory, and processors desired.

8. Perform the following for each Linux partition:
  - Create a Virtual SCSI Server adapter in the i5/OS partition.
  - Create a Virtual Serial client adapter in the i5/OS partition that points to the Virtual serial Server in the Linux partition in slot 0.
  - Create a new partition for Linux. You want to place the Virtual SCSI Client adapter in Virtual slot 2 because data in the NWSD points to this location.
  - Create any Virtual Ethernet devices you had in the Linux partition.
  - Make the Linux partition's power controlling partition to be the i5/OS partition.
  - Power on and Power off the Linux partitions. This drives the configuration down to the hypervisor.
9. Vary on the NWSD in the i5/OS partition.



# Establishing Network Connectivity for Linux Partitions

This chapter provides the steps for configuring support in the i5/OS partition for exposing the virtual LAN connections of the Linux partitions to an external network via a physical network connection in the i5/OS partition.

**Note:** There are multiple ways to configure virtual network access to a physical network including Proxy ARP, Network Address Translation, and Static Routing via a Linux partition. This document only presents setup instructions for the Proxy ARP method.

One method you can use for bridging virtual network connections to an external network is through the use of Proxy ARP. With Proxy ARP, the physical network adapter of the i5/OS partition responds to all network requests within a defined range and then routes those addresses to the virtual LAN segment.

There are a number of steps that you must complete for a Proxy ARP configuration, which includes the following:

- ▶ Define a virtual LAN segment that places all of the Linux partitions and the i5/OS partition on the same virtual LAN. Complete this through the LPAR definition (discussed earlier).
- ▶ Create an Ethernet Line Descriptor for the virtual LAN adapter defined for the i5/OS partition.
- ▶ Create a TCP/IP interface for the virtual LAN adapter defined for the i5/OS partition. This TCP/IP interface is “associated” with the TCP/IP interface of the physical adapter allocated to the i5/OS partition.
- ▶ Define network parameters in the Linux partition(s) including IP Address, subnet mask, and gateway (which is the address of the i5/OS partition on the virtual LAN).

## 6.1 Defining i5/OS Components that support Proxy ARP

Following are detailed steps for defining the i5/OS components that support Proxy ARP.

1. Display the communication resources in the i5/OS partition (WRKHDWRSC \*CMN) to determine the resource that was created for the virtual network adapter in the i5/OS partition.

The communication resource used for the virtual LAN connection is of a type 268C, enabled and found when you use the **WRKHDWRSC \*CMN** command, as shown in Figure 6-1. The corresponding resource name (CMNxx) is used in the Ethernet Line Descriptor.

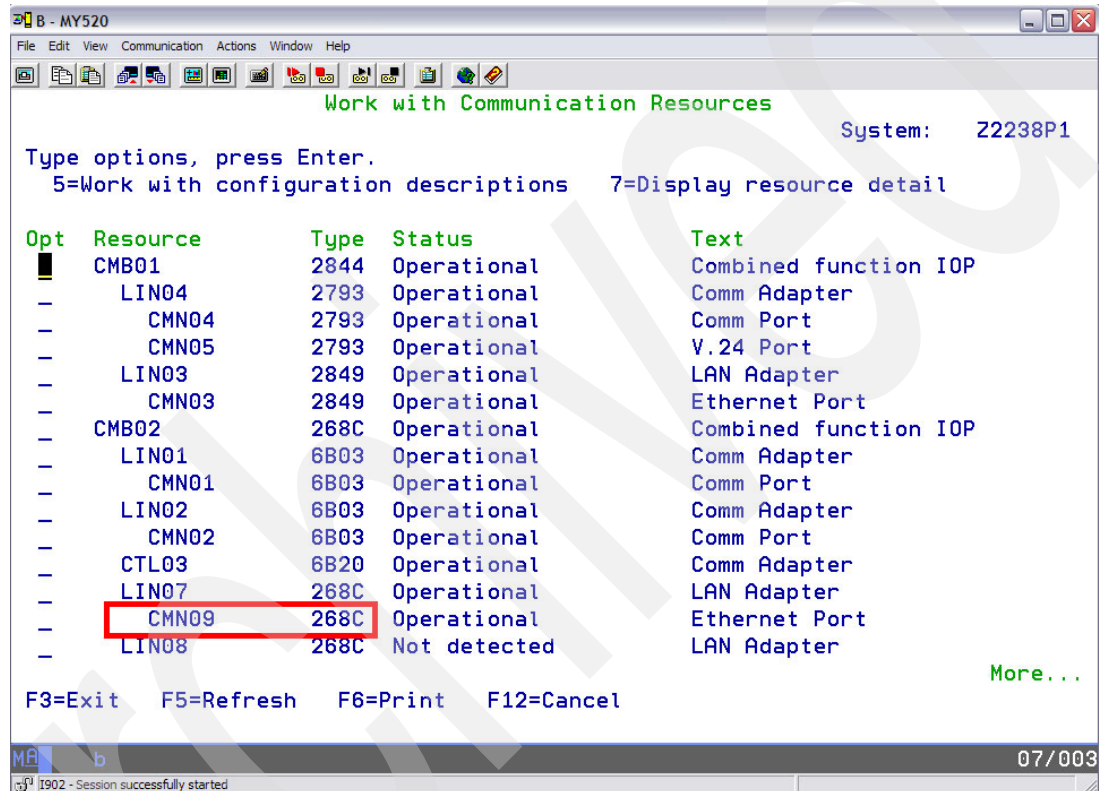


Figure 6-1 Work with Hardware Resources

2. Use the **CRTLINETH** command to create the Ethernet line descriptor. See Figure 6-2 on page 33.

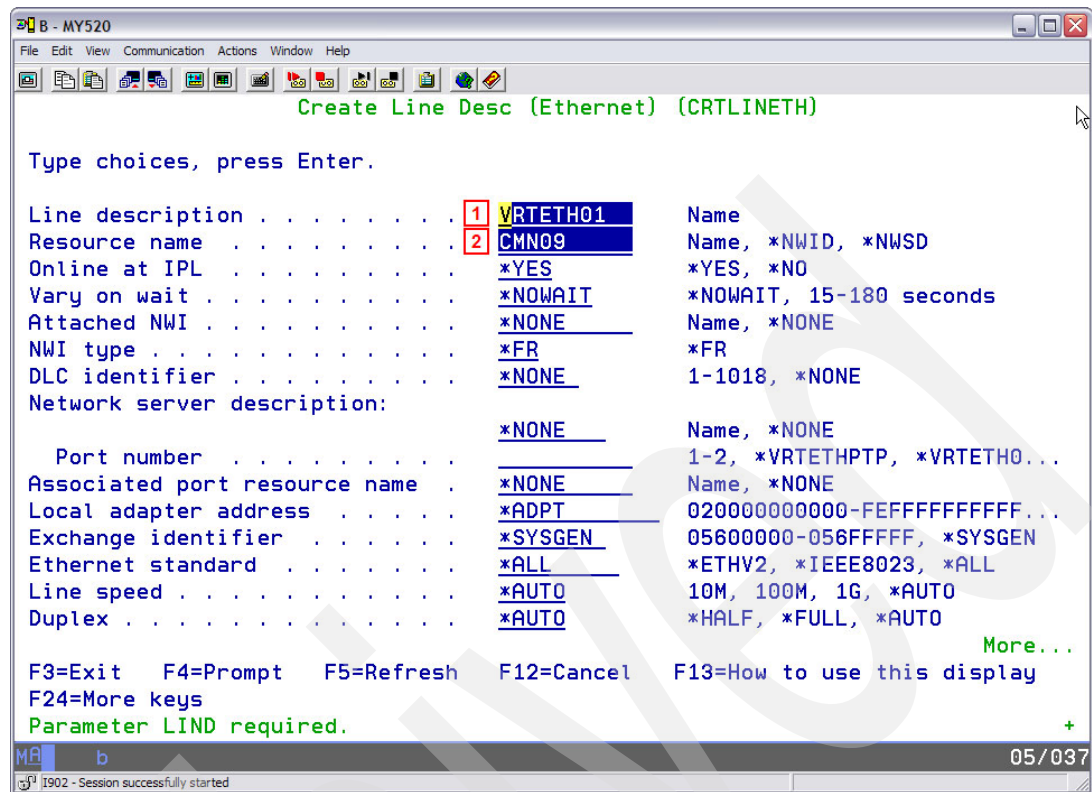


Figure 6-2 Create Ethernet Line Description

- **1 Line Description:** Enter the name for the Ethernet line description. For virtual Ethernets it is a common practice to start the name with 'VRT' and include the virtual Ethernet number in the name. As an example, if you are creating the line descriptor for the 1<sup>st</sup> virtual Ethernet, a common name to use would be 'VRTETH01'.
  - **2 Resource Name:** The resource name is the name of the communication resource for the virtual network connection on the virtual LAN. This is the resource that was identified earlier with the **WRKHDWRSC \*CMN** command.
3. Once the Ethernet line descriptor is created, it needs to be varied on. You can accomplish this with the Work with Line Descriptors (**WRKLND**) command.

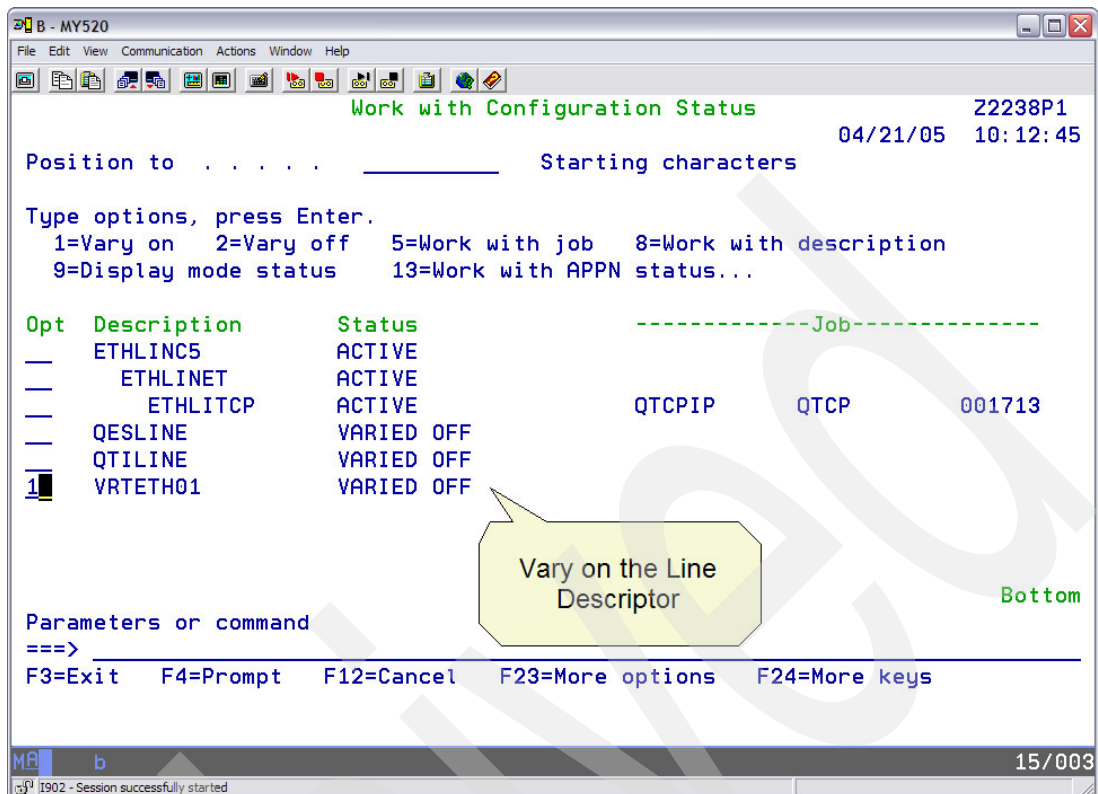


Figure 6-3 Work with Configuration Status

4. Create the TCP/IP interface for the i5/OS network adapter for the virtual LAN. To create the TCP/IP interface, type the command **ADDTCPIFC** (Add TCP/IP Interface) as seen in Figure 6-4 on page 35.

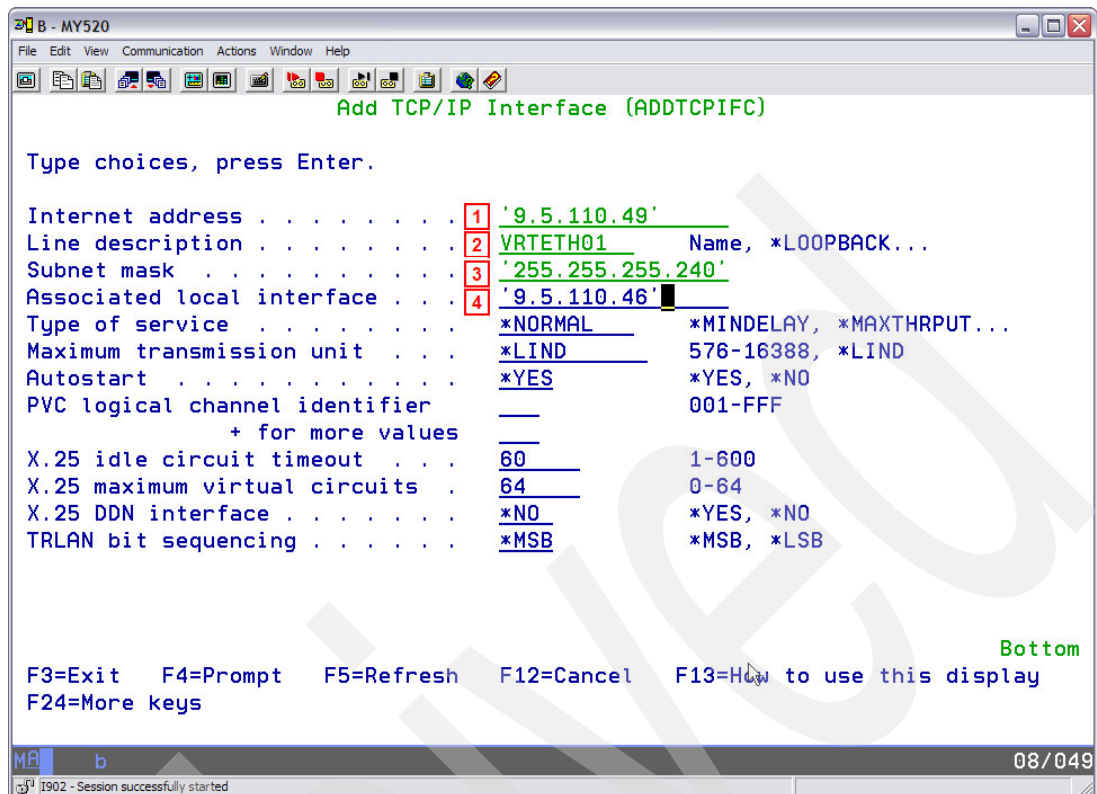


Figure 6-4 Add TCP/IP interface

- **1 Internet Address:** Type the address of the network interface for the i5/OS partition on the virtual LAN.

**Note:** This is the address that Linux partitions use as their gateway (or route) to the external network.

- **2 Line description:** The line description is the name of the Ethernet line descriptor (defined earlier) for the network adapter on the virtual LAN.
- **3 Subnet Mask:** The subnet mask defines the size of the network to which the interface is being. For virtual LAN, the subnet mask, along with the address of the interface determine the range of addresses for which are proxied.
- **4 Associated local interface:** The associated local interface is the address of the TCP/IP interface for the real (physical) network adapter in the i5/OS partition. The associated local interface routes traffic between the external (physical) network and the virtual network.

**Note:** Setting up of a Proxy ARP environment requires that you define a set of addresses that meet a number of specific rules including starting and ending boundaries as well as network size. Use a subnet calculator to help define the network range.

5. Once the TCP/IP interface is created, start it. You can start the interface through the Configure TCP/IP (**CFGTCP**) command. After you specify the command, select option 1 to Work with TCP/IP Interfaces, and then select option 9 to start the newly defined interface.

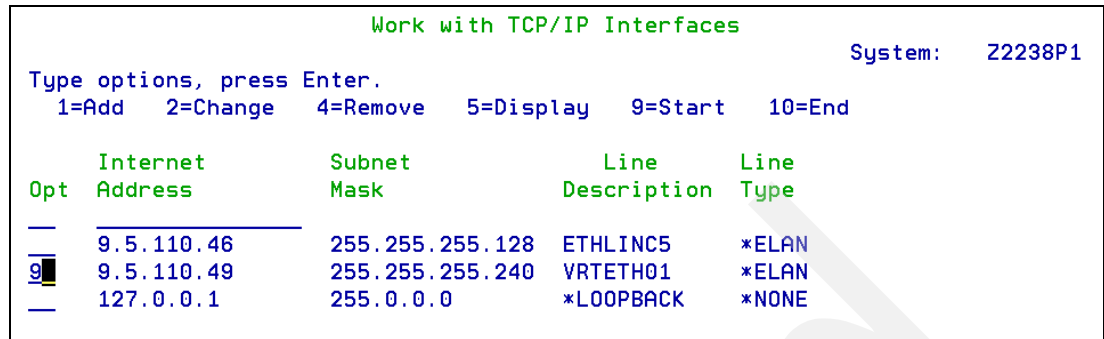


Figure 6-5 Start TCP/IP interface

6. Proxy ARP requires that TCP/IP packets flow between two network interfaces (the virtual and real/physical interface). This requires that "IP datagram forwarding" be enabled. Enter the command **CHGTCPA** (Change TCP/IP Attributes), and change the value of IP datagram forwarding to \*YES.

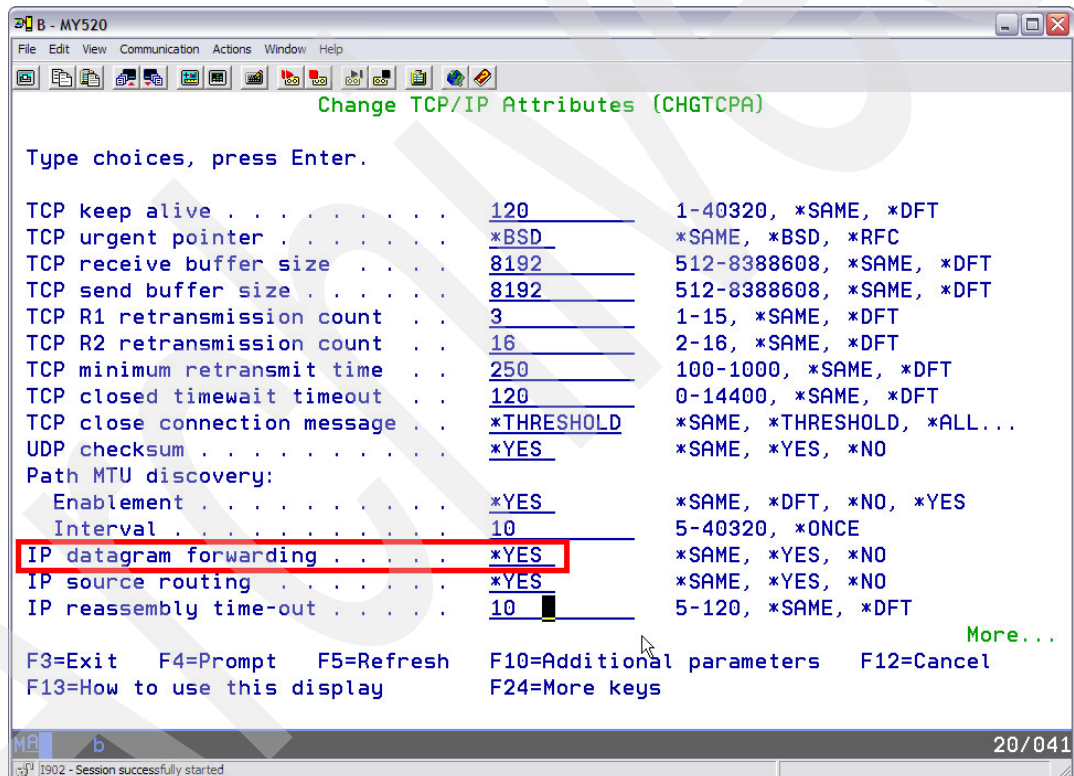


Figure 6-6 Change TCP/IP attributes

**Note:** After you enable datagram forwarding, ping the address of the i5/OS TCP/IP interface on the virtual LAN. If the interface responds, then the set up of Proxy ARP is complete and is ready for use by the Linux partitions.



## Setting up i5/OS Virtual I/O Resources for Linux Partition

There are three components you need create in i5/OS to support Linux partitions with hosted resources. This chapter provides instructions for defining the Network Server Descriptor and Network Storage Space.



## 7.1 Network Server Descriptor

The Network Server Descriptor defines a number of parameters for the Linux environment including startup location as well as startup parameters.

Use the following steps to define the Network Server Descriptor:

1. Start the Create Network Server Descriptor using the **CRTNWSD** command.

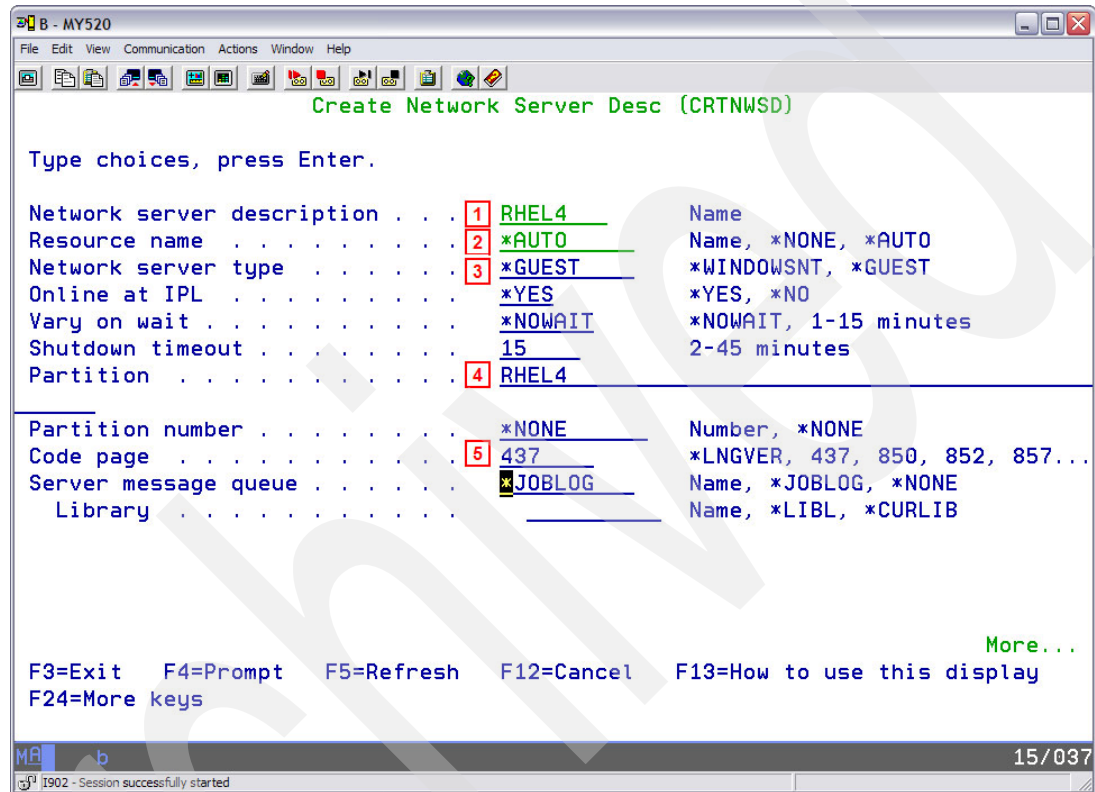


Figure 7-1 Create network server descriptor

- **1 Network sever description:** This is the user-defined name for the Network Server.
- **2 Resource name:** The Resource name indicates the Virtual SCSI server adapter that provides virtual I/O resources (virtual disk [NWSSTG], virtual CD/DVD, virtual tape) to the Linux partition that has the corresponding Virtual SCSI client adapter. \*AUTO indicates that the system determines the resource name of the first (and in this case the only) Virtual SCSI server adapter for the partition.
- **3 Network server type:** For Linux partitions, the Network server type is always set to \*GUEST.
- **4 Partition:** Partition is the name of the partition created with the Virtual Partition Manager via SST.
- **5 Code page:** For Linux partitions the code page is always set to 437.

**Note:** The Code page defined in the Network Server Descriptor has no relationship to the Language support provided by Linux. The Code Page defined here is used for internal communications between the Hypervisor and the Logical Partition.



2. After you complete the first page of parameters, press the <PgDn> key twice to display the last page of parameters.

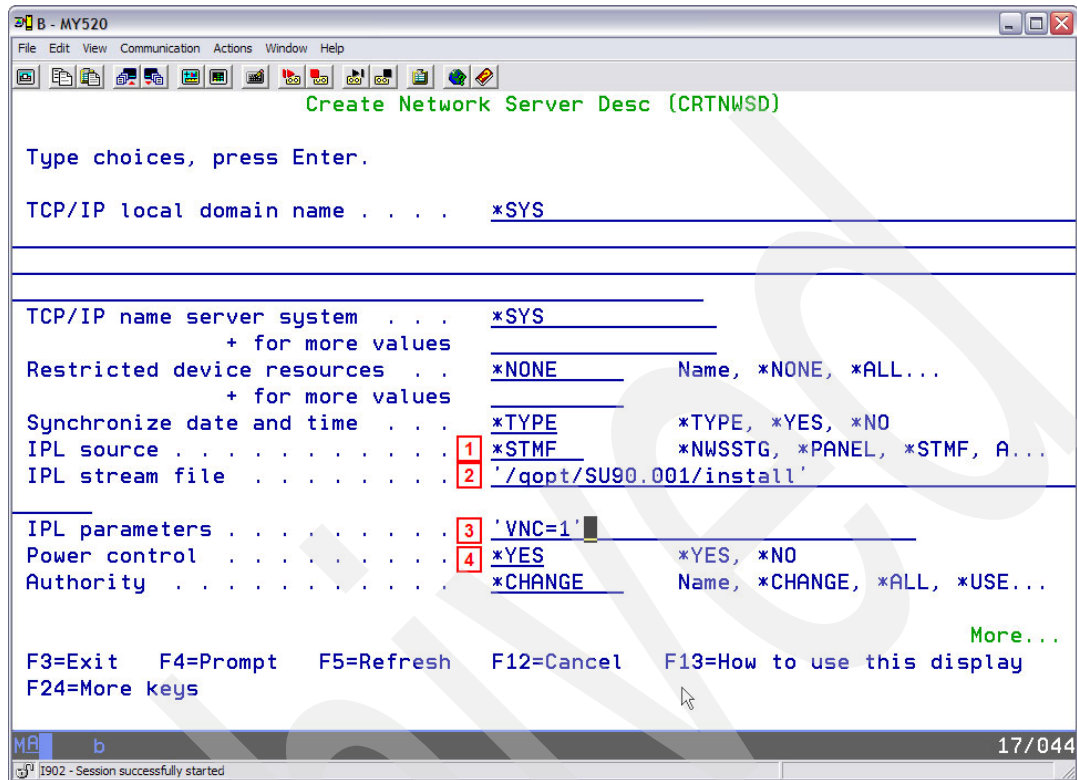


Figure 7-2 Network Server Description

- **1 IPL source:** The IPL source indicates where to look for the initial boot file. A \*NWSSTG setting indicates that the initial boot file is in the bootable disk partition of the first disk linked to the Network Server Descriptor. A \*STMF setting indicates that the initial boot file is a stream file located in the IFS. When the setting is \*STMF the path indicated by **2** is used.

**Note:** The installation of Linux is typically performed with IPL Source set to \*STMF. Post-installation changes the setting to \*NWSSTG to boot off of the Linux kernel written to the virtual disk by the installation program.

- **2 IPL stream file:** The IPL stream file is used when **1** is set to \*STMF. The path indicates the path to the initial boot file.
- **Note:** The initial boot file for an installation of Linux is indicated in the documentation provided with the distribution.
- **3 IPL parameters:** The IPL parameters field defines parameters that are sent directly to the Linux kernel. The IPL parameters are defined in the Linux-distributor documentation.

**Note:** Both Novell / SuSE SLES 9 and Red Hat RHEL 4 support graphic-based installations. The IPL parameters field can be used to indicate that a graphical-based installation is requested.

**Note:** The parameters defined in IPL parameters are sent directly to the Linux operating system; therefore, you must enter them exactly as specified in the Linux documentation including upper/lower case.

3. After you complete the fields, press Enter to create the Network Server Descriptor.

## 7.2 Network Storage Space

The Network Server Storage Space (NWSSTG), also referred to as virtual disk, provides the disk resource to the Linux partition. The Network Storage Space is an object within the Integrated File System (IFS) that is abstracted to the Linux partition such that it appears, and is used, as an actual disk drive.

Use the following steps to create the Network Server Storage Space:

1. Type the Create Network Server Storage Space command, **CRTNWSSTG**, which creates the Network Server Storage Space. Entering the command displays Figure 7-3.

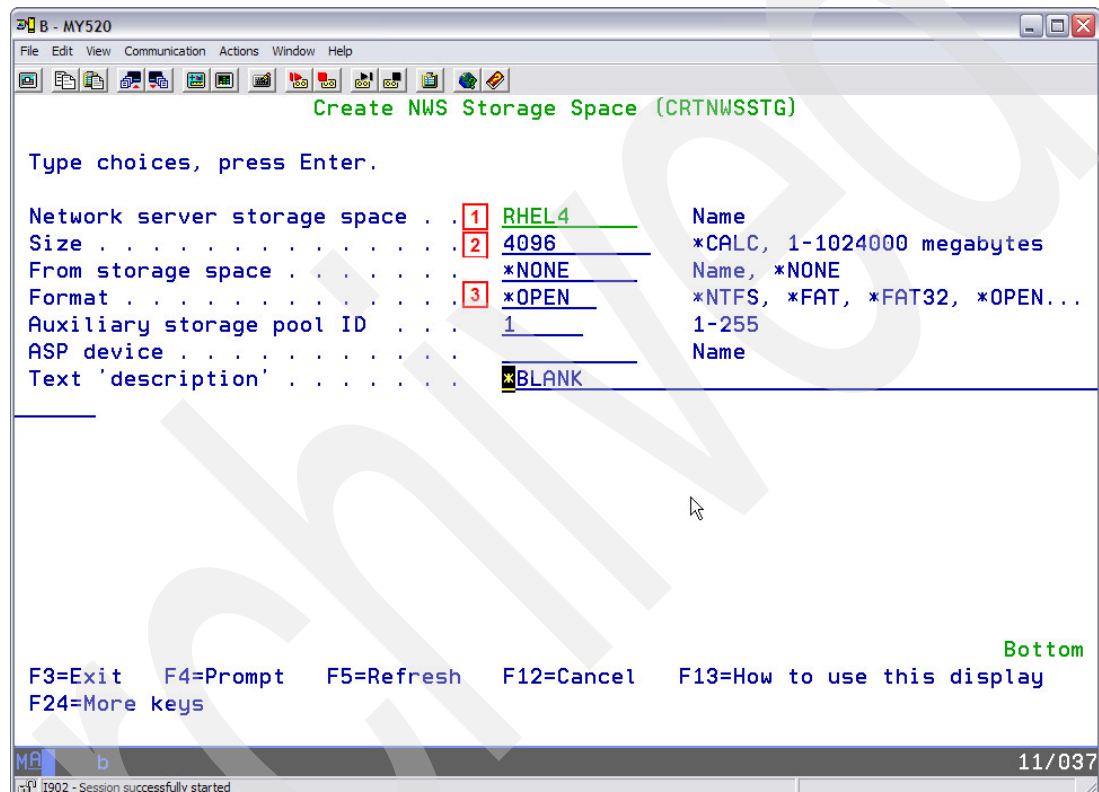


Figure 7-3 Create Server Storage Space

- **1 Network server storage space:** The Network server storage space is a user-defined name given to the network server storage space.
- **2 Size:** The size field indicates the size (in megabytes) for the virtual disk. The size can be anywhere from 1 megabyte to 1 terabyte. For a Linux installation, the installer uses the size of the virtual disk to determine the default package selection.

**Note:** For both Novell / SuSE SLES 9 and RedHat RHEL 4, a size of 4 GB (4096) supports a default package selection (during installation) that installs the most common open-source applications, including SAMBA, for file serving and Apache for Web Serving.

- **3 Format:** For Linux partitions, set the format to \*OPEN. During the Linux installation, the “disk” represented by the virtual disk is formatted to have the number of disk partitions that installation requires.

2. After you complete the fields, press Enter to cause the Network Server Storage Space creation. At this point the space requested is reserved in the IFS and the Network Server Storage Space is available for use.
3. Associate the Network Server Storage Space with the Network Server, by linking the storage space to the network server. Type the Add Server Storage Link command, **ADDNWSSTGL**.

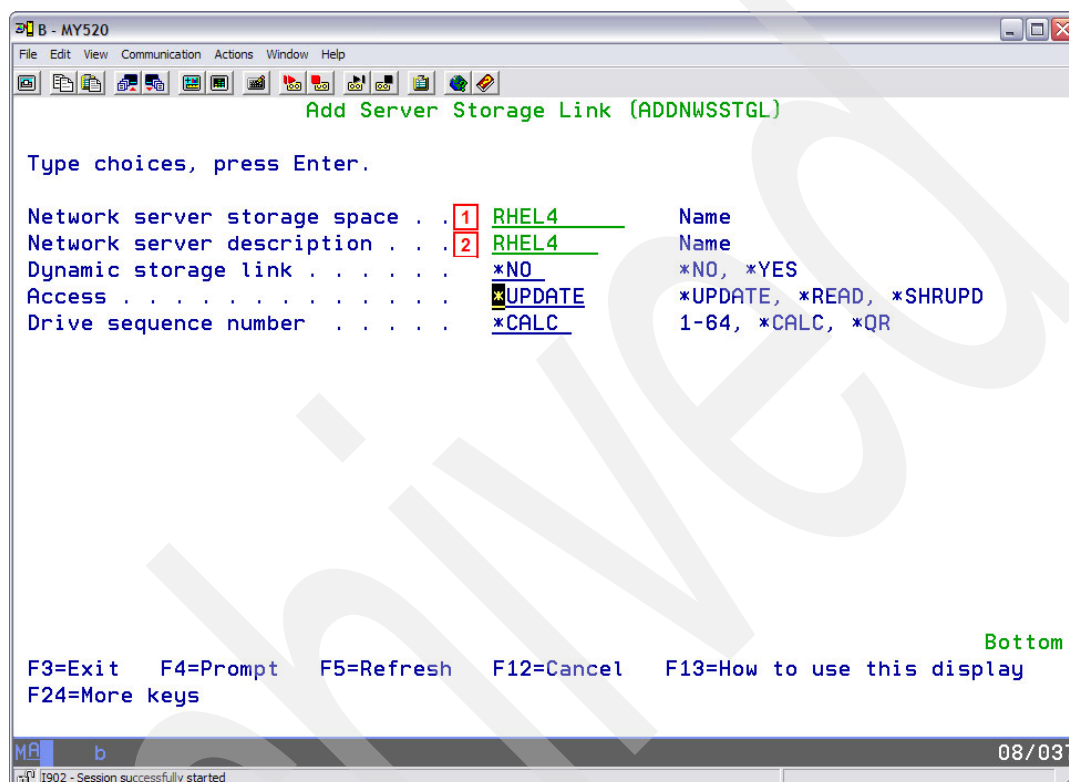


Figure 7-4 Add Server Storage Link

- **1 Network server storage space:** The name of the Network Server Storage Space to be linked to the Network Server defined in 2.
- **2 Network server description:** The name of the Network Server to which the storage space defined in 1 is linked. The Network Server is the component that provides access to the storage space(s), via the virtual SCSI adapters that are linked to the Network Server.

## 7.2.1 Virtual Console Access

Access to the Linux console is provided through the hosting i5/OS partition via a TCP/IP-based application. Access to the console is limited to DST user ids that were granted “remote panel key authority”. This section provides the instructions for defining the DST user and accessing the virtual console.

Use the following steps to Create the Dedicated System Server Tools user with the correct authorities.

1. DST users are created through System Server Tools. Type the command **STRSST** to start System Server Tools. When the System Service Tools menu is displayed, select option 8 (Work with service tools user IDs and Devices).

2. When the Work with Service Tools User IDs and Devices menu is displayed, select option 1 (Service Tools user IDs).
3. When the Work with Service Tools User IDs window is displayed, enter option 1 to create a new user.

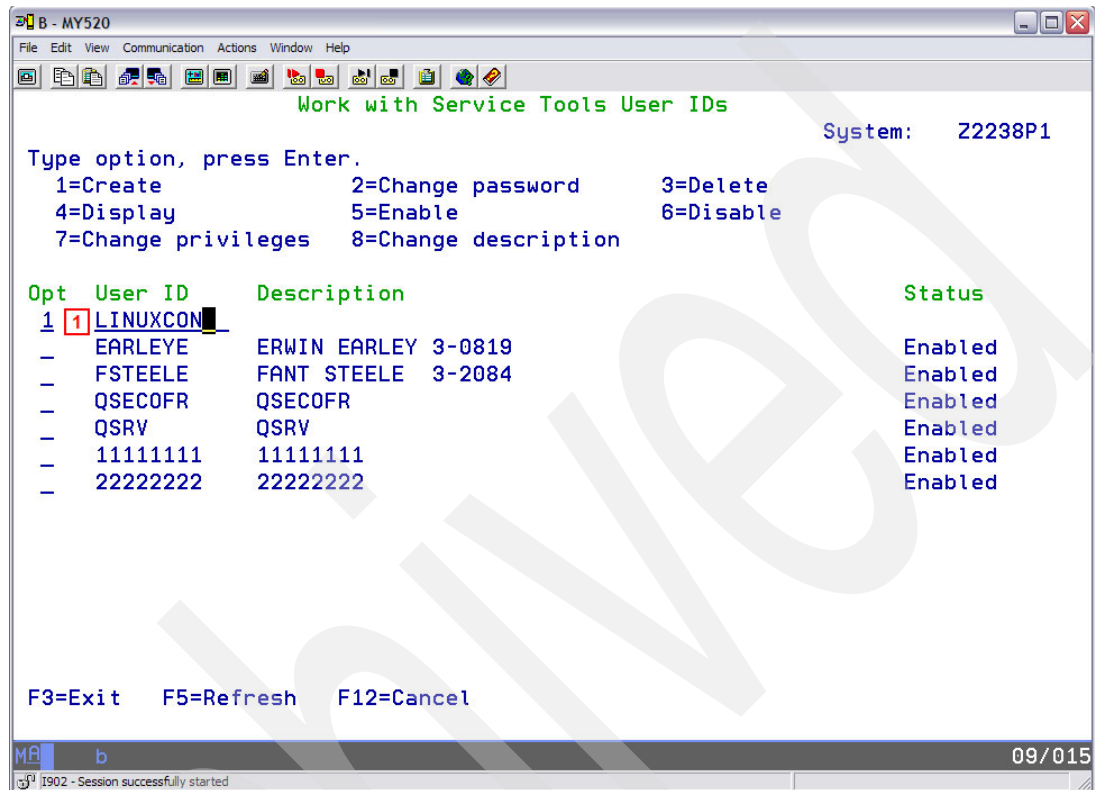


Figure 7-5 Work with Service Tools IDs

- **1 User ID:** The user-id being created for virtual console access.
4. Press Enter. The Create Service Tools User ID screen appears, as shown in Figure 7-6 on page 44.

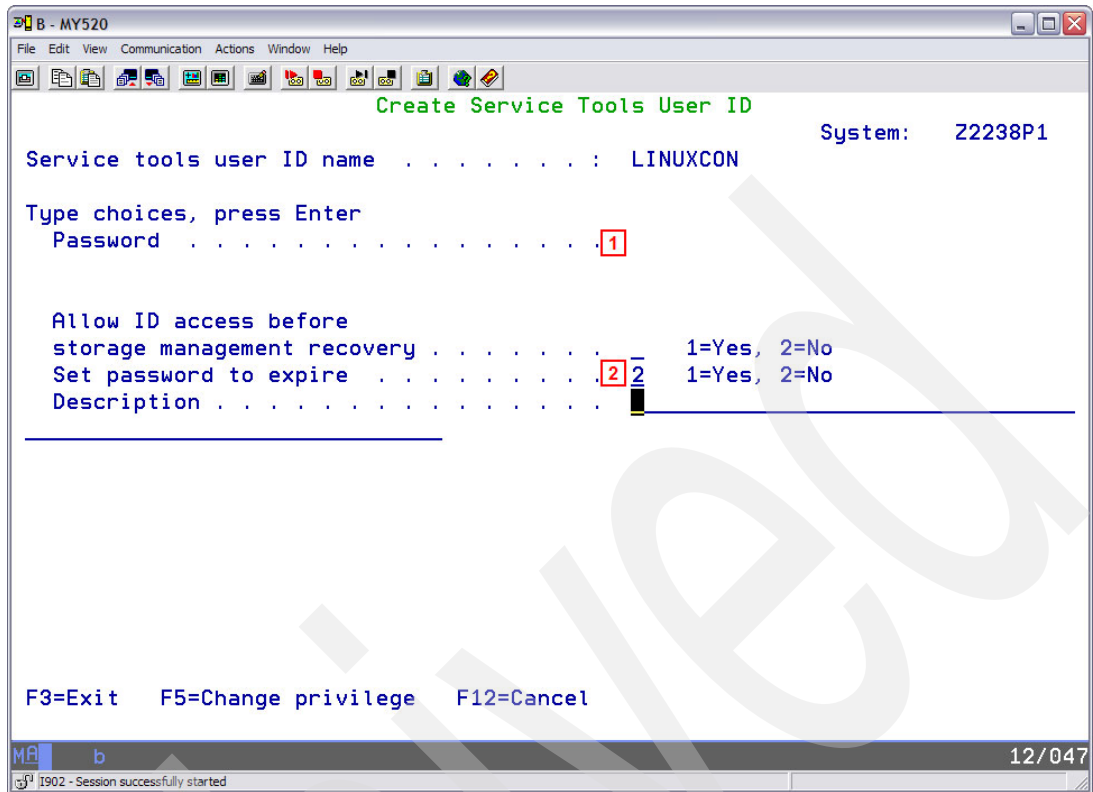


Figure 7-6 Create Service Tools ID

- **1 Password:** Type the password for the user-id being created. This is the password used to access the virtual console.
  - **2 Set password to expire:** Type 2 to indicate that the password should not be set to expired.
5. Press Enter to complete the DST user definition.
  6. After you create the DST user, modify the authorities for the user to include the remote panel key authority.
  7. On the Work with Server Tools User IDs, select option 7 (Change Privileges) for the user just created.

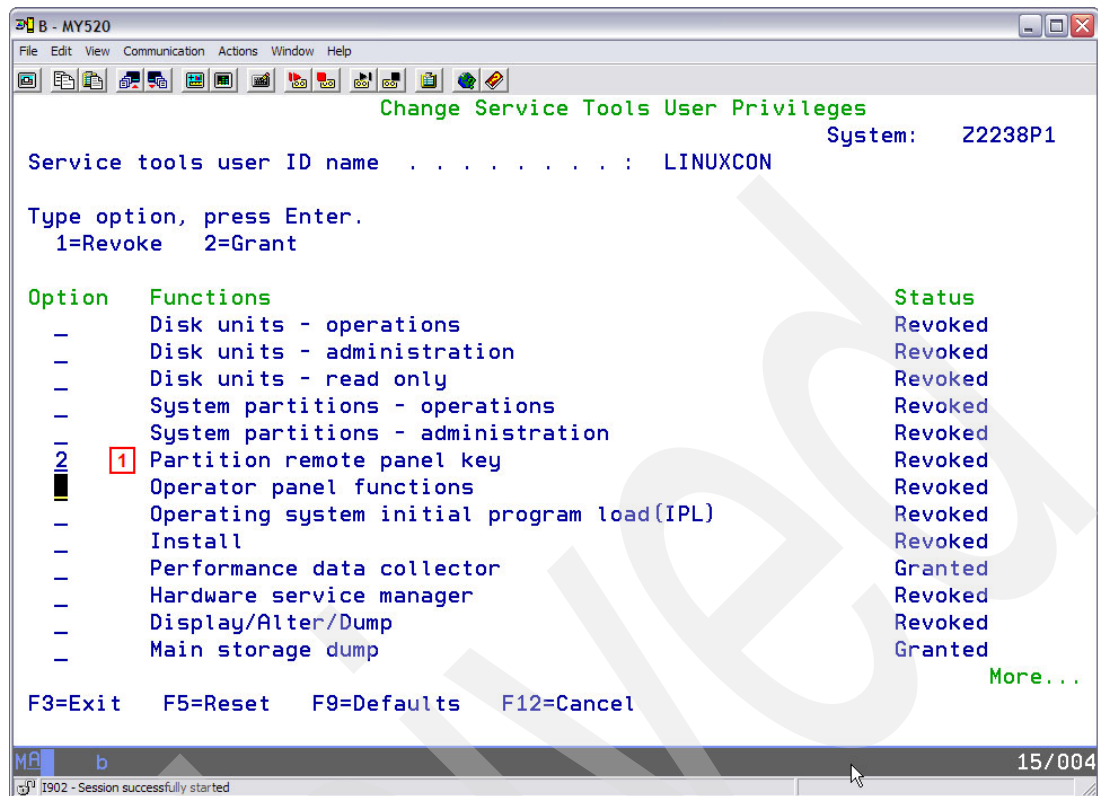


Figure 7-7 Change Service Tools User Privileges

- **1 Partition remote panel key:** This is the authority that needs to be granted for virtual console access.

**Note:** In addition to the Partition remote panel key authority, the user id also requires 'System partitions—operations' and 'System partitions—administration' authority.

8. After the required authority has been granted, press Enter.
9. Press the F3 key.
10. The DST is created and configured. Press F3 three times.
11. Press Enter to exit out of System Service Tools.

## 7.3 Starting the Linux Installation

At this point all of the components are defined for the Linux environment. You can start the Linux installation. This section provides the steps for accessing the virtual console and starting the Network Server.

1. Prior to starting the Network Server, access to the virtual console needs to be achieved so that messages generated by the installer can be viewed. To accomplish this, use a telnet client, such as the windows telnet client, and access port 2301 of the i5/OS hosting partition. As an example, if the IP address of the hosting i5/OS partition is 192.168.10.10 then access to the virtual console is accomplished by entering the command 'telnet 192.168.10.10 2301'.

2. A list of Linux partitions is provided. Type the number that corresponds to the partition for which you want to access the console.
3. When prompted for the OS/400® service tools user id, type the DST user that was created for virtual console access.
4. When prompted for the OS/400 service tools password, type the password defined for the DST user.
5. After the Virtual Console is accessed, the Network Server can be varied on. A vary on of the server is accomplished through the Work With Configuration Status command. Type the command **WRKCFGSTS \*NWS** to work with the configuration of the Network Servers.

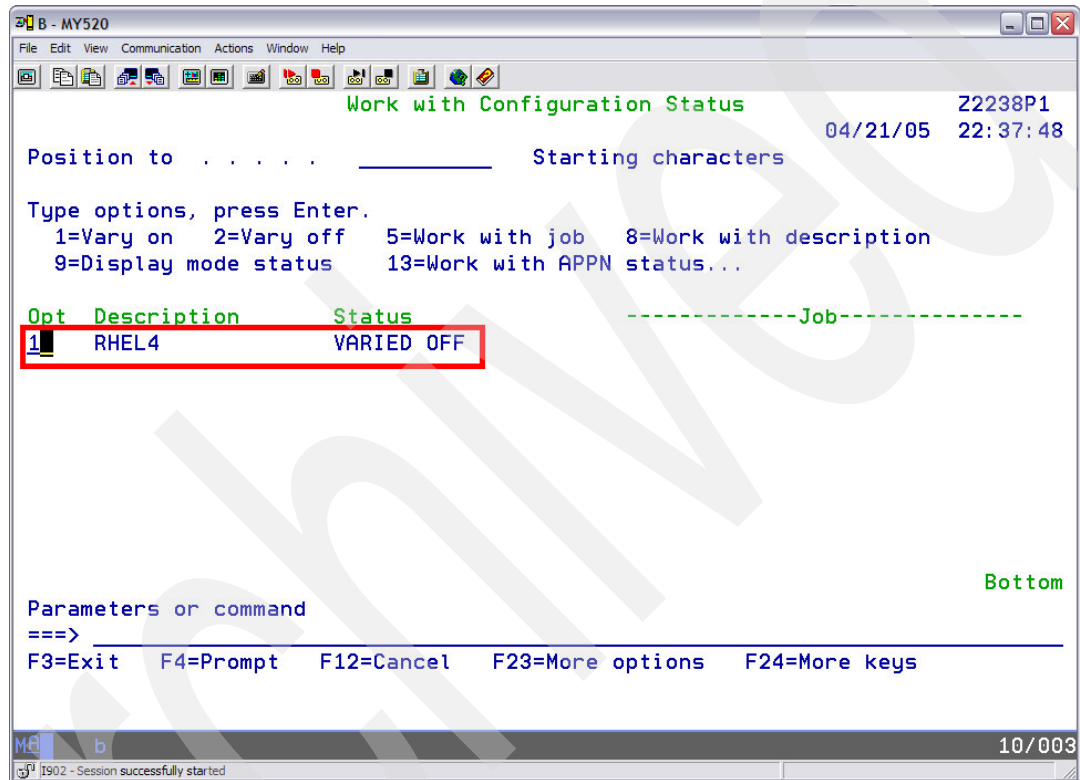


Figure 7-8 work with Configuration Status

6. An option '1' on the Network Server causes the network server to be varied on. As part of vary on process, a request is sent to power-on the partition defined in the Network Server Descriptor. After the partition starts, the Linux startup messages are displayed in the virtual console window.

**Note:** Detailed Linux installation instructions are provided in the distributor documentation.







# Virtual Partition Manager

## A Guide to Planning and Implementation



**Redpaper**

**Learn about the Virtual Partition Manager (VPM)**

**Review planning guidance for an eServer i5 server with VPM**

**Create partitions and allocate virtual resources with VPM**

With the recently announced POWER5 processor based eServer i5 systems, IBM is delivering the 3<sup>rd</sup> generation of logical partitioning for the iSeries family of servers. The new partitioning capabilities enable clients to further simplify their infrastructures. The IBM Virtualization Engine, which provides support for logical partitioning and resource virtualization through i5/OS, is included with eServer i5 servers.

The Virtual Partition Manager (VPM) introduces the capability to create and manage Linux partitions without the use of the Hardware Management Console (HMC). The Virtual Partition Manager supports the needs of small and medium customers that want to add simple Linux workloads to their eServer i5 server. The Virtual Partition Manager is included with i5/OS V5R3. The Virtual Partition Manager supports environments with one i5/OS partition and up to four Linux partitions. In addition, the single i5/OS partition must own and manage all of the I/O resources.

This document is intended to assist IBM Business Partners and clients that are planning to deploy Linux partitions on eServer i5 servers using the Virtual Partition Manager.

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