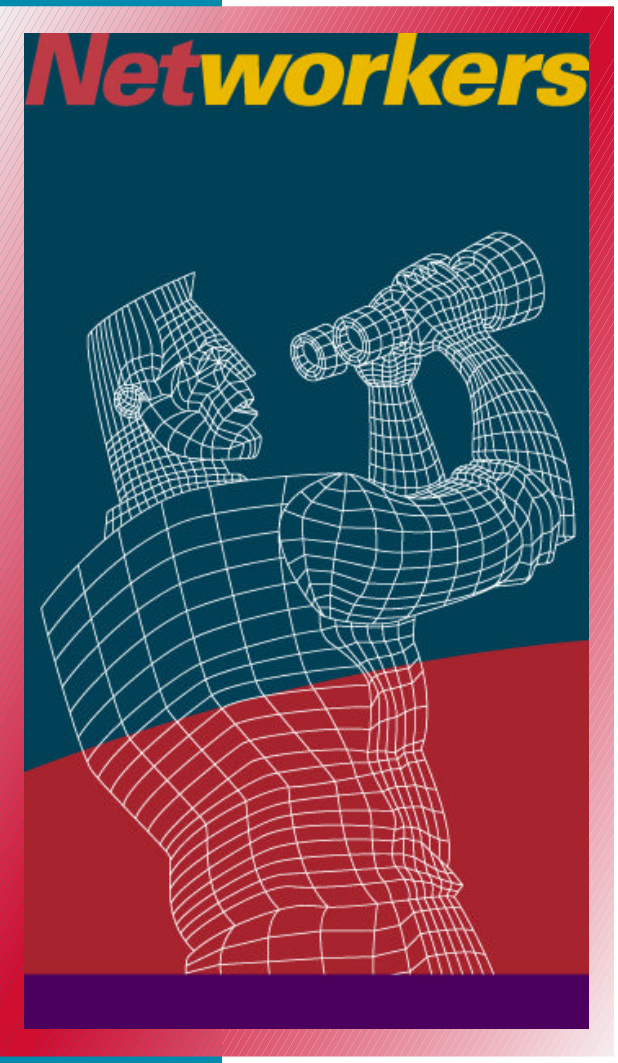


Managing Campus Networks

Cisco Systems

Agenda

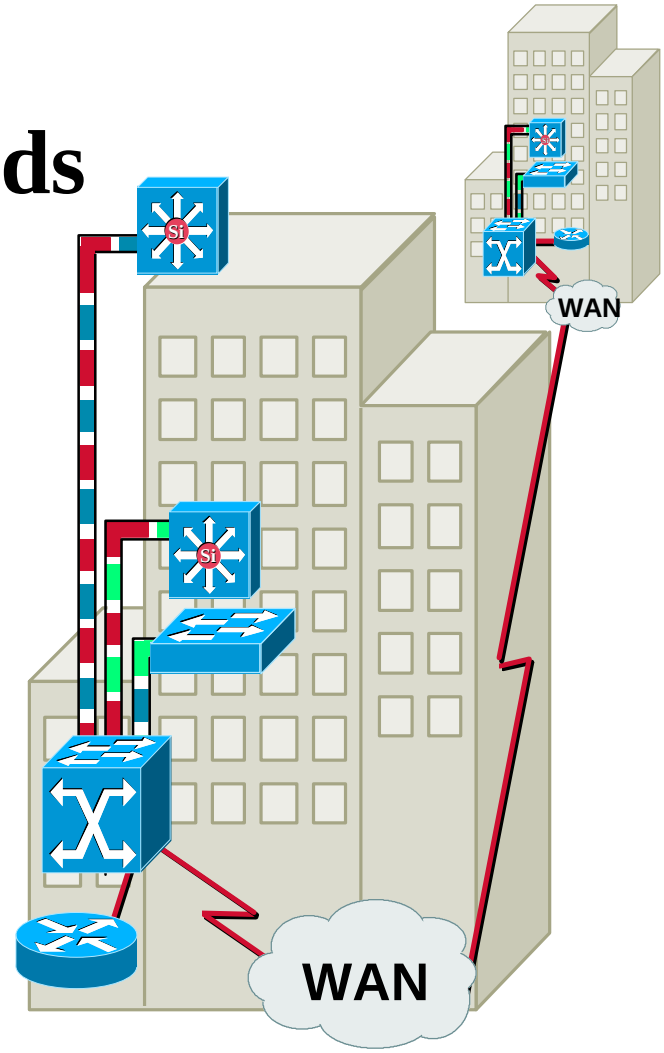
- **Campus Networks**
  - **Current Campus Network Products and Technologies**
  - **Current Campus Management Challenges**
- **Typical Campus Management Problem Scenarios**
- **Campus Management Product Overview**
- **Network Management Product Directions**
- **Summary**

Cisco Systems

What's Going on in Campus Networks?

Market Trends

- Hubs being replaced with switches
  - Catalyst® 5x00s, 3x00s, 2900s, etc.
- Increase in network users (i.e. up to 10,000) for a typical campus
- Increase in switch deployment (20–500+)
- Using logical network segmentation (i.e. VLANs)
- Deploying ATM, Fast Ethernet, Gigabit Ethernet in the backbone
  - LightStream® 1010s, Fast EtherChannel, etc.
- Using both centralized and distributed routing
  - RSMs, Cisco 7500s, etc.
- Introducing Layer 3 high-speed switching
  - NFFCs, RSMs



Cisco Systems

Network Management Challenges

- **Device-level (including end-user stations):**
  - **Tracking location and statistics**
  - **Configurations**
  - **Monitoring status and health performance**
- **Network-level:**
  - **Maintaining inventory**
  - **Configuring hardware and upgrading software**
  - **Performance monitoring and trending**
  - **Verifying connectivity and availability**
  - **Providing secure access**
  - **Tracking failures and alerts**
- **Management consoles:**
  - **Quantity of systems and applications**
  - **OS dependencies and processing power**
  - **Data storage and archiving**

CISCO SYSTEMS

Example Scenarios

Typical Campus Management Challenges

- Tracking network hardware and software inventory
  - Year 2000 compliance verification
- Upgrading network device software
- Tracking end-user stations
- ATM network configuration and monitoring
- Proactive WAN/Frame Relay usage monitoring

Cisco Systems

Scenario #1: Tracking Network Inventory

Company XYZ

- **CIO is conducting an audit**
  - **Need an accurate inventory of network switches and routers by week's end**
  - **Must verify all network software and provide a Year 2000 compliance report**
- **Challenges**
  - **100's of network devices**
  - **Insufficient planning time**
  - **Outdated topology understanding**
  - **Outdated hardware and software inventory**
  - **Unknown versions of compliant software**

Cisco Systems

Scenario #1: Tracking Network Inventory

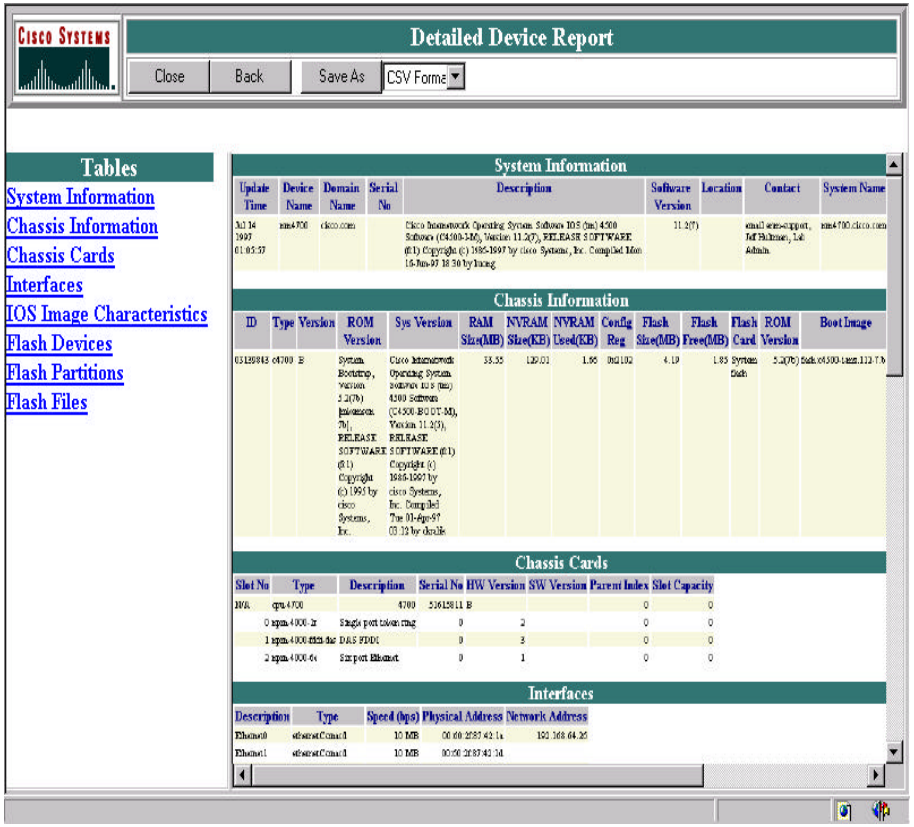
- **Traditional approaches**
  - **Manual collection of inventory**
    - **Check physical hardware**
    - **Check software versions (via CLI or Telnet)**
    - **Enter into spreadsheet**
    - **Find vendors' Y2K compliant software versions**
    - **Compare installed software with versions Y2K certified by vendors**
  - **Use of an NMS for discovery**
    - **Typically provides only device type, IP address and/or host name**

Tedious and Time Consuming!

Cisco Systems

Scenario #1: Tracking Network Inventory

- **Solution: Cisco Resource Manager (CRM)**
  - **Network data imported from NMS or from CiscoWorks**
  - **Provides complete report on network devices— including module level information**
  - **User customizable**
  - **Updated periodically**



Cisco Systems

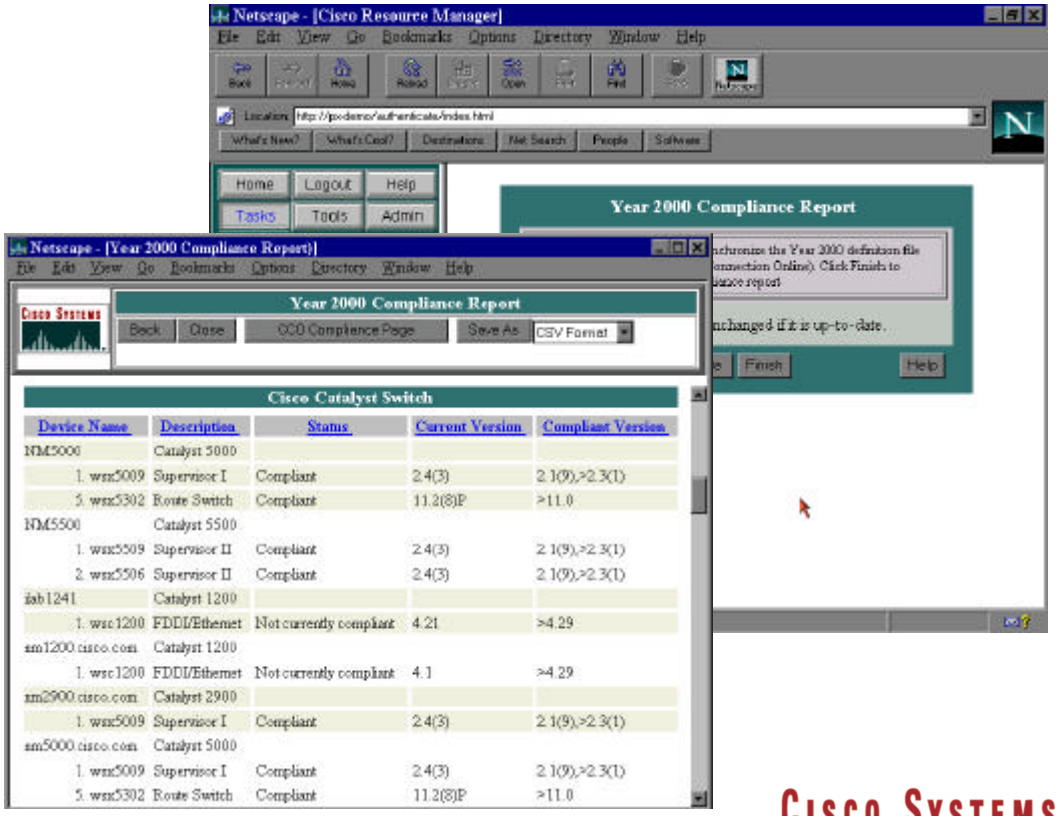
Scenario #1: Tracking Network Inventory

Year 2000 Compliance Checking

- **Solution: CRM**

  Automates year 2000 verification checking of your Cisco network inventory

  Updates based on latest CCO data



Easy and Accurate!

Cisco Systems

Scenario #2: Upgrading Network Device Software

Company XYZ

- Evaluated and certified Cisco IOS™ version 11.1 for routers and Catalyst 2.4.3 software for Catalyst 5000s
- Need to migrate from Cisco IOS 10.3 to Cisco IOS 11.1 for 75 routers and from 2.1.6 to 2.4.3 for 300 switches
- Challenges
  - Combination of router images and switch configs
  - Unknown hardware requisites
  - Understaffed to handle upgrades
  - Most be completed within a short time frame

Cisco Systems

Scenario #2: Upgrading Network Device Software

- **Traditional approach**
  - **Identify resource availability for project**
  - **Determine impact of upgrade**
  - **Review manual process**
  - **Acquire software from vendor(s) and test process**
  - **Schedule upgrades**
  - **Distribute software and validate, device-by-device**

Catalyst Software Upgrade Process

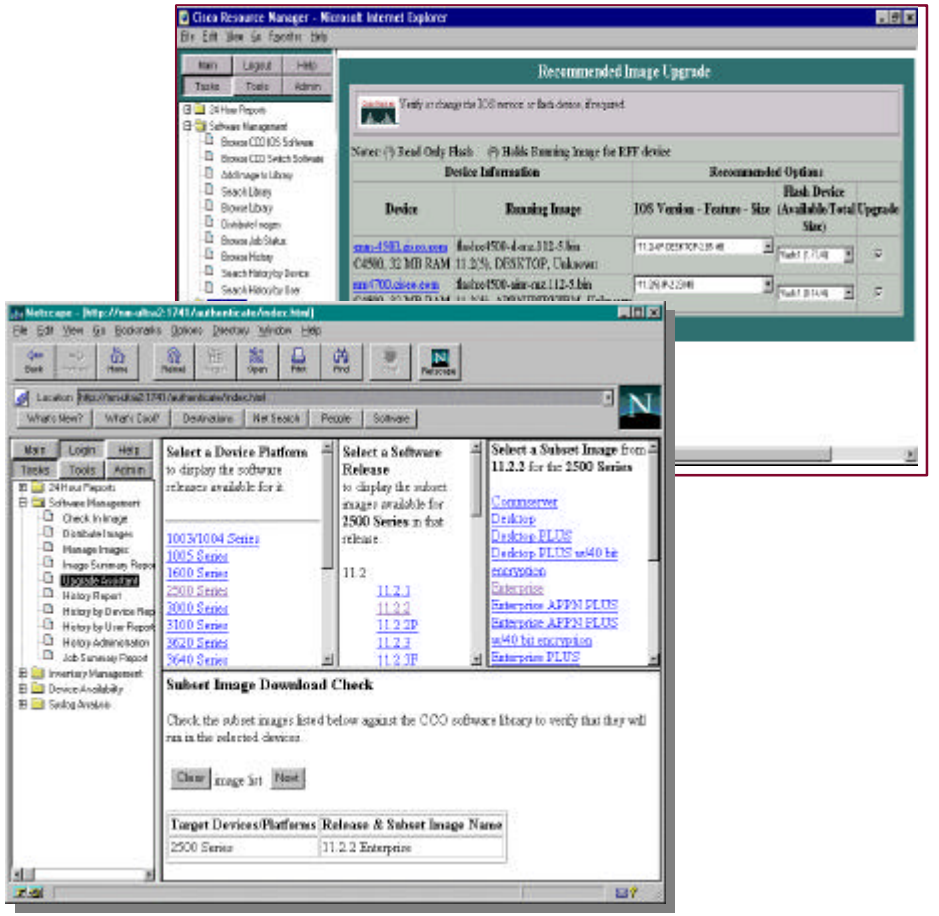
Itm	Task	Tools	Secured	Man/Aut	Time Req.
A.	**Planning**				
1	Identify Cat5 for upgrade	Spreadsheet	Y	M	20
2	Check Pre-reqs	Release Notes	N	M	120
3	Split up upgrades	Spreadsheet	N	M	60
4	Schedule windows	Spreadsheet	N	M	60
			Planning cost:		260
B.	**Implementation**				
1	Telenet to box	Telnet	Y	M	1
2	Initiate TFTP command for backup	TFTP	Y	M	2
3	Copy image to TFTP server	TFTP	Y	M	5
4	Initiate TFTP command for device	TFTP	Y	M	1
5	Copy image to box	TFTP	Y	M	5
6	Validate image copy	Telnet	N	M	2
7	Reload device	CLI	Y	M	3
8	Validate image reload	Telnet	Y	M	2
			Per device cost:		21

A Slow Process Susceptible to Problems!

Cisco Systems

Scenario #2: Upgrading Network Device Software

- **Solution: CRM**
  - **Automates image creation and distribution**
  - **Recommends image download from CCO**
  - **Checks device hardware and software requisites**
  - **Retrieves and backups images**
  - **Provides batch image distribution and reboot**



Fast and Efficient!

Cisco Systems

Scenario #3: Tracking End-User Stations

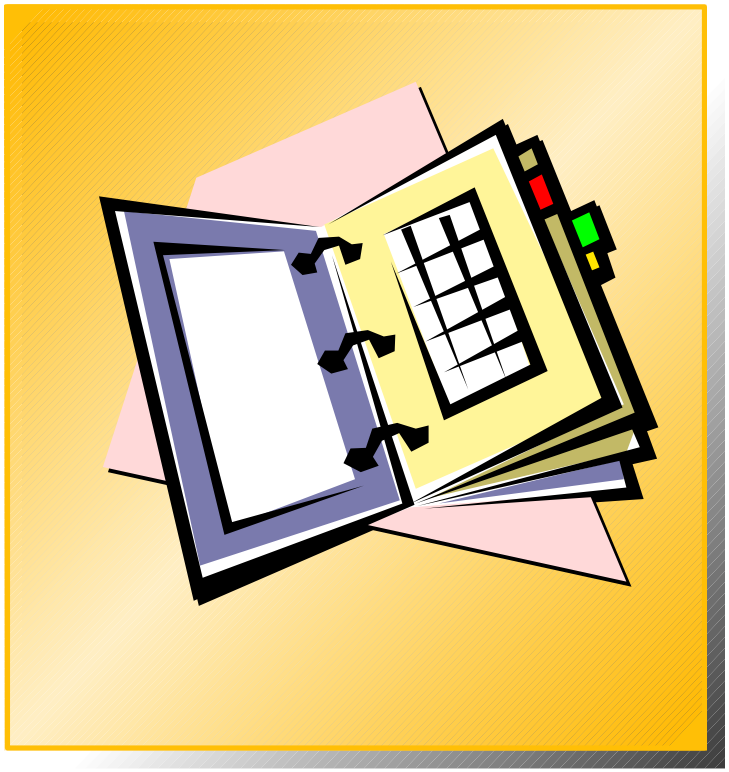
Company XYZ

- **Need to obtain an up-to-date end-user station inventory and location report**
  - **Will assist in troubleshooting end-station problems**
- **Challenges**
  - **Outdated user inventory/location information**
  - **100's of end-user stations**
  - **Insufficient time for gathering data**
  - **Supporting dynamic networks with mobile users**

Cisco Systems

Scenario #3: Tracking End-User Stations

- **Traditional approaches**
  - **Manually gather end-station statistics and enter into spreadsheet**
    - **MAC address**
    - **IP Address**
    - **Station/host name**
    - **User name**
    - **Wall jack location**
    - **Switch and switch port, etc.**
  - **Use an NMS to collect information about IP clients**

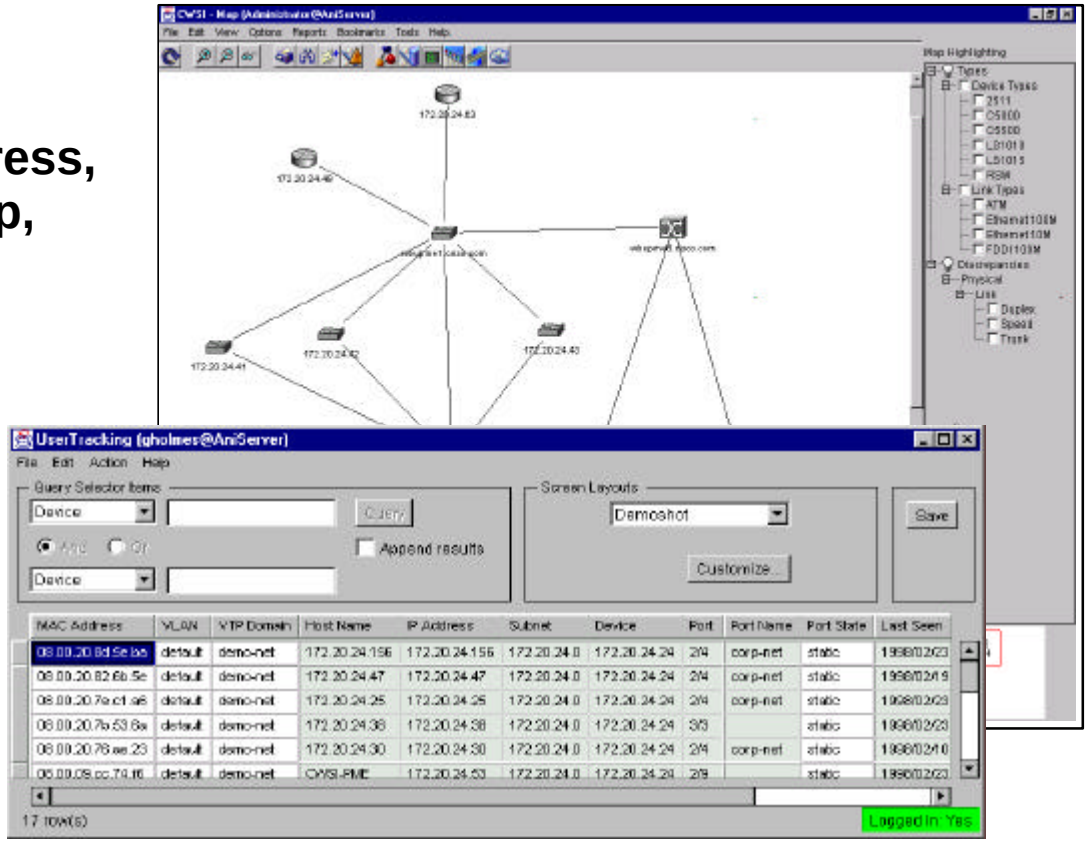


Too Many Changes to Keep Accurate!

Cisco Systems

Scenario #3: Tracking End-User Stations

- **Solution: CWSI**
  - **Automatically gathers station information: MAC and IP address, host name, VLAN membership, attached switch, etc.**
  - **Display can be customized by the user**
  - **Supports queries, pinpoints location and provides for more detailed analysis**
  - **Updates Catalyst switches for dynamic VLAN support (i.e. VMPS)**



Automatically Discovers End Station Data!

Cisco Systems

Scenario #4:
ATM Configuration and Monitoring

Company XYZ

- **Deploying ATM in the backbone network**
  - **Migrating from FDDI to ATM backbone**
  - **Utilizing LightStream 1010s and Catalyst 5x00 switches**
- **Challenges**
  - **Lack of expertise in ATM technology**
  - **Creating Emulated LANs (ELANs) to maintain LAN connectivity**
  - **Monitoring VC usage throughout the network**

Cisco Systems

Scenario #4: ATM Configuration and Monitoring

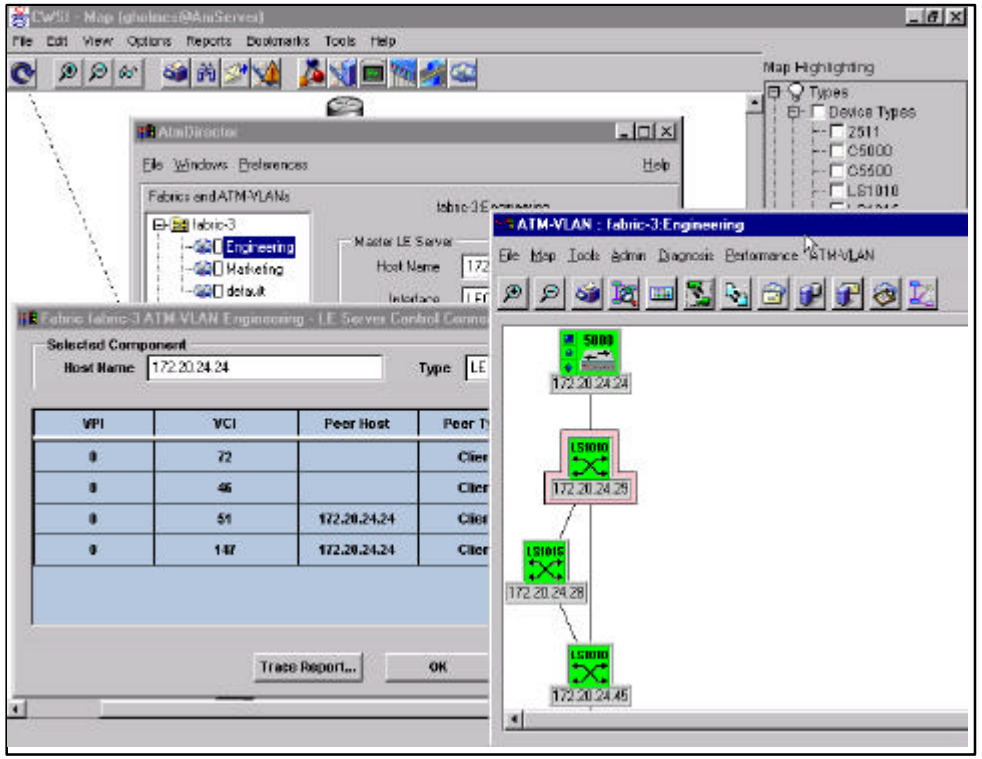
- **Traditional approach**
  - **Use CLI or Telnet for device-by-device:**
  - **ELAN configuration**
    - **LEC, LES/BUS, LECS**
    - **Active, backup**
  - **VC monitoring**

Lacks a Network-Wide Focus!

Cisco Systems

Scenario #4: ATM Configuration and Monitoring

- **Solution: CWSI**
  - **Automatically discovers ATM devices and links**
  - **Provides easy configuration of ATM VLANs (i.e. ELANs)**
  - **Offers simple setup of LANE components**
  - **Monitors status of LANE components**
  - **Tracks and monitors ATM links and VCs end-to-end**



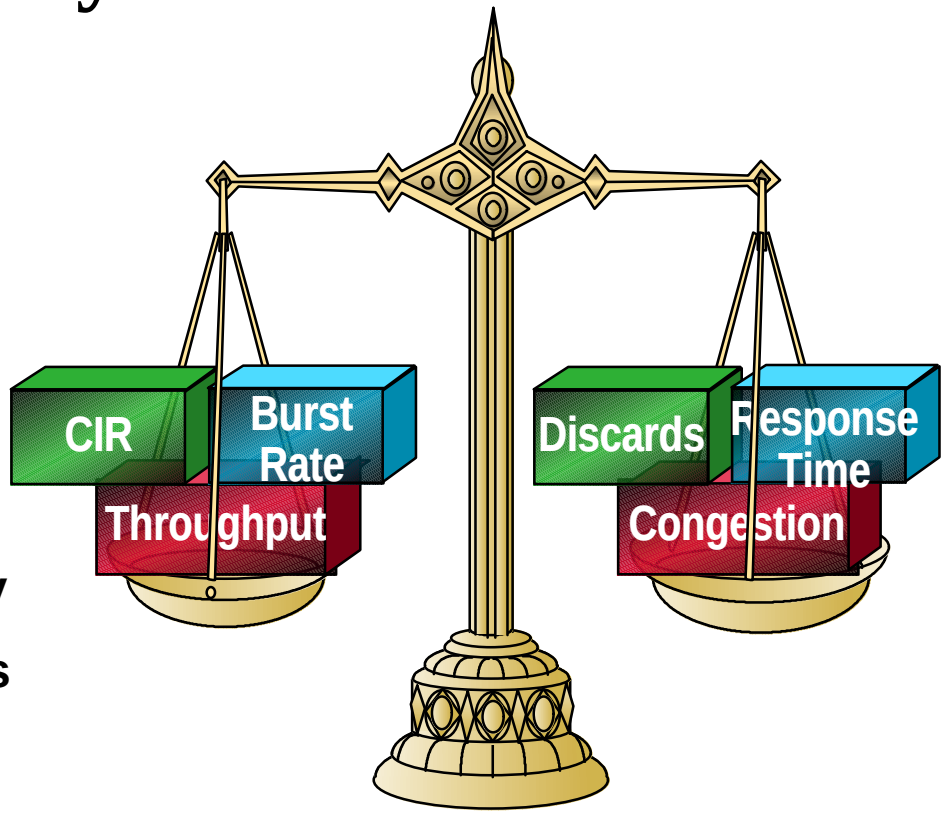
Eases ATM Management!

Cisco Systems

Scenario #5: Proactive WAN/Frame Relay Monitoring

Company XYZ

- **Deploying T1, T3 links for connectivity to remote sites**
  - **Increase of LAN-based traffic over wide-area links**
- **Challenges**
  - **Optimizing bandwidth allocation**
  - **Providing high network availability**
  - **Quick resolution of WAN problems**
  - **Tracking and allocation of costs**
  - **Planning for future bandwidth requirements**



Cisco Systems

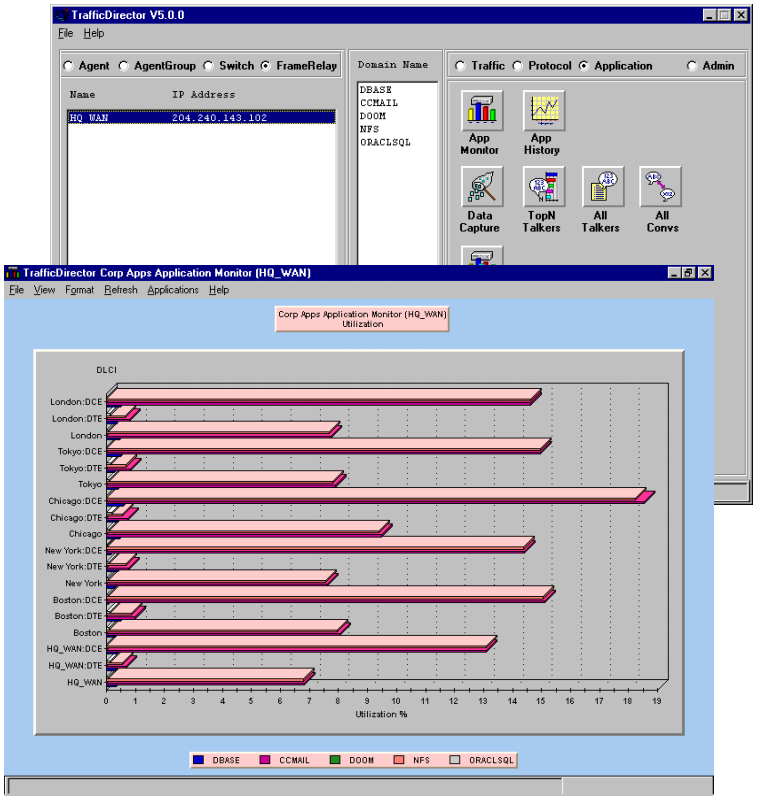
Scenario #5: Proactive WAN/Frame Relay Monitoring

- **Traditional approaches**
  - **Gather router WAN interface statistics**
    - **SNMP polling**
  - **Use network analyzers**
    - **Portable**
    - **Protocol-level analysis**

CISCO SYSTEMS

Scenario #5: Proactive WAN/Frame Relay Monitoring

- **Solution: CWSI and SwitchProbes**
  - **Utilizes RMON2-compliant T1 and T3 probes on WAN links**
  - **Gathers statistics on DLCIs and CIRs**
  - **Detailed 7-layer analysis on a per-PVC basis**
  - **Provides real-time and long-term trending data for network baselining and forecasting**
  - **Same powerful traffic management available in the LAN**



Applications/DLCI

Pinpoints WAN Bottlenecks!

Cisco Systems

Network Management Product Overview

- Agents
- Applications

Cisco Systems

Cisco Management Agents

- **Cisco IOS provides embedded management across all devices**

SNMP
MIB Structures
RMON
Security

HTTP Servers
NetFlow™
Diagnostics

Cisco IOS™

Switches

SNMP v1.0, 2.0c
RMON ('mini-RMON'),
Telnet/CLI,
NetFlow

SwitchProbes

RMON,
RMON 2,
NetFlow,
CLI

Routers and Access Servers

SNMP v1.0, v2.0c
RMON, Telnet/CLI,
HTTP Server, Trace Route,
Accounting, NetFlow

Cisco Systems

Enhanced Agent Technologies

- **Industry standards**
  - **SNMP: device get and sets**
  - **RMON, RMON2: traffic monitoring**
  - **ILMI: ATM discovery**
- **Cisco extensions**
  - **CDP: adjacent neighbor discovery**
  - **ISL: VLAN trunking**
  - **VTP: automated VLAN setup**
  - **VMPS: dynamic VLANs**
  - **VQP: dynamic station Id**

Cisco Systems

Campus Management Applications

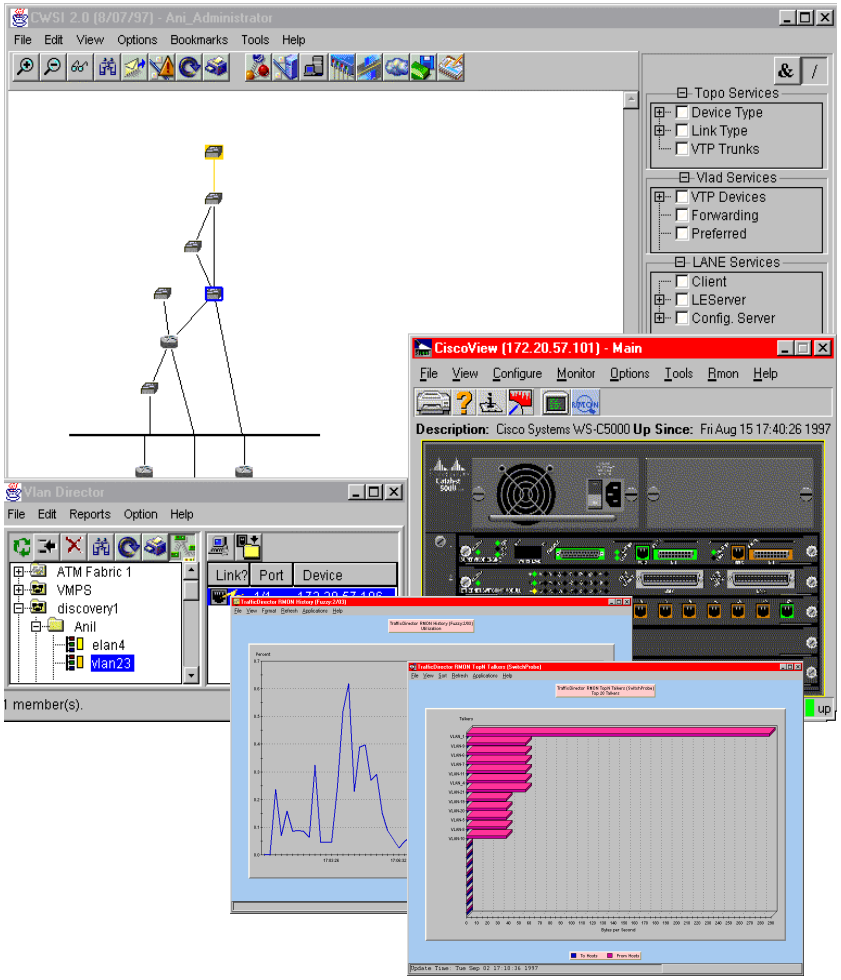
- CiscoWorks for Switched Internetworks (CWSI)
  - Catalyst and LightStream switch focused
  - Supports Windows NT and UNIX operating systems
  - Compliments CiscoWorks and Cisco Resource Manager (CRM)
  - Standalone solution that can integrate with NMSs
  - Currently includes CRM bundled in product package

- Cisco Resource Manager (CRM)
  - Supports Cisco routers and switches
  - Offered on Windows NT and UNIX operating systems
  - Complete Web-based architecture
  - Standalone solution that also integrates with CiscoWorks, CWSI and network management systems (NMSs)

CWSI Overview

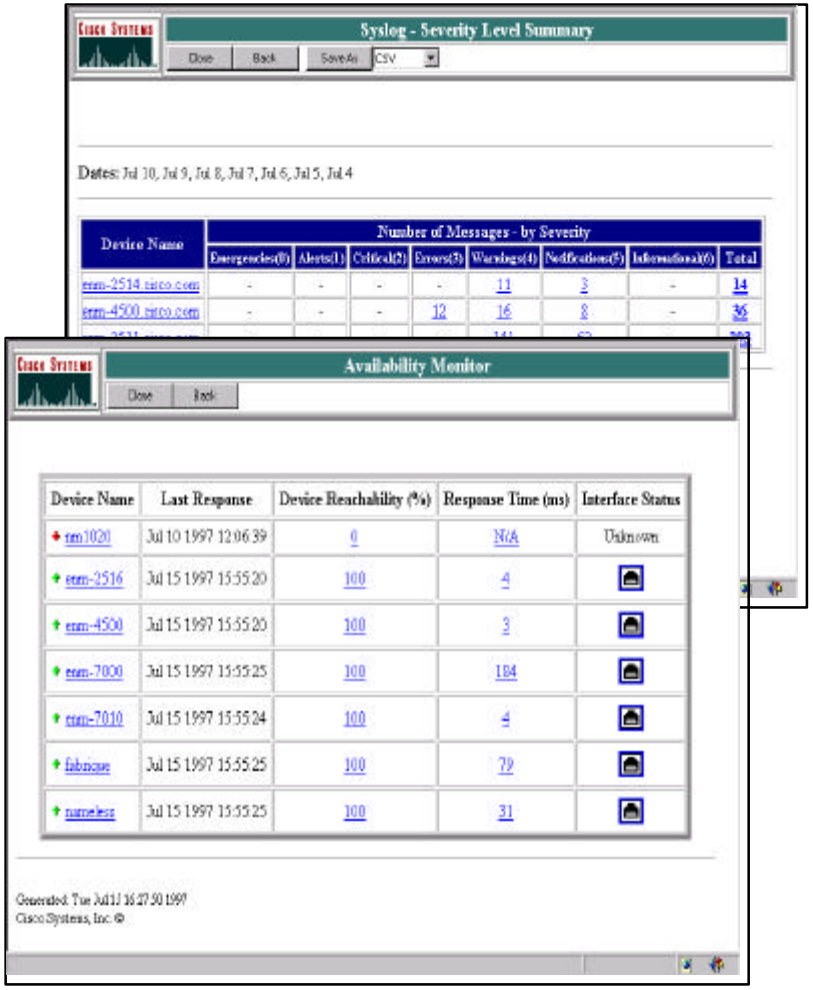
Enterprise Manageability

- Comprehensive network discovery and topology mapping
- Campus-wide scalability
- Powerful device configuration and monitoring
- VLAN configuration and monitoring
- Integrated ATM management
- Network-wide analysis and monitoring
- End-station tracking and authentication
- Network diagnostics

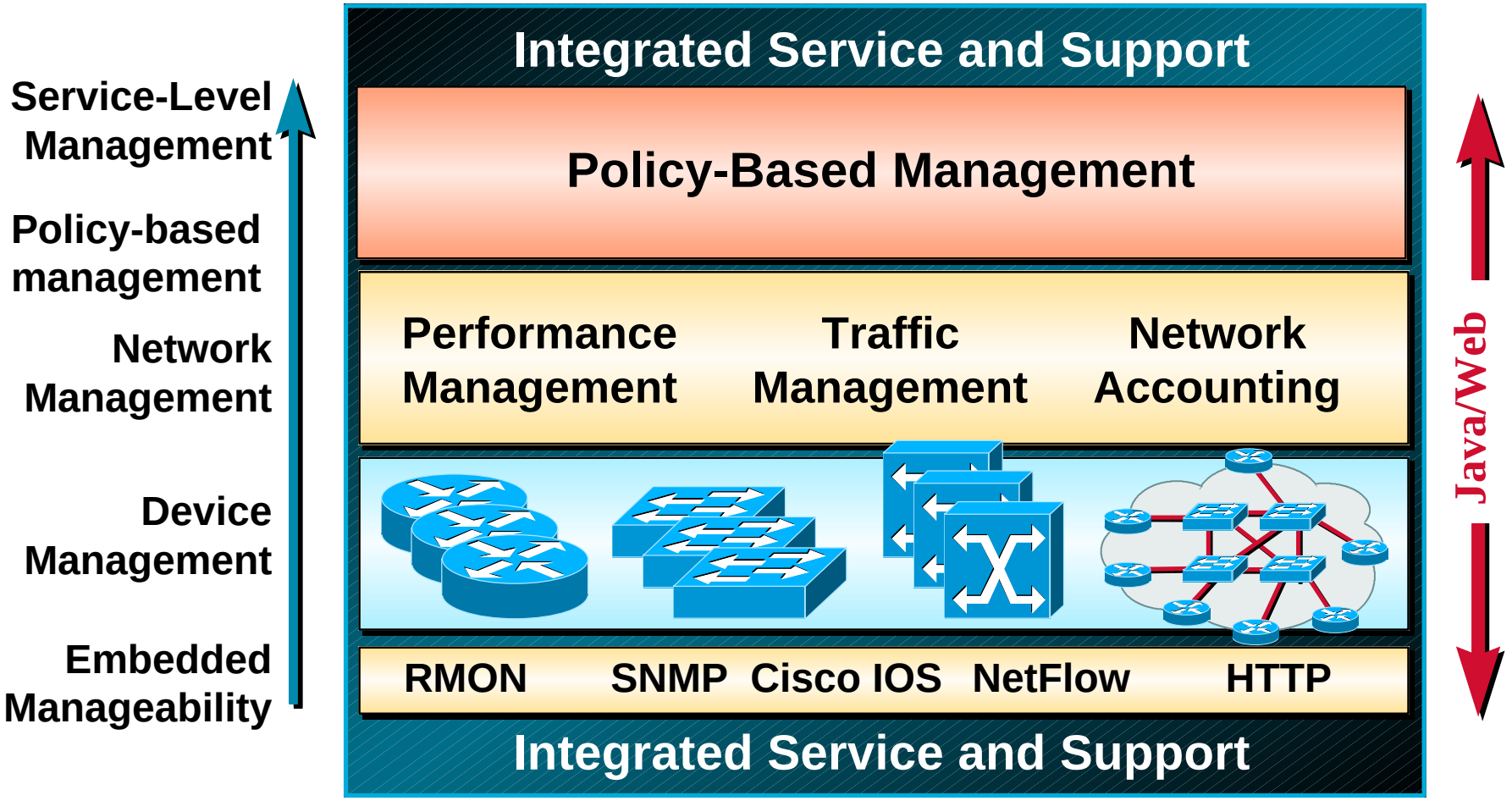


CRM Overview

- **Flexible network inventory reporting of Cisco and other MIB II devices**
- **Generates change reports for hardware and software changes**
- **Distributes software images to routers and switches using wizards**
  checks device prerequisites
- **Schedules download of different images to multiple devices**
- **Reports download status, job details and notification of job results**
- **User-defined views of critical device availability including response time history**
- **View Syslog messages by device, severity, and alert type**

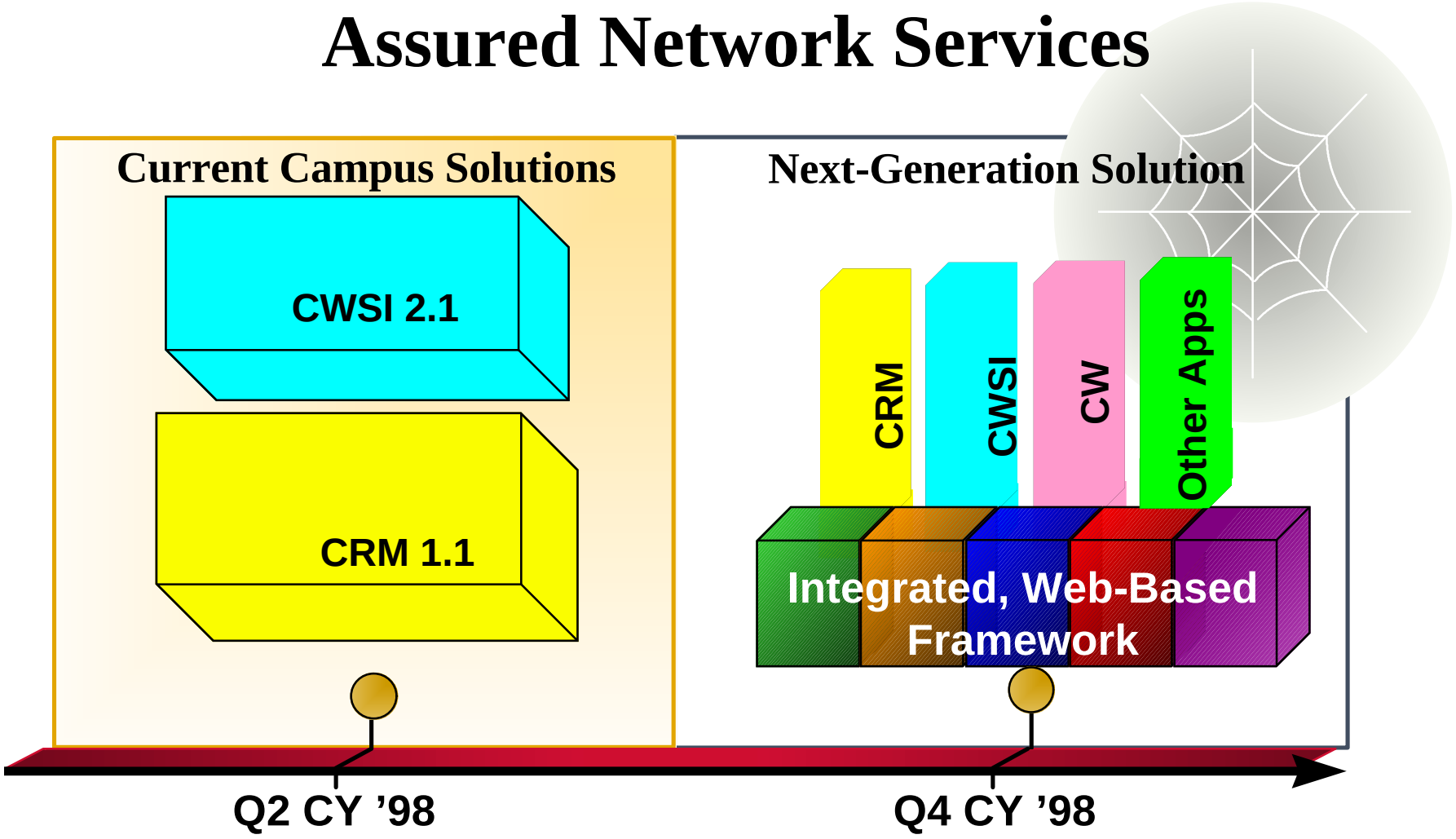


Cisco Network Management Strategy: Assured Network Services



Network Management Product Directions

Assured Network Services



Summary

Cisco Campus Management Solutions

- **Powerful embedded management combined with comprehensive applications that address typical network management challenges**

  CRM: Easy-to-use, Web-based management suite for administering routers and switches throughout your network

  CWSI: Powerful application suite for managing ATM and LAN switches throughout your network

- **Simplify and expedite the deployment and operation of Cisco networks**

- **The foundation for the Assured Network Services strategy**

  Evolving to a complete Web-based architecture

  Evolving to to support policy-based management

For More Information

- **Related NetWorkers presentations:**

  Cisco Enterprise Accounting—Ben Gibson

  Designing Web-based Network Management—John McCormack

  Policy Implementation and Management—Joe Hielscher

- **Cisco network management information on the Cisco Connection Online (CCO) Web site:**

  General information:

  http://www.cisco.com/warp/public/734/

  Enterprise Network Management Products

  http://www.cisco.com/warp/public/734/enm.shtml

  Partner information (listings, products, etc.):

  http://www.cisco.com/warp/public/734/partner/

Cisco Systems

CISCO SYSTEMS
EMPOWERING THE
INTERNET GENERATION℠