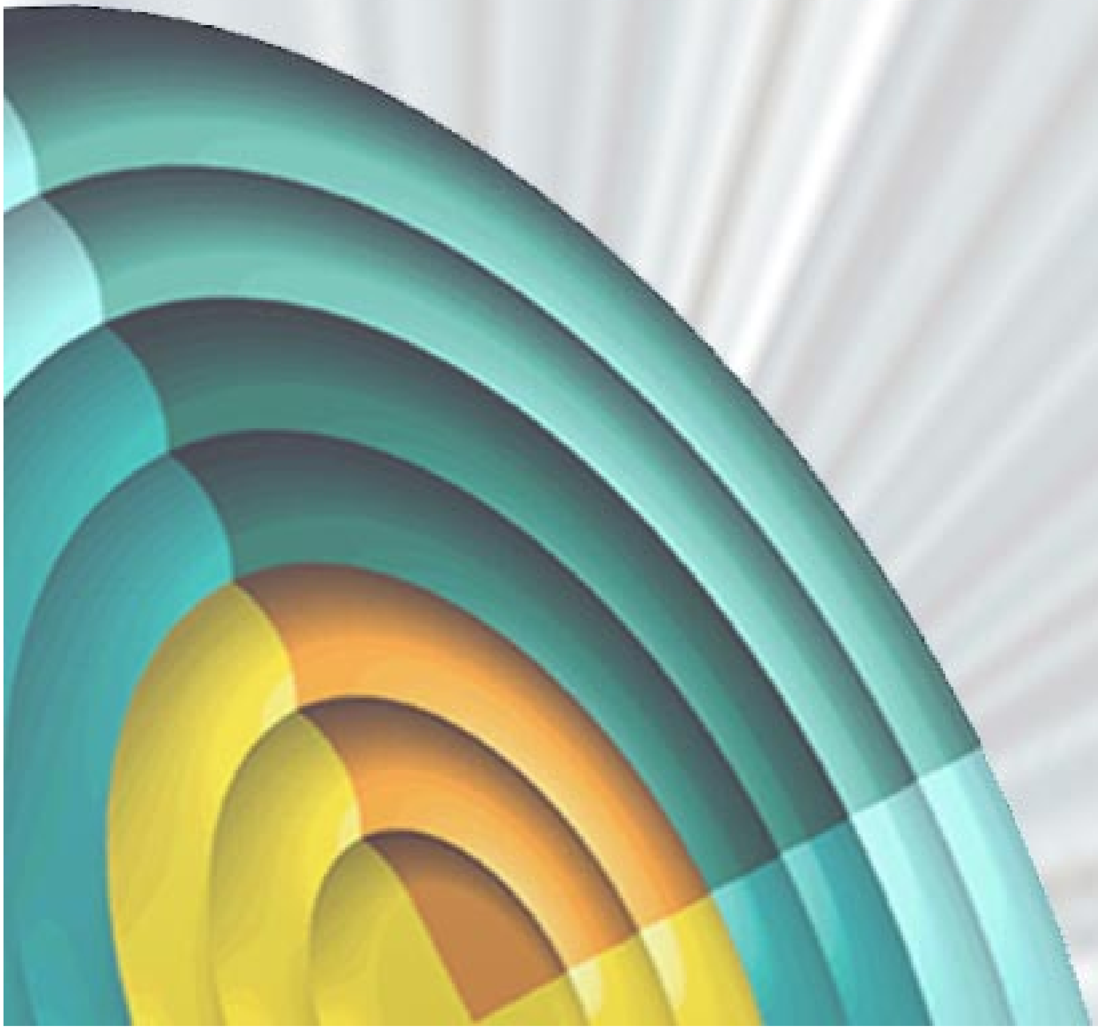
FORE SYSTEMS

Technical Education

ForeView
For Network Managers



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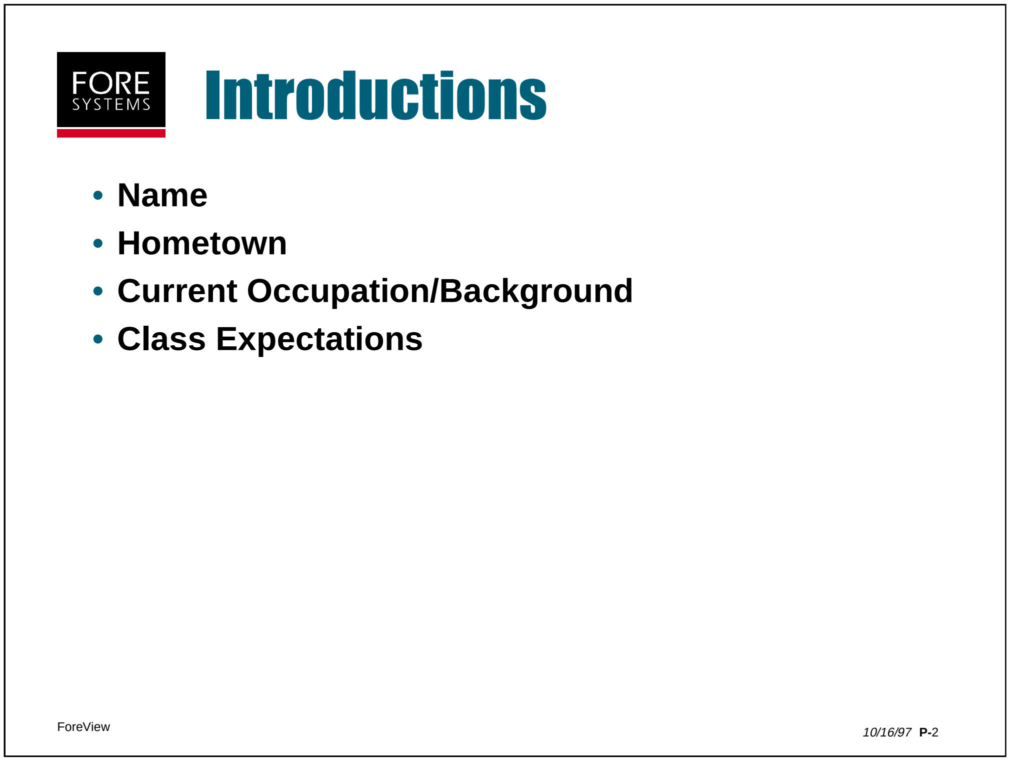
FORE SYSTEMS

Welcome to FORE Systems

ForeView Training



Introductions

- Name
- Hometown
- Current Occupation/Background
- Class Expectations

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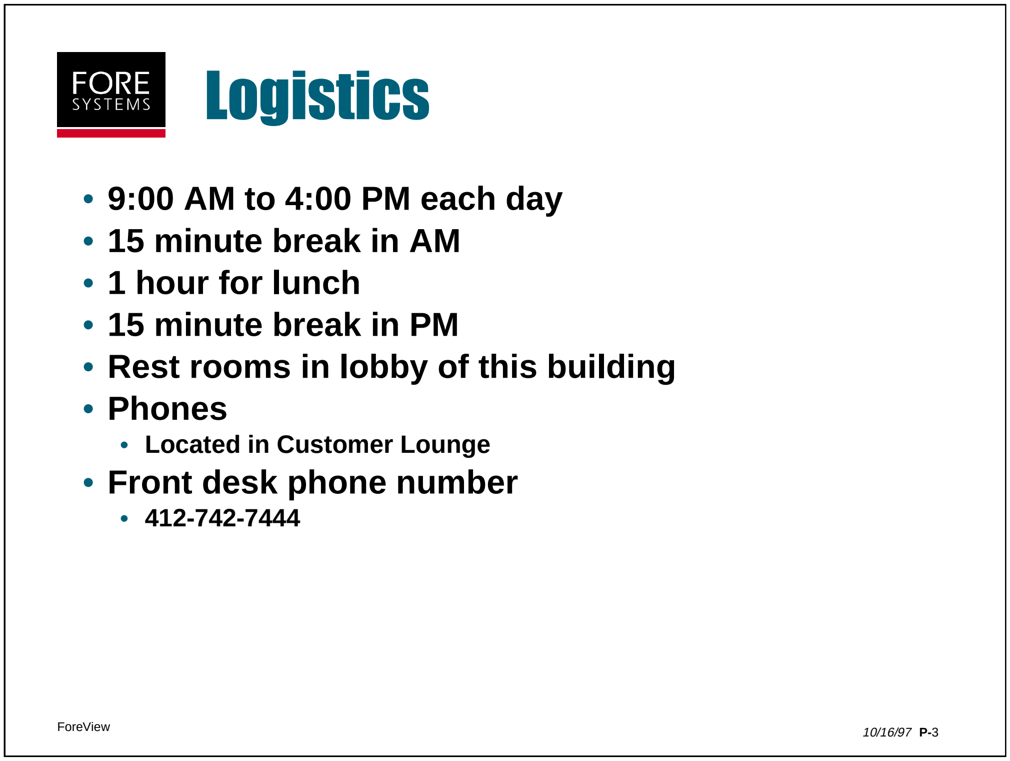
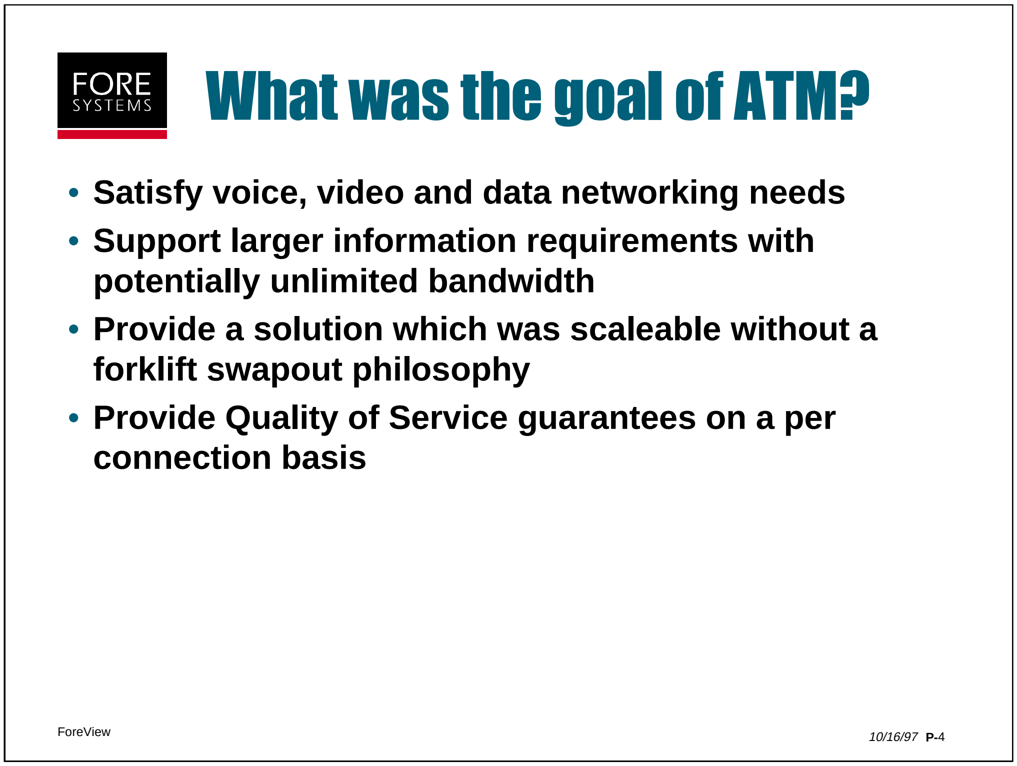


Logistics

- 9:00 AM to 4:00 PM each day
- 15 minute break in AM
- 1 hour for lunch
- 15 minute break in PM
- Rest rooms in lobby of this building
- Phones
  - Located in Customer Lounge
- Front desk phone number
  - 412-742-7444



FORE SYSTEMS

What was the goal of ATM?

- Satisfy voice, video and data networking needs
- Support larger information requirements with potentially unlimited bandwidth
- Provide a solution which was scaleable without a forklift swapout philosophy
- Provide Quality of Service guarantees on a per connection basis

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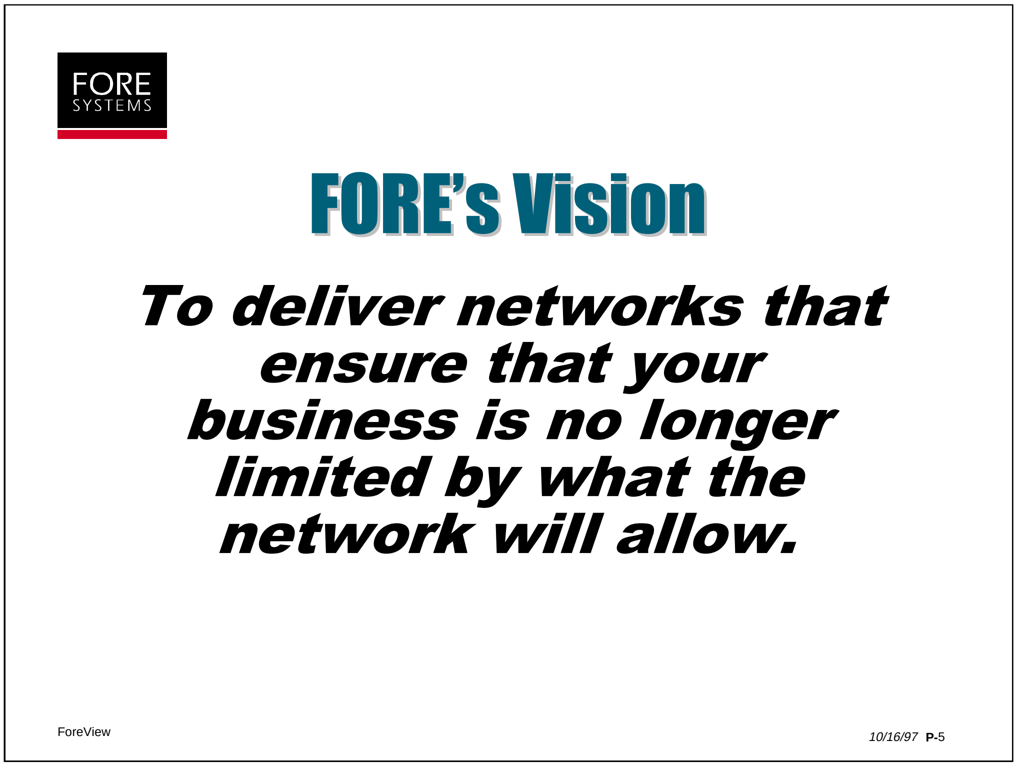
Asynchronous Transfer Mode (ATM) as defined by CCITT at the time (now ITU) and later the ATM Forum, was targeted from the beginning as the switching technology for a future network that included support for three major forms of traffic (voice, data and video).

ATM's bandwidth handling capability was (and still is) open-ended. SONET pipes were proposed to connect ATM switches, and those pipes continue today to evolve into larger and larger entities.

Scalability was designed into ATM, and the ATM Forum has been particularly keen recently to insure a level of downward compatibility with each new technology enhancement.

One of the most important differentiators of ATM was also designed in from the beginning, and that is per-connection QoS guarantees.



FORE SYSTEMS

FORE's Vision

To deliver networks that ensure that your business is no longer limited by what the network will allow.

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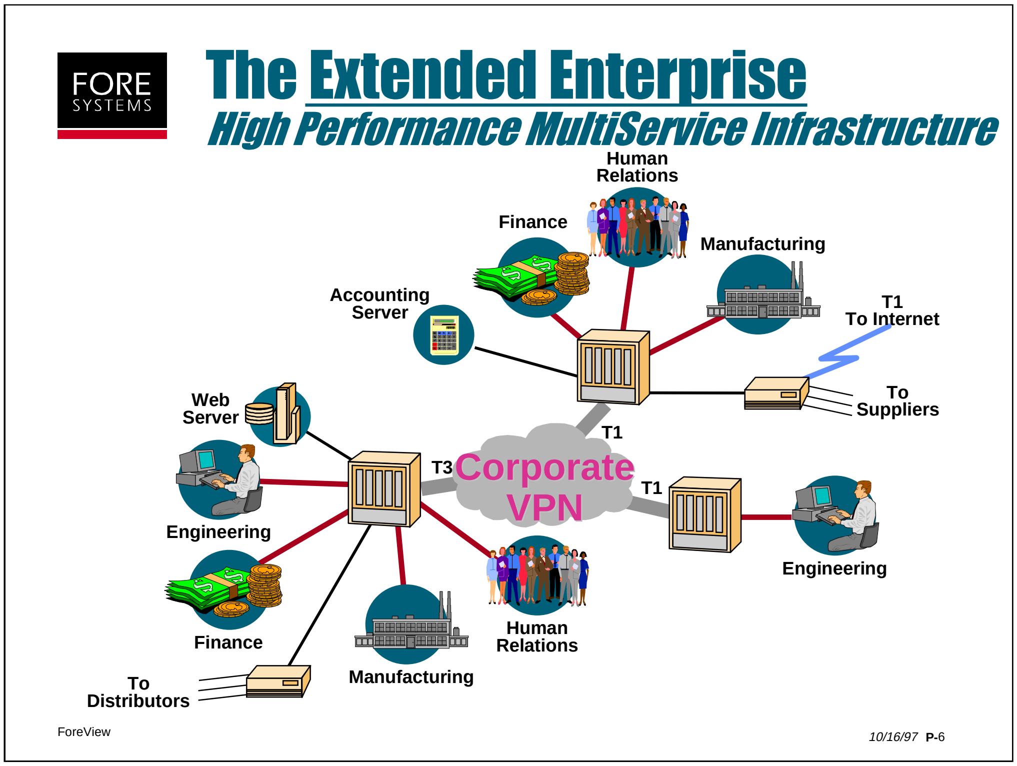

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The Extended Enterprise

High Performance MultiService Infrastructure

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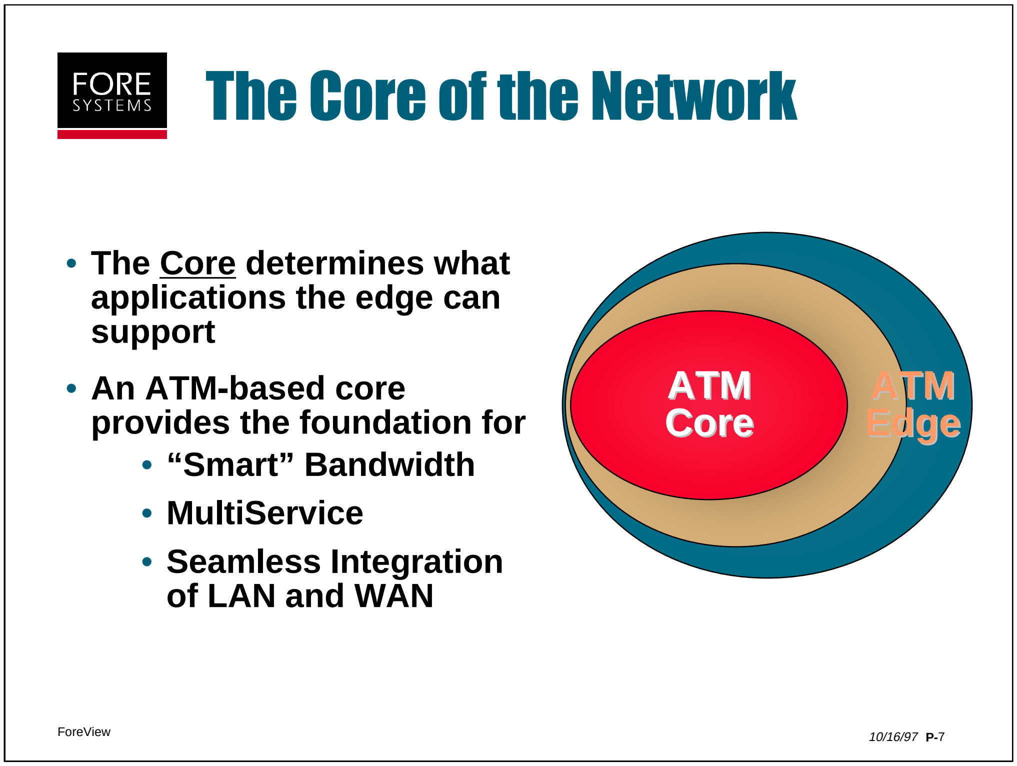
Our goal is then to deliver the network components needed to model an extended enterprise utilizing a high performance multiservice infrastructure.



The Core of the Network

- The <u>Core</u> determines what applications the edge can support
- An ATM-based core provides the foundation for
  - “Smart” Bandwidth
  - MultiService
  - Seamless Integration of LAN and WAN

ForeView

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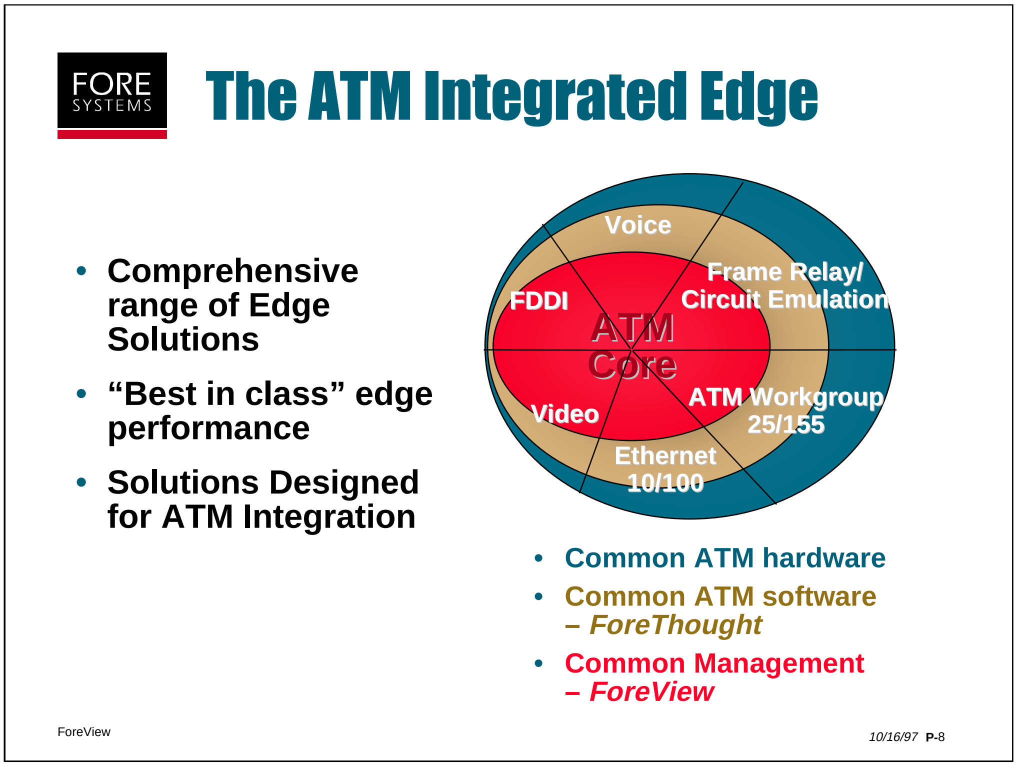
FORE’s Core is built on family of ATM switches including the ASX-1000, ASX-200BX and LE-155 plus families of ATM network interface cards which support a variety of server or workstation applications.

The elimination of the LAN/WAN “seam” is simply that a cell in the LAN is identical to a cell in the WAN.



FORE SYSTEMS

The ATM Integrated Edge

- Comprehensive range of Edge Solutions
- “Best in class” edge performance
- Solutions Designed for ATM Integration

- Common ATM hardware
- Common ATM software
  – *ForeThought*
- Common Management
  – *ForeView*

ForeView

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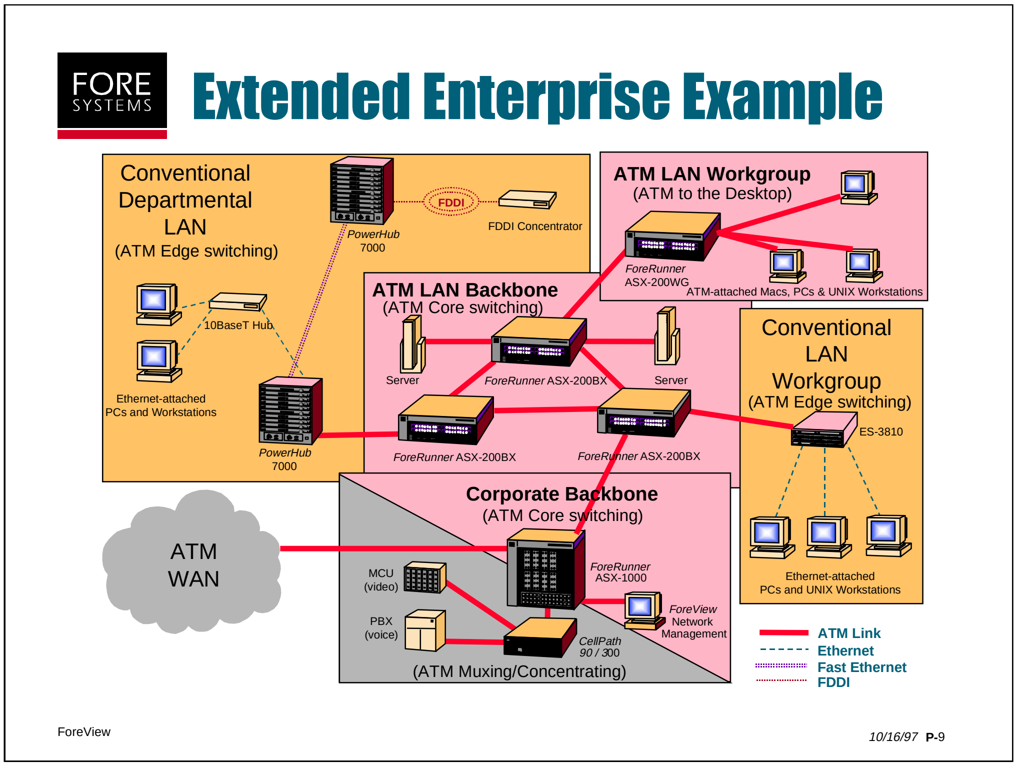
FORE’s Edge products include the PowerHub 6000/7000 product family, the ES-3810/3850 product family, the CellPath product family and our video over ATM product family.



Extended Enterprise Example

- ATM Link
- Ethernet
- Fast Ethernet
- FDDI

ForeView

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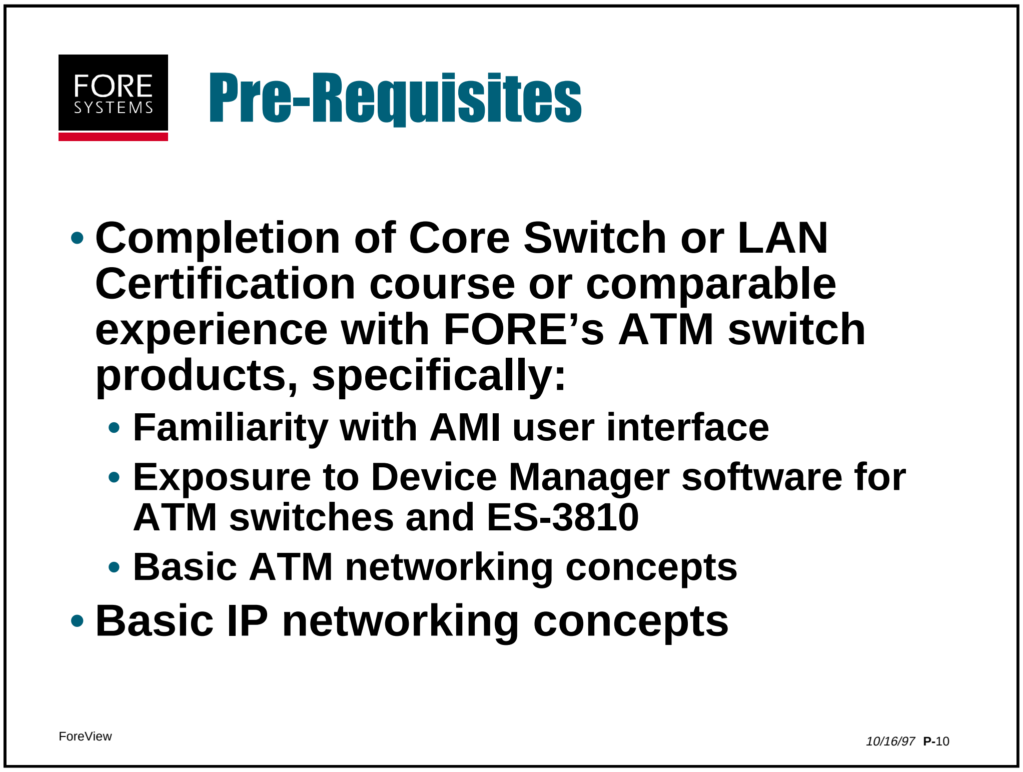
FORE Systems provides a complete Extended Enterprise solution including support for conventional LAN connectivity (through ATM Edge switching) and ATM Core switching which as shown above could include applications such as ATM to the desktop for workgroups, ATM LAN Backbones and ATM Corporate Backbones. The Corporate Backbone is often connected across the wide area and many times includes support for a corporate-wide voice and/or video network. Together, the products represented performing the applications shown above, provide a solution that solves today’s problems and lays the foundation for tomorrow’s multi-service network.



Pre-Requisites

- Completion of Core Switch or LAN Certification course or comparable experience with FORE’s ATM switch products, specifically:
  - Familiarity with AMI user interface
  - Exposure to Device Manager software for ATM switches and ES-3810
  - Basic ATM networking concepts
- Basic IP networking concepts

ForeView

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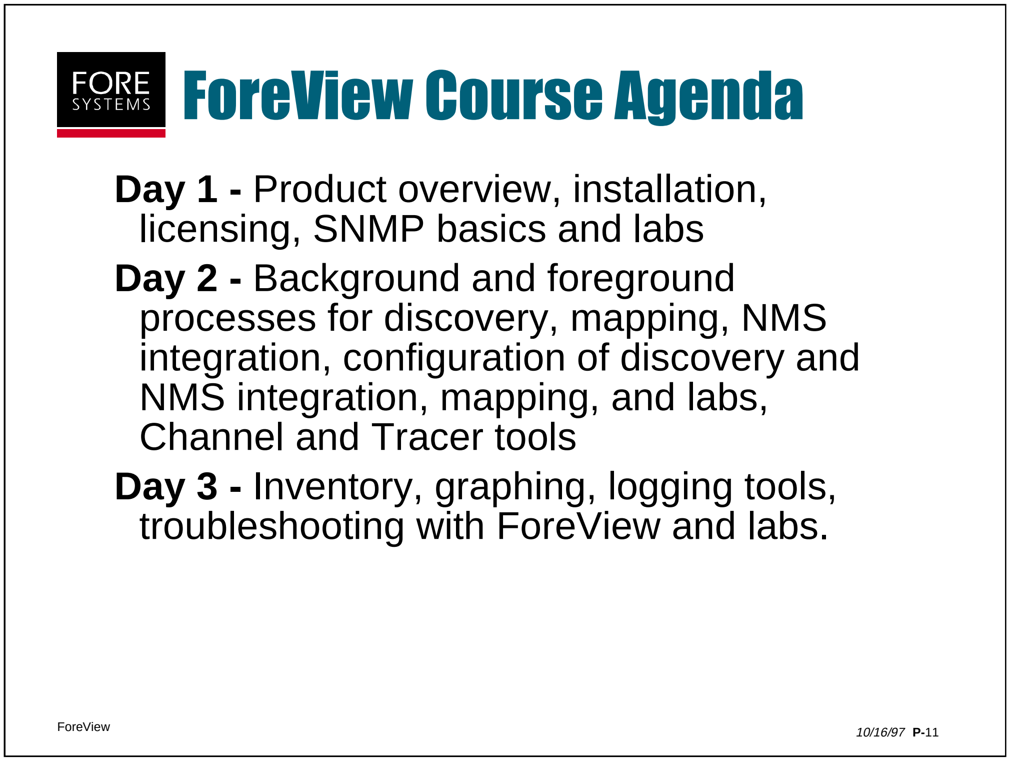
The scope of this class is coverage of SNMP-based management of FORE’s products. Instructors assume knowledge of FORE’s products and use of element manager . IP connectivity is a crucial issue in SNMP-based management and success of the labs will depend on the student’s ability to take steps needed to initialize, manage and configure IP interfaces on desktop systems and FORE’s ATM switches.

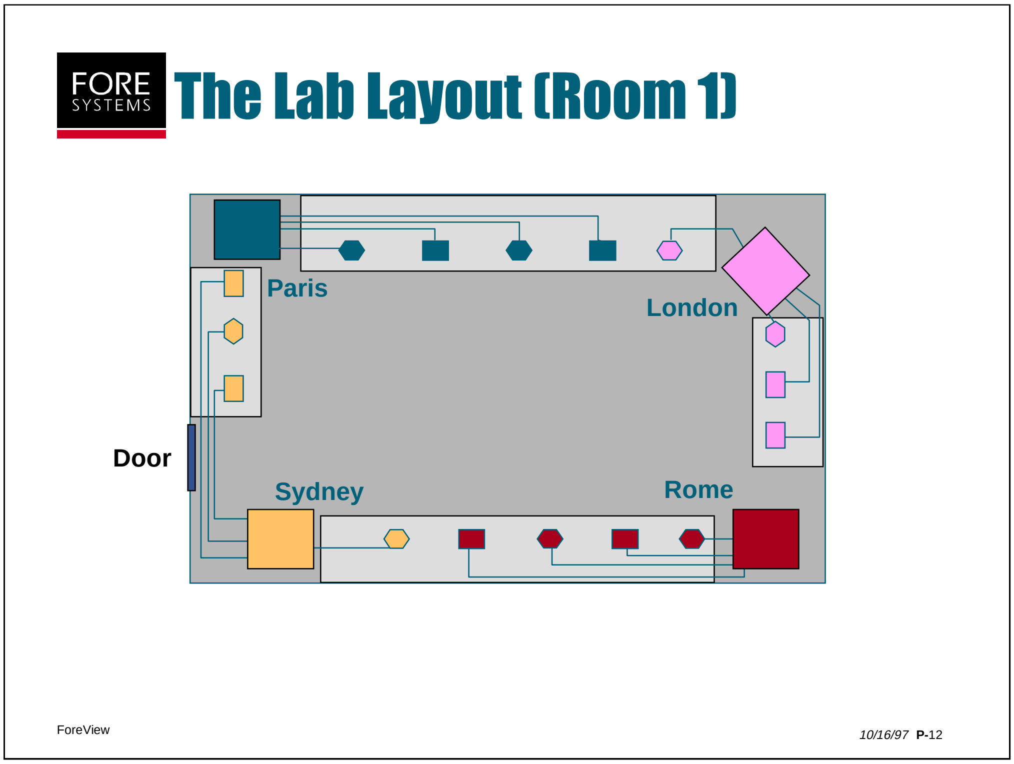


ForeView Course Agenda

Day 1 - Product overview, installation, licensing, SNMP basics and labs

Day 2 - Background and foreground processes for discovery, mapping, NMS integration, configuration of discovery and NMS integration, mapping, and labs, Channel and Tracer tools

Day 3 - Inventory, graphing, logging tools, troubleshooting with ForeView and labs.



The Lab Layout (Room 1)

ForeView

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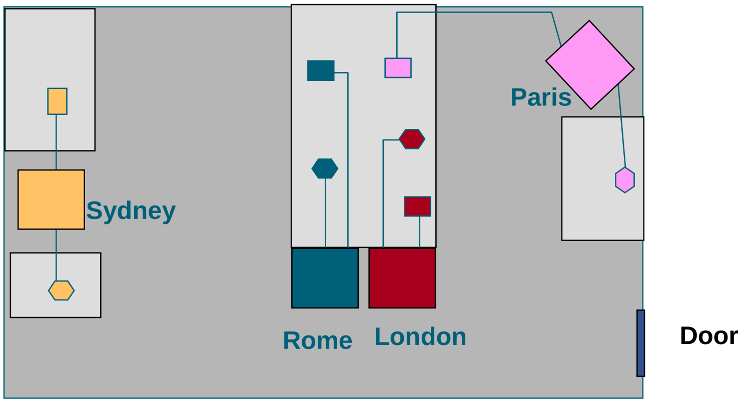
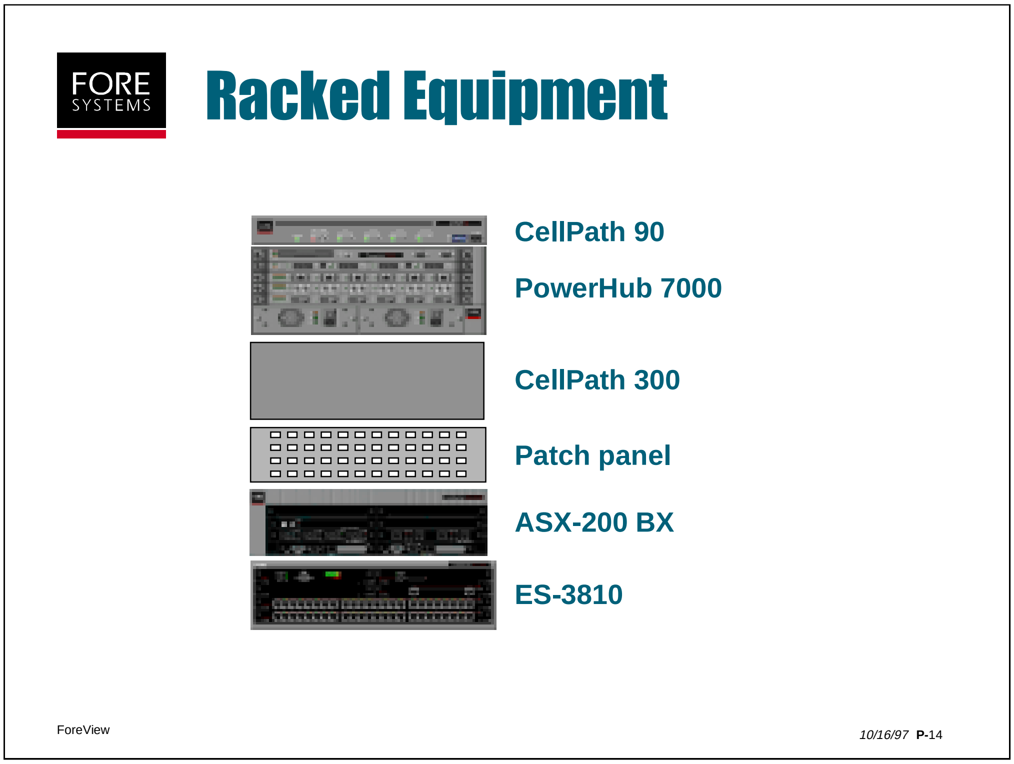
The network facility that you have access to for this class includes enhancements to help you maximize your learning efforts. The student-to-keyboard ratio is 1:1. Two basic ATM desktop platforms are in the training room -- Unix (on Suns) and Windows NT (on Compaqs). Throughout the course you will have ample opportunity to use both platforms. It is to your advantage to switch between end nodes within your group to get firsthand experience on both and to see the differences in features enabled on each platform.

The network equipment is clustered in racks. Naming conventions for the equipment is based on names for each rack. London, Paris, Rome and Sydney are the rack names, so the host names are simply Rome1, Rome2, Rome3, etc. With a maximum of four students per rack, there should be ample opportunity to "do it yourself" on each lab. Watching someone else execute a lab will not result in the same learning experience.

The Lab Layout (Room 2)





Racked Equipment

CellPath 90

PowerHub 7000

CellPath 300

Patch panel

ASX-200 BX

ES-3810

ForeView

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Each rack may contain one of the following (starting at the top):

CellPath 90 - a T1 ATM interface supporting voice, video and data.

PowerHub 7000 - a routing, switching hub providing ATM connectivity, this PowerHub has 16 10BaseT ports, an ATM uplink, and dual power supplies.

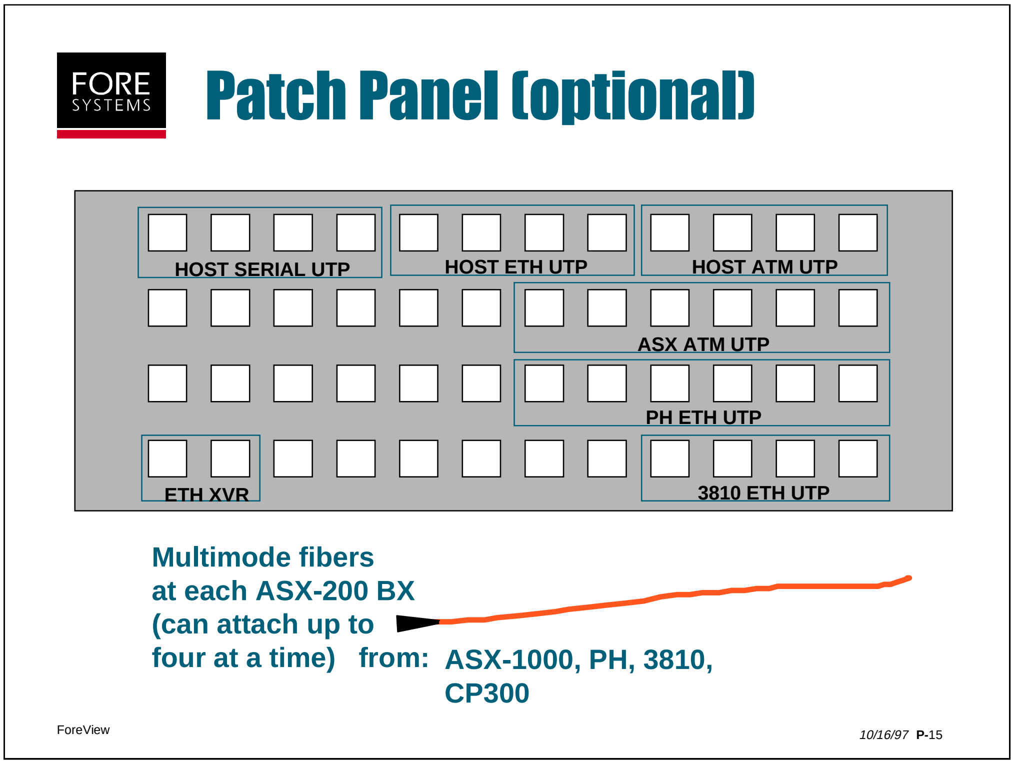
CellPath 300 - a cell midplane multiplexer supporting various services including ATM.

Patch Panel - the point of all UTP wiring concentration.

ASX-200BX - a 2.5 Gbps ATM switch with 4 ATM 155 Mbps UTP ports, 6 ATM 1.5 Mbps T1 ports, 4 ATM 155 Mbps OC-3c multimode ports and dual power supplies.

ES-3810 - a low-cost Ethernet switch with 24 ports of Ethernet 10BaseT, one ATM 155 Mbps uplink, and a network management module.

The London rack also contains an **ASX-1000** ATM switch with two switching fabrics (5 Gbps total) containing several ATM 155 Mbps OC-3c multimode ports.



Patch Panel (optional)

Multimode fibers at each ASX-200 BX (can attach up to four at a time) from: ASX-1000, PH, 3810, CP300

ForeView

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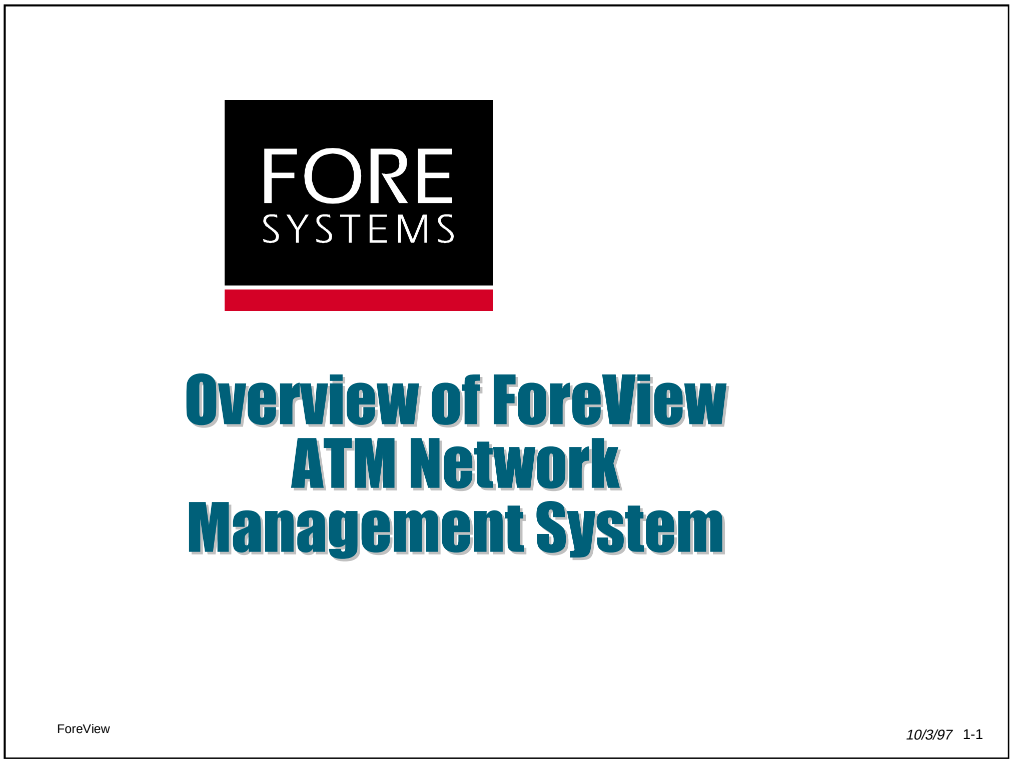
The patch panel in each rack is there to make things easier to connect any device to any device. Two Cat5 UTP cables are run from each host (Ethernet and ATM UTP ports) to the ports marked as “Host” in the top row of connectors. Below the Host ATM UTP ports are device ports for the ASX-200BX, PowerHub and ES-3810. These ports are wired to ports on the named devices. There is an Ethernet crossover built into the panel at the lower left, to allow easy interconnection between racks using straight through UTP cable runs.

To facilitate connecting the racks together, a duplex strand of multimode fiberoptic cable is run from each of the ASX-200BX switches to the ASX-1000 switch in the London rack. Also, multiple straight through UTP cables may be run between racks on the same side of the room to facilitate certain lab exercises.

The intent is to allow simultaneous use of the Ethernet and ATM ports on the hosts and any-to-any ATM virtual connections. The hosts can be connected by use of the patch cords. The local ASX-200BX can participate in a larger ATM network or isolate itself by using the provided fiber.



FORE SYSTEMS

Overview of ForeView ATM Network Management System

ForeView

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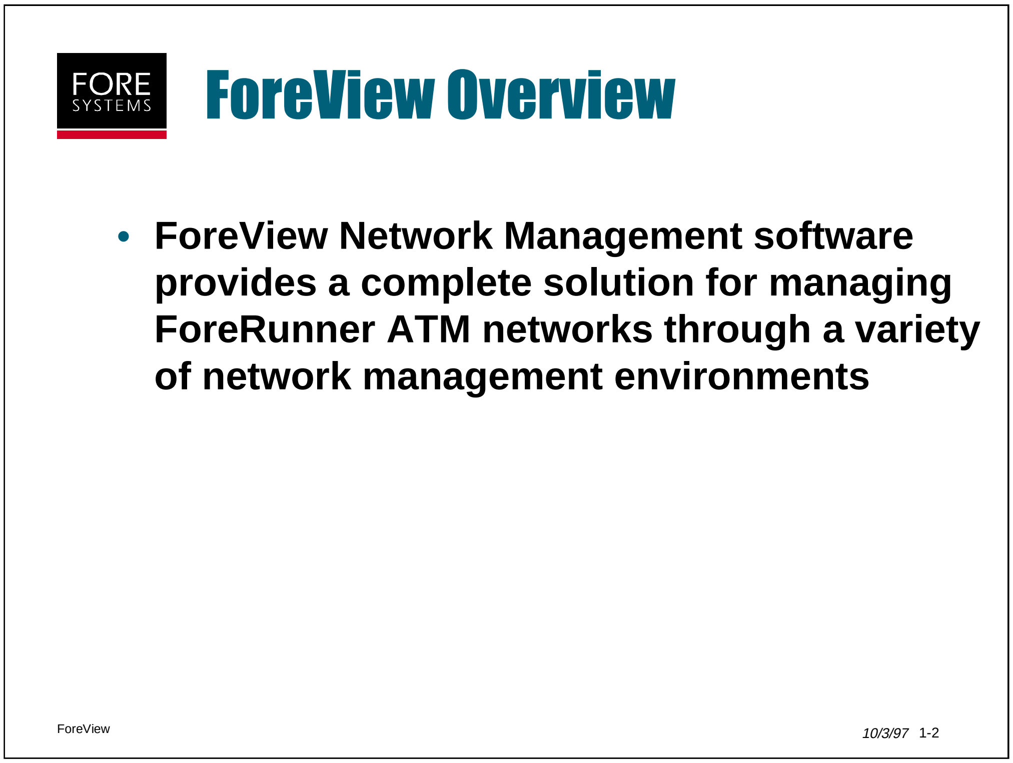

ForeView Overview

- **ForeView Network Management software provides a complete solution for managing ForeRunner ATM networks through a variety of network management environments**

ForeView

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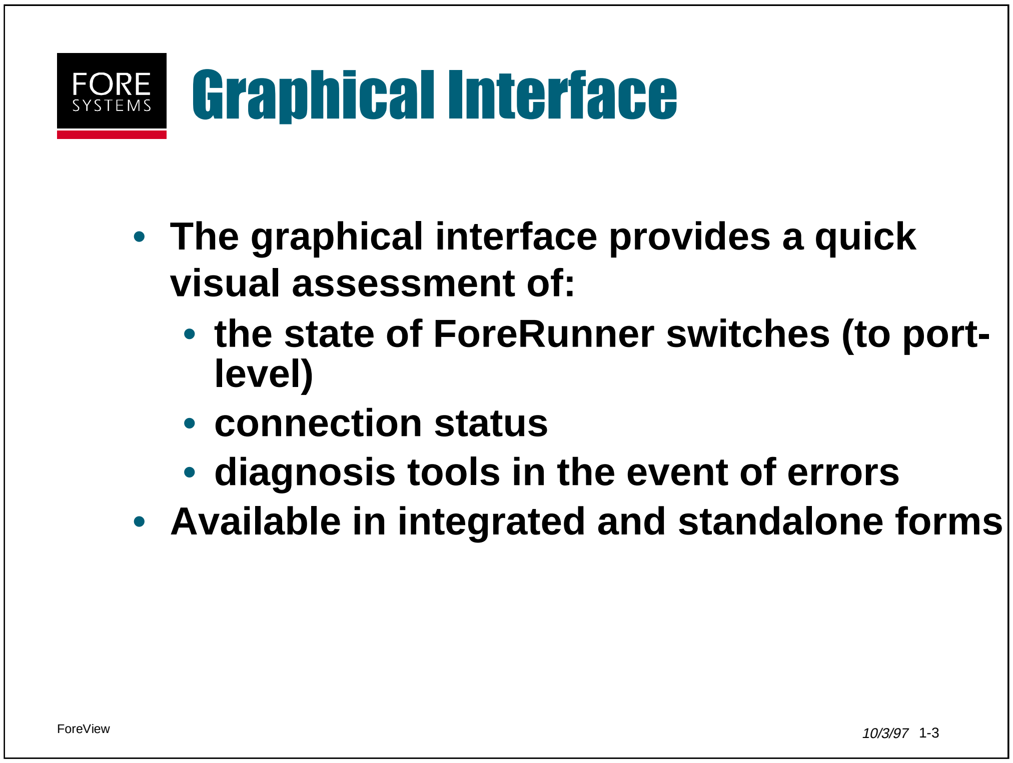
There are many industry standard network management systems that allow network managers to manage and monitor legacy LANs, WANs, and MANs. These products are mostly protocol-centric using protocols such as IP, IPX, and AppleTalk. They support a a number of different topologies such as Ethernet, Token Ring, and FDDI and Frame Relay.

The ForeView Network Management system is part of FORE Systems ForeThought product line and is used to specifically manage and monitor ATM networks. Although ForeView manages the network using the IP protocol, it does not manage the IP network itself and leaves those functions to programs such as Hewlett Packard OpenView, IBM NetView and Sun Net Manager.

ForeView is written to work integrally with these IP network management systems or to function as a stand-alone management system. In either form, only FORE Systems’ devices are managed. under native operating systems such as SunOS, Solaris, HP-UX, IRIX, AIX, and Windows NT.



Graphical Interface

- The graphical interface provides a quick visual assessment of:
  - the state of ForeRunner switches (to port-level)
  - connection status
  - diagnosis tools in the event of errors
- Available in integrated and standalone forms

ForeView

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ForeView is designed to operate under graphical environments including Sun OpenWindows, CDE and Windows NT. The ForeView program is actually a number of components that allow the network manager to evaluate the ATM network topology, inventory the ATM devices, execute element configuration and management, and graph and trace traffic through the network.

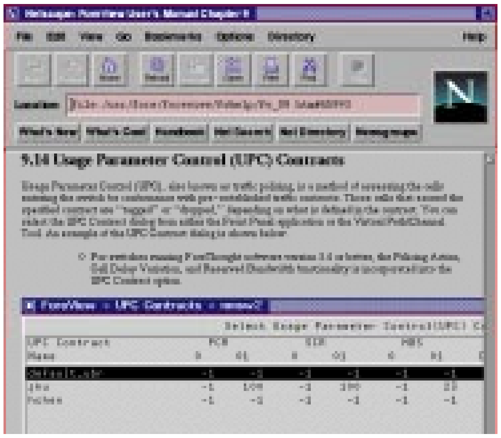
The base set of “tools” are available under a number of operating systems and all look and function the same way.

When the workstation utilizes an NMS (Network Management System) such as HP OpenView, IBM NetView or Sun Net Manager, ForeView will take advantage of the NMS’ Event Logs and Error Trapping, Graphing modules, Topology Managers, Threshold Programming and User Defined Functions. These are the “integrated” versions of ForeView. If you are already familiar with one of these NMS platforms, ForeView blends naturally.

The Standalone version of ForeView provides its own mapping, graphing and logging utilities. The look and feel of this version is unique and provides all the necessary functions.

Which is “better”? That’s completely up to the user, and sometimes the task at hand.

ForeView On-line Help



Netscape: ForeView User's Manual Chapter 9

Location: file:/usr/fore/foreview/fvhelp/fv_09.html#[illegible]

9.14 Usage Parameter Control (UPC) Contracts

Usage Parameter Control (UPC), also known as traffic policing, is a method of screening the cells entering the switch for conformance with pre-established traffic contracts. Those cells that exceed the specified contract are "tagged" or "dropped," depending on what is defined in the contract. You can select the UPC Contract dialog from either the Front Panel application or the Virtual Path/Channel Tool. An example of the UPC Contract dialog is shown below.

- For switches running ForeThought software version 3.4 or better, the Policing Action, Cell Delay Variation, and Reserved Bandwidth functionality is incorporated into the UPC Contract option.

ForeView : UPC Contracts : [illegible]

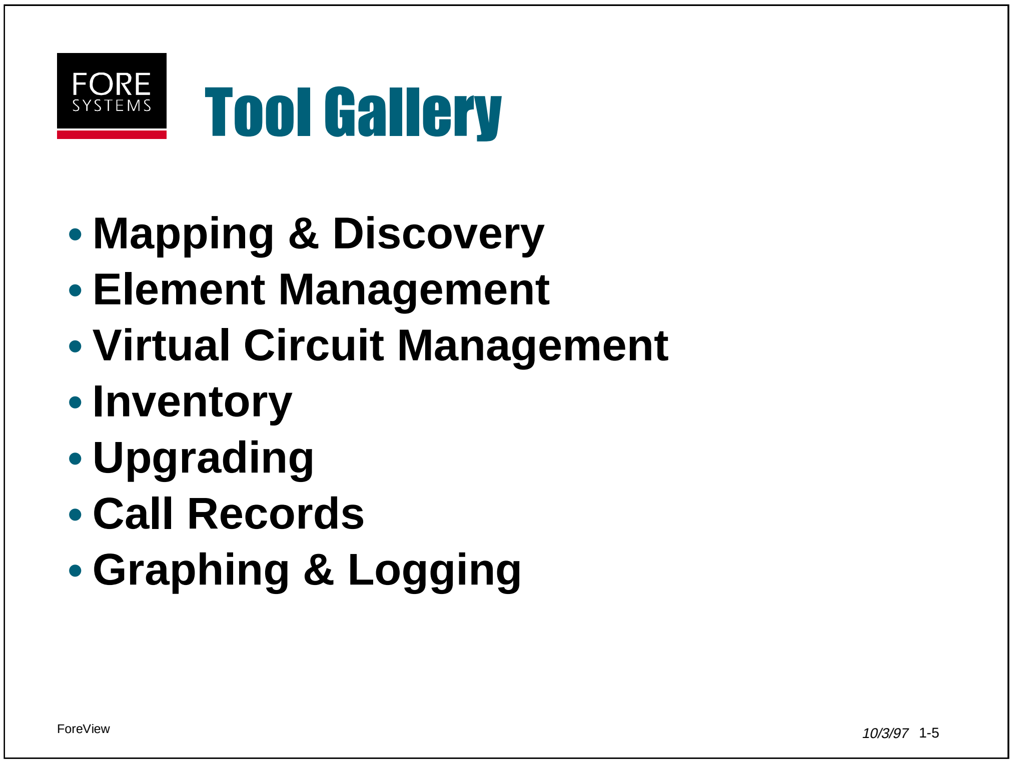
Select Usage Parameter Control(UPC) C

UPC Contract	PCR		SCR		MBS	
Name	0	01	0	01	0	01
default_upc	-1	-1	-1	-1	-1	-1
[illegible]	-1	[illegible]	-1	100	-1	[illegible]
[illegible]	-1	-1	-1	-1	-1	-1

ForeView's context-sensitive On-line Help is now in HTML format. Any browser supporting frames can be used.

The Help files in ForeView are context-sensitive and are in HTML format. they include not only text but many images and screen shots that can be viewed directly through a browser program that supports frames.

Most of the user manual is located in this searchable, on-line resource.



Tool Gallery

- Mapping & Discovery
- Element Management
- Virtual Circuit Management
- Inventory
- Upgrading
- Call Records
- Graphing & Logging

ForeView

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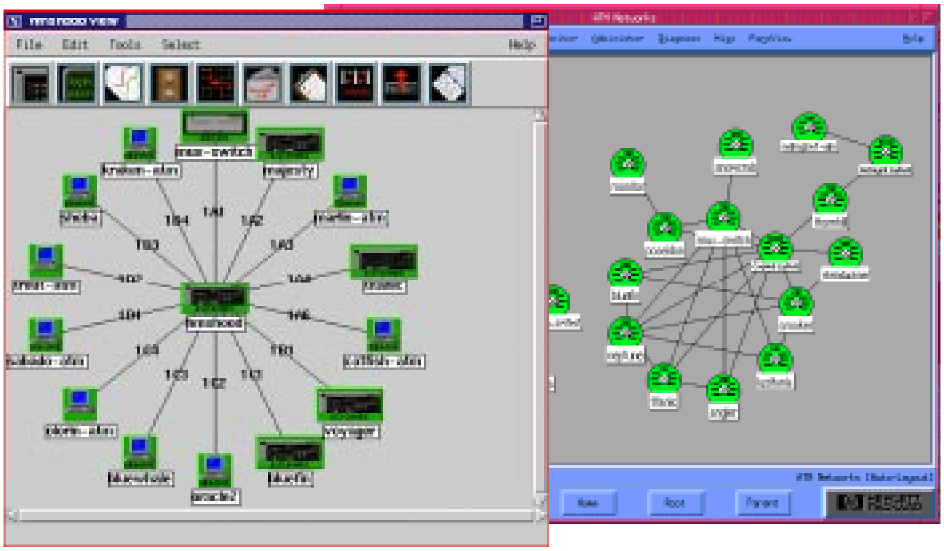
ForeView’s list of tools is always growing. Of all that’s available, the list above are the most “popular” among users. That is, these are what would be considered core functions of the products.

More can be done with ForeView, this is simply the short list that identifies the most commonly used features.

Topology Mapping



ForeView

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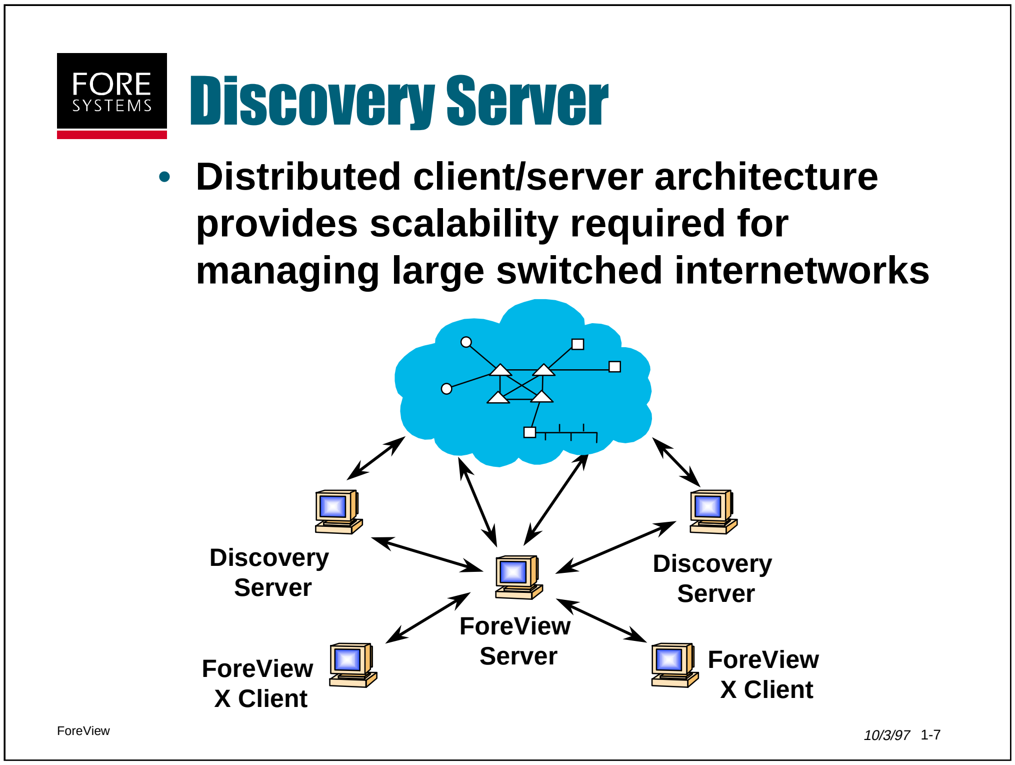
ForeView has applications for discovering and mapping ATM networks. Unlike most networks today, ATM is connection-oriented. The mapping developed for connectionless networks is protocol address based. ForeView provides topology information representative of the physical network. Discovery of the topology is done via ATM signalling (UNI 3.0/3.1 and/or SPANS). Any UNI 3.0/3.1 or SPANS compliant device can be discovered and the data is segregated into specific map views.

There is a standalone mapping utility (on the left) and an integrated mapping utility (on the right) for use with network management systems such as HP OpenView (shown above). In integrated platforms, ForeView complements rather than replaces the existing NMS.



Discovery Server

- **Distributed client/server architecture provides scalability required for managing large switched internetworks**

Discovery Server

Discovery Server

ForeView Server

ForeView X Client

ForeView X Client

ForeView

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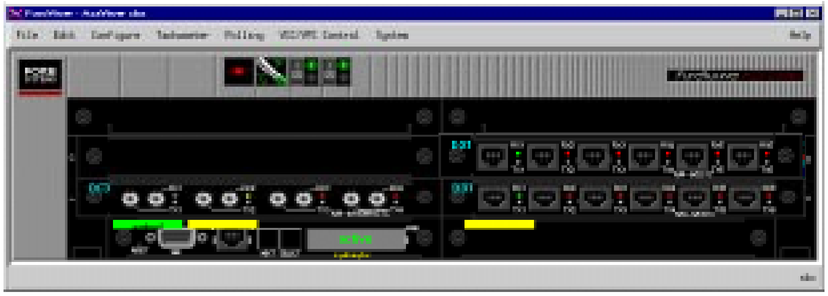
By performing discovery via signalling information and seeking every ATM backbone component, a scalability problem is introduced in larger networks. The solution is a client/server architecture for discovery and status monitoring purposes. This change increases scalability by a factor of 5-10, allows true distributed network management, and allows the user to customize the discovery and status polling capabilities of ForeView. Field use has shown that users can now effectively manage networks with hundreds of switches, while at the same time lowering the latency in keeping up-to-date with actual network status changes.

As scalability is increased, so is flexibility.

The discovery and status daemon serves the network topology information to the any of the supported Network Management Systems (OpenView, SunNet Manager, and NetView) as well as Standalone ForeView.

Device Managers

- Graphical, point-and-click device configuration and status monitoring at the device level for ATM switches, PowerHubs, and LAN Access switches



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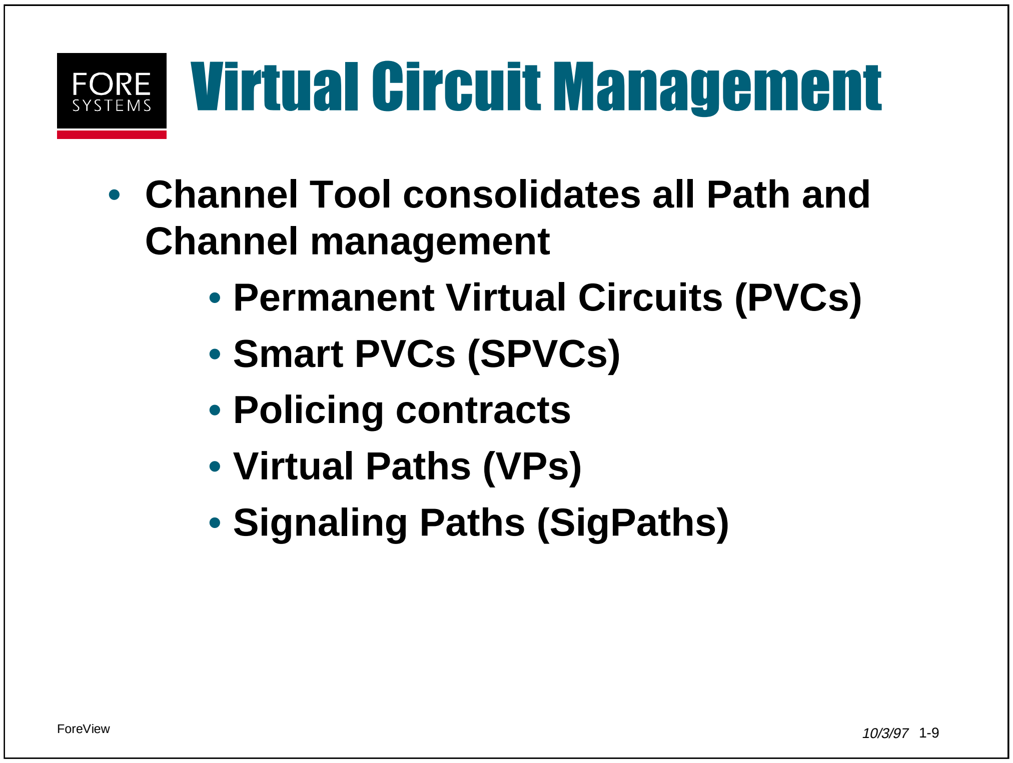
The Device Manager provides an intuitive, graphics-based interface for device management. A photo-like image of the device in question allows users to easily configure and monitor the device using simple point-and-click operations. Users can configure the full complement of OC12, OC3, DS3, DS1, E3, E1, and J2 parameters. Configure NSAP addresses, Distributed Timing and Netmod Buffer allocations. Turn Signaling On/Off (SPANS, UNI3.0/3.1) per port. A Tachometer can be displayed below each port to provide a visual assessment of traffic on a per port basis (input/output utilization, queue loading, or input/output reservation).

Device Manager supports ASX-1000s. The main view summarizes all fabrics in the enclosure, major and minor alarms for ports, links and alarms for environmental traps (Power Supplies, Overtemp Sensor, 4 Fan Banks).

ForeView includes Device Manager support for the ES3810, ES3850, and PowerHub in addition to the ASX ATM Switch products.



Virtual Circuit Management

- Channel Tool consolidates all Path and Channel management
  - Permanent Virtual Circuits (PVCs)
  - Smart PVCs (SPVCs)
  - Policing contracts
  - Virtual Paths (VPs)
  - Signaling Paths (SigPaths)

ForeView

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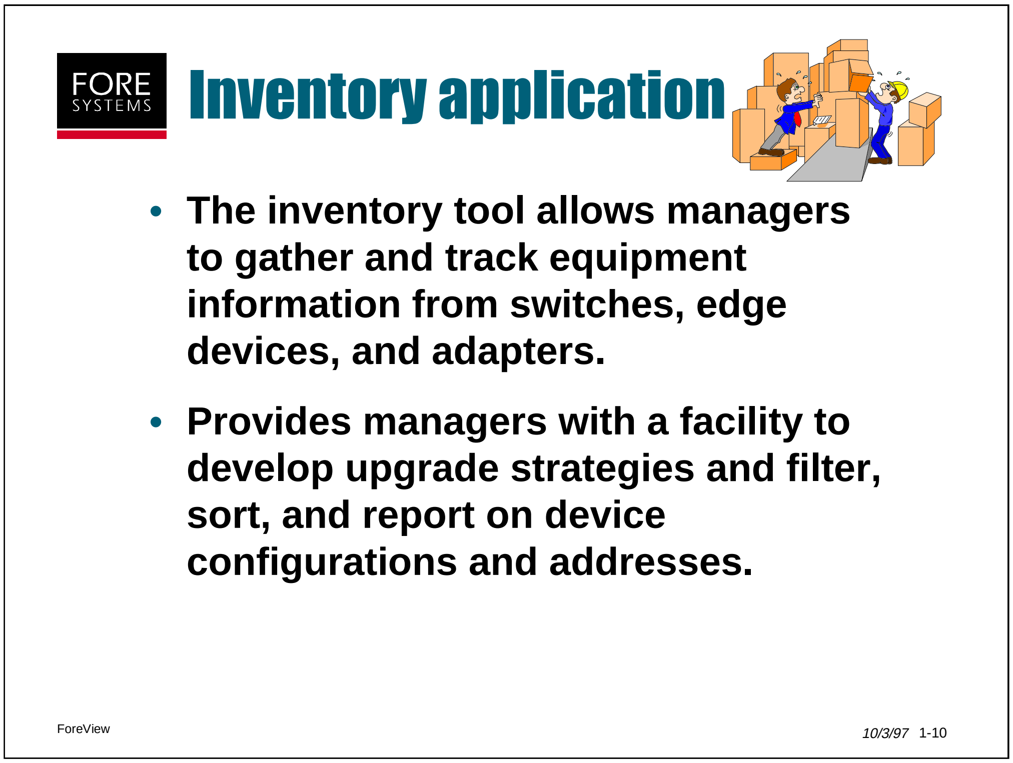
ForeView allows the user to create and modify VC's through a simple and efficient "channel tool". This tool is a dialog box that allows a single point of entry of port information, user-selected Virtual Path Identifier (VPI), Virtual Channel Identifier (VCI), reserved bandwidth, direction, and any Usage Parameter Control (UPC) contract to be used. The user can browse existing virtual circuits and even filter the circuits to be shown. A unique feature in ForeView allows the user to trace the route of a specific circuit through a number of switch hops.

A browsing function permits the inspection of particular path and channel types on a switch to speed monitoring and control without working through long lists.



FORE SYSTEMS

Inventory application

- **The inventory tool allows managers to gather and track equipment information from switches, edge devices, and adapters.**
- **Provides managers with a facility to develop upgrade strategies and filter, sort, and report on device configurations and addresses.**

ForeView

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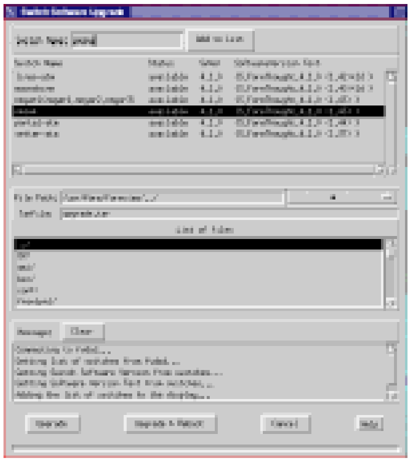
The inventory tool provides managers with strategic information about all the FORE switches, end devices, and host adapters within ATM network.

For example, a manager could query the network to provide a report of all ASX-200BX switches that had the ForeThought 4.0 operating system. This would allow an efficient strategy to be developed for the upgrade to ForeThought 4.1 or newer switches.

The tool gives network managers a tabular view of all the FORE ATM equipment in your network, including information such as model number, serial number, software version number, IP address, and logical name and version history of ForeThought software running on your ATM switches. Version history can be stored as a file for offline use.

Software Manager

- Global software upgrades with a single point-and-click operation
- Simplifies and accelerates the process of downloading new and upgraded software across the enterprise



ForeView

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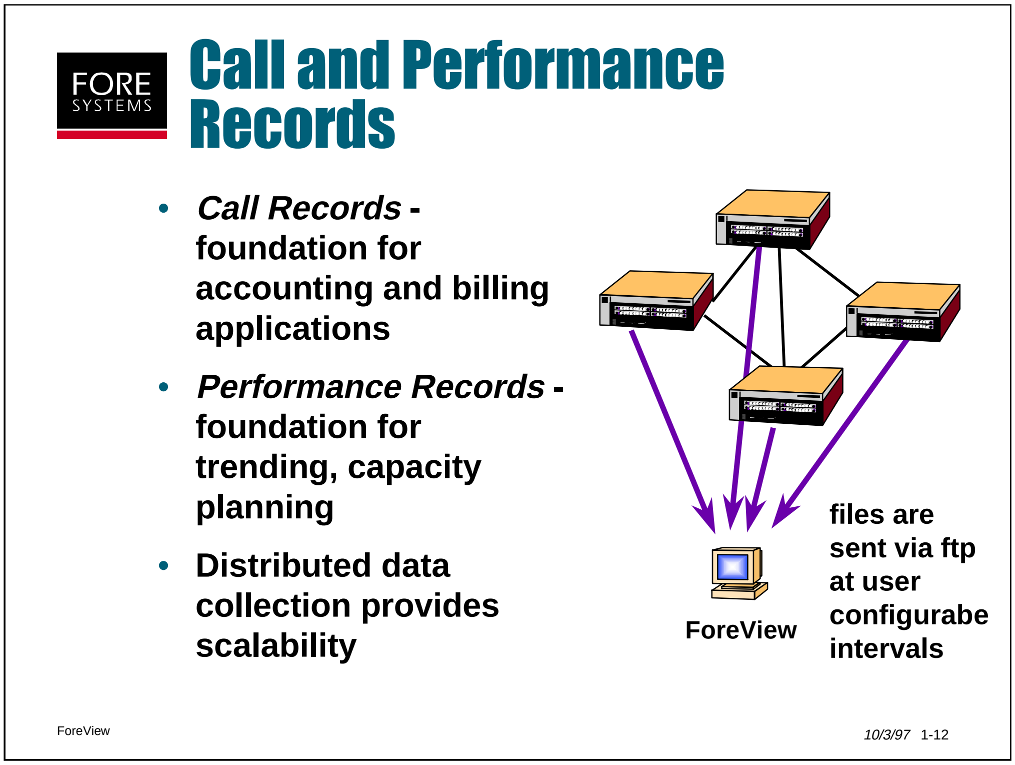
ForeView Software Manager greatly simplifies the process of downloading new and upgraded software across the enterprise.

This feature complements the functionality provided by ForeView Inventory by allowing the user to perform remote software upgrades to ATM switches globally or selectively.



FORE SYSTEMS

Call and Performance Records

- ***Call Records*** **- foundation for accounting and billing applications**
- ***Performance Records*** **- foundation for trending, capacity planning**
- **Distributed data collection provides scalability**

ForeView

files are sent via ftp at user configurabe intervals

ForeView

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These two unique features address scalability and proactive management. Call Records collects information on a 'call' basis (VC and VP level) whereas Performance Records collects port activity information.

Call Record information can be used to generate accounting and billing reports, whereas Performance Record information can be used to perform trend analysis, capacity planning, and performance modeling.

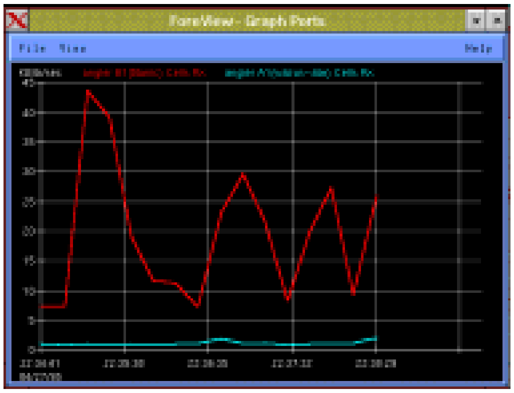
Instead of using a polling-based architecture for collecting this information, Call and Performance Record information is collected locally on the switch, greatly distributing the management load. The collected data is transferred at user configurable intervals from the switch to a data collection server where *ForeView* can convert it from binary to ASCII file format.

Call Records provides a comprehensive list of over 40 variables for each call, including start time of the call, duration of the call, source and destination NSAP addresses, etc.

Performance Records provide detailed performance and error statistics on all interfaces including OC3, OC12, DS1, DS3, E1, E3, and J2 netmods. Users can also configure the amount of memory allocated to record collection and specify a primary and secondary server to upload the records to for redundancy.

Graphing Tool

Example: **Transmitted cells per second on two switch ports**



ForeView

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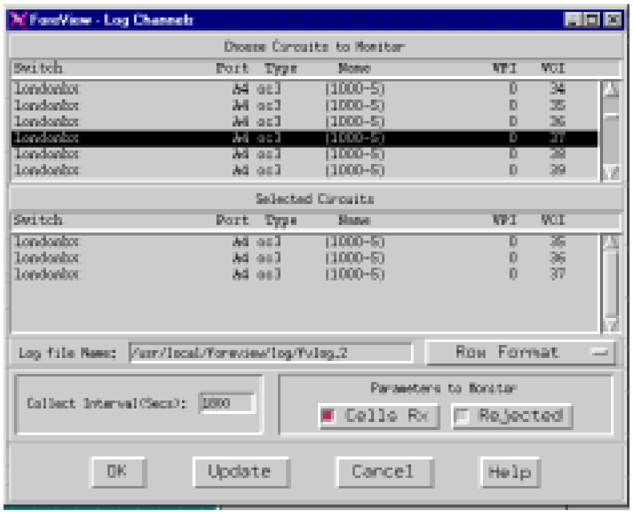
The ForeView graphing tool displays graph statistics on ports, virtual channels, virtual paths, or hosts.. The collection interval is user selectable and can be different for each graph. The display width, represented in minutes, is user selectable as well.

ForeView Grapher enables users to graph statistics including transmit and receive cell counts. Additional statistics are available depending on what type of interface is involved.

Logging Tool



ForeView - Log Channels

Choose Circuits to Monitor

Switch	Port	Type	Name	VPI	VCI
londonbox	A4	oc3	(1000-5)	0	34
londonbox	A4	oc3	(1000-5)	0	35
londonbox	A4	oc3	(1000-5)	0	36
londonbox	A4	oc3	(1000-5)	0	37
londonbox	A4	oc3	(1000-5)	0	38
londonbox	A4	oc3	(1000-5)	0	39

Selected Circuits

Switch	Port	Type	Name	VPI	VCI
londonbox	A4	oc3	(1000-5)	0	35
londonbox	A4	oc3	(1000-5)	0	36
londonbox	A4	oc3	(1000-5)	0	37

Log file Name: /usr/local/foreview/log/fvlog.2

Raw Format

Collect Interval(Secs): 1800

Parameters to Monitor

☒ Cells Rx ☐ Rejected

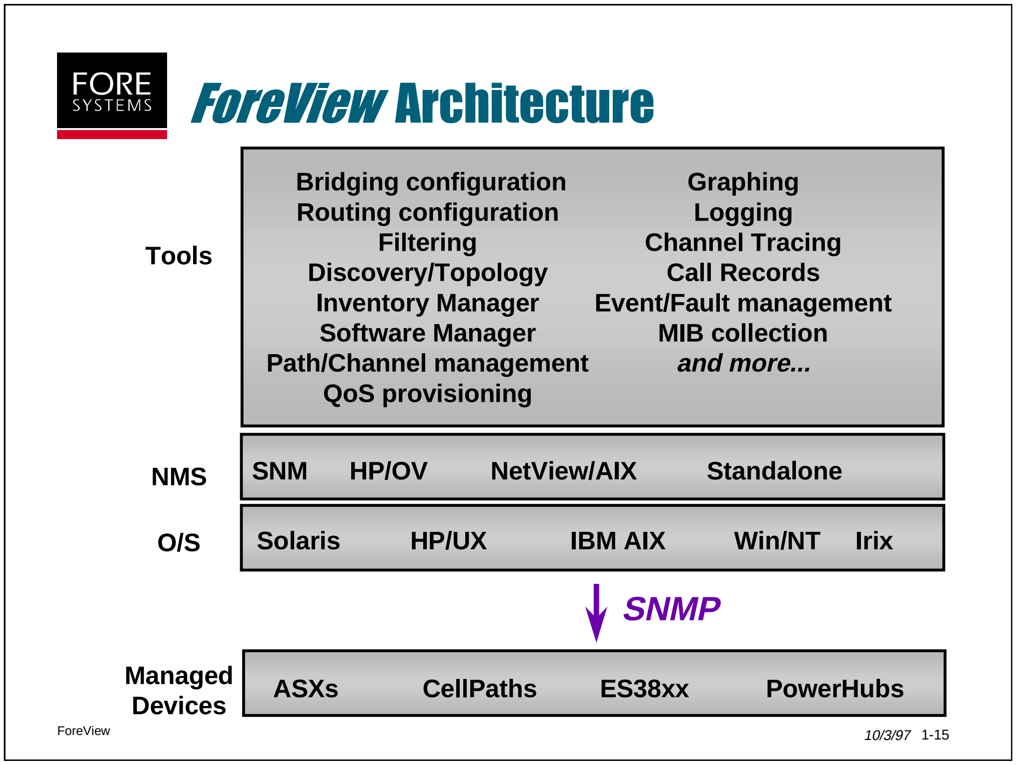
Example:
UBR cells received on port 1A4, collected every 1800 seconds

Similar to the graphing tool, the logging tool writes the collected information to a file. Users can choose the collection Interval.

Transmit and receive utilization is recorded in raw cell counts. These counts can be per channel, per path or per port. Output file is comma-delimited ASCII format.

The log can be launched from pull-down menus, command line or port status dialog boxes.

The delimited information can be exported to other software programs for additional processing, analysis, and report generation.



ForeView Architecture

Tools

Bridging configuration
Routing configuration
Filtering
Discovery/Topology
Inventory Manager
Software Manager
Path/Channel management
QoS provisioning

Graphing
Logging
Channel Tracing
Call Records
Event/Fault management
MIB collection
and more...

NMS: SNM HP/OV NetView/AIX Standalone

O/S: Solaris HP/UX IBM AIX Win/NT Irix

SNMP

Managed Devices: ASXs CellPaths ES38xx PowerHubs

ForeView

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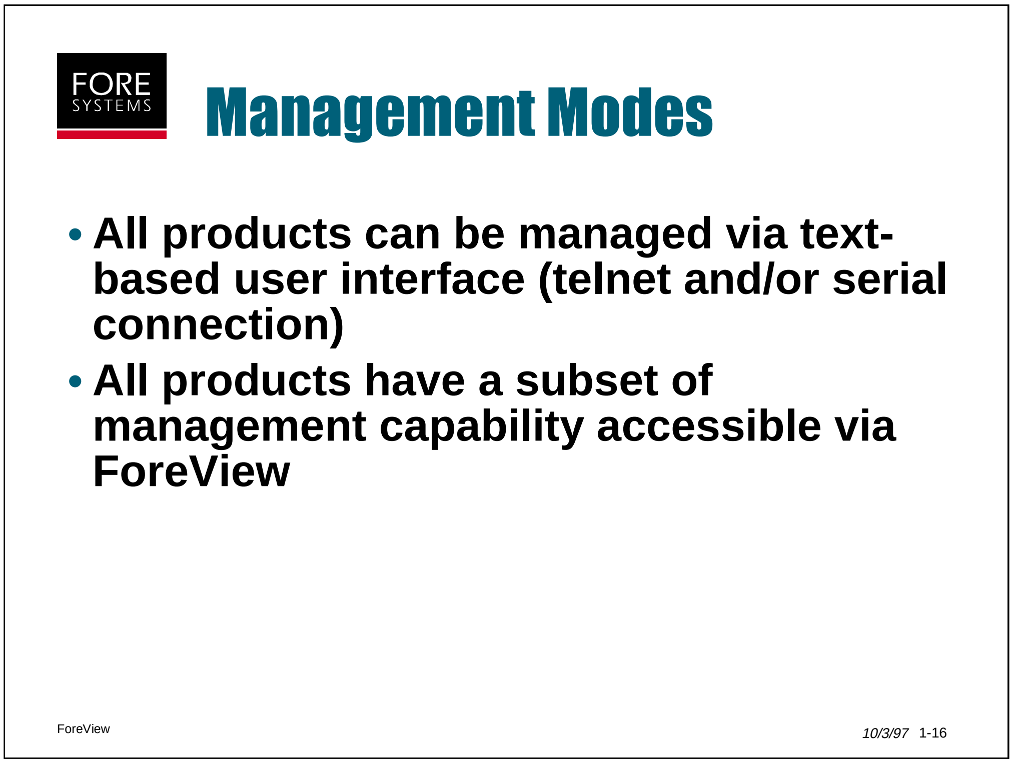
ForeView can be viewed as a simple layered architecture as shown in the upper half of the diagram. ForeView communicates with FORE’s products using SNMP. ForeView software can reside on either Unix or a WinNT operating system, and depending on which OS is chosen, the user can then choose to run ForeView in standalone mode or in conjunction with some of the industry’s most popular Network Management Systems (NMS) as shown. Please refer to the ForeView Web page for latest version numbers.

ForeView is designed to manage all of FORE’s products from a single unified application. We’ve listed just some of the key tools within ForeView used to manage the various networking products. Some tools are device specific, such as or the Path/Channel Tool that works only with ATM switches and routing configuration works only with PowerHub. Some tools work at a network level, such as discovery/topology, graphing, and logging.



Management Modes

- All products can be managed via text-based user interface (telnet and/or serial connection)
- All products have a subset of management capability accessible via ForeView

ForeView

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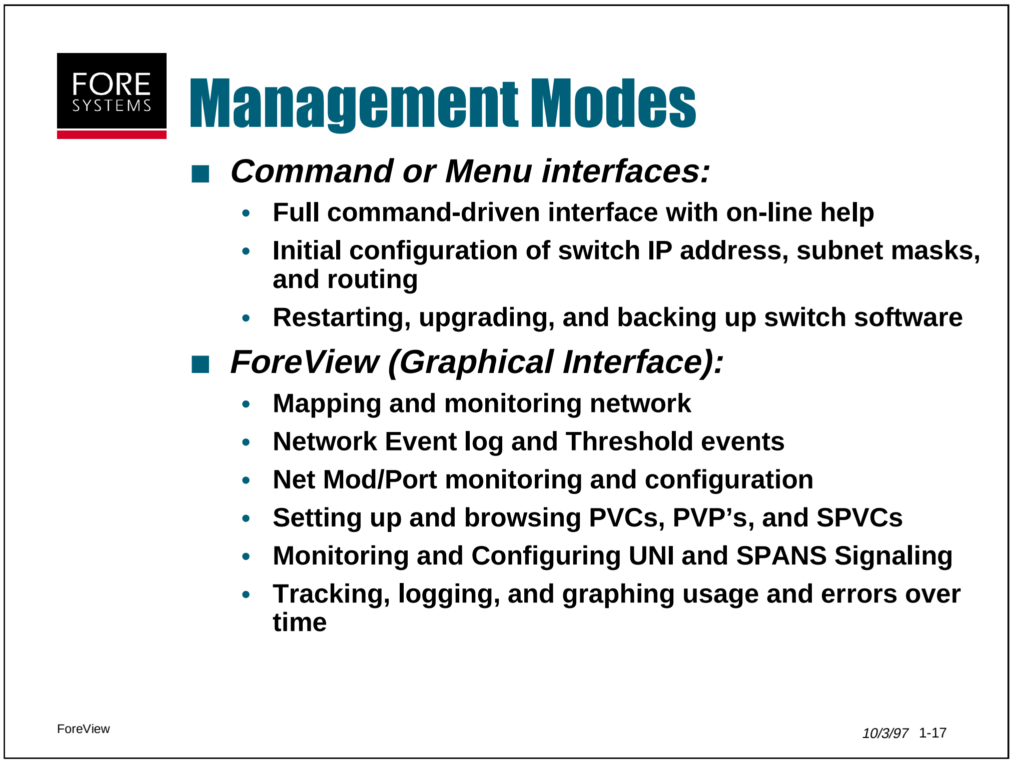
Since some users do not employ SNMP-based network management, all products have a simple command-line or menu-driven user interface. these interfaces are accessed through the product’s serial port or via a telnet session.

SNMP-based management tools such as ForeView provide that management capability via an alternate interface.

The question left to be answered is: When to use which mode?



Management Modes

- *Command or Menu interfaces:*
  - Full command-driven interface with on-line help
  - Initial configuration of switch IP address, subnet masks, and routing
  - Restarting, upgrading, and backing up switch software
- *ForeView (Graphical Interface):*
  - Mapping and monitoring network
  - Network Event log and Threshold events
  - Net Mod/Port monitoring and configuration
  - Setting up and browsing PVCs, PVP's, and SPVCs
  - Monitoring and Configuring UNI and SPANS Signaling
  - Tracking, logging, and graphing usage and errors over time

ForeView

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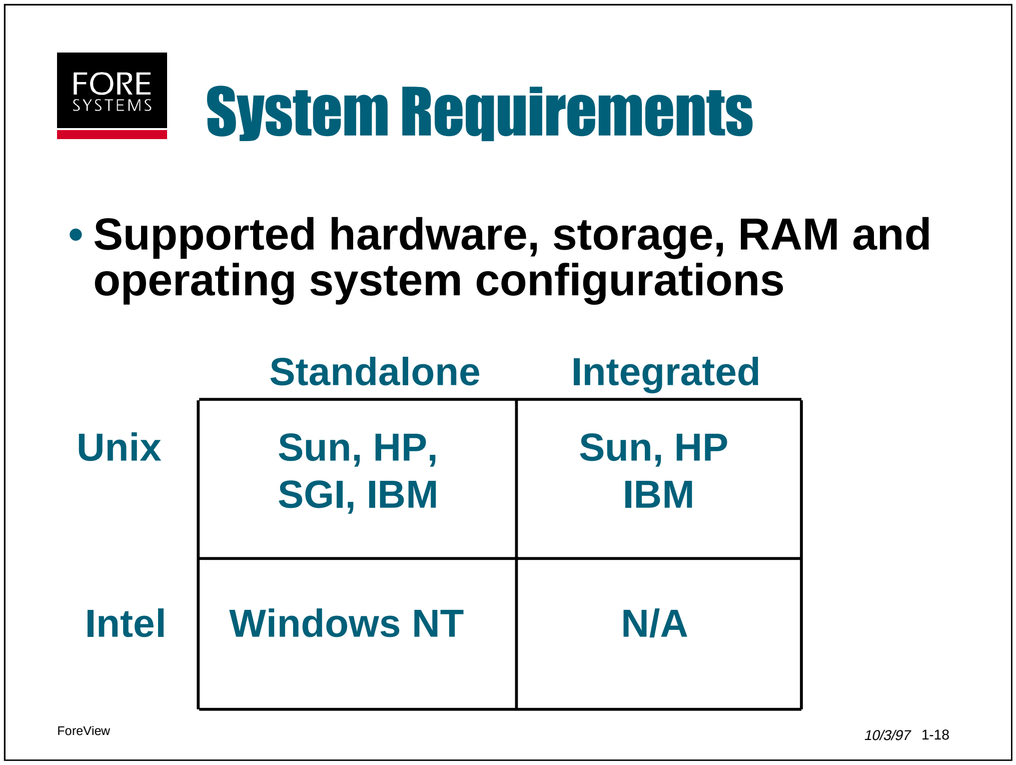
Certain procedures are necessary at the initial setup of the switch - setting the IP address of an interface, setting subnet masks and routing, or certain system maintenance tasks. Certain commands are better to keep as command line and not “point and shoot” to avoid the ease of detrimental mistakes (like the initialization of the flash file system or resetting of the configuration database). These tasks, at least, ought to be executed through the command or menu interface.

Other complex command-line procedures like the creation of a non-zero Virtual Path and its virtual channels and QoS (Quality of Service) functions are much easier through a dialog box in ForeView. The nature of a graphical user interface makes it easier to initialize graphs, topology maps, and bitmaps representing device status.

It is important to remember that ForeView only manages switches and edge devices and not the host or host adapter.

The bottom line usually is: Do what works best for you.



FORE SYSTEMS

System Requirements

- Supported hardware, storage, RAM and operating system configurations

	Standalone	Integrated
Unix	Sun, HP, SGI, IBM	Sun, HP IBM
Intel	Windows NT	N/A

ForeView

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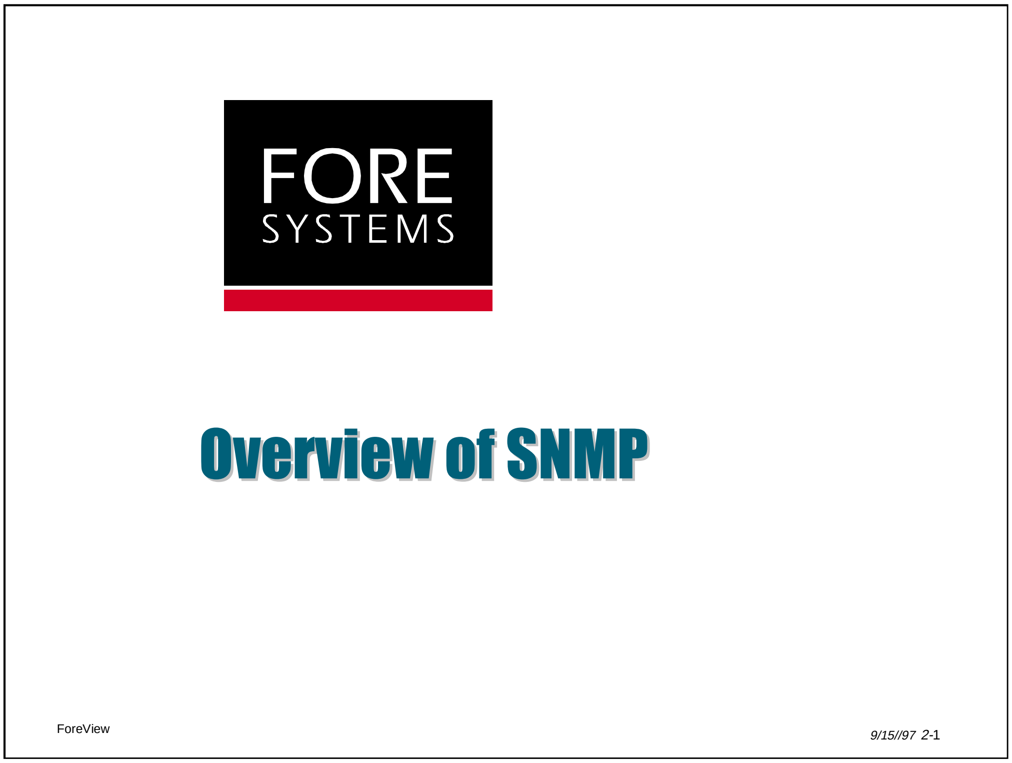
	Sun Microsystems	Hewlett-Packard	Silicon Graphics	IBM	Intel Platforms
Operating System	Solaris 2.4 or 2.5.x	HP-UX 10.01 or 10.10	IRIX 5.3	AIX 4.1	Windows NT 3.5.1 or 4.0
Supported platform	SPARCstation 10 or higher	HP9000, Series 700	MIPS R4000 machines	RS/6000	IBM-compatible with Pentium
Network interface	Ethernet or ATM card (SBA-200)	Ethernet or ATM card (HPA-200)	Ethernet or ATM card (GIA-200)	Ethernet or ATM card (MCA-200)	Ethernet or ATM card (ESA- or PCA-200)
Monitor	Color	Color	Color	Color	1024x768
Available disk space	32 MB min.	32 MB min.	32 MB min.	130 MB min.	100 MB min.
Swap space (standalone)	64 MB min.	64 MB min.	64 MB min.	64 MB min.	N/A
Swap space (OV, SNM)	96 MB min., 128 MB recommended	96 MB min., 128 MB recommended	N/A	N/A	N/A
Paging space	N/A	N/A	N/A	192 MB recommended	N/A
System memory	32 MB min. 64 MB recommended	32 MB min. 64 MB recommended	64 MB min.	64 MB min.	64 MB min.



Overview of SNMP

ForeView

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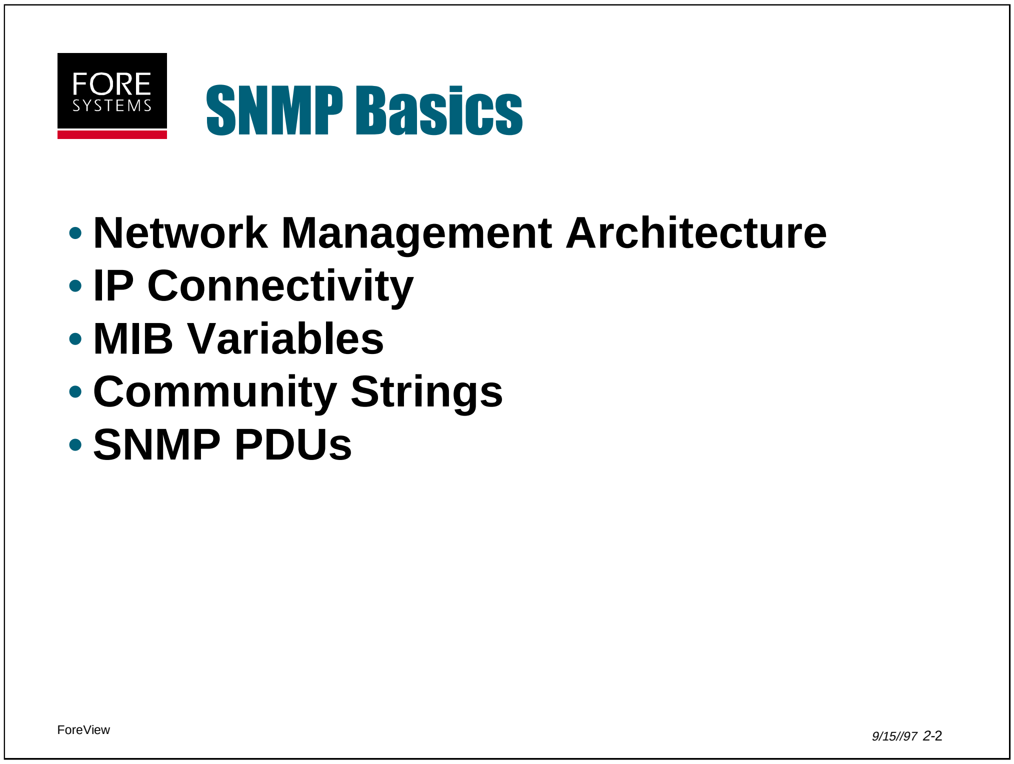

FORE SYSTEMS

SNMP Basics

- Network Management Architecture
- IP Connectivity
- MIB Variables
- Community Strings
- SNMP PDUs

ForeView

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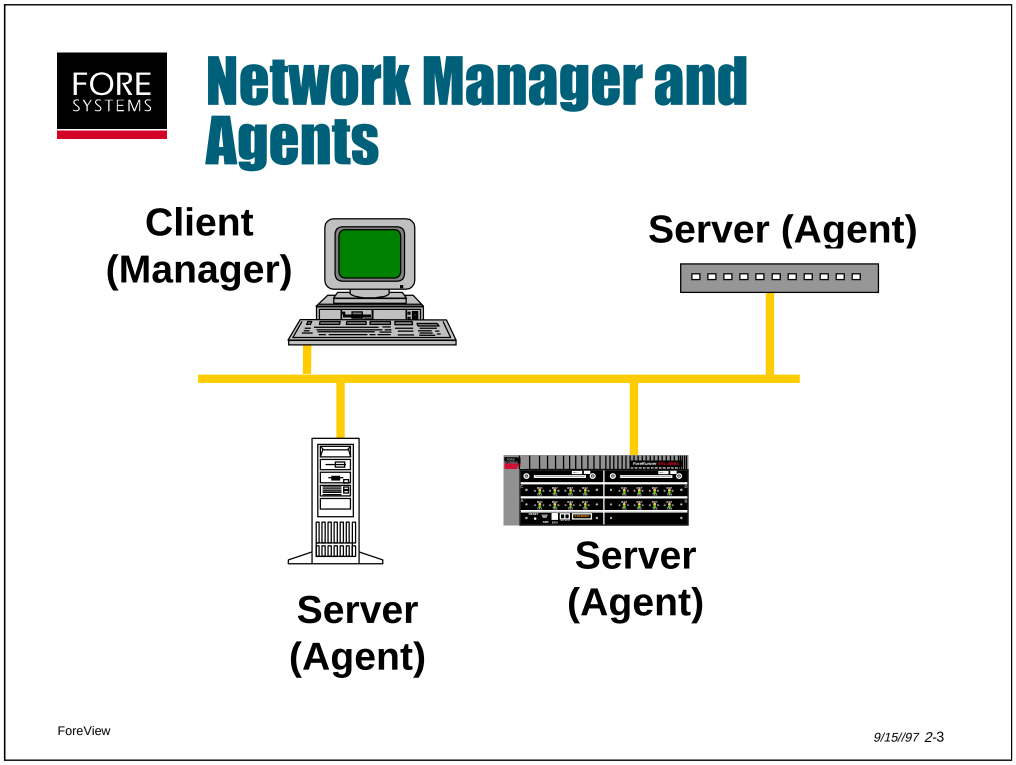
This is not intended to be a comprehensive treatment of SNMP. Rather, it is intended to address the basic operating model for SNMP and then address some specific aspects that should be of particular use for understanding and retaining the rest of this network management curriculum.



FORE SYSTEMS

Network Manager and Agents

Client (Manager)

Server (Agent)

Server (Agent)

Server (Agent)

ForeView

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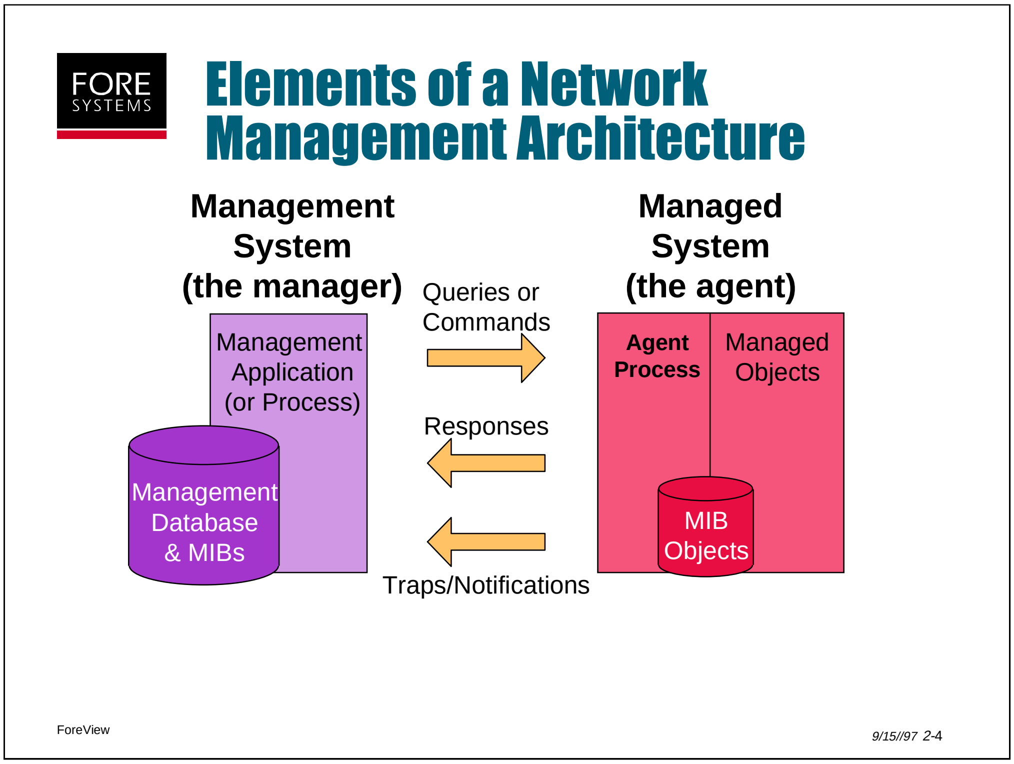
The model SNMP employs to provide network management capability is the familiar client/server model. It is a significant departure from the common form of client/server in the client-to-server ratio.

Most client/server implementations have a small number of servers compared to the number of clients. For example, a client/server mail application based on the SMTP (Simple Mail Transfer Protocol) could have hundreds, even thousands, of clients and only a few servers. A similar ratio is common with file server applications.

Network management using SNMP inverts this ratio. SNMP clients are management stations while every manageable device is a server. When you consider how many hubs, switches, routers, multiplexers, etc. might be in a corporate network, you can see this architecture does not follow a typical client/server model.

Some alternate language is used in this case. Clients are often referred to as managers and the many servers as agents.



FORE SYSTEMS

Elements of a Network Management Architecture

Management System (the manager)

Management Application (or Process)

Management Database & MIBs

Queries or Commands

Responses

Traps/Notifications

Managed System (the agent)

Agent Process

Managed Objects

MIB Objects

ForeView

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The Management System is any network management platform. A very simple platform would be a Unix workstation using a command-line “snmp-walk-like” function. A more sophisticated example would be the same workstation running HP OpenView Network Node Manager, Sun NetManager or IBM’s NetView/6000 Network Management software.

The Managed System is any network device that responds to and issues snmp messages. For example, a Unix workstation that runs the snmpd process could be a managed system. Let’s clarify the nomenclature.

Management System = Manager = Client

Managed System = Agent = Server

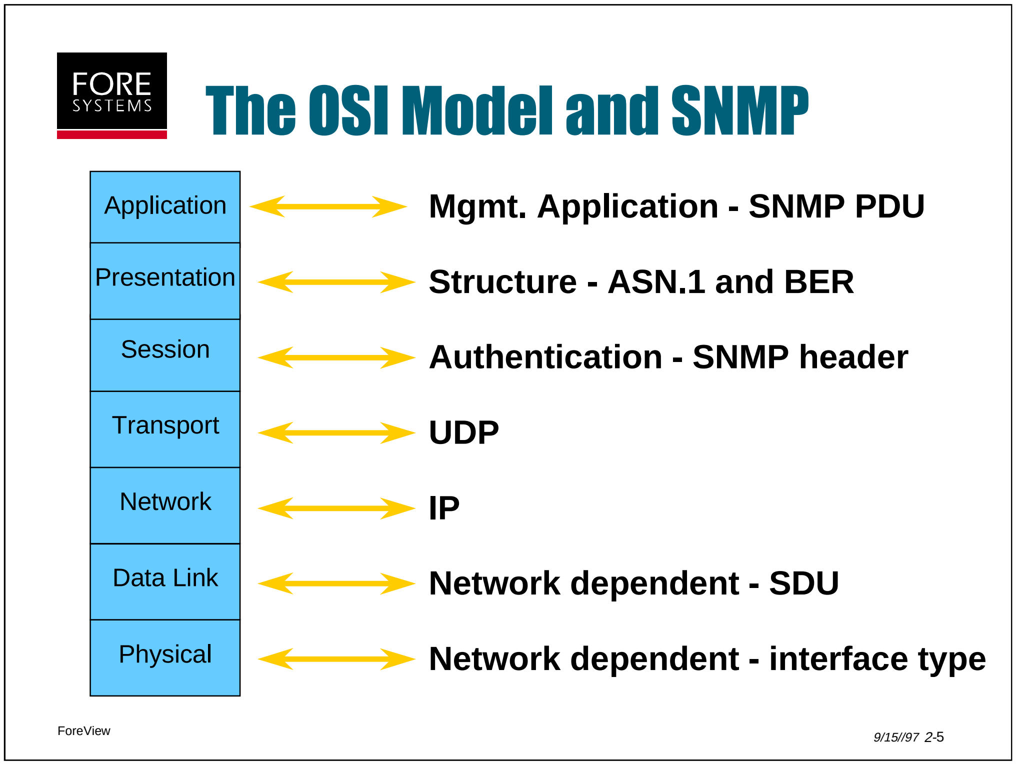
The messages exchanged are:

Queries/Commands - requests sent from the manager to the agent to get information or alter system parameters.

Responses - the messages an agent sends in reply to queries or commands sent by the manager.

Traps/Notifications - unsolicited information coming from the agent to the manager. Usually to alert of a status change or problem.

MIBs are shown in the diagram. They are an important component and will be covered shortly.



FORE SYSTEMS

The OSI Model and SNMP

Application	Mgmt. Application - SNMP PDU
Presentation	Structure - ASN.1 and BER
Session	Authentication - SNMP header
Transport	UDP
Network	IP
Data Link	Network dependent - SDU
Physical	Network dependent - interface type

ForeView

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SNMP maps to the ISO 7-layer model for networking as follows:

Application - could be any program capable of creating SNMP PDUs.

General	Specific
OpenView, Sun NetManager	ForeView, MIB walker

Presentation - proper structuring of the information using a subset of ASN.1

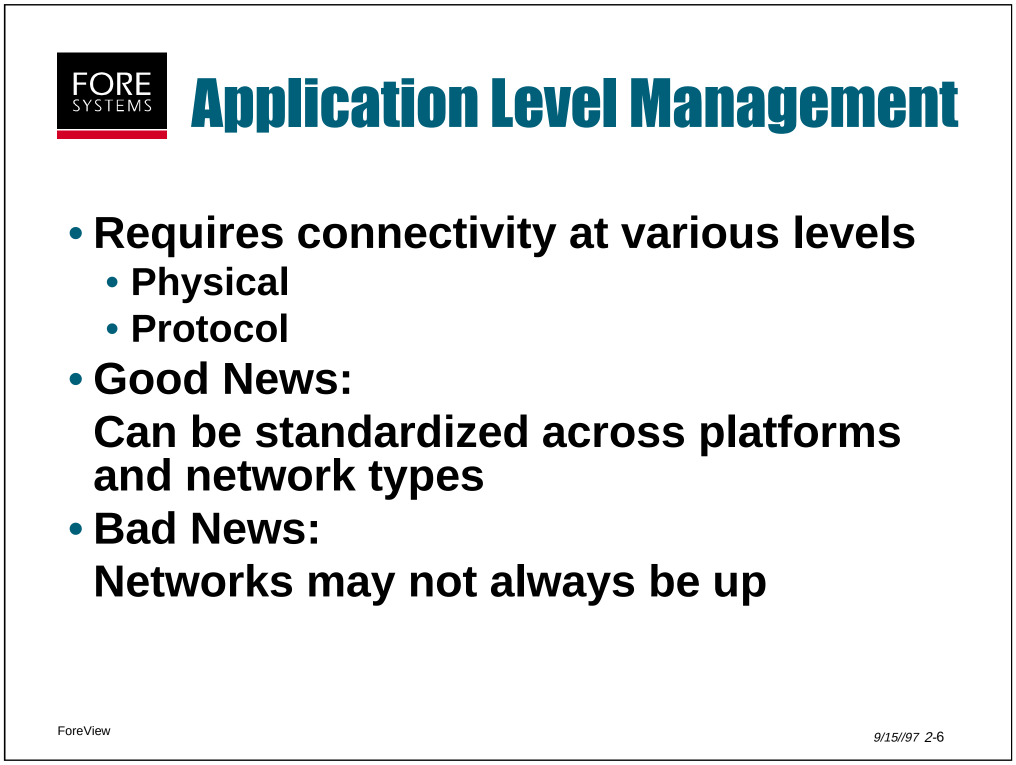
Session - version and community string insertion/authentication

Transport - typical UDP transfer, uses port 161 (except trap messages - port 162)

Network - Typical IP datagram

Datalink - any datalink supporting IP

Physical - any interface supporting IP



FORE SYSTEMS

Application Level Management

- Requires connectivity at various levels
  - Physical
  - Protocol
- Good News:

  Can be standardized across platforms and network types
- Bad News:

  Networks may not always be up

ForeView

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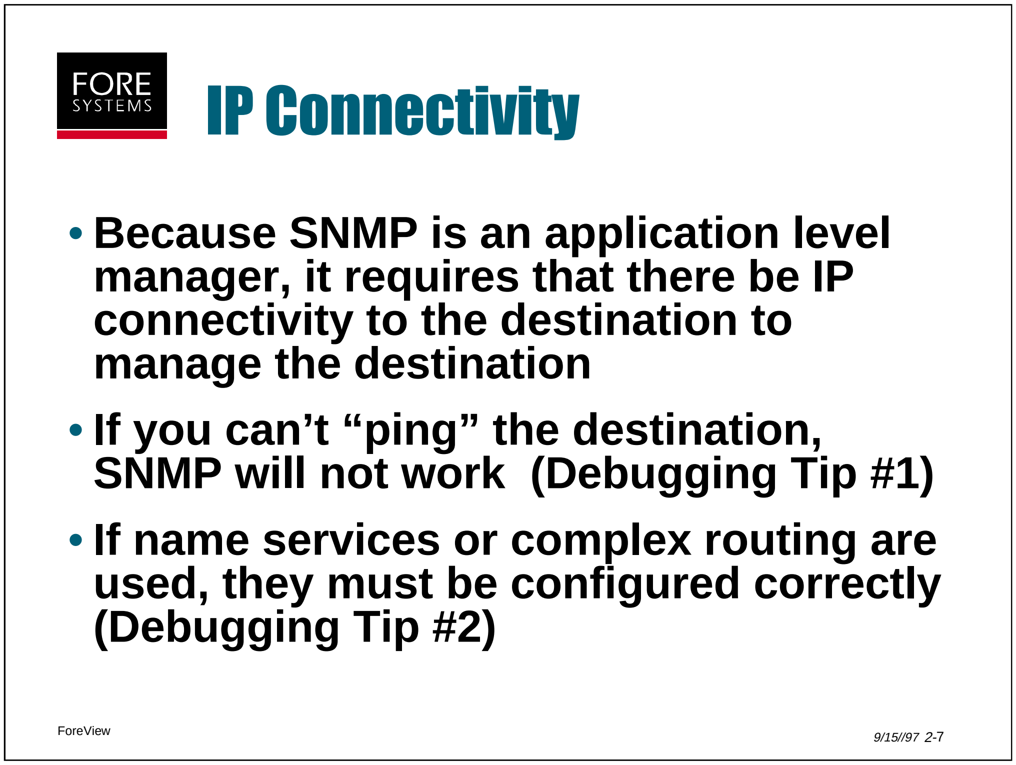
As SNMP is an application level form of management, connectivity is assumed. We know that such an assumption can be dangerous. So why use application level management?

Many reasons could be stated, but foremost is the ability to manage devices connected by nearly any kind of network infrastructure. The management station is likely to be directly connected to only one or perhaps two network types. For example, a management station connected via FDDI and Ethernet would not be uncommon. This limited connectivity does not limit the station’s ability to monitor and control devices connected via Frame Relay, ATM, X.25 or any other network type that is capable of supporting IP traffic. Application-level network management then need not influence the kind of networks deployed.

As networks go, however, there are periods when connectivity is broken and parts of the network are unreachable. This can be limited by proper network planning, but it is unlikely to be eliminated entirely. The price of a robust network may be too high for some network operators. In these cases, the likelihood of downtime is greater.

Every network manager must balance the cost of network fault tolerance against his need to monitor and control the network elements.



IP Connectivity

- Because SNMP is an application level manager, it requires that there be IP connectivity to the destination to manage the destination
- If you can’t “ping” the destination, SNMP will not work (Debugging Tip #1)
- If name services or complex routing are used, they must be configured correctly (Debugging Tip #2)

ForeView

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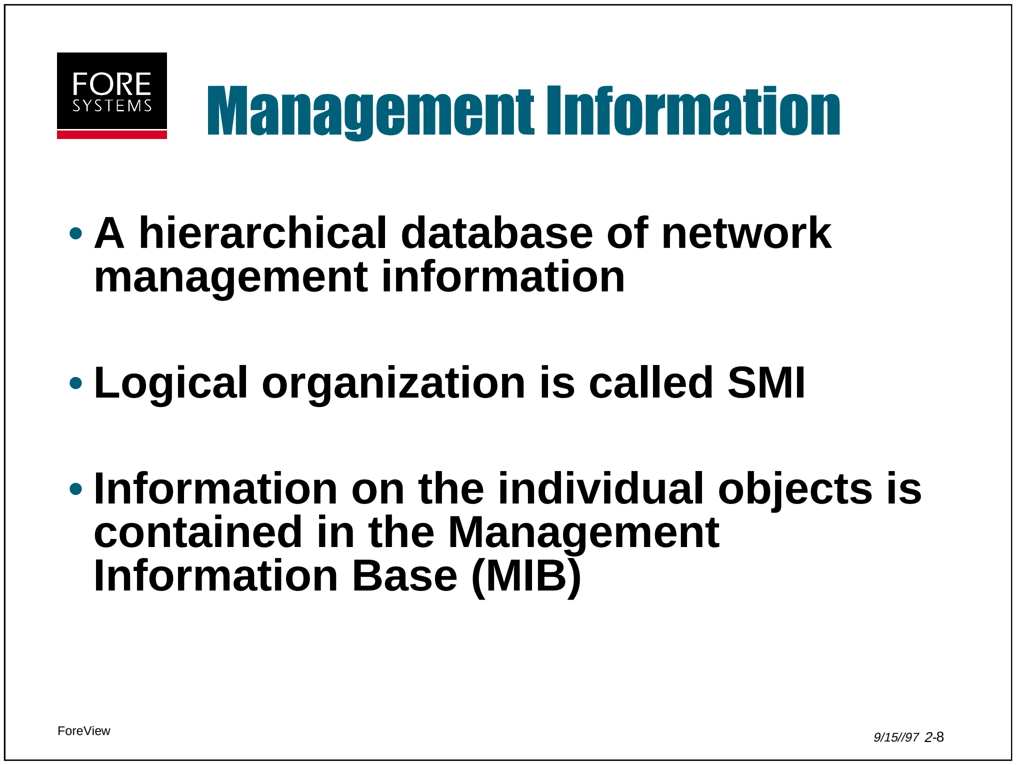
One of the pre-requisites for performing SNMP-based management is IP connectivity with the network elements. This may sound simple and obvious, but the statistics say that most network downtime comes from low-level, simple problems. The irony is that these problems are exactly what network management is implemented to help resolve. Yes, a network symbol can go red on a net management map, but that only informs the network operator the device cannot be contacted. It doesn’t say why it cannot be contacted.

With this simple concept in mind, please be aware FORE System’s TAC reports the most frequent source of problems with ForeView is IP connectivity. The IP basics (address, mask, and gateway information) are often the culprits in a trouble call. Some more advanced IP issues can be at fault, such as name resolution services and routing problems.

Keep in mind the SNMP application can only report on the network as seen from the NMS’s perspective. Something as simple as a typographical error in a hosts file can give the appearance some of your network is unreachable. Because there are many reasons a device might be unreachable or non-responsive, the device should not be assumed to be down or malfunctioning when the NMS loses contact with it.



FORE SYSTEMS

Management Information

- A hierarchical database of network management information
- Logical organization is called SMI
- Information on the individual objects is contained in the Management Information Base (MIB)

ForeView

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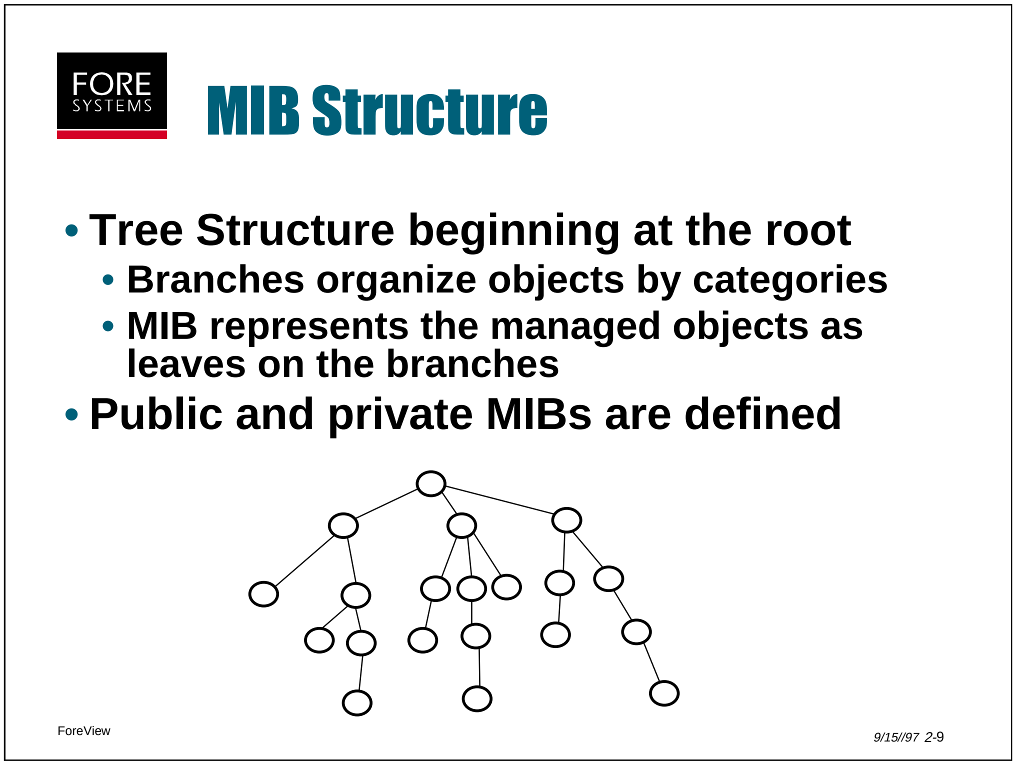
A portion of the SNMP specification indicates how to represent network information and what it means to the administrator. This information is kept in a database format.

To allow interoperability of many different kinds of management applications, the information is in a tree-like structure defined in the Structure of Management Information, or SMI.

A hierarchy is defined, logically dividing the information to provide a path and location for variables in the database. Abstract Syntax Notation 1 (ASN.1) and Basic Encoding Rules (BER), specified in SMI, are used to define the database contents. ASN.1 encodes a) integer, b) octet string, c) object identifier and d) null variable types for use in SNMP message exchanges.

This is an object-oriented database, so each node in the tree structure has an identifier for that object. This is called the Object Identifier or OID.

An OID then is a unique location for storing or retrieving values. The Management information Base (MIB) is the resulting database where objects are addressed, named and defined for the managed device.



FORE SYSTEMS

MIB Structure

- Tree Structure beginning at the root
  - Branches organize objects by categories
  - MIB represents the managed objects as leaves on the branches
- Public and private MIBs are defined

ForeView

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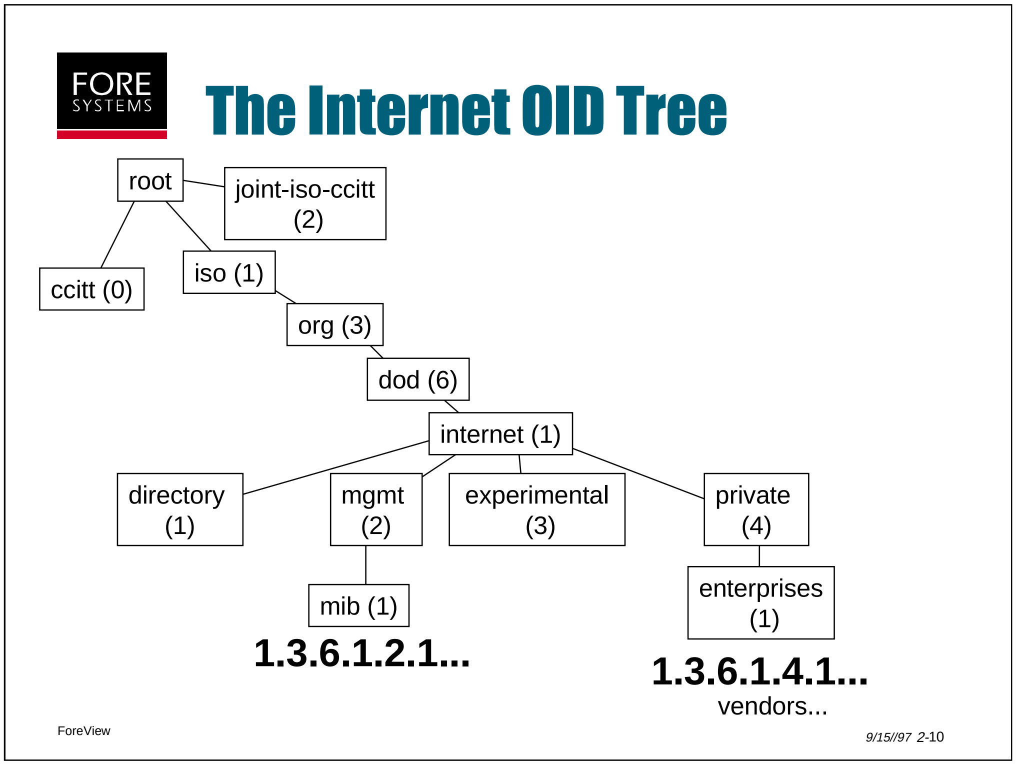
The OIDs for all managed devices begin at the root. Descending into the hierarchy, categories are encountered until managed objects are reached. For instance, the interface status for a particular device may be a simple binary value (up or down), but to get to that value requires you to go through increasingly specific categories. This permits adds and changes to the MIB without affecting the structure of the existing objects.

MIBs have been defined for public and private use. Public MIBs would be for objects common to many devices. For example, Ethernet, IP and DS-1 MIBs are available for anyone to use if their devices have need of such support. This enables off-the-shelf management products to know how to query anybody's product with an Ethernet, IP or DS-1 interface.

Private MIBs are created by the device's maker. For instance, an Ethernet switch might have an LED indicating excessive collisions on that port. The status of this LED would not be in the public Ethernet MIB because not all Ethernet products have such an LED. The makers of that switch would define the LED's status into the private portion of the MIB structure.



The Internet OID Tree

root

ccitt (0)

iso (1)

joint-iso-ccitt (2)

org (3)

dod (6)

internet (1)

directory (1)

mgmt (2)

experimental (3)

private (4)

mib (1)

enterprises (1)

1.3.6.1.2.1...

1.3.6.1.4.1...

vendors...

ForeView

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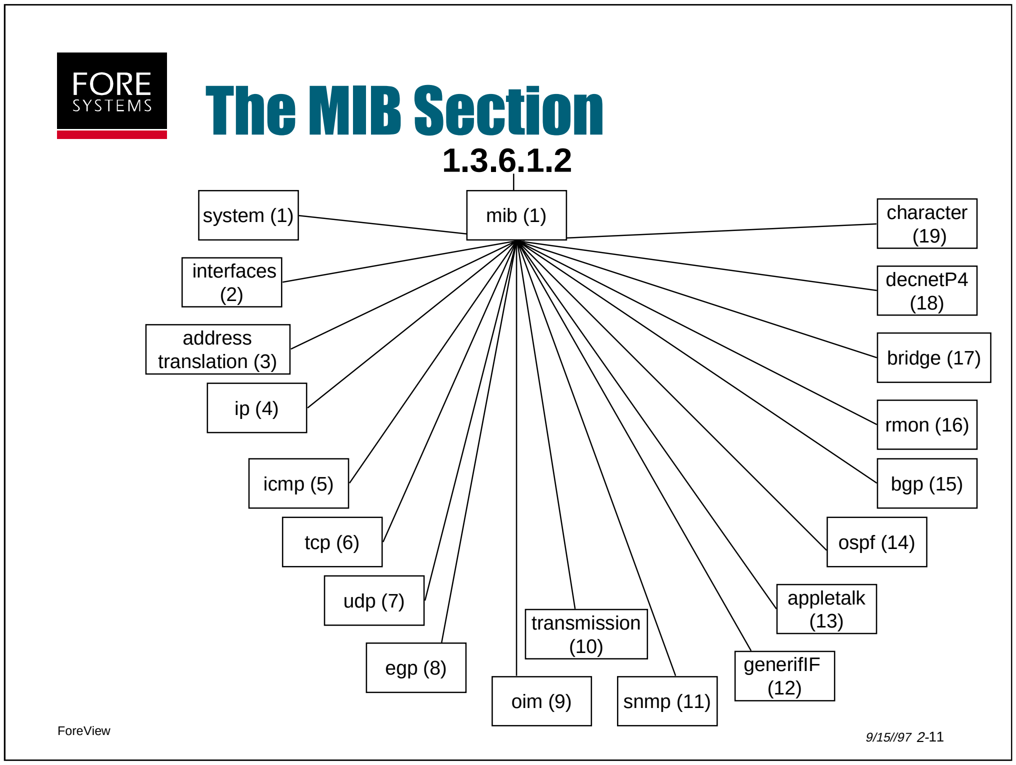
Moving to the actual structure, this diagram shows the root in the upper left. There are three choices from the root. CCITT (now the ITU), ISO and joint categories are the only choices. A new category (3) could be added without affecting any of the others.

The representation of an OID is done in a dotted notation that is as short or long as it needs to be to indicate the proper place on the tree.

In the example on the lower left, public MIBs share the prefix 1.3.6.1.2.1. The ellipsis indicates that object is still only a category, more definition is needed to reach an actual managed object.

The example on the lower right is the OID prefix found for vendor-specific products. The OID 1.3.6.1.4.1 is followed by the vendor’s registered number. For FORE Systems, most of the products are defined under 1.3.6.1.4.1.326.



FORE SYSTEMS

The MIB Section

1.3.6.1.2

mib (1)

system (1)

interfaces (2)

address translation (3)

ip (4)

icmp (5)

tcp (6)

udp (7)

egp (8)

oim (9)

transmission (10)

snmp (11)

generifIF (12)

appletalk (13)

ospf (14)

bgp (15)

rmon (16)

bridge (17)

decnetP4 (18)

character (19)

ForeView

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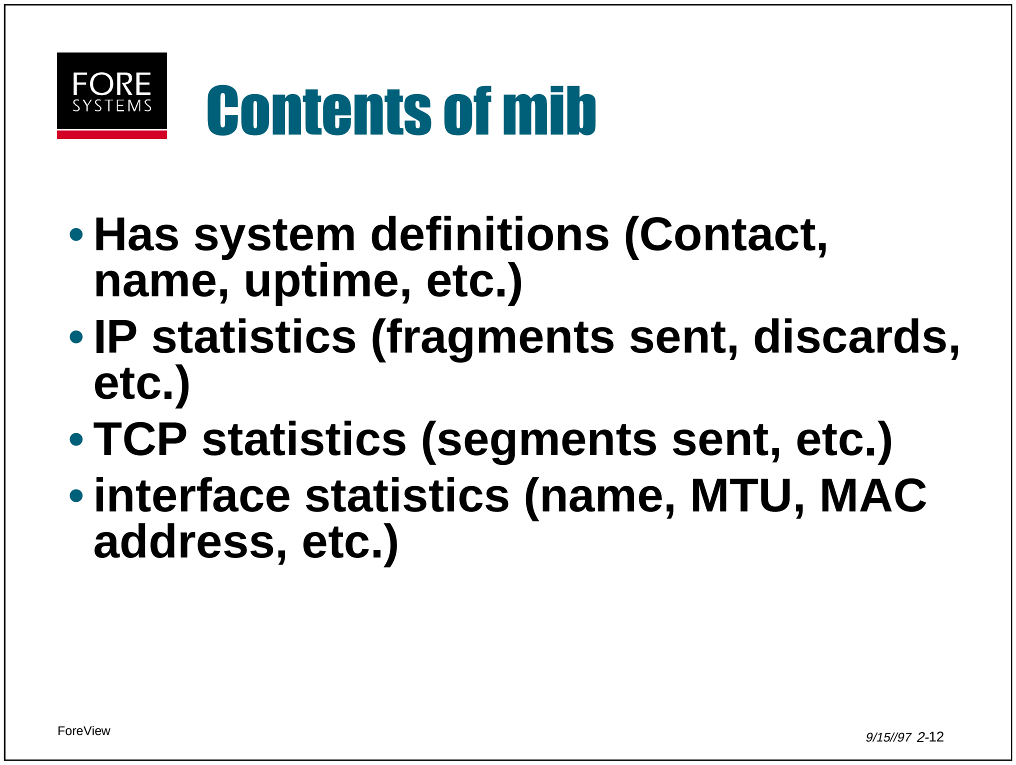
In the MIB section (1.3.6.1.2.1), 19 categories exist. For an Ethernet switch product, the system, interfaces, IP and bridge MIBs may be the only ones supported. A similar product could also implement the TCP and UDP MIBs, if needed.

A multiprotocol router would likely implement more MIBs such as ICMP, EGP, SNMP, appletalk, OSPF, BGP and DecnetP4 MIBs.

The point is, there are many choices available. The implementor must decide in advance what will be manageable and choose or create the MIBs needed.



FORE SYSTEMS

Contents of mib

- Has system definitions (Contact, name, uptime, etc.)
- IP statistics (fragments sent, discards, etc.)
- TCP statistics (segments sent, etc.)
- interface statistics (name, MTU, MAC address, etc.)

ForeView

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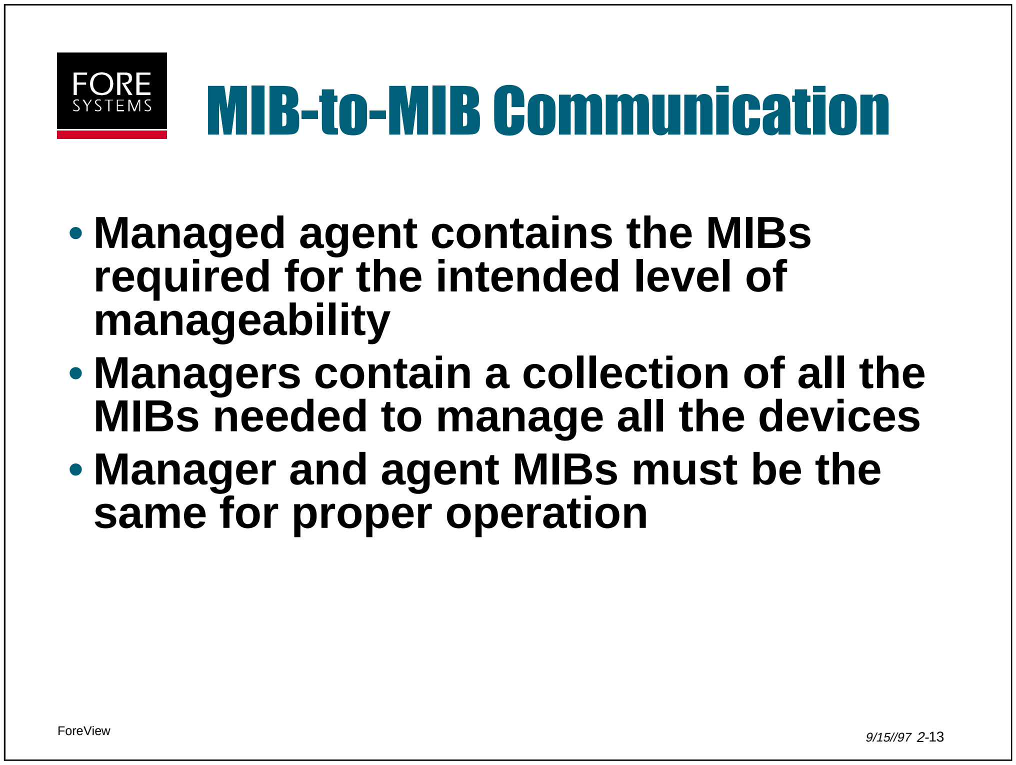
Because it is a public MIB, not specific to any manufacturer, the managed objects are those common to any type of product.



MIB-to-MIB Communication

- Managed agent contains the MIBs required for the intended level of manageability
- Managers contain a collection of all the MIBs needed to manage all the devices
- Manager and agent MIBs must be the same for proper operation

ForeView

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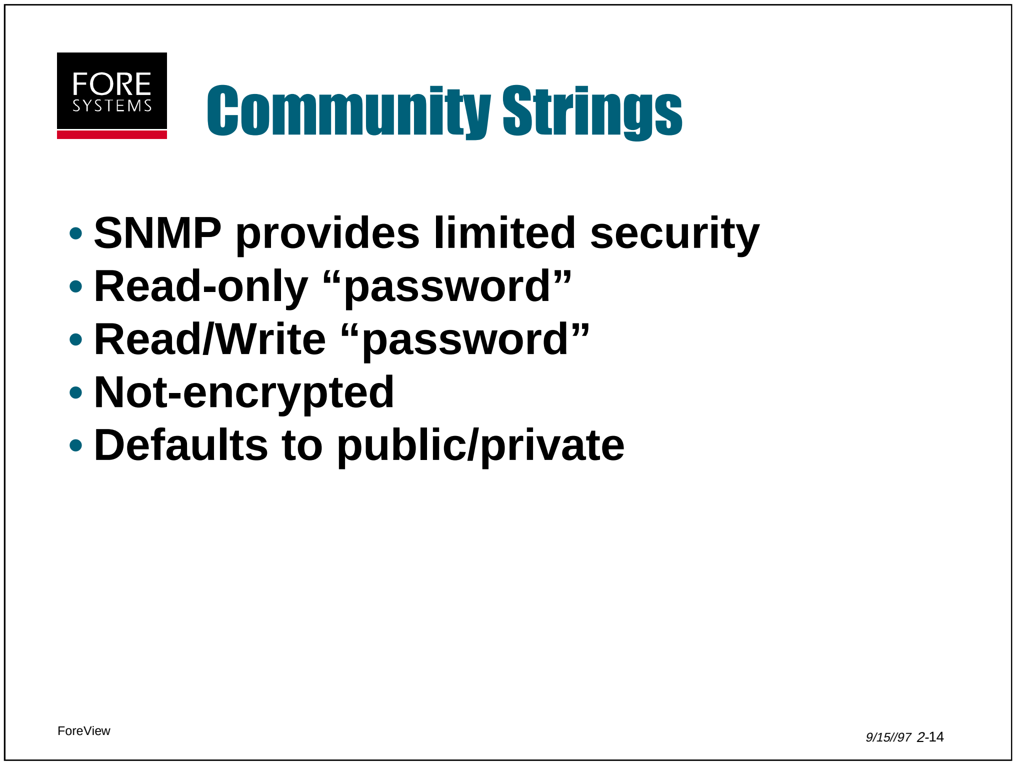
The degree of manageability is determined by how much information the agent stores in its MIB. You can have a multiprotocol router that doesn't implement the ip MIB, for example. It will route IP traffic, but it can't have that function controlled or monitored by a remote manager. The makers of the device can make all, some, or none of the device SNMP manageable.

The manager is responsible for having all the MIBs for all the products in its management domain. That may mean MIBs from a number of different manufacturers.



Community Strings

- SNMP provides limited security
- Read-only “password”
- Read/Write “password”
- Not-encrypted
- Defaults to public/private

ForeView

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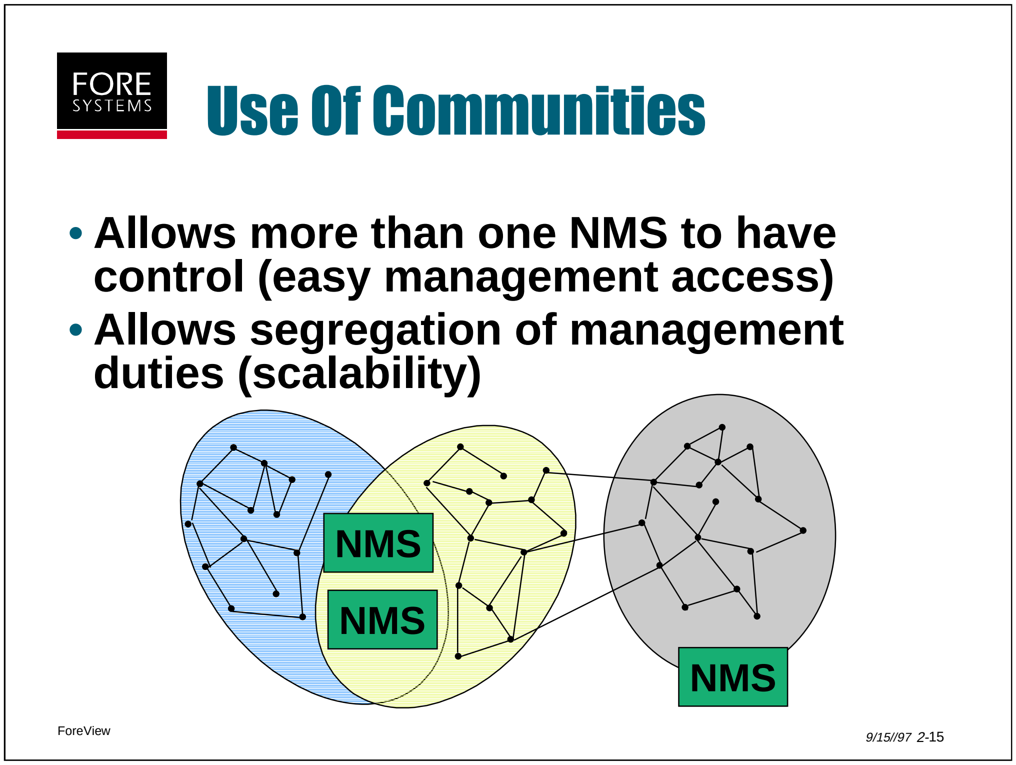
Since the SNMP relationship is connectionless, it needs some form of authorization so the agent can be sure the sender is a manager who is supposed to manage him and deserves a response. This authorization is included every SNMP message, not just the initial ones. The term *community string* refers to the characters used to identify a group of devices in a management domain.

While not as secure as a user or session-type password, the community string idea divides the conversations by function. A read-only string is configured for queries, a read-write string is used for control functions.

The string is not at all secure. Anyone with a sniffer on a LAN segment could trap SNMP frames and discover the community strings in use. There are defaults for these, “public” for read-only and “private” for read-write. But in this day of internet connectivity no one should leave the strings alone on a manageable device.

This is, in part, the price for simplicity for something as complex as network management.



FORE SYSTEMS

Use Of Communities

- Allows more than one NMS to have control (easy management access)
- Allows segregation of management duties (scalability)

ForeView

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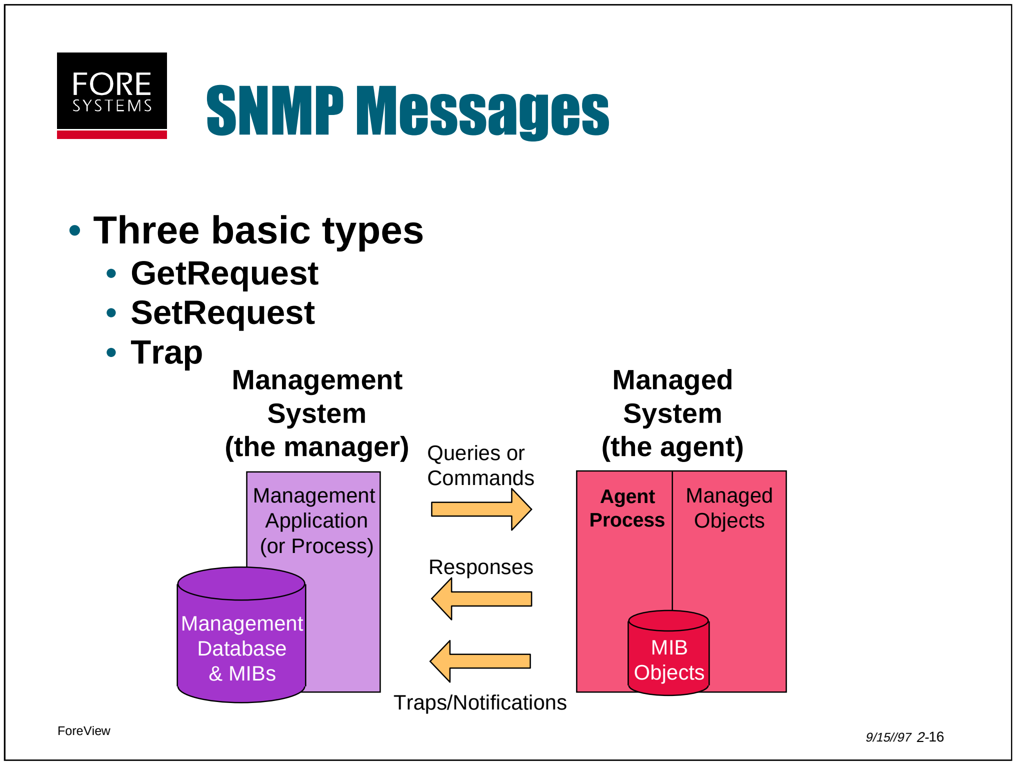
The community is not supposed to be a secured area, rather it’s an area of management shared by managers and agents.

The managers on the left show that two communities can be managed by multiple stations--even when the communities themselves have no inter-connectivity. Each of these two managers would need to know the strings in each community and which IP addresses are associated with each community.

The network of the middle community is so large two distinct communities are established, even though they are one network. The manager on the right would not know how to reach the devices in the middle. Even if it discovered their IP addresses, no SNMP communication would be established because the community authentication would fail.



FORE SYSTEMS

SNMP Messages

- Three basic types
  - GetRequest
  - SetRequest
  - Trap

Management System (the manager)

Management Application (or Process)

Management Database & MIBs

Queries or Commands

Responses

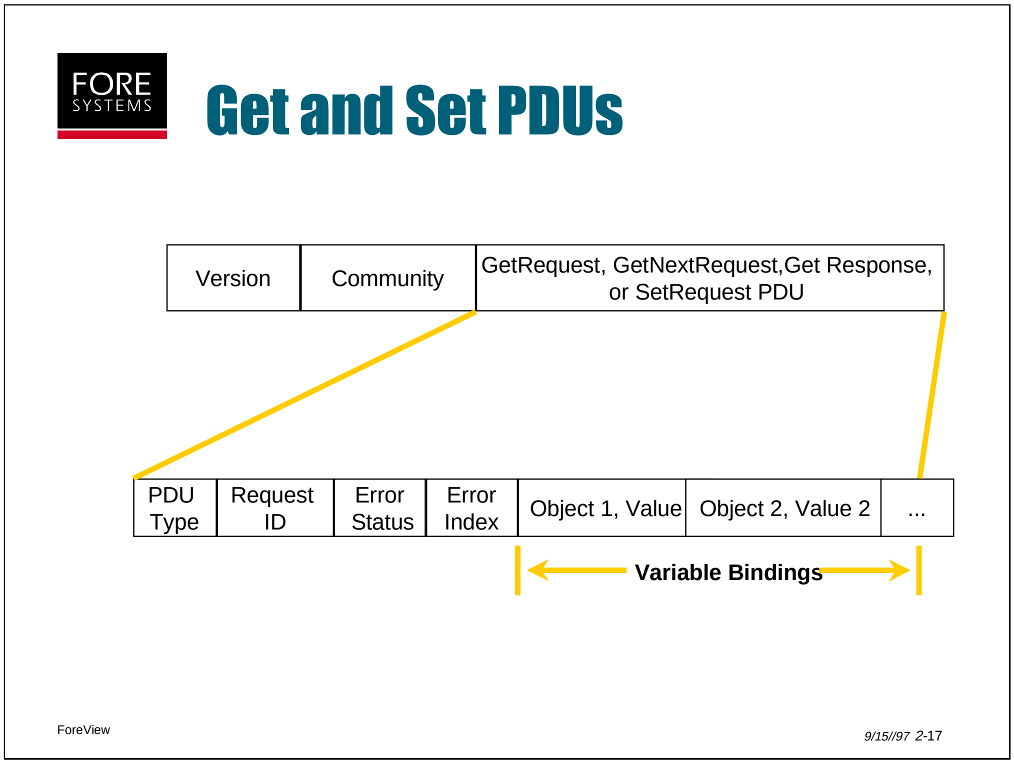
Traps/Notifications

Managed System (the agent)

Agent Process

Managed Objects

MIB Objects



FORE SYSTEMS

Get and Set PDUs

Version	Community	GetRequest, GetNextRequest,Get Response, or SetRequest PDU

PDU Type	Request ID	Error Status	Error Index	Object 1, Value	Object 2, Value 2	...

Variable Bindings

PDU Type:

GetRequest	0	Set Request	3
GetNextRequest	1	Trap	4
GetResponse2			

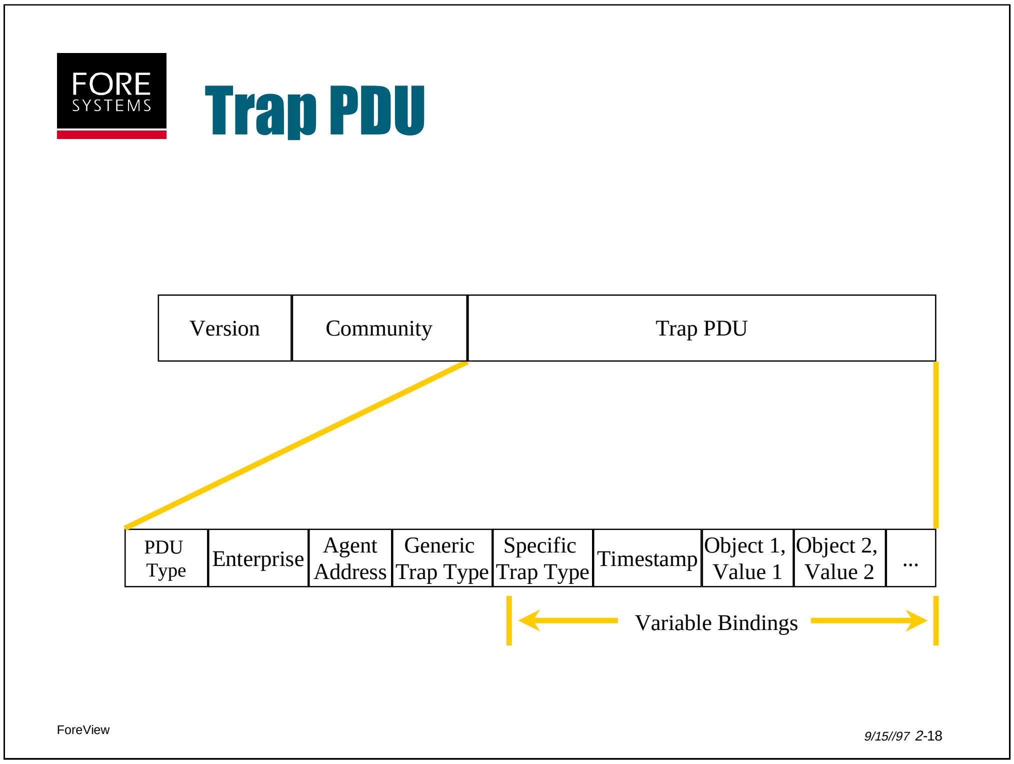
Request ID: Integer that correlates the managers request and the agents response. Analogous to TCP segment numbers

Error Status: Integer field identifies the entry within the variable bindings list which caused the error.

Error Index:

noError	0	badValue	3
tooBig	1	readOnly	4
noSuchName	2	genErr	5

Variable Bindings List: the list of variables and their values. The object is the OID encoding of the object plus the instance for the variable being communicated. The value is the desired (setRequest) or actual (Get Request) value for the object.



FORE SYSTEMS

Trap PDU

Version | Community | Trap PDU

PDU Type | Enterprise | Agent Address | Generic Trap Type | Specific Trap Type | Timestamp | Object 1, Value 1 | Object 2, Value 2 | ...

Variable Bindings

ForeView

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PDU Type : Traps = 4

Enterprise: OID prefix of the enterprise sending the trap (1.3.6.1.4.1.326 would indicate FORE Systems)

Agent Address: IP address of the agent.

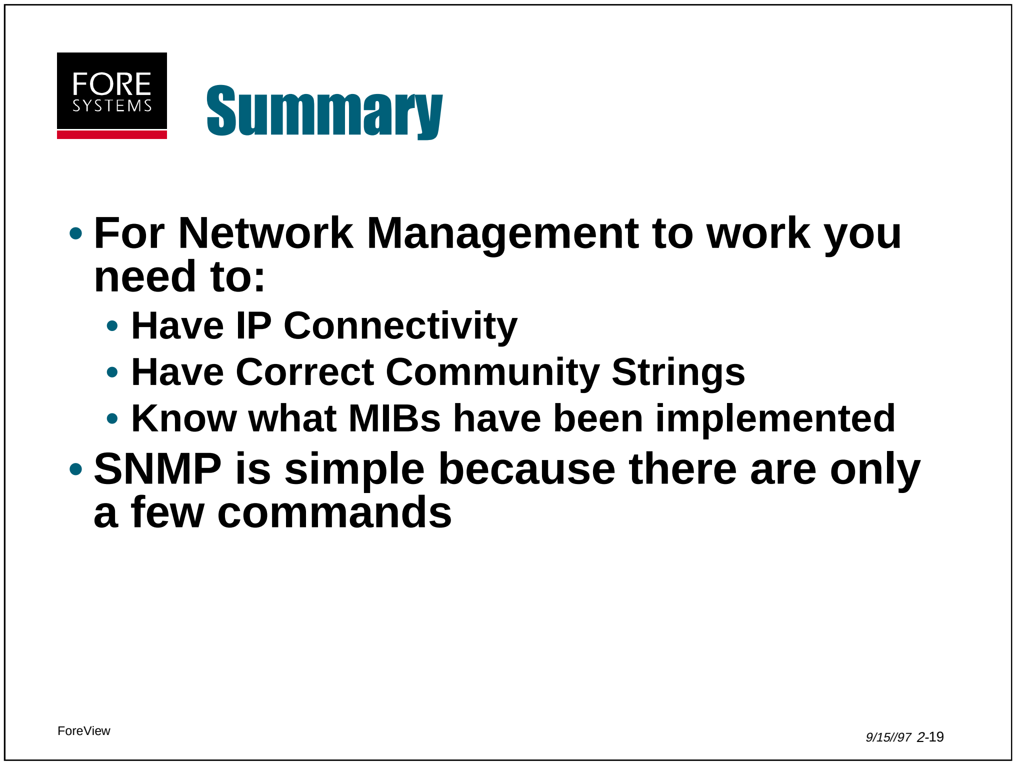
Generic Traps:

Value	Type	Value	Type
0	coldStart	4	authenticationFailure
1	warmStart	5	egpNeighborLoss
2	linkDown	6	enterpriseSpecific
3	linkUp		

If a non-generic trap has occurred (Generic Trap Type = 6), it will be further identified in the Specific Trap Type Field and the Enterprise Field.

Timestamp: contains the value of the sysUpTime object indicating the amount of time elapsed between the last (re-) initialization of the agent and the generation of that trap.

Variable Bindings List: the list of variables and their values. The object is the OID encoding of the object plus the instance for the variable being communicated.



Summary

- For Network Management to work you need to:
  - Have IP Connectivity
  - Have Correct Community Strings
  - Know what MIBs have been implemented
- SNMP is simple because there are only a few commands

FORE SYSTEMS

Installation of ForeView

ForeView

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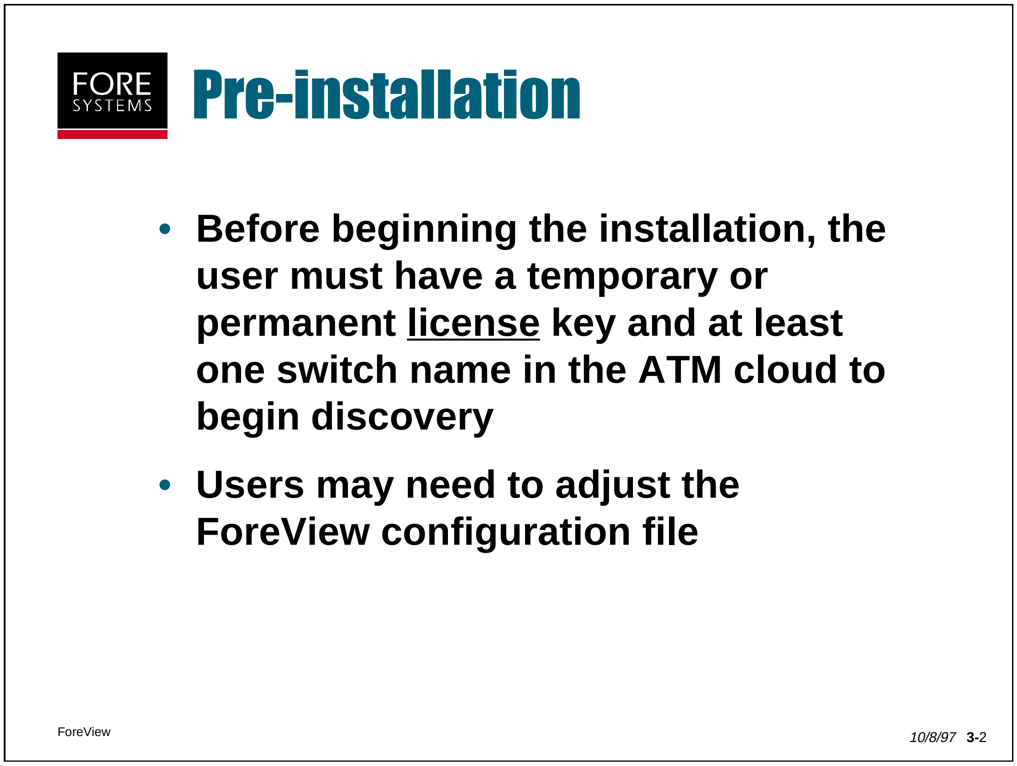

Pre-installation

- Before beginning the installation, the user must have a temporary or permanent license key and at least one switch name in the ATM cloud to begin discovery
- Users may need to adjust the ForeView configuration file

ForeView

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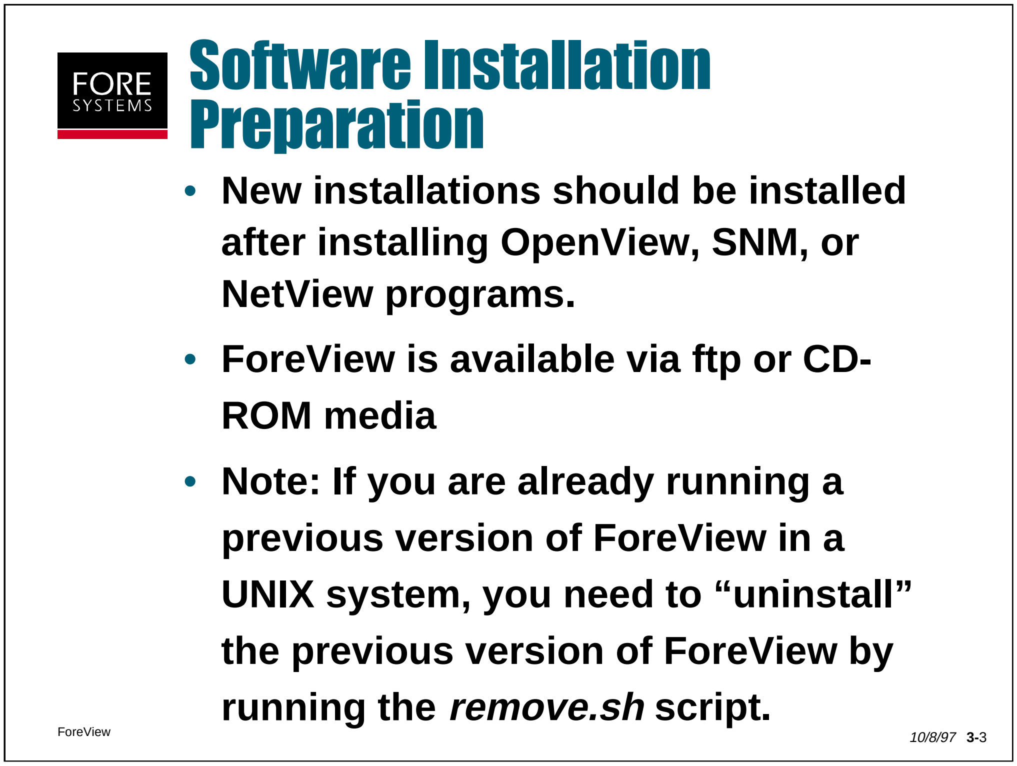
The ForeView license file is sent along with the program media packet.

The user will receive a temporary key which is designed to expire within a 90 day period. During this time, the user can call FORE TAC and request a permanent license that is “locked” to the IP address of the workstation that will be running ForeView. If the IP address changes, FORE TAC must be contacted to send out a new key for the new address.

The configuration file is a template of configuration settings that can be altered for specific ATM network needs. To make things easier for the user, the configuration file acts as a template with all resource variables described and “remarked”. To change a variable, the user simply adjusts the resource variable information and “unremarks” specific lines using their favorite text editor.



Software Installation Preparation

- New installations should be installed after installing OpenView, SNM, or NetView programs.
- ForeView is available via ftp or CD-ROM media
- Note: If you are already running a previous version of ForeView in a UNIX system, you need to “uninstall” the previous version of ForeView by running the *remove.sh* script.

ForeView

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Before any installation of ForeView products, make sure that any network management systems such as HP OpenView, SunNet Manager, or IBM NetView/AIX are installed and functional. The ForeView installation program will load and configure appropriate files into the NMS file systems.

It is recommended to remove previous versions of ForeView before installation of the new version. FORE has provided a script called remove.sh that will delete the older version.

Before running the script, do the following:

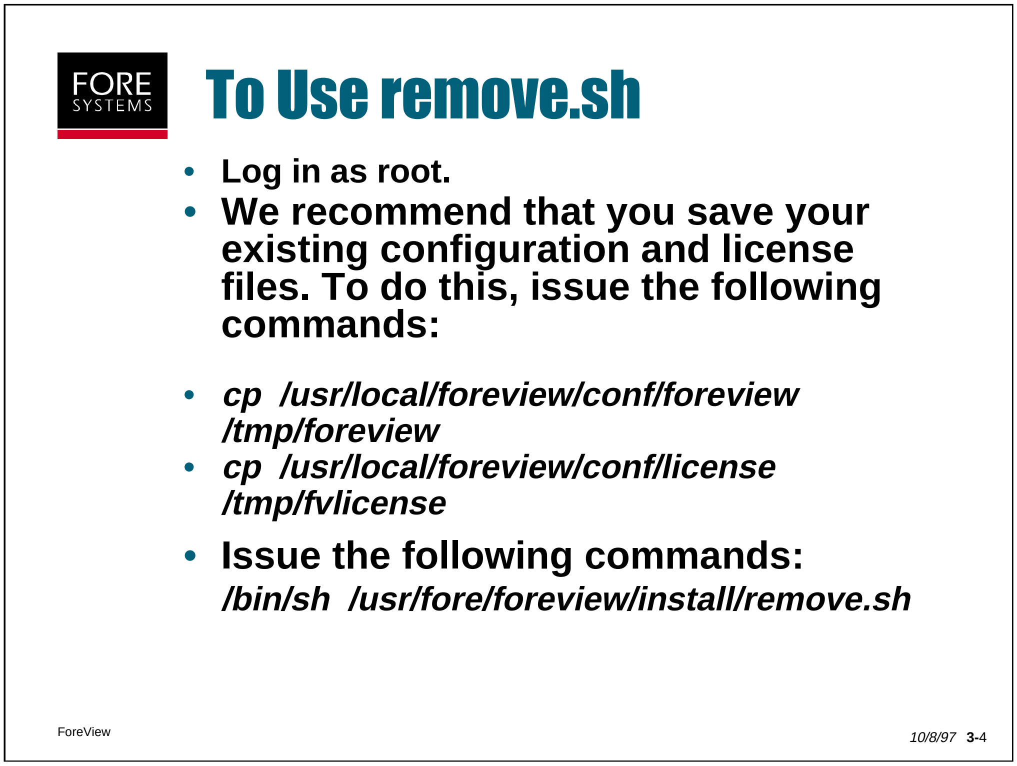
Exit all ForeView applications.

Exit your network management system (HP OpenView or SunNet Manager).

If ForeView is installed in an alternate directory, make sure that the environment variable FOREVIEW_HOME is set.

If ForeView is installed in an alternate directory it is imperative that you set the FOREVIEW_HOME environment variable before you begin the removal to avoid problems during the procedure.

NOTE: ForeView assumes a default location of /usr/fore/foreview, but the Sun workstations in our lab use the alternate directory /usr/local/foreview.



To Use remove.sh

- Log in as root.
- We recommend that you save your existing configuration and license files. To do this, issue the following commands:

- *cp /usr/local/foreview/conf/foreview /tmp/foreview*
- *cp /usr/local/foreview/conf/license /tmp/fvlicense*

- Issue the following commands:
  /bin/sh /usr/fore/foreview/install/remove.sh

ForeView

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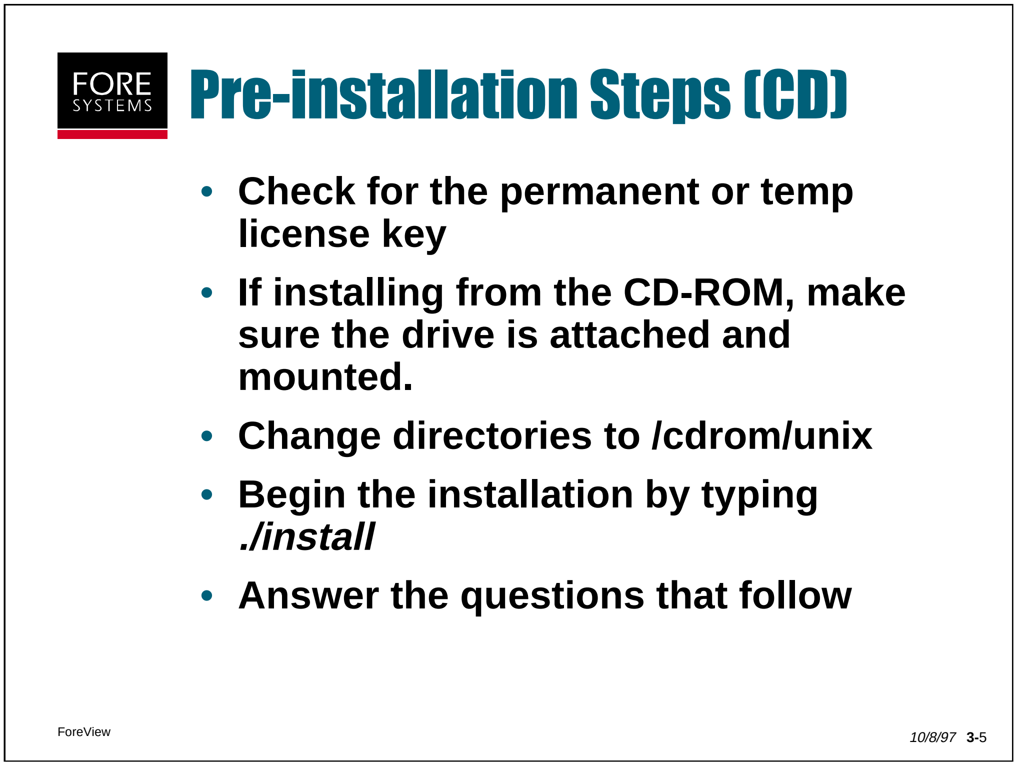
After following the steps (above) to remove the older version, you are now ready to install the latest version of ForeView. The software installation instructions have been divided into two sections, installation procedures for Unix platforms and for the Windows NT Stand-alone platform. Please proceed to the installation instructions for the platform you are using.

All users of ForeView on the OpenView platform must be informed that their personal configuration file ($HOME/ .foreview) needs to be updated to reflect any changes in the system-wide configuration file ($FOREVIEW_HOME/conf/foreview).



Pre-installation Steps (CD)

- Check for the permanent or temp license key
- If installing from the CD-ROM, make sure the drive is attached and mounted.
- Change directories to /cdrom/unix
- Begin the installation by typing *./install*
- Answer the questions that follow

ForeView

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Before starting the installation, decide where ForeView will reside.

Insert the ForeView Network Management CD-ROM into the CD-ROM drive and mount the file system as /cdrom. See your system's user guide for instructions on mounting CD-ROMs. Use the instructions above to start the installer software.

As you are prompted for information, enter information appropriate for your site.

FORE SYSTEMS

Pre-installation (ftp)

- The software image can be obtained from TACtics Online or the public ftp site
- Move the ftp'd file (such as fv42_sol.tar.Z) to one level above the intended $FOREVIEW_HOME (such as /usr/fore or /usr/local)
- Uncompress the file
- Once uncompressed, you can execute the tar command

tar -xvf /usr/local/fv42.sol.tar

ForeView

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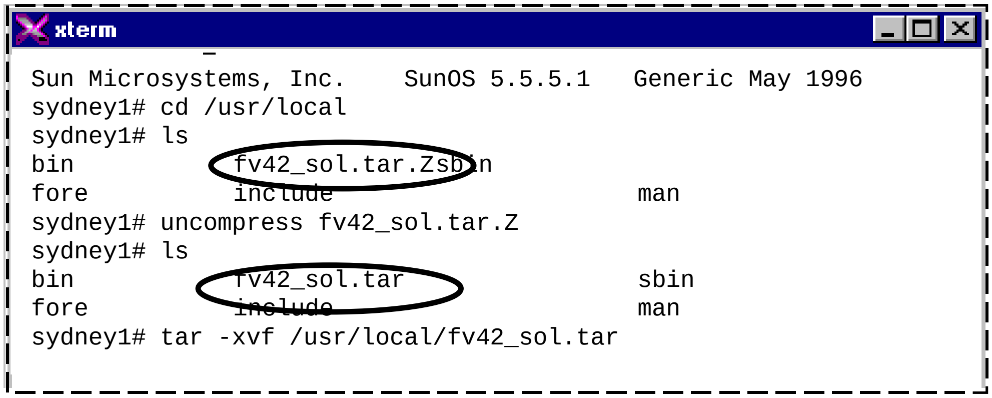
The commands here are specific to the Solaris operating system we'll use in the lab. If you use a different OS, make sure you obtain the appropriate file.

The uncompress function is done with:

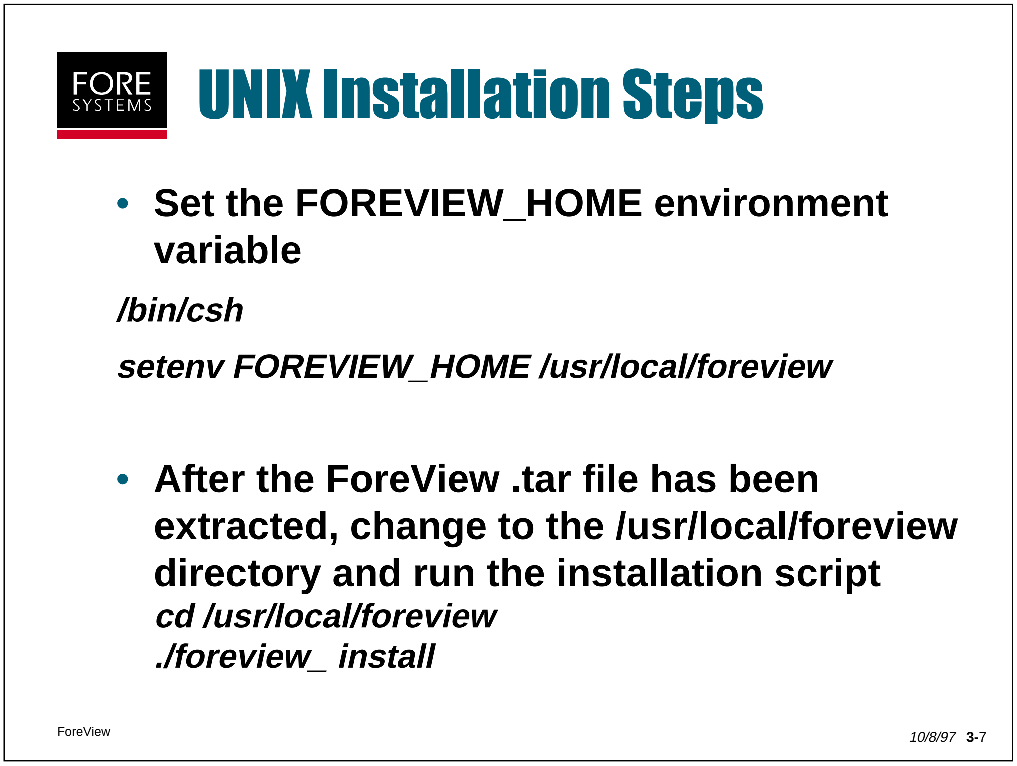
uncompress /usr/local/fv42_sol.tar.Z

The tar command will create subdirectories within the current location if they don't already exist. A common "mistake" is to put the .tar file in /usr/local/foreview, then extract the .tar file. The subdirectories will still be created but the home directory will be /usr/local/foreview/foreview. This is not fatal, just excessive. Extract with:

tar -xvf /usr/local/fv42.sol.tar



```
Sun Microsystems, Inc.    SunOS 5.5.5.1   Generic May 1996
sydney1# cd /usr/local
sydney1# ls
bin            fv42_sol.tar.Zsbin
fore           include                    man
sydney1# uncompress fv42_sol.tar.Z
sydney1# ls
bin            fv42_sol.tar               sbin
fore           include                    man
sydney1# tar -xvf /usr/local/fv42_sol.tar
```



FORE SYSTEMS

UNIX Installation Steps

- **Set the FOREVIEW_HOME environment variable**

/bin/csh

setenv FOREVIEW_HOME /usr/local/foreview

- **After the ForeView .tar file has been extracted, change to the /usr/local/foreview directory and run the installation script**
  cd /usr/local/foreview
  ./foreview_ install

ForeView

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Set the environment variable FOREVIEW_HOME to reflect the new directories if necessary.

The extracted tar file will create the directory foreview in /usr/local. Change directory to /usr/local/foreview:

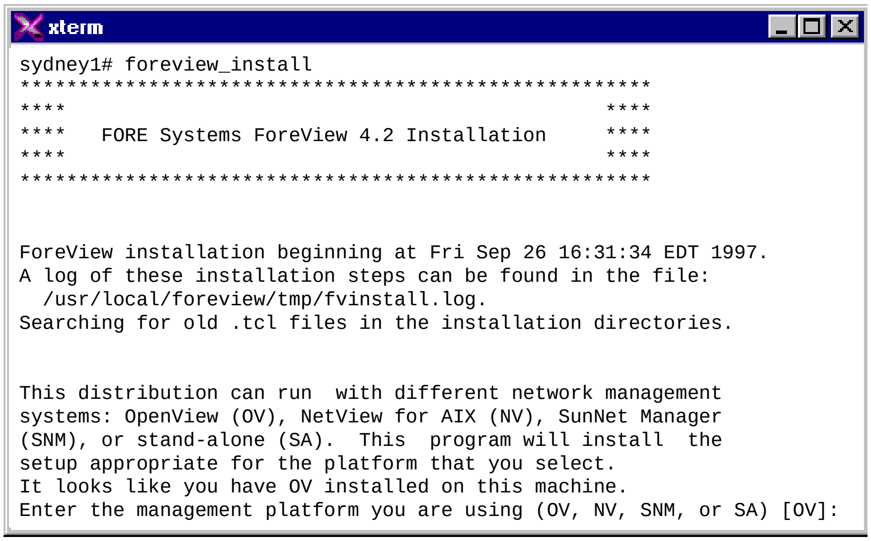
cd /usr/local/foreview

Run the following command to begin the installation:

./foreview_ install

Answer the questions that follow to complete the installation

Installation Script

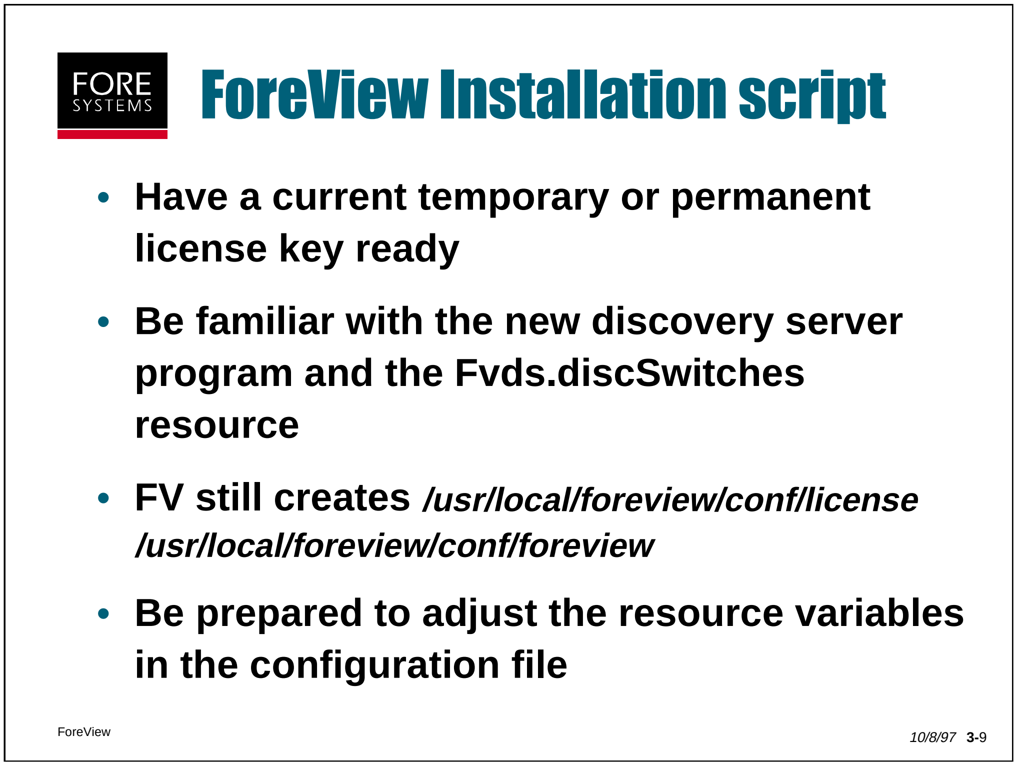


```
sydney1# foreview_install
******************************************************
****                                              ****
****   FORE Systems ForeView 4.2 Installation     ****
****                                              ****
******************************************************


ForeView installation beginning at Fri Sep 26 16:31:34 EDT 1997.
A log of these installation steps can be found in the file:
  /usr/local/foreview/tmp/fvinstall.log.
Searching for old .tcl files in the installation directories.


This distribution can run  with different network management
systems: OpenView (OV), NetView for AIX (NV), SunNet Manager
(SNM), or stand-alone (SA).  This  program will install  the
setup appropriate for the platform that you select.
It looks like you have OV installed on this machine.
Enter the management platform you are using (OV, NV, SNM, or SA) [OV]:
```

The script will explain what is happening as well as provide choices. Remember, it is only a script and nothing is being written to the system until the end. You can exit the script at any time using <ctrl-c>.



ForeView Installation script

- Have a current temporary or permanent license key ready
- Be familiar with the new discovery server program and the Fvds.discSwitches resource
- FV still creates */usr/local/foreview/conf/license /usr/local/foreview/conf/foreview*
- Be prepared to adjust the resource variables in the configuration file

ForeView

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ForeView checks to see if you have a license file in /tmp/fvlicense OR in /usr/local/foreview/conf/license. If it does not find a license file, it asks you to enter the license information.

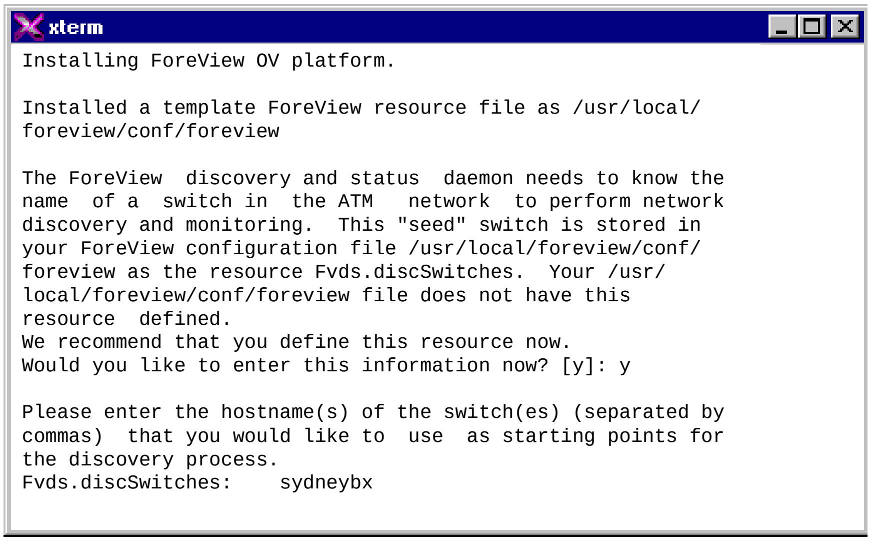
Your ForeView product arrives with a License Certificate and a temporary license good for approximately 90 days.

If you have no license certificate, ForeView will generate a 15-day temporary license.

To receive a permanent license key, please fill in all the information on the License Certificate and fax the card to FORE Systems' Technical Support.

Resource variables such as the Discovery Switch, are discussed in more detail later.

Choosing an OpenView Installation



```
Installing ForeView OV platform.

Installed a template ForeView resource file as /usr/local/
foreview/conf/foreview

The ForeView  discovery and status  daemon needs to know the
name  of a  switch in  the ATM   network  to perform network
discovery and monitoring.  This "seed" switch is stored in
your ForeView configuration file /usr/local/foreview/conf/
foreview as the resource Fvds.discSwitches.  Your /usr/
local/foreview/conf/foreview file does not have this
resource  defined.
We recommend that you define this resource now.
Would you like to enter this information now? [y]: y

Please enter the hostname(s) of the switch(es) (separated by
commas)  that you would like to  use  as starting points for
the discovery process.
Fvds.discSwitches:    sydneybx
```

ForeView

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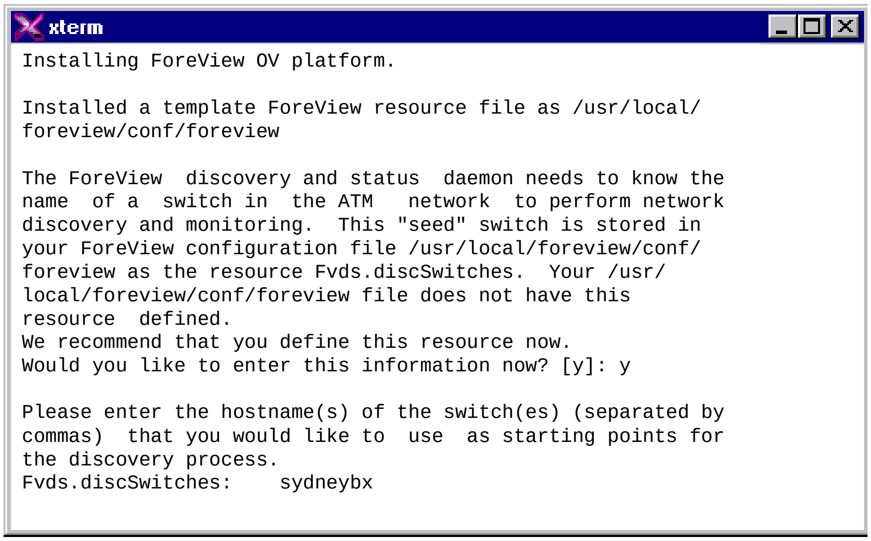
The next decision you make is to install the standalone version of ForeView or a version integrated with HP OpenView (OV), SunNet Manager (SNM), or NetView/AIX (NV).

When an integrated version is selected, please note the standalone files are also installed.

FORE SYSTEMS

Enter The Discovery Switch(es)



```
Installing ForeView OV platform.

Installed a template ForeView resource file as /usr/local/
foreview/conf/foreview

The ForeView  discovery and status  daemon needs to know the
name  of a  switch in  the ATM   network  to perform network
discovery and monitoring.  This "seed" switch is stored in
your ForeView configuration file /usr/local/foreview/conf/
foreview as the resource Fvds.discSwitches.  Your /usr/
local/foreview/conf/foreview file does not have this
resource  defined.
We recommend that you define this resource now.
Would you like to enter this information now? [y]: y

Please enter the hostname(s) of the switch(es) (separated by
commas)  that you would like to  use  as starting points for
the discovery process.
Fvds.discSwitches:    sydneybx
```

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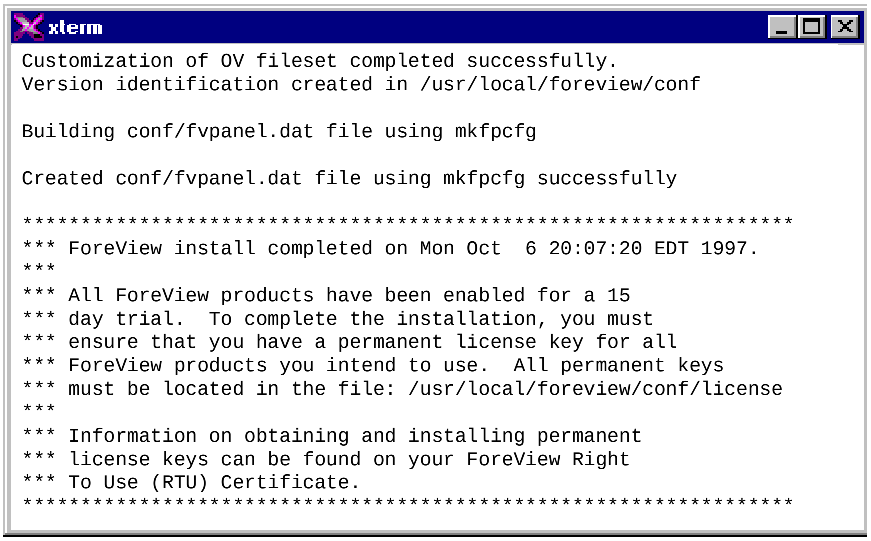
The information needed is the IP address or DNS hostname of the ForeRunner ATM switch that will be the starting point of network discovery. There are different strategies here. A simple strategy is to name the ATM switch nearest you. Later, you can decide which switch or switches best suit your application. Another strategy is to select a well-connected switch (many NNI links) in each building or group of switches.

The IP interface specified by name or address can be ATM- or Ethernet-attached, but must be reachable from this host. More on this in an upcoming section.

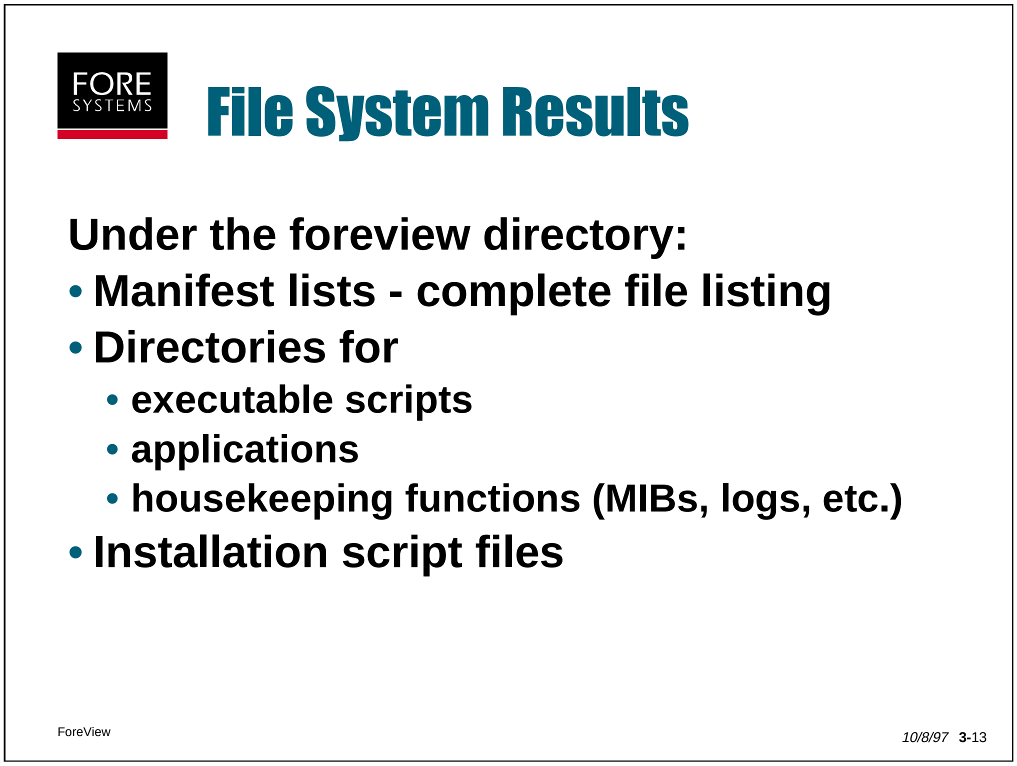
Finish The Installation



```
Customization of OV fileset completed successfully.
Version identification created in /usr/local/foreview/conf

Building conf/fvpanel.dat file using mkfpcfg

Created conf/fvpanel.dat file using mkfpcfg successfully

*****************************************************************
*** ForeView install completed on Mon Oct  6 20:07:20 EDT 1997.
***
*** All ForeView products have been enabled for a 15
*** day trial.  To complete the installation, you must
*** ensure that you have a permanent license key for all
*** ForeView products you intend to use.  All permanent keys
*** must be located in the file: /usr/local/foreview/conf/license
***
*** Information on obtaining and installing permanent
*** license keys can be found on your ForeView Right
*** To Use (RTU) Certificate.
*****************************************************************
```

Prior to this display, an OpenView status will have scrolled up. “RUNNING” and “WELL BEHAVED” are the indicators you are looking for on the OpenView processes.

When the installation is finished, ForeView will inform you of a successful procedure and log the installation in the text file /usr/fore/foreview/tmp/fvinstall.log. If the installation is unsuccessful, the log will keep track of where the procedure failed.



FORE SYSTEMS

File System Results

Under the foreview directory:

- **Manifest lists - complete file listing**
- **Directories for**
  - **executable scripts**
  - **applications**
  - **housekeeping functions (MIBs, logs, etc.)**
- **Installation script files**

ForeView

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Manifest lists - Specific lists of all the files created as a result of the installation. For an installation with another NMS, bothe the standalone and integrated files will be listed. On the lab equipment, see MANIFEST-OV and MANIFEST-SA.

Directories -

Executable scripts: **bin**

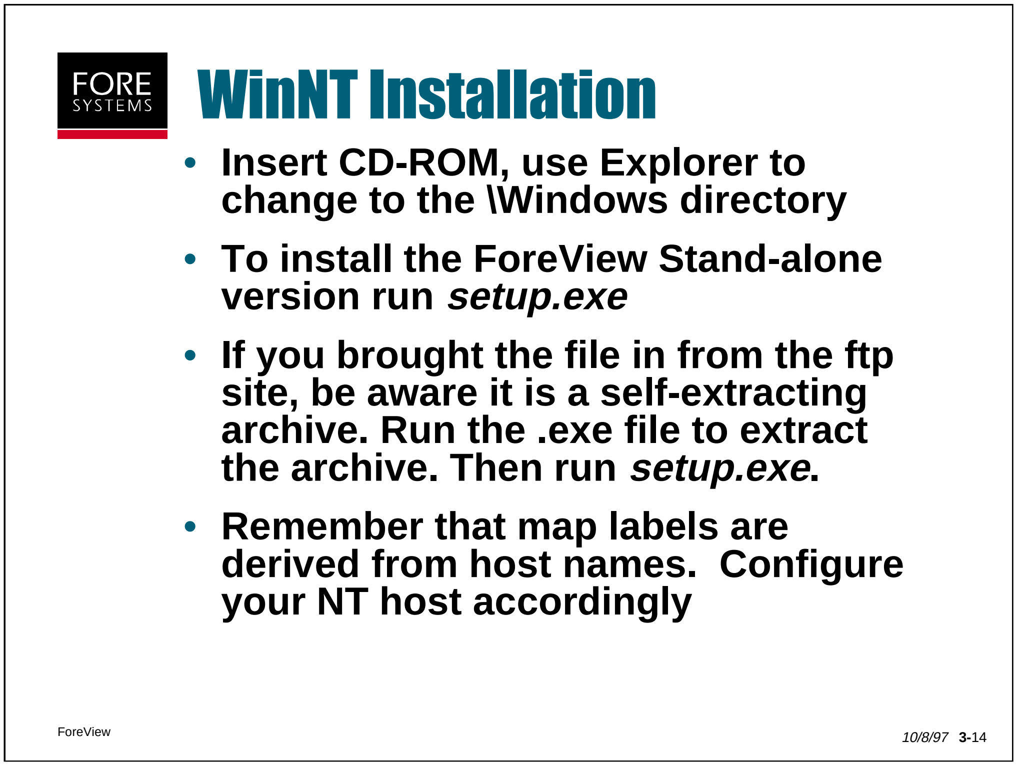
Applications: frontpnl fvcall fvchan fvdisco fvgraph
fvinv fvmap fvmsg fvoams fvphub fvsuppfvtracer
fvupgrad

Housekeeping functions: OV **conf** fvhelp fvtcllib install
log man* mibs tcl_apps tcl_lib **tmp**

Installation script files - foreview_install, fvrmon_install

The script fvrmon_install is used with ForeView RMON ST, a separate software product.

*NOTE: Support for man pages ceases with version 4.2



FORE SYSTEMS

WinNT Installation

- Insert CD-ROM, use Explorer to change to the \Windows directory
- To install the ForeView Stand-alone version run *setup.exe*
- If you brought the file in from the ftp site, be aware it is a self-extracting archive. Run the .exe file to extract the archive. Then run *setup.exe*.
- Remember that map labels are derived from host names. Configure your NT host accordingly

ForeView

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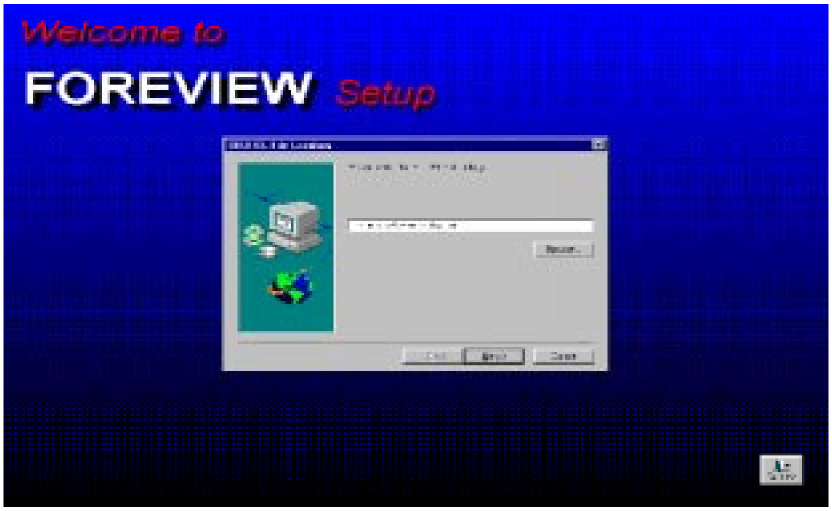
ForeView uses NT installation tools, so it should look very familiar. To align host names with the rest of the network, see section 2.4.2 in the user's manual.

If you importing the file via ftp, the file you get will be something very similar to fv42_5nt.exe, which is a self-extracting executable. Simply run the file and the archived files will be unpacked. Running the setup program installs the files to their appropriate places.

NT installation screen



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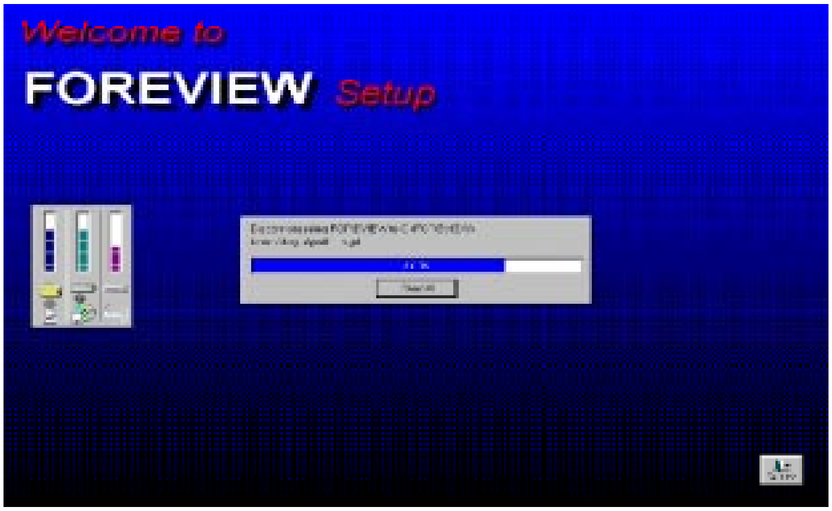
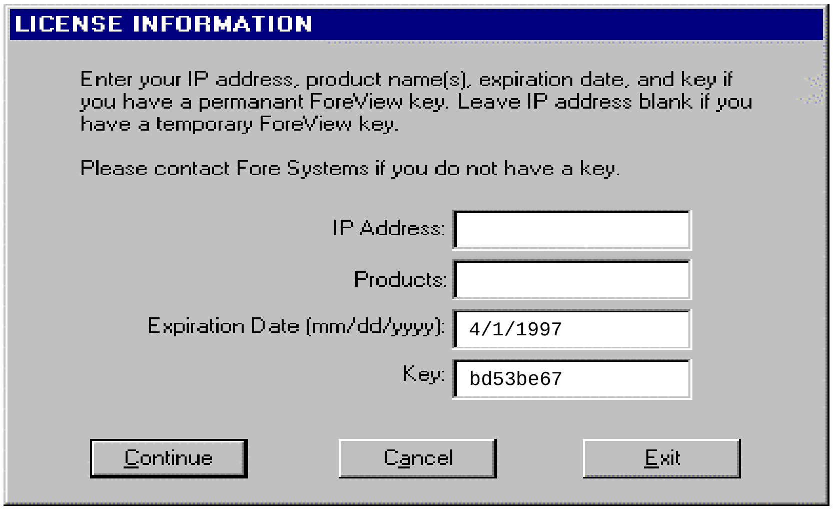
In the initial steps of the installation, ForeView will prompt for the source of the installation files and the destination. By default the source directory is the current directory that launched the setup.exe program and the destination is C:\FOREVIEW.

NT Files are copied



[illegible]

Enter the license info



LICENSE INFORMATION

Enter your IP address, product name(s), expiration date, and key if you have a permanant ForeView key. Leave IP address blank if you have a temporary ForeView key.

Please contact Fore Systems if you do not have a key.

IP Address:	
Products:	
Expiration Date (mm/dd/yyyy):	4/1/1997
Key:	bd53be67

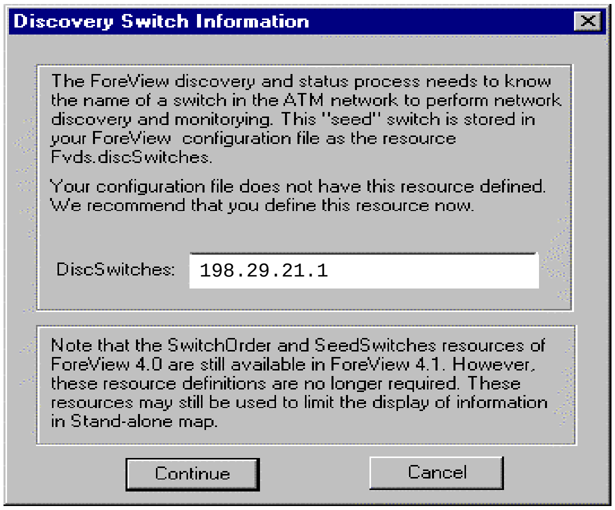
The ForeView NT installation will prompt for the IP address, products, Expiration Date and Expiration Key Code in a dialog box. When using a permanent license, all the fields must be completed.

The temporary license requires only the Expiration Date and the Key fields. Do NOT fill in the fields for IP Address and Products when using the temporary keys.

Make a special note that the format for the Expiration Date is MM/DD/YYYY where MM is the two digit month (ie April=04), DD is the two digit date (ie 01 is the first day), and YYYY is the four digit year (ie YYYY = 1997).

FORE SYSTEMS

Enter Discovery Switch information



Discovery Switch Information

The ForeView discovery and status process needs to know the name of a switch in the ATM network to perform network discovery and monitoring. This "seed" switch is stored in your ForeView configuration file as the resource Fvds.discSwitches.

Your configuration file does not have this resource defined. We recommend that you define this resource now.

DiscSwitches: 198.29.21.1

Note that the SwitchOrder and SeedSwitches resources of ForeView 4.0 are still available in ForeView 4.1. However, these resource definitions are no longer required. These resources may still be used to limit the display of information in Stand-alone map.

ForeView

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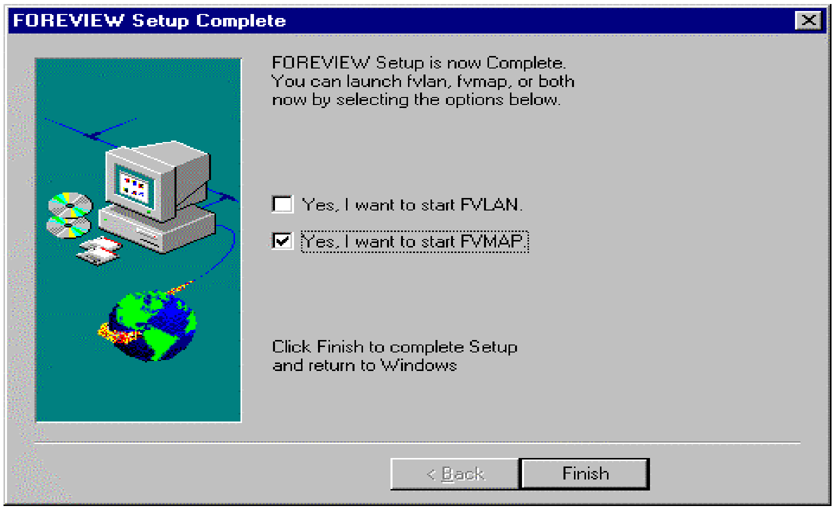
Note DiscSwitches can be entered as host names, IP addresses, or a mixture. Lists entries must be comma-separated. The valid switch count for DiscSwitches is one to all of the managed switches.

Finish the installation



FOREVIEW Setup Complete

FOREVIEW Setup is now Complete.
You can launch fvlan, fvmap, or both
now by selecting the options below.

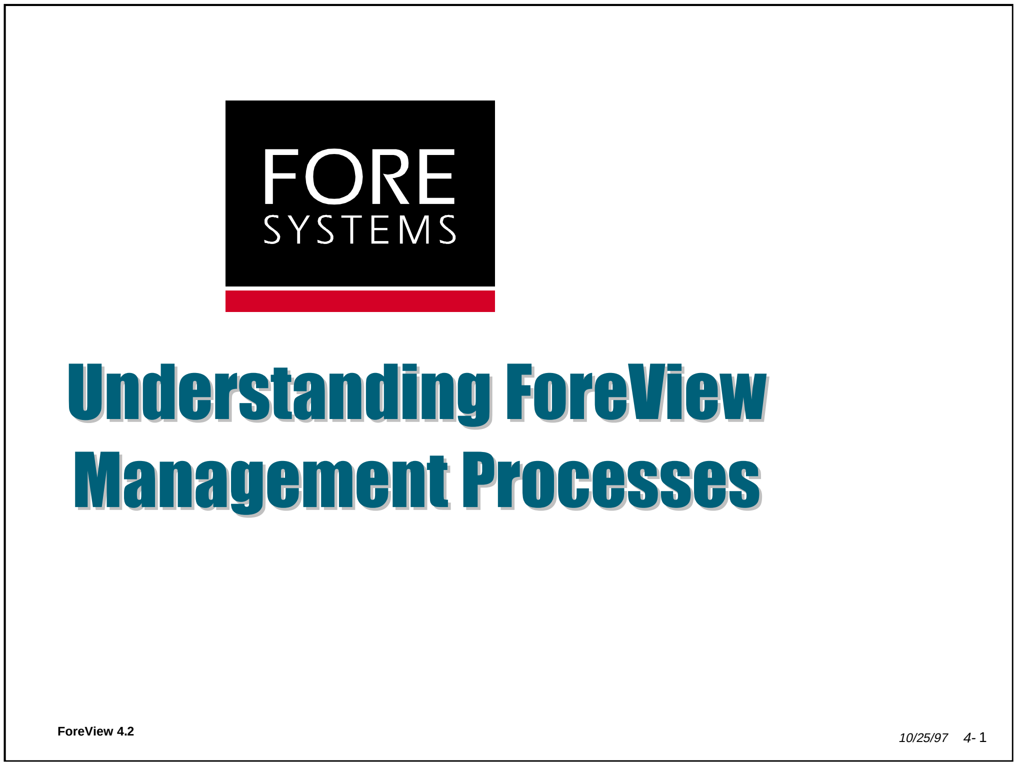
□ Yes, I want to start FVLAN.

☑ Yes, I want to start FVMAP.

Click Finish to complete Setup
and return to Windows

When the installation finishes, ForeView will create a program group for ForeView that includes icons for five different programs:

fvds	the discovery server program
fvlan	the VLAN manager program
fvmap	the ForeView topology map
fvpanel	the ForeView Front Panel device manager display
fvpsview	a tool to manage the ForeView background processes



FORE SYSTEMS

Understanding ForeView Management Processes

ForeView 4.2

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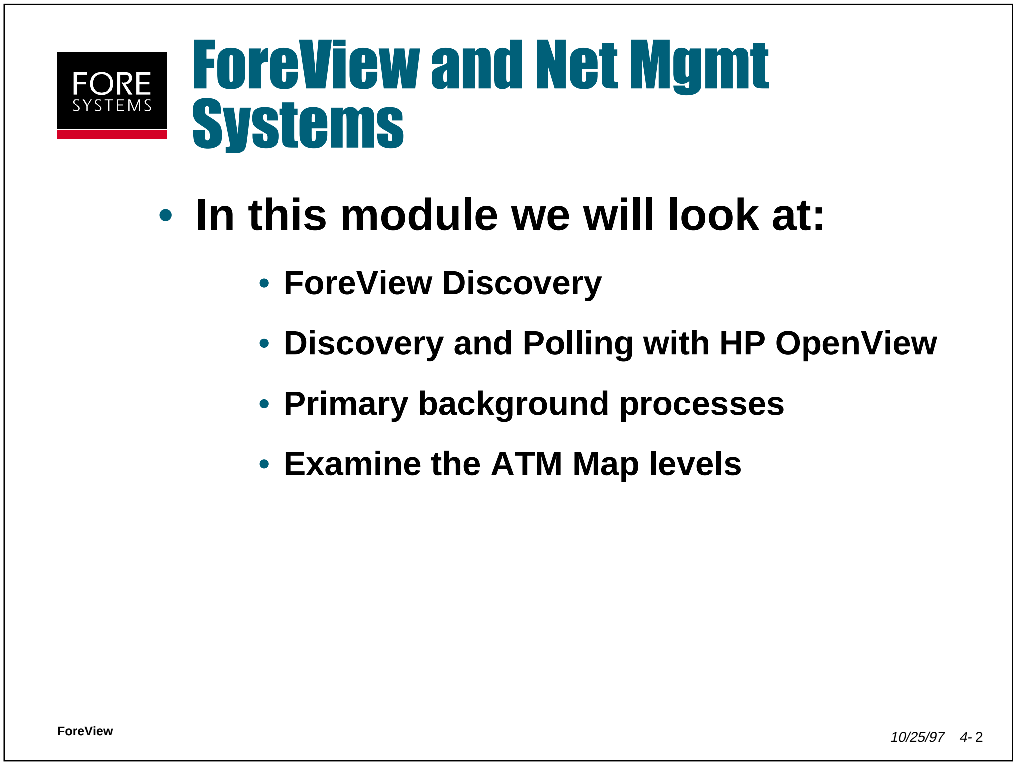

ForeView and Net Mgmt Systems

- In this module we will look at:
  - ForeView Discovery
  - Discovery and Polling with HP OpenView
  - Primary background processes
  - Examine the ATM Map levels

ForeView

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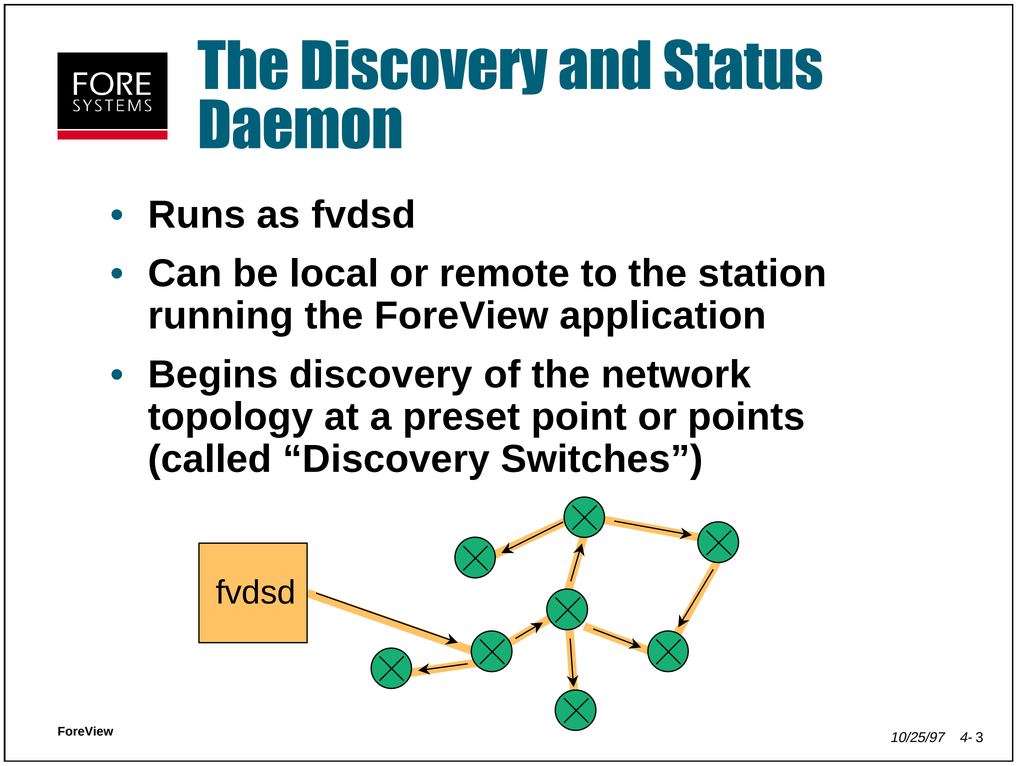
In this module we will take our first look at the ForeView Discovery and Status daemon. The Discovery daemon provides service to ForeView applications in stand-alone and integrated modes.

We will look at the primary background processes and the schematic of how Open View uses these in its operation. We can then examine the results of the OpenView discovery and look at the default maps.



The Discovery and Status Daemon

- Runs as fvdsd
- Can be local or remote to the station running the ForeView application
- Begins discovery of the network topology at a preset point or points (called “Discovery Switches”)

ForeView

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ForeView utilizes a discovery and status server application that discovers the manageable entities, that is the switches, NNI and UNI links, and the endpoints of NNI and UNI links in the ATM network.

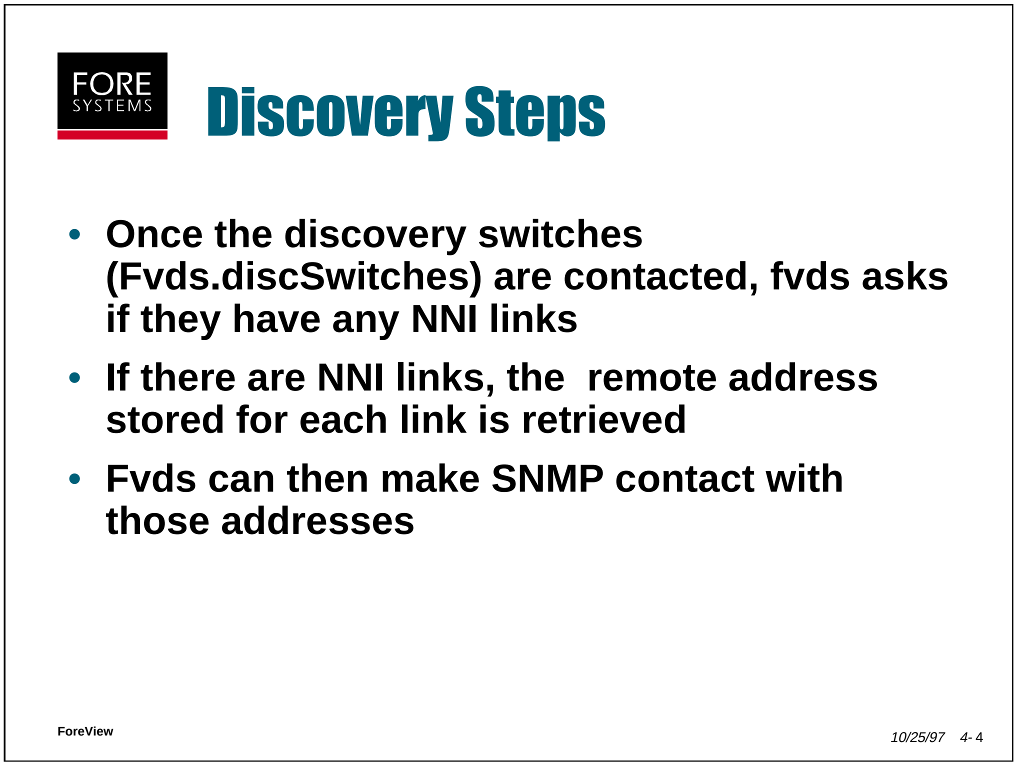
All switches and devices connected to any of the switches in the list, which can be communicated with via IP and/or SNMP, will be discovered and monitored, by default. For example take:

Fvds.discSwitches: switch1, switch2

In this case, the discovery process will discover switch1 and switch2. It will then issue SNMP gets to find out which ports are in NNI status and the remote IP address on that link. As get responses are returned, these addresses are added to the list of known switches. This NNI query moves onto the new switches, and so on, until all the switches are discovered.

The Fvds.discSwitches resource defines the switches that the daemon fvdsd uses to begin discovery of the network, and does NOT specify what the applications will use to show on a map.

During the installation process, if this resource is not defined in the configuration file, the user is prompted for the Discovery Switch.



Discovery Steps

- Once the discovery switches (Fvds.discSwitches) are contacted, fvds asks if they have any NNI links
- If there are NNI links, the remote address stored for each link is retrieved
- Fvds can then make SNMP contact with those addresses

ForeView

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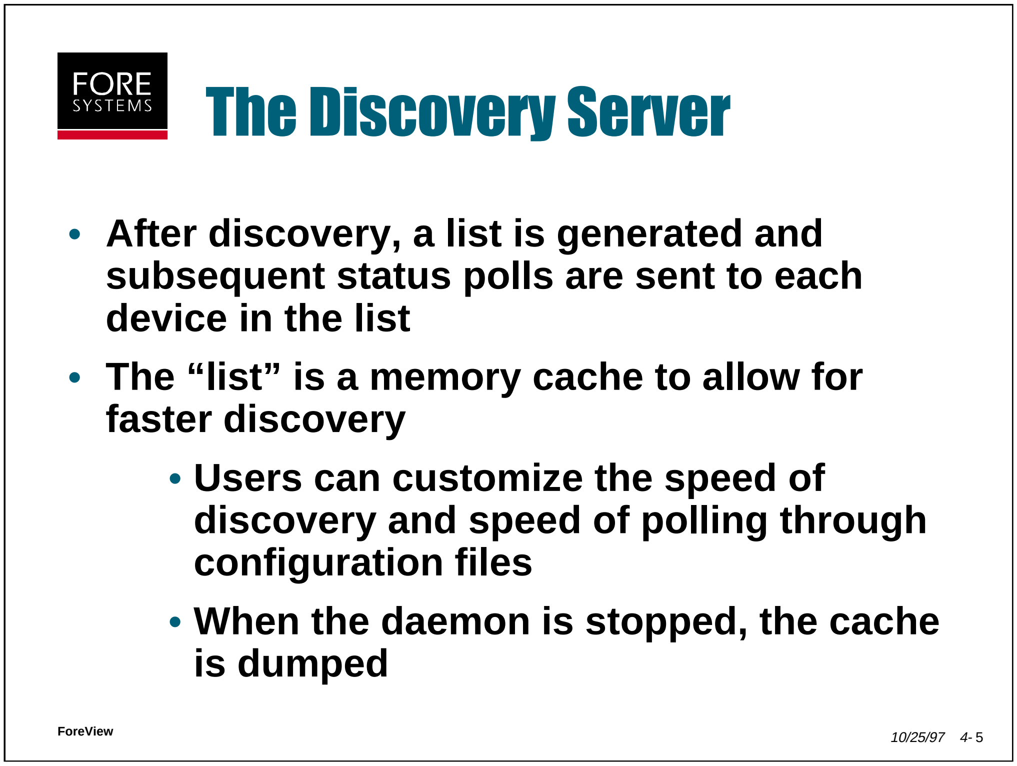

The Discovery Server

- After discovery, a list is generated and subsequent status polls are sent to each device in the list
- The “list” is a memory cache to allow for faster discovery
    - Users can customize the speed of discovery and speed of polling through configuration files
    - When the daemon is stopped, the cache is dumped

ForeView

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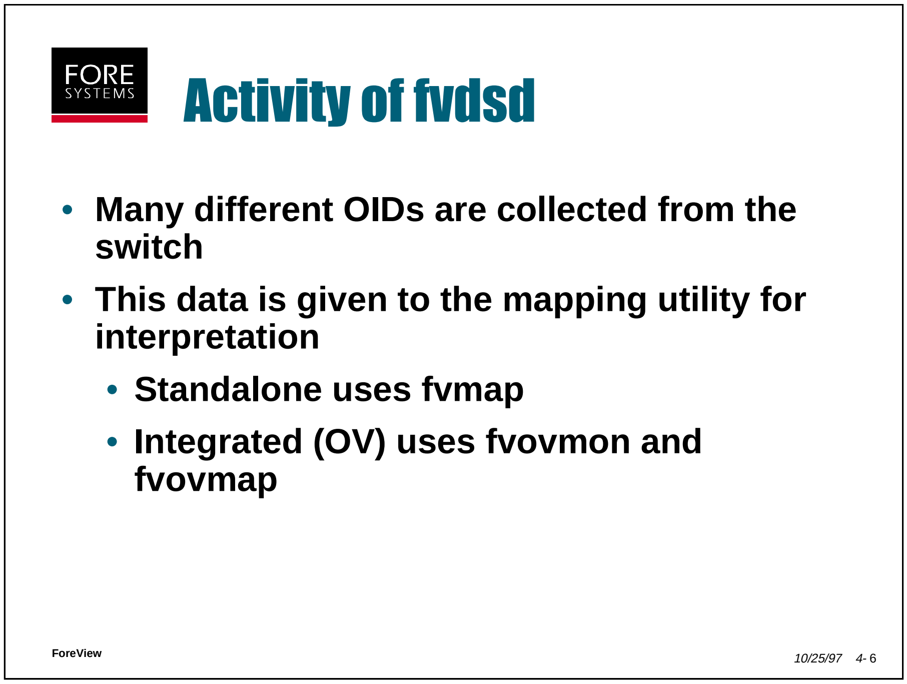
The fvds daemon has two tasks. First, the application discovers the network elements and polls the information to keep its own internal cache up-to-date. Second, it makes the network topology and status information available to clients through a TCP socket. Remote ForeView stations can contact these fvds instances and read data from there.

It is important to note that the Discovery Server will not “volunteer” or “relinquish” the data without an appropriate request from one of these applications.

Fvdsd is a true server and does not send things out unsolicited. Therefore, when a client asks for status on a particular object such as port 1b3 on a switch named Voyager, it will respond. This is why the interval value for fvovmon is important, it asks fvdsd if any switch status has changed according to the interval. A switch may have actually changed status 10 minutes ago, but until fvovmon asks for the information, it will not make the appropriate changes. So, when configuring fvovmon and fvdsd, their pollings should be configured with this in mind.



Activity of fvdsd

- Many different OIDs are collected from the switch
- This data is given to the mapping utility for interpretation
  - Standalone uses fvmap
  - Integrated (OV) uses fvovmon and fvovmap

ForeView

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Status, general switch info:

switchAtmAddress

switchType

envMgmtBoardSerialNumber

switchThisAgentBoardNumber

controlPort

sysObjectId

Netmod info:

hwPortNumber

hwPortGlobalIndex

moduleNumber

moduleBoard

moduleNumberOfPorts

Multiple interfaces on a switch:

variables in ifTable

variables in ipAddrTable

Port/link discovery and status info:

hwPortOperStatus

portOperStatus

portRemoteIpAddress

portRemoteAtmAddress

portNumber

portManagementStatus

Sigpath (SPANS and UNI) discovery and status info:

sigPathPort

sigPathVPI

sigPathVCI

sigPathOperStatus

sigPathRemoteIpAddress

portOperStatus

portRemoteIpAddress

portRemoteAtmAddress

portNumber

sigPathRemoteAtmAddress

q2931AdminPort

q2931AdminVPI

q2931AdminVCI

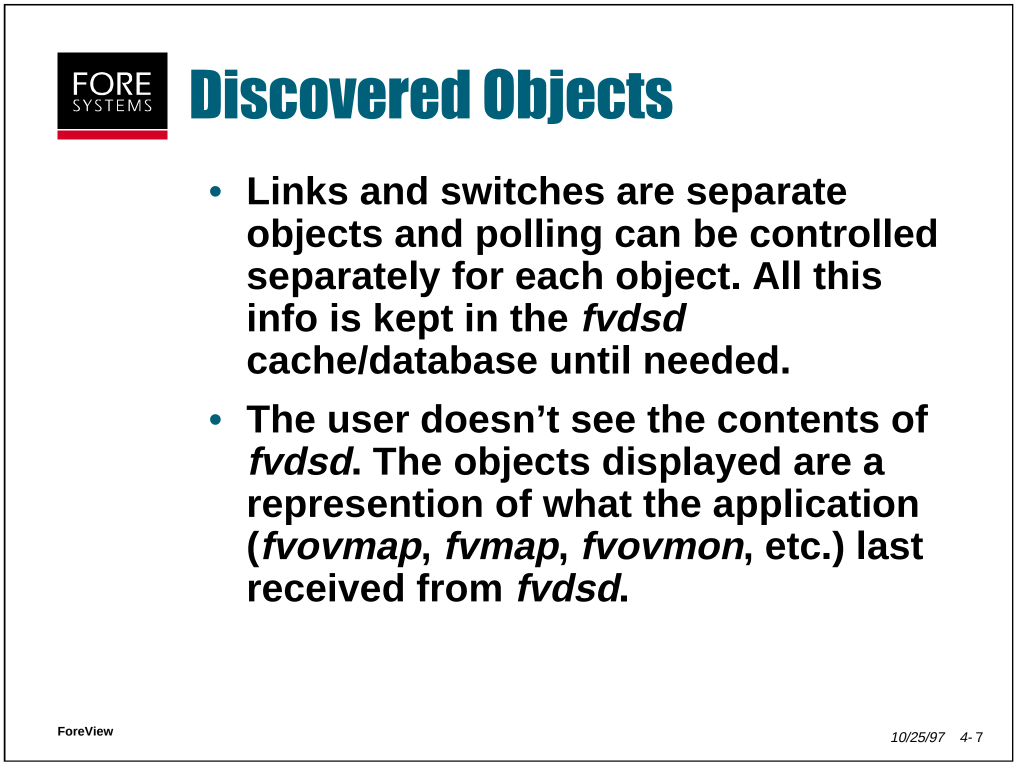
q2931OperStatus

q2931AdminRemoteIpAddress

q2931AdminOPerType

q2931UNIOperVersion

q2931PeerPort



FORE SYSTEMS

Discovered Objects

- **Links and switches are separate objects and polling can be controlled separately for each object. All this info is kept in the *fvdsd* cache/database until needed.**
- **The user doesn’t see the contents of *fvdsd*. The objects displayed are a represention of what the application (*fvovmap*, *fvmap*, *fvovmon*, etc.) last received from *fvdsd*.**

ForeView

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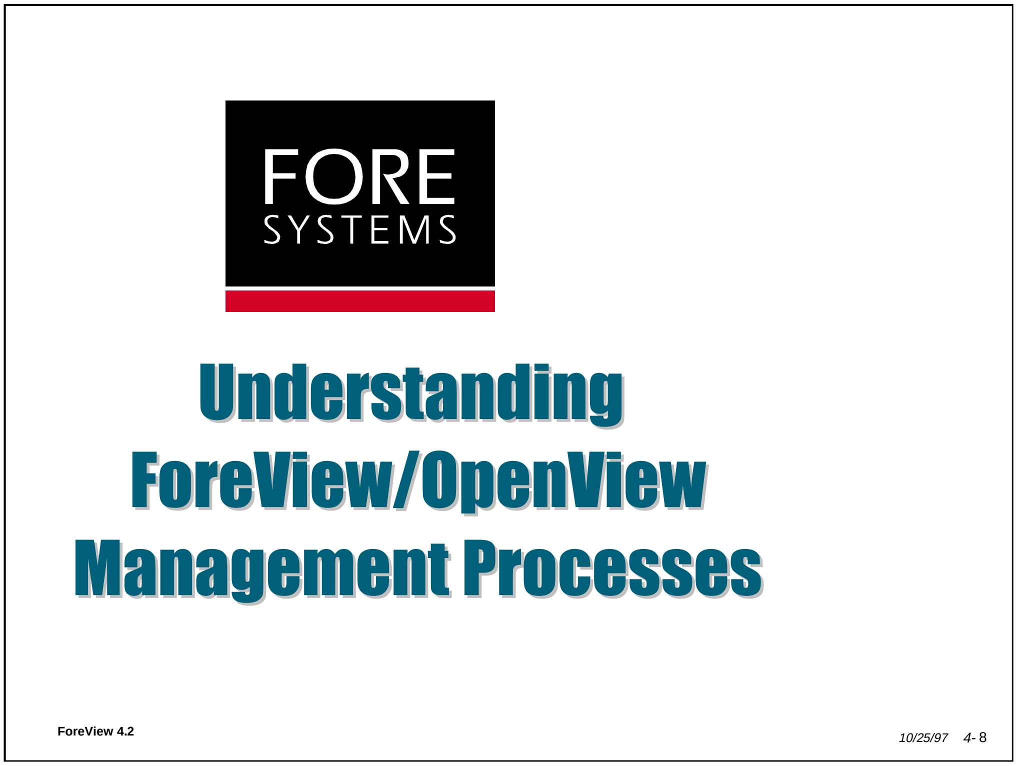
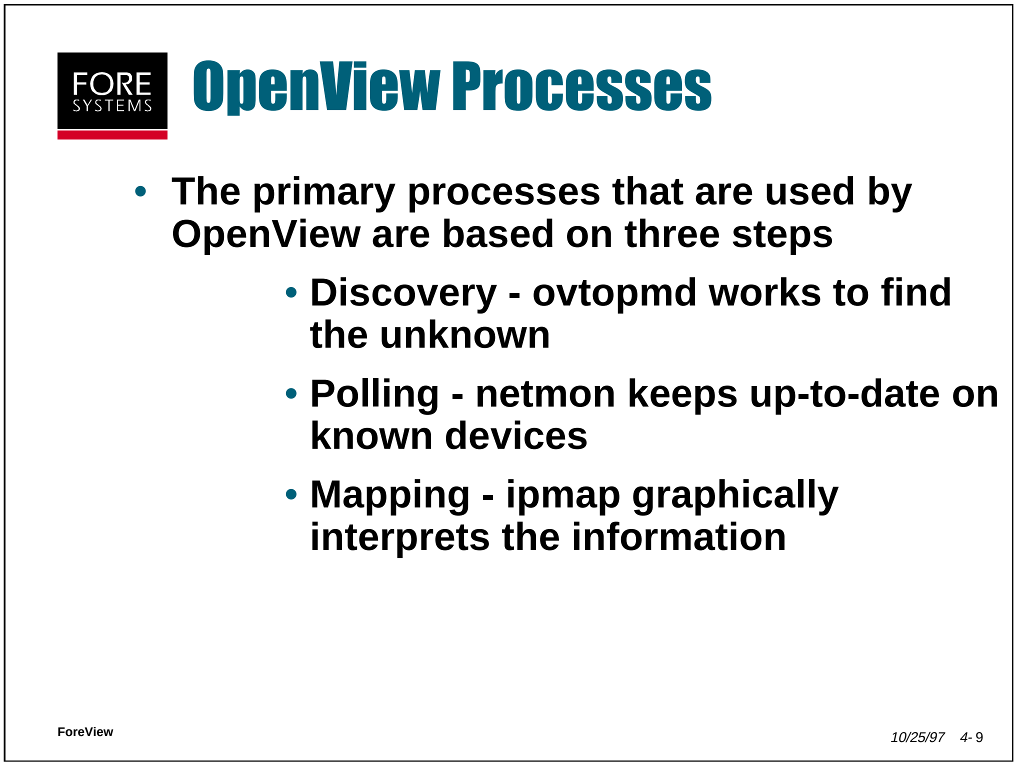
Discovery server is initially slow to discover the networks but eventually caches all switches found in memory for later use. If it found 70 switches, it would put each one in the cache as individual objects for use later by the topology .

If you start up fvmap right away, it will act as a client to fvdsd, asking what it knows. It may have only discovered one switch, so only one switch will be displayed. As fvdsd learns more and more, fvmap continues to ask about the network. Only after full discovery can fvmap get all the information it needs to map the whole network.

To prevent the “partial map” problem, fvdsd should be started first, then after time passes (about an hour with defaults), start map or other client functions.



Understanding ForeView/OpenView Management Processes



OpenView Processes

- The primary processes that are used by OpenView are based on three steps
  - Discovery - ovtopmd works to find the unknown
  - Polling - netmon keeps up-to-date on known devices
  - Mapping - ipmap graphically interprets the information

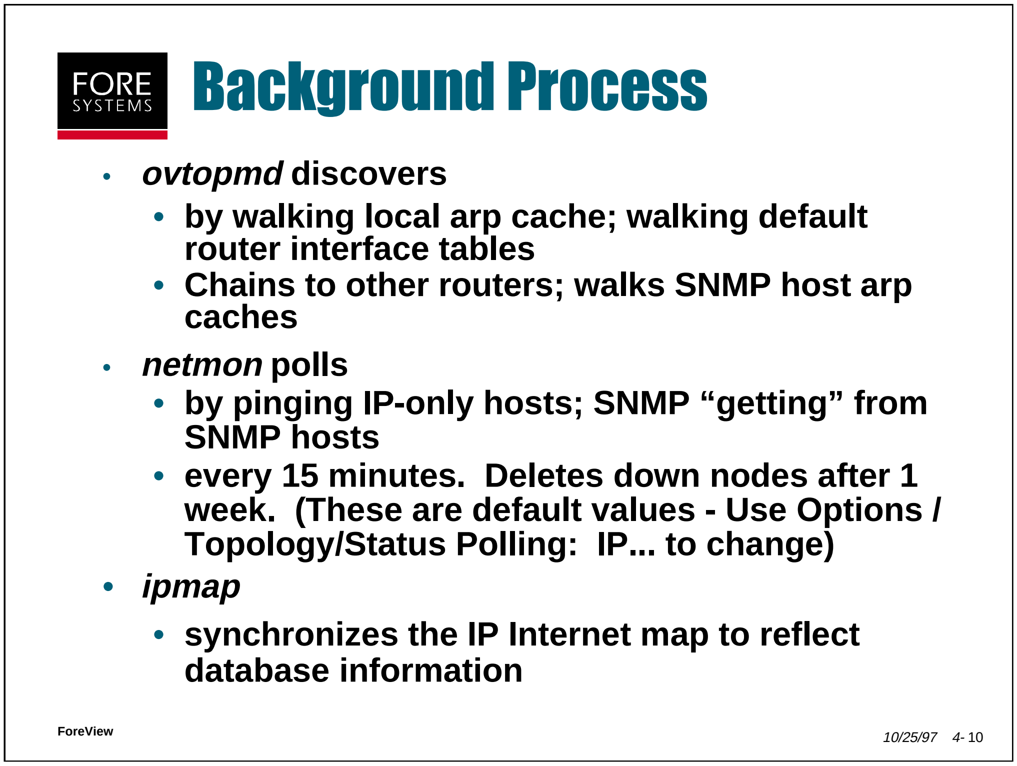
ForeView

10/25/97 4- 9

HP OpenView is one the more popular ways of managing an IP network. It uses SNMP to gather information about devices with IP addresses without discriminating about whether they are connected by Ethernet, Token Ring, FDDI, or ATM.

OV runs as a collection of persistent processes that are started when the host workstation boots up. These processes include System Process Management Daemon (**ovspmd**), an SNMP data collector (**snmpCollect**), a trap management daemon (**ovtrapd**), an action/reaction daemon (**ovactiond**), the database of devices (**ovwdb**), a topology manager (**ovtopmd**), and a polling daemon (**netmon**). All of these processes run in the background when OpenView is started. When requested by the application, a mapping daemon (**ipmap**) will take information from the database to make the topology map and adjusts the map based on traps and polling.

The operation of **netmon** and **ipmap** is independent of any ForeView processes.



Background Process

- *ovtopmd* discovers
  - by walking local arp cache; walking default router interface tables
  - Chains to other routers; walks SNMP host arp caches
- *netmon* polls
  - by pinging IP-only hosts; SNMP “getting” from SNMP hosts
  - every 15 minutes. Deletes down nodes after 1 week. (These are default values - Use Options / Topology/Status Polling: IP... to change)
- *ipmap*
  - synchronizes the IP Internet map to reflect database information

ForeView

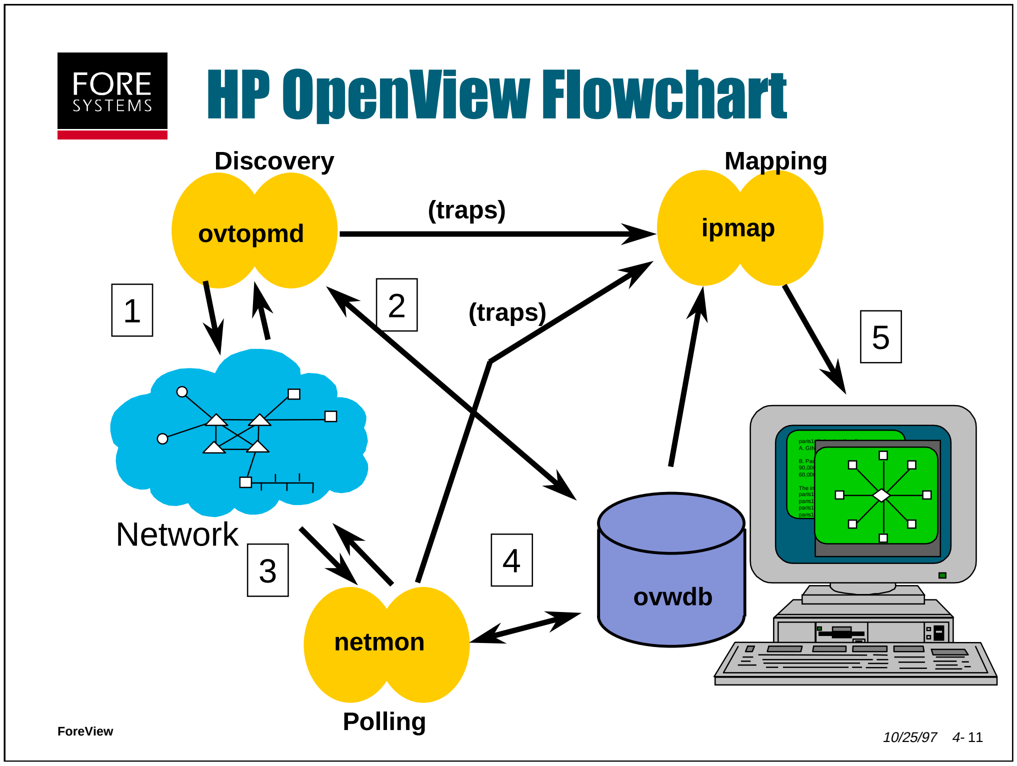
10/25/97 4- 10

OpenView discovery begins at home by walking the local ARP cache for addresses. These addresses and the address of the default gateway are contacted by ping then SNMP query. Once a gateway is reached, the neighboring routers are contacted, and their ARP caches examined. The results are reported to the database.

The netmon process takes the list of devices contacted in the last poll and adds any devices recently added by the discovery process. This new list is then contacted using pings (at minimum) and SNMP queries. The results are reported to the database.

The interval between polls can be an import parameter to customize. For example, if a poll takes 11 minutes to complete, and is executed at the default interval of 15 minutes, an unusually high amount of overhead traffic will be generated. Adjusting to a longer interval or dividing the network into multiple communities could bring the overhead in line with expectations.

When a map is opened, ipmap starts it’s synchronizing phase (if ipmap is enabled for that map). While ipmap is synchronizing, OpenView displays [Synchronizing] on the status bar of all displayed submaps. During this phase, ipmap searches the OpenView Database (ovwdb), and looks for changes since the map was last opened. If new objects are discovered, ipmap brings the map up to date by drawing new symbols.



FORE SYSTEMS

HP OpenView Flowchart

Discovery

ovtopmd

(traps)

Mapping

ipmap

1

2

(traps)

5

Network

3

4

ovwdb

netmon

Polling

ForeView

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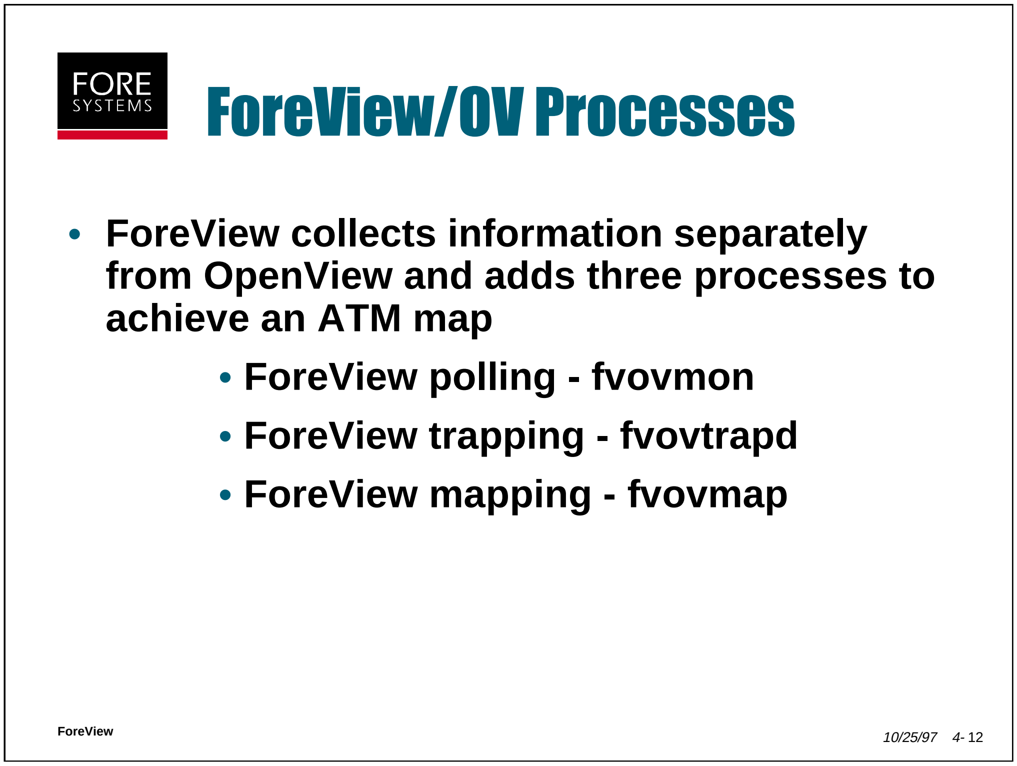
1 ovtopmd discovers the network topology

2 ovtopmd builds a database (ovwdb) that is stored on the host

3 netmon then checks the network devices against the database to find any inconsistencies

4 netmon continues to poll and adjust the database for all changes.

5 ipmap renders the information graphically, receiving input from ovwdb and real-time traps from ovtopmd and netmon



ForeView/OV Processes

- ForeView collects information separately from OpenView and adds three processes to achieve an ATM map
  - ForeView polling - fvovmon
  - ForeView trapping - fvovtrapd
  - ForeView mapping - fvovmap

ForeView

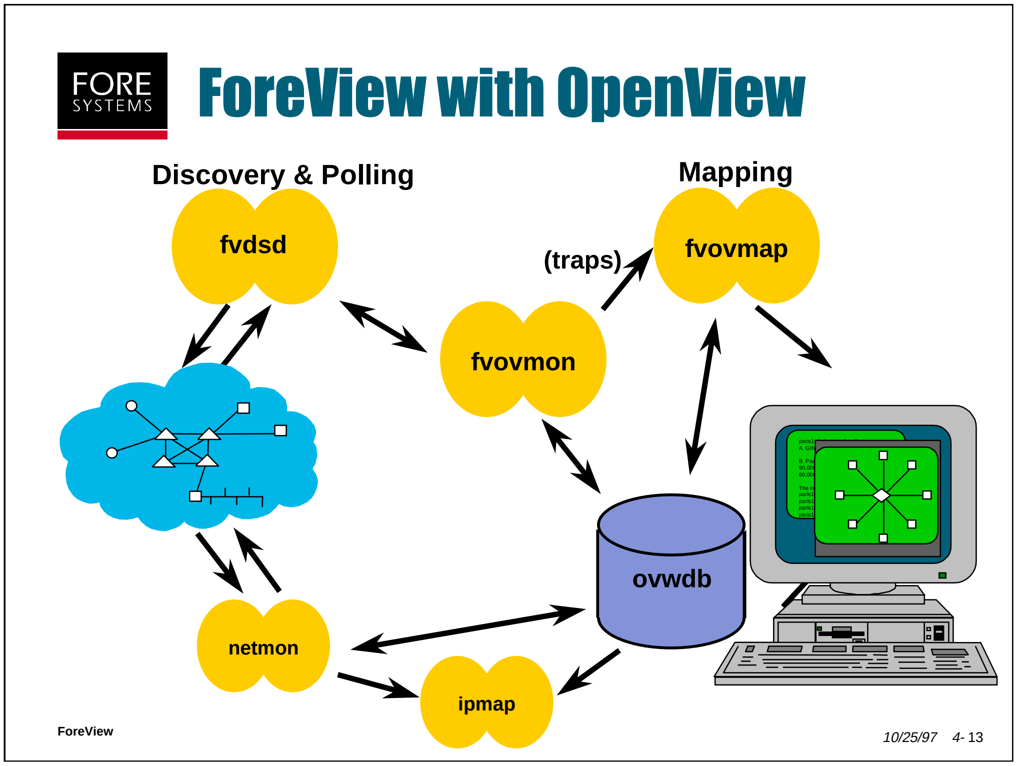
10/25/97 4- 12

ForeView is responsible for maintaining and displaying information about the FORE Systems portion of the network. ForeView uses many of the OpenView APIs so the look of the information is familiar to an OpenView user.

In addition to displaying and tracking the status of FORE devices, a separate map must be kept for the ATM topology. The ipmap OpenView displays is subnet-centric communicating reachability. ForeView's map is switch-centric and communicates connectivity. This is a reflection of the difference in nature between a connectionless (traditional IP) network and connection-oriented (ATM) network.

The processes needed are *fvovmon* for polling, *fvovtrapd* to process traps and *fvovmap* to integrate ATM information into the OpenView database. All three are clients of discovery server instances in the network.

In release 4.2 and earlier, the *fvovmon* process polls devices for status using information from both the *fvdsd* cache and the OpenView database (items identified as FORE devices). Therefore, the IP identity of a switch discovered by *ovtopmd* could seed *fvdsd* with a starting point for discovery. For releases later than 4.2, scalabilty and performance are improved, as no interaction between discovery processes takes place.



FORE SYSTEMS

ForeView with OpenView

Discovery & Polling

fvdsd

Mapping

(traps)

fvovmap

fvovmon

ovwdb

netmon

ipmap

ForeView

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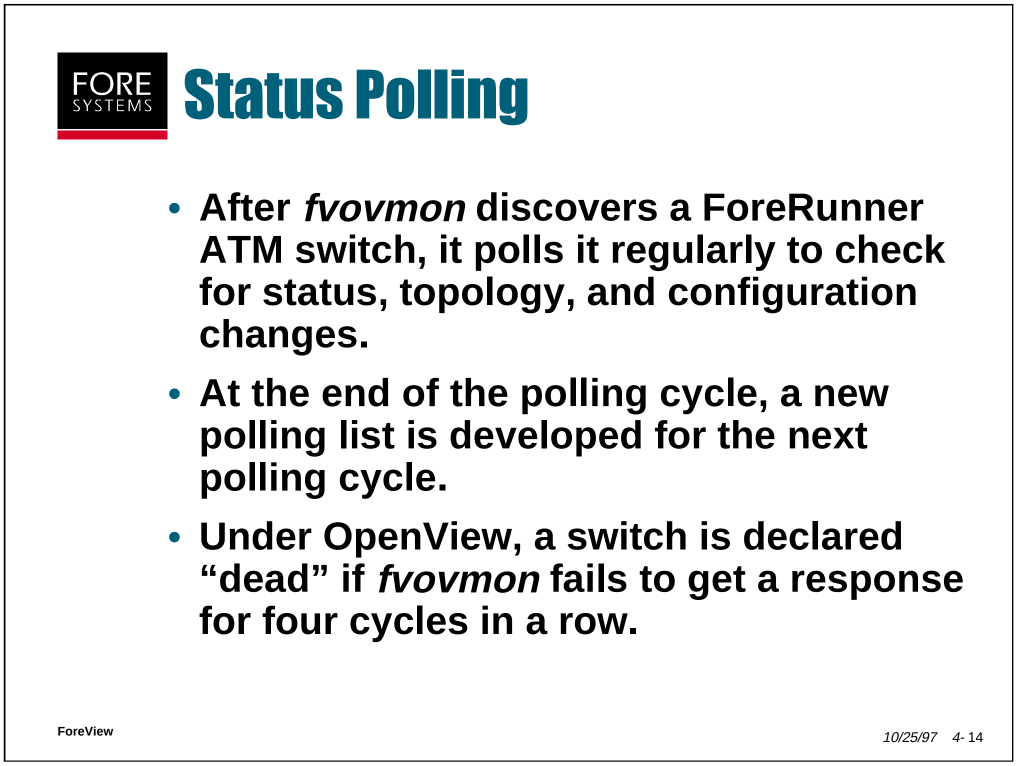
ForeView installation adds some persistent processes that accompany the OpenView processes - the ForeView discovery server (fvds) a ForeView trapping daemon (fvovtrapd) and the ForeView polling daemon (fvovmon). The *fvovtrapd* daemon receives traps from OpenView's *trapd* process and then relays the information to a non-persistent mapping application called *fvovmap*.

The *fvovmon* daemon is responsible for inserting any changes on FORE items into the OpenView database ovwdb, usually after some trap has been received and forwarded. The database starts by getting its initial device information from all the IP items and brings back their IP addresses, device specifics, etc through SNMP. It then evaluates the ATM devices and extracts them to the Discovery Server database of cached objects.

The Discovery server database can be filled in manually if the user wishes to "jump start" the discovery process. Host names can be added to the ForeView configuration file - for example cat.fore.com, python.fore.com. The *fvovmon* process then queries the database regularly, updates it, and passes information along to *fvovmap*. The *fvovmap* daemon runs only when the ATM map is active and is not a persistent process like the other two. Its function is to control the ATM map and to make changes when notified through polling or trap mechanisms.



FORE SYSTEMS

Status Polling

- After *fvovmon* discovers a ForeRunner ATM switch, it polls it regularly to check for status, topology, and configuration changes.
- At the end of the polling cycle, a new polling list is developed for the next polling cycle.
- Under OpenView, a switch is declared “dead” if *fvovmon* fails to get a response for four cycles in a row.

ForeView

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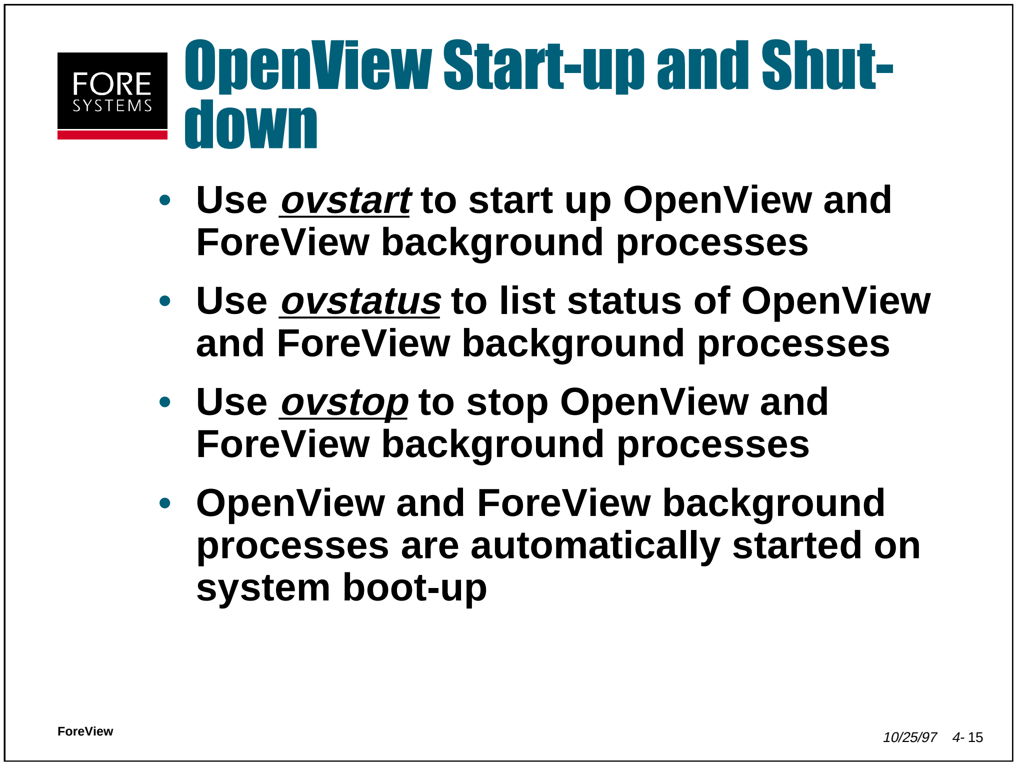
After *fvds* discovers a ForeRunner ATM switch, it polls it regularly with *fvovmon* to check for status, topology, and configuration changes. It creates a polling list and then polls regularly to get info from the standard switch MIB on cells transmitted, link status, etc. *fvovmon* uses SNMP to accomplish this information polling and may bring back an ATM switch’s ATM address and other parameters from FORE-specific switch MIBs as well.

After the switch, network module, and port and signaling info is retrieved, it is parsed and the object database is updated. If an interswitch connection is discovered, the remotely connected switch is added to the polling list. After all switches in the polling list are polled, an updated list of polled switches is written to a file. This file serves as the seed file for the next polling cycle.

When a new polling cycle starts the seed file is read. At that time, the OpenView database is searched for new switches may have been discovered by *netmon/ipmap*. The switches in the polling list are polled, and both the database and polling list are updated accordingly.

A switch is declared “dead” if *fvovmon* fails to get a response for “n” polling cycles in a row. The current default value for “n” is 4. Every 15 minutes, *fvovmon* checks the database of all managed objects. If an object has not been updated for 24 hours the object becomes unmanaged and *fvovmap* is notified.



FORE SYSTEMS

OpenView Start-up and Shut-down

- Use ***ovstart*** to start up OpenView and ForeView background processes
- Use ***ovstatus*** to list status of OpenView and ForeView background processes
- Use ***ovstop*** to stop OpenView and ForeView background processes
- OpenView and ForeView background processes are automatically started on system boot-up

ForeView

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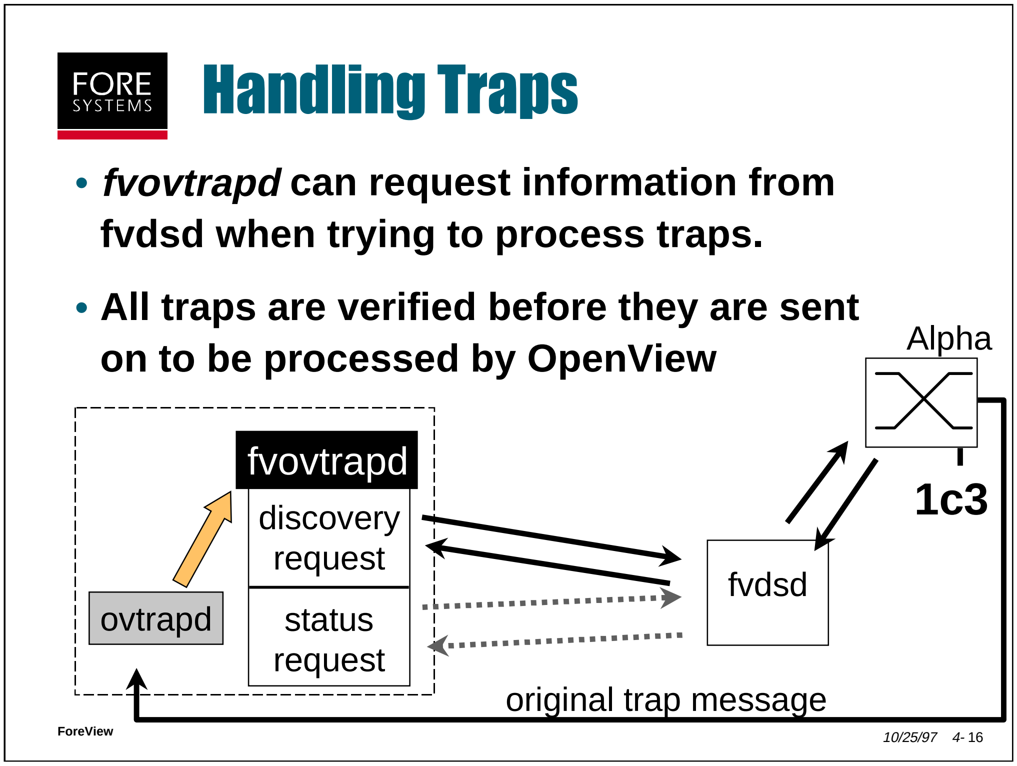
OpenView and ForeView both run in the background, meaning they are operating even when the user is not currently using the applications.

Using the ovstart command causes both the OpenView and ForeView processes to begin running. The ovstatus command will show a list of all the background processes and their status. The ovstop command will stop all the background processes. These commands can be used globally (without specifying any options or particular processes), or as directed commands to individual processes.

ovstart, ovstop, and ovstatus can all be used to start, stop, or get status on a single OpenView background process

ovstart fvds (starts the discovery server)

ovstart fvovmon (starts fvovmon)
ovstatus snmpCollect (status on snmpCollect)
ovstop (stops all OpenView and ForeView background processes)



FORE SYSTEMS

Handling Traps

- ***fvovtrapd*** **can request information from fvdsd when trying to process traps.**
- **All traps are verified before they are sent on to be processed by OpenView**

ForeView

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Conceptually, when fvovtrapd receives a trap, it filters the trap to be sure it's from a FORE Switch, then decodes the message. Then fvdsd is requested to verify the trap information.

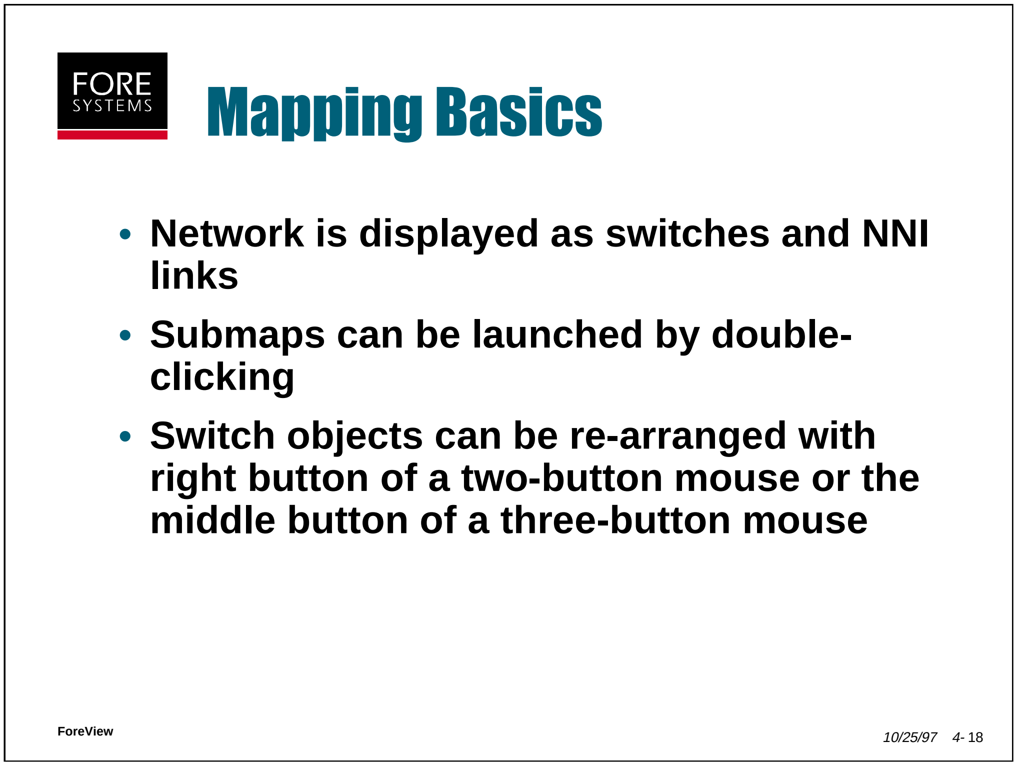
For example, the trap indicating a link failure on port 1c3 of a switch named "Alpha" (wide arrow) would trigger fvovtrapd to request fvdsd to discover the status of Alpha:1c3 (black lines).

Fvdsd sends an SNMP Get Request to Alpha querying that port (black lines to Alpha). If a change has taken place, fvdsd's cache is updated. When fvdsd receives Alpha's response, a message goes to fvovtrapd indicateing a response has been received. Now fvovtrapd can request the status of Alpha:1c3 from fvdsd (dashed lines).

This verifies the contents of the trap using discovery and status processes in fvdsd. This process is used to verify all FORE SNMP traps. If the verification shows the trap to be incorrect, then fvovtrapd will not update anything in the OpenView database, nor will it update fvovmap. If something has changed, fvovtrapd will notify the database and the ATM map.

FORE
SYSTEMS

Mapping



FORE SYSTEMS

Mapping Basics

- Network is displayed as switches and NNI links
- Submaps can be launched by double-clicking
- Switch objects can be re-arranged with right button of a two-button mouse or the middle button of a three-button mouse

ForeView

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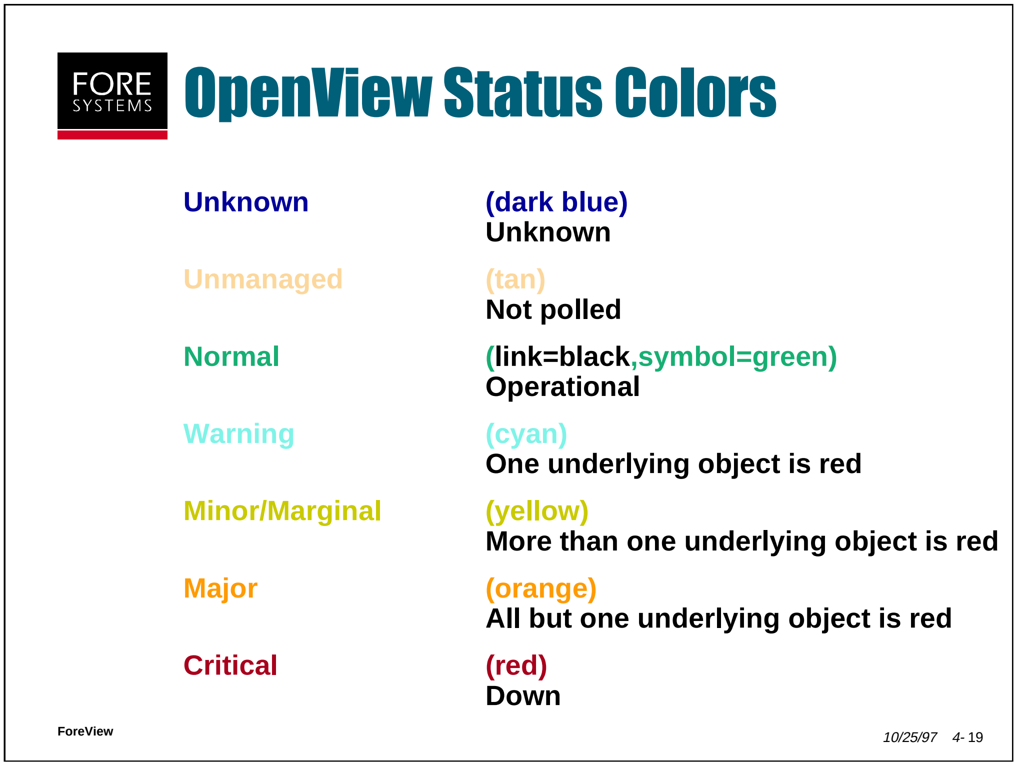
The connectivity-based map displays switches and links at the top level, adding more detail in submaps.

The objects on any standalone map can be moved around to suit your tastes by using the proper mouse buttons. On the Integrated maps, the display must be a read/write access map to re-arrange things.

In OpenView, the first map opened gets read/write privledges, additional instances are read-only.



OpenView Status Colors

Unknown	(dark blue) Unknown
Unmanaged	(tan) Not polled
Normal	(link=black,symbol=green) Operational
Warning	(cyan) One underlying object is red
Minor/Marginal	(yellow) More than one underlying object is red
Major	(orange) All but one underlying object is red
Critical	(red) Down

ForeView

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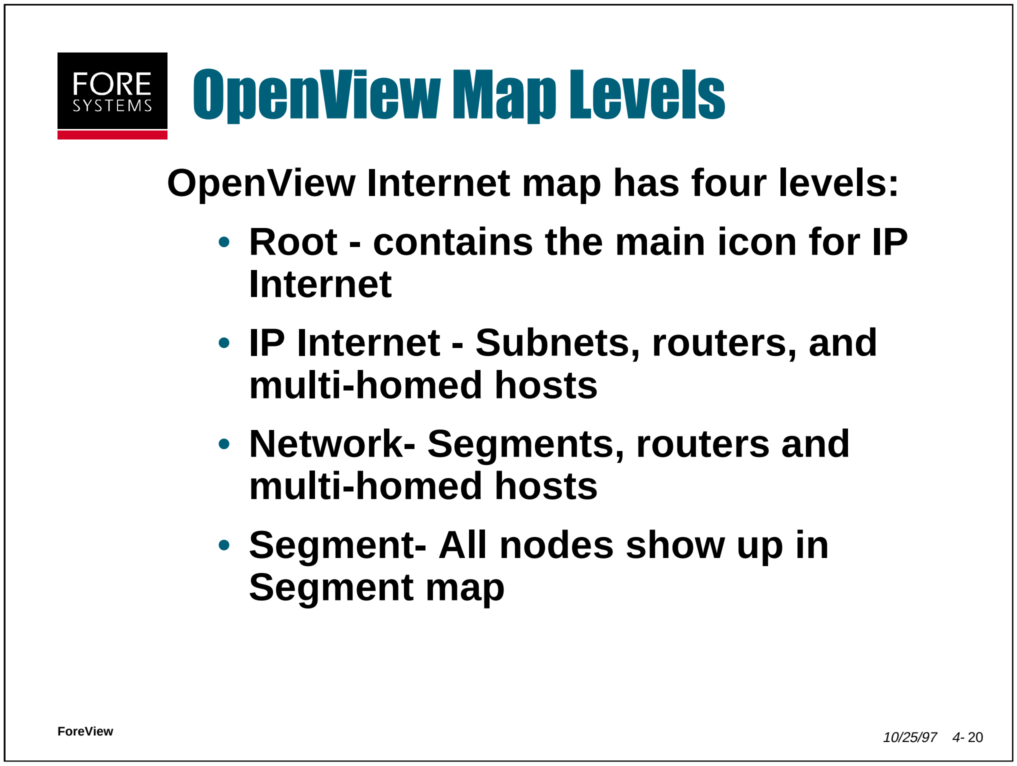
Objects are colored according to their status. If an object is made of sub-components, the status of the sub-components affects the higher level status.

Also, events can have a color set, according to their severity.

The default severity settings are:

*Critical -	Network Mgmt System going down
*Major -	Router, subnet going down
*Minor -	Switch/host going down
*Warning -	Alerts user of changes
*Normal -	Host up/down



FORE SYSTEMS

OpenView Map Levels

OpenView Internet map has four levels:

- **Root - contains the main icon for IP Internet**
- **IP Internet - Subnets, routers, and multi-homed hosts**
- **Network- Segments, routers and multi-homed hosts**
- **Segment- All nodes show up in Segment map**

ForeView

10/25/97 4- 20

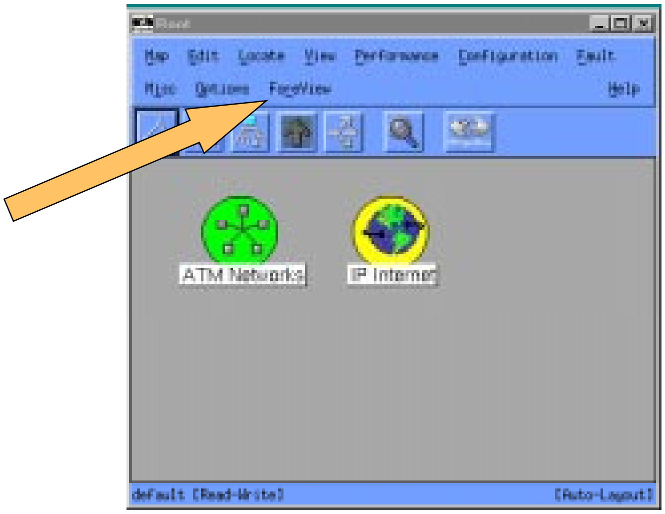
OpenView will initially present the Root map showing two icons - one for the IP internet and the other for the ATM network (installed by ForeView).

When you double-click on an icon, you “explode” the icon into the next submap layer. On the IP map side, if you explode through each level and then explode a host from the Segment map, you will see the host interfaces including fa0 (ATM interface), qaa0 through qaa3 (Classical IP interfaces), le0 (for Ethernet port), and el0-16 (for defined VLANs).

On the ATM map side, ForeView concentrates on showing all the switches and their interswitch and host connections. ForeView shows the host and switch devices as well as detailed information on the signaling paths used to communicate with them.

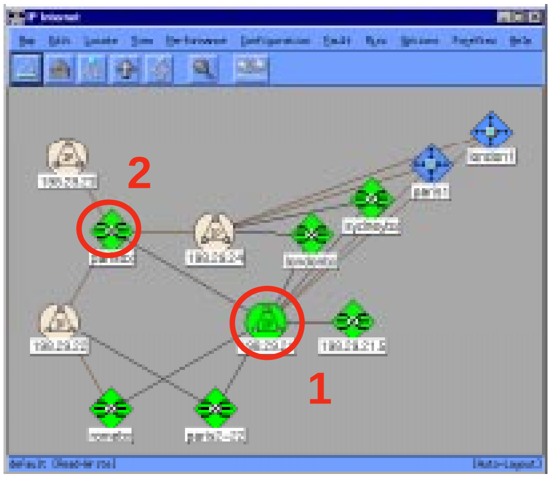
When communicating with a device that is comprised of other devices such as an ASX1000, ForeView will show the enclosure and its component fabrics. ForeView will show an icon for the ASX1000 with a label of “Enclosure”. When the enclosure is double-clicked, a submap with each icons for each individual fabric is shown. Double-clicking on a fabric is like selecting a stand-alone BX switch.

Root Map


Root
Map Edit Locate View Performance Configuration Fault
Misc Options ForeView Help
ATM Networks
IP Internet
default [Read-Write]
[Auto-Layout]

Under OpenView, all ForeView functions are found under the ForeView menu.

IP Internet



ForeView

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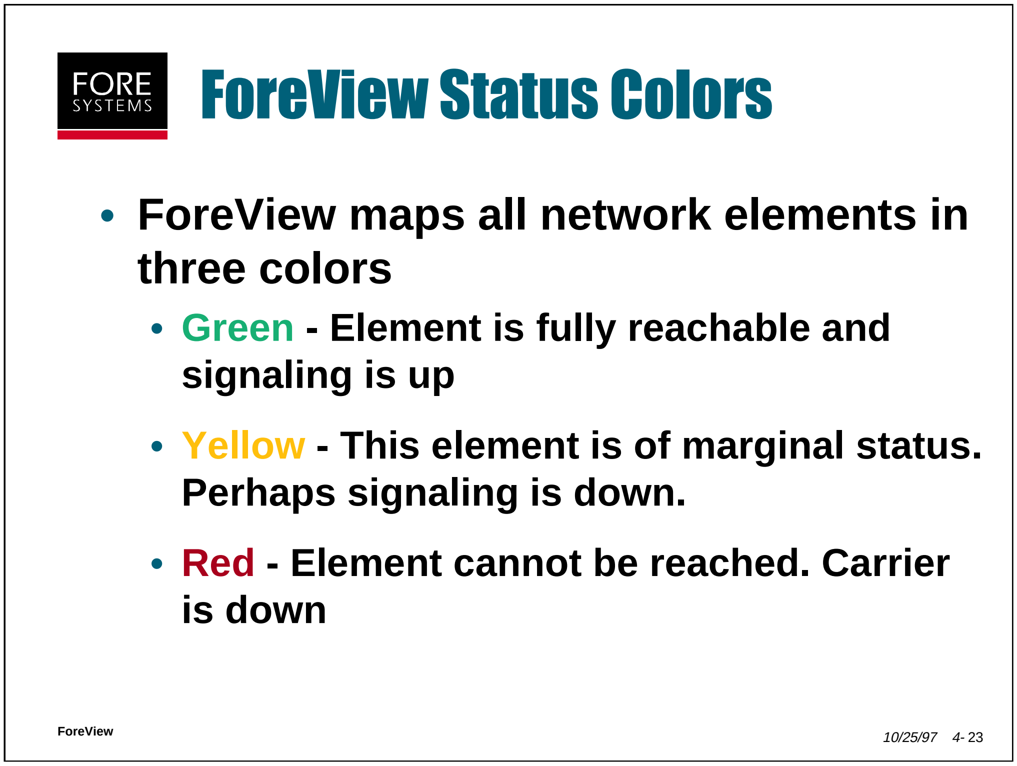
This is the result of ipmap. Its subnet-centric view displays each subnet plus any special devices in the subnet (gateways, etc.).

1. The subnet icon, the color indicates it is up.
2. One special device is a ForeRunner ATM switch, note its icon.



ForeView Status Colors

- ForeView maps all network elements in three colors
  - Green - Element is fully reachable and signaling is up
  - Yellow - This element is of marginal status. Perhaps signaling is down.
  - Red - Element cannot be reached. Carrier is down

ForeView

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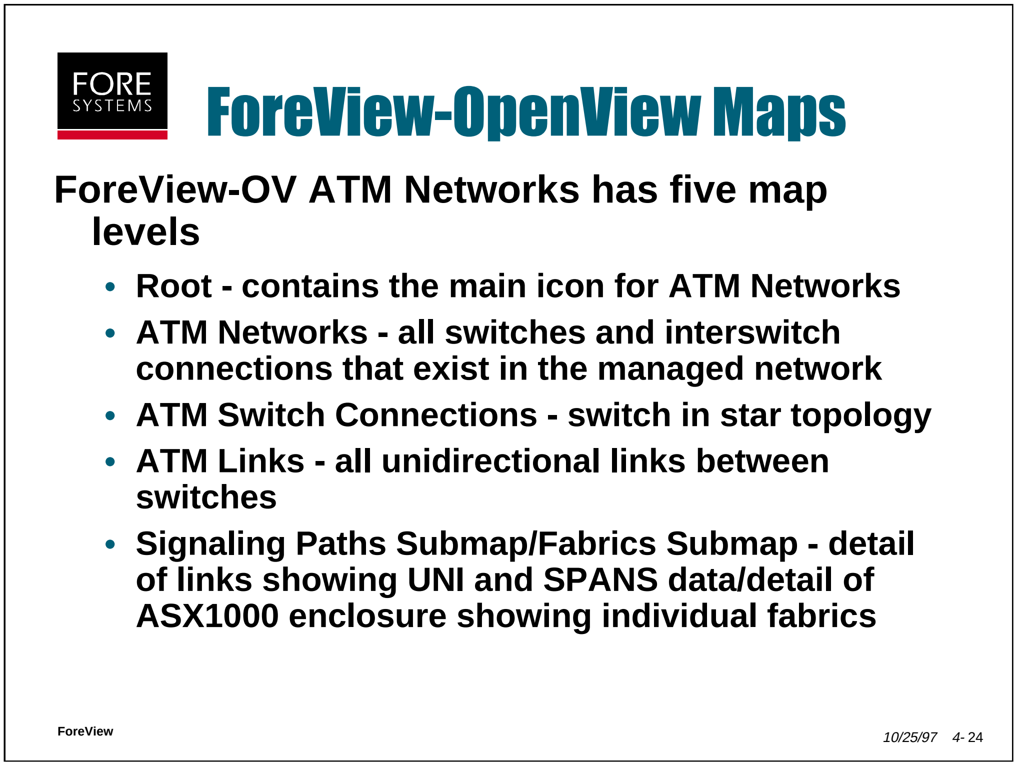
ForeView uses universally accepted colors to represent the status of an object in the map.

For example, when a host symbol becomes red, that means that the host cannot be reached (pinged) from the management station. The status of a link is based on the combined status of the signaling paths that make up that link. A black link means that it is operational. A link of any other color indicates that one or more signaling paths on that link is down.

If the color of a switch turns red, it indicates either:

•an unsuccessful poll of the switch for some period of time

•a trap indicating a down state was verified

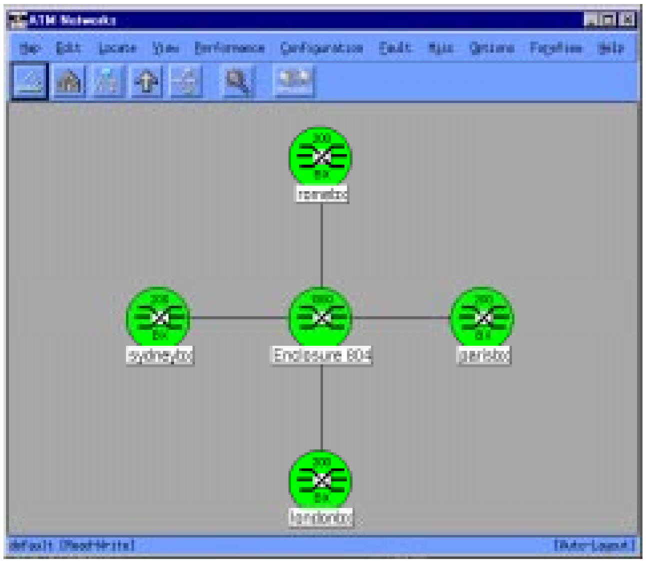


ForeView-OpenView Maps

ForeView-OV ATM Networks has five map levels

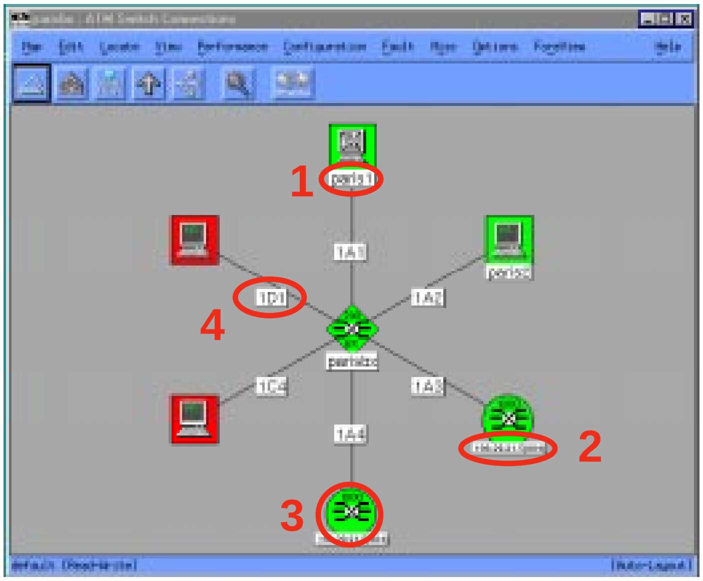
- Root - contains the main icon for ATM Networks
- ATM Networks - all switches and interswitch connections that exist in the managed network
- ATM Switch Connections - switch in star topology
- ATM Links - all unidirectional links between switches
- Signaling Paths Submap/Fabrics Submap - detail of links showing UNI and SPANS data/detail of ASX1000 enclosure showing individual fabrics

ATM Networks



FORE SYSTEMS

ATM Switch Connections


Map Edit Locate View Performance Configuration Fault Misc Options ForeView Help
1
1A1
1A2
4
1D1
1C4
1A3
1A4
2
3

ForeView

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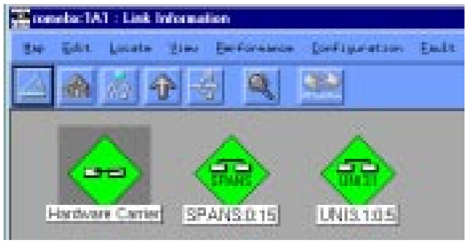
The Switch Connections map shows all the devices attached to a particular switch.

1. Name labels are used when the interface’s name is known
2. IP address labels are used if names are not known
3. The icon shows what kind of device is attached
4. The port number of each link is displayed, referencing the switch at the center.

HP-OV and NetView Only...

- **Link status submap including hardware carrier status**


romeba:1A1 : Link Information
Map Edit Locate View Performance Configuration Fault
Hardware Carrier
SPANS.0.15
UNI3.1:0.5

- **Link propagation to higher levels**
  - **When a switch fails, the network icons on higher map will now reflect a status change by changing colors.**

ForeView 10/25/97 4- 27

Since a link is a separate, managed object, three different characteristics can be displayed in a submap.

Hardware carrier - If carrier is down, signaling will also be down

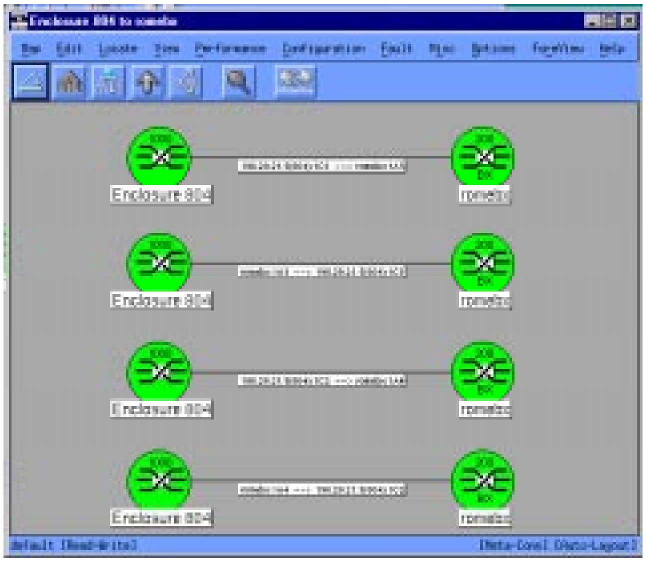
NOTE: Following release 4.2, this object will be called “Line Status” and will incorporate carrier and physical link status (such as alarms)

SPANS - If green, SPANS communication between the devices is running error-free

UNI - if green, UNI messages are being exchanged

FORE SYSTEMS

Meta-Connections



ForeView

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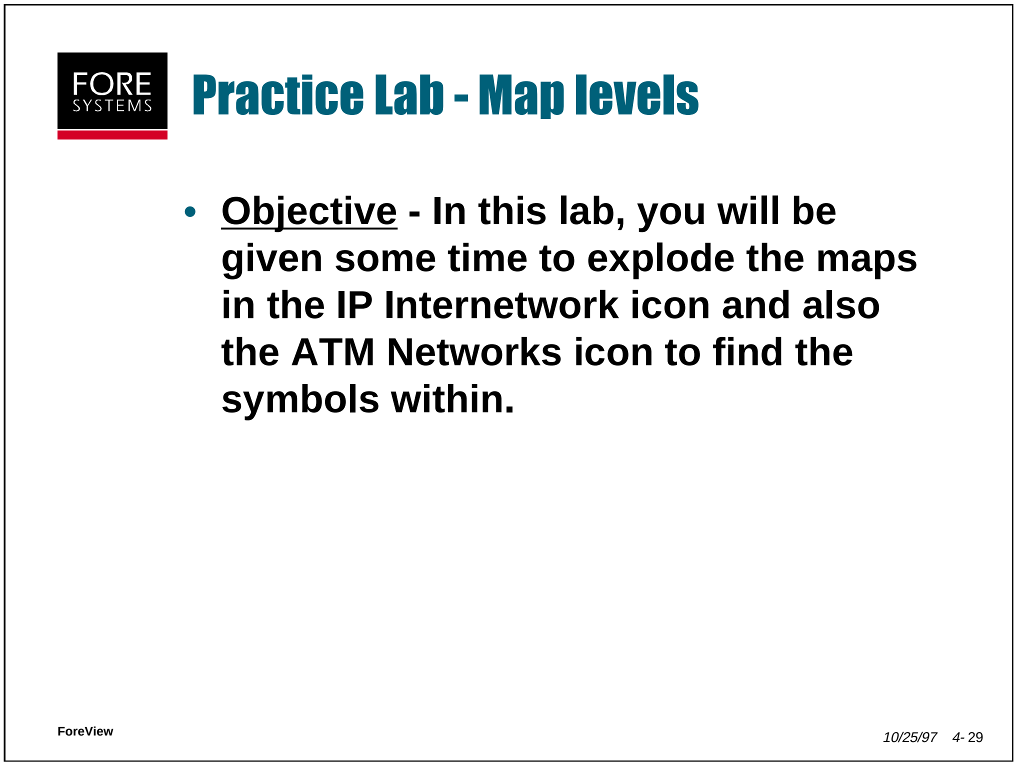
A logical link between two switches may be made of more than one physical link. Meta connections indicate port numbers at each end.



FORE SYSTEMS

Practice Lab - Map levels

- <u>Objective</u> - In this lab, you will be given some time to explode the maps in the IP Internetwork icon and also the ATM Networks icon to find the symbols within.

ForeView

10/25/97 4- 29

Procedures

1. From the OpenView Root Map, double-click the IP Networks icon.

2. From the OpenView Root Map, double-click the ATM Networks icon

3. Examine the way the IP map lays out each network with a label and how it shows ATM devices (switches, hosts, etc.)

4. Examine the way the ATM maps lay out the network and shows the relationship of switches and hosts.

5. Double-click on links on either map to see what happens. Notice the labeling conventions that are used to identify the links and ports. Can you explode a link from a switch to a host (UNI)? How about switch to switch (NNI)?

6. Try to answer the following questions:

What interfaces does your host have? ______________________

How many interfaces on a switch? ______________________

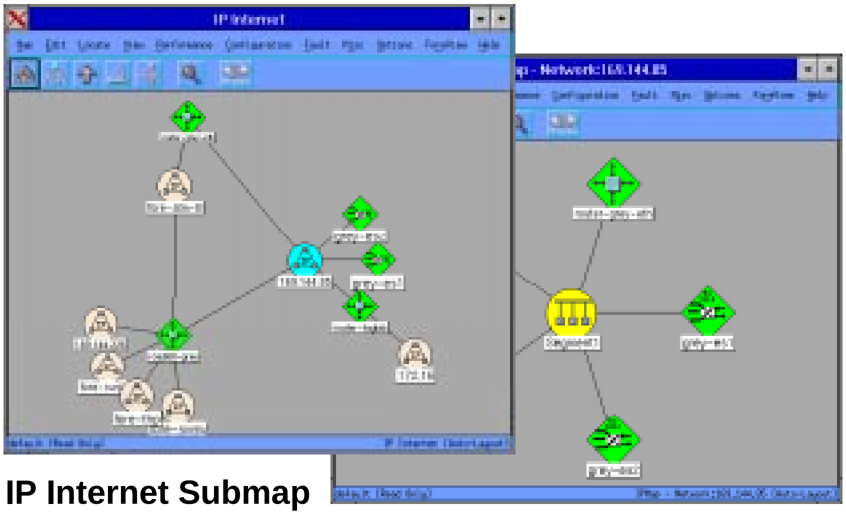
What are the differences between the IP map and the ATM map?

____

____

____

Lab - Results



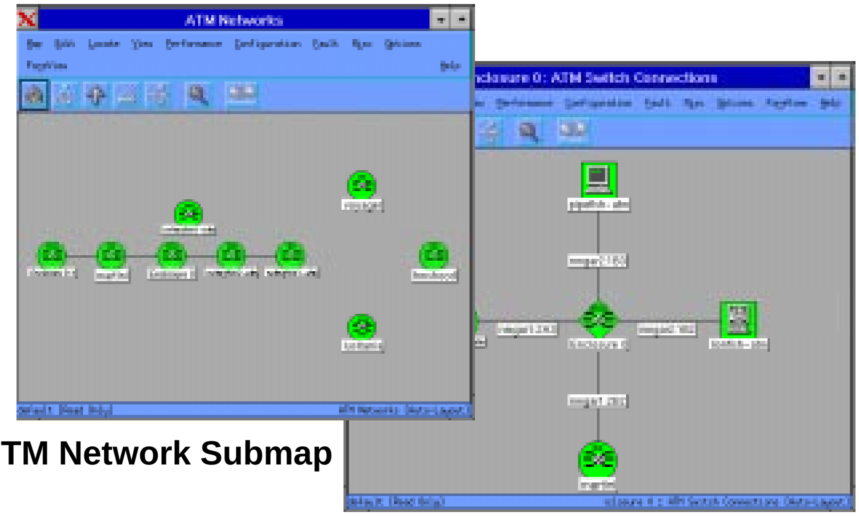
IP Internet Submap

IP Network Submap

After double-clicking on the Root Map icon for IP Internet, you should see the IP Internet submap appear. Note how OpenView assigns separate symbols for IP network addresses (for example you may have a round icon with a triangle in it with a network id of 198.29.21.0). The map also shows symbols for routers and switches and uses colors to give their status.

FORE SYSTEMS

Lab - Results (cont'd)



ATM Network Submap

Switch Connections Submap

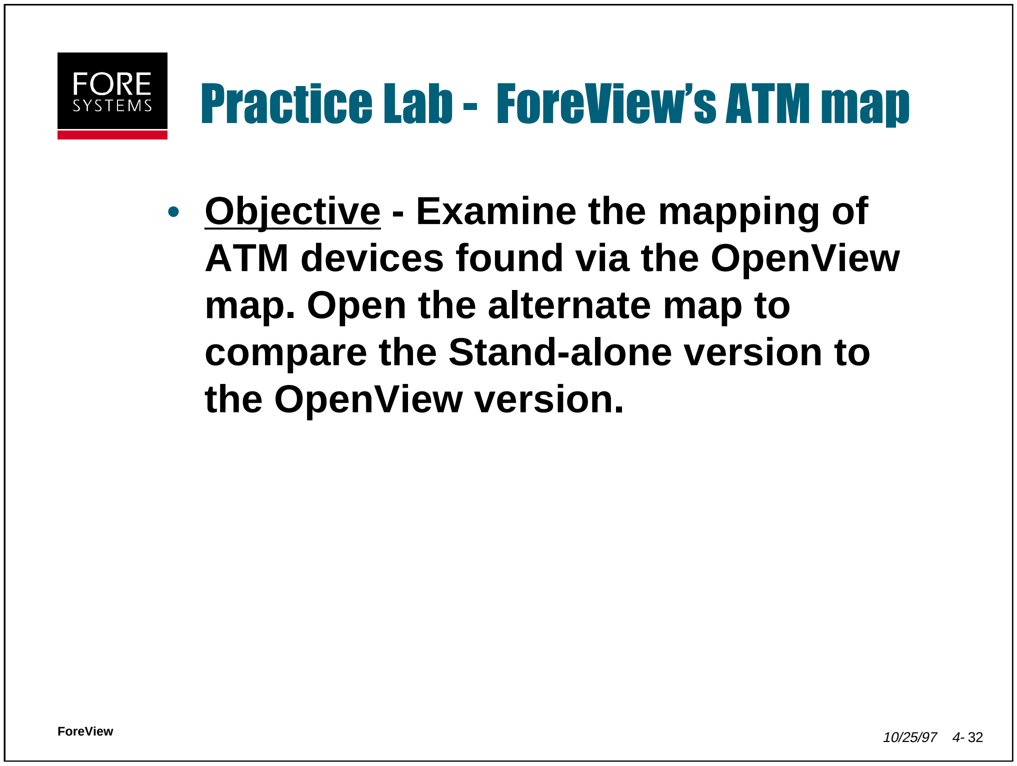
ForeView

10/25/97 4- 31

ForeView shows the ATM network as a series of linked switches and allows the user to then “explode” the switches to show connected hosts, edge devices, and NNI connected switches.

Each link is labeled with the connection port on the switch. Interswitch links are labeled with a source and destination port. When there are redundant links between switches, OpenView returns a “*metalink*” - a single line with no label.

When you double click on a metalink, it will explode into its component unidirectional links. For example, if there are two links between switches and you double click on the metalink, OpenView will explode the link into four individual links - unidirectional sends and receives on one link and then the send and receive on the other link.



Practice Lab - ForeView's ATM map

- **<u>Objective</u> - Examine the mapping of ATM devices found via the OpenView map. Open the alternate map to compare the Stand-alone version to the OpenView version.**

ForeView

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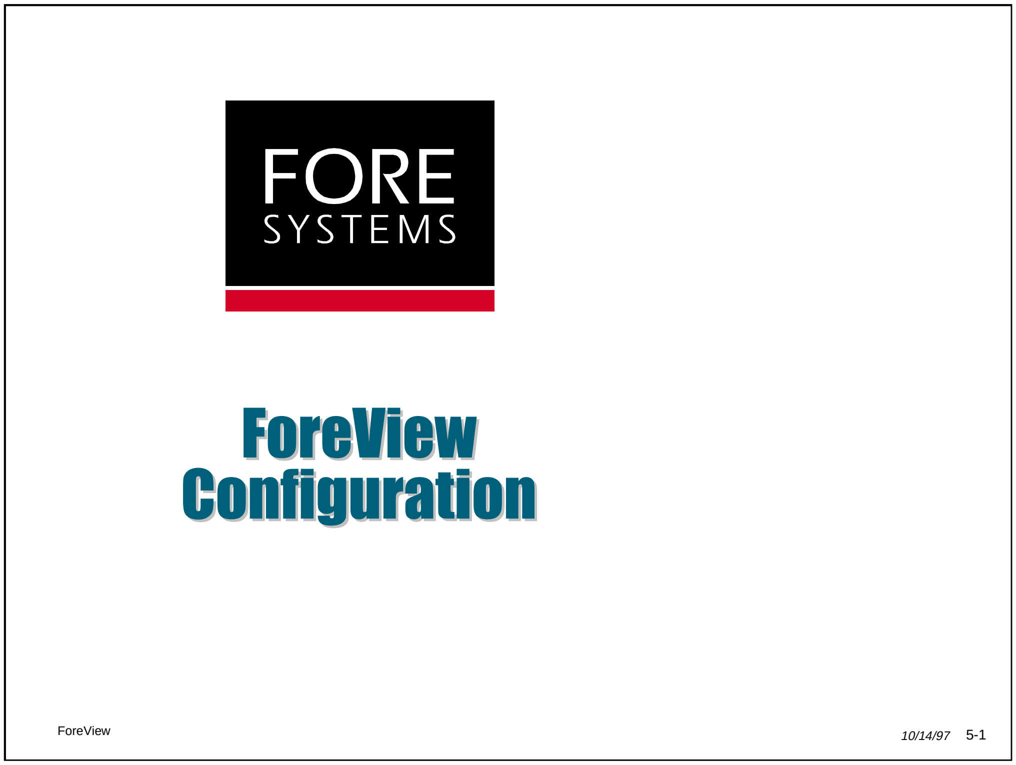
Procedures:

1. From the OpenView “Root” map, double-click on the ATM Networks icon to bring up the ATM Networks submap. Examine the “star topology” layout of the map and how switches are linked.

2. From the OpenView menu line bring up the ForeView menu options. Choose “Alternate Map” and watch as ForeView maps using the Stand-alone module (even running concurrently with the OpenView map)

3. Close the alternate map by choosing File/Exit from the map’s menu line.



FORE SYSTEMS

ForeView Configuration

ForeView

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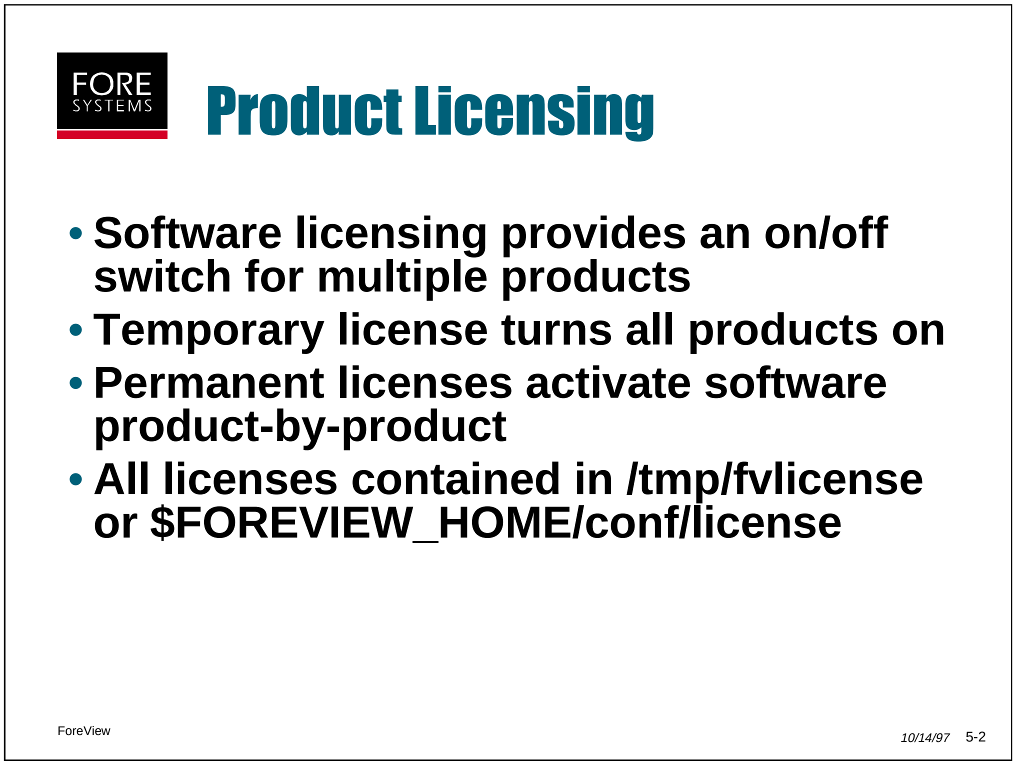

Product Licensing

- Software licensing provides an on/off switch for multiple products
- Temporary license turns all products on
- Permanent licenses activate software product-by-product
- All licenses contained in /tmp/fvlicense or $FOREVIEW_HOME/conf/license

ForeView

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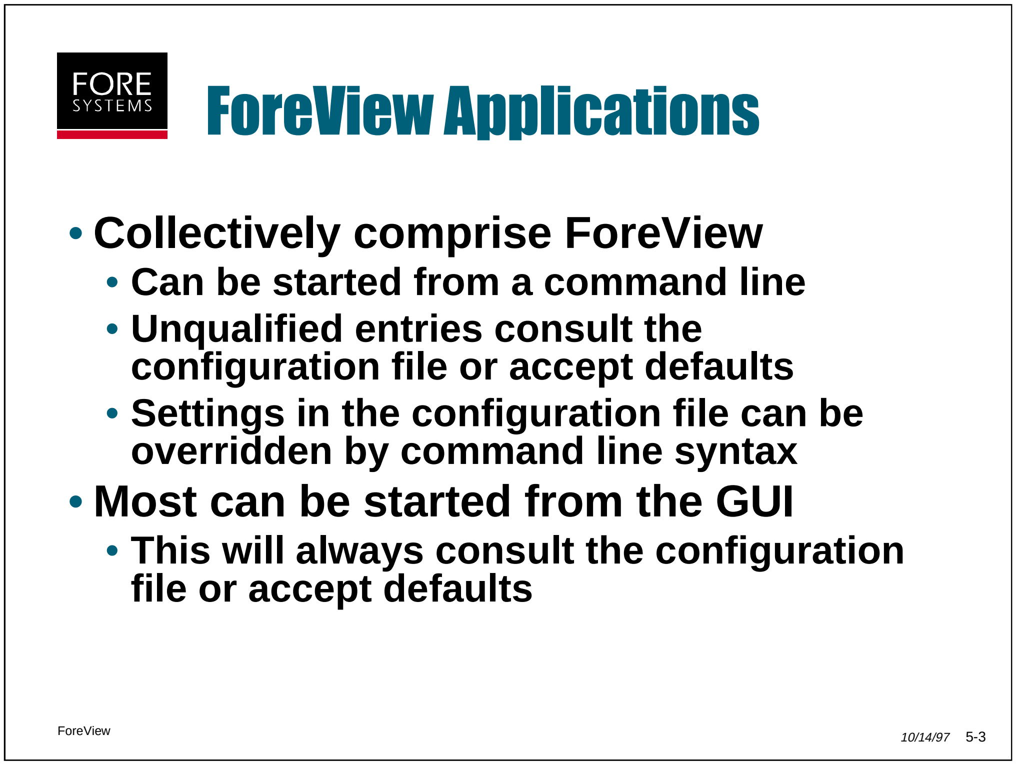
The various ForeView applications check for the presence of a valid key on the host. Generally speaking, users migrate a station from a temporary license to a permanent license tied to the IP address of the host.

With Foreview 4.2, FORE's TAC generates a license key by serial number and IP address. Each product a customer buys has its own serial number. A license key is generated for each one and then 'stacked' into the ForeView license file.

For example, if the NMS IP address is 1.1.1.1 and the serial number is 0000111111, we would get:

```
# ForeView License Certificate
Address:   1.1.1.1
Products:  FV
Key:       26715c72
```

Also, a customer can lump these keys together for administrative ease. If he had puchased 5 copies of ForeView for 5 stations, one file containing all 5 licenses could be copied to all machines instead of making sure each license file had the correct key on each machine.



ForeView Applications

- Collectively comprise ForeView
  - Can be started from a command line
  - Unqualified entries consult the configuration file or accept defaults
  - Settings in the configuration file can be overridden by command line syntax
- Most can be started from the GUI
  - This will always consult the configuration file or accept defaults

ForeView

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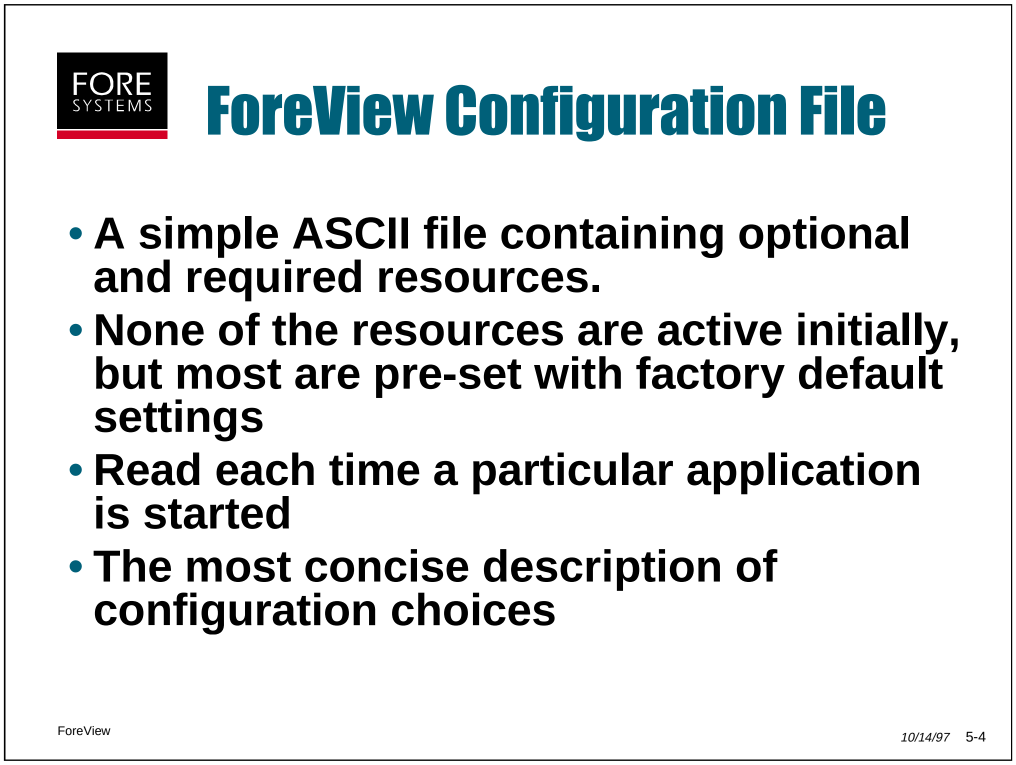
Directories of ForeView applications:

frontpnl -	Front panel element management tools
fvcall -	Call record/statistics tools
fvchan -	Virtual path/virtual channel tools
fvdisco -	Discovery and status server diagnostic utility
fvgraph -	Graphing and logging tool
fvhelp -	Help files
fvinv -	Network inventory tool
fvmap -	ATM mapping tools
fvoams -	OA&M cell activation and monitoring
fvphub -	Element management of PowerHub products
fvtaclnk -	Error and stack trace utility
fvtracer -	Channel tracing tool
fvswmgr -	Software management/upgrade tool



FORE SYSTEMS

ForeView Configuration File

- A simple ASCII file containing optional and required resources.
- None of the resources are active initially, but most are pre-set with factory default settings
- Read each time a particular application is started
- The most concise description of configuration choices

ForeView

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General format:

ResourceName: value [, value] [, value] ...

or

Specifier.ResourceName: value [, value] [, value]

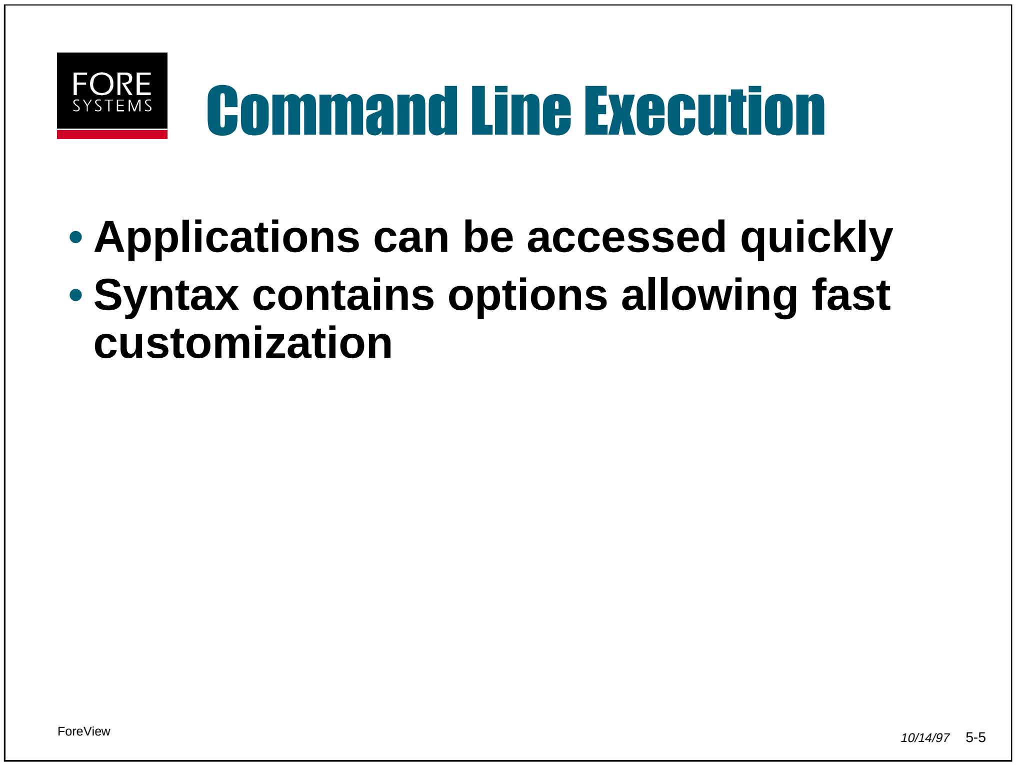
Samples:

ClusterName.123: CentralASX1000

In this case, ClusterName has only one value, no other information is needed.

Fvds.discSwitches: romebx, 1000-5

Here, the specifier, Fvds, is given multiple values, which are names or IP addresses of switches to use for discovery starting points.



FORE SYSTEMS

Command Line Execution

- Applications can be accessed quickly
- Syntax contains options allowing fast customization

ForeView

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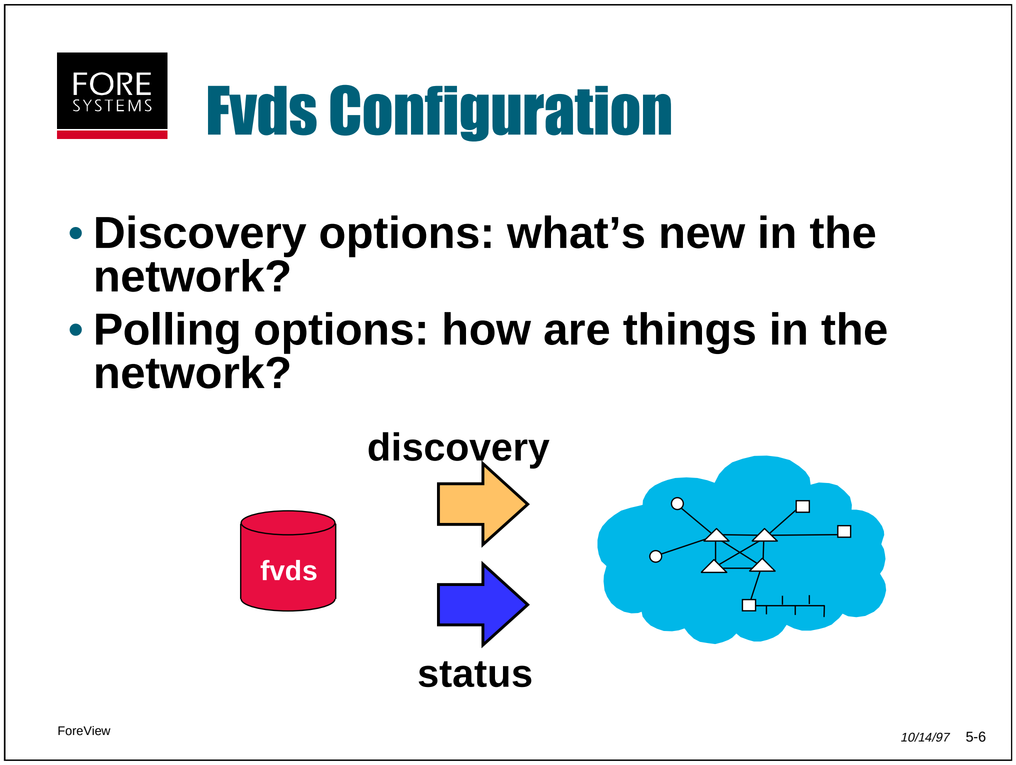
The recommended method of configuration is to store desired values in the configuration file. However, certain circumstances make command line execution appropriate because different resource values can be specified in the command line, overiding the parameters in the configuration file.

For example, if a network failure occurred, and it would be helpful for troubleshooting to more frequently poll certain switches, the regular *fvdsd* instance could be stopped and a new instance with very different behavior could be started. This would provide more up-to-the-minute information about the equipment in question.

```
# more /usr/local/foreview/tmp/DS.pid
# kill -9 <contents-of-DS.pid>
# fvds -t -pollNNIDevices 20  -pollNNILinks 1 -discInterval 2 -discSwitches cannes,
marseille, paris -discInListOnly
```

This fvdsd instance would limit its discovery and status polling to a few switches and provide information 5 times faster than the regular parameters would and would write all the results to a log file.

Parameter	Normal value	“New” value
time between switch polls	30 sec.	20 sec.
time between NNI link polls	3 min.	1 min.
time between discovery polls	15 min.	2 min.
switches polled	entire network	3 switches



FORE SYSTEMS

Fvds Configuration

- Discovery options: what’s new in the network?
- Polling options: how are things in the network?

ForeView

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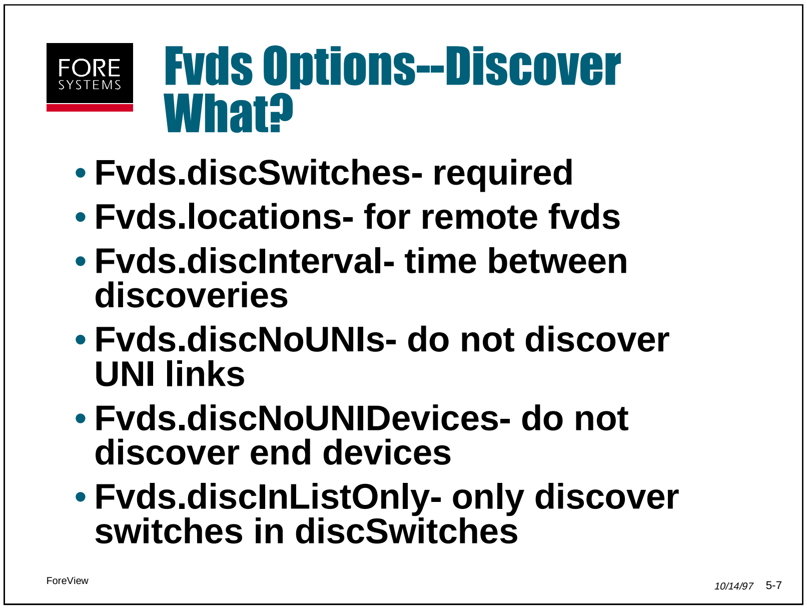

FORE SYSTEMS

Fvds Options--Discover What?

- Fvds.discSwitches- required
- Fvds.locations- for remote fvds
- Fvds.discInterval- time between discoveries
- Fvds.discNoUNIs- do not discover UNI links
- Fvds.discNoUNIDevices- do not discover end devices
- Fvds.discInListOnly- only discover switches in discSwitches

ForeView

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Fvds.discSwitches: defines a list of Fore ATM switches to be used by the discovery and status daemon as starting points for network discovery. All switches and devices connected to any of the switches in the list, which can be communicated with via IP and/or SNMP, will be discovered and monitored, by default. Note that this resource defines the switches that the daemon fvdsd uses to discover the rest of the network, and does NOT specify what the applications will use to show on a map. Applications that retrieve this resource: fvdsd. **No default.**

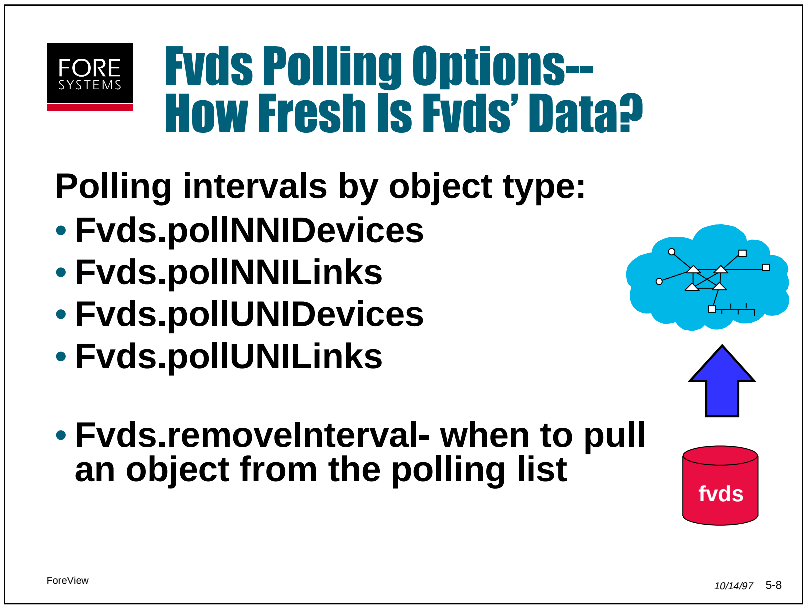
Fvds.locations: defines the DNS names of the hosts on which the discovery and status (fvds) daemons are running. Applications that need to retrieve information from the daemons use this resource to determine where the daemons are running. In general, if this resource is not defined, or the fvds daemon on the specified host cannot be reached, applications attempt to contact a daemon on the local host. Applications that retrieve this resource: fvinv, fvmap, fvupgrad, fvovmon, and fvovtrapd. Example: Fvds.locations: london1:7890, 10.5.25.4:7891. **No default.**

Fvds.discInterval: interpreted in minutes, this resource specifies the interval over which all known switches, their links, and connected hosts are "discovered" -- i.e., all information about these devices are retrieved from the switches/hosts. Application that retrieves this resource: fvdsd. **Default: 15**

Fvds.discNoUNIs: this resource takes a boolean value. When set to TRUE, no UNI devices or links are discovered by fvdsd. Application that retrieves this resource: fvdsd. **Default: FALSE**

Fvds.discNoUNIDevices: this resource takes a boolean value. When set to TRUE, no UNI devices are discovered by fvdsd. I.e., the link information to the UNI devices is discovered and monitored, but information about the endpoint is not discovered or monitored. Application that retrieves this resource: fvdsd. **Default**: **FALSE.**

Fvds.discInListOnly: this resource takes a boolean value. When set to TRUE, no NNI devices besides those explicitly listed in the discSwitches argument/resource are discovered or polled. Application that retrieves this resource: fvdsd. **Default**: **FALSE.**



Fvds Polling Options-- How Fresh Is Fvds' Data?

Polling intervals by object type:

- **Fvds.pollNNIDevices**
- **Fvds.pollNNILinks**
- **Fvds.pollUNIDevices**
- **Fvds.pollUNILinks**

- **Fvds.removeInterval- when to pull an object from the polling list**

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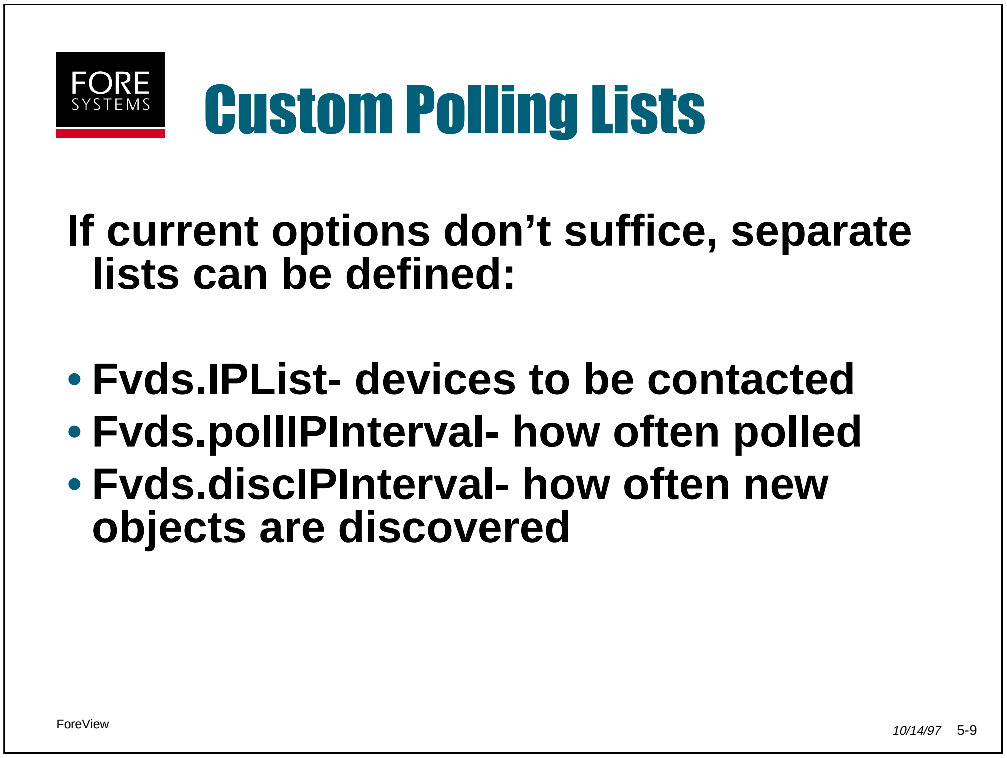
Fvds.pollNNIDevices: interpreted in seconds, this resource specifies the interval for polling all known switches for their statuses. Application that retrieves this resource: fvdsd. **Default: 30.** **Note:** After release 4.2, this resouce will be in minutes, default: 1.

Fvds.pollNNILinks: interpreted in minutes, this resource specifies the interval for polling all known NNI links for their statuses. Application that retrieves this resource: fvdsd. **Default: 3.**

Fvds.pollUNIDevices: interpreted in minutes, this resource specifies the interval for polling all known UNI devices for their statuses. Application that retrieves this resource: fvdsd. **Default: 10.**

Fvds.pollUNILinks: interpreted in minutes, this resource specifies the interval for polling all known links to UNI devices for their statuses. Application that retrieves this resource: fvdsd. **Default: 30.**

Fvds.removeInterval: interpreted in minutes, this resource specifies the time that a switch must be recorded as down before its status is changed to "removed". Application that retrieves this resource: fvdsd. **Default: 60.**



Custom Polling Lists

If current options don’t suffice, separate lists can be defined:

- **Fvds.IPList- devices to be contacted**
- **Fvds.pollIPInterval- how often polled**
- **Fvds.discIPInterval- how often new objects are discovered**

Fvds.IPList[0-20]: this resource takes a comma-separated list of IP addresses or hostnames as its value. The list number 0-20 identifies these hosts as belonging to a special group of devices that should be discovered and/or polled by fvdsd at a different rate than the other devices.

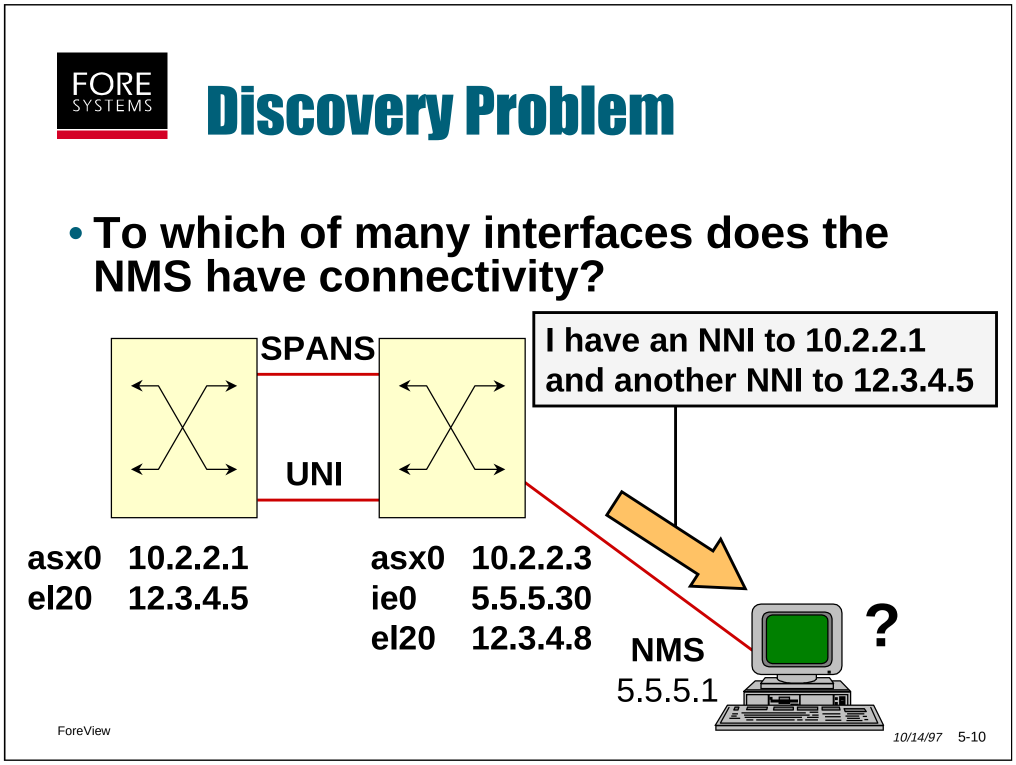
Fvds.pollIPInterval[0-20]: interpreted in minutes, this resource specifies the interval that the devices in a list should be polled for their statues.

Fvds.discIPInterval[0-20]: interpreted in minutes, this resource specifies the interval that the devices in a list should be discovered. "Discovery" of a device means that the fvdsd retrieves all the information about the device that it can.

Example:

```
Fvds.IPList1: paris1, romebx, 10.4.4.2, paris-3810
Fvds.pollIPInterval1: 10
Fvds.discIPInterval1: 15

Fvds.IPList2: london1, 1000-5
Fvds.pollIPInterval2: 6
Fvds.discIPInterval2: 11
```



Discovery Problem

- To which of many interfaces does the NMS have connectivity?

I have an NNI to 10.2.2.1 and another NNI to 12.3.4.5

asx0 10.2.2.1
el20 12.3.4.5

asx0 10.2.2.3
ie0 5.5.5.30
el20 12.3.4.8

NMS
5.5.5.1

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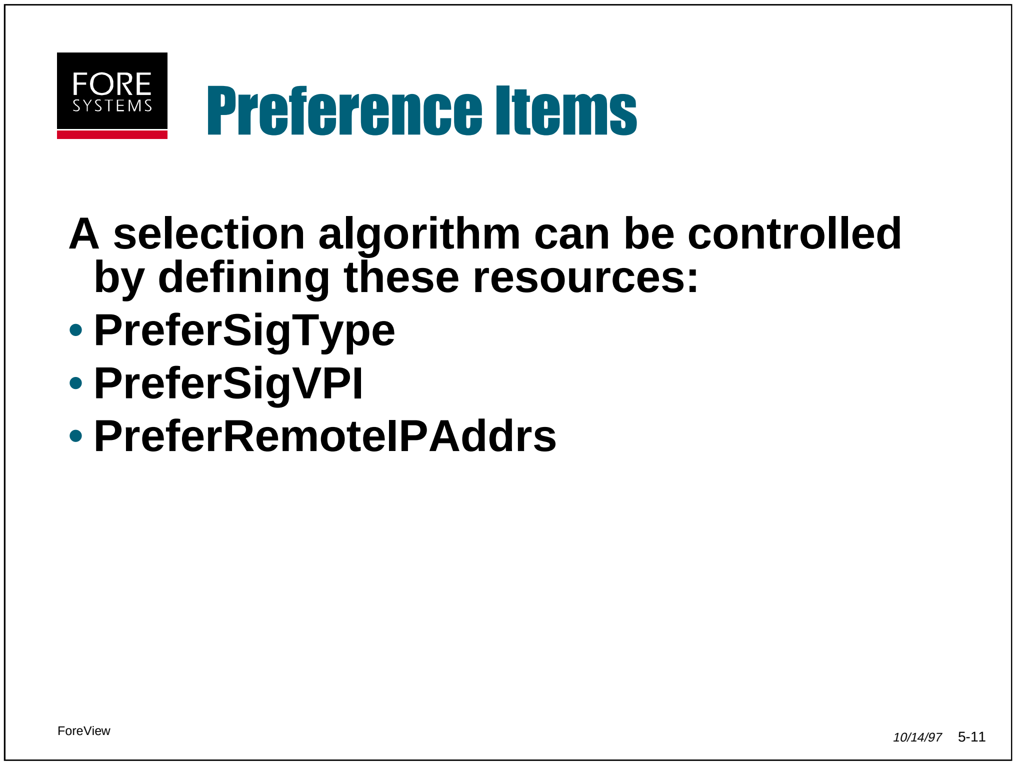

Preference Items

A selection algorithm can be controlled by defining these resources:

- PreferSigType
- PreferSigVPI
- PreferRemoteIPAddrs

ForeView

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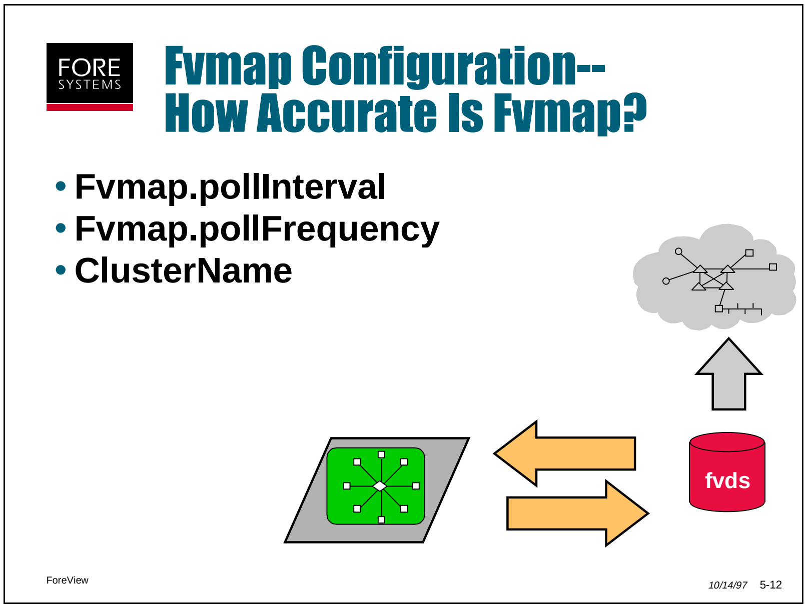
Because a devce in the network is discovered with signaling information and its reported IP address, multiple sets of this information can cause confusion. These resources help influence an algorithm used to determine which among several sets of information will be used by ForeView.

PreferSigType: this resource takes one of "SPANS", "UNI30", or "UNI31" as a recognized value. This resource specifies how host information should be shown when there are multiple signalling paths from a switch to the host. **No default.**

PreferSigVPI: this resource takes an integer as a value. This resource specifies how host information should be shown when there are multiple signalling paths from a switch to the host. **No default.**

PreferRemoteIPAddrs: this resource takes a comma-separated list of IP addresses or IP ranges. A range is specified using either "*" to mean all value subcomponents (1-255), or "x-y" to mean all integers between x and y inclusive. For example:

PreferRemoteIPAddrs: 169.143.243.7-250, 10.11.*.14, 122.234.33.11



Fvmap Configuration-- How Accurate Is Fvmap?

- Fvmap.pollInterval
- Fvmap.pollFrequency
- ClusterName

ForeView

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Fvmap.pollInterval: this resource specifies the polling interval for the standalone map in seconds. The standalone map polls the discovery server in every 'Fvmap.pollInterval' seconds to update the statuses of switches and links displayed on the map. Used by fvmap. **Defaults to 600 (10 minutes).**

Fvmap.pollFrequency: this resource specifies the frequency with which fvmap asks discovery server for newly discovered switches in addition to status. This resource **defaults to 5**, therefore, fvmap will query for new switches on every 6th polling cycle.

An example at default settings:

12:00 - Initial discovery complete

12:10 - 1st poll

12:20 - 2nd poll

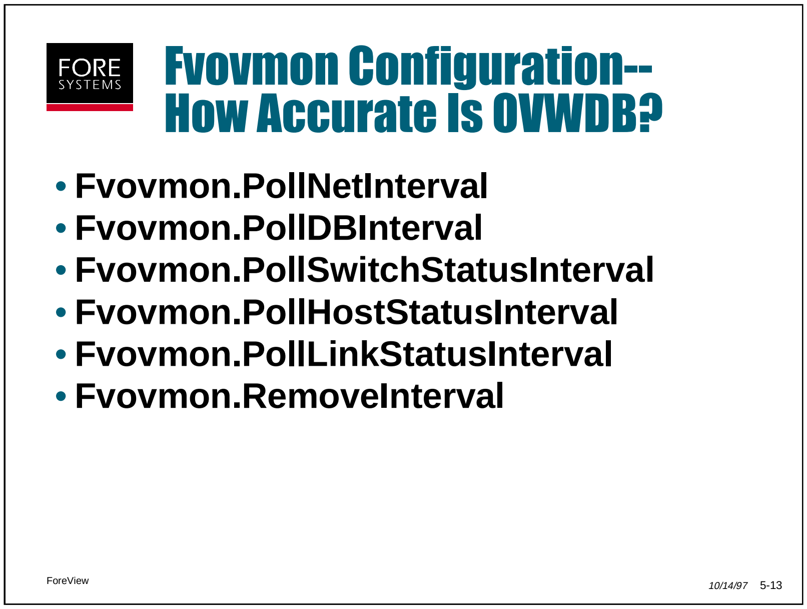
12:30 - 3rd poll

12:40 - 4th poll

12:50 - 5th poll

1:00 - 6th poll **discover new objects**

ClusterName.<enc_id>: defines a mapping between a cluster's (ASX-1000) enclosure identifier and a more human-readable name. In addition to its effect on ForeView maps, this resource is read by OpenView, NetView and SunNet Manager mapping utilities. **No default.**



Fvovmon Configuration-- How Accurate Is OVWDB?

- Fvovmon.PollNetInterval
- Fvovmon.PollDBInterval
- Fvovmon.PollSwitchStatusInterval
- Fvovmon.PollHostStatusInterval
- Fvovmon.PollLinkStatusInterval
- Fvovmon.RemoveInterval

ForeView

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Fvovmon.PollNetInterval: specifies the amount of time between subsequent polls of all switches in the network. Analogous to a discovery cycle. **Default is 900 (15 minutes).**

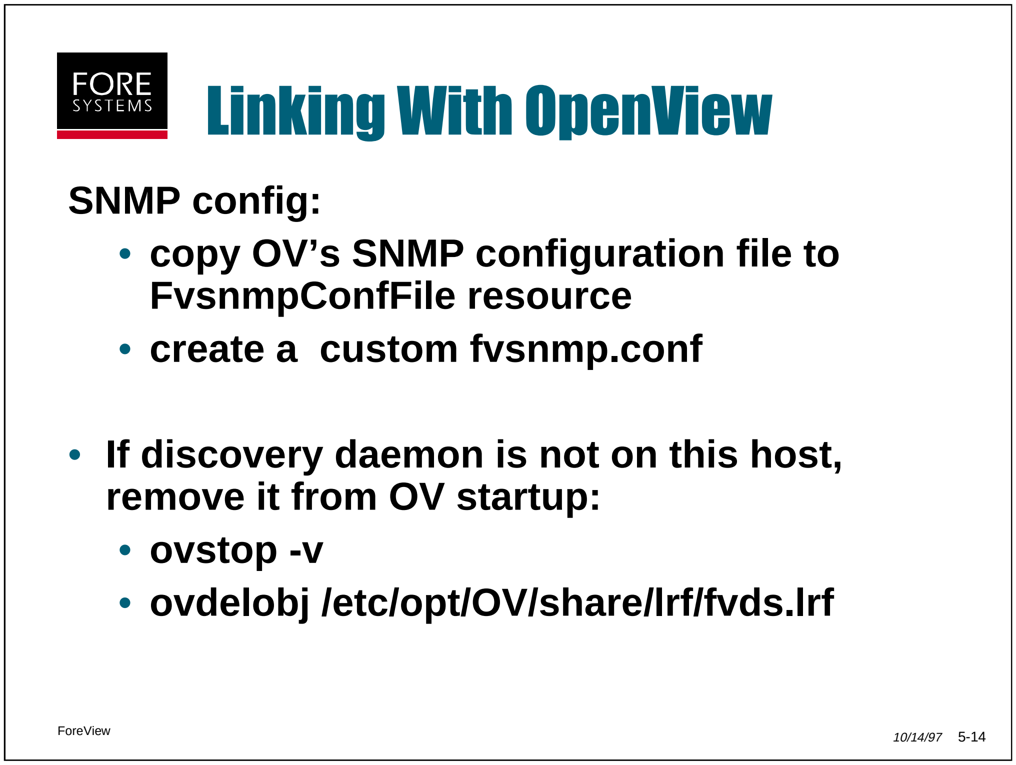
Fvovmon.PollDBInterval: specifies the amount of time between subsequent polls of the OVw database. **Default is 3600 (60 minutes).**

Fvovmon.PollSwitchStatusInterval: specifies the amount of time in seconds between subsequent queries to the discovery and status daemon for changes in the status of managed switches. Analogous to a status poll. **Default is 30.**

Fvovmon.PollHostStatusInterval: specifies the amount of time in seconds between subsequent queries to Fvds for changes in the status of managed UNI devices. **Default is 600 (10 minutes).**

Fvovmon.PollLinkStatusInterval: specifies the amount of time in seconds between subsequent queries to Fvds for changes in the status of managed links. **Default is 300 (5 minutes).**

Fvovmon.RemoveInterval: the amount of time in seconds an object in the OVwdb is "dead" before it is removed from the map. **Default is 86400 (7 days).**



Linking With OpenView

SNMP config:

- **copy OV’s SNMP configuration file to FvsnmpConfFile resource**
- **create a custom fvsnmp.conf**

- **If discovery daemon is not on this host, remove it from OV startup:**
  - **ovstop -v**
  - **ovdelobj /etc/opt/OV/share/lrf/fvds.lrf**

ForeView

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If ForeView is added to an existing NMS, it is simple to align ForeView’s SNMP configuration to the existing OpenView configuration. ForeView reads the OpenView format, so it is only a question of getting the information in place.

For example, assume the source of the information is /usr/OV/conf/ovsnmp.conf. You can modify the FvsnmpConfFile resource in the $FOREVIEW_HOME/conf/foreview file to read:

FvsnmpConfFile: /usr/OV/conf/ovsnmp.conf

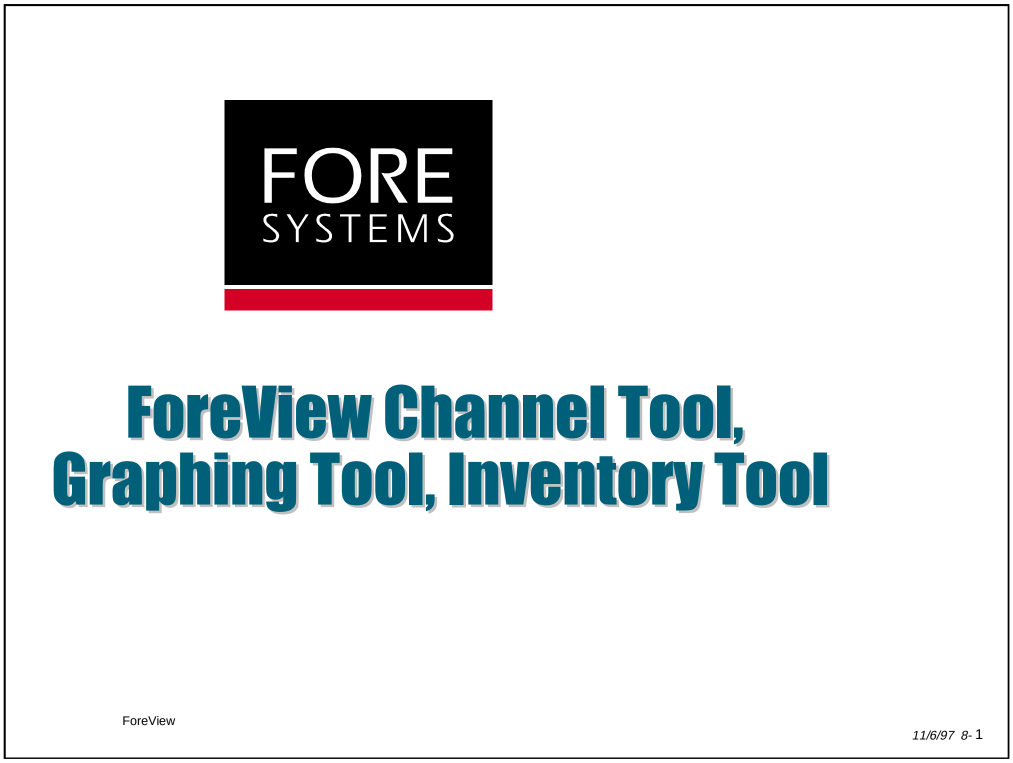
Users of OpenView 4.0 on Solaris or HP-UX 10.x should use:

FvsnmpConfFile: /etc/opt/

You can make a custom configuration file or copy the ovsnmp.conf file to $FOREVIEW_HOME/conf/fvsnmp.conf.

This is especially helpful when the community strings are not “public” and “private” and where multiple communities will be managed by same NMS.

If the ForeView station is using the discovery server from another device, you can keep the fvdsd process from starting by removing it from the OpenView startup list. The syntax is listed above.



FORE SYSTEMS

ForeView Channel Tool, Graphing Tool, Inventory Tool

ForeView

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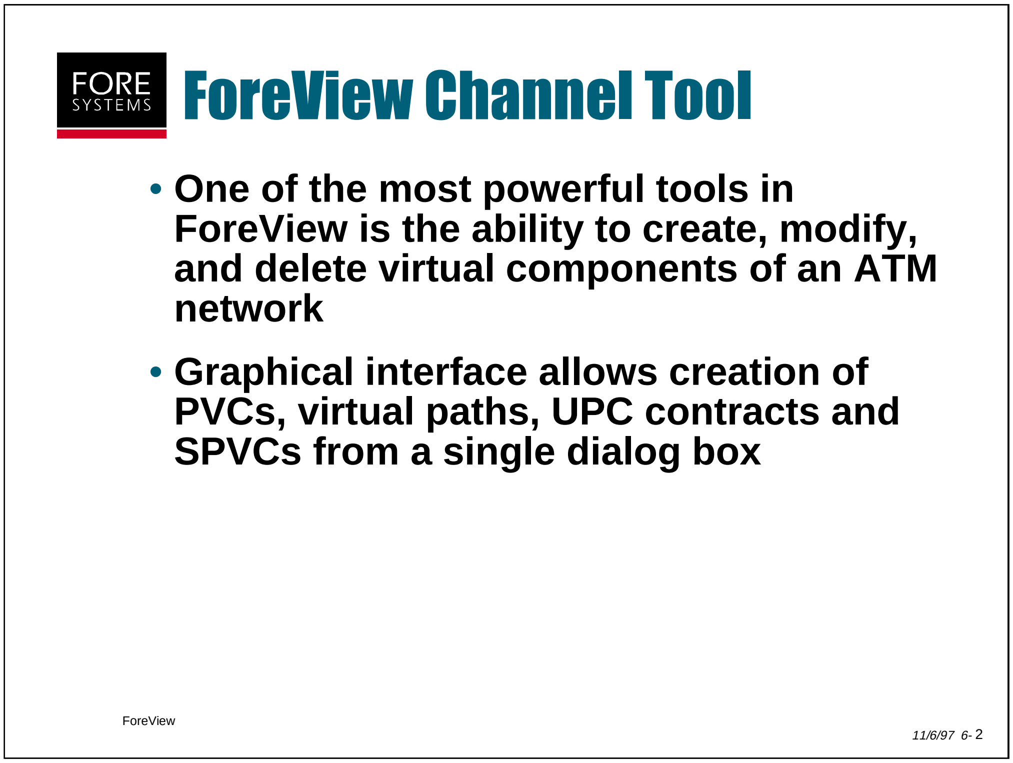

ForeView Channel Tool

- One of the most powerful tools in ForeView is the ability to create, modify, and delete virtual components of an ATM network
- Graphical interface allows creation of PVCs, virtual paths, UPC contracts and SPVCs from a single dialog box

ForeView

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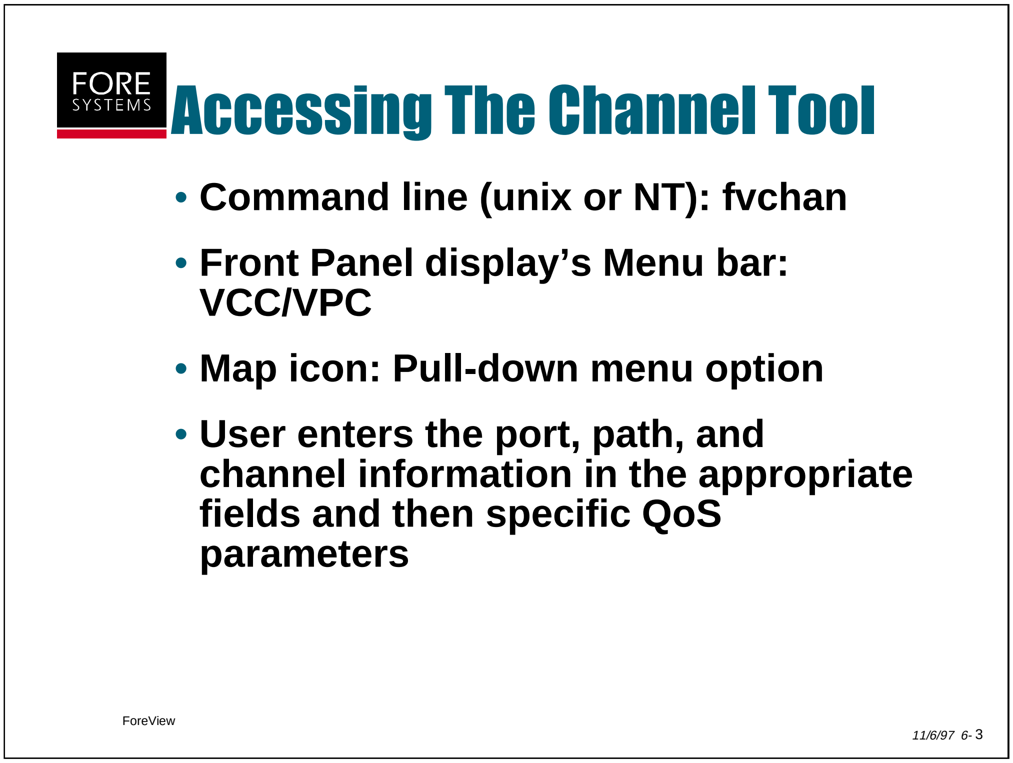
Virtual Circuits can be created in ForeRunner Switches by using AMI. In general, the steps to create a VCC consist of selecting the input port, the Virtual Path, Virtual Channel, output port, Virtual Path, Virtual Channel, and other parameters regarding the Quality of Service (QoS). The ForeThought operating system on the switch is very sophisticated but the steps to create a Virtual Path, Virtual Channel, and modify its parameters may be cumbersome.

ForeView provides these parameter choices in an easy to manage dialog box called the Channel Tool. The steps to create PVCs in the switch are very similar to the AMI command line except that they are added in columns and parameters are found as menu choices and buttons.



Accessing The Channel Tool

- Command line (unix or NT): fvchan
- Front Panel display's Menu bar: VCC/VPC
- Map icon: Pull-down menu option
- User enters the port, path, and channel information in the appropriate fields and then specific QoS parameters

ForeView

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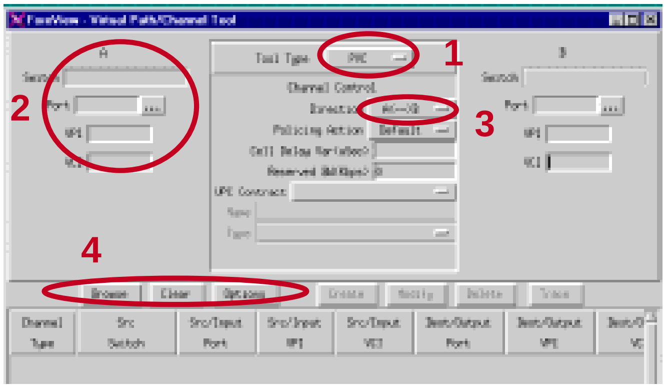
The Channel tool application can be accessed in three different ways. It contains buttons that invoke other channel-related tools. No particular access method is better than another, it is designed to be easy-to-reach.

The Channel tool application is a client of an individual switch. That means IP connectivity is required for the tool to work.

FORE SYSTEMS

Channel Tool



ForeView

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```
SmartPVC
PVC
PVP
SigPath
PNNISPVC
Path
OPath
```

1. The Channel Tool has several “sub-tool” options. The presentation of the screen changes with each one. As a review,

SmartPVCs are a hybrid of a PVC and an SVC using SPANS addressing

PVC (Permanent Virtual Channel) is a static, manually applied channel

PVP (Permanent Virtual Path) is a static, manually-applied path moving all its traffic to the same destination port based on the incoming VPI

SigPath the logical signaling path instance (up to one on each VPC)

PNNISPVC a SmartPVC (PVC/SVC hybrid) using ATM Forum addressing

Path for incoming path terminators (allows dynamic switching)

Opath for outgoing path terminators (destination points for dynamic switching decisions)

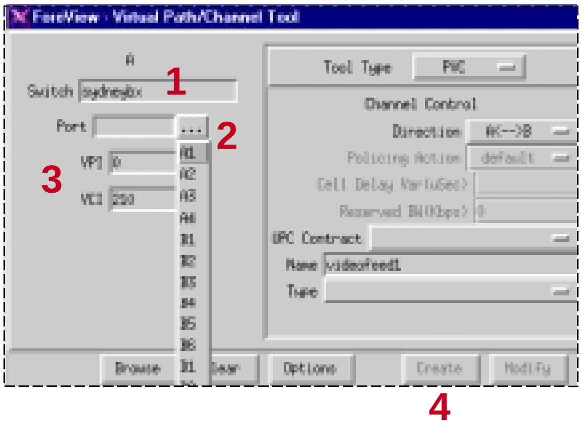
2. Switch, port, path and channel information

```
A<-->B
A--->B
A<---B
```

3. Channel direction

4. Browse, Clear and Options -- Options provides customization choices affecting the browse (scan) function. Clear empties the function displays.

Entering port info



ForeView - Virtual Path/Channel Tool

A

Switch: sydneybx

Port:

VPI: 0

VCI: 250

Tool Type: PVC

Channel Control

Direction: A<-->B

Policing Action: default

Cell Delay Var(uSec):

Reserved BW(Kbps): 0

UPC Contract:

Name: videofeed1

Type:

This graphic is the upper left (incoming side) of the full Channel tool.

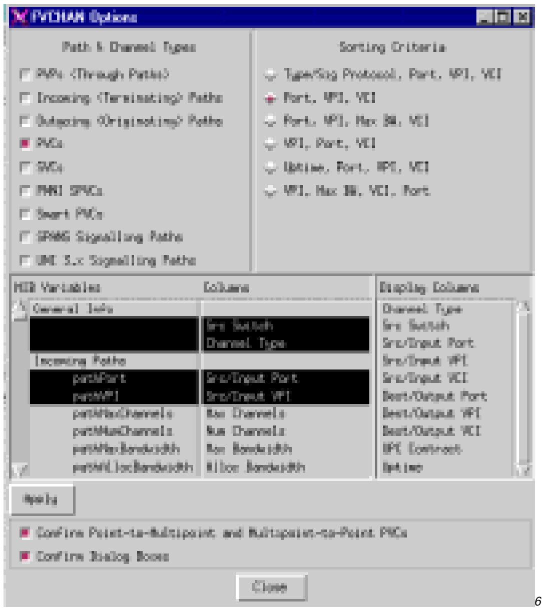
Creating a PVC

1. Indicate the switch to be configured.
2. Press the ellipsis button to present input port choices. Repeat this step on the output side (not shown).
3. Key in VPI and VCI values (and on other side, not shown)
4. Press the Create button.

The system's acknowledgment appears in the message box at the bottom of the display. Any errors encountered will be indicated here.

The Browse Options Box

The Options button from the Channel Tool permits the user to selectively browse the VCs and set filters as to how they are displayed.



PVCHAN Options

Path & Channel Types

- ☐ PVPs (Through Paths)
- ☐ Incoming (Terminating) Paths
- ☐ Outgoing (Originating) Paths
- ☒ PVCs
- ☐ SVCs
- ☐ PNNI SPVCs
- ☐ Smart PVCs
- ☐ SPANS Signalling Paths
- ☐ UNI 3.x Signalling Paths

Sorting Criteria

- ○ Type/Sig Protocol, Port, VPI, VCI
- ● Port, VPI, VCI
- ○ Port, VPI, Max BW, VCI
- ○ VPI, Port, VCI
- ○ Uptime, Port, VPI, VCI
- ○ VPI, Max BW, VCI, Port

MIB Variables	Columns
General Info	
	Src Switch Channel Type
Incoming Paths	
pathPort	Src/Input Port
pathVPI	Src/Input VPI
pathMaxChannels	Max Channels
pathNumChannels	Num Channels
pathMaxBandwidth	Max Bandwidth
pathAllocBandwidth	Alloc Bandwidth

Display Columns

Channel Type
Src Switch
Src/Input Port
Src/Input VPI
Src/Input VCI
Dest/Output Port
Dest/Output VPI
Dest/Output VCI
UPC Contract
Uptime

- ☒ Confirm Point-to-Multipoint and Multipoint-to-Point PVCs
- ☒ Confirm Dialog Boxes

The upper left portion of the Options dialog box allows the selecting and deselecting of specific path and channel types to be searched for in a browse. The upper right permits choices for sorting the resulting display. The lower part of the dialog box permits additional MIB object values to be displayed (in addition to the standard group of objects).

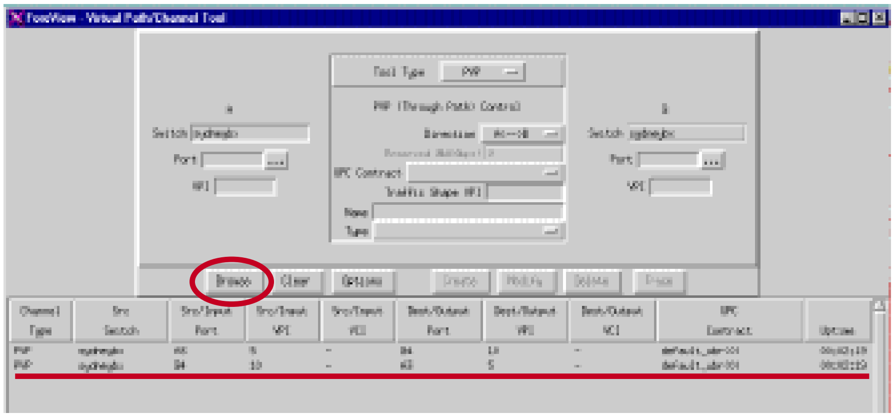
The standard set of displayed parameters is:

Channel type
Source switch
Source/input port
Source/input VPI
Source/input VCI
Destination/output port
Destination/output VPI
Destination/output VCI
UPC contract
Uptime

The options to add are too numerous to list.

The VC Browser

- **Selecting the Browse button will use the Options settings to filter the number and type of VCs to be displayed on the indicated switch**



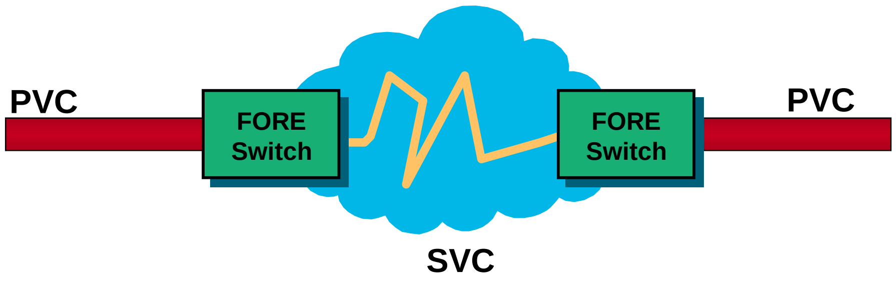
Channel Type	Src Switch	Src/Input Port	Src/Input VPI	Src/Input VCI	Dest/Output Port	Dest/Output VPI	Dest/Output VCI	UPC Contract	Uptime
PVP	[illegible]	[illegible]	5	-	[illegible]	10	-	[illegible]	[illegible]
PVP	[illegible]	[illegible]	10	-	[illegible]	5	-	[illegible]	[illegible]

After options are set, the Browse button searches for matching entries. The underlined area is a standard display for a PVP. Once an entry is found by the browser, it can be deleted, modified or traced.

FORE SYSTEMS

SmartPVC

- Smart PVCs bring the advantages of SVCs to PVC applications
- Channel tool only needs to know ingress switch and egress switch



ForeView

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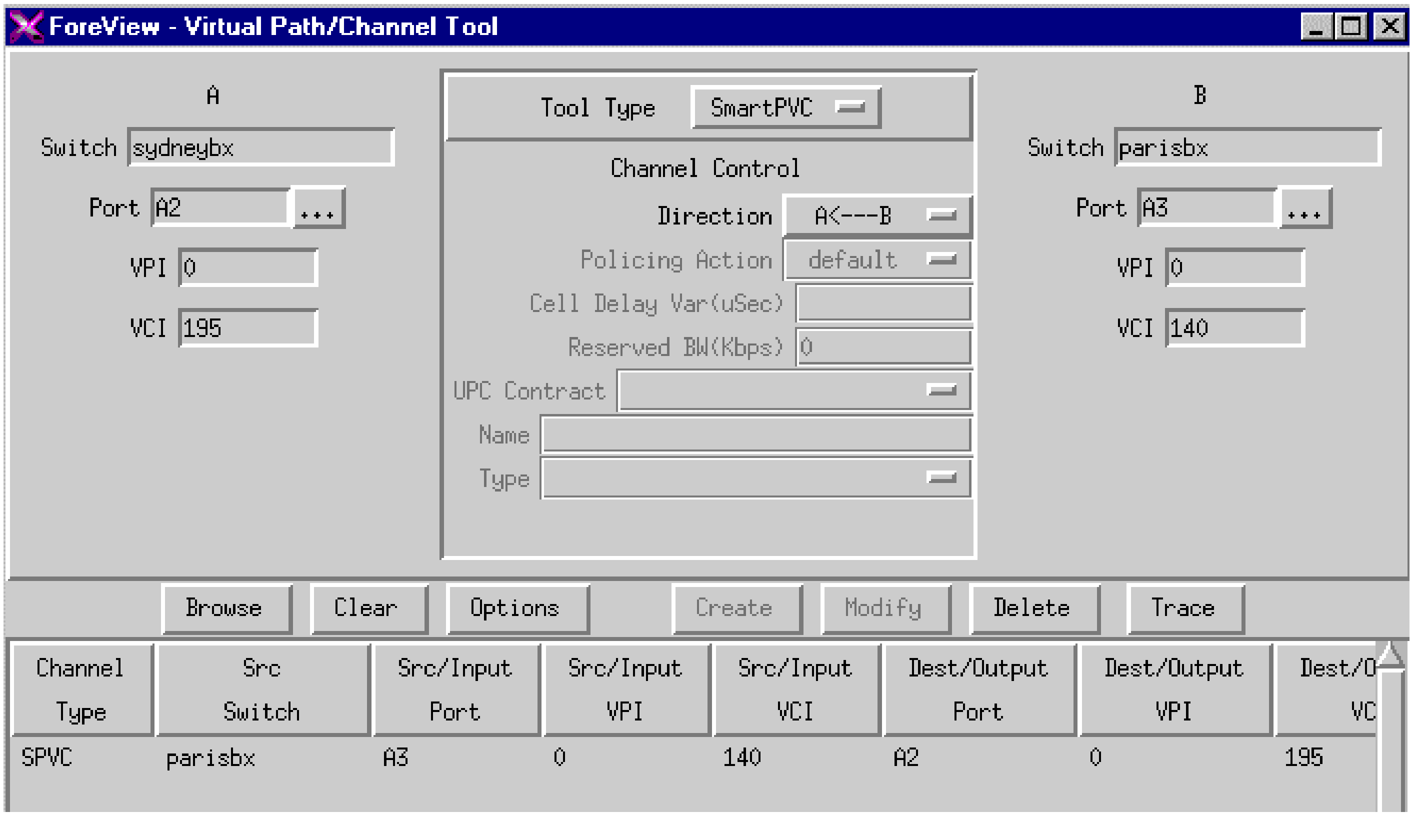


Tool Type: SmartPVC

A

Switch: sydneybx

Port: A2

VPI: 0

VCI: 195

Channel Control

Direction: A<---B

Policing Action: default

Cell Delay Var(uSec):

Reserved BW(Kbps): 0

UPC Contract:

Name:

Type:

B

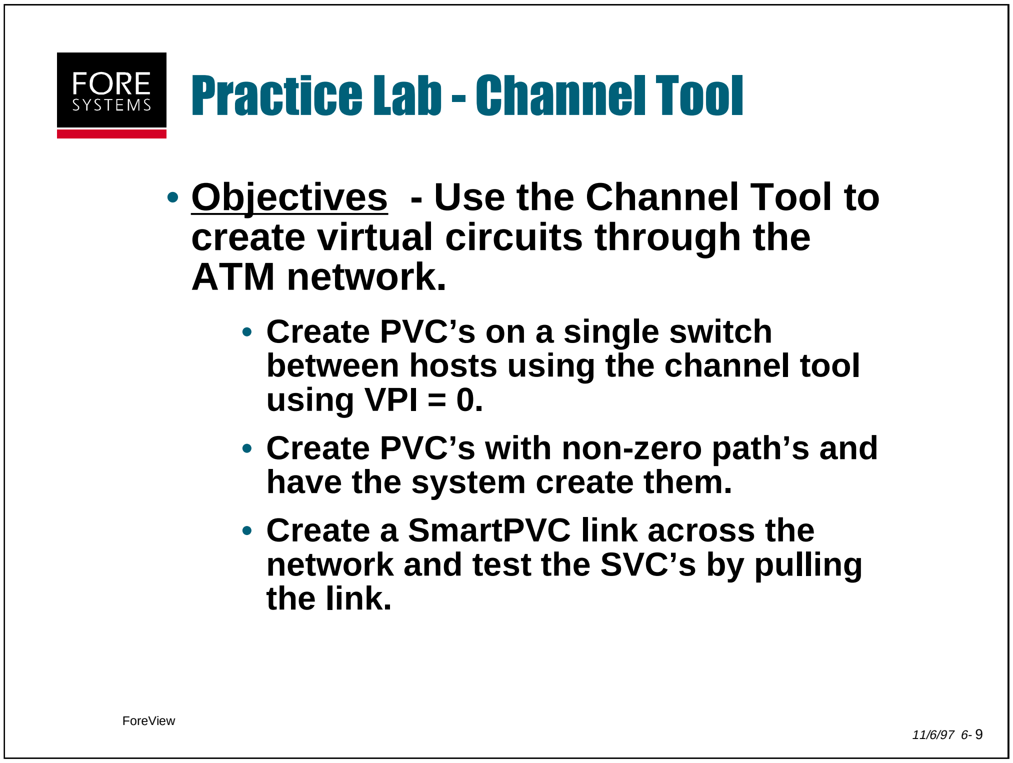
Switch: parisbx

Port: A3

VPI: 0

VCI: 140

Channel Type	Src Switch	Src/Input Port	Src/Input VPI	Src/Input VCI	Dest/Output Port	Dest/Output VPI	Dest/O VC
SPVC	parisbx	A3	0	140	A2	0	195



FORE SYSTEMS

Practice Lab - Channel Tool

- **Objectives - Use the Channel Tool to create virtual circuits through the ATM network.**
  - **Create PVC's on a single switch between hosts using the channel tool using VPI = 0.**
  - **Create PVC's with non-zero path's and have the system create them.**
  - **Create a SmartPVC link across the network and test the SVC's by pulling the link.**

ForeView

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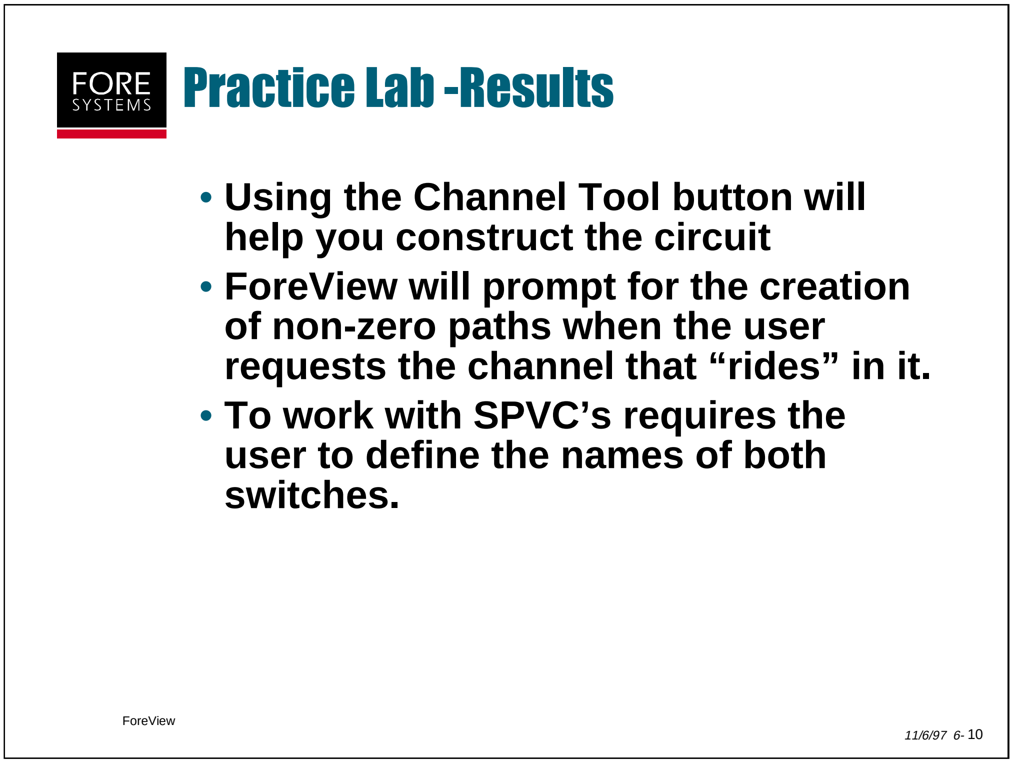
Procedures:

1. Bring up the ForeView Channel Tool. Enter in the following information as your instructor assigns them to you.

Your hostname ___________ Partner's hostname___________
IP address _______________ IP Address _________________
Switch port ______________ Switch Port _________________
VPI ___0________ VPI _____0_______
VCI __<host final octet>__ VCI __<host final octet>___
QoS parameters? _CBR 20000 cps

2. Fill in the Channel Tool fields as needed and press Create to construct the circuit.
3. Choose the clear button to clear the top list box and then click the Browse button to browse the existing VCs and make sure that your VCs were created. Try changing selections in the Options box to restrict your search of circuits.
4. At both hosts, run the *atmarp* command to set the PVC's in the host ATM arp cache. For your review the FORE-IP syntax is:

```
atmarp -s {hostname} fa0  path channel AAL
atmarp -l fa0 path channel AAL
```



Practice Lab -Results

- Using the Channel Tool button will help you construct the circuit
- ForeView will prompt for the creation of non-zero paths when the user requests the channel that “rides” in it.
- To work with SPVC’s requires the user to define the names of both switches.

ForeView

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Procedures:

1. Bring up the ForeView Channel Tool. Enter in the following information as your instructor assigns them to you.

Your hostname ____________	Partner’s hostname____________
IP address ________________	IP Address __________________
Switch port _______________	Switch Port ___________________
VPI ____________ (non-zero?)	VPI ____________ (non-zero?)
VCI ____________	VCI ____________

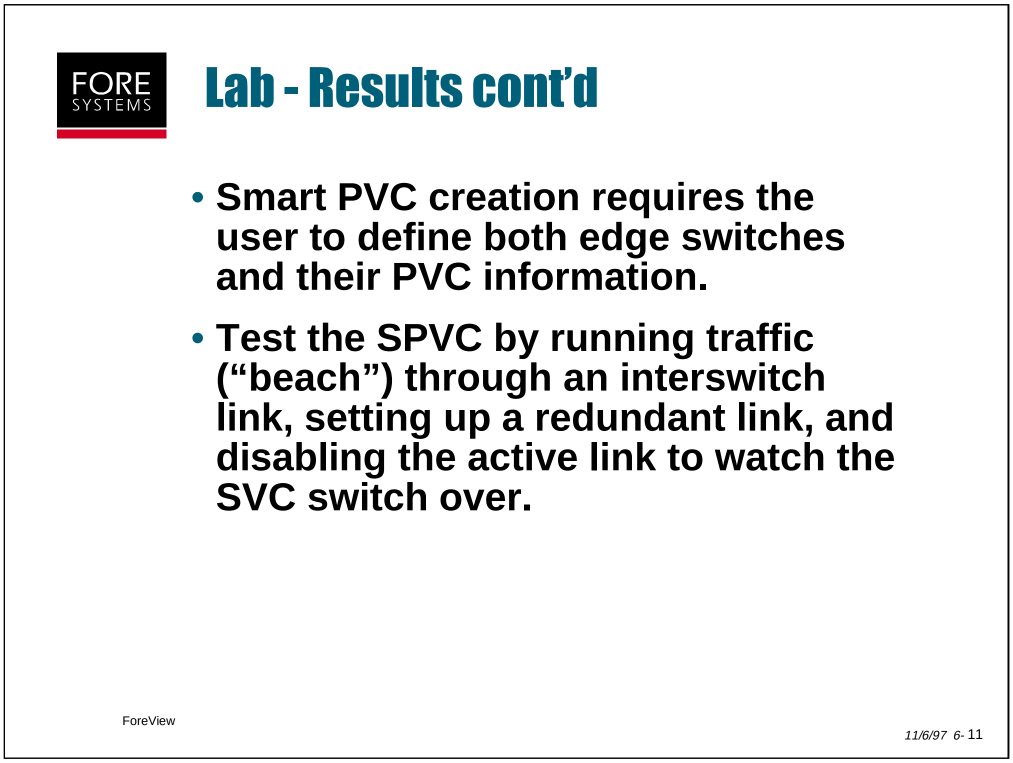
QoS parameters? ________________

Direction of links ___________

2. When you enter a non-zero path, ForeView prompts to create as many Terminating and Originating paths as necessary for the connection. Examine the prompts

3. Create the PVC including the *atmarp* statements on the hosts.

NOTE: For review: Can a host RECEIVE on a non-zero path?



Lab - Results cont'd

- Smart PVC creation requires the user to define both edge switches and their PVC information.
- Test the SPVC by running traffic ("beach") through an interswitch link, setting up a redundant link, and disabling the active link to watch the SVC switch over.

ForeView

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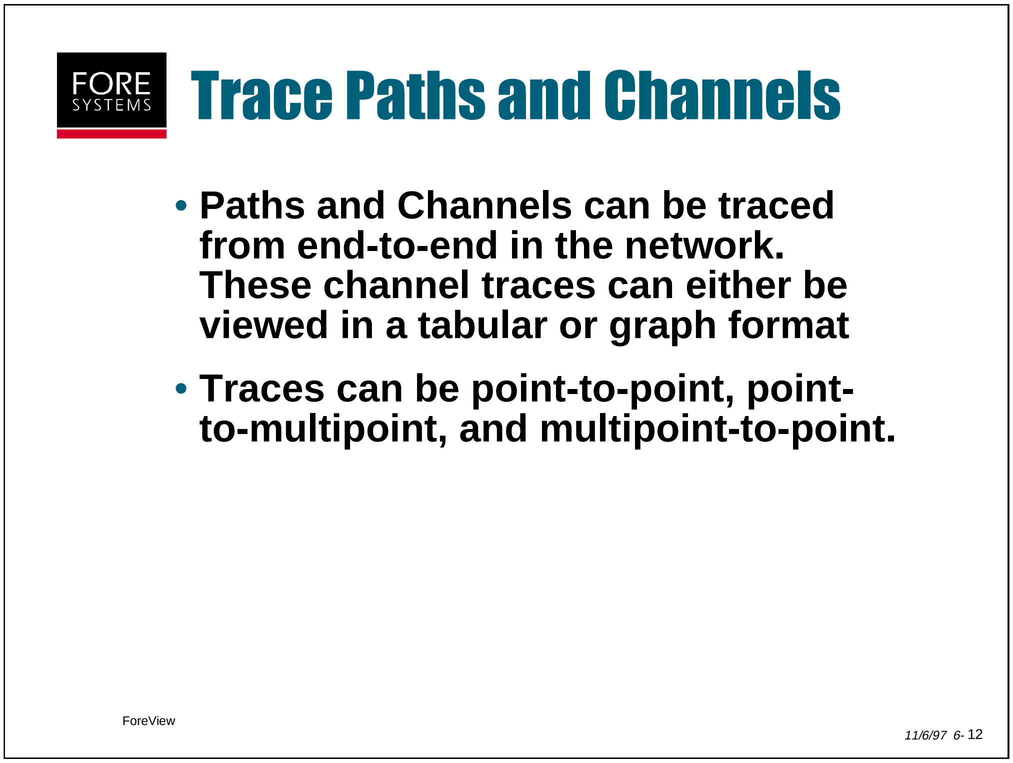
1. Bring up the ForeView Channel Tool. Enter in the following information as your instructor assigns them to you.

Your hostname ___________ Partner's hostname___________
IP address _______________ IP Address _________________
Edge Switch Name ________ Edge Switch Name __________
Switch port ______________ Switch Port _________________
VPI ___________ VPI ___________
VCI ___________ VCI ___________
QoS parameters? ___UBR_____
Direction of links __________



Trace Paths and Channels

- Paths and Channels can be traced from end-to-end in the network. These channel traces can either be viewed in a tabular or graph format
- Traces can be point-to-point, point-to-multipoint, and multipoint-to-point.

ForeView

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The Channel/Path Tracer can be used for several purposes including:

• Isolation of hosts consuming the most bandwidth in the network

• Studies of node communication destinations

• Examinations of cell throughput, droppage, and rejections at each hop a channel makes as it traverses a network.

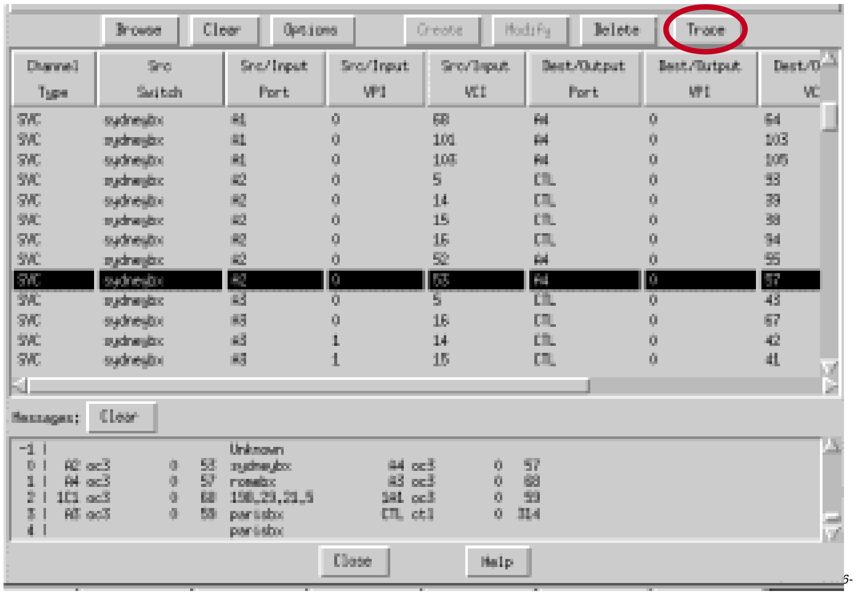
It can be invoked to determine the source of the traffic on the channel and which node is receiving traffic. The graphing facility of the tool allows tracking of cell flows and rejects at each hop that a channel makes through the network allowing rapid isolation of problems on that channel as it crosses the network.

The Tabular Trace looks similar to routing tables and contains a hop by hop description of the device, port, VPI, VCI, and hop count as it goes from the source host to the destination.

The Graph Trace can trace a channel, graph the cell loss (cells and rejects), notification of cell loss by framing errors, or show a policing graph.

Although the previous examples of tracing were concerned with point-to-point, the trace tool can also do point-to-multipoint and multipoint-to-point channel traces as well.

Tracing Tool

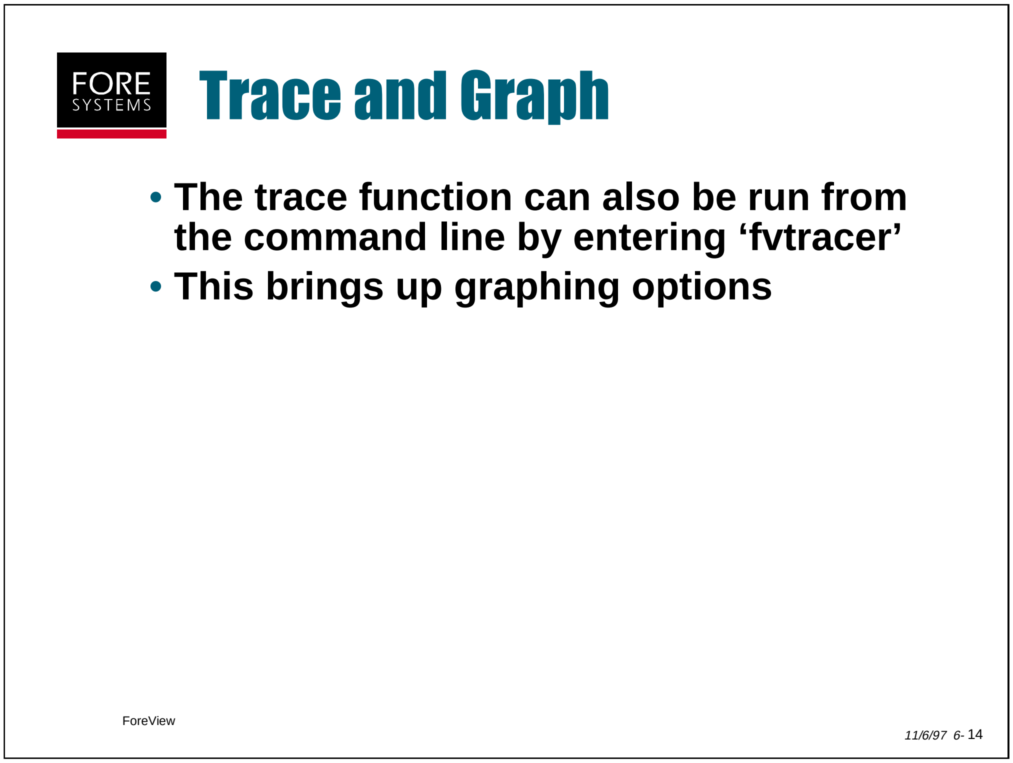


Channel Type	Src Switch	Src/Input Port	Src/Input VPI	Src/Input VCI	Dest/Output Port	Dest/Output VPI	Dest/O VC
SVC	sydneybx	A1	0	68	A4	0	64
SVC	sydneybx	A1	0	101	A4	0	103
SVC	sydneybx	A1	0	103	A4	0	105
SVC	sydneybx	A2	0	5	CTL	0	53
SVC	sydneybx	A2	0	14	CTL	0	39
SVC	sydneybx	A2	0	15	CTL	0	38
SVC	sydneybx	A2	0	16	CTL	0	54
SVC	sydneybx	A2	0	52	A4	0	55
SVC	sydneybx	A2	0	53	A4	0	57
SVC	sydneybx	A3	0	5	CTL	0	43
SVC	sydneybx	A3	0	16	CTL	0	67
SVC	sydneybx	A3	1	14	CTL	0	42
SVC	sydneybx	A3	1	15	CTL	0	41

```
-1 |                     Unknown
 0 |   A2 oc3      0  53 sydneybx            A4 oc3     0   57
 1 |   A4 oc3      0  57 romebx              A3 oc3     0   68
 2 |  1C1 oc3      0  68 198.29.21.5        1A1 oc3     0   59
 3 |   A3 oc3      0  59 parisbx             CTL ctl     0  314
 4 |                     parisbx
```

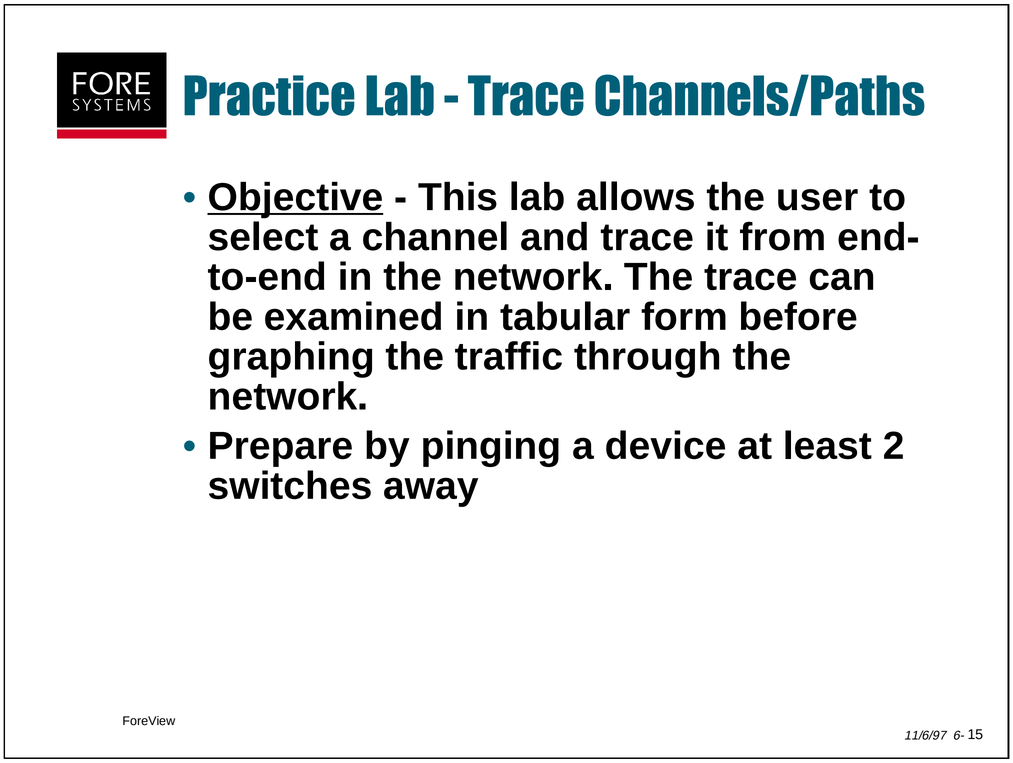
6- 13

The results of a browse will display the candidate channels and/or paths to be traced. Simply highlight one in the list and press the Trace button.



Trace and Graph

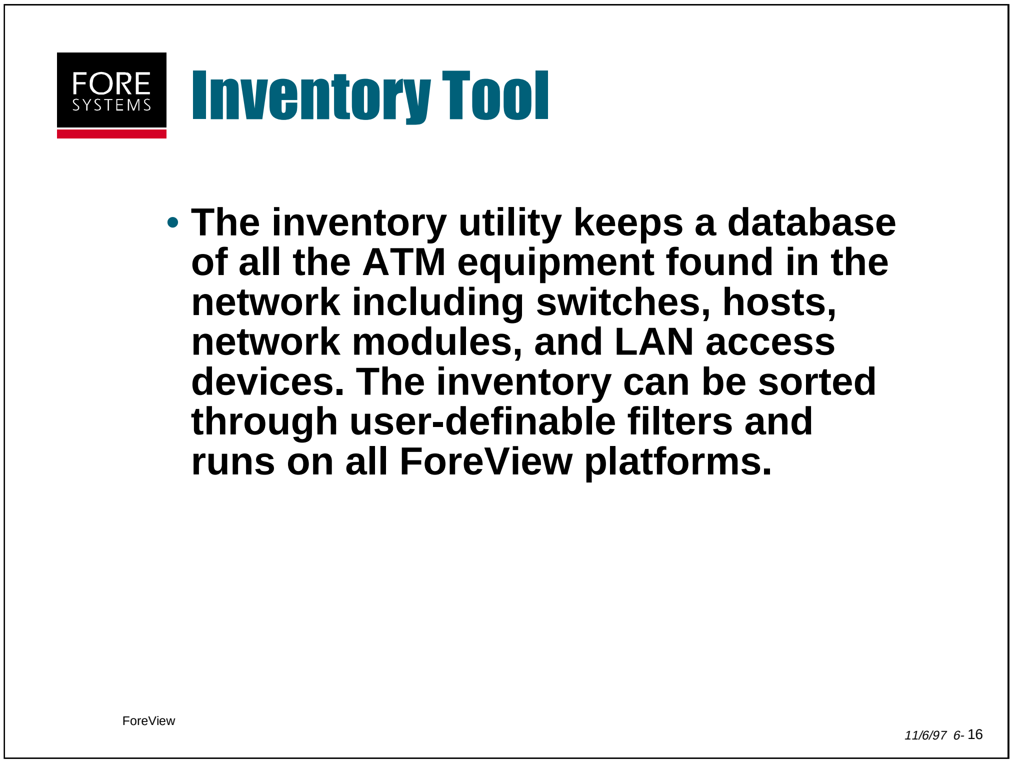
- The trace function can also be run from the command line by entering ‘fvtracer’
- This brings up graphing options



Practice Lab - Trace Channels/Paths

- Objective - This lab allows the user to select a channel and trace it from end-to-end in the network. The trace can be examined in tabular form before graphing the traffic through the network.
- Prepare by pinging a device at least 2 switches away

Procedures
1. Open the Trace Channel Tool. You can launch it from the Map icons, the ForeView menu bar, or from the Front Panel display under the VCCs option.
2. Select an appropriate channel from the upper list box, preferably one that you know is carrying traffic (ping -s). Select the Trace Channel/path button to get the tabular form of the trace. Examine the number of hops that it takes from the starting host to the destination. Also look at the switches and ports the channel uses to traverse the network
3. After examining the tabular form, click on the Trace and Graph button to bring up the cell traffic graph of the circuit



Inventory Tool

- The inventory utility keeps a database of all the ATM equipment found in the network including switches, hosts, network modules, and LAN access devices. The inventory can be sorted through user-definable filters and runs on all ForeView platforms.

ForeView

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The Inventory tool can be launched from the ForeView Stand-alone Map, OpenView menu bar for ForeView, or from the command line as *fvinv*.

Version history of ForeThought software on ATM switches is an option. This information is stored in a version history file and can be initially defined in the .foreview configuration file and has a default name of /usr/fore/.foreview/conf/version.conf.

If you fail to define a version history file in the configuration file, you will be prompted for a file name every time you run the inventory utility similar to the box shown below:

The Inventory Tool

- Once you choose the inventory application, it contacts the Discovery server to collect and tabulate all connected ATM components. The run time is directly relate to network size.

ForeView

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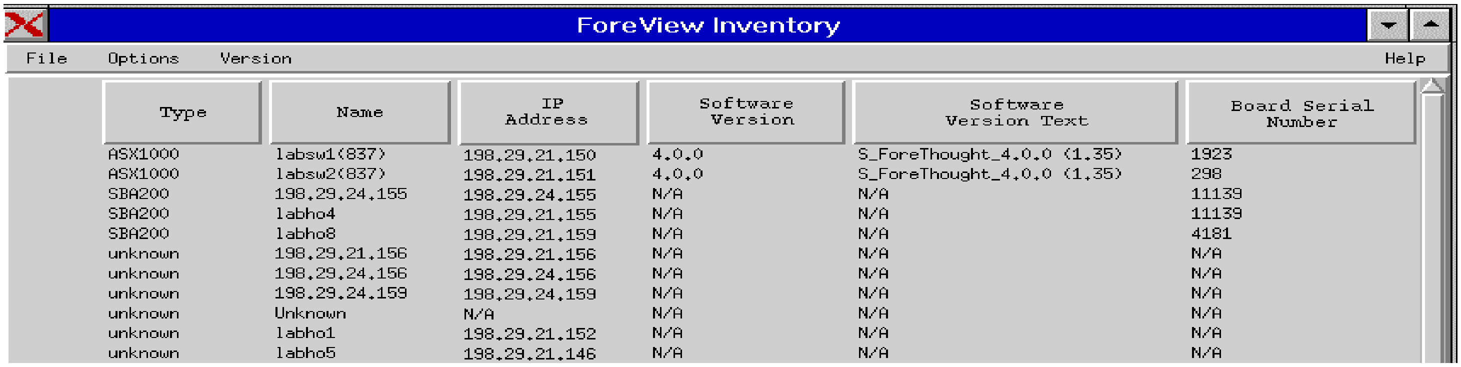
By default, the inventory application will list the type of device found, the name, IP address, Software version, Software version text, and Board Serial Number . By selecting Options from the menu bar, the table can apply sorting orders and filters.
Here’s a close-up of the Inventory Tool:



Type	Name	IP Address	Software Version	Software Version Text	Board Serial Number
ASX1000	labsw1(837)	198.29.21.150	4.0.0	S_ForeThought_4.0.0 (1.35)	1923
ASX1000	labsw2(837)	198.29.21.151	4.0.0	S_ForeThought_4.0.0 (1.35)	298
SBA200	198.29.24.155	198.29.24.155	N/A	N/A	11139
SBA200	labho4	198.29.21.155	N/A	N/A	11139
SBA200	labho8	198.29.21.159	N/A	N/A	4181
unknown	198.29.21.156	198.29.21.156	N/A	N/A	N/A
unknown	198.29.24.156	198.29.24.156	N/A	N/A	N/A
unknown	198.29.24.159	198.29.24.159	N/A	N/A	N/A
unknown	Unknown	N/A	N/A	N/A	N/A
unknown	labho1	198.29.21.152	N/A	N/A	N/A
unknown	labho5	198.29.21.146	N/A	N/A	N/A

FORE SYSTEMS

Inventory Filters and Version History

- The inventory table can be filtered and displayed by Switches, network modules, LAN Access devices, Hosts, and Other (non-FORE equipment)
- Filters simply alter the way that the information is displayed and do not affect the information gathering.
- Selecting Version from the menu bar gives a software version history of devices and/or host types

ForeView

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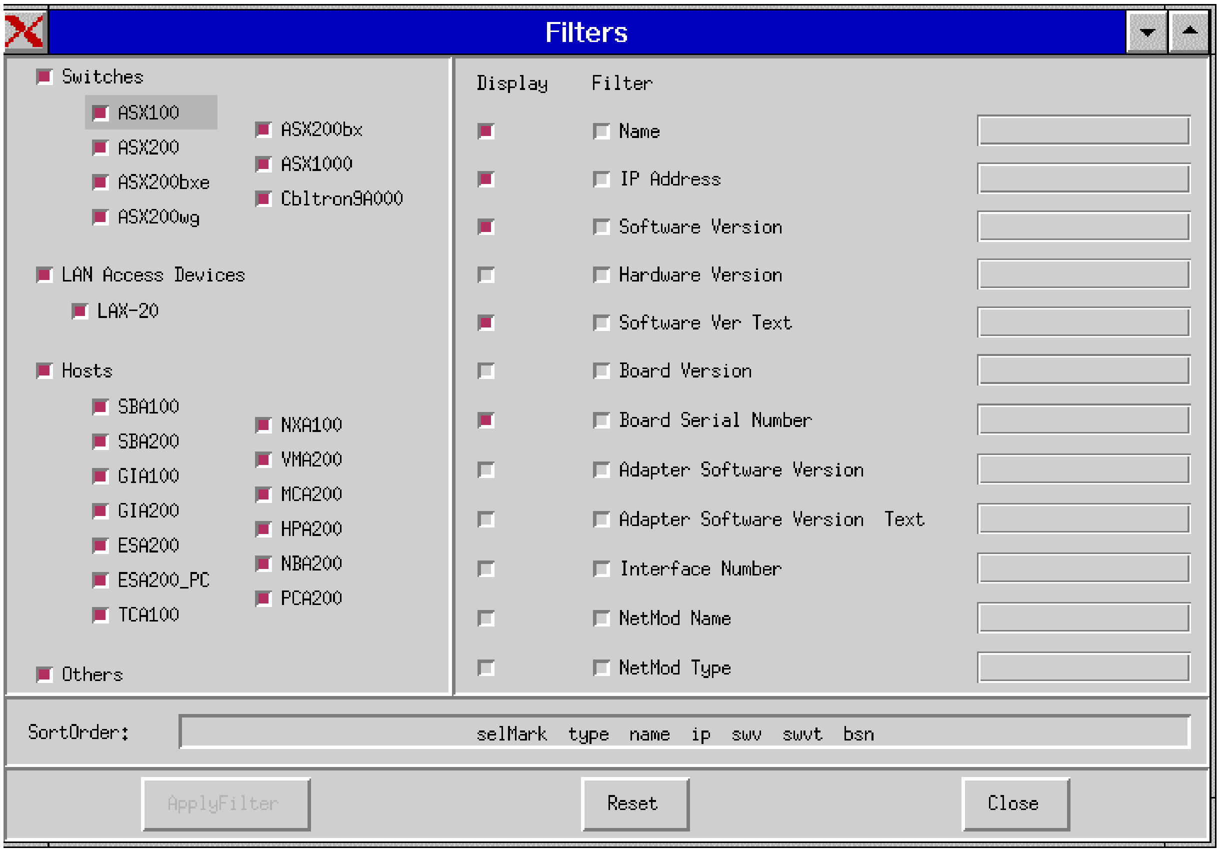
Here is an example of the Filtering dialog box:



Filters

☒ Switches
- ☒ ASX100
- ☒ ASX200
- ☒ ASX200bxe
- ☒ ASX200wg
- ☒ ASX200bx
- ☒ ASX1000
- ☒ Cbltron9A000

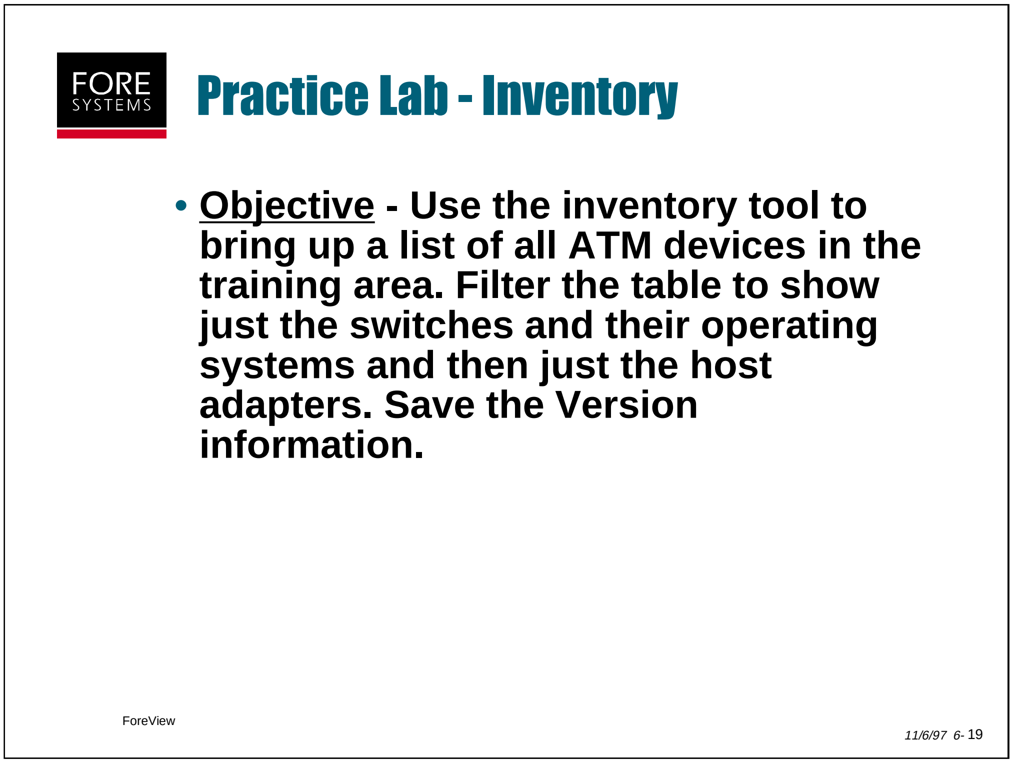
☒ LAN Access Devices
- ☒ LAX-20

☒ Hosts
- ☒ SBA100
- ☒ SBA200
- ☒ GIA100
- ☒ GIA200
- ☒ ESA200
- ☒ ESA200_PC
- ☒ TCA100
- ☒ NXA100
- ☒ VMA200
- ☒ MCA200
- ☒ HPA200
- ☒ NBA200
- ☒ PCA200

☒ Others

Display	Filter	
☒	☐ Name	
☒	☐ IP Address	
☒	☐ Software Version	
☐	☐ Hardware Version	
☒	☐ Software Ver Text	
☐	☐ Board Version	
☒	☐ Board Serial Number	
☐	☐ Adapter Software Version	
☐	☐ Adapter Software Version Text	
☐	☐ Interface Number	
☐	☐ NetMod Name	
☐	☐ NetMod Type	

SortOrder: selMark type name ip swv swvt bsn



FORE SYSTEMS

Practice Lab - Inventory

- **<u>Objective</u> - Use the inventory tool to bring up a list of all ATM devices in the training area. Filter the table to show just the switches and their operating systems and then just the host adapters. Save the Version information.**

ForeView

11/6/97 6- 19

Procedures

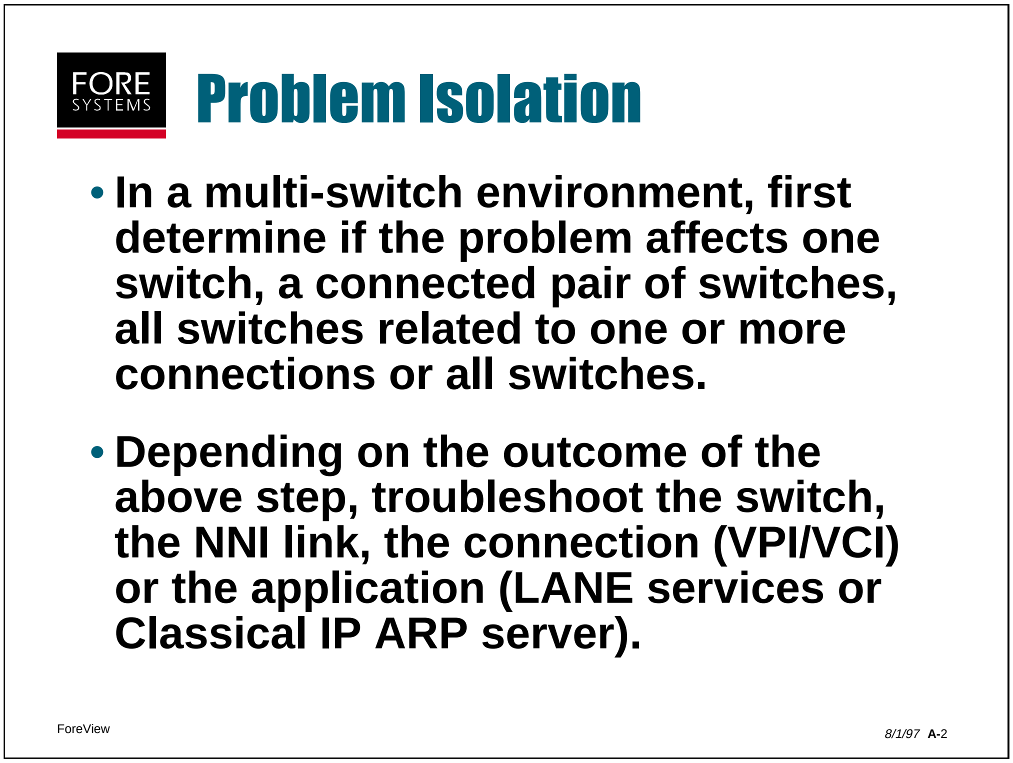
1. Launch the Inventory application and accept the default for the configuration history file.
2. Examine the table and use the Sort Decreasing function. What happens?
3. Use the Options command to bring up the Filters box. Select (highlight) only the boxes for the switches and observe how the table presentation changes. Use the filter box again to select (highlight) just the host adapters to their information. Select all the display fields and examine the inventory table.
4. Open the Version command from the menu bar and examine the version history.

FORE SYSTEMS

Appendix 1 Switch Network Troubleshooting Using ForeView

ForeView

8/1/97 **A**-1



FORE SYSTEMS

Problem Isolation

- In a multi-switch environment, first determine if the problem affects one switch, a connected pair of switches, all switches related to one or more connections or all switches.
- Depending on the outcome of the above step, troubleshoot the switch, the NNI link, the connection (VPI/VCI) or the application (LANE services or Classical IP ARP server).

ForeView

8/1/97 **A**-2

In any multi-product (in this case, ATM switch) network, the first troubleshooting step is to ascertain the extent of the problem. Does the problem seem to be affecting only one switch, a pair of connected switches, all switches involved in the support of one end to end connection, or all switches?

This first step will dictate the approach used to troubleshoot, and if that approach is followed to the end will either solve the problem or lead to the discovery of a more extensive problem. In either case, these are positive corrective actions.

A few guidelines to remeber:

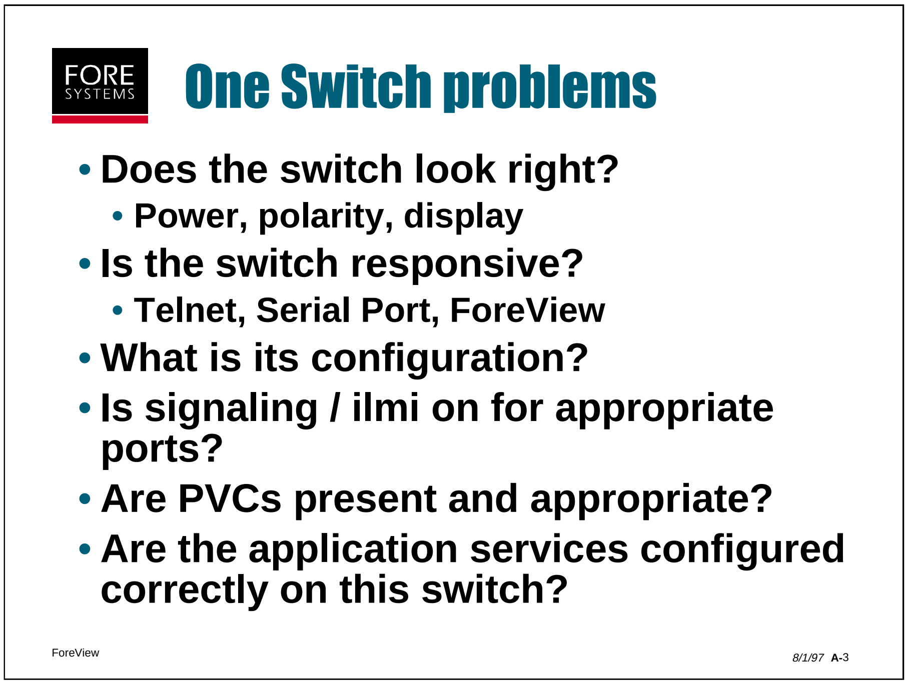
- IP connectivity (ping or SNMP response) does not prove very much with regard to ATM. It's a connectioless proof of connection-oriented system.

- A switch's neighbors can be almost as informative as the switch in question (signaling status, port status).

-Swapping ports/ modules is very fast and easy.

-If a ForeView map doesn't show the switch as up, frequently, you will be able to contact it.

The following slides review each of these possible approaches.



One Switch problems

- Does the switch look right?
  - Power, polarity, display
- Is the switch responsive?
  - Telnet, Serial Port, ForeView
- What is its configuration?
- Is signaling / ilmi on for appropriate ports?
- Are PVCs present and appropriate?
- Are the application services configured correctly on this switch?

ForeView

8/1/97 A-3

For one switch problems (those affecting only one switch in the network), the approach is to focus only on that one switch from a logical physical-to-application progression.

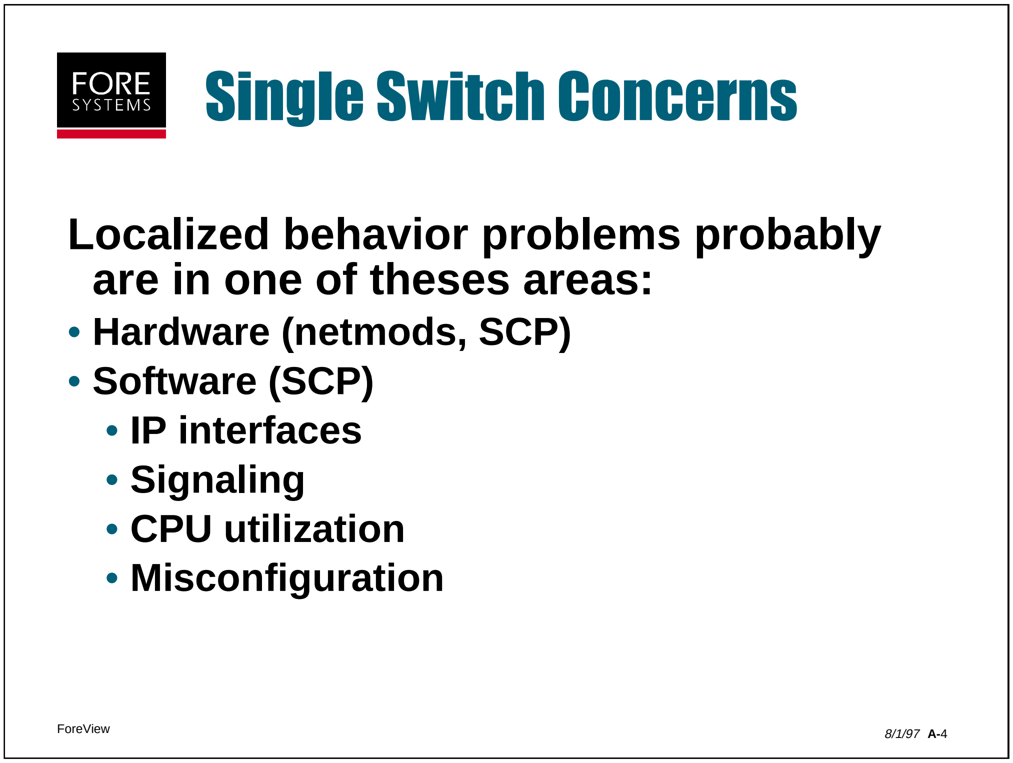
First, just look at the switch. Are there any lights on? Are there any red lights on? Remember, our port LED indicators are out when polarity is correct and when the switch is powered off. Are the power supply lights on and green? Remember, only one has to be on and green for BXs and 1000s. Is the display indicating the name of the switch? Some people create a name longer than the display so that it must constantly scroll. Is it scrolling? If not, what does it say? If it flashes Bootp over and over, it means the operating system can't be found and it is looking for a new one on its Ethernet interface.

Can you access the switch using any management technique? If you can, click on the FORE logo on the Front Panel display in ForeView to see if you can find out which revision of hardware, firmware and software is running.

Look at the color of the port status bars under ForeView to determine if the appropriate signaling type is active and address registration has taken place for the device attached to the port.

Use VPC/VCC Control under ForeView to determine whether any PVCs are present and potentially causing problems for your connection creation process.

Lastly, if you are running LANE or Classical IP, this switch may not be configured correctly for the application. Perhaps its NSAP address was incorrectly entered into an lecs.cfg file, or it is not part of the Classical IP subnet, etc.



Single Switch Concerns

Localized behavior problems probably are in one of theses areas:

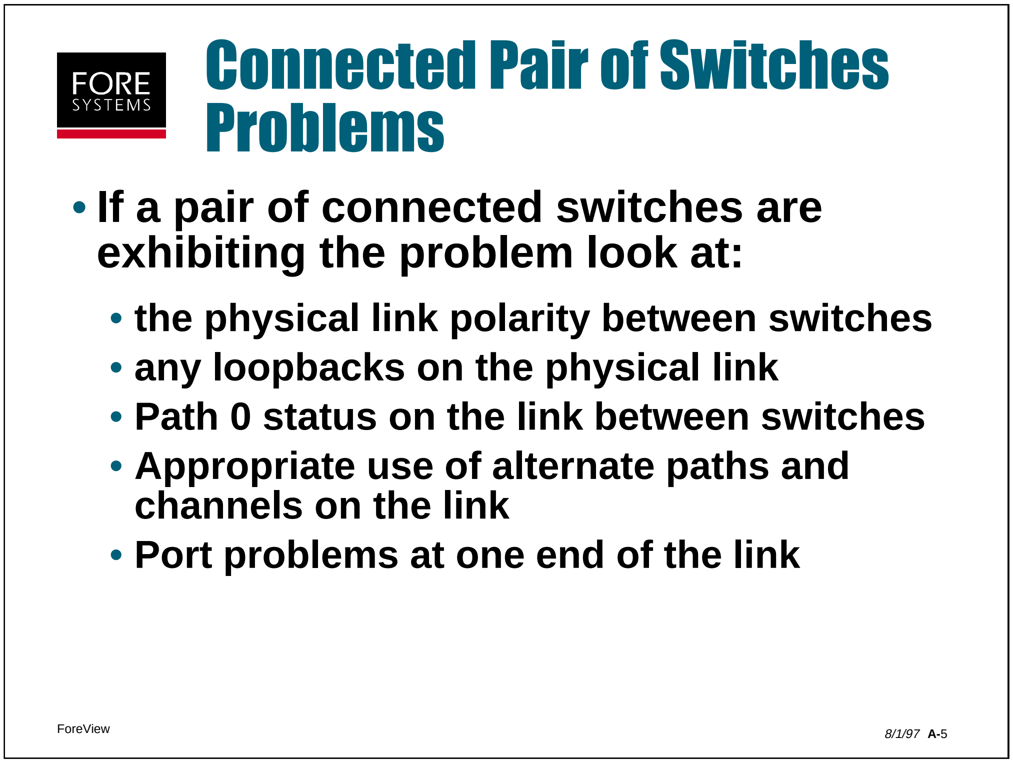
- **Hardware (netmods, SCP)**
- **Software (SCP)**
  - **IP interfaces**
  - **Signaling**
  - **CPU utilization**
  - **Misconfiguration**

ForeView

8/1/97 **A**-4

Hardware: SCP health is checked by the display LED and proper seating. Netmods should have LED displays characteristic of connected or unused ports and be correctly seated. Attaching a device to the serial port allow errors to display.

Software: Attempt remote connectivity (telnet or FV), use serial port if necessary. If you can't get into a user interface session, there is either an SCP failure or no software loaded. Verify IP interface status, signaling status and stats indicating cell movement. CPU utilization is measured by user interface response. Ports, PVCs, modules and software services can be misconfigured.



FORE SYSTEMS

Connected Pair of Switches Problems

- If a pair of connected switches are exhibiting the problem look at:
  - the physical link polarity between switches
  - any loopbacks on the physical link
  - Path 0 status on the link between switches
  - Appropriate use of alternate paths and channels on the link
  - Port problems at one end of the link

ForeView

8/1/97 **A-5**

For problems related to a pair of connected switches, the approach is to focus on the link between the switches.

First, look at the port LED indicators for the interconnecting link. Are the polarity indications correct?

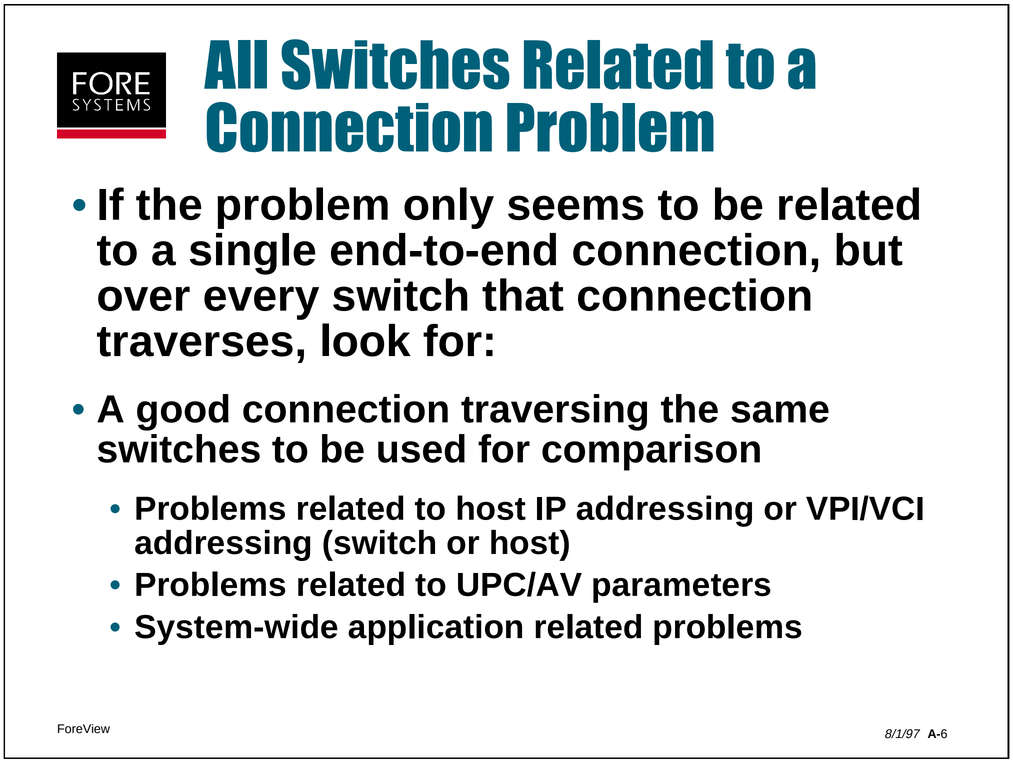
Next, access the Port Control screen under ForeView to determine if the interconnecting link port on either end is in loopback.

Is path 0 required on the link (signaling) for the application you are running, and if so, is it enabled and the proper signaling up? Look at the color of the port status bars under ForeView to determine if the appropriate signaling type is active and address registration has taken place for the device attached to the port. Is the ForeView NNI symbol showing up on the interconnecting ports Front Panel view?

If you are using an alternate path between switches, is that path configured correctly and is signaling required for that path on the link for the application you are running, and if so, is it enabled?

Try to rule out IP-related issues.

Lastly, ensure that the interconnecting ports on either end of the link are configured correctly.



FORE SYSTEMS

All Switches Related to a Connection Problem

- If the problem only seems to be related to a single end-to-end connection, but over every switch that connection traverses, look for:
- A good connection traversing the same switches to be used for comparison
  - Problems related to host IP addressing or VPI/VCI addressing (switch or host)
  - Problems related to UPC/AV parameters
  - System-wide application related problems

ForeView

8/1/97 **A-6**

To troubleshoot a connection related problem, where a connection cannot be made or is broken between two end points in a multi-switch environment, first try to find a good connection to compare against.

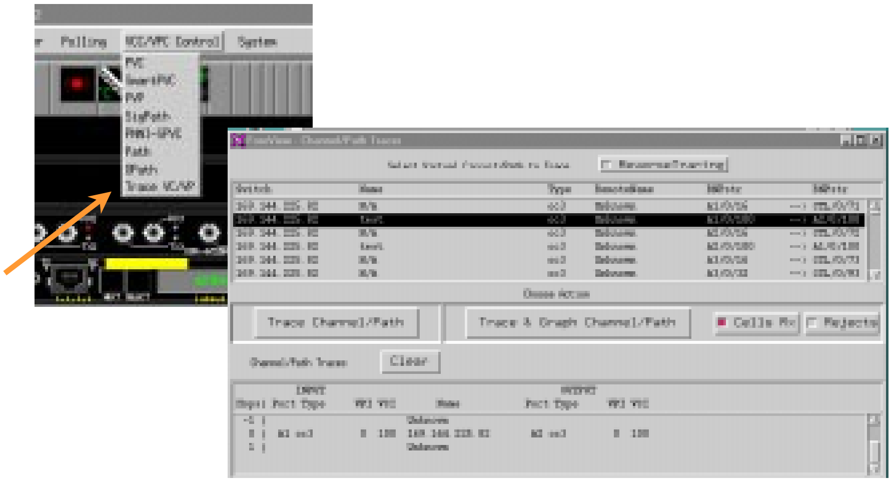
In some cases it is easiest to start at one end of a connection and verify link-by-link in a uni-directional fashion. This can be done using the channel trace tool under ForeView (shown on the next slide).

Another place to look is addressing. If this is a PVC connection, VPI/VCI addressing may have been typed incorrectly for one of the links in the connection, or incorrect IP addressing applied to one end of the connection. Again, the channel trace tool of ForeView is a very valuable tool to determine this.

If the connection has a Usage Parameter Control (UPC) contract or Address Validation (AV) rules applied to it, there is a possiblitity that the parameters defined are not robust enough to allow the application to operate. In this case, try removing the contract/AV rules or increasing the UPC values.

Many single connection problems are related to the application itself, such as, ILMI off on a link or device requiring signaling, pointing to the wrong ARP server NSAP address, or incorrect application of accept and/or reject statements in the lecs.cfg.

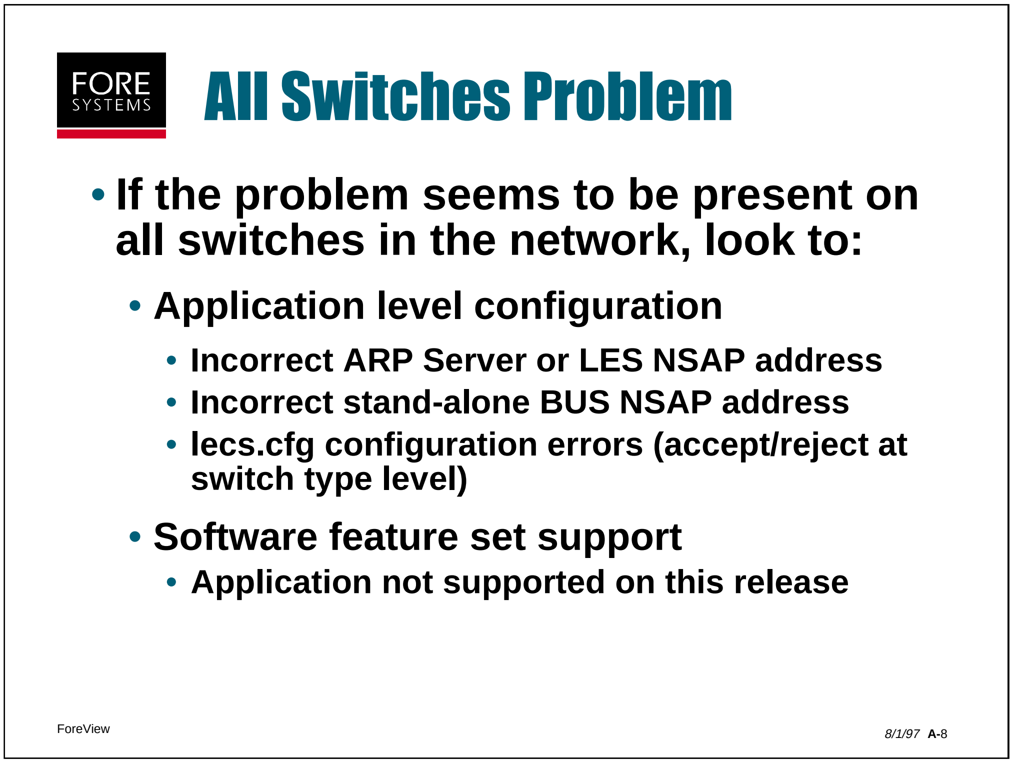
The ForeView Channel Trace Tool



To perform a channel trace with ForeView, select Trace VP/VC from the Front Panel display “Control VPC/VCC” pull-down menu.

The Trace screen shown above on the right is displayed showing all end point addresses in this network. Select an end point to start tracing from, and then select either to trace the connection, or trace and graph the connection.

The response from the trace identifies all the switches/modules/ports involved. Verify that similar applications can run over each switch displayed.



FORE SYSTEMS

All Switches Problem

- If the problem seems to be present on all switches in the network, look to:
  - Application level configuration
    - Incorrect ARP Server or LES NSAP address
    - Incorrect stand-alone BUS NSAP address
    - lecs.cfg configuration errors (accept/reject at switch type level)
  - Software feature set support
    - Application not supported on this release

ForeView

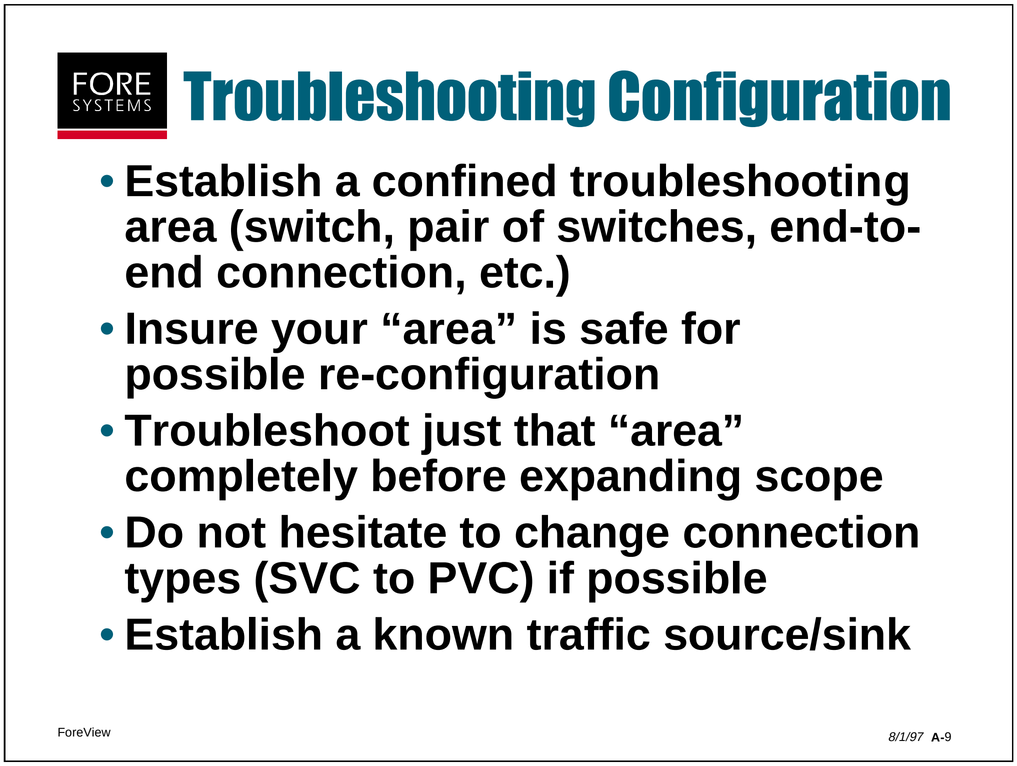
8/1/97 **A-8**

If your problem seems to be present on all switches (or all hosts on all switches), it is most likely related to the application that you are attempting to run on the network.

For instance, if the real NSAP address of the ARP server or LES is different from that which was configured originally (i.e. replaced ATM card in host or SCP in switch acting as ARP server or LES), or the stand-alone BUS NSAP address was incorrectly entered.

Also, lecs.cfg problems related to ATM network parameters (affecting all ELANs) or accept/reject rules problems at the switch type level (i.e. accept one NSAP of a particular switch type says to reject all other NSAPs of that switch type).

Finally, it is possible, however unlikely, that someone would try to run an application on products which do not support that application in the release of software running on the product (i.e. LANE 1.0 support on a 3.x release of FT software).



FORE SYSTEMS

Troubleshooting Configuration

- Establish a confined troubleshooting area (switch, pair of switches, end-to-end connection, etc.)
- Insure your “area” is safe for possible re-configuration
- Troubleshoot just that “area” completely before expanding scope
- Do not hesitate to change connection types (SVC to PVC) if possible
- Establish a known traffic source/sink

ForeView

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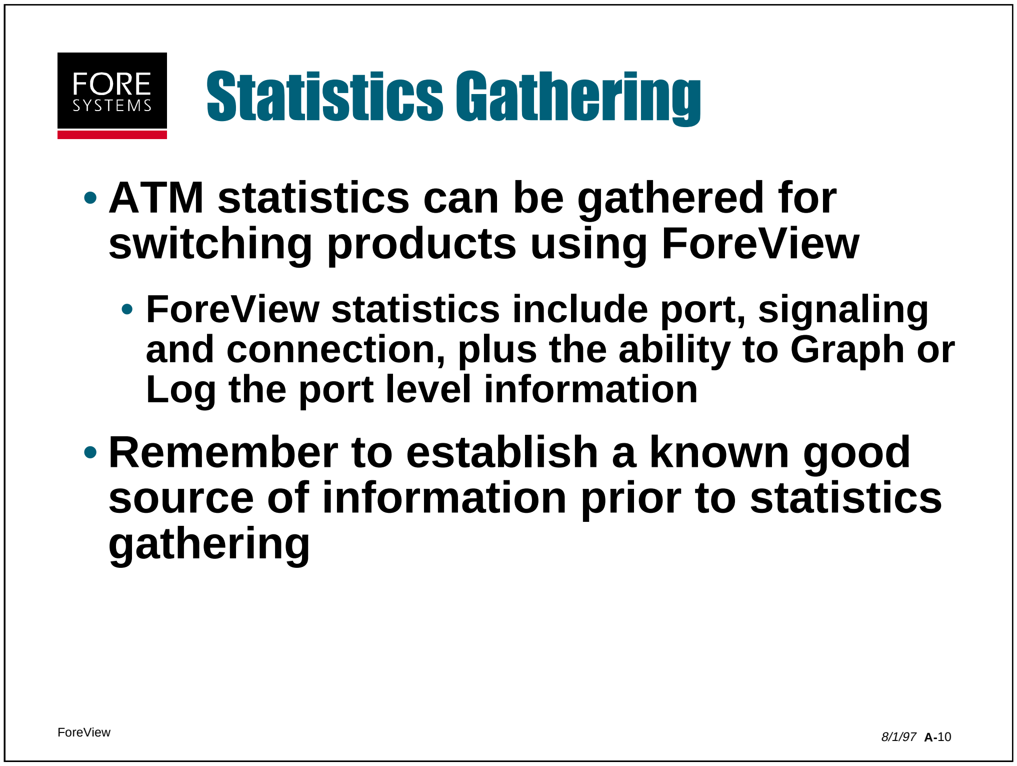
For network troubleshooting in general, it is imperative to first limit your scope of problem solving. Establish a confined test area and then test that area fully, before moving to other or larger areas. Record you original test setup and steps that were taken (plus results).

Remember that ATM is connection oriented and that information will not pass without a connection being established first. Also remember that PVC connections, although cumbersome, are also able to be used to test devices, interfaces, links, addressing, etc.

One of the most important steps is to establish what you are going to use as your traffic source to prove that a connection was made (i.e. directed ping, broadcast ping, meaty ping, resident program, ELAN join request, etc.), and what you are going to use to monitor success (i.e. ping response, elconfig show -configured, atm statistics gathering, etc.).



FORE SYSTEMS

Statistics Gathering

- ATM statistics can be gathered for switching products using ForeView
  - ForeView statistics include port, signaling and connection, plus the ability to Graph or Log the port level information
- Remember to establish a known good source of information prior to statistics gathering

ForeView

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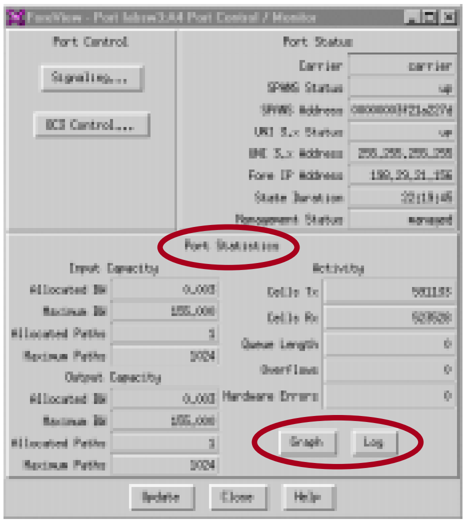
The following slides show how to use ForeView to gather port, signaling and connection statistics.

Statistics (port)



ForeView - Port [illegible] Port Control / Monitor

Port Control

Port Status

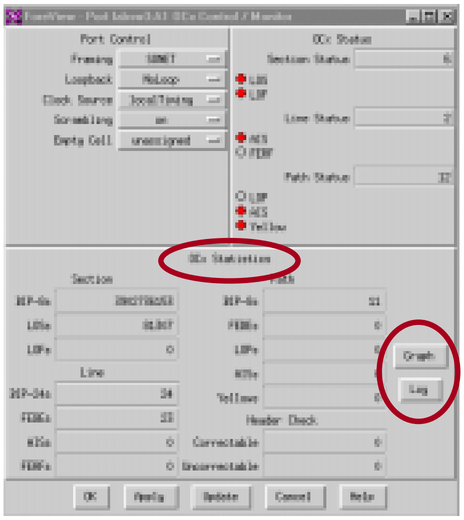
Carrier: carrier
SPANS Status: up
SPANS Address: 08000003f21a2274
UNI 3.x Status: up
UNI 3.x Address: 255.255.255.255
Fore IP Address: 198.29.21.156
State Duration: 22:19:46
Management Status: managed

Port Statistics

Input Capacity
Allocated BW: 0.000
Maximum BW: 155.000
Allocated Paths: 1
Maximum Paths: 1024

Output Capacity
Allocated BW: 0.000
Maximum BW: 155.000
Allocated Paths: 1
Maximum Paths: 1024

Activity
Cells Tx: 593135
Cells Rx: 523528
Queue Length: 0
Overflows: 0
Hardware Errors: 0



ForeView - Port [illegible] OCx Control / Monitor

Port Control
Framing: SONET
Loopback: NoLoop
Clock Source: localTiming
Scrambling: on
Empty Cell: unassigned

OCx Status
Section Status: 6
● LOS
● LOF
Line Status: 2
● AIS
○ FERF
Path Status: 32
○ LOP
● AIS
● Yellow

OCx Statistics

Section
BIP-8s: 2062708253
LOSs: 68,867
LOFs: 0

Line
BIP-24s: 34
FEBEs: 33
AISs: 0
FERFs: 0

Path
BIP-8s: 11
FEBEs: 0
LOPs: 0
AISs: 0
Yellows: 0

Header Check
Correctable: 0
Uncorrectable: 0

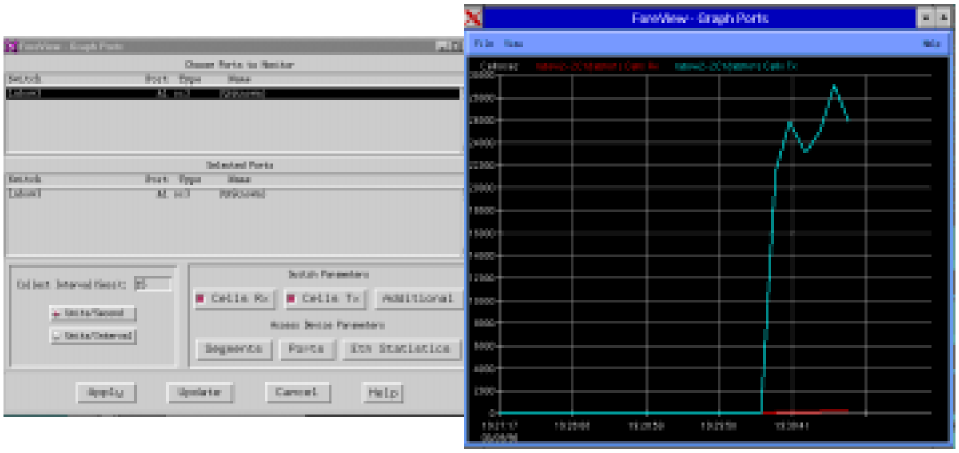
Notice that Port related ForeView statistics are collected on the Port Control screen and on the Media Control screen.

Notice also that there is a Graph and a Log button on each of these screens to allow graphing or logging of the statistical data.

These features are shown on the next two slides.

Port Graphing

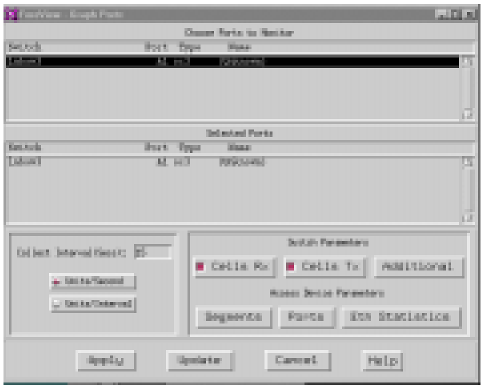
- **The Graph dialog box will yield the graph.**

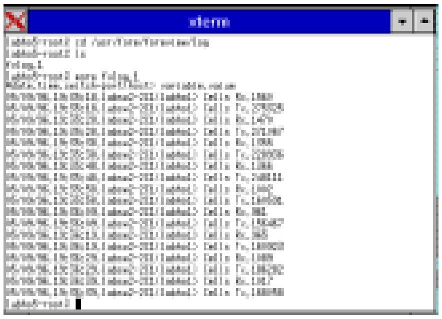


When you select Graph from the Port Control screen, the Graph Tool dialog box appears, which allows you to select which items will be graphed.

Port Logging

- **The logging dialog box is very similar to the graphing box.**



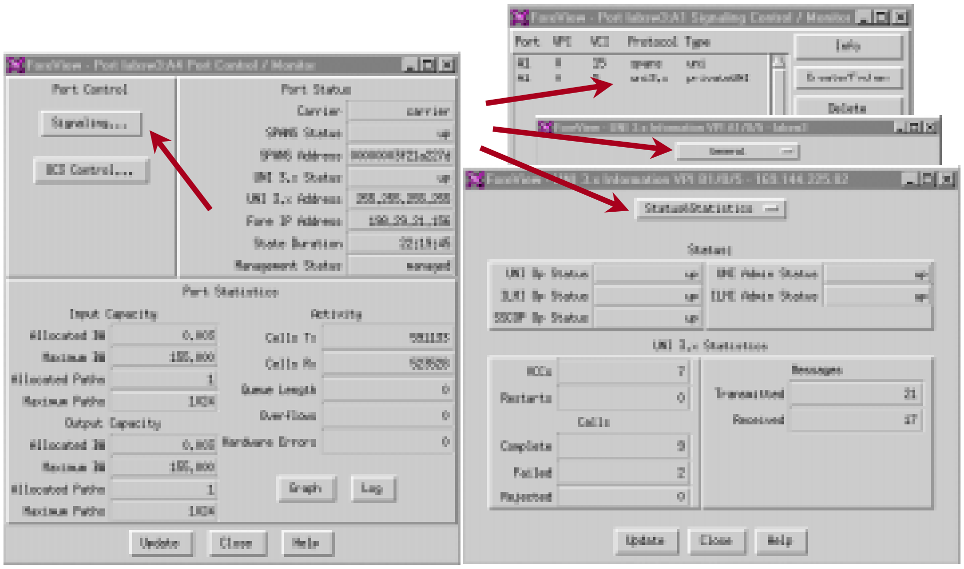


```
[illegible] cd /usr/fore/foreview/log
[illegible] ls
fvlog.1
[illegible] more fvlog.1
#date,time,switch-port(host) variable,value
[illegible]
```

When you select Log from the Port Control screen, the Logging dialog box appears, which allows you to select which items will be logged and the logging interval.

All logged items will be stored as comma-delimited text files in the foreview directory under /log/fvlog.1.

Statistics (signaling)



Port Control

Port Status

Carrier	carrier
SPANS Status	up
SPANS Address	[illegible]
UNI 3.x Status	up
UNI 3.x Address	255.255.255.255
Fore IP Address	198.29.21.156
State Duration	22:13:45
Management Status	managed

Port Statistics

Input Capacity		Activity	
Allocated BW	0.008	Cells Tx	581135
Maximum BW	155.000	Cells Rx	525828
Allocated Paths	1	Queue Length	0
Maximum Paths	1024	Overflows	0
Output Capacity		Hardware Errors	0
Allocated BW	0.008		
Maximum BW	155.000		
Allocated Paths	1		
Maximum Paths	1024		

Port	VPI	VCI	Protocol	Type
A1	0	15	spans	uni
A1	0	5	uni3.x	privateUNI

Status

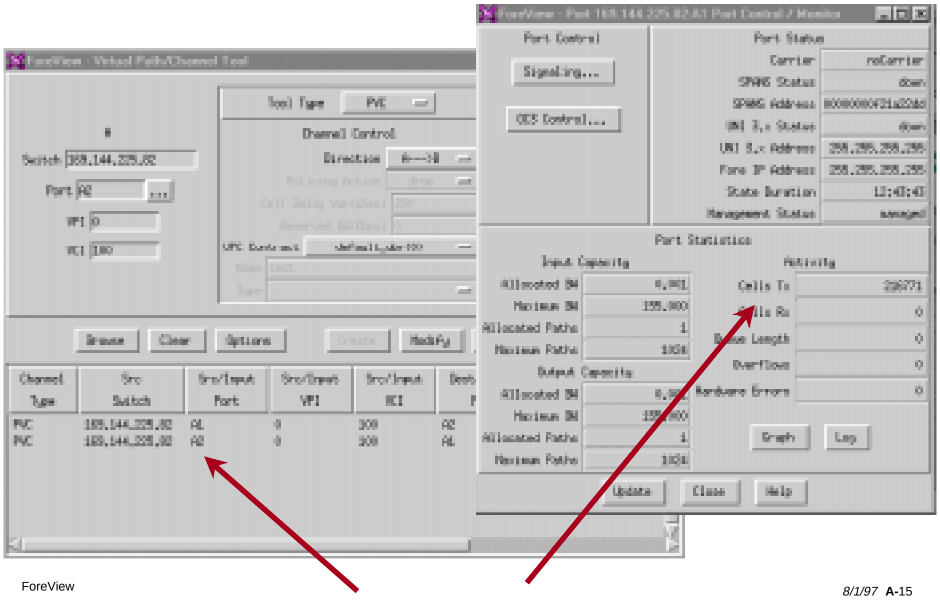
UNI Op Status	up	UNI Admin Status	up
QSAAL Op Status	up	ILMI Admin Status	up
SSCOP Op Status	up		

UNI 3.x Statistics

		Messages	
VCCs	7	Transmitted	21
Restarts	0	Received	17
Calls			
Complete	3		
Failed	2		
Rejected	0		

Signaling statistics in ForeView are obtained by selecting “Signaling” from the Port Control screen shown above on the left. This brings up the Signaling Control screen shown above (upper right). By selecting the type of signaling you want information about, and clicking the upper right info button you are taken to the Signaling Information screen. By selecting “Status & Statistics” from the button at the top, you will see the Signaling Status and Statistics information.

Statistics (connection)


ForeView - Virtual Path/Channel Tool
Browse
Clear
Options
Create
Modify
ForeView - Port 169.144.225.82:A1 Port Control / Monitor
Port Control
Signaling...
OES Control...
Graph
Log
Update
Close
Help

Switch 169.144.225.82
Port A2
VPI 0
VCI 100

Tool Type PVC

Channel Control
Direction A<-->B
Policing Action drop
Cell Delay Var(uSec) 250
Reserved BW(Kbps) 0
UPC Contract <default_ubr 0>
Name test
Type

Channel Type	Src Switch	Src/Input Port	Src/Input VPI	Src/Input VCI	Dest
PVC	169.144.225.82	A1	0	100	A2
PVC	169.144.225.82	A2	0	100	A1

Port Status

Carrier	noCarrier
SPANS Status	down
SPANS Address	00000000f21a22dd
UNI 3.x Status	down
UNI 3.x Address	255.255.255.255
Fore IP Address	255.255.255.255
State Duration	12:43:43
Management Status	managed

Port Statistics

Input Capacity	
Allocated BW	6,001
Maximum BW	155,000
Allocated Paths	1
Maximum Paths	1024
Output Capacity	
Allocated BW	6,001
Maximum BW	155,000
Allocated Paths	1
Maximum Paths	1024

Activity	
Cells Tx	216771
Cells Rx	0
Queue Length	0
Overflows	0
Hardware Errors	0

ForeView

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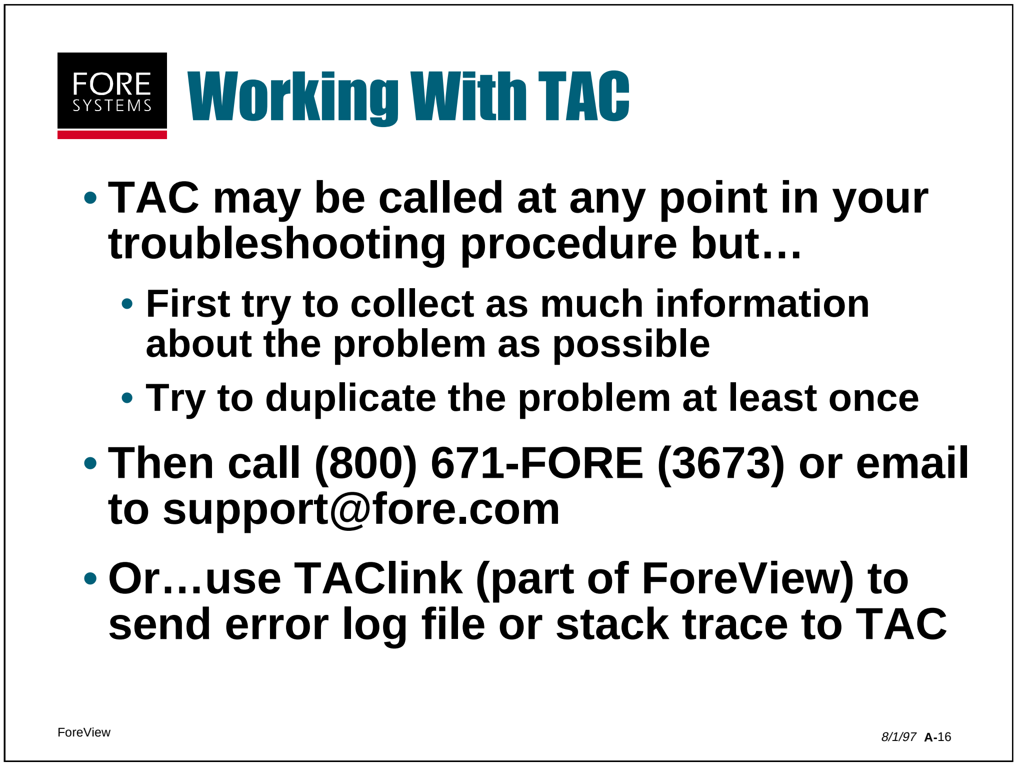
Connection statistics within ForeView are displayed in two areas.

If you select a particular type of connection under “Control VPC/VCC” on the Front Panel display, you will be taken to that type of connection’s channel tool (PVC is shown above on the left).

When you browse that conection type, information is displayed showing all connections of that type, including uptime.

Also, information such as transmitted cell counts and errors associated with cell movement can be found as part of the port status screen (right click on a selected port).



Working With TAC

- TAC may be called at any point in your troubleshooting procedure but…
  - First try to collect as much information about the problem as possible
  - Try to duplicate the problem at least once
- Then call (800) 671-FORE (3673) or email to support@fore.com
- Or…use TACIink (part of ForeView) to send error log file or stack trace to TAC

ForeView

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TAC may be called, faxed, emailed or written anytime you encounter a problem with FORE equipment, but it will help both parties if some information collection is done first.

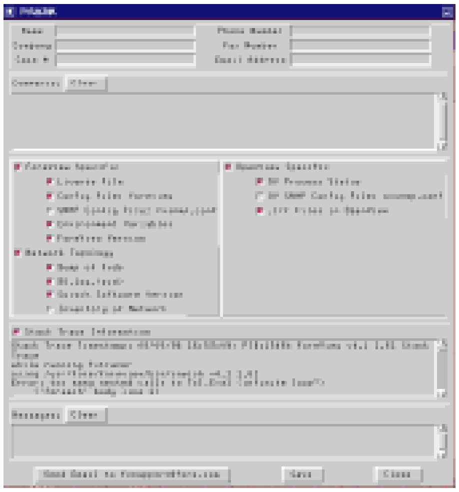
As part of ForeView, we also offer TACIink, which is an automated way to inform TAC of a problem encountered by ForeView at your site.

The following slide shows the TACIink screen and explains how it is used.

FORE SYSTEMS

ForeView TAClink

- Auto/manual retrieval of critical network information
- Automatically e-mailed to FORE’s Technical Assistance Center (TAC)
- Simplifies and speeds problem resolution
- The fvtaclnk form lets you enter information about the stack trace, comments, and environment before it is sent via e-mail to TAC



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FV TAClink is a GUI application provided with ForeView that helps the user of ForeView report problems back to FORE Systems' Technical Assistance Center (TAC). ForeView applications launch FV TAClink automatically when a "fatal error" occurs in the application. Alternatively, the user may launch FV TAClink directly from the command-line. FV TAClink allows the user to provide information about the ForeView user, and also retrieves information about the system on which ForeView is running. A user may select which pieces of information should not be included. The information that is gathered is automatically packaged by FV TAClink, and the user may choose to send the information directly to FORE Systems' Technical Support via email, or to save the information to file. The information is stored in clear text so that the user can inspect the information and make sure that no company-sensitive information is mistakenly sent to FORE Systems.

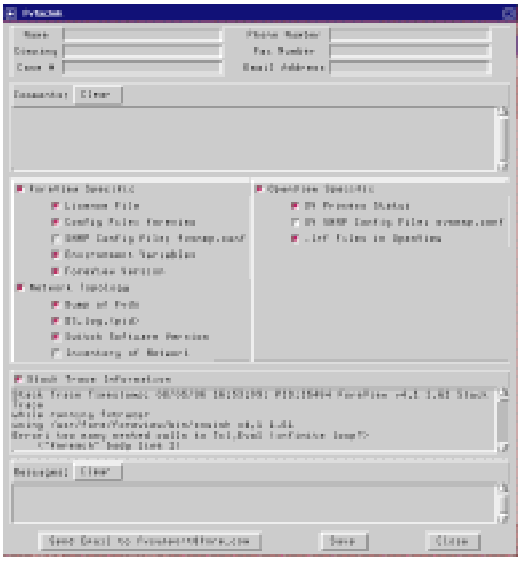
The information that FV TAClink gathers from the ForeView workstation is organized into 3 sections. First, there is ForeView-specific information, including the ForeView license file, the ForeView site-wide configuration file, ForeView version, etc. Second, there is Switch Topology information, which gives Technical support some information about the network that is being managed with ForeView. Finally, there is OpenView-specific information which is retrieved, including a database dump, local registration files, etc. A section for user comments exists so that the user can insert more information about what caused the fatal error to occur.

If a stacktrace file is not specified, the error.log file in /usr/fore/foreview/tmp directory is sent (as long as the environment variable FOREVIEW_HOME is set).

Selectable filter options (ForeView Specific, Network Topology, OpenView Specific) provide additional information to aid in troubleshooting your problems. In addition, use the Comments box to provide additional configuration information (SNMP configuration, software version, etc.).

fvtaclnk form

- **The fvtaclnk form lets you enter information about the stack trace, comments, and environment before it is sent via e-mail to FORE TAC**



```
Stack Trace Timestamp: 08/05/96 16:53:09: PID:15464 ForeView v4.1 1.61 Stack
Trace
while running foreuser
using /usr/fore/foreview/bin/xxwish v4.1 1.61
Error: too many nested calls to Tcl_Eval (infinite loop?)
    ("foreach" body line 3)
```

ForeView

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If a stacktrace file is not specified, the error.log file in /usr/fore/foreview/tmp directory is sent (as long as the environment variable FOREVIEW_HOME is set).

Selectable filter options (ForeView Specific, Network Topology, OpenView Specific) provide additional information to aid in troubleshooting your problems. In addition, use the Comments box to provide additional configuration information (SNMP configuration, software version, etc.)