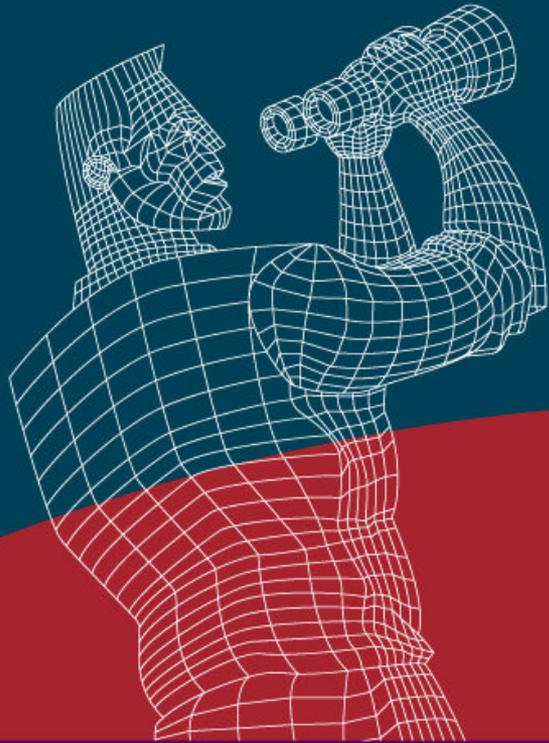
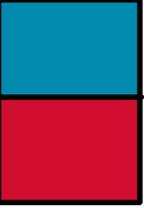


Networkers



Managing Campus Networks



Agenda

- **Campus Networks**

 - Current Campus Network Products and Technologies

 - Current Campus Management Challenges

- **Typical Campus Management Problem Scenarios**

- **Campus Management Product Overview**

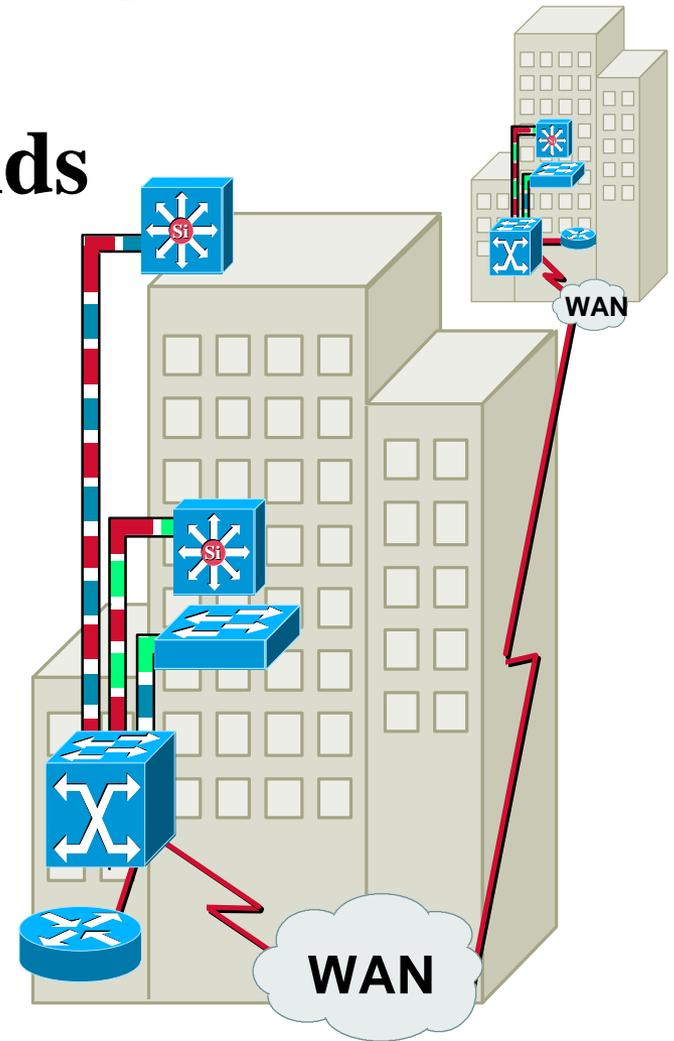
- **Network Management Product Directions**

- **Summary**

What's Going on in Campus Networks?

Market Trends

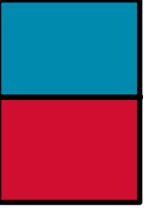
- Hubs being replaced with switches
Catalyst® 5x00s, 3x00s, 2900s, etc.
- Increase in network users
(i.e. up to 10,000) for a typical campus
- Increase in switch deployment (20–500+)
- Using logical network segmentation
(i.e. VLANs)
- Deploying ATM, Fast Ethernet,
Gigabit Ethernet in the backbone
LightStream®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



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





Example Scenarios

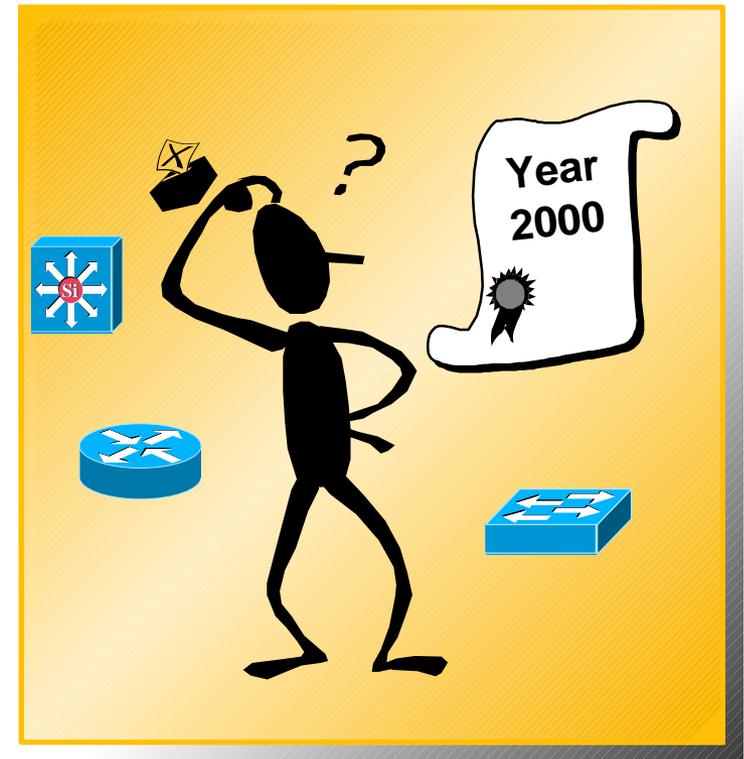
Typical Campus Management Challenges

- **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**

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



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!

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

System Information

Update Time	Device Name	Domain	Serial No	Description	Software Version	Location	Contact	System Name
3/13/07 10:07:57	rm4700	cisco.com		Cisco Internetwork Operating System Software (IOS) (rm4700) (M) 4700 Software (C4700-346), Version 11.2(7), RELEASE SOFTWARE (81) Copyright (c) 1986-2007 by Cisco Systems, Inc. Compiled Mon: 15-Jun-97 18:30 by Hong	11.2(7)		email:rm-support, Inf@Cisco.com, L&A Admin	rm4700.cisco.com

Chassis Information

ID	Type	Version	ROM Version	Sys Version	RAM Size(MB)	NVRAM Size(KB)	NVRAM Used(KB)	Config Reg	Flash Size(MB)	Flash Free(MB)	Flash Card	ROM Version	Boot Image
03129418	04700	B	System Bootstrap, version 3.2(7b)	Cisco Internetwork Operating System Software (IOS) (rm4700) (M) 4700 Software (C4700-346), Version 11.2(7), RELEASE SOFTWARE (81) Copyright (c) 1986-2007 by Cisco Systems, Inc. Compiled Mon: 15-Jun-97 18:30 by Hong	38.55	120.01	1.95	0x2102	4.19	1.83	System	5.2(7b)	boot:0310001rom.112.7.b

Chassis Cards

Slot No	Type	Description	Serial No	HW Version	SW Version	Parent Index	Slot Capacity
0	cpu-4700		4700	51612811 B		0	0
0	spm-4700-2r	Single port sfp-wan-rng		0	2	0	0
1	spm-4700-452a	452a SFP-D01		0	3	0	0
2	spm-4700-6c	6c sfp-port Ethernet		0	1	0	0

Interfaces

Description	Type	Speed (bps)	Physical Address	Network Address
Ethernet0	sfportCanacl	10 MB	00:00:20:87:42:14	102.168.64.25
Ethernet1	sfportCanacl	10 MB	00:00:20:87:42:14	



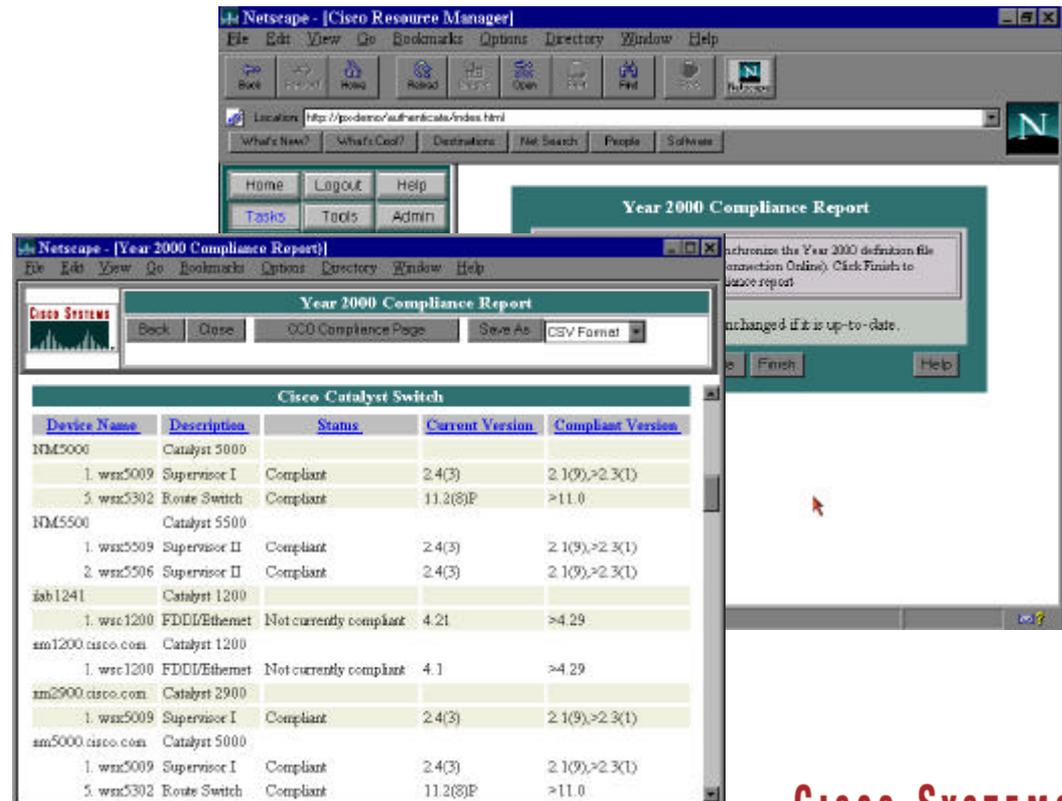
Scenario #1: Tracking Network Inventory

Year 2000 Compliance Checking

- **Solution: CRM**

Automates
year 2000 verification
checking of your
Cisco network
inventory

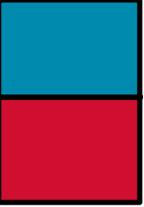
Updates based on
latest CCO data



Device Name	Description	Status	Current Version	Compliant Version
NM5000	Catalyst 5000			
1. wxc5009	Supervisor I	Compliant	2.4(3)	2.1(9),>2.3(1)
5. wxc5302	Route Switch	Compliant	11.2(8)P	>11.0
NM5500	Catalyst 5500			
1. wxc5509	Supervisor II	Compliant	2.4(3)	2.1(9),>2.3(1)
2. wxc5506	Supervisor II	Compliant	2.4(3)	2.1(9),>2.3(1)
lab1241	Catalyst 1200			
1. wxc1200	FDDI/Ethernet	Not currently compliant	4.21	>4.29
nm1200.cisco.com	Catalyst 1200			
1. wxc1200	FDDI/Ethernet	Not currently compliant	4.1	>4.29
nm2900.cisco.com	Catalyst 2900			
1. wxc5009	Supervisor I	Compliant	2.4(3)	2.1(9),>2.3(1)
nm5000.cisco.com	Catalyst 5000			
1. wxc5009	Supervisor I	Compliant	2.4(3)	2.1(9),>2.3(1)
5. wxc5302	Route Switch	Compliant	11.2(8)P	>11.0

Easy and Accurate!

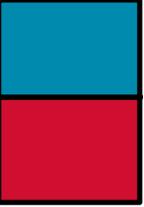




Scenario #2: Upgrading Network Device Software

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**



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

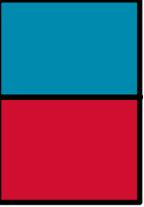
Schedule upgrades

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	Telnet to box	Telnet	Y	M	1
	Initiate TFTP command				
2	for backup	TFTP	Y	M	2
	Copy image to TFTP				
3	server	TFTP	Y	M	5
	Initiate TFTP command				
4	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!





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

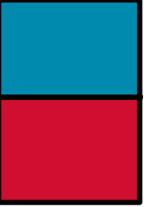
- **Challenges**

Outdated user inventory/location information

100's of end-user stations

Insufficient time for gathering data

Supporting dynamic networks with mobile users



Scenario #3: Tracking End-User Stations

- **Traditional approaches**

Manually gather end-station statistics and enter into spreadsheet

MAC address

IP Address

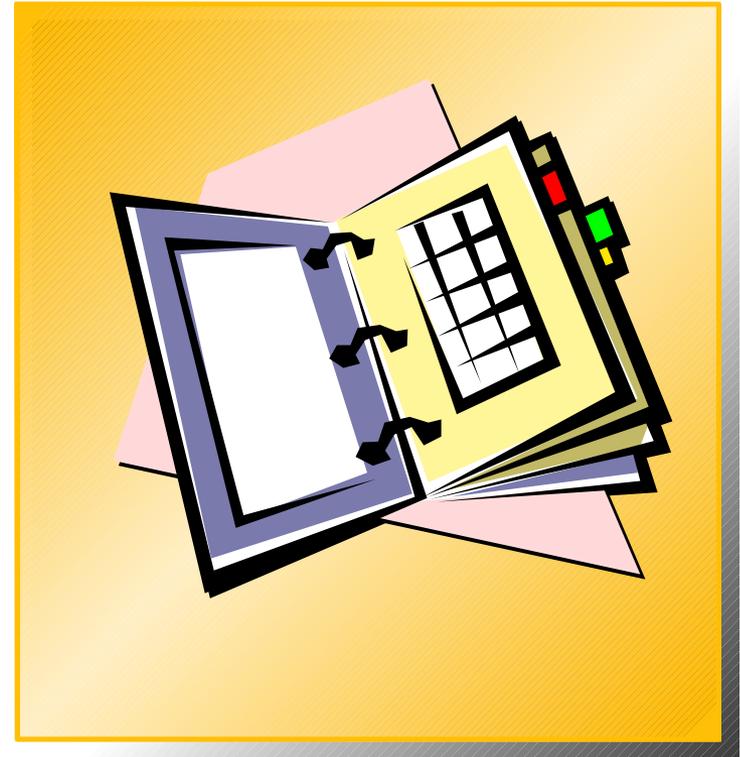
Station/host name

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!

Scenario #3: Tracking End-User Stations

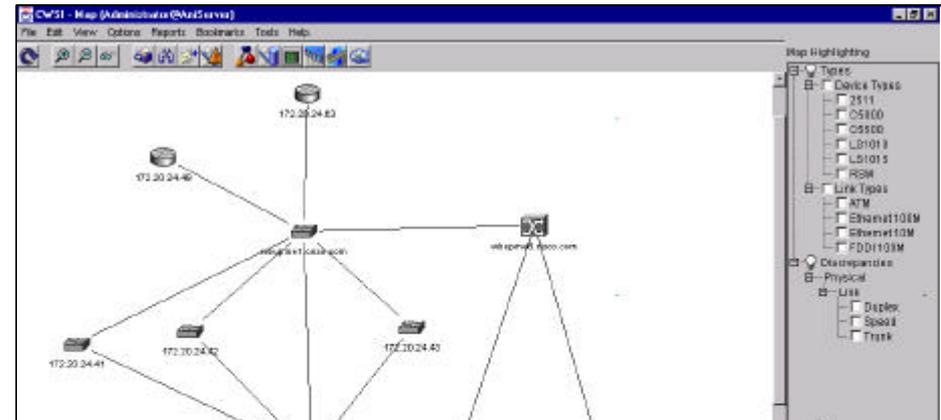
- **Solution: CWSI**

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)



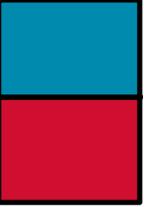
The screenshot shows the 'UserTracking (gholmes@AnsServer)' window. It features a 'Query Selector Items' section with a 'Device' dropdown and a 'Query' button. Below this is a table of tracked stations. The table has columns for MAC Address, VLAN, VTP Domain, Host Name, IP Address, Subnet, Device, Port, Port Name, Port State, and Last Seen. The first row is highlighted in blue.

MAC Address	VLAN	VTP Domain	Host Name	IP Address	Subnet	Device	Port	Port Name	Port State	Last Seen
08:00:20:8d:5e:ba	default	demo-net	172.20.24.156	172.20.24.156	172.20.24.0	172.20.24.24	2/4	corp-net	static	1986/02/19
08:00:20:82:6b:5e	default	demo-net	172.20.24.47	172.20.24.47	172.20.24.0	172.20.24.24	2/4	corp-net	static	1986/02/19
08:00:20:7a:c1:a6	default	demo-net	172.20.24.25	172.20.24.25	172.20.24.0	172.20.24.24	2/4	corp-net	static	1986/02/23
08:00:20:7b:53:8a	default	demo-net	172.20.24.38	172.20.24.38	172.20.24.0	172.20.24.24	3/3	static	static	1986/02/23
08:00:20:78:a8:23	default	demo-net	172.20.24.30	172.20.24.30	172.20.24.0	172.20.24.24	2/4	corp-net	static	1986/02/10
00:00:0c:cc:74:16	default	demo-net	CWSI-FME	172.20.24.53	172.20.24.0	172.20.24.20	2/9	static	static	1986/02/23

At the bottom of the window, it says '17 row(s)' and 'Logged in Yes'.

Automatically Discovers End Station Data!



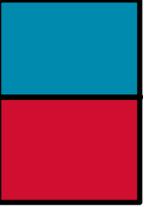


Scenario #4: ATM Configuration and Monitoring

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





Scenario #4: ATM Configuration and Monitoring

- **Traditional approach**

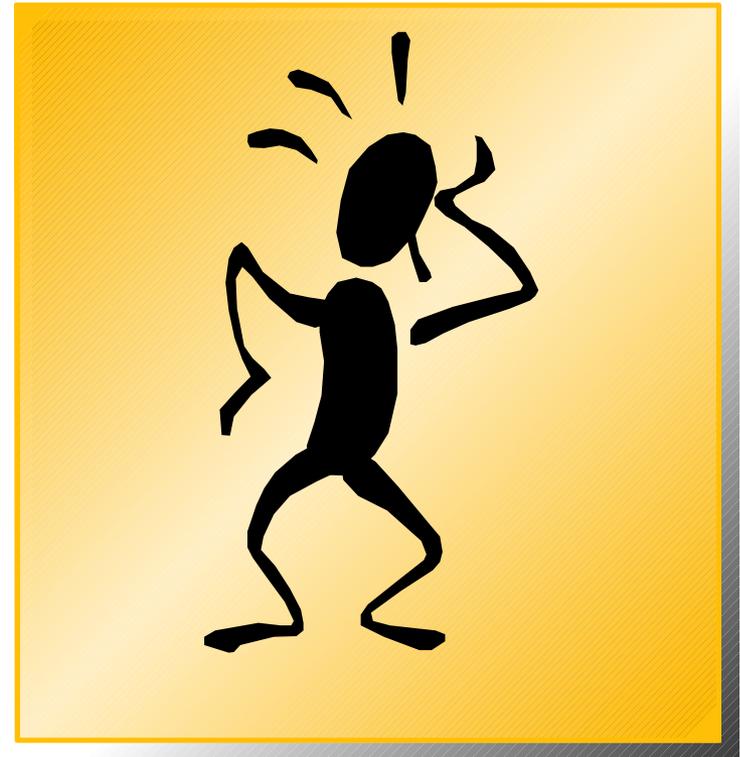
Use CLI or Telnet for device-
by-device:

ELAN configuration

LEC, LES/BUS, LECS

Active, backup

VC monitoring



Lacks a Network-Wide Focus!

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

VPI	VCI	Peer Host	Peer Type
0	72		Citer
0	46		Citer
0	51	172.20.24.24	Citer
0	147	172.20.24.24	Citer

Eases ATM Management!



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**

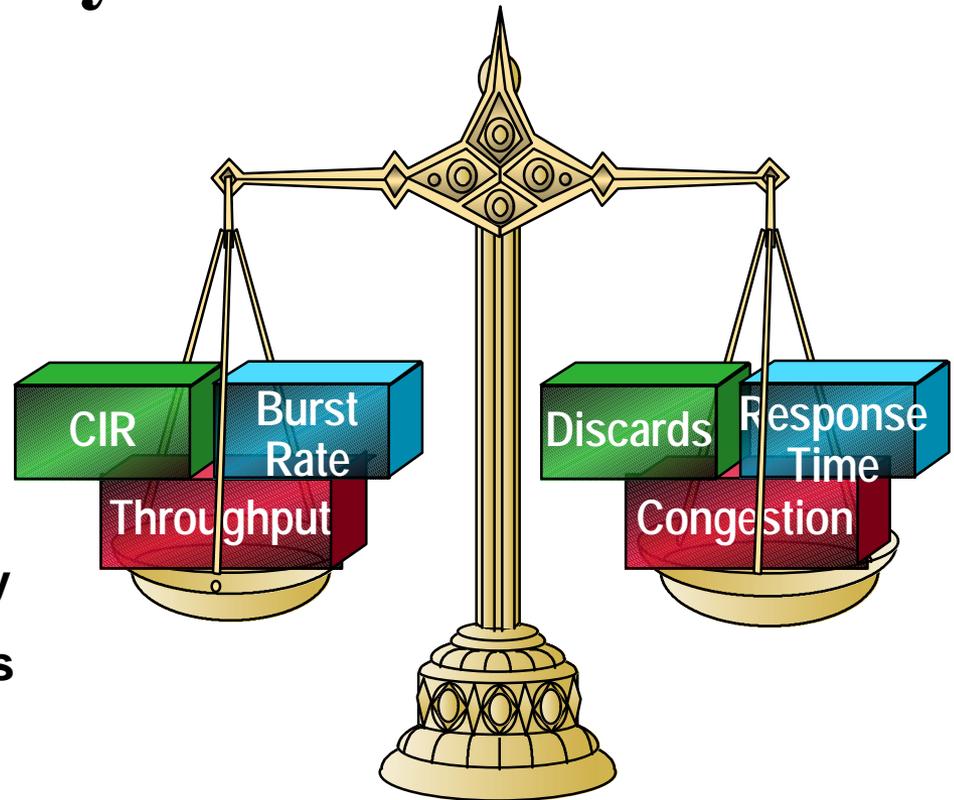
Optimizing bandwidth allocation

Providing high network availability

Quick resolution of WAN problems

Tracking and allocation of costs

Planning for future bandwidth requirements



Scenario #5: Proactive WAN/Frame Relay Monitoring

- **Traditional approaches**

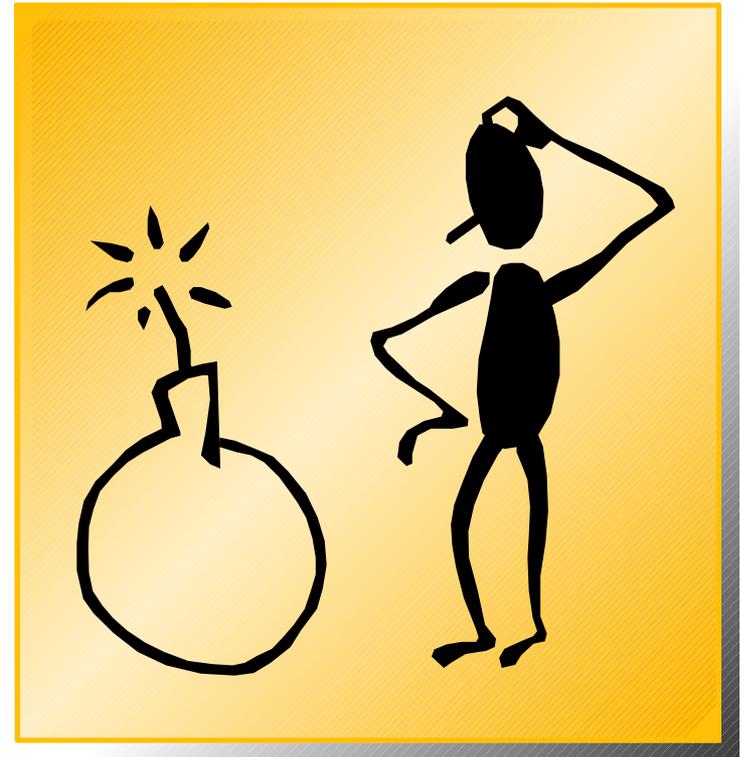
- Gather router WAN interface statistics

- SNMP polling

- Use network analyzers

- Portable

- Protocol-level analysis



Scenario #5: Proactive WAN/Frame Relay Monitoring

- **Solution: CWSI and SwitchProbes**

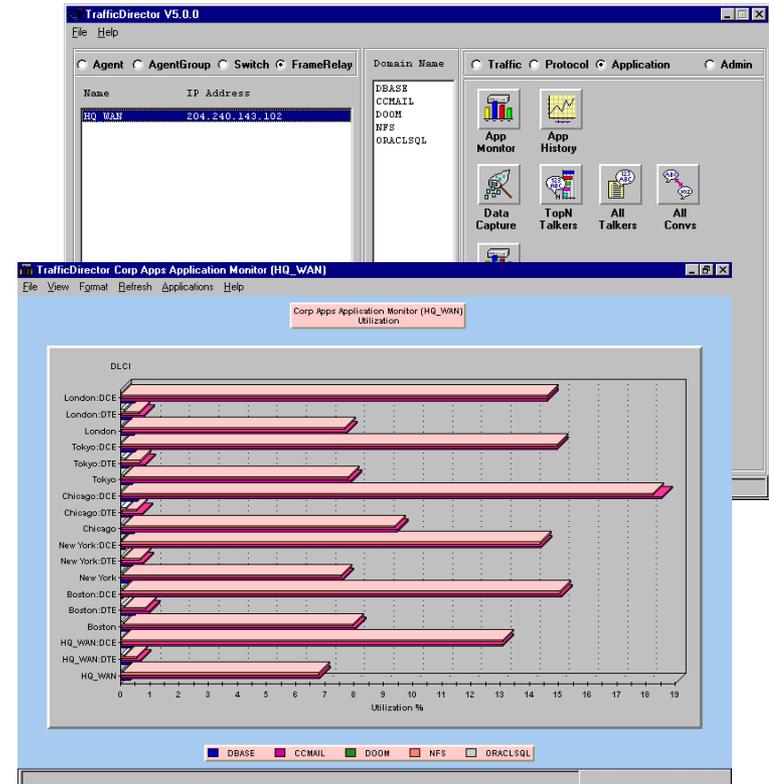
Utilizes RMON2-compliant T1 and T3 probes on WAN links

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

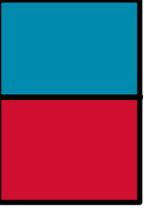
Same powerful traffic management available in the LAN



Applications/DLCI

Pinpoints WAN Bottlenecks!





Network Management Product Overview

- **Agents**
- **Applications**

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

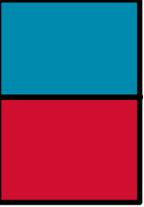


RMON,
RMON 2,
NetFlow,
CLI

Routers and Access Servers



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



Enhanced Agent Technologies

- **Industry standards**

SNMP: device get and sets

**RMON, RMON2:
traffic monitoring**

ILMI: ATM discovery

- **Cisco extensions**

**CDP: adjacent neighbor
discovery**

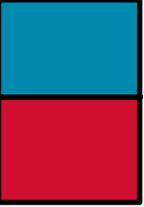
ISL: VLAN trunking

**VTP: automated VLAN
setup**

VMPS: dynamic VLANs

VQP: dynamic station Id





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

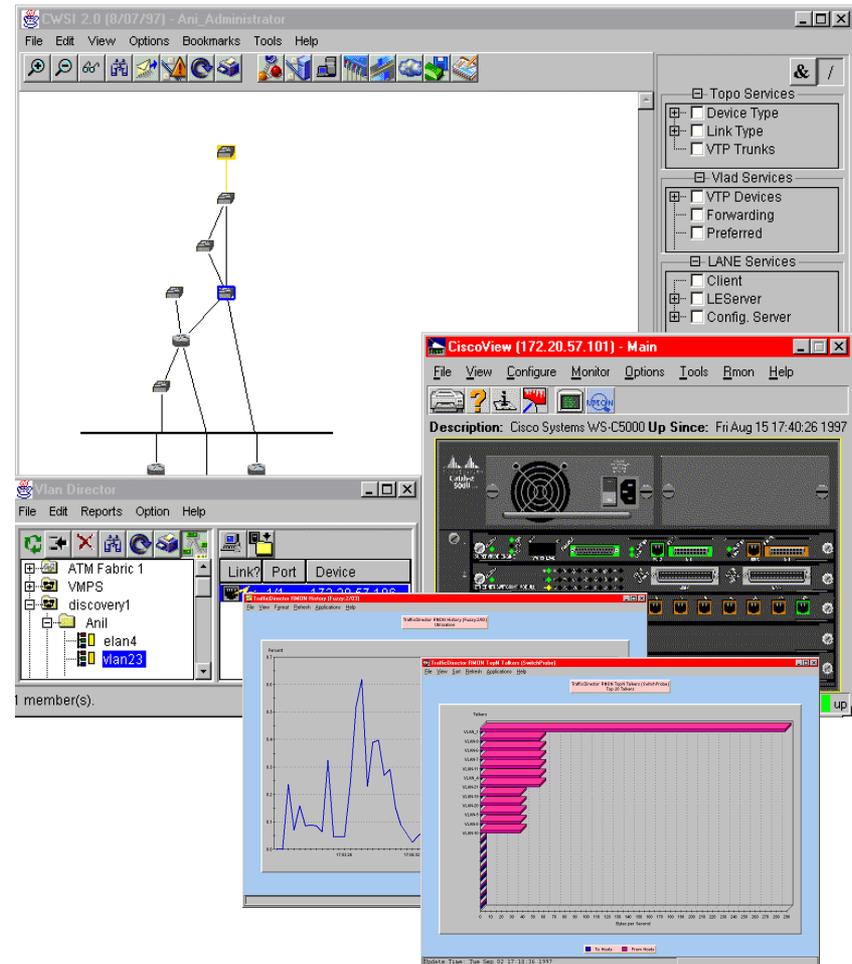
Complete Web-based architecture

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

The screenshot displays two overlapping windows from the Cisco Systems CRM interface. The top window, titled "Syslog - Severity Level Summary", shows a table of Syslog messages categorized by severity level for two devices: "rnm-2514.cisco.com" and "rnm-4500.cisco.com". The bottom window, titled "Availability Monitor", shows a table of device availability metrics for several devices, including "rnm1020", "rnm-2516", "rnm-4500", "rnm-7000", "rnm-7010", "fabnicue", and "nameless".

Syslog - Severity Level Summary

Dates: Jul 10, Jul 9, Jul 8, Jul 7, Jul 6, Jul 5, Jul 4

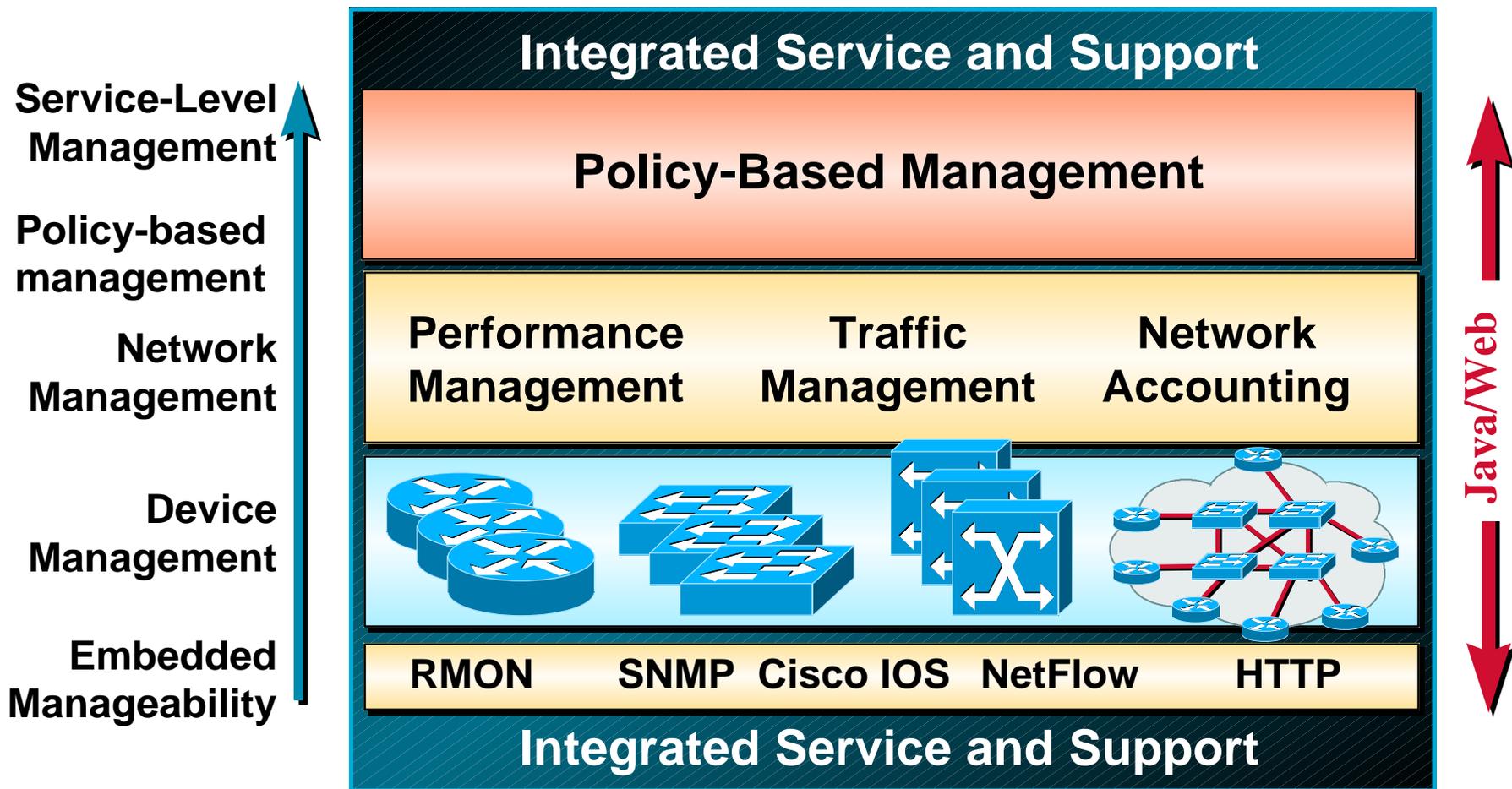
Device Name	Number of Messages - by Severity							Total
	Emergencies(0)	Alerts(1)	Critical(2)	Errors(3)	Warnings(4)	Notifications(5)	Informational(6)	
rnm-2514.cisco.com	-	-	-	-	11	3	-	14
rnm-4500.cisco.com	-	-	-	12	16	8	-	36

Availability Monitor

Device Name	Last Response	Device Reachability (%)	Response Time (ms)	Interface Status
rnm1020	Jul 10 1997 12:06:39	0	N/A	Unknown
rnm-2516	Jul 15 1997 15:55:20	100	4	
rnm-4500	Jul 15 1997 15:55:20	100	3	
rnm-7000	Jul 15 1997 15:55:25	100	184	
rnm-7010	Jul 15 1997 15:55:24	100	4	
fabnicue	Jul 15 1997 15:55:25	100	79	
nameless	Jul 15 1997 15:55:25	100	31	

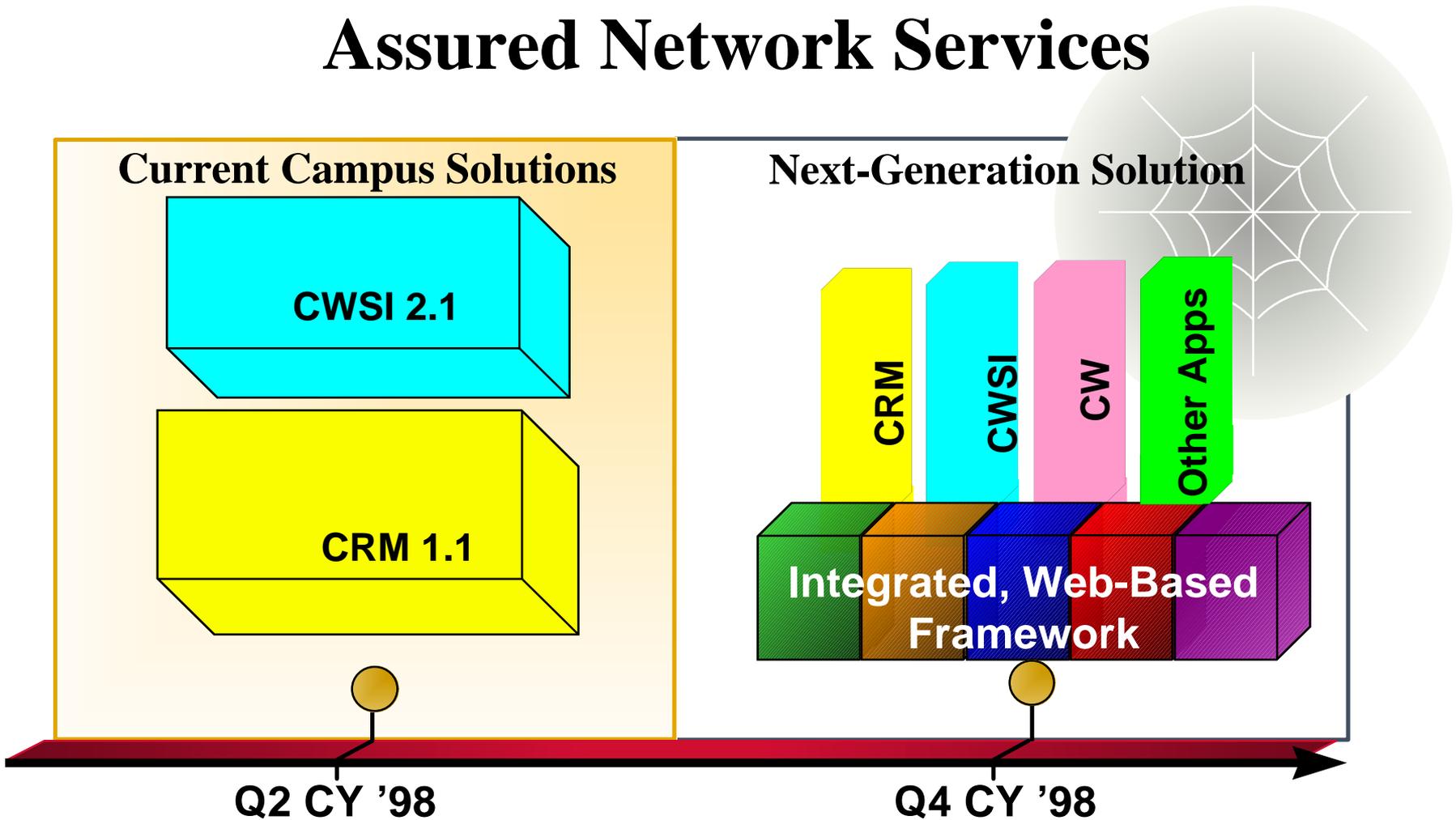
Generated: Tue Jul 11 16:27:50 1997
Cisco Systems, Inc. ©

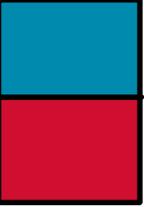
Cisco Network Management Strategy: Assured Network Services



Network Management Product Directions

Assured Network Services

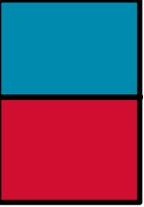




Summary

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/>

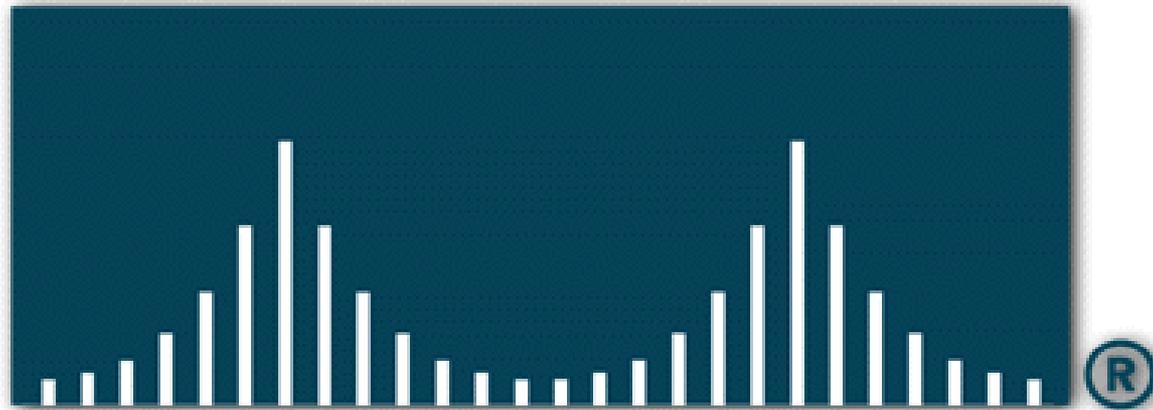
Enterprise Network Management Products

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

Partner information (listings, products, etc.):

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

CISCO SYSTEMS



EMPOWERING THE
INTERNET GENERATIONSM