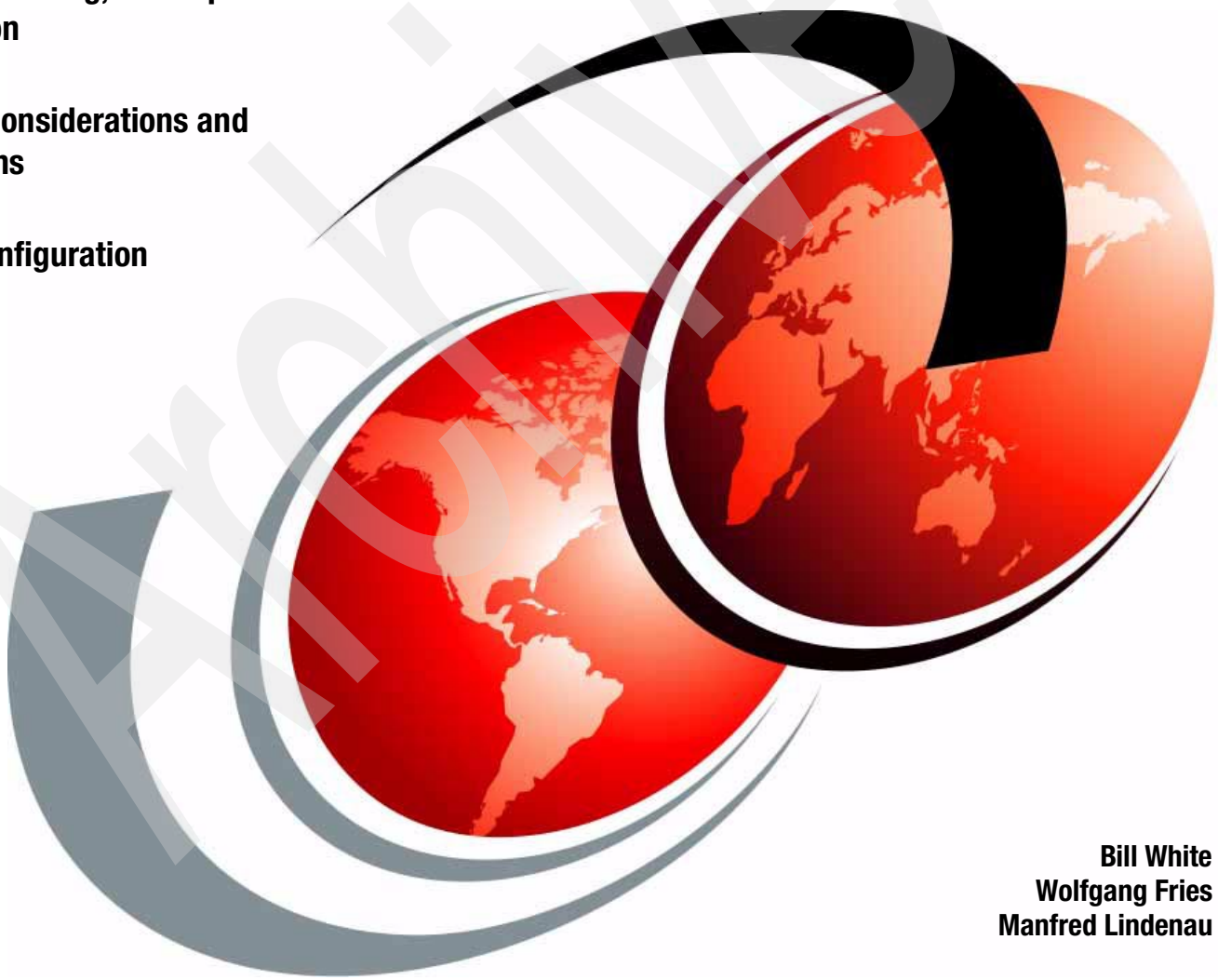
IBM

Getting Started with the INRANGE FC/9000 FICON Director

- Product, planning, and implementation information
- Realistic considerations and suggestions
- Helpful configuration examples



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International Technical Support Organization

Getting Started with the INRANGE FC/9000 FICON Director

March 2003

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

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Contents

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Preface

This IBM Redbook discusses how to install, tailor, and configure the INRANGE FC/9000 FICON Director, in conjunction with the FICON topologies supported by zSeries and 9672 Generation 5 and Generation 6 servers. It focuses on the hardware installation as well as the software definitions needed to provide connectivity for supported FICON environments.

This book provides planning information and FICON Director setup information. Also included are helpful utilities for monitoring and managing the INRANGE FC/9000 FICON Director environment.

This document is intended for system engineers, SAN administrators, and system programmers who will plan and install INRANGE FC/9000 FICON Directors. A good background in systems planning, hardware and cabling infrastructure planning, and zSeries I/O definitions (HCD or IOCP), as well as Fibre Channel or FICON Directors, is assumed.

The team that wrote this redbook

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Introduction

INRANGE FC/9000 FICON Directors are a product of a reseller agreement between IBM and INRANGE Technologies. They are designed to provide enterprise-class availability and Fibre Channel connectivity for IBM servers and storage products supporting Fibre Channel (FC) and FICON protocols.

The intent of this chapter is to provide background information about the zSeries FICON environment in which INRANGE FC/9000 FICON Directors are deployed. In the subsequent sections, you will find the following topics discussed:

- Basic FICON and Fibre Channel terms
- FICON overview
  - FICON channel support
- Supported FICON Director topologies
  - Switched point-to-point
  - Cascaded FICON Directors
  - High integrity

1.1 Basic Fibre Channel terminology

This section discusses some general terms used in the Fibre Channel (FC) environment. These terms are also used in FICON environments when installing/configuring and operating in a switched point-to-point or cascaded FICON Director configuration, therefore you will find them throughout this document.

Node

A node is an endpoint that contains or uses information. it can be a computer (host), a device controller or a peripheral device (such as disk or tape drives). A node has a unique 64-bit identifier known as the Node_Name. The Node_Name is typically used for management purposes.

Port

Each node must have at least one port (hardware interface) to connect the node to the FC topology. This node port is referred to as an N_Port.

Each N_Port has a Port_Name which is a unique 64-bit identifier that is assigned when it is manufactured. The N_Port associates an access point to a node's resources.

Other port types present in an FICON switched environment include:

E_Port An *expansion port* is used to interconnect switches and build a switched fabric.
F_Port A *fabric port* is used to connect an N_Port to a switch that is not loop-capable.
G_Port A *generic port* is a port that has not assumed a role in the fabric.

Switched fabric

One or more FC switches (FC-SW) can be interconnected to create a fabric, to which N_Ports are connected. A switched fabric takes advantage of aggregated bandwidth via switched connections between N_Ports using *packet-switching*. FC switches (FICON Directors) allow multiple concurrent I/O operations (read and write) between multiple FICON-capable servers and multiple FICON-capable control units (devices).

FC link

The port connects to the topology through an FC link (see Figure 1-1). The transmission medium for the FC link (FICON interface) is a fiber optic cable. Physically, it is a pair of optical fibers that provide two dedicated, unidirectional, serial-bit transmission lines. Information in a single optical fiber flows, bit by bit, always in the same direction. At any link interface, one optical fiber is used to receive data while the other is used to transmit data. Full duplex capabilities are exploited for data transfer. The Fibre Channel Standard (FCS) specifies that for normal I/O operations, frames flow serially in both directions, allowing several concurrent read and write I/O operations on the same link.

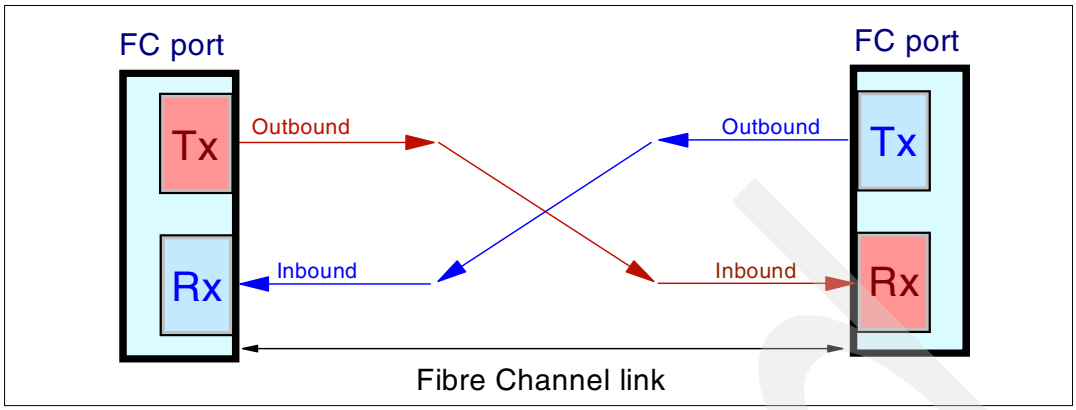

Figure 1-1 Fibre Channel link

An FC link (port-to-port connection) can be:

- Node-to-node (N_Port-to-N_Port)
- Node-to-switch (N_Port-to-F_Port)
- Switch-to-switch (E_Port-to-E_Port)

The FC link data rate is 1 Gbps (100 MBps) for zSeries and 9672 G5/G6 FICON feature ports, and 1 Gbps or 2 Gbps (200 MBps) for zSeries FICON Express feature ports. The 2 Gbps link capability is auto-negotiated between the zSeries server and FICON Director, as well as the Director and devices, and is transparent to the operating system and application. With devices in general, the zSeries FICON Express, FICON Director and/or device communicate and agree upon either a 1 Gbps or 2 Gbps (100 MBps or 200 MBps) link speed. This speed determination is based upon the adapter speeds in the zSeries server, FICON Director, and device, as well as the fiber optic cable infrastructure capabilities. For those parts of the I/O infrastructure that are not 2 Gbps link-capable, the link speed is auto-negotiated to 1 Gbps (100 MBps).

Note: The 2 Gbps line speed is the theoretical maximum unidirectional bandwidth capability of the fiber link. The actual throughput potential of the 2 Gbps link (whether it is measured in I/O operations per second, or MBps) will depend on the type of workload, fiber infrastructure, and storage devices in place.

World-Wide Names (WWNs)

As mentioned, nodes and ports have unique 64-bit addresses that identify them in an FC or FICON topology. These addresses are assigned by the manufacturer, with a vendor-specific portion defined by the IEEE standards committee. These addresses (in the FC standard) are called Node_Names and Port_Names, and when they are world-wide unique, they are referred to as:

- World-Wide Node_Name (WWNN)
- World-Wide Port_Name (WWPN)

A WWN (any WWNN or WWPN) is usually written in sets of two hex digits, separated by colons (for example, 08:45:12:56:43:00:D5:A0). Figure 1-2 illustrates the use of WWNs.

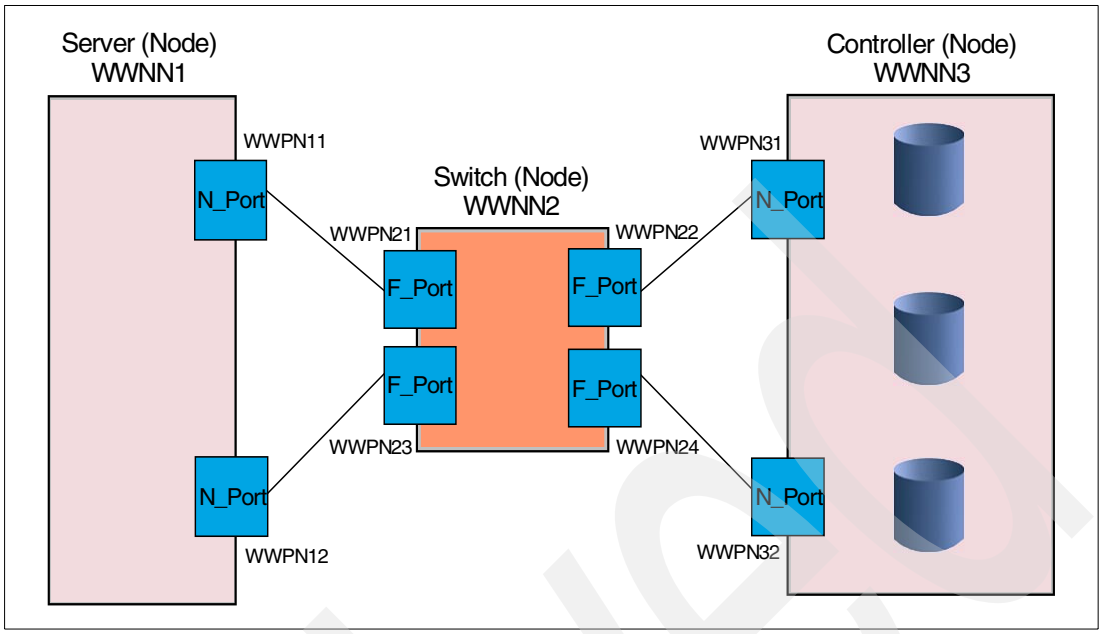

Figure 1-2 Example of World-Wide Names

1.2 FICON overview

There are a number of characteristics and functional areas that need to be understood in designing an I/O configuration that exploits FICON technology. This section introduces the basics of these areas for the FICON channel.

1.2.1 FICON channel architecture

The FICON channel architecture consists of the following Fibre Channel (FC) protocols:

- **FC-0 level — Interface and Media:** The Fibre Channel physical interface (FC-0), specified in FC-PI, consists of the transmission media, transmitters, receivers, and their interfaces. The physical interface specifies a variety of media and associated drivers and receivers capable of operating at various speeds.
  - ANSI NCITS xxx-200x FC-PI T11/Project 1235D
- **FC-1 level — Transmission Protocol:** This is a link control protocol that performs a conversion from the 8-bit EBCDIC code into a 10-bit transmission code; a unique bit-pattern is assigned to each known hexadecimal character. Encoding is done by the N_Port when sending the character stream over the fiber and decoding back to 8-bit code is performed by the receiving N_Port.
- **FC-2 level — Signaling Protocol:** Fibre Channel physical framing and signaling interface (FC-PH) describes the point-to-point physical interface, transmission protocol, and signaling protocol of high-performance serial links for support of higher-level protocols associated with HIPPI, IPI, SCSI, FC-SB2 (FICON), and others.
  - Fibre Channel - Framing and Signalling (FC-FS)

    ANSI X3.230-1994

    Describes the signaling protocol of the high-performance serial link for support of higher-level protocols associated with HIPPI, IPI, FC-FCP (SCSI), FC-SB2 (FICON) and others.

This architecture covers the Fibre Channel levels FC-1, FC-2, and some parts of the FC-3 level.

The FC-FS architecture consolidates the relevant clauses of FC-PH (the initial Fibre Channel architecture), its amendments 1 and 3, and FC-PH-2 and FC-PH-3 protocols, but does not replace those protocols. In this redbook the FC-FS architecture is referred to as the zSeries and 9672 G5/G6 processors, which comply with the FC-FS functions. These functions are described in more detail in the FC-FS architecture.

- **FC-3 level — Common Services:** This level is reserved for future functions.
- **FC-4 level — Mapping:** Channels Upper Level Protocol (ULP) as part of FC-4 and describes IPI/FC-FCP (SCSI)/ HIPPI/SB/IP and FC-SB-2 (FICON) protocols.

Following are some other standards used in the Fibre Channel architecture, and their references:

- Fibre Channel - Switch Fabric (FC-SW):

  ANSI X3T11/Project 959-D/Rev 3.3
- Single-Byte Command Code Sets Connection Architecture (SBCON):

  ANSI X3.296-199x
- Fibre Channel Fabric Generic Requirements (FC-FG): Describes minimum requirements for a topology-independent interconnecting fabric to support FC-PH:

  ANSI X3.289-199x
- Fibre Channel Switch Fabric (FC-SW): Specifies tools and algorithms for interconnection and initialization of FC switches to create a multi-switch Fibre Channel Fabric.

  ANSI X3T11/Project 959-D/Rev 3.3

FC-SB-2 (FICON) architecture information and all other documentation mentioned can be obtained from the following Web site:

`www.t11.org`

1.2.2 FICON channel support

FICON channel support in the zSeries and 9672 G5/G6 servers can operate in one of three modes:

1. A FICON channel in FICON Bridge (FCV*)* mode allows access to ESCON control units with ESCON interfaces by the channel connected to a FICON Bridge adapter in a 9032-5 ESCON Director. This mode is applicable only to the FICON LX features.
2. A FICON channel in FICON native (FC*)* mode allows access to FICON native interface control units either directly by a FICON channel in FC mode (point-to-point), or from a FICON channel in FC mode connected in series through one or two Fibre Channel switches (FICON Directors). Channel-to-channel (FCTC) is also supported in this mode.

   Note: The 9672 G5/G6 processors only support a single switch topology, known as switched point-to-point. Whereas, the zSeries processors support single and dual switch topologies. A two-switch configuration is known as cascaded FICON Directors.

3. A FICON channel in Fibre Channel Protocol (FCP) mode can access FCP devices in one of two ways:
   - Via a FICON channel in FCP mode through a single Fibre Channel switch or multiple switches to an FCP device

– Via a FICON channel in FCP mode through a single Fibre Channel switch or multiple switches to a Fibre Channel-to-SCSI bridge

Note: The 9672 G5/G6 processors *do not* support FICON channels in FCP mode. Point-to-point and arbitrated loop topologies *are not* supported as part of the zSeries FCP enablement. This mode is only supported in conjunction with Linux environments.

1.3 FICON channel topology

A FICON channel in FICON native (FC) mode uses the Fibre Channel communication infrastructure supported by the zSeries and 9672 G5/G6 servers to transfer channel programs (CCWs) and data via its FICON and FICON Express features to another FICON-capable node, such as a storage device, printer or server (channel-to-channel).

A FICON channel, in conjunction with the INRANGE FICON Director, can operate in two topologies:

1. Switched point-to-point (through a single FICON Director to FICON-capable control units)
2. Cascaded FICON Directors (through two FICON Directors to FICON-capable control units)

The FICON channel in FICON native (FC) mode supports multiple concurrent I/O connections. Each concurrent I/O operation can be to the same FICON control unit (but to different devices/CU images), or to different FICON control units.

1.3.1 Switched point-to-point configuration

In a switched point-to-point connection, at least two Fibre Channel (FC) links are needed in the channel-control unit path. One is between the FICON channel card (N_Port) and the FICON Director port (F_Port), then internally within the switch (through the backplane) to another port (F_Port) and then via the second link to a FICON adapter card in the control unit (N_Port).

The FICON channel determines whether the associated link is in a point-to-point or switched topology. It does this by logging into the fabric, fabric login (FLOGI ELS) and checking the accept response to the fabric login (ACC ELS). The FLOGI-ACC (accept) response indicates if the channel N_Port is connected to another N_Port (point-to-point) or an F_Port (fabric port).

An example of a switched point-to-point topology is shown in Figure 1-3.

Multiple channel images and multiple control unit images can share the resources of the Fibre Channel link and the Fibre Channel switch, such that multiplexed I/O operations can be performed.

Channels and control unit links can be attached to the Fibre Channel switch in any combination, depending on configuration requirements and available resources in the Fibre Channel switch.

Sharing a control unit through a Fibre Channel switch means that communication from a number of channels to the control unit can take place over one switch to CU link (in the case where a control unit has only one link to the Fibre Channel switch), or over multiple link interfaces (in the case where a control unit has more than one link to the Fibre Channel switch).

Just one Fibre Channel link is attached to a FICON channel in a FICON switched point-to-point configuration, but from the FC switch (FICON Director) that FICON channel can communicate with a number of FICON CUs on different FC switch ports. Once at the control unit, the same control unit and device addressing capability exists as for a point-to-point configuration. However, the communication and addressing capability is increased for the channel when the channel is connected to a FC switch with the ability to use the domain and port address portion of the 24-bit N_Port address (8 bits for the domain and 8 bits for the port) to access multiple control units.

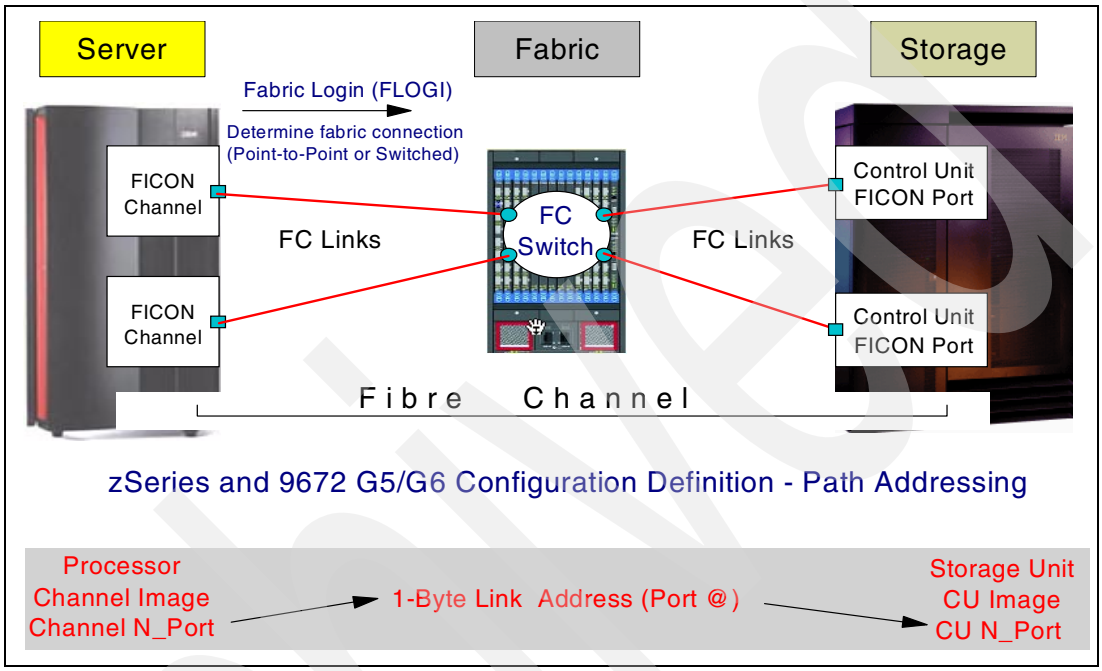

Figure 1-3 Switched point-to-point configuration

The communication path between a channel and a control unit is composed of two different parts, the physical channel path and the logical path.

In a FICON switched point-to-point topology (with a single switch) the physical paths are the FC links, or interconnection of two FC links connected by a FC switch, that provides the physical transmission path between a channel and a control unit.

A FICON (FC-SB-2) logical path is the relationship established between a channel image and a control unit image for communication during execution of an I/O operation and presentation of status.

1.3.2 Cascaded FICON Director configuration

In a cascaded FICON Director connection, at least three Fibre Channel (FC) links are needed in the channel-control unit path. One is between the FICON channel card (N_Port) and the FICON Director port (F_Port), then internally within the switch (through the backplane) to another port (E_Port) that connects to the second FICON Director E_Port via the second FC link, and then to a FICON adapter card in the control unit (N_Port) via the third FC link. With this configuration, the connection between sites can consist of multiple FC links.

An example of cascaded FICON Directors is shown in Figure 1-4.

Multiple channel images and multiple control unit images can share resources of the Fibre Channel link and Fibre Channel switches, such that multiplexed I/O operations can be performed.

Channels and control unit links can be attached to the Fibre Channel switches in any combination, depending on configuration requirements and on available switch ports.

Sharing a control unit through a Fibre Channel switch means that communication from a number of channels to the control unit can take place either over one switch-to-CU link (in the case where a control unit has only one link to the Fibre Channel switch), or over multiple link interfaces in the case where a control unit has more than one link to the Fibre Channel switch.

Just one Fibre Channel link is attached to a FICON channel in a cascaded FICON Director configuration. However, from the FC switch (FICON Director) the FICON channel can communicate with a number of FICON CUs on different ports of the second FC switch. Once at the control unit, the same control unit and device addressing capability exists as for a point-to-point configuration. However, the communication and addressing capability is greatly increased for the channel when connected to a FC switch with the ability to use the domain and port address portion of the 24-bit N_Port address (8 bits for the domain and 8 bits for the port) to access multiple control units. Note the domain address portion of the FC 24-bit port address is different since there are two FC switches in the channel-to-control unit path.

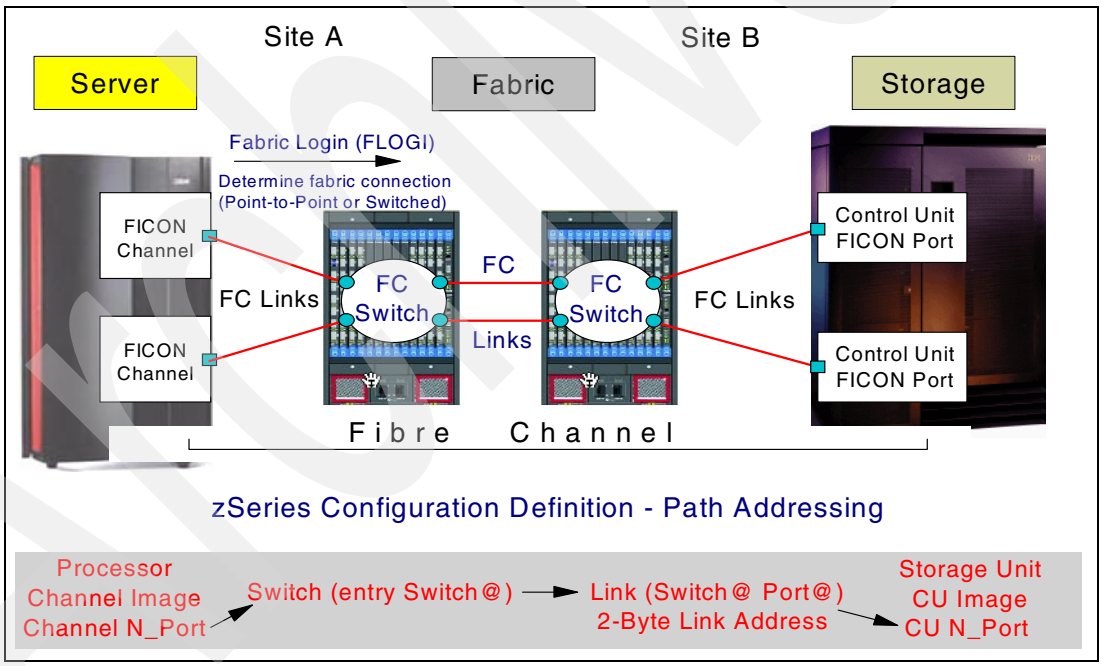

Figure 1-4 Cascaded FICON Director configuration

The communication path between a channel and a control unit is composed of two different parts, the physical channel path and the logical path.

In a cascaded FICON Director topology, the physical paths are the FC links that provide the physical transmission path between a FICON channel and a control unit.

A FICON (FC-SB-2) logical path is the relationship established between a FICON channel image and a control unit image for communication during execution of an I/O operation and presentation of status.

Note: The cascaded FICON Director configuration is only supported by the zSeries (z800 and z900) servers.

High-integrity data path

Another important value of FICON support of cascaded Directors is its ability to provide high-integrity data paths. The high integrity function is an integral component of the FICON architecture when configuring FICON channel paths through a cascaded fabric.

To support the introduction of FICON cascaded switching, IBM has worked with INRANGE to ensure robustness in the channel-to-control unit path is maintained to the same high standard of error detection, recovery, and data integrity that has existed for many years with both ESCON and the initial implementation of FICON.

End-to-end data integrity is designed to be maintained through the cascaded Director fabric. Data integrity ensure that any changes to the customer's data streams are always detected, and that the data frames (data streams) are delivered to the correct end point, an end point being a FICON channel port or a FICON Control Unit port. For FICON channels, Cyclical Redundancy Checking (CRC) and Longitudinal Redundancy Checking (LRC) are bit patterns added to the customer data streams to allow for detection of any bit changes in the data stream. With FICON support of cascaded switching, new integrity features are introduced within the FICON channel and the FICON cascaded switch fabric to ensure detection and reporting of any miscabling actions occurring within the fabric during operational use that may cause a frame to be delivered to the wrong end point.

A FICON channel, when configured to operate with a cascaded switch fabric, requires the switch fabric supports high integrity. During initialization, the FICON channel queries the switch fabric to determine that it supports high integrity. If it does, the channel completes the initialization process, allowing the channel to operate with the fabric.

Once a FICON switched fabric is customized to support FICON cascaded Directors and the required World-Wide Node Name (WWNN) and Domain IDs have been added in the fabric membership list, the Director checks that its Inter-Switch Links (ISLs) are attached to the correct Director before they are made operational. If an accidental cable swap occurs, the Director invokes logical path testing, reporting, isolation, and recovery. The high-integrity fabric feature for cascaded FICON Directors protects against mis-cabling and mis-directing of data streams.

High-integrity fabric architecture support includes:

- **Fabric binding support:** The ability of the fabric to prevent a switch from being added to the fabric that is not configured to support the “high integrity fabric”; for example, all switches must be defined to all other switches via a fabric membership list.
- **Insistent Domain IDs support:** This support will not allow a switch address to be automatically changed when a duplicate switch address is added to the enterprise fabric. It requires overt operator action to change a switch address.

Note: FICON Directors in a cascaded configuration require the High-Integrity feature .

For more detailed information about FICON planning, implementation, and architecture refer to *FICON Native Implementation and Reference Guide,* SG24-6266.

2

Technical description

This chapter provides a technical description of the INRANGE FC/9000 FICON Directors. Included are these topics:

- INRANGE FC/9000 FICON Director overview
- Hardware components
- Model configurations
- Software features:
  - Enterprise Manager (EM)
  - High Integrity feature
  - Control Unit Port

2.1 Introduction to the FICON Director

This section provides an overview of the INRANGE FC/9000 FICON Director and discusses the hardware components, models, configurations, and software.

2.1.1 FICON Director overview

This FICON Director is based on the INRANGE FC/9000-64 Fiber Channel Switch. The FICON Director provides an expandable and scalable Fibre Channel platform and is designed to support FICON attachment of IBM servers and storage products.

Port count
One chassis of an FC/9000 FICON Director can hold up to 64 ports. By interconnecting backplanes of two chassis in one cabinet, a non-blocking 128 port Director can be created, and with two cabinets totaling four chassis these can be merged to make 256 ports available.

Due to the usage of Small Form Factor (SFF) or GigaBit Interface Converter (GBIC) instead of fixed optical port cards, the granularity of port upgrades is one port.

Any mix of short wavelength and long wavelength ports is allowed with any I/O module (port card) in the Director.

Redundancy and non-disruptive activities
The FC/9000 features a N+1 redundancy for all of its elements. This redundancy results in high availability. Even in the case of failure of any internal elements, the FICON Director remains operational.

All activities, including code loads, code-activation, and replacement of failed parts can be done non-disruptive.

Protocol intermix
The INRANGE FC/9000 supports Fibre Channel Protocol (FCP) and FICON protocol intermix at the port level. If protocol intermix is used within the same Director, FCP and FICON ports should be isolated using zoning.

Note: Protocol intermix is not supported by zSeries servers at this time. However, it is expected to be available during the first half of 2003.

Interconnection
With firmware version 4.1.0.6 and above, the INRANGE FC/9000 FICON Directors support High Integrity Fabric (Feature Code 7203), which is required for cascaded FICON Directors configuration.

2.1.2 Management capabilities

FC/9000 fabrics can be managed using different communication methods:

- IN-VSN Enterprise Manager (IP based client/server management software)
- Simple network management protocol (SNMP)
- Serial interface (RS232, dedicated for INRANGE and/or IBM engineers)
- Call home (modem connection for notification purposes)
- Trivial file transfer protocol (TFTP) to load microcode

The most commonly used interface with the INRANGE FC/9000 FICON Directors is the IN-VSN software tool. An example of a FICON Director view is shown in Figure 2-1.

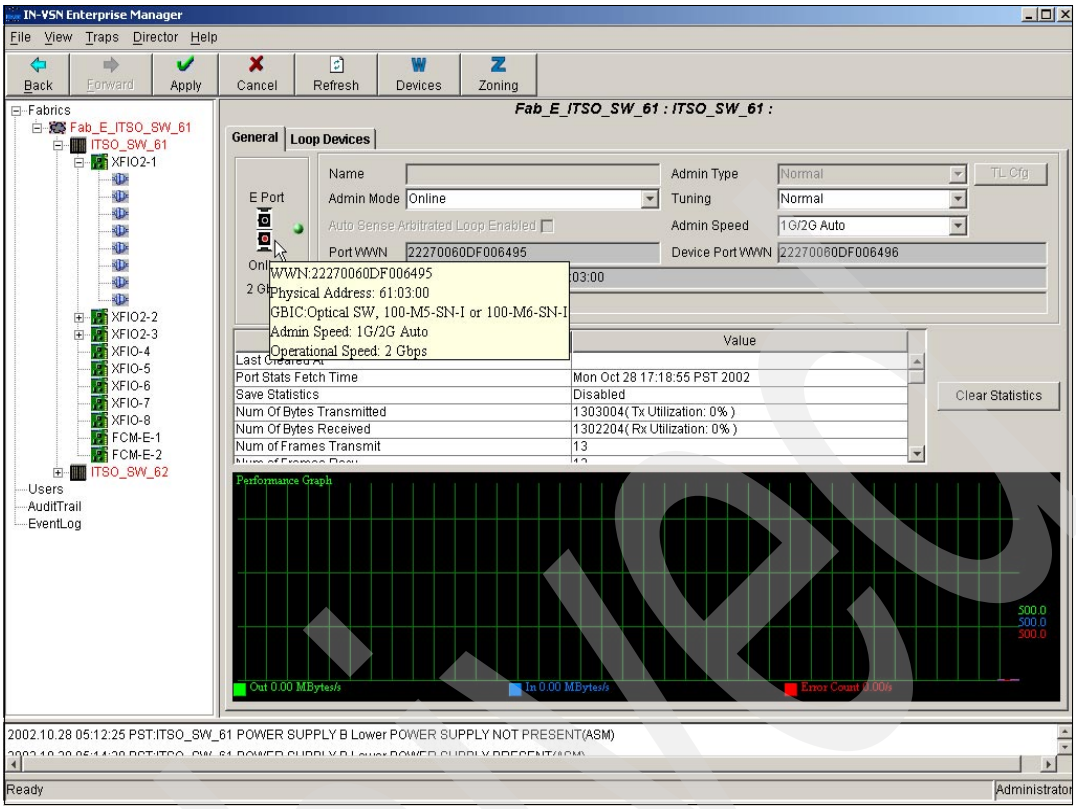

Figure 2-1 Example of IN-VSN management view

Chapter 4, “Setting up the IN-VSN Enterprise Manager environment” on page 35 and Chapter 5, “Configuring the FICON Director” on page 45 discuss the IN-VSN management functions in more detail.

2.1.3 Hardware components

This section lists the various hardware components that are available with the INRANGE FC/9000 FICON Directors.

I/O Module (FIO, XCAF FIO and XCAF FIO2)

The main function of the FIO cards are to provide the physical connectivity between the FC/9000 and the external devices being connected to the Director. There are three FIO module cards available:

- FIO Base module:
  - Each Fabric I/O (FIO) module provides eight 1 Gbps user ports, which are managed by an on board processor.
  - The corresponding switching module is a FSW.
  - This module uses SC type connectors.
- XCAF FIO module:
  - The extended credit and addressing facility Fabric I/O (XFIO) module performs the same function like the basic FIO module but has 64 buffer-to-buffer credits to support distances up to 100 km.
  - The corresponding switching module is a FSW.
  - This module uses SC type connectors.

- XCAF FIO2 module:
  - The extended credit and addressing facility Fabric I/O 2 (XFIO2) module provides 128 buffer-to-buffer credits to support distances up to 100 kilometer, FICON addressing and acceptance of 1 Gbps and 2 Gbps speed and two mirror ports. One mirror port is used to monitor the transmit side while the other monitors the receive side.
  - The corresponding switching module is a FWI.
  - This module uses LC type connectors.

The XFIO2 (8-port) module can co-exist with the original 1 Gbps FIO (8-port) modules, supporting an easy transition to the latest Fibre Channel technology.

The 2 Gbps XFIO2 supports both 1- and 2-Gbps fabric devices. The 1 Gbps FIO supports both 1 Gbps fabric and loop devices. Intermixing XFIO2 and FIO on the same Director enables support of 1- and 2-Gbps fabric devices and 1 Gbps FC-AL devices, such as the IBM 3590 and LTO tape.

The front panel of each FIO, XFIO, and XFIO2 card contains some important LED indicators:

- The **OT** LED illuminates red to indicate that the temperature of the module is higher than the acceptable operating temperature ranges.
- The **PWR OK** LED illuminates green to indicate DC power to this module is good
- The **L - A** (Logged in - Activity) LEDs indicate the port status. L-LED illuminates green to indicate when a Fibre Channel device is logged into the port. The A-LED illuminates yellow to indicate data is passing.

  If there is a FWI switch module installed, there are four L - A LEDs available. Two of these are performing the same function as described above, and the other two are signalling as follows:
  - The **L** LED illuminates green to indicate when a Fibre Channel device or an ISL is logged into the port successfully. When the **L** LED illuminates amber in a regular pattern, the port/Director is isolated due to fabric security or, if in FICON mode, the port may be reporting an invalid attachment.

    If the **L** LED illuminates solid amber, the port has been taken offline automatically due to excessive, disruptive traffic on the link.
- The **HEART BEAT** LED illuminates yellow and is toggled on and off every second, indicating that the FIO module is executing its flash code and functioning correctly. Error conditions are indicated by a distinctive blink pattern.

Switching module (FSW)

This switching module provides the physical and logical connectivity between the installed FIO modules. The FSW module provides the middle or cross connect stage of the FC/9000 Director architecture.

Switching module (FWI)

These switching modules perform the same function as the FSW module and are used with the XFIO or XFIO2 modules. FWI modules must be used in support of 2 Gbps speeds and with the 256-port Director.

Control module (FCM)

The control module provides the common command and control interface for the Director and has connection capability to the Enterprise Manager which is used to monitor and control the Director.

Each FCM front panel has six LED indicators to indicate FCM module status and in addition there is a 4-character alphanumeric display.

The same 4-character display is used to display system fault codes. Each code references to a Field Replaceable Unit (FRU) and a specific fault code. The module number and specific fault code is displayed where the fault occurred. The messages are scrolled across the display.

Control module (FCME)
This control module, enhanced, provides the same function as the above mentioned FCM module. In addition, it monitors the node and acts as a proxy for all external communications from the other modules going to the IN-VSN Enterprise Manager. Furthermore, this module has zoning enhancements, as well as, additional memory and processors. The FCME is a critical module within the system and has a redundant FCME module that acts as a hot standby. The FCME must be used in support of 2 Gbps speeds and with the 256-port Director.

Backplane module
The FC/9000 backplane provides the connectivity between all system modules including FIO/XFIO/XFIO2, FSW/FWI, FCM, FCME, power supply assemblies, and fan assemblies. The backplane has the capability to expand the FC/9000 system from 64 ports to 128 ports, from 64 ports to 256 ports, or from 128 ports to 256 ports.

It also has the capability to provide connectivity within the chassis and to other FC/9000 chassis at rates of 1 Gbps and 2 Gbps.

Power supply assembly
The power supply assemblies are located in the front left and right sides at the bottom of each chassis. Each power supply assembly is a removable, hot-swappable unit. Two power assemblies provides the FC/9000 with full redundancy (load sharing) for a single chassis system.

Fan module assembly
Four fan module assemblies, located in the rear of the chassis, provide the cooling capability for the FC/9000 Director. In the event of a single fan failure, the three remaining fans may increase their speeds to a higher operating rpm to compensate for the single fan failure. The fan module assembly is hot-swappable

2.1.4 FICON Director configurations

The FC/9000 FICON Director can be configured in 8-port increments (one module card) with a minimum of 24 ports, to a maximum of 64 ports per chassis.

There are three different models available (see Example 2-2), which consist of:

1. One FC/9000-64 chassis supporting up to 64 ports
2. Two FC/9000-64 chassis stacked in a single cabinet (backplanes are interconnected using special cables), to support up to 128 ports
3. Four FC/9000-64 chassis stacked in two cabinets (backplanes are interconnected using special cables), to support up to 256 ports

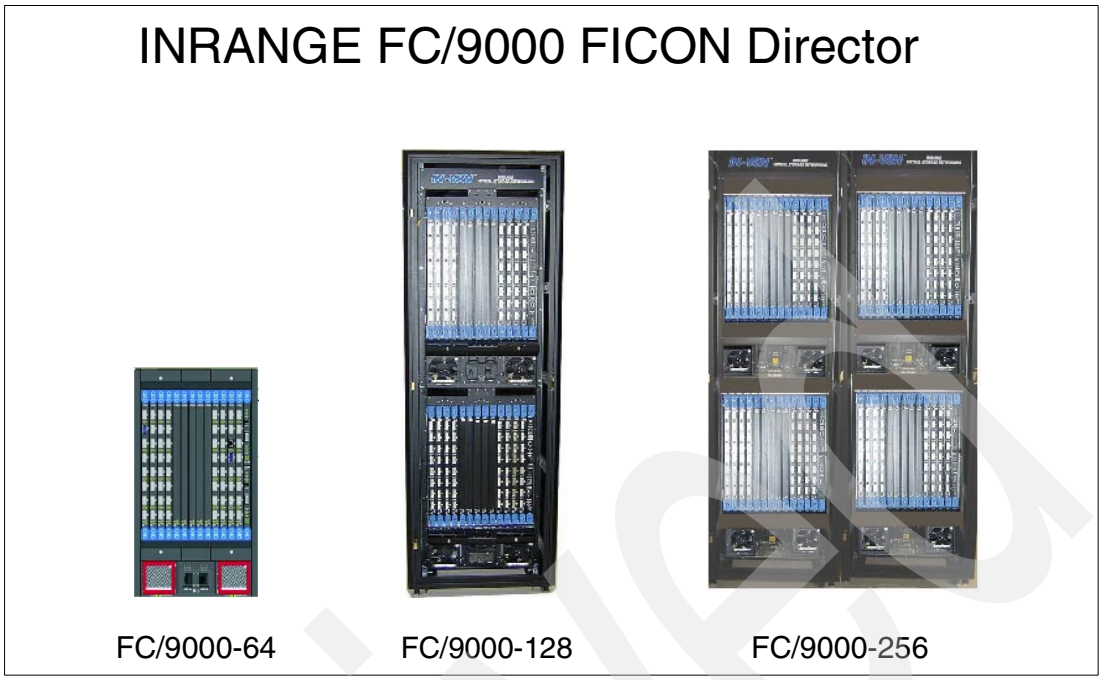

Figure 2-2 INRANGE FC/9000 models

For each FC/9000 FICON Director model, four configuration types are available:

- Basic configuration with 1Gbps ports
- Basic configuration with 2Gbps ports
- High availability configuration with 1 Gbps ports
- High availability configuration with 2 Gbps ports

Table 2-1 shows the different configuration types for each model. The high availability and 256-port models can be ordered with XFIO (1 Gbps) or XFIO2 (1 Gbps/2 Gbps).

Table 2-1 Basic- and high availability configurations

Model	1 Gbps Basic	1 Gbps High Availability	1 Gbps / 2 Gbps Basic	1 Gbps / 2 Gbps High Availability
FC/9000-64	1 Chassis 3 - 8 FIO modules 4 FSW modules 1 FCM module 1 Power Supply ASM 4 Fan ASM	1 Chassis 3 - 8 FIO modules 5 FSW modules 2 FCM modules 2 Power Supply ASM 4 Fan ASM	1 Chassis 3 - 8 XFIO/2 modules 2 FWI modules 1 FCME module 1 Power Supply ASM 4 Fan ASM	1 Chassis 3 - 8 XFIO/2 modules 3 FWI modules 2 FCME modules 2 Power Supply ASM 4 Fan ASM
FC/9000-128	2 Chassis 6 - 16 FIO modules 8 FSW modules 2 FCM modules 2 Power Supply ASM 8 Fan ASM	2 Chassis 6 - 16 FIO modules 9 FSW modules 4 FCM modules 4 Power Supply ASM 8 Fan ASM	2 Chassis 6 - 16 XFIO/2 modules 4 FWI modules 2 FCME modules 2 Power Supply ASM 8 Fan ASM	2 Chassis 6 - 16 XFIO/2 modules 5 FWI modules 4 FCME modules 4 Power Supply ASM 8 Fan ASM
FC/9000-256	4 Chassis 6 - 32 XFIO/2 modules 8 FWI modules 4 FCM modules 4 Power Supply ASM 16 Fan ASM	4 Chassis 6 - 32 XFIO/2 modules 9 FWI modules 8 FCM modules 8 Power Supply ASM 16 Fan ASM	4 Chassis 6 - 32 XFIO/2 modules 8 FWI modules 4 FCME modules 4 Power Supply ASM 16 Fan SM	4 Chassis 6 - 32 XFIO/2 modules 9 FWI modules 8 FCME modules 8 Power Supply ASM 16 Fan ASM

It is recommended to have two separate, independent, and uninterruptable power sources and circuit brakers for the FC/9000 Directors, and using a high-availability configuration.

The FC/9000 FICON Director offers multiple configuration options for FICON connectivity. The FIO ports are served by GBICs or SFFs (LC-Duplex type), dependent if 1 Gbps or 2 Gbps cards are used. These components contain the transmitter and receiver so that they can send and receive optical signals to and from other switches or devices. The signals are converted by the SFF or GBIC into electrical signals that are processed by the unit. Electrical signals coming from the unit are converted into optical signals.

There are two different GBICs available, which can be plugged into the FIO ports, to meet the following zSeries and 9672 G5/G6 FICON channel configuration options:

- LX — Long wavelength laser (1300 nm), single mode fiber (9 micron), LC-Duplex connector
  - Distance: Up to 10 km unrepeated
- LX — Long wavelength laser (1300 nm), multimode fiber (50 or 62.5 micron), LC-Duplex connector, and Mode Conditioning Patch (MCP) cables.
  - Distance: 550 meters (maximum)
- SX — Short wavelength laser (850 nm), multimode fiber (50 or 62.5 micron), LC-Duplex connector
  - Distance: 500 meters maximum using 50 micron fiber cables
    300 meters maximum using 62.5 micron fiber cables

For more information on the zSeries and 9672 G5/G6 FICON channel support, refer to “FICON channel support for zSeries and 9672 G5/G6 servers” on page 32.

All ports in the FC/9000 Directors function either as F_Ports, E_Ports, or FL_Ports (not support with FICON). When the E_Port attaches to an end device’s node port (N_Port) it automatically functions as an F_Port (Self-Discovering/Self Configuring port).

2.2 IN-VSN Enterprise Manager (EM)

The designated IN-VSN Enterprise Manager (EM) workstation is not a physical part of the INRANGE FC/9000 FICON Director, but an integral part of the operation. This workstation is where the IN-VSN Enterprise Manager software is installed.

There are a number of different ways in which the IN-VSN EM software can be delivered:

- If software Feature Code 7600 is ordered, the workstation package will include a PC, Monitor, Ethernet hub, and modem. The management software comes pre-installed on the PC. Additional cables can be ordered with this feature code.
- If more than one version of the IN-VSN EM client code is needed, and/or monitoring and controlling the FC/9000 from the corporate network is required, then this is achieved by using Feature Code 7201.
- If no additional software feature codes are ordered together with the INRANGE FICON Director, you will receive a CD that contains the IN-VSN EM server and EM client code. This CD is only licensed for one copy of the server and one copy of the EM client.

2.2.1 PC hardware for IN-VSN EM server

The EM server and EM client can be installed on a customer owned and designated PC, as long as it meets with the following minimum recommended specifications:

- An IBM Pentium III PC or an IBM-Compatible Pentium III PC
- 500 MHz processor
- 128 MB SDRAM
- 4 MB Video RAM
- 13 GB hard drive
- 1.44 MB diskette drive
- CD-ROM
- 1 parallel port
- 1 Ethernet 10Base-T/100 Base-TX
- IBM or equivalent mouse
- 2 external serial com ports (debug serial cable, external modem)
- 1 internal com port (internal modem)
- 17-inch 1280 x 1024 x 256 SVGA monitor
- Windows NT 4.0 with Service Pack 6a and higher or Windows 2000 Professional
- Internal and External modem compatibility
- Analog protocol support: V.90 56kb/s ITU Standard, 3Com/US Robotic/Multi-Tech (international) hardware compatible modems recommended (do not use Win modem software controlled modems)

Note: The IN-VSN EM software can only run under Windows operating systems.

IN-VSN EM server and EM client software

Both the IN-VSN EM server and EM client require the following programs from the installation CD:

- Use j2re1_4_0-win.exe to install the required Java programs
- Use setup.exe to install the IN-VSN server and/or the IN-VSN client software

For systems that run the IN-VSN server code, the following driver must be installed:

- odbcinst.exe

All of the required programs are available on the supplied CD, which comes with the FC/9000 FICON Directors.

Detailed installation steps are described in Chapter 4, “Setting up the IN-VSN Enterprise Manager environment” on page 35.

2.3 FICON cascading activation feature

If you intend to establish a cascaded FICON Directors environment it is mandatory that the two Directors are put into a High Integrity Fabric. To do this, Feature Code 7203 (FICON cascading activation feature) has to be enabled. This feature includes Fabric Binding and Insistent Domain ID functions, as part of *Fabric Security*.

Note: Be aware that the FICON Directors used for a cascaded environment must be from the same vendor, and both must be at the same firmware level.

During channel initialization, if connected to a cascaded environment, it will be checked to ensure that Fabric Security is enabled, by using a new channel command (Query Security Attributes). If the feature is not present or enabled, channel initialization will not continue.

“Activating the High Integrity feature” on page 47 describes how to establish Fabric Binding and Insistent Domain ID functions.

2.4 Control Unit Port (CUP)

The Control Unit Port (CUP) is supported by the INRANGE FC/9000 FICON Director, and is known as FICON Management Server. This feature is an additional option and must be ordered separately (Feature Code 7202). The CUP function allows z/OS or OS/390 to manage the FICON Director with the same level of control and security as it is known from an ESCON Director.

Host communication includes control functions like blocking/unblocking ports as well as monitoring and error reporting functions.

Note: The INRANGE FICON Director must be defined in the IOCP as device type 2032 for this function to work.

System Automation (SA) I/O-Ops V2.1 includes support for FICON Native (FC) channels and FICON Directors. APAR OW47972 is required to correct a problem with the FICON Director support.

SA I/O-Ops V1.3 adds support for FICON Native (FC) channels and FICON Directors with APAR OW40040 (PTFs UW69057 for RA30 and UW69058 for RA3U). APAR OW48434 is also recommended.

Before using I/O-Ops within a FICON configuration, check the latest maintenance recommendations in the product’s PSB buckets:

Table 2-2 SA OS/390 I/O-Ops PSP buckets

Upgrade	Subset
HKYS100	HKYS100
JKYS103	JKYS103

For additional z/OS and OS/390 information, refer to the *FICON Native Implementation and Reference Guide,* SG24-6266.

3

Pre-installation planning

This chapter provides information and recommendations for planning the installation of an INRANGE FC/9000 FICON Director for attachment to FICON or FICON Express channels on zSeries and 9672 G5/G6 servers.

The following topics are covered in this chapter:

- Planning considerations
- Physical port layout
- IP addressing
- Switch numbering
- Fabric binding and Insistent Domain IDs
- Zoning
- Cables and connectors
- zSeries and 9672 G5/G6 FICON channel support

3.1 Planning considerations

The following items should be considered during the installation planning phase of the INRANGE FC/9000 FICON Directors:

- Which topology will be implemented?
  - Switched point-to-point topology. For a more detailed explanation of this topology, refer to “Switched point-to-point configuration” on page 6.
  - Cascaded FICON Directors topology. For a more detailed explanation of this topology, refer to “Cascaded FICON Director configuration” on page 7.
  - A mix of both switched point-to-point and cascaded FICON Directors.
- How many channels and control unit (CU) ports will be connected to each FICON Director?
  - The number of channels and CU ports to be connected to each Director depends on the number of FICON channels on the server(s) and CU ports on the devices, as well as the individual performance, availability, and growth requirements.
- How should the channels, CU ports, and/or Inter-Switch links (ISLs) be distributed among the FIO/FIO2 cards in the Director(s)?
  - Each FICON Director layout should satisfy all availability, performance, and growth requirements. Refer to “Physical port layout” on page 23.
- Should the Switch IDs in the IOCP definitions and switch addresses in the FICON Directors match?
  - We recommend using the same IDs/addresses in both places to avoid any potential errors that could be caused by having two different values.
- Should zoning be used to separate specific channels and CU ports from other connected channels and CU ports?
  - Zoning is recommended if there is a requirement to prevent random access to confidential data (see “Zoning” on page 30).

Important: Zoning is highly recommended in a mixed environment with FICON and FCP devices connected to the same Director. Protocol intermix is expected to be available for zSeries servers during the first half of 2003.

- Should the FICON Director(s) and the Enterprise Manager (EM) workstation be connected to a separate LAN or to the corporate network?
  - The Director(s) and EM workstation should always be interconnected on a separate LAN, known as the service LAN to isolate Director management traffic from other IP traffic. However, if remote access is required to operate and maintain the FICON Director(s), then we recommend that the EM workstation be connected to the corporate network via a second LAN adapter. Refer to “IP addressing and connectivity” on page 23.
- What are my fiber optic cabling requirements?
  - Can the existing fiber optic cables, patch panels and trunk cables be reused?
  - Are Mode Conditioning Patch (MCP) cables and/or conversion kits required?
  - Is there a link distance constraint?

  Refer to “Cables and connectors” on page 32 and “FICON channel support for zSeries and 9672 G5/G6 servers” on page 32 for more information.

3.2 Physical port layout

Before installing the FICON Director, consider where to connect your FICON channels from the server and the control unit ports, as well as the ISLs (if applicable), based on your requirements.

- Distribute the channels among different FIO/FIO2 cards.

  If two channels are defined to access the same CU, plug both fiber optic cables into different FIO/FIO2 cards in the Director (for example, Slot 0/Port 00 and Slot 1/Port 08).

- Distribute the CU ports among different FIO/FIO2 cards.

  If two paths are defined to attach the CU to the server via the Director, then connect both fiber optic cables to ports on different cards (for example, Slot 0/Port 01 and Slot 1/Port 09).

- Distribute the ISLs across different FIO/FIO2 cards.

  If two or more ISLs are to be attached between the Directors, then connect the fiber optic cables to ports on different cards (for example, Slot 0/Port 03, Slot 1/Port 0B, Slot 2/Port 13, and so on).

- If more than one Chassis is available (>64 ports) consider distributing the fiber optic cables among two or more Chassis in the Director.

Following these rules will ensure that there is always one path available between the server and the CU in case of a defective FIO/FIO2 card in the Director. For additional information pertaining to the port allocation of the INRANGE FC/9000 Director(s), go to:

`http://www.inrange.com`

Refer to Appendix B, “Chassis and port location” on page 77 for Physical Port Addresses and Port Locations on the FIO/FIO2 card in Chassis #1 through Chassis #4.

In Appendix C, “FICON Director configuration worksheet” on page 83, you will find a worksheet to help with documenting the physical layout of your FICON Director(s).

3.3 IP addressing and connectivity

For controlling and maintaining the INRANGE FICON Director two FCM modules in the chassis have connectivity to the INRANGE Enterprise Manager console via an Ethernet LAN, known as the service LAN. An Ethernet hub is shipped together with the FICON Director which can be used to interconnect the FCM modules and the Enterprise Manager console.

If the FICON Director and the Enterprise Manager console are to be connected to a corporate network instead of the service LAN, then their IP addresses and subnetwork mask have to conform to the IP addressing standard used in the corporate network. Refer to “Altering IP address in FCM module” on page 70.

For the FICON Directors with more than one chassis (more than 64 ports) only two FCM modules in chassis #1 (also known as Port Block 1), are connected to the service LAN. Refer to Appendix , “Chassis location” on page 78 for chassis numbering.

All other FCM modules in other chassis will have no Ethernet connection, however, they will still have an IP address. Although these FCM modules are not connected to the service LAN we recommend altering the IP addresses in these cards to the same IP address range as the FCM modules in chassis #1. That way, if FCM modules have to be swapped for any reason, they will have a proper IP address and subnetwork mask.

The following IP addresses are reserved for internal communication in the FC/9000 and must *not* be used for the FCM modules:

- 10.1.1.x to 10.1.4.x
- 10.2.1.x to 10.2.4.X

The subnet mask must be set to 255.255.255.0 to ensure that these subnetworks are isolated.

The recommended network configuration for the FICON Director(s), Enterprise Manager console, and EM client workstation is shown in Figure 3-1.

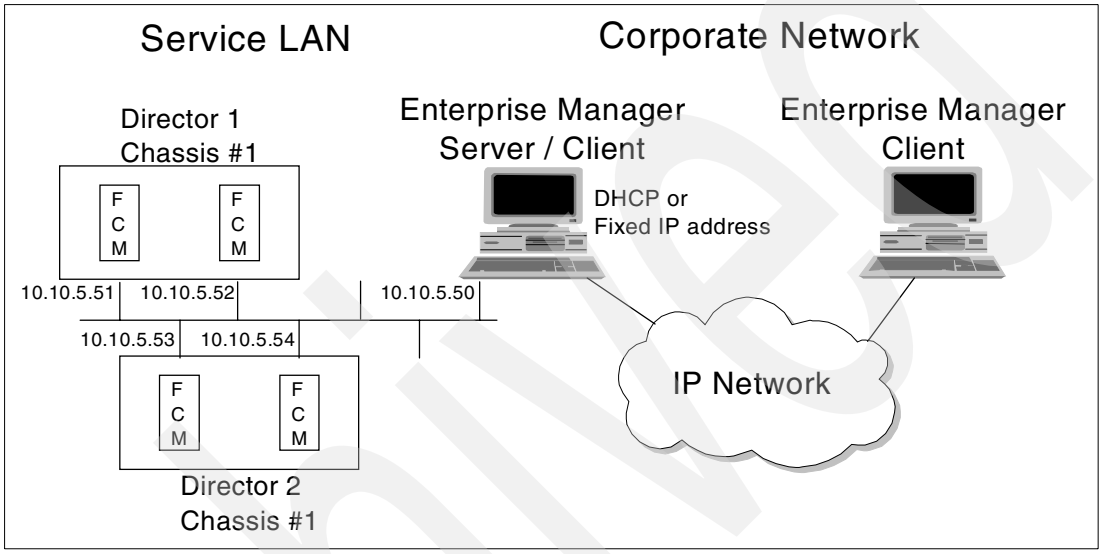

Figure 3-1 Recommended network connections

In this configuration, the Enterprise Manager console has two Ethernet adapters installed, one to connect the console with the FICON Director via the service LAN and the second to provide connectivity to the EM client workstation via the corporate network for remote access to the FICON Director(s).

If multiple FICON Directors are connected to the same service LAN, it is required to alter the IP address of the FICON Directors. Refer to “Altering IP address in FCM module” on page 70.

Figure 3-2 shows an IN-VSN Enterprise Manager display of the actual IP address of an FICON Director.

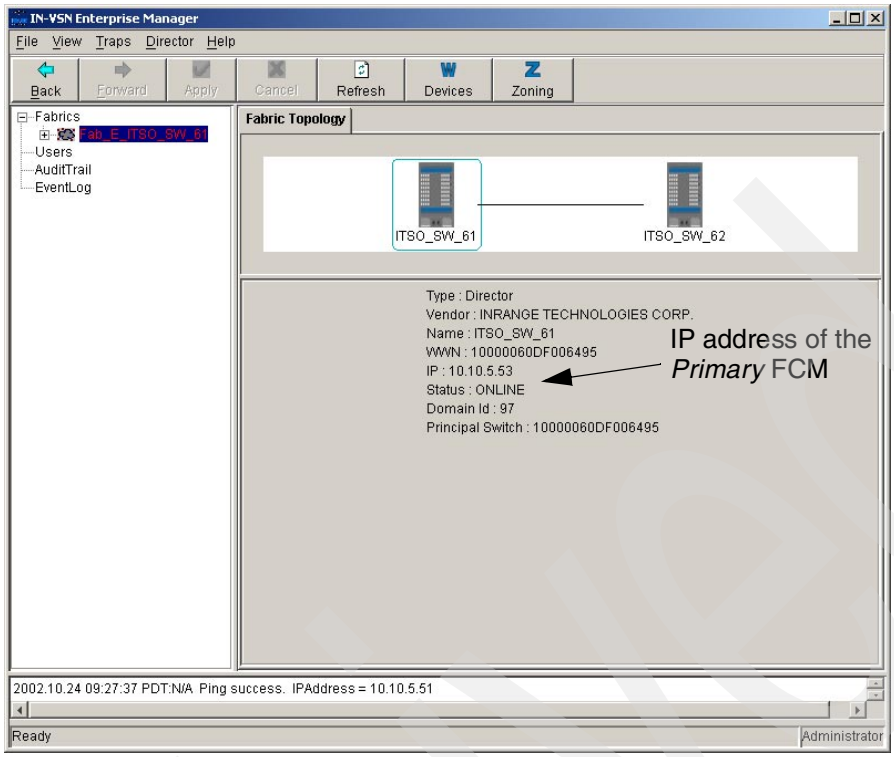

Figure 3-2 Display IP address of FICON Director

Chapter 4, “Setting up the IN-VSN Enterprise Manager environment” on page 35 describes the necessary steps for setting up the EM environment.

3.4 Switch numbering

Each FICON Director in a fabric must have a unique switch address (Domain ID) and a unique Switch ID. This Switch ID is used in IOCDS to define the link between the FICON channel and CU. The Switch ID can be any value between x’00” to x’FF’, while the switch address range may be restricted by the FICON Director firmware.

The valid switch address range for the INRANGE FC/9000 is between x‘01’ to x’EF’ (1-239). Ensure that the switch ID of the FICON Director is not outside this range when defining the Switch ID and link addresses in the IOCP definitions.

It is important to point out that some definition terms used in the IOCP and HCD are carried over from the ESCON environment. An example of the terms used and how they relate to the FICON environment are shown in Figure 3-3.

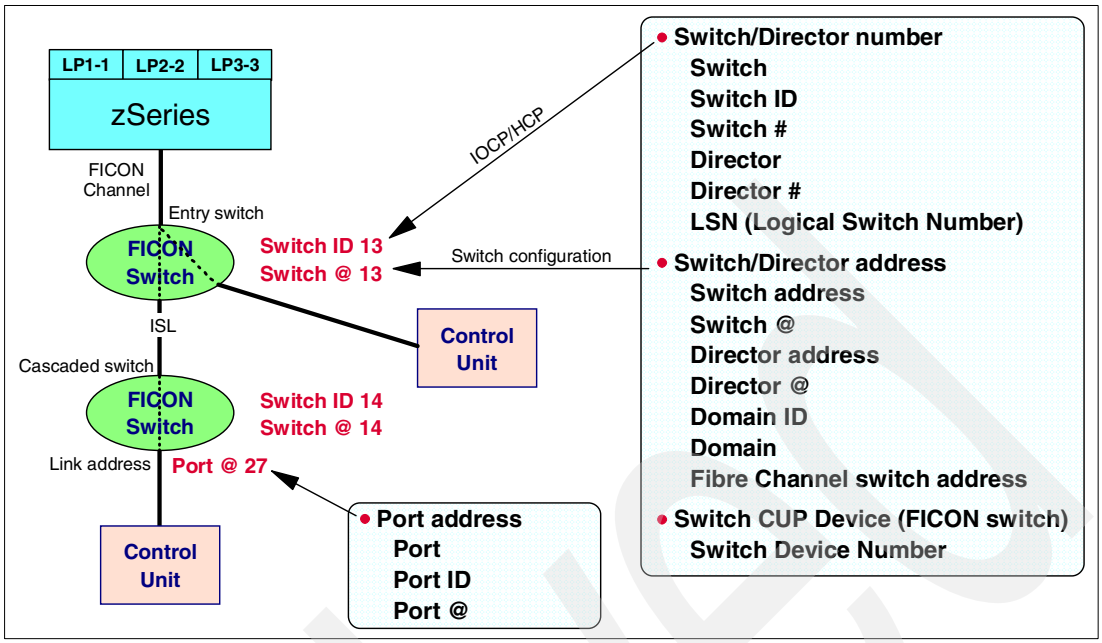

Figure 3-3 Term usage with FICON Directors

- The Switch ID has to be assigned by the user and must be unique within the scope of the definitions (IOCP and HCD).
- The switch address is assigned by the manufacturer and may be customized to a different value and must be unique within the fabric.

We recommend that the Switch ID be set to the same value as the switch address of the FICON Director, which is defined to the FICON Director at installation time. This will simplify the configuration and reduce confusion by having a common designation across all definitions.

Note: These rules should be followed not only for a cascaded FICON Director configuration, but also for a switched-point-to-point configuration. If any single switch is to be merged into a fabric in the future, there will be no need to change the switch address (Domain ID) setting, which is a disruptive action.

While the switch ID in the CHPID statement is a logical switch number and defines the entry point to the fabric, the link address in the CNTLUNIT statement points to the exit port of the fabric.

In a switched point-to-point configuration shown in Figure 3-4, the logical switch number is used in IOCP to define the entry point to the fabric. This is done using the SWITCH keyword. For the exit port, a 1-byte link address value must be defined with the LINK keyword. This value is the FICON Director port address of the physical port that the CU is attached to.

Important: It is possible to define a 2-byte link address (switch address and port address). However, the FICON Director must have the Fabric Binding and Insistent Domain ID feature installed and configured. Refer to “Binding and Insistent Domain IDs” on page 29 for more details.

Also, once a 2-byte link address is defined to a channel path, all link addresses defined to be accessed from that same channel path must be 2-byte link addresses.

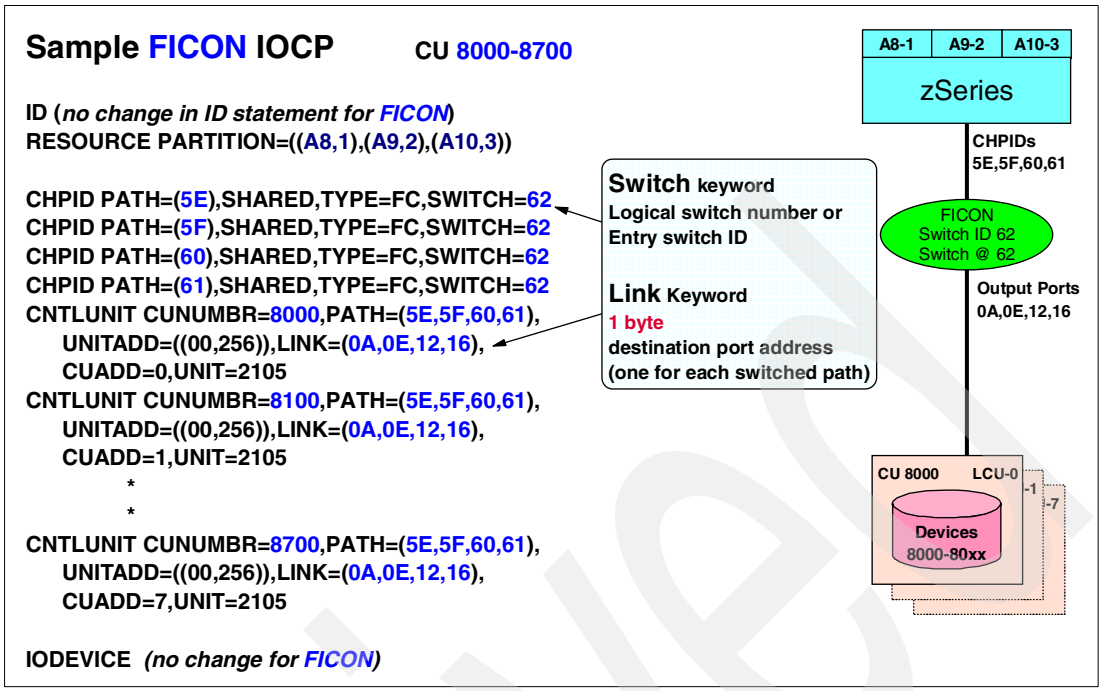

Figure 3-4 Sample IOCP coding for switched point-to-point configuration

For a cascaded switch configuration, refer to Figure 3-5 for the relation between Switch IDs and link address definitions in the IOCDS and the switch address settings in the FICON Director. For the exit port, you must define a 2-byte link address value (destination switch address and port address) in the LINK keyword.

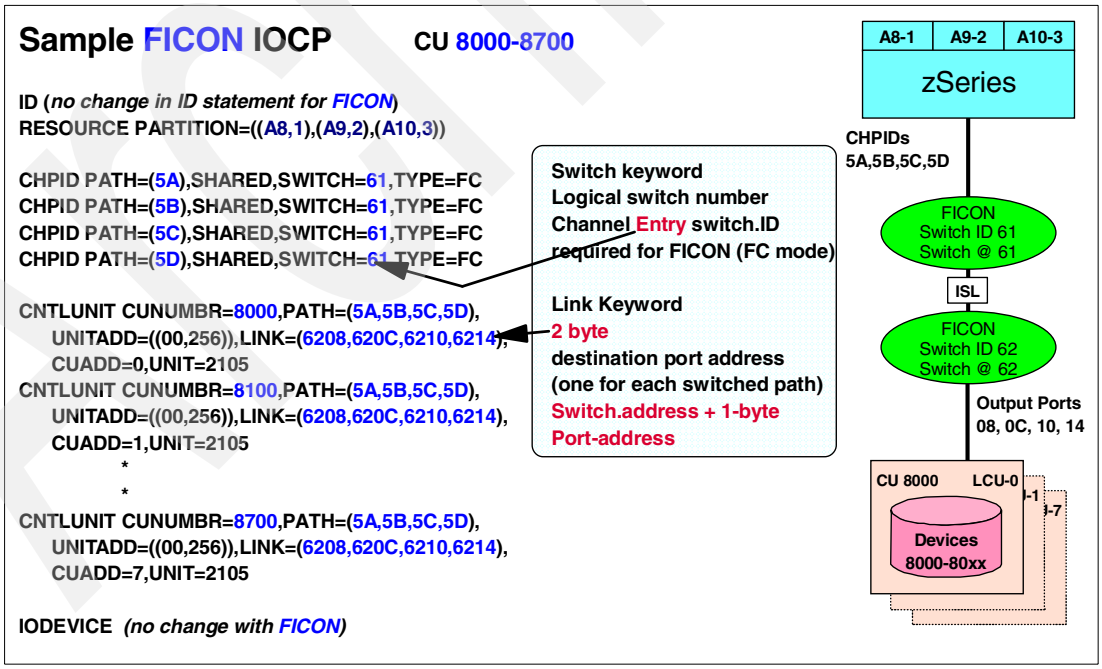

Figure 3-5 Sample IOCP coding for cascaded FICON Directors configuration

During installation of the FICON Director, a valid switch address has to be assigned. The Director has a defined switch address which can be altered to match the customer requirements.

Figure 3-6 shows the System Configuration panel where the switch address (Director Domain ID) can be altered. This value has to be entered in decimal and is calculated to hexadecimal by the application.

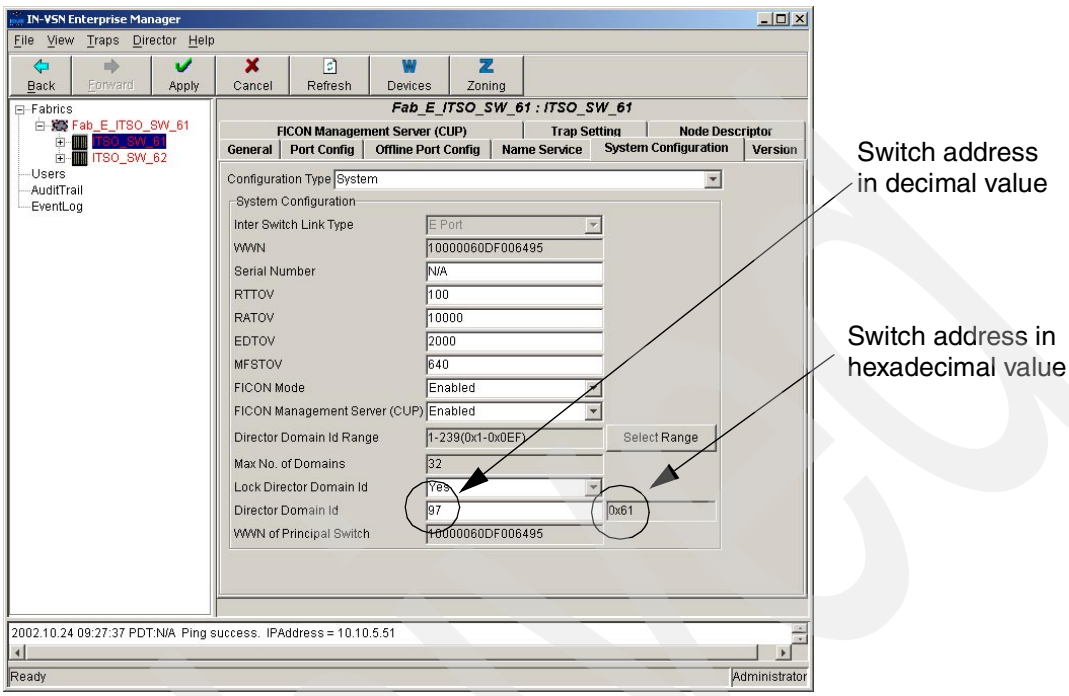

Figure 3-6 System Configuration screen

Keep in mind that, even though the switch address (Director Domain ID) is entered as a decimal value, the hexadecimal value is used. The valid address range for the INRANGE FC/9000 Directors is between x'01' to x'EF' (1-239). The hexadecimal value specified for the Director Domain ID is used in the HCD/IOCP definitions.

Inter-Switch Links (ISLs) defined to HCD

If HCD is used to build the IOCDS, we suggest that the ports used for ISLs be marked as "occupied" in HCD. This prevents accidental attempts to define these ports to channels or CUs.

If you are not familiar with HCD, refer to the *Input/Output Configuration Program Users Guide* at:

`http://www.ibm.com/servers/resourcelink`

An example for this new function in HCD is shown in Figure 3-7.

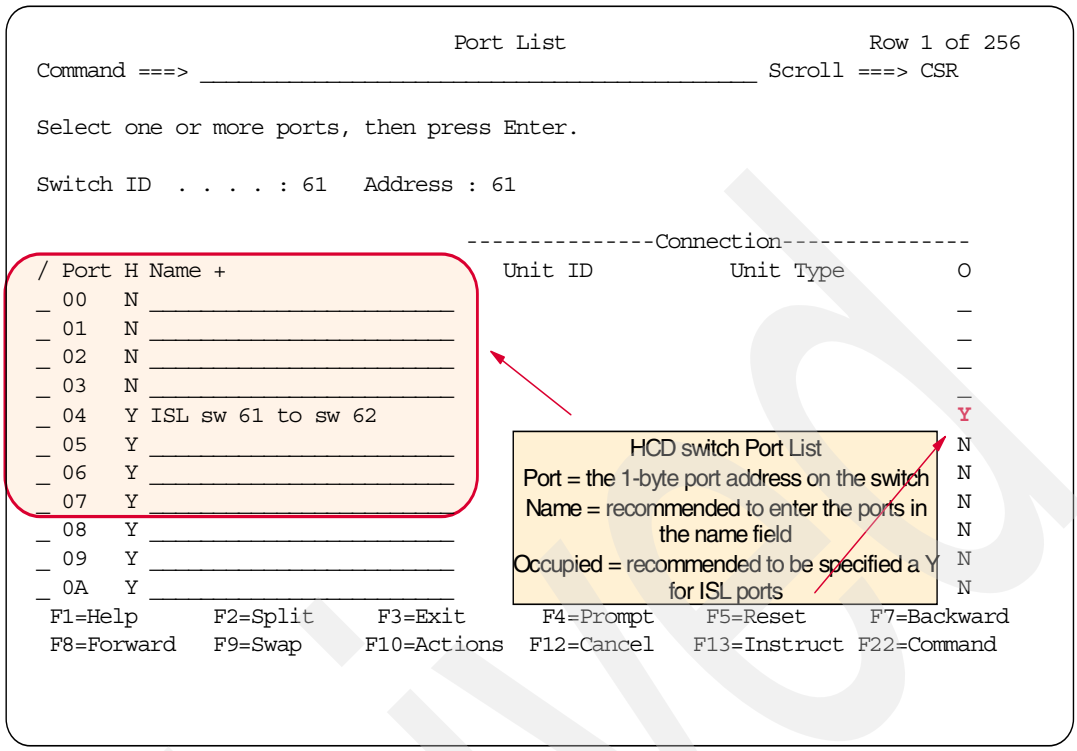

Figure 3-7 Mark ISL ports as "occupied" in HCD

3.5 Binding and Insistent Domain IDs

Insistent Domain IDs prohibit the use of dynamic Domain IDs to ensure that predictable Domain IDs are enforced within the fabric. For example, if a switch has this feature enabled and a new switch is connected to it (via an ISL) without the preferred Domain ID, then the new switch is segmented into a separate fabric and user data will not flow.

Fabric binding

FICON Directors that are allowed to connect to the fabric must be added to the fabric *membership list* of each FICON Director within the fabric. The fabric membership list is composed of the WWNN and Domain ID of each FICON Director permitted to communicate within the fabric.

Exchanging fabric membership data is a Switch Fabric Internal Link Service (SW_ILS). The fabric membership list is exchanged between connected switches in the fabric before path selection is started.

If an unauthorized FICON Director port (E_Port) is attached to another Director, then the port between the two switches will be placed in an "Invalid Attachment" state.

Fabric binding is a software-enforced security feature that permits an administrator to control the switch composition of a fabric by explicitly defining which switches are capable of forming a fabric. Thus an operator is able to prevent non-authorized switches access into a fabric. A non-authorized switch attempting to gain entry into a fabric becomes isolated by embedded software. Fabric binding also validates that the formation about any inter-switch link (ISL) between previously unconnected switches is not restricted. If the establishment of the ISL is not authorized, the link is isolated and the state of the associated E_Port is updated to reflect the "Invalid Attachment".

In addition to ISL verification, fabric binding provides in-band propagation of fabric membership data updates to all switches within a fabric, thus ensuring a consistent and unified behavior across all potential fabric access points.

When an ISL becomes available the switch on either end of the fiber may verify that fabric binding and insistent Domain ID are supported and enabled on the adjacent switch. If both sides of the ISL support fabric binding, each switch verifies that the newly-connected neighbor switch and all switches in the adjacent fabric (of which the neighbor switch is a member) are authorized to form a fabric or expand the current fabric. If authorization is not granted, the switch on which the authorization check failed isolates the link and sets the corresponding port state to “Invalid Attachment”.

Figure 3-8 shows a cascaded FICON Director environment with high integrity. The FICON Director prevents FC frames (user-data streams) from being delivered to the wrong destination if cables are incorrectly connected.

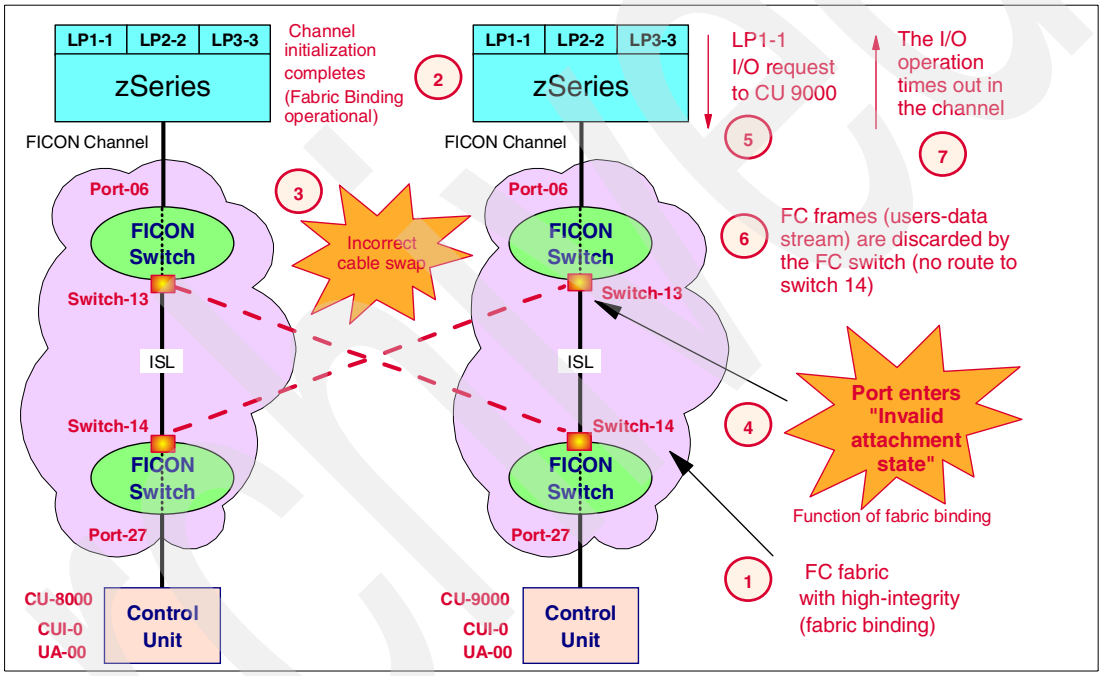

Figure 3-8 Cascaded FICON Directors with Fabric Binding and Insistent Domain IDs

Restriction: Fabric binding is required for FICON support of cascaded Director, and switched point-to-point configuration when a 2-byte link address is used.

3.6 Zoning

Zoning is a method used in the Director to enable or disable communication between different attached devices based on WWN. You can put a group WWNs into the same zone to enable communication only between those devices. There are good reasons to zone, for example:

- To prevent non-FICON-capable devices from seeing FICON-capable devices
- To limit the access to devices with confidential data to specific servers
- To control the amount of paths between servers and devices
- In an intermixed environment, restrict FCP traffic from accessing FICON-capable devices

Several zones can be included in one zone set. An active zone set is valid for all Directors belonging to the same fabric.

Only one zone set can be active in a fabric at a time. Although more than one zone set can be defined in a switch.

For a better understanding of zoning, refer to the configuration example in Figure 3-9.

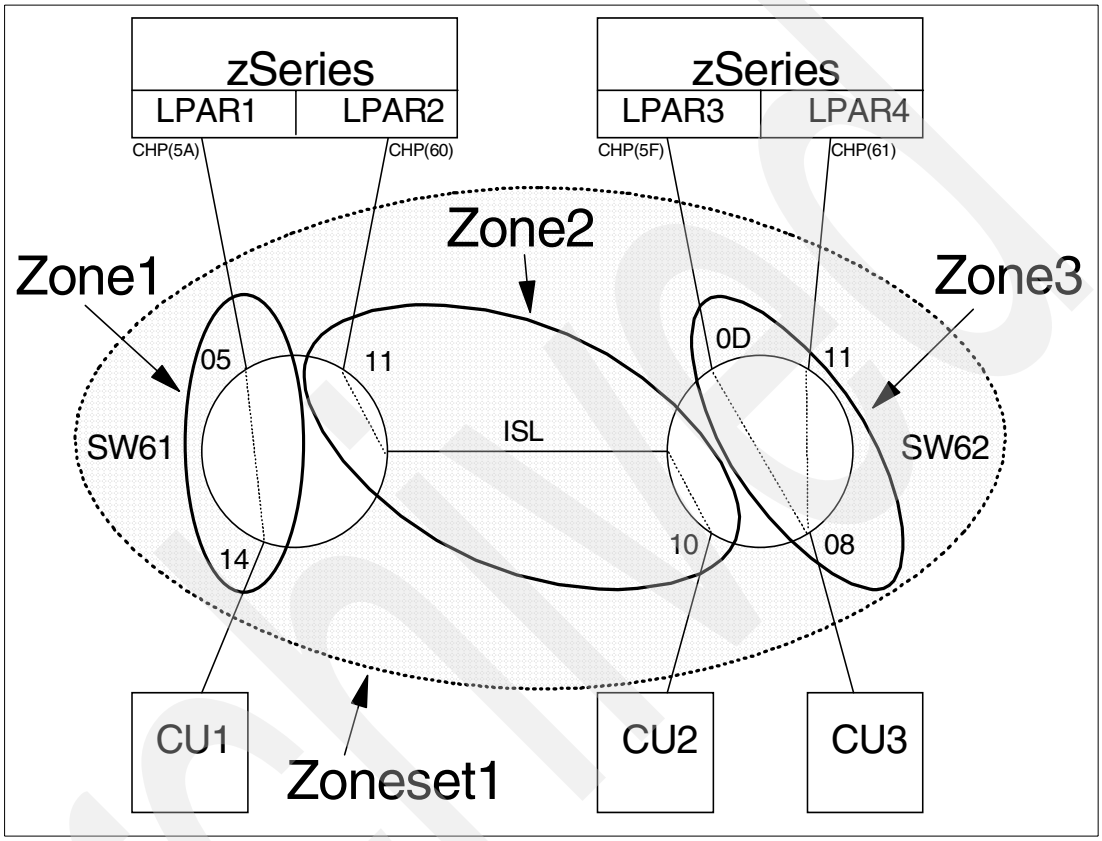

Figure 3-9 Configuration example of zoning

In this example we have several LPARs with paths to different CUs via two FICON Directors. Each LPAR must get access only to a specific CU and no access to CUs belonging to other partitions.

To prevent intended access by others, we have grouped the WWNs belonging to the LPARs and CUs into zones. There are three zones defined as follows:

Zone1 Zone1 has the WWNs of LPAR1 and CU1, which are connected to ports 05 and 14 in SW61.

Zone2 Zone2 has the WWNs of LPAR2 and CU2, which are connected to port 11 in SW61 and port 10 in SW62, respectively.

Zone3 Zone3 has the WWNs of LPAR3, LPAR4 and CU3, which are connected to ports 0D, 11, and 08 in SW62, respectively.

All three zones are added into Zoneset1.

The link between both Directors (ISL) is transparent in the path between LPAR2 and CU2.

3.7 Cables and connectors

Considerations for fiber optic cables and connectors depend on the environment. If there are existing fiber optic cables in the environment, consider reusing these cables rather than installing new ones.

The required distance between the FICON channel and the FICON CU has to be considered. Refer to Table 3-3 on page 33 for zSeries and 9276 G5/G6 FICON Channel distance specifications.

Conversion kits may be required if the connectors are of differing types (LC Duplex, SC Duplex, or ESCON Duplex).

When connecting a single mode port of the Director to an existing multimode cable, mode conditioning patch (MCP) cables are required at both ends of the existing multimode fiber optic cable. Verify the MCP cable type (connector, receptacle, and fiber (50 or 62.5 micron)), needed.

Note: With a FICON channel, MCP cables can *only* be used with a link data rate of 1 Gbps (100 MBps). Hence, a link data rate of 2 Gbps is not supported with MCP cables.

3.8 FICON channel support for zSeries and 9672 G5/G6 servers

There are two types of FICON features available: FICON and FICON Express. Both types support a long wavelength (LX) laser version and a short wavelength (SX) laser version for the transceiver.

The z900 is the only server that supports both types of FICON features. However, for new z900 configurations only the FICON Express features is orderable. The z800 family only supports the FICON Express features, whereas the 9672 G5/G6 servers only support the FICON features.

FICON and FICON Express features

Table 3-1 lists the FICON and FICON Express feature codes with the appropriate laser type (short wavelength (SX) or long wavelength (LX)), number of ports per card, and the server type that supports them.

Table 3-1 FICON and FICON Express feature codes

Feature Code	Ports per adapter	9672 G5/G6	z900[a]	z800[b]
FC 2314 (FICON LX)	one	X		
FC 2316 (FICON SX)	one	X		
FC 2315 (FICON LX)[c]	two		X	
FC 2318 (FICON SX)[c]	two		X	
FC 2319 (FICON Express LX)	two		X	X
FC 2320 (FICON Express SX)	two		X	X

a. Can intermix FICON and FICON Express cards at driver level 3C or later.
b. Only supports FICON Express cards.
c. Can no longer be ordered.

Table 3-2 maps the supported FICON topologies to their corresponding FICON and FICON Express feature codes.

Table 3-2 FICON topologies with supported FICON and FICON Express feature codes

FICON topology	FC 2314	FC 2316	FC 2315	FC 2318	FC 2319[a]	FC 2320[a]
Switched point-to-point	Yes	Yes	Yes	Yes	Yes	Yes
Cascaded FICON Directors	No	No	Yes[b]	Yes[b]	Yes[c]	Yes[c]

a. Auto-negotiate (2 Gbps) support
b. LIC CC needed to be enabled
c. DRV3G with MCL(J11206) or later must be applied

Check with your local service representative to ensure that your zSeries or 9672 G5/G6 server has the required code levels.

3.8.1 FICON channel distances

The distance supported by the zSeries FICON features is dependent upon the transceiver (LX or SX), the fiber being used (9 micron single mode, or 50 micron or 62.5 micron multimode), and the speed at which the feature is operating. A FICON Express feature supports a link data rate of 1 Gbps or 2 Gbps. A FICON feature supports a link data rate of 1 Gbps. Table 3-3 shows the distance impacts and the link budget impacts of high data rates.

In Table 3-3, a link is a physical connection over a transmission medium (fiber) used between an optical transmitter and an optical receiver. The Maximum Allowable Link Loss, or link budget, is the maximum amount of link attenuation (loss of light), expressed in decibels (dB), that can occur without causing a possible failure condition (bit errors). Note that as the link data rate increases, the unrepeated distance and link loss budget decreases when using multimode fiber.

These numbers reflect the Fibre Channel Physical Interface specification. The link budget is derived from combining the channel insertion loss budget with the unallocated link margin budget. The link budget numbers have been rounded to the nearest tenth of a dB.

Table 3-3 FICON channel distance specifications

		1 Gbps link		2 Gbps link	
Fiber type	**Light source (nanometers)**	**Unrepeated distance**	**Link budget**	**Unrepeated distance**	**Link budget**
9 micron single mode	LX laser (1300 nm)	10 km[a] (6.2 miles)	7.8 dB	10 km[b] (6.2 miles)	7.8 dB
50 micron[c] multimode	LX laser (1300 nm)	550 meters (1804 feet)	5 dB	Not supported	N/A
62.5 micron[c] multimode	LX laser (1300 nm)	550 meters (1804 feet)	5 dB	Not supported	N/A
50 micron multimode	SX laser (850 nm)	500 meters (1640 feet)	3.8 dB	300 meters (984 feet)	2.8 dB
62.5 micron multimode	SX laser (850 nm)	250 meters (820 feet)	2.8 dB	120 meters (394 feet)	2.2 dB

a. An RPQ is available to extend the maximum unrepeated distance up to 20 km
b. An RPQ is available to extend the maximum unrepeated distance up to 12 km
c. Mode conditioning patch (MCP) cables are required

For more information, refer to *Fiber Optic Link Planning,* GA23-0367.

For all FICON features using repeaters, the end-to-end distance between the FICON channel and the FICON Director port can be up to 100 km. The same end-to-end distance is also available between the FICON Director port and the control unit port. However, the overall end-to-end distance between the FICON channel and control unit should not exceed 100 km.

3.8.2 FICON channel to control unit characteristics

The control unit vendor must provide all the control unit addressing and connectivity characteristics, as these affect how the control unit can be configured in a FICON environment. The control unit vendor should also provide connectivity recommendations to allow the full exploitation of the control unit capability in a FICON environment.

The following items are dependent on the control unit characteristics:

- Number of installed FICON adapters at the control unit
- Number of logical paths supported by the control unit at each FICON adapter
- Number of logical paths supported by the control unit, when there is only one control unit function within the physical control unit
- Number of logical paths supported by each logical control unit within a physical control unit
- Number of logical control units supported and the LCU address for each LCU
- Number of concurrent I/O transfers per physical control unit
- Number of concurrent I/O transfers per logical control unit
- Number of devices and device unit addresses (UAs) supported per logical control unit

  Some devices may be supported by more than one unit address (UA), each device unit address being supported by a different device number (this is the case for the IBM ESS control unit that supports Base and Alias device addresses). This function is known as Parallel Access Volumes (PAV).
- For each LCU, the base device unit address (UA) and address range per LCU

4

Setting up the IN-VSN Enterprise Manager environment

This chapter describes how to set up the IN-VSN Enterprise Manager (EM) environment.

The following topics are covered:

- Installing the EM console
- Checking and altering the FICON Director IP address
- Checking the version of EM application
- Connecting the FICON Directors and EM console
- Defining the FICON Directors to the EM console
- Checking the firmware version of FICON Director
- Examples of EM client usage options

4.1 Installation and setup

The first steps to install the INRANGE FC/9000 FICON Director are described in the installation instructions shipped with the machine. The instructions will guide you through the following steps:

- Unpacking the FICON Director
- Connecting the FICON Director to power
- Powering on the FICON Director
- Unpacking and installing the EM console

Once these steps are completed, the following steps can be used to help you through the setup process of the IN-VSN Enterprise Manager (EM) environment.

Step 1. Checking and altering the pre-defined IP address

Before connecting the FICON Director and the Enterprise Manger console to the service LAN, check the predefined IP addresses. As soon as the FICON Director is powered on, the IP address is displayed on the small status panel on each FCM module. The initial display for the FICON Director is as follows:

```
FC/9000-64 [Ext. IP: 10.1.5.50] (Ch1) [Offl]
```

Figure 4-1 shows where the FCM module status panels are located.

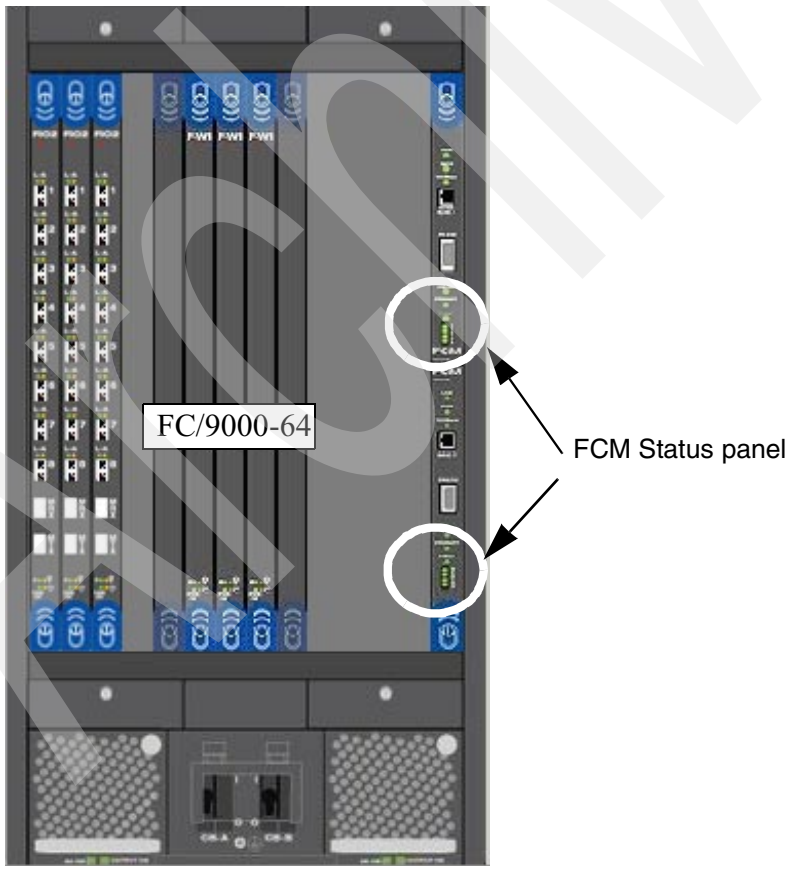

Figure 4-1 Display IP address on FCM panel

Record the IP address from each FCM module in the chassis. In a fully populated machine with 256 ports installed, you will have a total of 8 FCM modules. Refer to Appendix , “Chassis location” on page 78 for chassis numbers and location.

Check to ensure that the IP addresses match your requirements and that there are no FCM modules with the same IP address. Each FCM module must have a unique IP address.

If one or more IP addresses needs to be changed, see “Altering IP address in FCM module” on page 70.

Attention: Changing the FCM module’s IP address may also require changing the EM console IP address to allow connectivity between them.

Step 2. Logging into the EM server

On the EM console, double-click the IN-VS EM Client icon, and the IN-VSN Enterprise Manager Logon will be displayed. Type in the user ID (admin) and password (admin), then press Enter.

Step 3. Checking the EM server version

Once logged in, the Enterprise Manager window will open on the console display. Click the **Help** tab, then the **About** tab; the current version of the EM server application appears (see Figure 4-2).

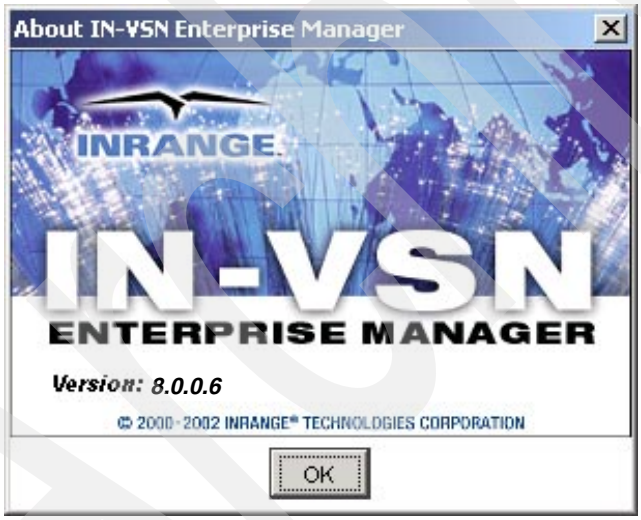

Figure 4-2 EM console application version display

If a newer version is available, it should be installed at this time. See “Installing EM Server/Client application” on page 73 for the proper procedure.

Step 4. Connecting the FICON Director and Enterprise Manager console

Using UTP cables, connect the Primary and Alternate FCM modules in chassis #1 (also known as Port Block 1), and the EM console to the Ethernet hub (service LAN). Refer to “IP addressing and connectivity” on page 23 for details.

If remote access to the EM console is also required, then we suggest using the configuration that was depicted in Figure 3-1 on page 24.

Step 5. Defining EM server-to-FICON Director communication

Type in the IP address of the Primary and Alternate FCM of each FICON Director in the IP Address fields. Click **Save** to save IP addresses to the Enterprise Manager server and to activate the connection to the FICON Directors. An example of a successful activation is shown in Figure 4-3.

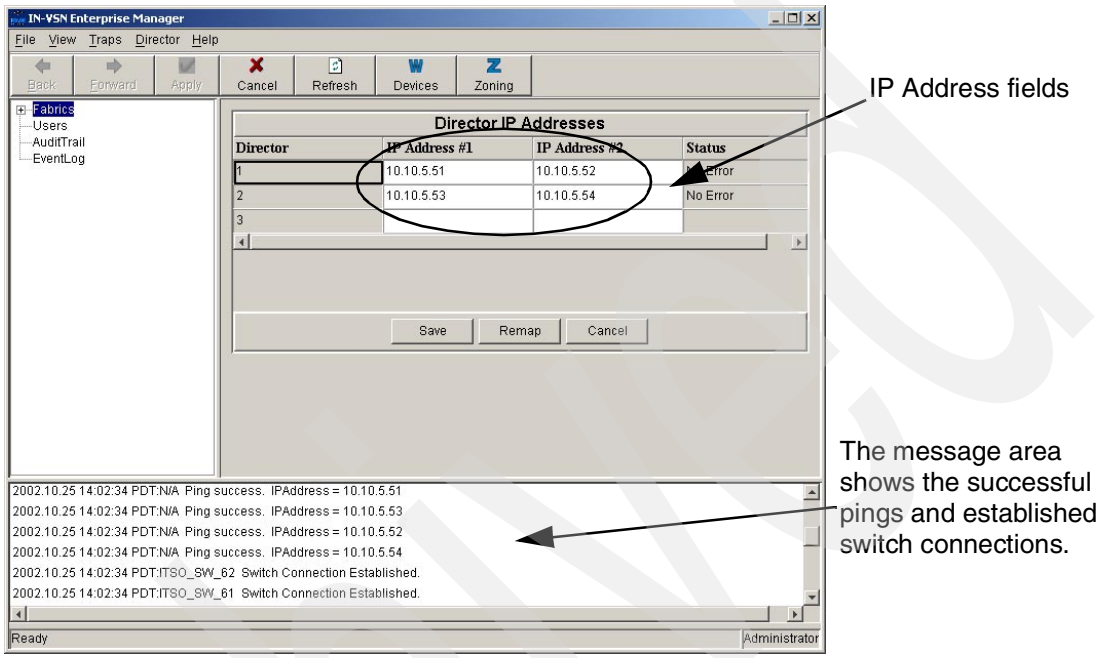

Figure 4-3 Enter Director IP addresses

Check the message area to ensure that all IP addresses were successfully pinged and that the connection to each Director (switch) was established. If an IP address was unsuccessfully pinged, check the actual IP address, subnetwork mask, and default gateway of that FCM module, and the IP address fields in the EM server. Also check the physical connection between the FCM module and the Ethernet hub, by reseating the cable connectors.

Step 6. Verifying the Director firmware version

Click **Fabric** in the left column to get a list of defined fabrics connected to the EM console. Then click all lines with fabric names in the left column to display the FICON Directors in each fabric. Finally, click the **Version** tab for each FICON Director and notice the current version of the firmware.

Figure 4-4 shows an example of the firmware version. Here we have two fabrics with one FICON Director in each fabric. Later on we will configure the fabric to have both Directors attached together in one single fabric.

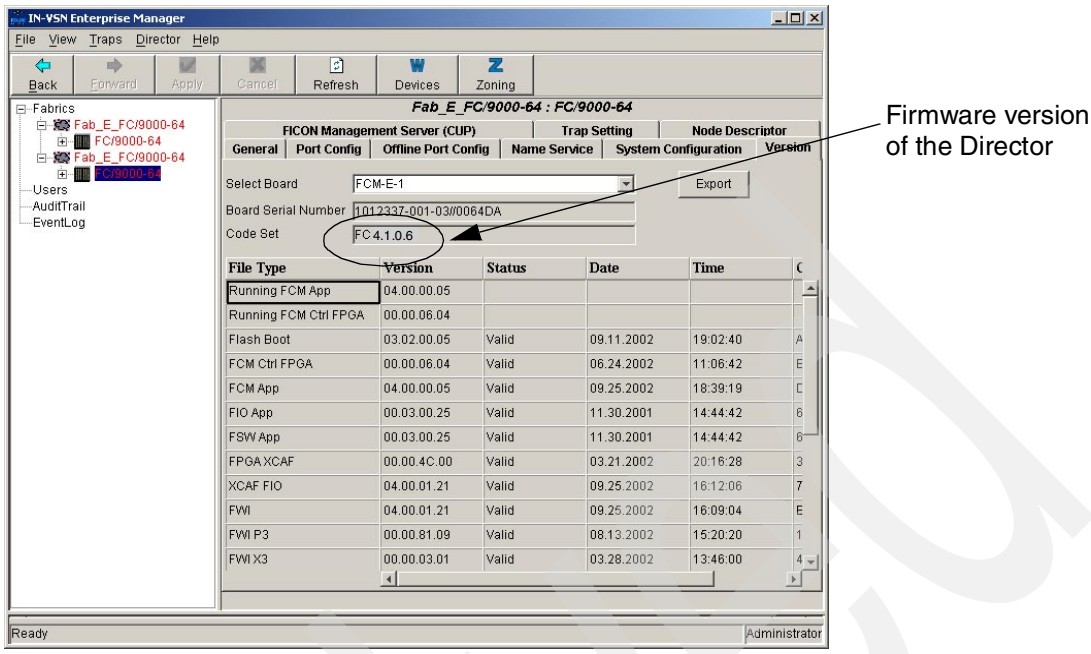

Figure 4-4 Director firmware version display

If a newer firmware version for the Director is available, it should be installed at this time. See “Upgrading Director firmware” on page 73 for the procedure.

Ready to configure

At this time the basic installation of the FICON Director and the EM workstation is finished. If you want to access the EM server via a separate workstation, then the EM client has to be installed with the same version level as the EM server version level.

You are now ready to configure your FICON Directors and fabrics; however, we suggest that you get familiar with the Enterprise Manager and try some basic functions. These functions, which can be selected from the navigator tree, are described in the next section.

4.2 Usage options

Double-click the IN-VSN Client icon and enter User ID and password in the logon window to start the EM client. The EM client window will open as shown in Figure 4-3 on page 38.

Four options are available in the left column navigator tree in the window:

- Fabrics
- Users
- Auditrail
- EventLog

4.2.1 Fabrics

The Fabrics option will display information about your fabrics, Directors, and ports. Here you can also make changes to your configuration, if desired.

In the left column of the screen, click your fabric name to display the Directors belonging to that fabric. Click one of the Directors to display status information (see Figure 4-5).

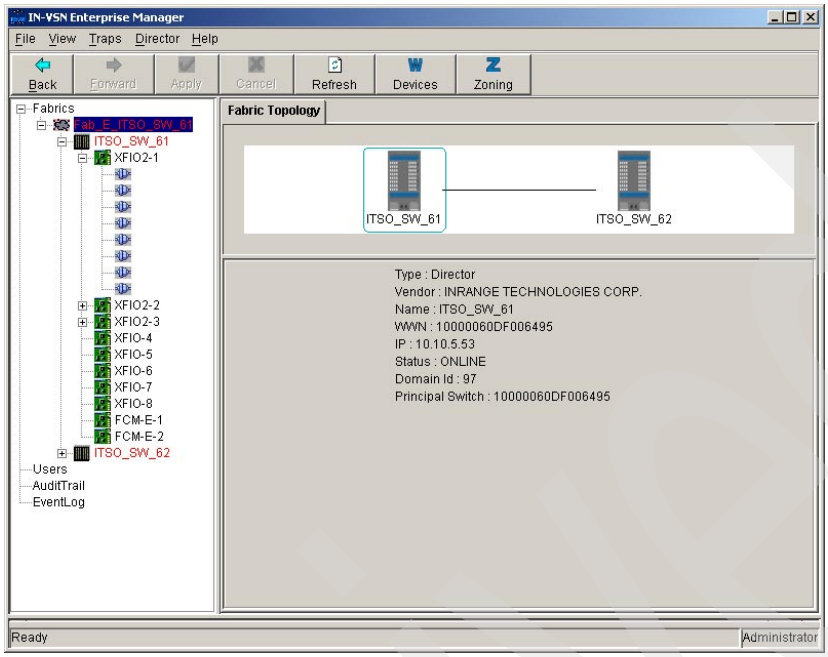

Figure 4-5 Fabric information display

For a further breakdown of your fabric, select one of Directors in the left column of the window. You will find current configuration information for that Director by selecting the tabs at the top of the display:

- General
- Port Configuration
- Offline Port Configuration
- Name Service
- System Configuration
- Version
- FICON Management Server (CUP)
- Trap Setting
- Node Descriptor

Some of these options are used in Chapter 5, “Configuring the FICON Director” on page 45 for configuring fabrics, Directors, and ports.

See Figure 4-6 for a sample display when the **General** tab was selected.

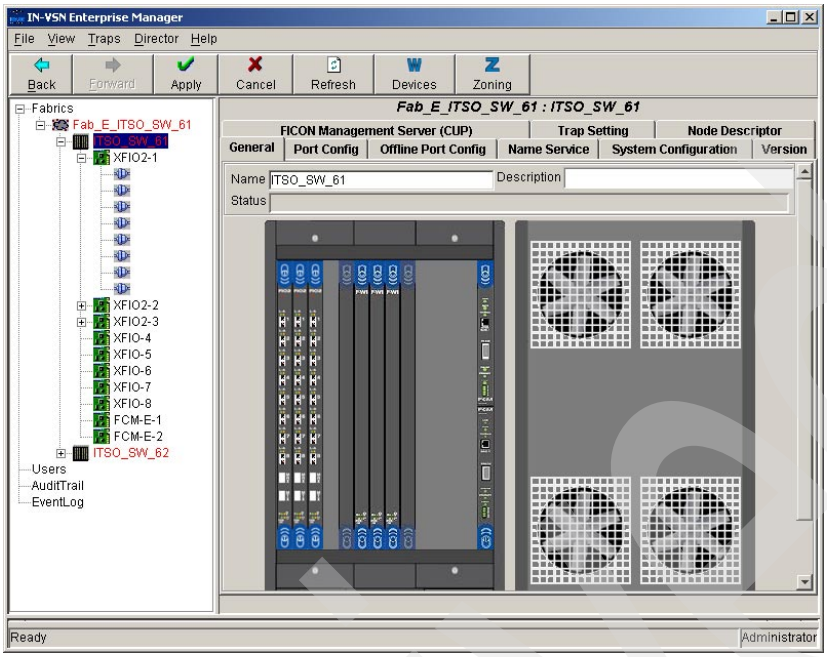

Figure 4-6 General Information display

4.2.2 Node and port information

Table 4-1 shows the various types of information that can be found under the Port Configuration, Node Descriptor, and Name Services tabs. This information is very useful when configuring the Director, as well as for fault isolation.

Table 4-1 Node and port information

	Port Config	Node Descriptor	Name Service
Port name	X	X	X
Port number (decimal)	X		
Port address (hexadecimal)	X	X	
Device name			X
Device vendor		X	X
Device type		X	
Device model		X	
Device plant		X	
Device serial #		X	
Port description	X		
Port WWN			X
Node WWN			X
Device name			X

	Port Config	Node Descriptor	Name Service
Port Status	X		
Port speed	X		
Port type			X
Link Sequence number		X	
Link tag		X	
Link Class		X	
Link address			X
Link protocol			X

4.2.3 Users

This option allows you to add or delete users. You have to be logged on as *admin* to be able to add or delete a user. While adding a new user, a role for this user can be selected. There are: operator, admin, or viewer (see Figure 4-7). The activities of all users can be displayed by the AuditTrail option.

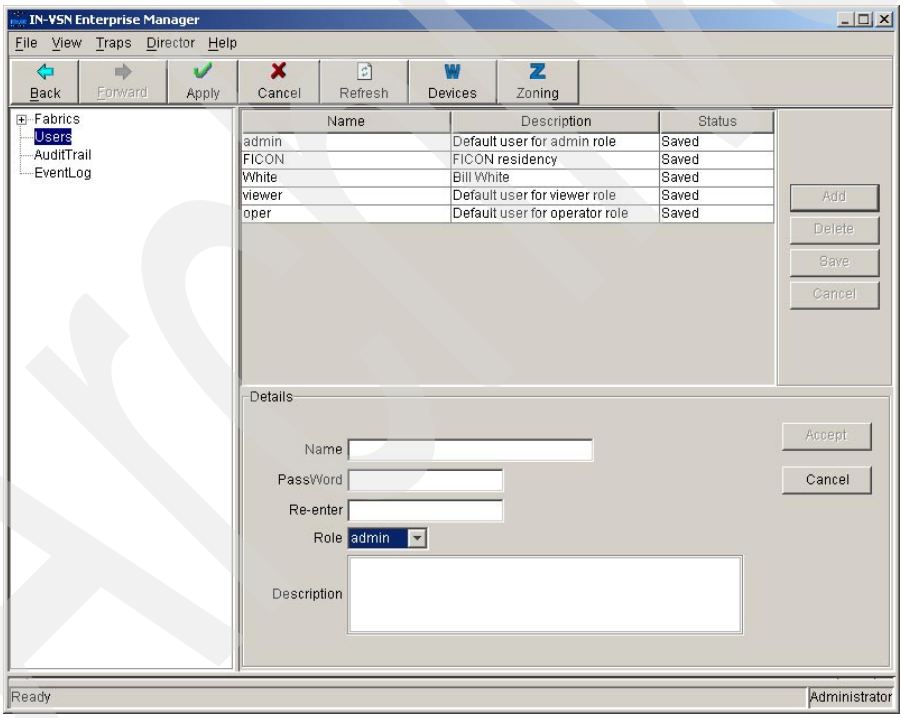

Figure 4-7 User example

4.2.4 AuditTrail

The AuditTrail option will show all activities, such as Logon/Logoff by users, on the Enterprise Manager console (see Figure 4-8).

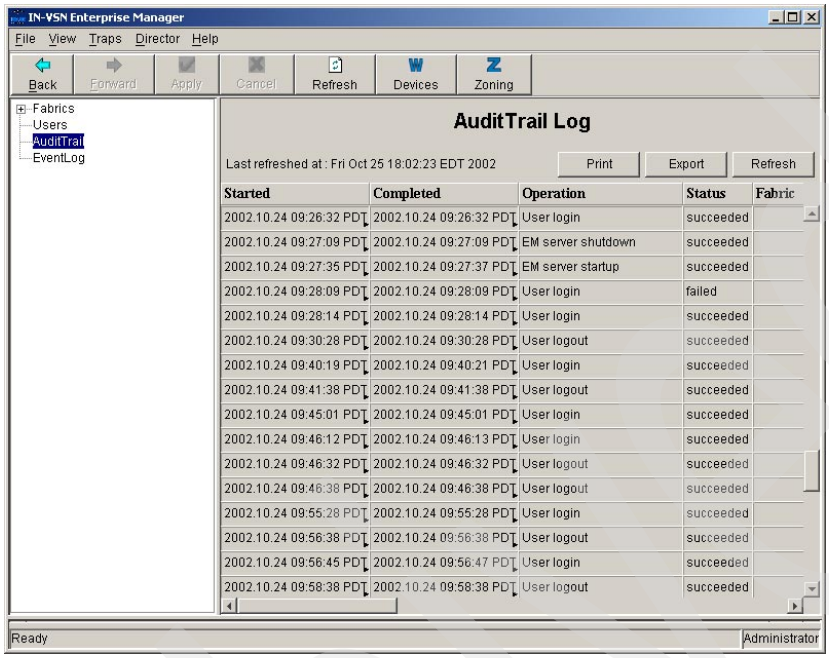

Figure 4-8 AuditTrail example

4.2.5 EventLog

The EventLog option provides information about all events in your fabrics. It allows the user to print and/or Export the event log. See Figure 4-9 for a sample EventLog display.

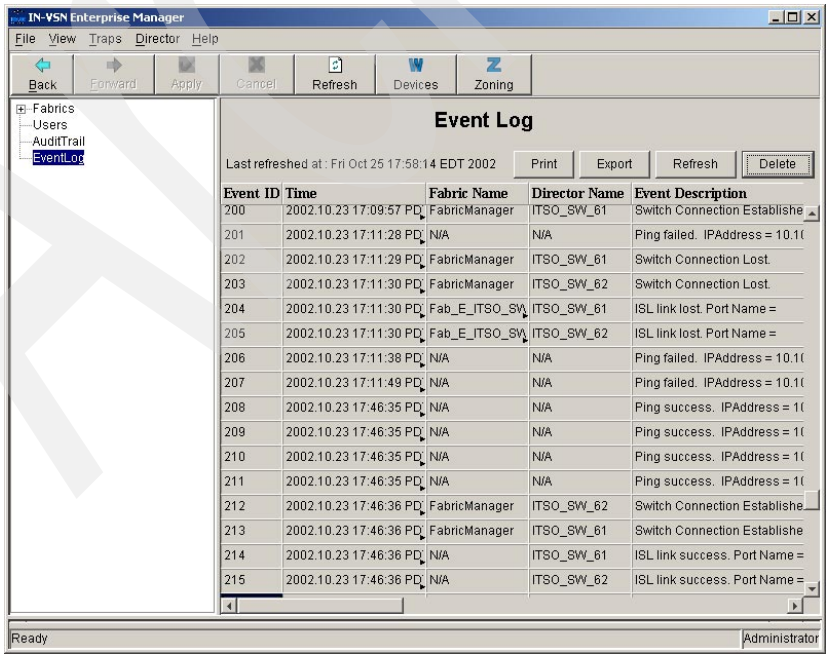

Figure 4-9 EventLog example

5

Configuring the FICON Director

This chapter provides information about how to configure the INRANGE FC/9000 FICON Director for a switched point-to-point configuration and a cascaded FICON Directors configuration.

The following topics are discussed in detail:

- Setting up a FICON director
- Activating High Integrity Fabric feature
- Enabling the CUP feature
- Building a High Integrity Fabric
- Port configuration
- Port WWN Device Name configuration
- Zoning
- Verifying the configuration

Note: All tasks described in this chapter require administrator authority. See “Users” on page 42 for an example.

5.1 Setting up a FICON Director

After installing the FICON Director and establishing connectivity to the Enterprise Manager (as described in “Setting up the IN-VSN Enterprise Manager environment” on page 35), only a few initial steps have to be performed (see Figure 5-1).

The following steps must be done for each FICON Director, regardless of whether it will be used in a switched point-to-point configuration or a cascaded FICON Directors configuration, and should be based on your planned configuration.

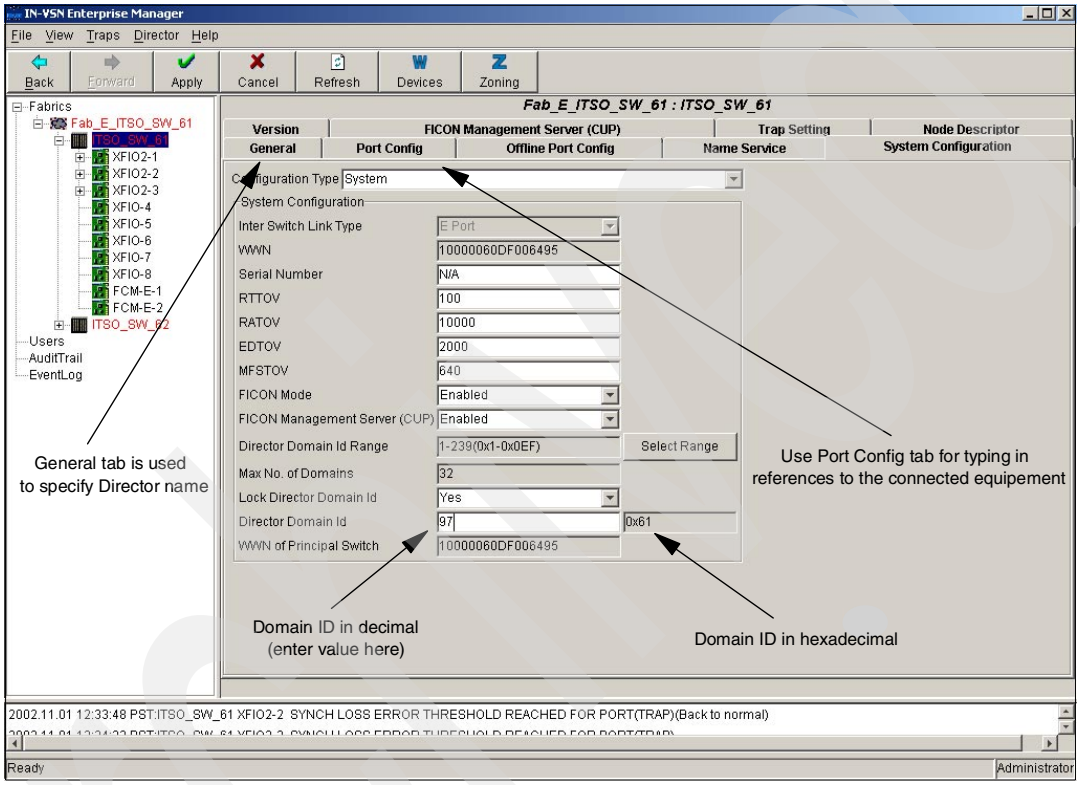

Figure 5-1 Required settings for a FICON Director (System Configuration panel)

1. From the Director view, select the **General** tab to provide a name for this Director, then click the green **Apply** button at the top of the screen.
2. Select the **System Configuration** tab and add the following settings:
   - Define *Domain ID*. Notice that each single FICON Director must be set up with a unique Domain ID (which is recommended to be the same as the Switch ID used in IOCP/HCD). Enter the required Domain ID in decimal (for example, 97 equals x’61’). The corresponding ID is displayed in hexadecimal in the box to the right of the decimal value field.
   - Enable FICON mode.
   - Enable Management Server (CUP). This feature has to be ordered separately and requires a password. The enablement is described in detail in “Enabling the Control Unit Port (CUP)” on page 49.
   - Lock Director Domain ID = Yes. This enables Insistent Domain ID, which is required for cascading and the use of 2-byte link addresses.
3. Click the green **Apply** button to activate all the changes.

5.2 Activating the High Integrity feature

Establishing a High Integrity fabric is mandatory for FICON Directors when implemented in a cascaded environment. Both Directors must have the FICON Cascading Activation feature installed. The FICON Cascading Activation feature (FC 7203) is ordered separately.

Important: If the you decide to use 2-byte link addresses in your switched point-to-point configuration, then the Director must have the FICON Cascading Activation feature installed. See “Binding and Insistent Domain IDs” on page 29 for details.

The following steps describe how to activate the FICON Cascading Activation feature:

1. Start IN-VSN Enterprise Manager Server, by double-clicking the icon on the EM console’s desktop.
2. Invoke the Product License Client, by clicking the **Configuration** tab, then the **License** tab, as shown in Figure 5.2.

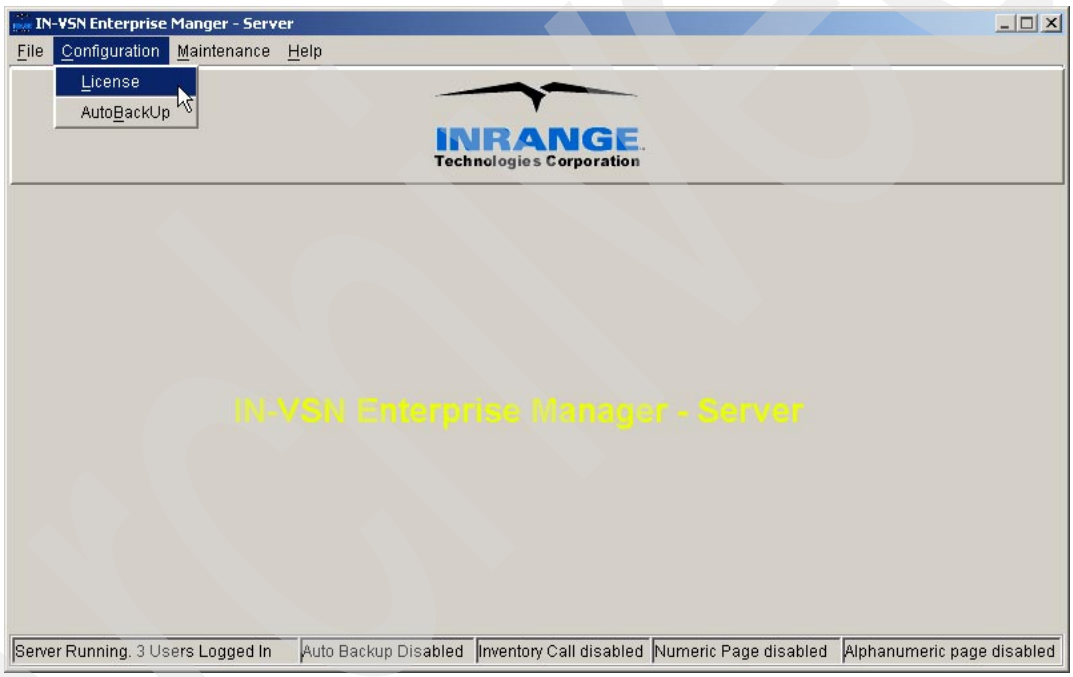

Figure 5-2 Product License Client selection

3. On the next screen, click **Apply** to view the User Key. This key must be given to INRANGE customer service so that they can generate Licence Keys for the ordered features.

   Figure 5-3 shows the screen from which you can obtain the User Key.

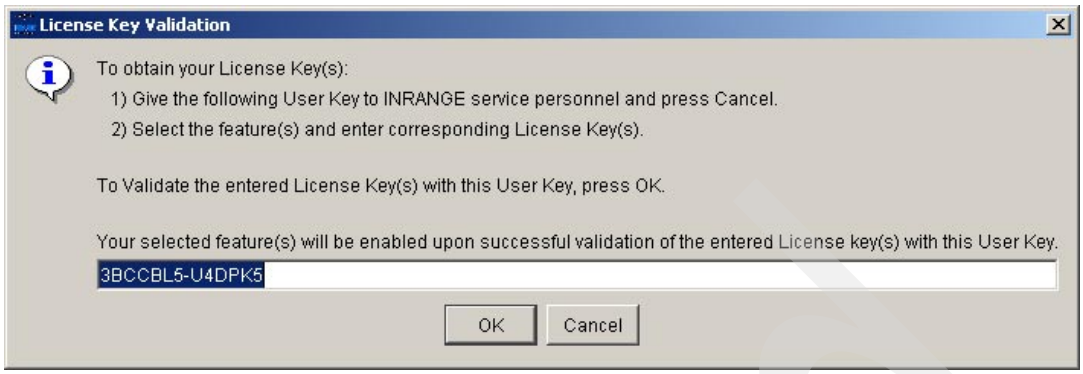

Figure 5-3 License Key Validation

4. After obtaining the User Key, click **Cancel** to return to the Product Licence Client to be able to check and enter the feature keys. The blank fields are shown in Figure 5-4.

Figure 5-4 IN-VSN Product License Client

5. In the Product Licence Client, check the features that are licenced, and enter the corresponding license keys, then click **Apply** and click **OK** to get to the License Key Required prompt. This will cause the Product License Client to verify the License keys on the machine against the user key and enable the authenticated features. The corresponding filled out Product License Client screen is shown in Figure 5-5, notice that the status field now has valid license keys.

Figure 5-5 IN-VSN Product License Client with checked features and entered keys

After you have entered all data, click **Close** to save settings. The server need not to be restarted because the settings take effect immediately.

6. Logon to the IN-VSN EM client.
7. Select the **System Configuration** tab.

8. Click the arrow next to the drop-down box of the Fabric Security option.
9. Select **Enabled**.
10. Click the green **Apply** button to activate the changes.

Figure 5-6 shows the System Configuration screen with the enabled fabric security option active.

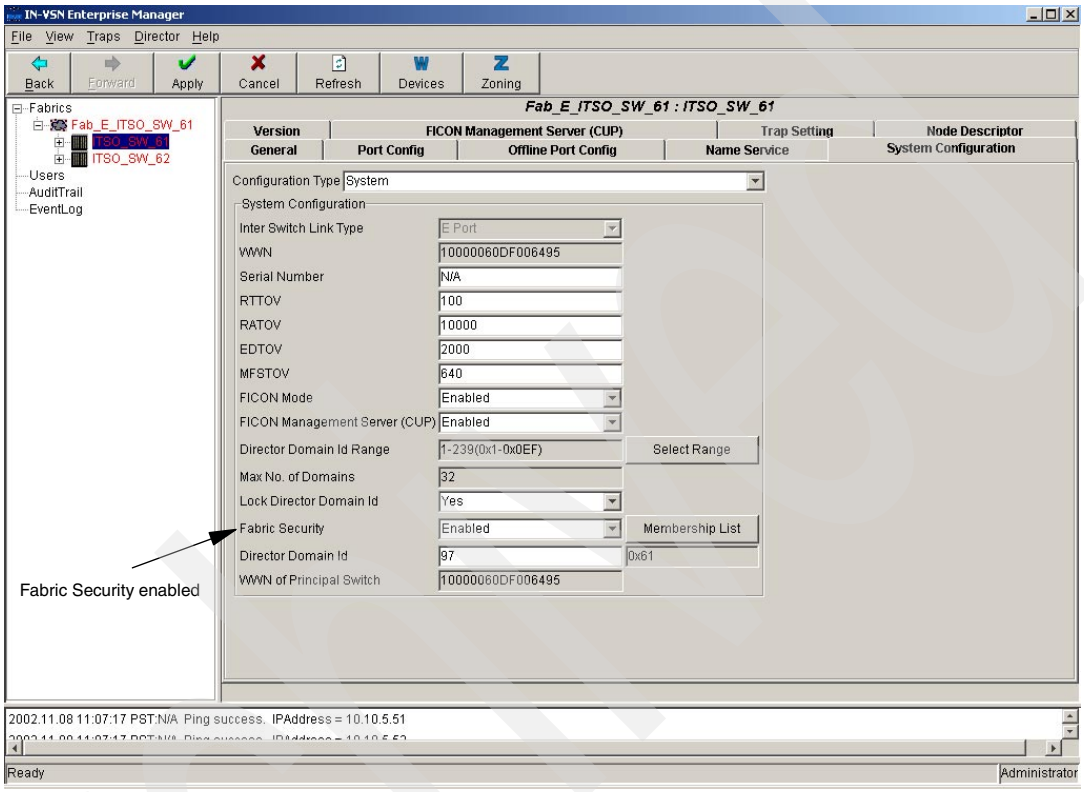

Figure 5-6 Fabric Security enabled

5.3 Enabling the Control Unit Port (CUP)

The FICON Management Server or CUP feature (FC 7202) can be enabled or disabled via the Enterprise Manager at any time. The enablement of the CUP feature is password protected. To obtain a password, contact INRANGE customer service.

Note: If the CUP feature is enabled and for any reason is disabled, a new password has to be requested from INRANGE customer service to enable the CUP function again.

Clicking on the FICON Management Server (CUP) tab inside of the Director view, the referenced screen is shown in Figure 5-7.

If you have a valid password for enablement of the CUP feature, log on as an administrator. Note that these passwords must be used within the time frame specified by INRANGE customer service.

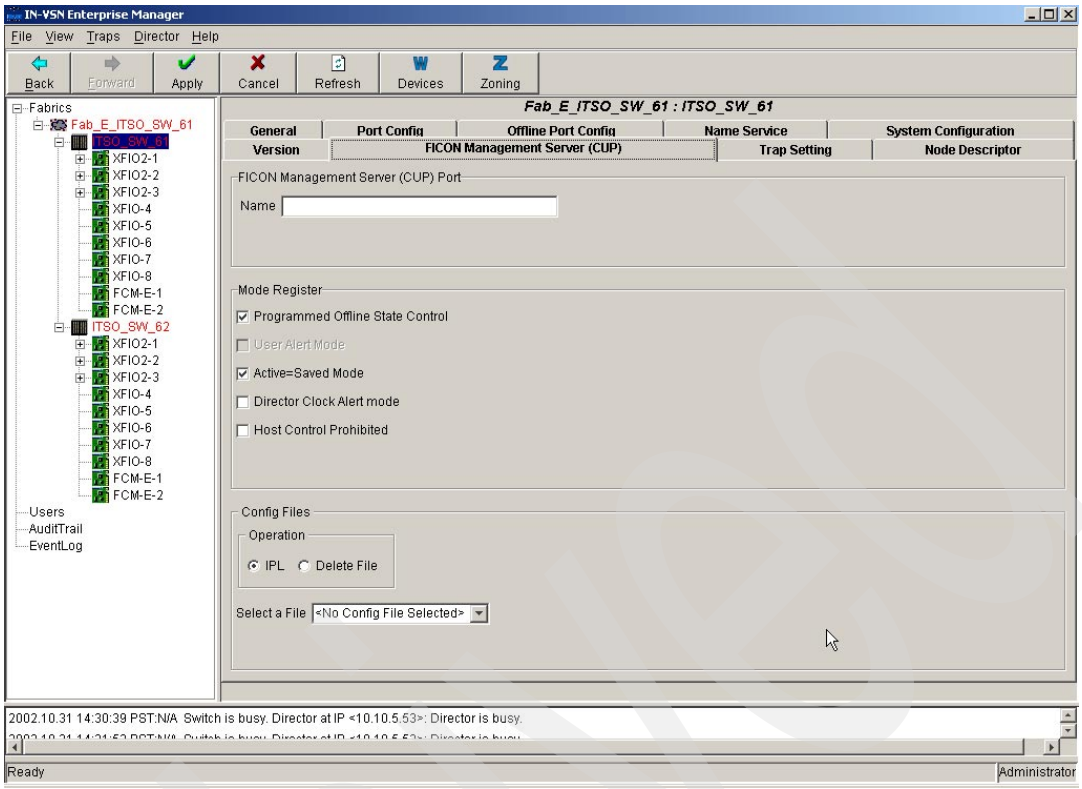

Figure 5-7 Director with enabled CUP

Steps to be performed to enable the CUP feature:

1. Bring up the Director view of the Director in which the CUP feature should be enabled and click the **System Configuration** tab, then select **Enabled** from the drop-down box next to the CUP. Figure 5-8 shows the corresponding screen.
2. Click the green **Apply** button.
3. Click **OK** at the confirmation screen.
4. At the password pop-up screen, enter the password received from INRANGE customer service, then click the **OK** button.

   If successful, you see the message: **`The changes were applied successfully.`**
5. Click the **OK** button at that message window.

   If the above message is not seen, then you have to contact INRANGE customer service.

Note: The FC/9000 FICON Director must be defined in HCD/IOCP as device type 2032 to be able to work with the management server (CUP).

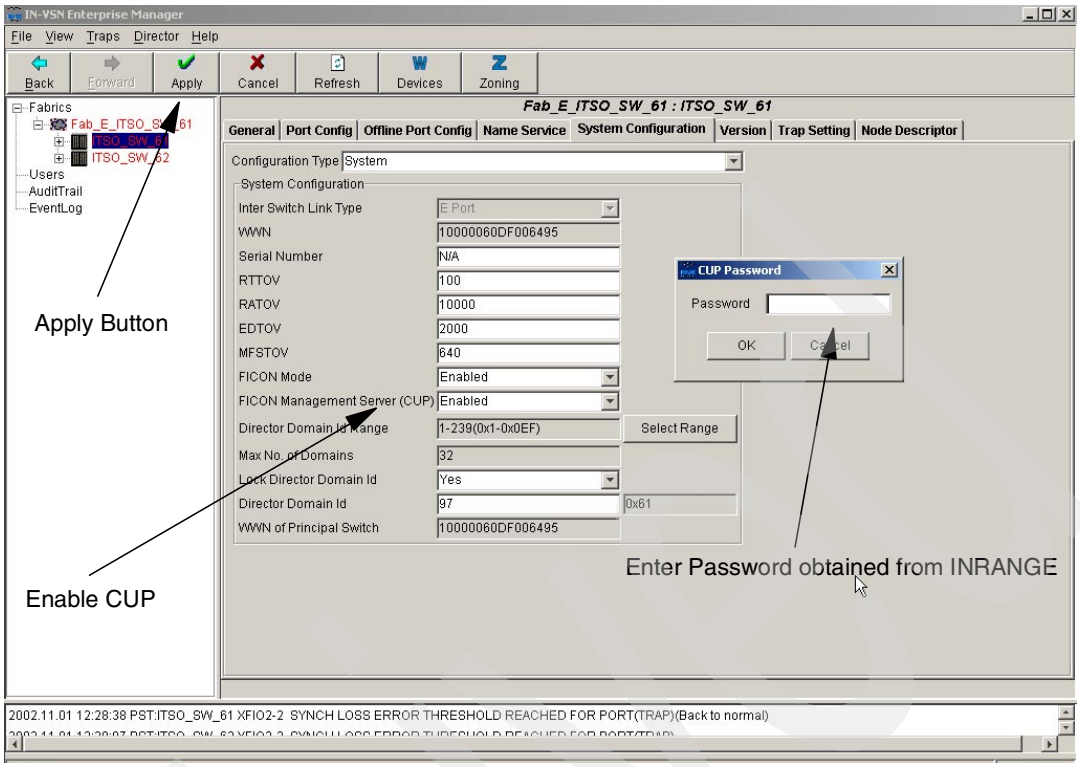

Figure 5-8 Enable CUP feature

5.4 Building a fabric

To establish a cascaded fabric (two FICON Directors are merged together), several steps are required. Before starting the merging process, perform the following steps:

1. Select the first Director which will be part of the fabric, then click the **System Configuration** tab.
2. Verify that the appropriate setup has been completed according to the procedure in “Setting up a FICON Director” on page 46.

Important: If the Directors are already configured and in use, make sure they have *FICON mode* enabled. The merge into a cascaded fabric can then be done concurrent to normal operation.

As shown in Figure 5-9, the settings should be as follows:

a. The R_A_TOV and E_D_TOV time-out values are the same for both Directors, otherwise they cannot be merged into a cascaded fabric.

b. The FICON Mode option is set to Enabled.

c. The Lock Director Domain ID option is set to Yes.

d. The Fabric Security option is set to Enabled.

e. The Director Domain ID (switch address) corresponds to your IOCP definitions.

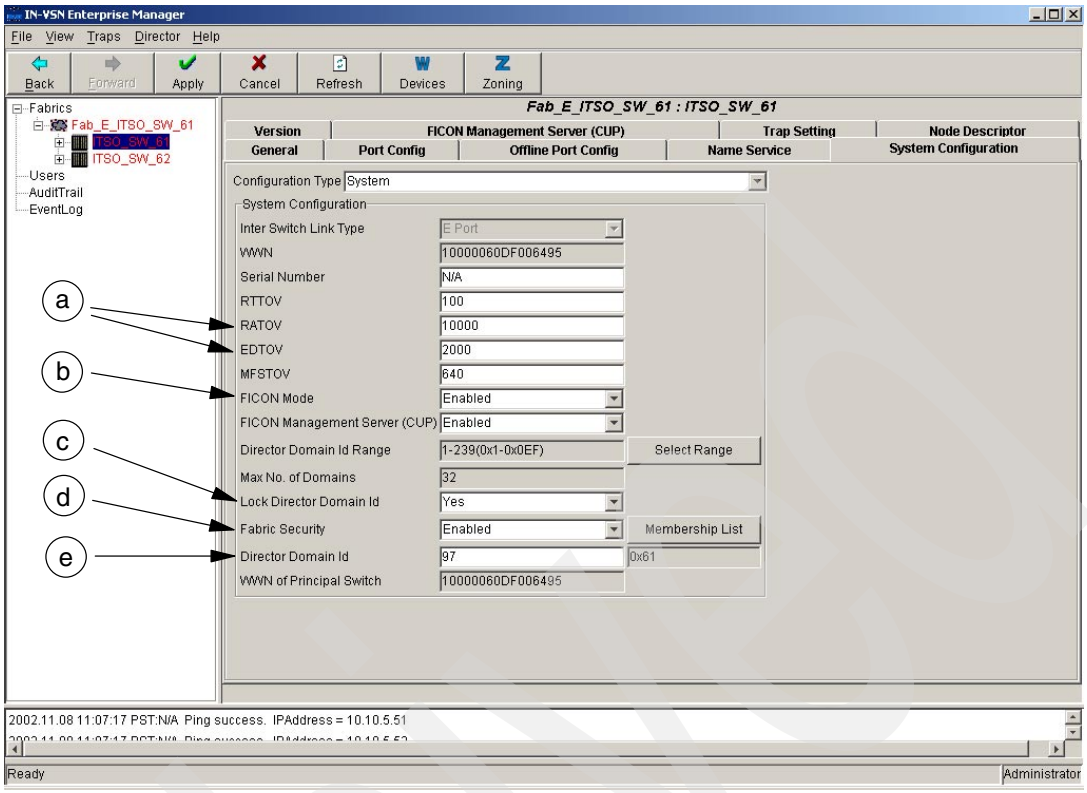

Figure 5-9 Verify settings of FICON Directors

3. Verify/apply settings on the second Director which will be included in the fabric.
4. Connect the ISL cables according to your planned configuration.

Note: Before connecting the ISL cables, it is recommended to block all ports that will be used for ISLs. Once the ISL cables are connected, unblock the ports one-by-one and check for errors (see “EventLog” on page 43).

5. Click **Fabrics option** in tree view, then click the **Add** button.
6. Enter the name of the Fabric to be generated, then tab to the description field and type in the name of the fabric.
7. Click the **Accept** button to finalize the fabric, then click the **Save** button to save the newly generated Fabric.
8. To finish the task, click the green **Apply** button on the toolbar.

   The new fabric appears under the Fabrics header in the tree view (Figure 5-11).
9. The next step is to include or exclude Directors to be connected together by the ISLs. To do this, you have to click the **Membership List** button to the right of the Fabric Security option field.

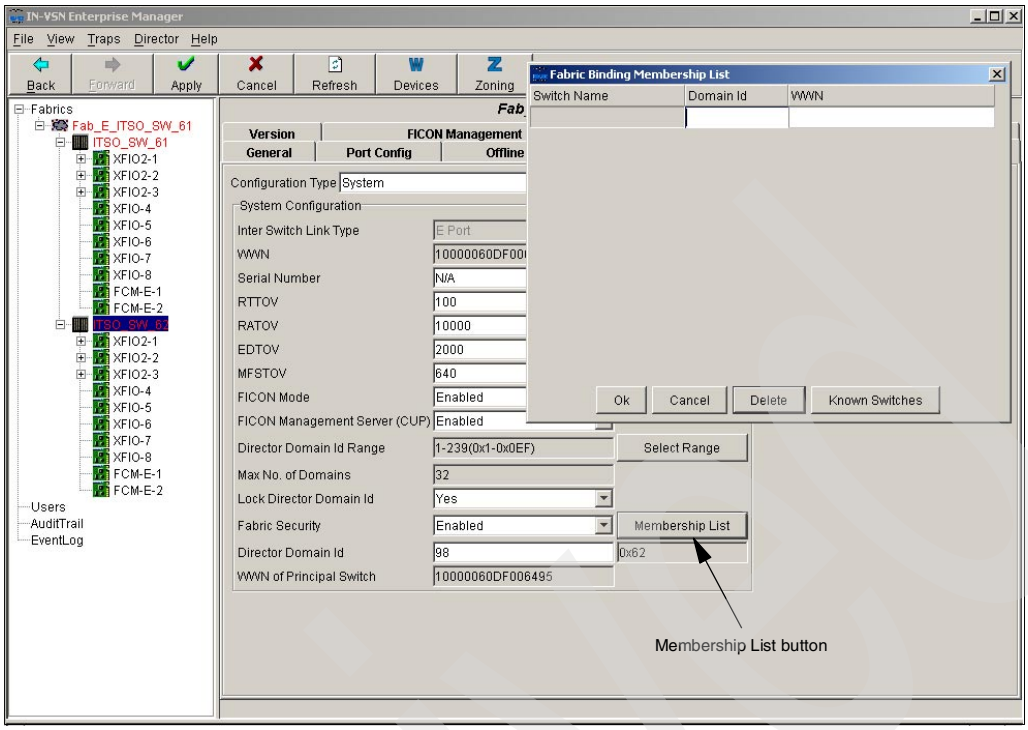

Figure 5-10 Empty Membership List

10. Since the ISLs are already connected, you can use the **Known Switches** button to move Directors into the Fabric Binding membership list (see Figure 5-11). Click the Director you would like to add to the list, then click the **Add** button.

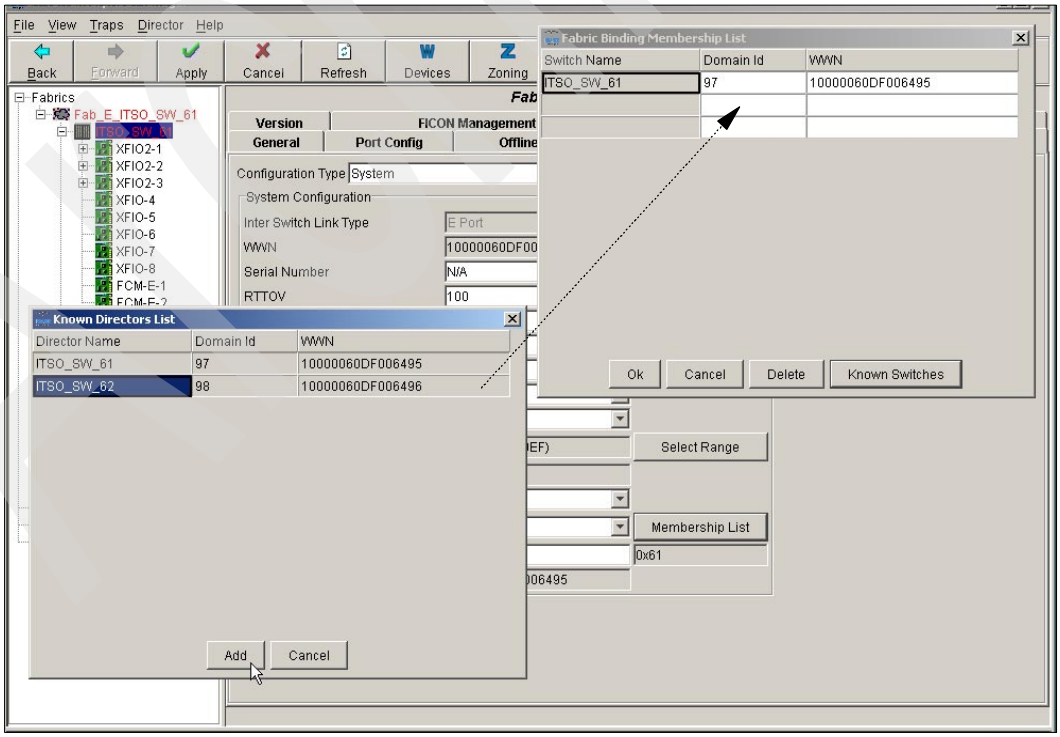

Figure 5-11 Add a Director to the membership list

11. After adding the Directors you would like to have included in the list, click the **OK** button.

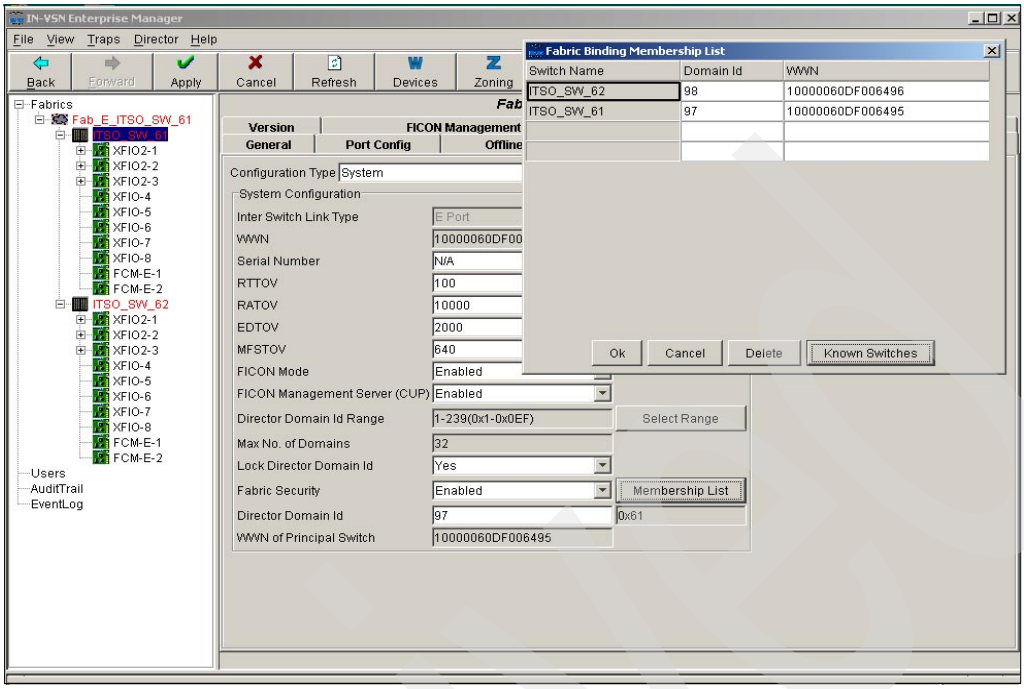

Figure 5-12 Completed membership list

Figure 5-13 shows the fabric including both Directors with Domain ID 61 and Domain ID 62, and the available ISLs.

Note: If any Director that is not on the membership list is connected to this Director, the ISL link will not go online. Instead, an “invalid attachment” is reported on the isolated E_Port.

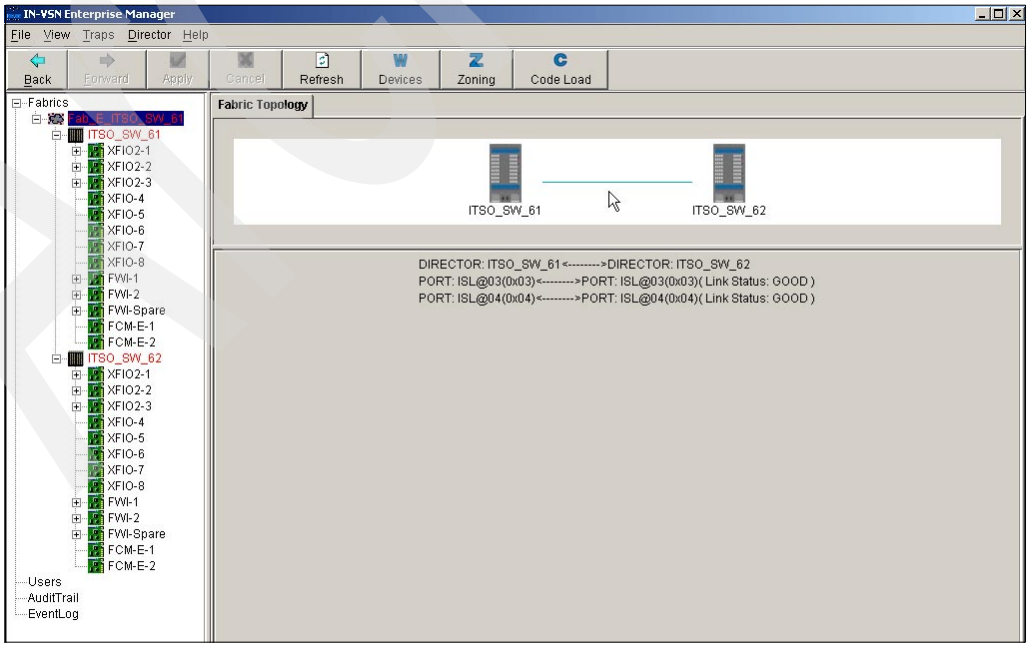

Figure 5-13 Display of the cascaded fabric

5.5 Port configuration

On the Port Configuration screen you can display the current port configuration. Some fields on this screen can be altered for a given port.

The following data fields are displayed on the port configuration screen for each port:

Name This an alterable field to enter the port name. The port name entered in this field will be shown on the Names Service panel later on.

Number This is the port number in decimal.

Description This field to type in a meaningful description of the port.

Address This is the port address in hexadecimal.

Status/Speed In this column the current port status and port speed is displayed.

Prohibit This displays if the port is prohibited (restricts the use of the port).

Blocked In this field you can block a port to prevent communication to any connected device.

Admin Speed This field displays the current selected speed for this port and allows you alter the speed to another value.

Refer to Table 4-1 on page 41 for a quick reference regarding useful node and port information contained within the Enterprise Manager server.

5.5.1 Defining port names and blocking ports

At installation time you have to configure each port as follows. Have your worksheet ready with all of the information required for each port.

1. Select a Director in the left hand navigation tree.
2. Click the **Port Configuration** tab. The Port Configuration panel will be displayed as shown in Figure 5-14.

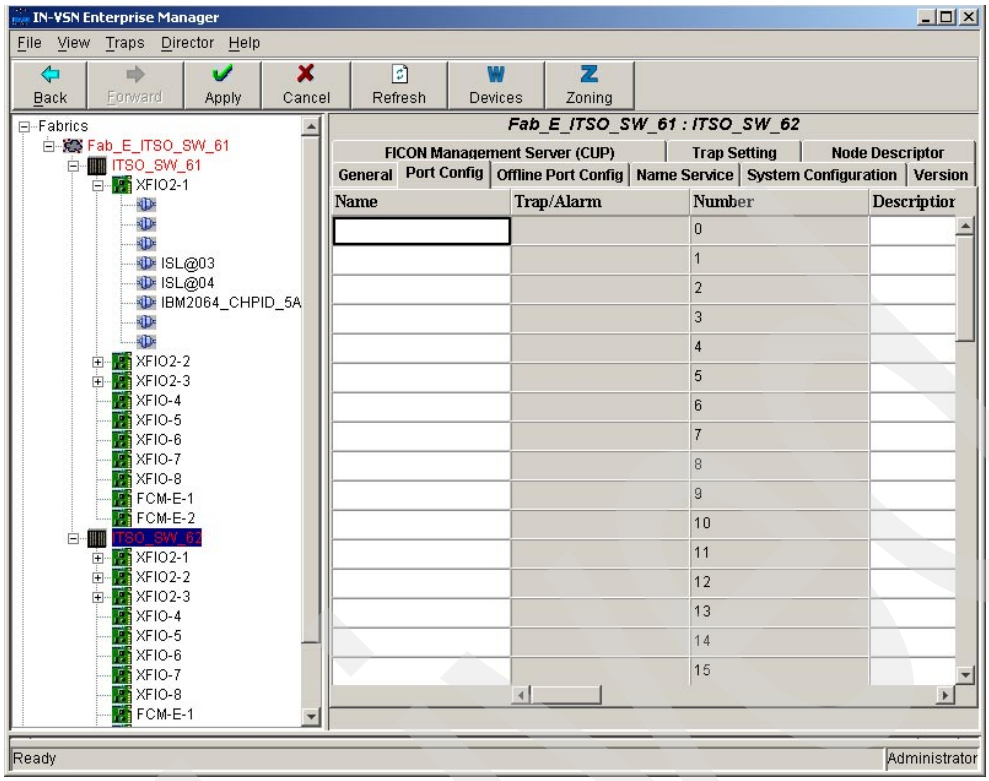

Figure 5-14 Port Configuration panel

3. Take your worksheet and type in the Port name, a description of that port, block a port if required, and select the speed for this port.

   Take special care in regard to port numbers and port addresses. On some panels the port numbers (in decimal) are displayed and on other panels port addresses (in hexadecimal) are displayed.

   The Name and the Description fields are initially blank and should be filled with meaningful names and descriptions. Especially, the port name should give useful information about the port and the connected device. The Port name entered on the Port Configuration panel will be displayed on several other information panels in the Enterprise Manager.

   Blocked ports still transmit offline sequences (OLS), but can not communicate with an attached device.

4. For each port that already has a device attached, check that device is connected to the correct port. To display information about the connected device, right-click the appropriate port. On that option menu, select **View Node Descriptor**. The Port Node Descriptor panel provides information about the connected device. See the example in Figure 5-15.

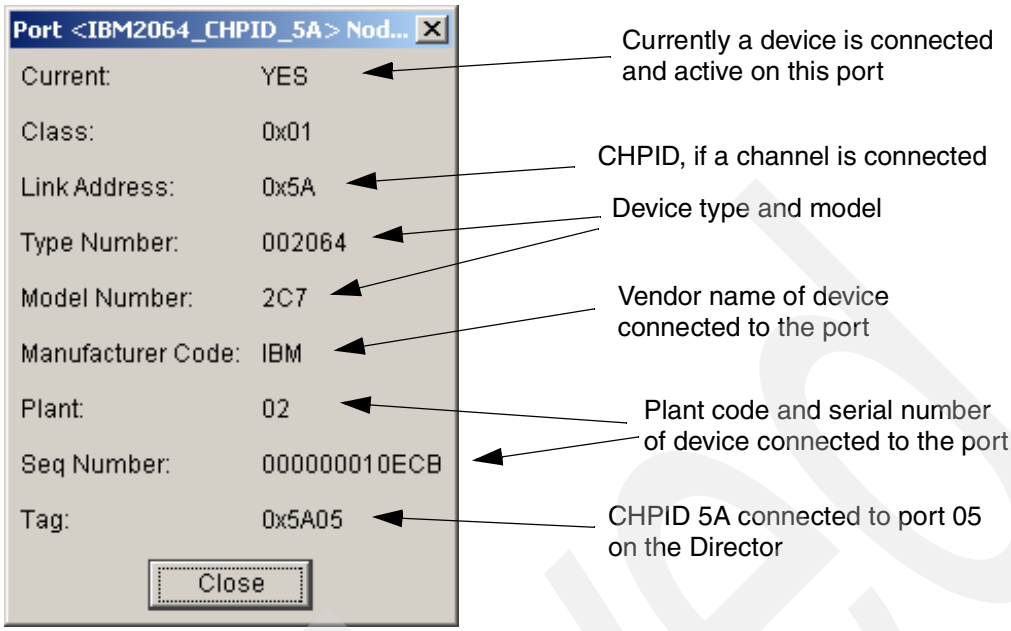

Figure 5-15 Port Node Information panel

5. Close the Port Node information panel and enter the required information for each port.

   If your worksheet has port numbers in decimals, use the *Number* column on the Port Configuration screen to identify the correct physical port.

   If numbers on your worksheet have hexadecimal numbers, use the *Address* column on the Port Configuration to identify the correct physical port.

   Port names have to be unique within a switch. Additionally, we recommend using unique port names within the whole fabric.

   Type in all the required information for each port. If you have finished the configuration, click **Apply** on top of the screen.
6. Confirm the changes on the next panel.
7. Wait for the Port(s) Information “Setting succeeded” message, then click **OK**.
8. The Port Configuration panel should now display all your settings for the ports. See the sample screen in Figure 5-16.

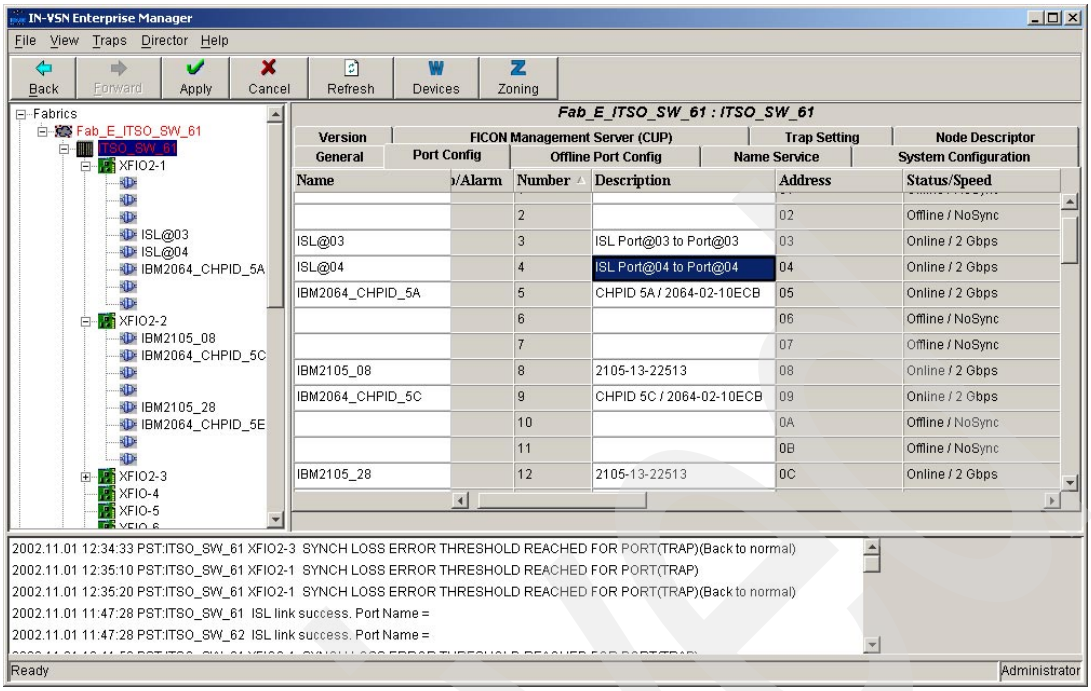

Figure 5-16 Port Configuration panel

The importance of having a meaningful port name is shown in Figure 5-17. When the port name is entered in the port configuration panel, it appears in other panels as well, making it easier to identify and track the physical port connection.

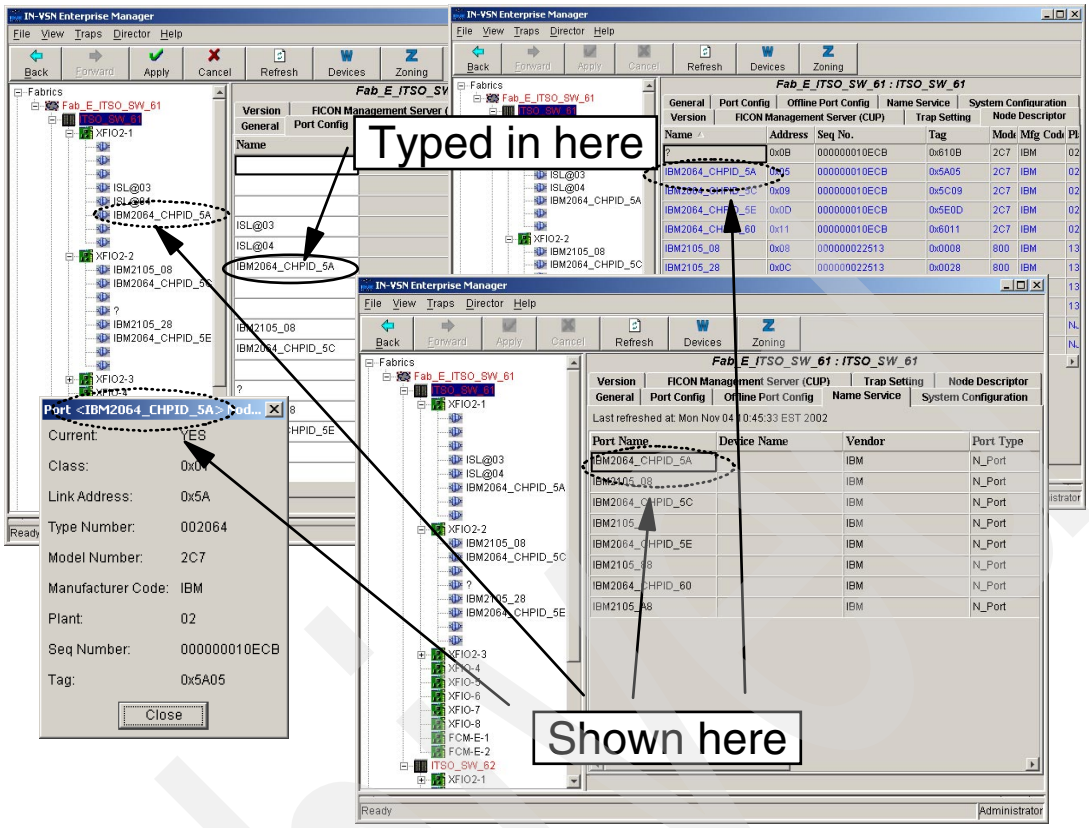

Figure 5-17 Shown Port Names

5.6 Port WWN Device Names Configuration

The Port WWN Device Names Configuration facility provides the option to map port WWNs to a device name. The WWN is the burnt-in name of a Fiber Channel/FICON adapter, and contains no information about the device in which the adapter card is plugged.

For easier navigation through the panel on the Enterprise manger application it is helpful to have a relation between WWNs and literal names or device names.

1. Click the **Devices** button in the upper part of the EM window (see Figure 5-18).

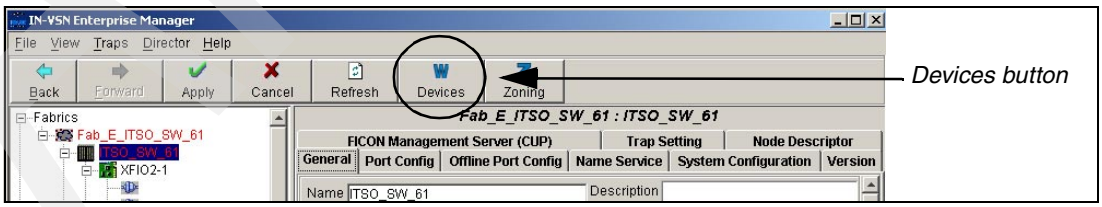

Figure 5-18 Devices button

2. The Port WWN Device Names Configuration window opens.

   In the Port WWN column, all the devices connected to this fabric are listed. Also, the vendor name of the device is shown. See the sample in Figure 5-19. Use the Names Service facility in the Enterprise Manager to find out which port and which device belongs to each WWN.

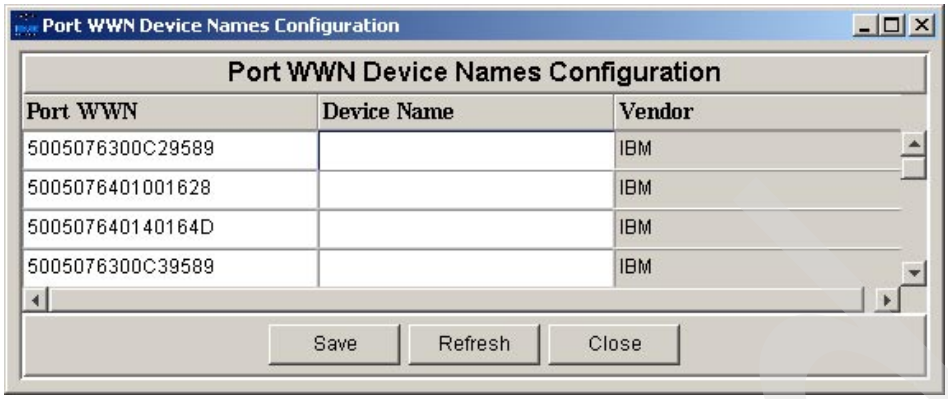

Figure 5-19 Port WWN Device Names Configuration window

3. In the Device Name field, type in a literal name for the device.
4. Click the **Save** button once all names are entered in the proper fields.

After saving the device name entered on the Port WWN Device Names Configuration panel, the device name is then displayed in Device Name field on the Names Service panel, as shown in Figure 5-20.

Later this will help to identify which port(s) on the Director are connected to which device(s).

Keep in mind that device (node) WWNs and port WWNs are different, and that a device may have multiple ports installed that are connected to the same Director.

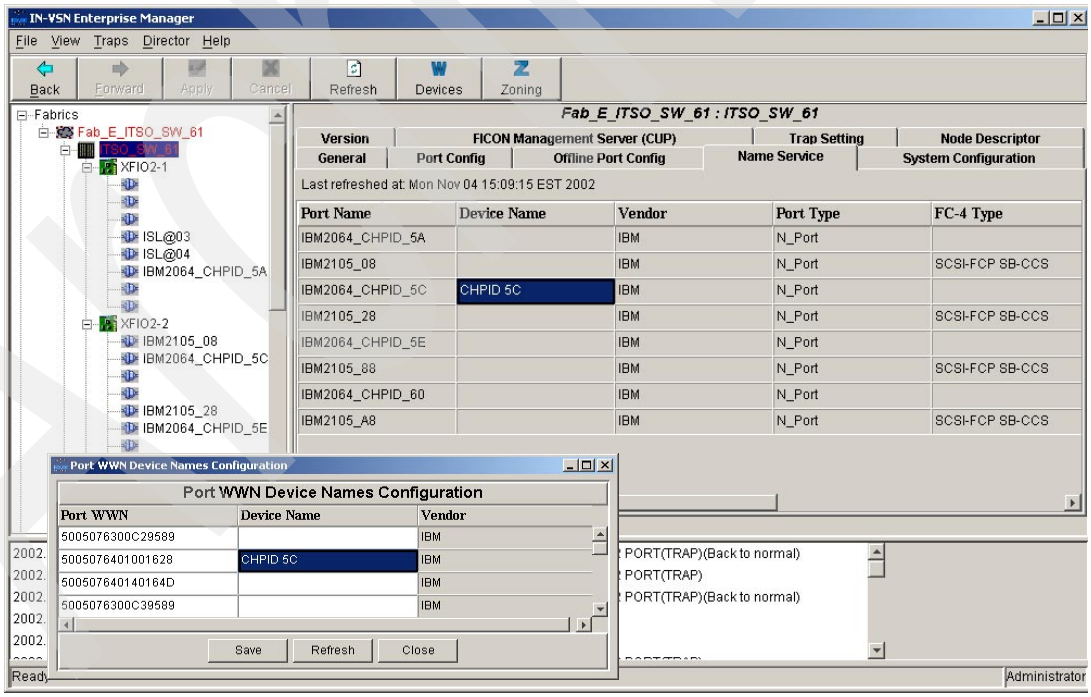

Figure 5-20 Device Name display on Names Service panel

5.7 Zoning

We suggest that zoning be used to group devices (based on WWN), together to prevent random access by other devices in a Director or fabric that are not members of the same zone. Refer to “Zoning” on page 30 for a description of zoning.

In a mixed environment with FICON and FCP devices connected to the same Director or fabric, zoning should be used to separate FICON and FCP traffic.

5.7.1 Creating a zone set

A zoneset has to be created first, which will hold all the zones defined thereafter.

1. Click the **Zoning** button in the upper part of the EM window (see Figure 5-21).

Figure 5-21 Zoning button

2. The E-Port Zoning window will open.
3. Click the fabric, then click the **Zoom In** button.
4. Select a switch and click the **Zoom In** button.

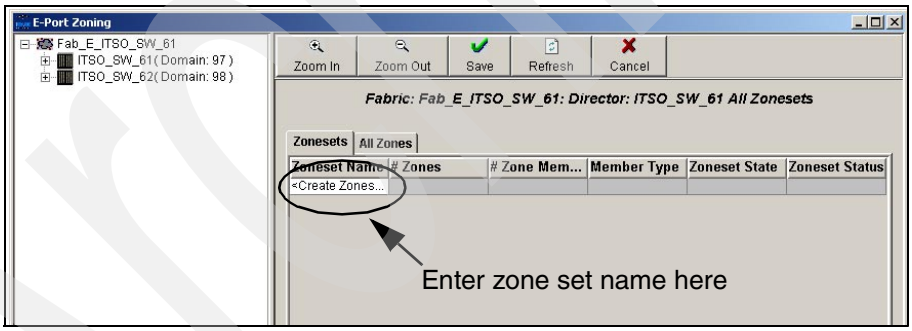

Figure 5-22 Create a zone set

5. Double-click the **<Create Zoneset>** text in the Zoneset Name column. Now type in the name of your zone set and press Enter to save the zone set name (see Figure 5-22).

5.7.2 Creating a zone and adding zone members

1. Click the **All Zones** button.
2. Double-click the **<Create Zone>** text, in the Zone Name column.
3. Type in the name of your zone and press Enter to save the zone name.
4. Select the zone you created and click **Zoom In**.
5. In the left navigation tree, find the ports you want to add to the zone.

6. If the Port WWN Device Names Configuration has been done the Device name will be displayed rather than the WWN of the port.

   There are two ways to add ports to a zone:

   – Either double-click the **<Add WWN>** text field in the Port WWN column, then type in WWN of the port you ant to add to the zone and press Enter to save.

   – Or drag-and-drop the Port from the navigation bar into an empty member row.

   Drag-and-drop was done in the example in Figure 5-23 for adding a port to a zone.

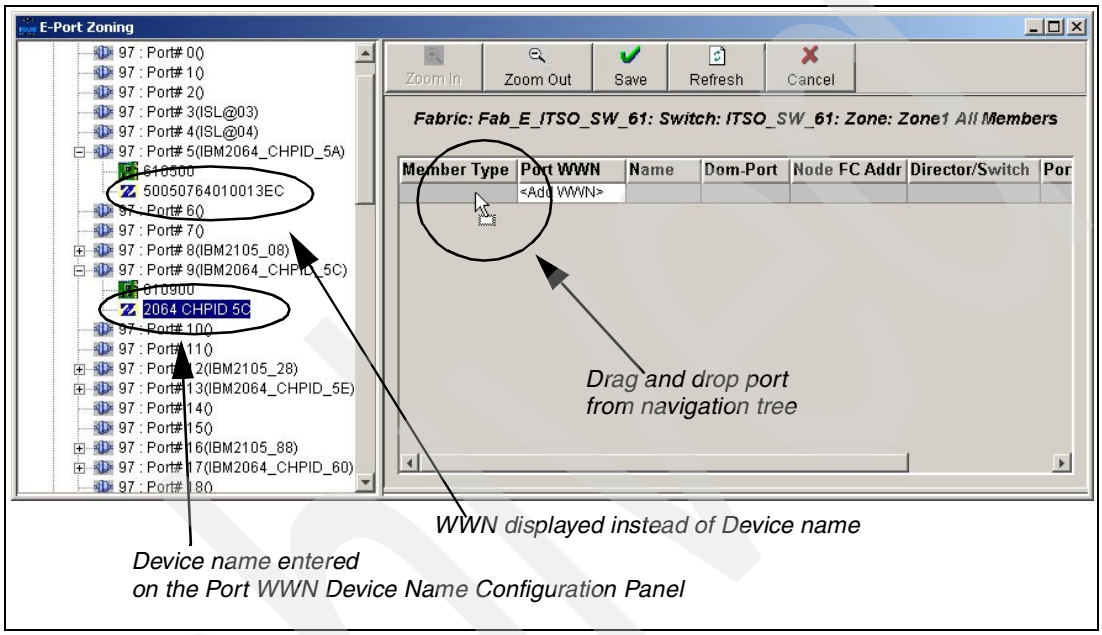

Figure 5-23 Add zone member

Repeat the steps above for each port you want to add this zone.

7. Once all ports are added, click the **Save** button.

5.7.3 Adding zones to a zone set

1. Click **Zoom Out** to get back to the zone names list. The number of ports previously added should match the number in the # Zone members column.
2. Click the **Zonesets** tab.
3. Right-click the Zoneset and select **Add Zones** from the menu (see Figure 5-24).

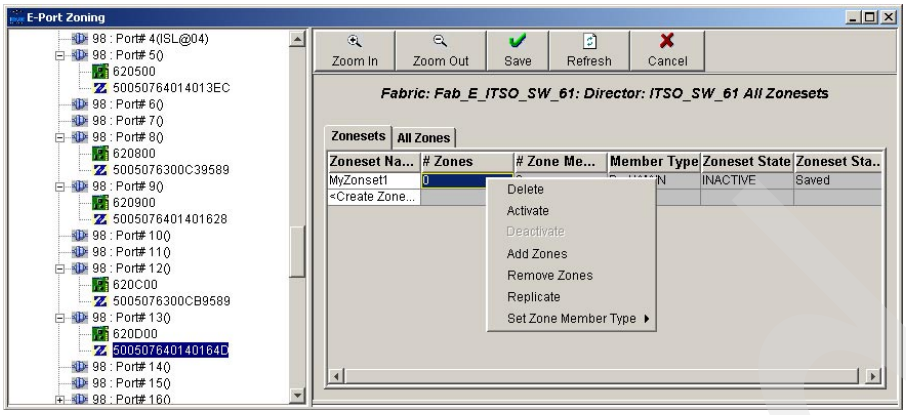

Figure 5-24 Add Zones menu

4. On the Add Zones to the Zoneset panel select the zone you created and click the **Add** button.
5. If a zone was added successfully to the Zoneset, check the # Zones and # Zone Members fields for the correct number of zones and zone members (see Figure 5-25).

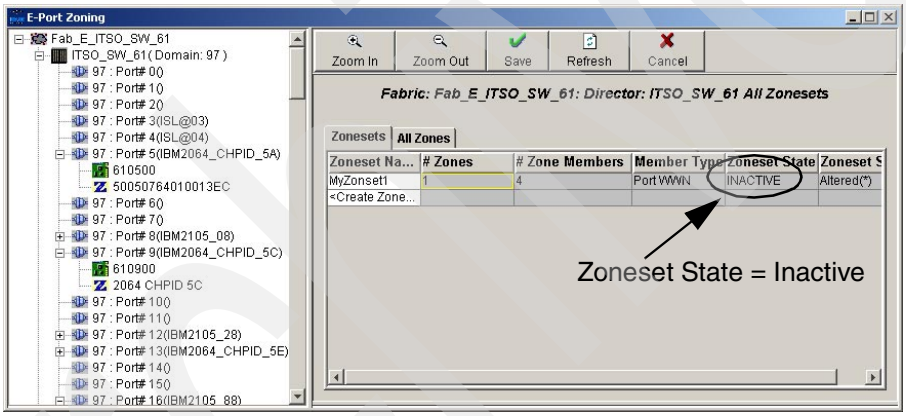

Figure 5-25 ZoneSet member display

Now a zoneset is defined and holds one or more zones, but this zoneset is not activated yet. You can replicate the zoneset if you want to define a similar zoneset or if you want to make changes. Only an inactive zoneset can be altered.

5.7.4 Activating a zone set

1. To activate zoning, select a zone set and right-click, then select **Activate** from the option menu.
2. Confirm the activation on the next panel.
3. If activation was successful, the zone set information will be propagated to all other Directors belonging to the fabric. The zone set and zone previously created in ITSO_SW_61 has also been sent to ITSO_SW_62, which is in the fabric shown in Figure 5-26.

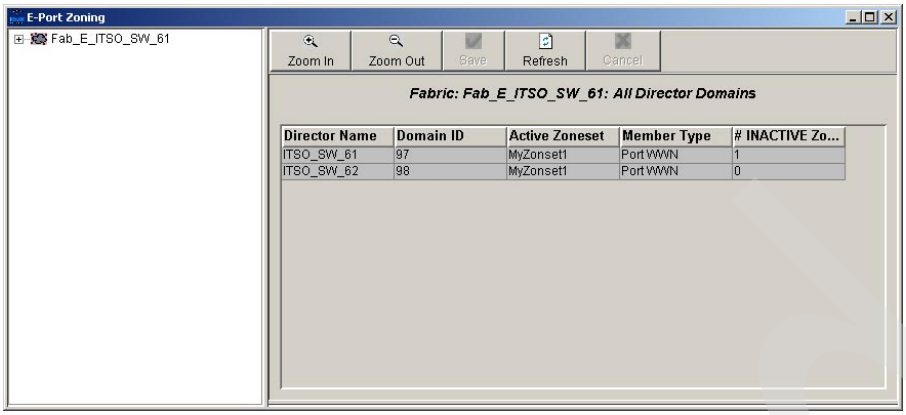

Figure 5-26 Zoneset propagation

Note: Each zone set may have more than one zone included.

Repeat the previous steps to define other zone sets and zones if required for future configurations.

5.8 Verifying and backing up the configuration

You should have finished the following installation and configuration steps in this chapter:

- Enable FICON mode
- Enable Management Server (CUP)
- Enter Domain ID and Director name
- Enable High Integrity Fabric
- Connect ISLs to build a fabric
- Port configuration
- Port WWN device configuration
- Define Zoneset and zones
- Add ports to zones
- Activate a Zoneset

The configuration details should be saved and printed. An export function is available in most of the configuration tasks:

- Node Descriptor
- Port Configuration
- Name Service
- Port WWN Device Configuration

Using the export function will save data either in text format (*.txt) or in a comma separated values file (*.csv) format. If data is saved in csv format, the file can be used to import the data into the Enterprise Manager again or can be imported to some other application programs accepting cvs formatted input files.

Create a new subdirectory (for example, C:\INRANGE\FC9000\Export_Files) on your Enterprise Manager workstation to store the exported files. To export data, display the desired configuration panel (for example, Port Configuration) and right-click in that window. Select **Export** from the option menu, as shown in Figure 5-27.

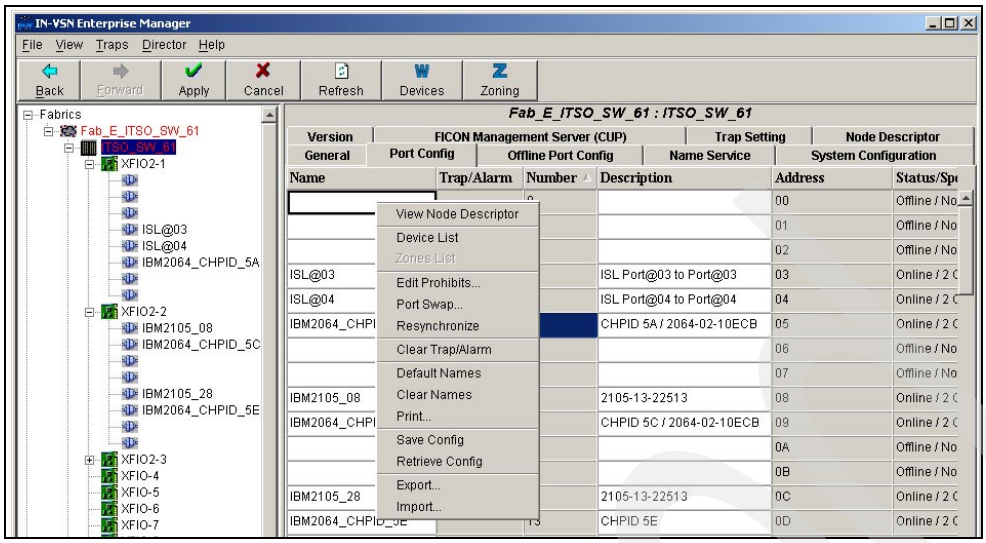

Figure 5-27 Export Port Configuration

You will be prompted to select the subdirectory where the export file should be stored. Enter a filename and choose the file format (txt or csv), then press Enter.

After the data has been stored on the workstation disk, copy the files to a diskette and keep it in a safe place. The csv formatted files can be used to restore the data to the Enterprise Manager workstation.

The txt formatted files can be viewed by any editor, as shown in Figure 5-28.

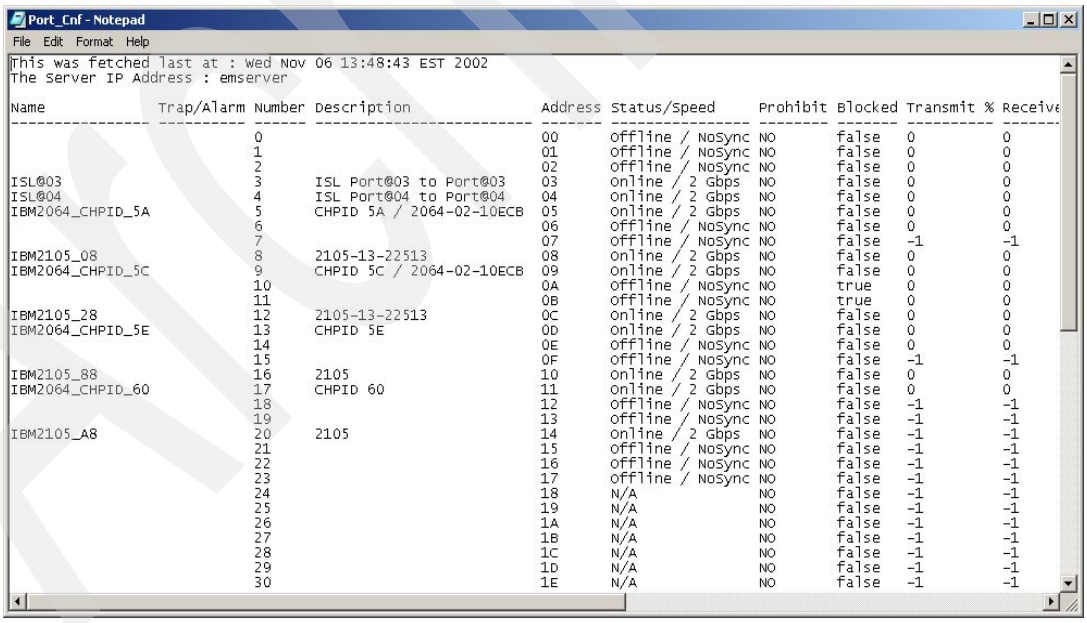

Figure 5-28 Port Configuration export file display (txt format)

Print out or display the data and compare the current configuration with the worksheet you have used to configure the Director(s).

A

Useful procedures

This appendix provides procedures needed to supplement configuration tasks described in this document.

In the subsequent sections, you will find the following topics discussed:

- Setting up a HyperTerminal session
- Altering the IP addresses of a FCM module
- Installing EM server/client code
- Installing Turbo TFTP software

Setting up a HyperTerminal session

Specific functions in the INRANGE FC/9000 FICON Director require using a HyperTerminal session. The communication is established via the serial debug port in the Director and a COM port on the workstation.

A HyperTerminal session is set up as follows (see Figure A-1):

1. Select **Start - Programs - Accessories - HyperTerminal** from your Windows desktop.
2. Enter a name (for example, FC9000) in the name field, then select an icon and click **OK**.

Figure A-1 HyperTerminal Connection Description

3. Select **COM2** and click **OK** (see Figure A-2).

Figure A-2 HyperTerminal Connect To options

4. On the COM2 Properties screen, select the following port settings:
   - Bits per second: 115200
   - Data Bits: 8
   - Parity: None
   - Stop Bits: 1

– Flow control: None

Then click **OK** to continue (see Figure A-3).

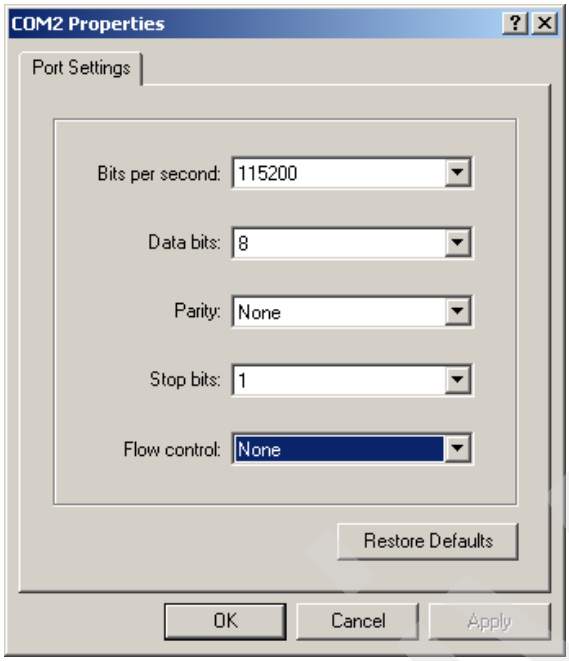

Figure A-3 COM2 properties panel

5. Select **Properties** from file menu. On the FC9000 Properties screen, click the **Settings** tab. Select the following settings:

   – Terminal keys
   – Emulation: ANSI
   – Backscroll buffer lines: 500

   Then click **OK**.

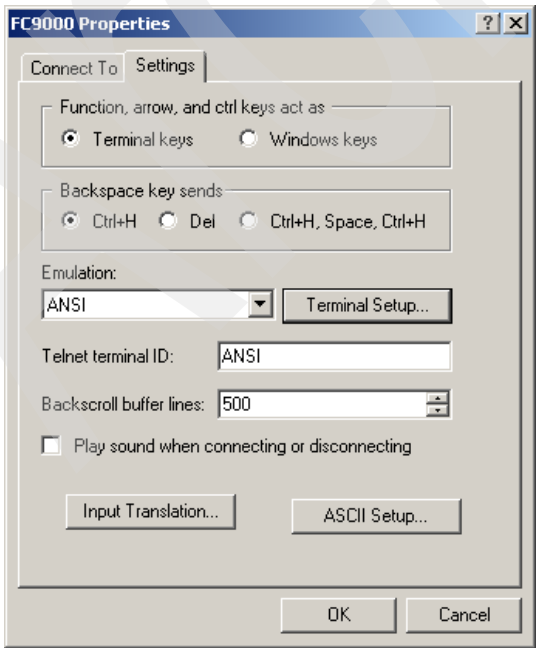

Figure A-4 FC9000 properties panel

To start a HyperTerminal session, you must first connect a null modem cable between the COM2 port on your workstation and the serial debug port on the FCM module of the FICON Director. From your Windows desktop, select **Start - Programs - Accessories - Hyperterminal - FC9000**.

The HyperTerminal window will open and is ready for you to enter commands.

Altering IP address in FCM module

Since each FCM module must have a unique IP address, it may be necessary to change the predefined IP address in the FCM modules. The following IP address range is reserved for internal communication of the Director and must not be used for any FCM module or external device connected to the service LAN:

- 10.1.1.x to 10.1.4.x
- 10.2.1.x to 10.2.4.x

If a HyperTeminal session is not already set up, then refer to “Setting up a HyperTerminal session” on page 68.

The necessary steps to change the IP address of a FCM module are as follows:

1. At the HyperTerminal window, press Enter. The ACM_Authorization Menu appears.

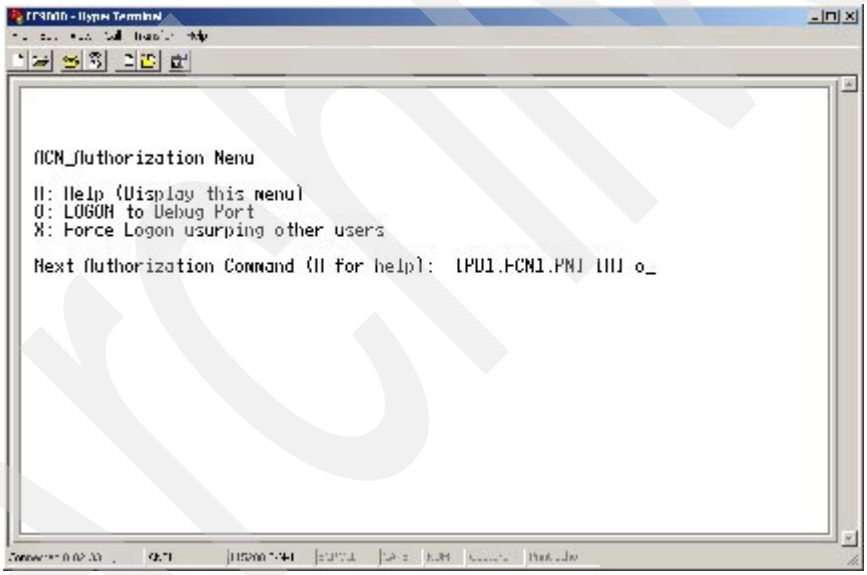

Figure A-5 ACM_Authorization Menu

2. Enter 0 at the command prompt (see Example A-1), and press Enter.
3. Type in the password: `admin` and press Enter.

Example: A-1 Logon to Debug Port

```
ACM_Authorization Menu

 H: Help (Display this menu)
 O: LOGON to Debug Port
 X: Force Logon usurping other users

 Next Authorization Command (H for help):  [PB1,FCM1,SB] [H] o
```

```
 Enter Password:  [] *****
Successful LOGON as a ADMINISTRATOR.
```

4. At the Main Debug Menu (see Example A-2), type in `H` to get detailed information for the debug menu.

Example: A-2 Main Debug Menu

```
MAIN DEBUG MENU (h for help)
 [PB1,FCM1,SB] [H] h
Today: October 29, 2002   Current Time: 3:25:40 PM
Menu Options for PB1: FCM1: Standby (Menu compiled: Sep 25 2002, 18:31:52)
------------------------------------------------------------------------
  0: Unit Settings and Testing Options
  1: Time since system was started
  2: PV Support
  4: System Configuration
  5: System Control
  C: CUP Info.
  L: LOGON / LOGOFF
  h: this help menu.
MAIN DEBUG MENU (h for help)
 [PB1,FCM1,SB] [H] 0as
```

5. Type in `0.A.S` and press Enter. Messages are displayed (see Example A-3).

Example: A-3 Settings and options

```
ASM-INFO: Status monitoring STOP cmd rcvd. State:0x1
Periodic monitoring stopped...
Today: October 29, 2002   Current Time: 3:25:43 PM
!!!!!!  FCM will Reset in 2 seconds at CTL SYS Request.
========================================================================
Boot Prom: Version for FCM-E hardware - 0.0.8.0
BP Application Version - 0.0.8.0
------------------------------------------------------------------------
Performing RAM Test (takes about 4 minutes) (Press ESC to abort) ...

Several other messages are displayed now. This may take several minutes ! Wait until you
get the following sequence of messages appear and be aware to press enter to a certain
message within 5 seconds !
Geo address based network parameters are used
NETWORK INTERFACE PARAMETERS USED:
             MAC Address     | IP Address | Subnet Mask
  Pri IPC: 00:FF:FF:FF:00:8D | 10.1.1.14  | 255.255.0.0
  Sec IPC: 00:FF:FF:FF:01:8D | 10.2.1.14  | 255.255.0.0
  Node   : 00:60:DF:20:26:A8 | 10.10.10.53 | 255.255.255.0
  Gateway for node IP interface: 10.0.0.11
------------------------------------------------------------------
FCM APPLICATION DOWNLOAD PARAMETERS:
  TFTP host IP  address: 10.1.5.99
  File to be downloaded: FCME_APP.TXT
------------------------------------------------------------------
After board is reset, start-up code will wait 5 seconds
------------------------------------------------------------------
To change any of this, press any key within 5 seconds
```

6. Press any key at this time to stop the process. Type in `M` and press Enter.

Example: A-4 Modify factory parameters

```
Modify flash boot(M) or Modify factory parameters(I) or Continue(C)? [M] m
For each of the following questions, you can press <Return> to select
the value shown in braces, or you can enter a new value.
FC9000 PARAMETERS:
  For setting chassis ids, use option '4' under the FCM application
  main debug menu.
```

7. If one of the following settings do not need to be changed you can press Enter to keep the current values.

   Type the new IP address in the *Enter Node IP Address* line, then press Enter.

   Type the Subnet mask in the *Enter Node Subnet Mask* line, then press Enter.

   Type the Gateway IP address in the *Enter Gateway for the node IP Interface* line, then press Enter.

Example: A-5 Network parameters

```
NETWORK INTERFACE PARAMETERS:
  Enter node IP  address:  [10.10.10.53] 10.10.5.53
  Enter node Subnet Mask:  [255.255.255.0] 255.255.255.0
  Enter Gateway for the node IP interface:  [10.0.0.11]
```

8. Type N to continue, then press Enter.

Example: A-6 Configuration parameters

```
How long (in seconds) should CPU delay before starting up?(5-60) [5]
------------------------------------------------------------------
FC9000 SYSTEM CONFIGURATION PARAMETERS:
  FCM GeoAddress: 0x8d
------------------------------------------------------------------
Geo address based network parameters are used
NETWORK INTERFACE PARAMETERS USED:
            MAC Address     | IP Address | Subnet Mask
  Pri IPC: 00:FF:FF:FF:00:8D | 10.1.1.14  | 255.255.0.0
  Sec IPC: 00:FF:FF:FF:01:8D | 10.2.1.14  | 255.255.0.0
  Node   : 00:60:DF:20:26:A8 | 10.10.5.53 | 255.255.255.0
  Gateway for node IP interface: 10.0.0.11
------------------------------------------------------------------
FCM APPLICATION DOWNLOAD PARAMETERS:
  TFTP host IP  address: 10.1.5.99
  File to be downloaded: FCME_APP.TXT
------------------------------------------------------------------
After board is reset, start-up code will wait 5 seconds
------------------------------------------------------------------
Modify flash boot(M) or Modify factory parameters(I) or Continue(C)? [M] c
Updating parameter storage. This may take a while...Done
Transferring control to the downloaded code. (@ 0x001C0004)
```

9. Several messages will be displayed on the screen, wait for the message: TELNET SERVER starting ... and verify that the IP address is correct.

Example: A-7 IP address verification

```
INFO: ASM - Updating the who is primary reg in primary FCM(0xf0) with 0x8e
ANC_IPtask is starting: NET 2, IP 10.10.5.53 .
SNMP Agent Started...
TELNET SERVER starting ...
```

Installing EM Server/Client application

This section describes how to install the IN-VSN EM Server/Client application on a workstation. On the IN-VSN EM console, both the server and the client component of the application have to be installed. On any other workstation it is recommended to install only the client component of the application.

1. On the workstation you want to install the IN-VSN Enterprise Manager, exit and close all applications.
2. Run the setup.exe file from the CD (or any other medium you received with the new IN-VSN EM version).
3. Click **Next** on the Welcome screen to get to the install wizard screen.
4. On the License agreement screen select **I Agree** and click **Next**.
5. The setup program is now searching for the current Java Version installed on your workstation. Java Version 1.3.0 is required to continue the installation. If the search completed successfully, click **Next**.
6. On the Feature Selection screen, select **Client** to install only the client component of the IN/VSN EM application, or select **Server** and **Client** if the workstation is responsible for running the server and the client components, then click **Next**.
7. The Ready to Install window displays all option you selected for this installation, click **Next** to start the installation.
8. If the installation was successful, the Install Summary is displayed. Click **Exit** to end the setup program.
9. Up to three icons should appear on your desktop, depending on your selection during installation:
   - IN-VSN Enterprise Mgr
   - IN-VSN Client
   - IN-VSN DB-Restore

Figure A-6 IN-VSN icons

Upgrading Director firmware

Special software is required to download firmware into the INRANGE FC/9000 FICON Director. This *Turbo TFTP* software is available on the CD labeled *FC/9000 FIBRE CHANNEL SWITCH Remote Link,* which is shipped with the machine. The Turbo TFTP software is already installed on the IN/VSN EM Server console, however if the EM Server software is on different workstation, then Turbo TFTP must also be installed.

Installing Turbo TFTP software

To install Turbo TFTP, follow these steps:

1. Insert the CD with the Turbo TFTP software into the CD drive.
2. Run the tftpt_fs.exe.
3. Accept the License agreement.
4. Select **No** to prevent the program from starting automatically.

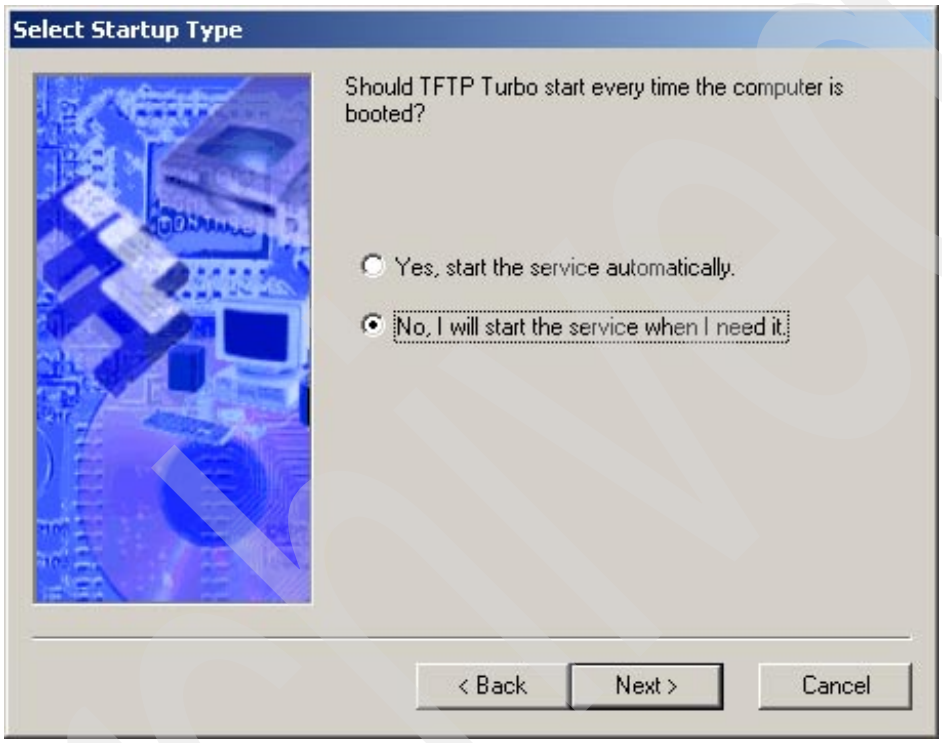

Figure A-7 Turbo TFTP Startup type selection

5. Click **Next** to continue, then click **Install**.
6. Your workstation must be rebooted to activate the installed software.

5.8.1 Defining Turbo TFTP program properties

7. After the reboot has finished, go to the control panel (**Start -> Settings -> Control panel**) and locate the TFTP Turbo icon.
8. Double-click the TFTP Turbo icon.
9. On the TFTP Turbo Properties panel:
   - Change the default directory to where the FC9000 IN/VSN software is installed.
   - Check Log file transfers, then type in the Log file location: `C:\tftp.log`.

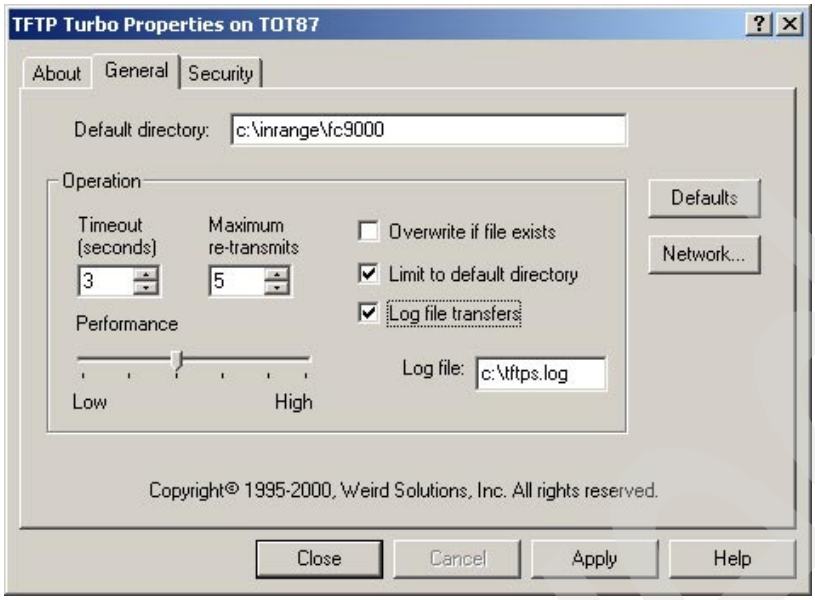

Figure A-8 Turbo TFTP Properties

10. Click **Apply** and **OK** to close the window.

The Turbo TFTP software is now configured to be used for downloading FC/9000 firmware.

5.8.2 Starting Turbo TFTP service

The Turbo TFTP program has to be started before downloading the firmware to a Director. Also, the Turbo TFTP program must be installed and configured on the EM console prior to start of the service. Refer to “Installing Turbo TFTP software” on page 74 and “Defining Turbo TFTP program properties” on page 74 for installation and definition procedures.

1. Open the control panel on the EM console (**Start -> Settings -> Control panel**).
2. Double-click the Administrative Tools icon in the Control panel window.
3. Double-click the Services icon in Administrative Tools window.
4. Click Weird Solutions’ **TFTP Turbo** to select this service.

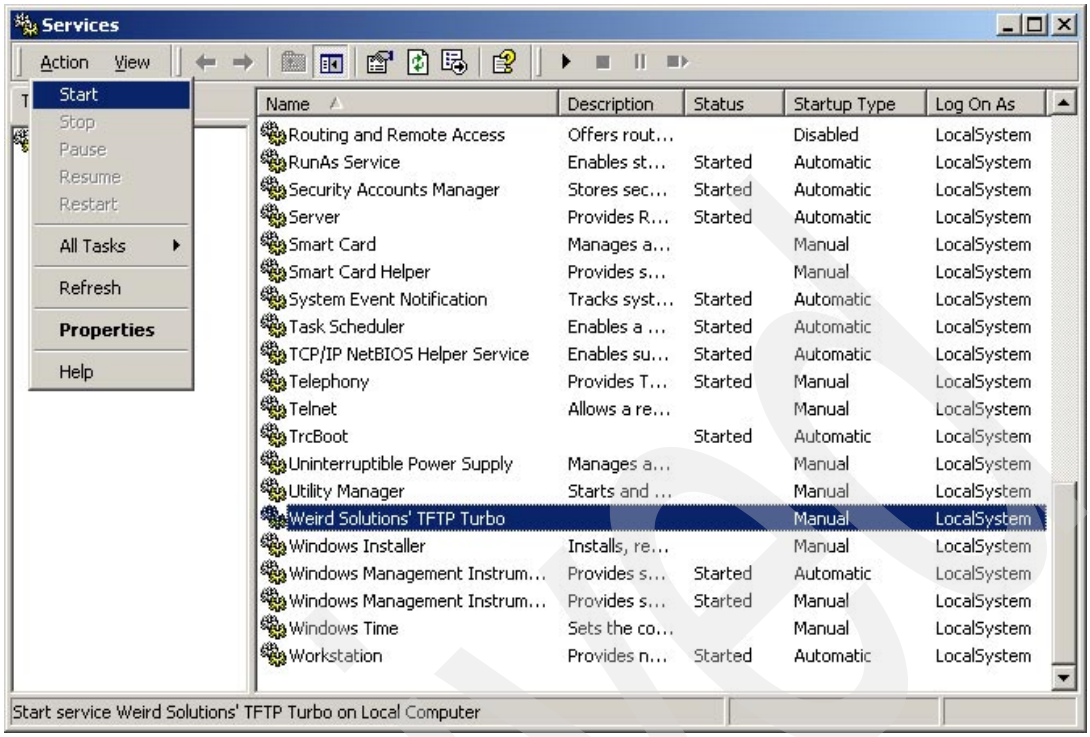

Figure A-9 Start Turbo TFTP service

5. From the Action menu, click **Start**.
6. The status of Weird Solutions' TFTP Turbo should now change to Started.

B

Chassis and port location

This appendix provides information about the physical layout of INRANGE FC/9000 FICON Director models. These models allow for a wide range of configuration options. The basic building block is the I/O module, which contains eight Fibre Channel/FICON ports using 1 Gbps or 2 Gbps technology. For more configuration details, see “FICON Director configurations” on page 15.

In the subsequent sections, you will find diagrams depicting the following:

- Chassis numbers and their location
- Corresponding port address ranges

Chassis location

The following figures show the chassis (also known as Port Block) numbering scheme for the 64, 128, and 256 port FICON Directors. Also the port address ranges for each chassis are shown. For detailed port layout for a specific chassis number, refer to “Physical port location” on page 80.

Figure B-1 shows a 64-port FICON Director with the assigned port address ranges.

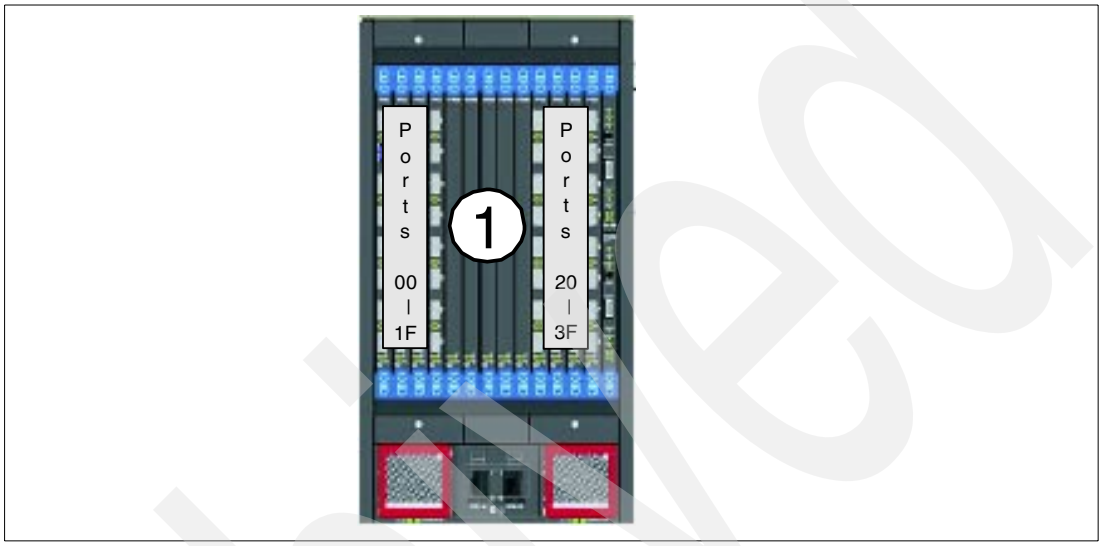

Figure B-1 Chassis layout for a 64-port FICON Director

Figure B-2 shows the layout of an 128-port FICON Director chassis with their associated port address ranges. There is an upper and a lower chassis with this model.

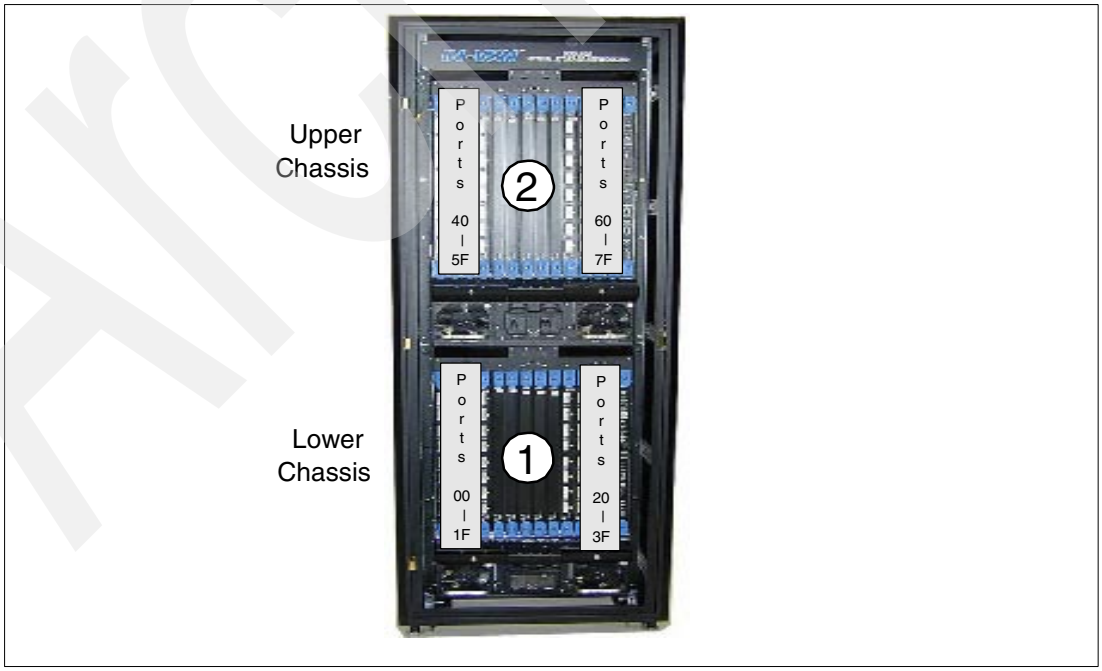

Figure B-2 Chassis layout for a 128-port FICON Director

Figure B-3 shows the layout for a 256-port FICON Director chassis with their associated port address ranges. There are upper and lower left chassis and upper and lower right chassis with this model.

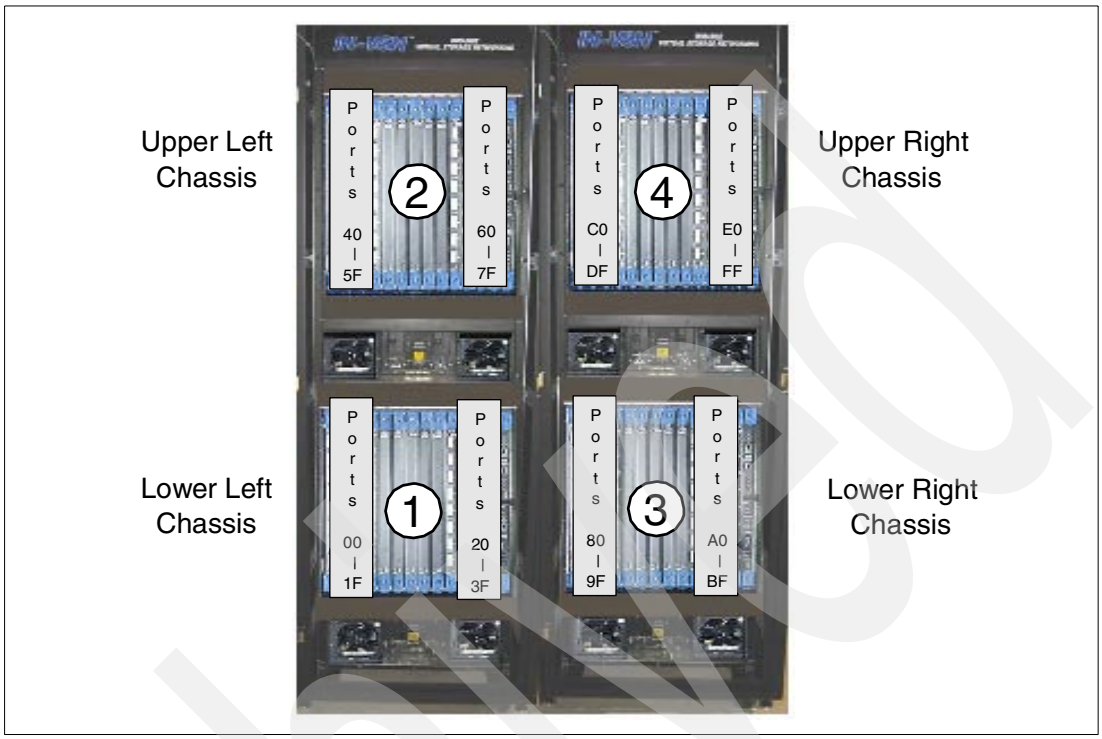

Figure B-3 Chassis layout for a 256-port FICON Director

Physical port location

The diagrams in Figure B-4, Figure B-5, Figure B-6, and Figure B-7 illustrate the physical layout of ports and their corresponding port addresses. The port numbering is shown in hexadecimal value.

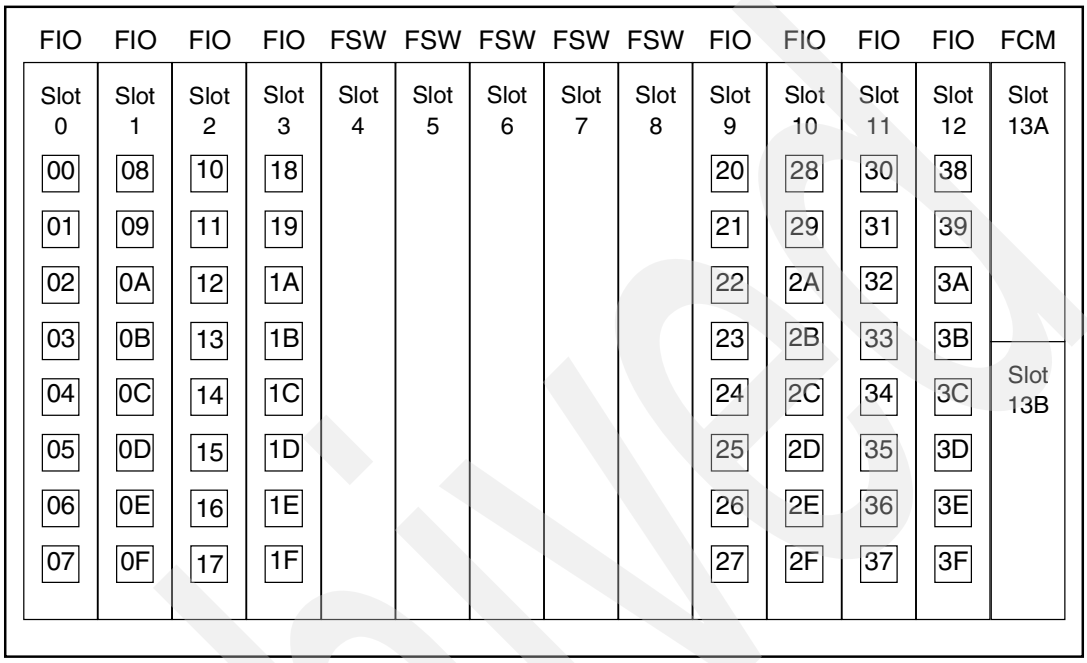

Figure B-4 Chassis #1, physical port numbering

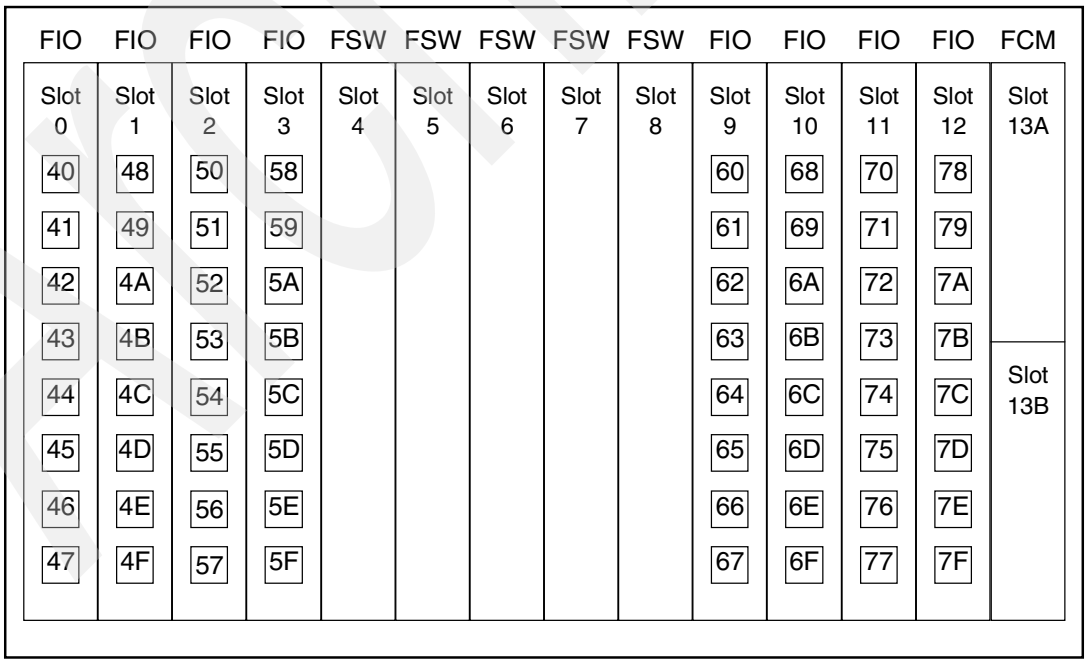

Figure B-5 Chassis #2, physical port numbering

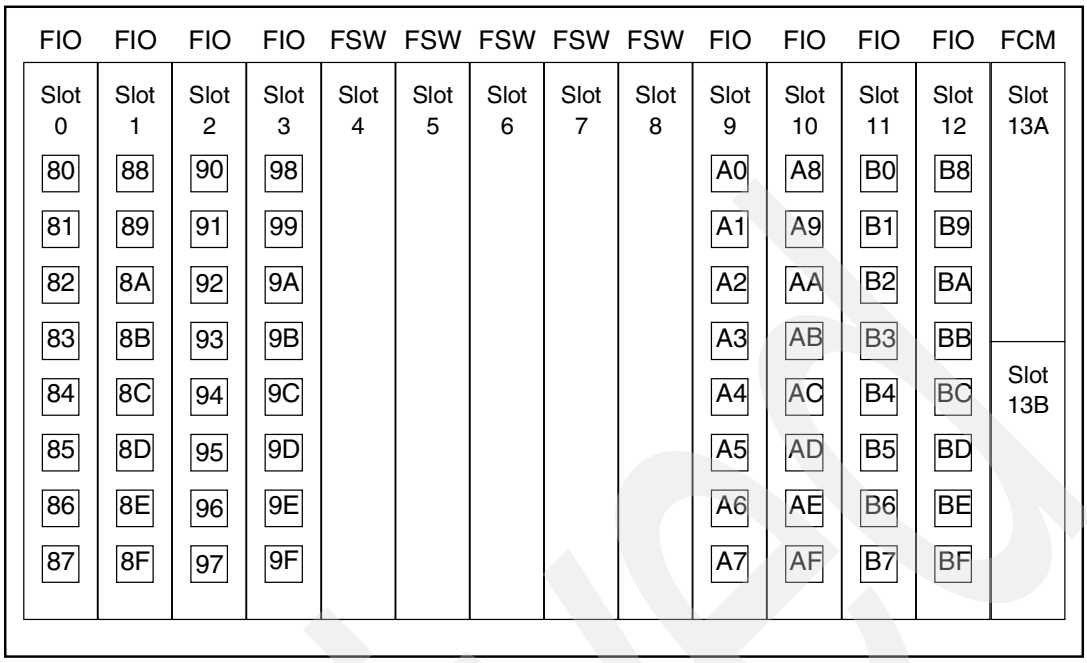

Figure B-6 Chassis #3, physical port numbering

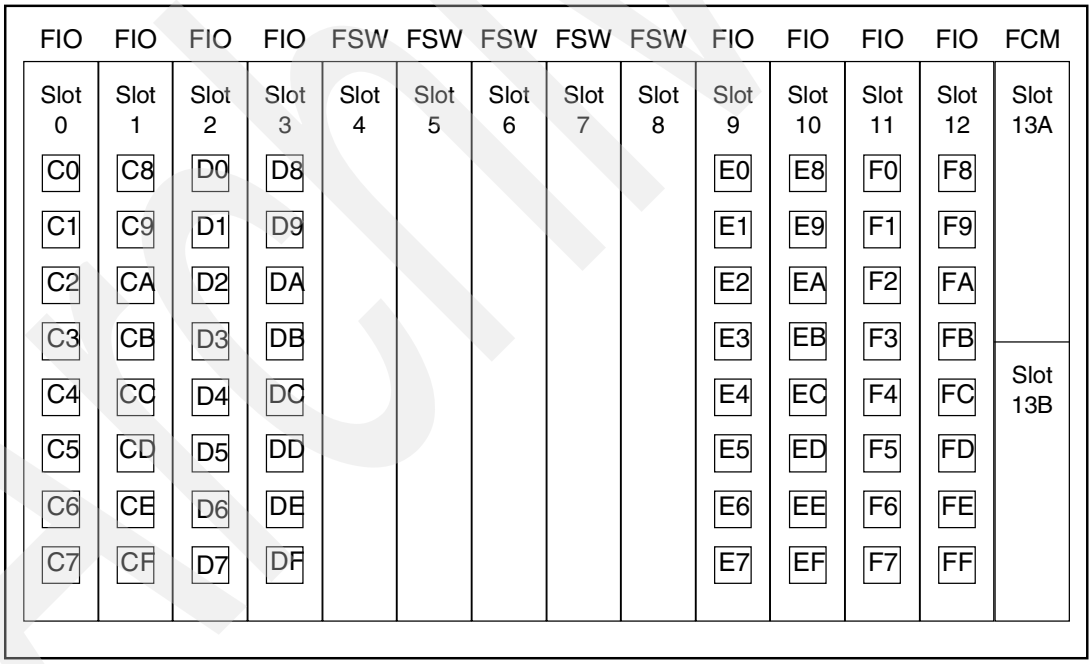

Figure B-7 Chassis #4, physical port numbering

C

FICON Director configuration worksheet

This appendix contains a worksheet to aid in documenting the layout of your FICON Director. It can be applied as a tool to help you understand how the ports are allocated for configuration and problem determination purposes.

FICON Director Configuration Worksheet

FICON Director Manufacturer: _____ Type: _____ Model: ____ S/N _____

HCD defined Switch ID _____ (Switch ID)
FICON Director Domain ID _____ (Switch @)

Cascaded Directors No ___ Yes ___
Corresponding cascaded Director Domain ID _____
Fabric name _____

FICON Director Ports					Attached N_Ports / E_Ports (CU, CPC or ISL)				
Slot Number	Port Number	Port Address	Laser Type: LX / SX	Port Name	Node Type CU / CHNL	Machine Type	Model	Serial Number	ISL CU I/F CPC CHPID

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

IBM Redbooks

For information on ordering these publications, see “How to get IBM Redbooks” on page 85.

- *FICON Native Implementation and Reference Guide,* SG24-6266

Other resources

These publications are also relevant as further information sources:

- *IN-VSN Enterprise Manager Software,* 9115435-203-00
- *IN-VSN FC/9000 Fibre Channel Director Maintenance Manual,* 9114572-307-00
- *IN-VSN FC/9000 Fibre Channel Director Site Planning Guide for E_Port Configurations,* 9115054-101-03
- *IN-VSN FC/9000 Fibre Channel Director Simple Network Management Protocol Reference Guide,* 9114428-205-00
- *IN-VSN Enterprise Manager Software Installation and Operation Manual,* 9114570-203-00

Referenced Web sites

These Web sites are also relevant as further information sources:

- INRANGE FC/9000 documentation and information

  `http://www.inrange.com/ibm`
- IBM offerings for INRANGE FC/9000

  `http://http://www.ibm.com/storage/inrange`

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Getting Started with the INRANGE FC/9000 FICON Director

(0.2”spine)
0.17”<->0.473”
90<->249 pages

Getting Started with the INRANGE FC/9000 FICON Director

Redbooks

Product, planning, and implementation information

Realistic considerations and suggestions

Helpful configuration examples

This IBM Redbook discusses how to install, tailor, and configure the INRANGE FC/9000 FICON Director, in conjunction with the FICON topologies supported by zSeries and 9672 Generation 5 and Generation 6 servers. It focuses on the hardware installation as well as the software definitions needed to provide connectivity for supported FICON environments.

This book provides planning information and FICON Director setup information. Also included are helpful utilities for monitoring and managing the INRANGE FC/9000 FICON Director environment.

This document is intended for system engineers, SAN administrators, and system programmers who will plan and install INRANGE FC/9000 FICON Directors. A good background in systems planning, hardware and cabling infrastructure planning, and zSeries I/O definitions (HCD or IOCP), as well as Fibre Channel or FICON Directors, is assumed.

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