Network Operations Center - Update

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Agenda

- Introduktion
- Et par typiske eksempler vedr. RFP’er og NMS ☺
- Design processen
- Baseline design
- Valg af applikationer
- FCAPS modellen
- Network Operations Center design eksempel

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Introduktion

- Tænkt system løsning / kunde
- System / netværksdiagram
- Meget få krav beskrevet i RFP'en
- Sammensætte en række applikationer
- Skal dække FCAPS modellen (så'en cirka)
- System Integration

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Kunde eksempel

- Mellemstor til stor dansk erhvervsvirksomhed
- 300+ netværksenheder: routere / switches
- IPT løsning med cirka 2000+ telefoner
- RFP’en er skrevet af eksternt konsultenthus

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RFP’en

- Er typisk fokuseret på selve løsningen
- F.eks IPT eller Data Center
- Har få eller ingen krav fremsat vedr. NMS
- Kommer næsten altid i sidste øjeblik mht besvarelse
- Er ikke skrevet af folk med NMS eller System Management erfaring

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Typiske RFP spørgsmål

- Systemet skal kunne administreres via et NMS system
- NMS systemet skal integreres til eksisterende NMS systemer
- Der må kun være en discovery process
- List samtlige SNMP variabler og objekter som systemet kan poll'e
- List samtlige SNMP traps som systemet kan sende
- Vi kører ITIL
- Det skal være muligt at måle performance og SLA

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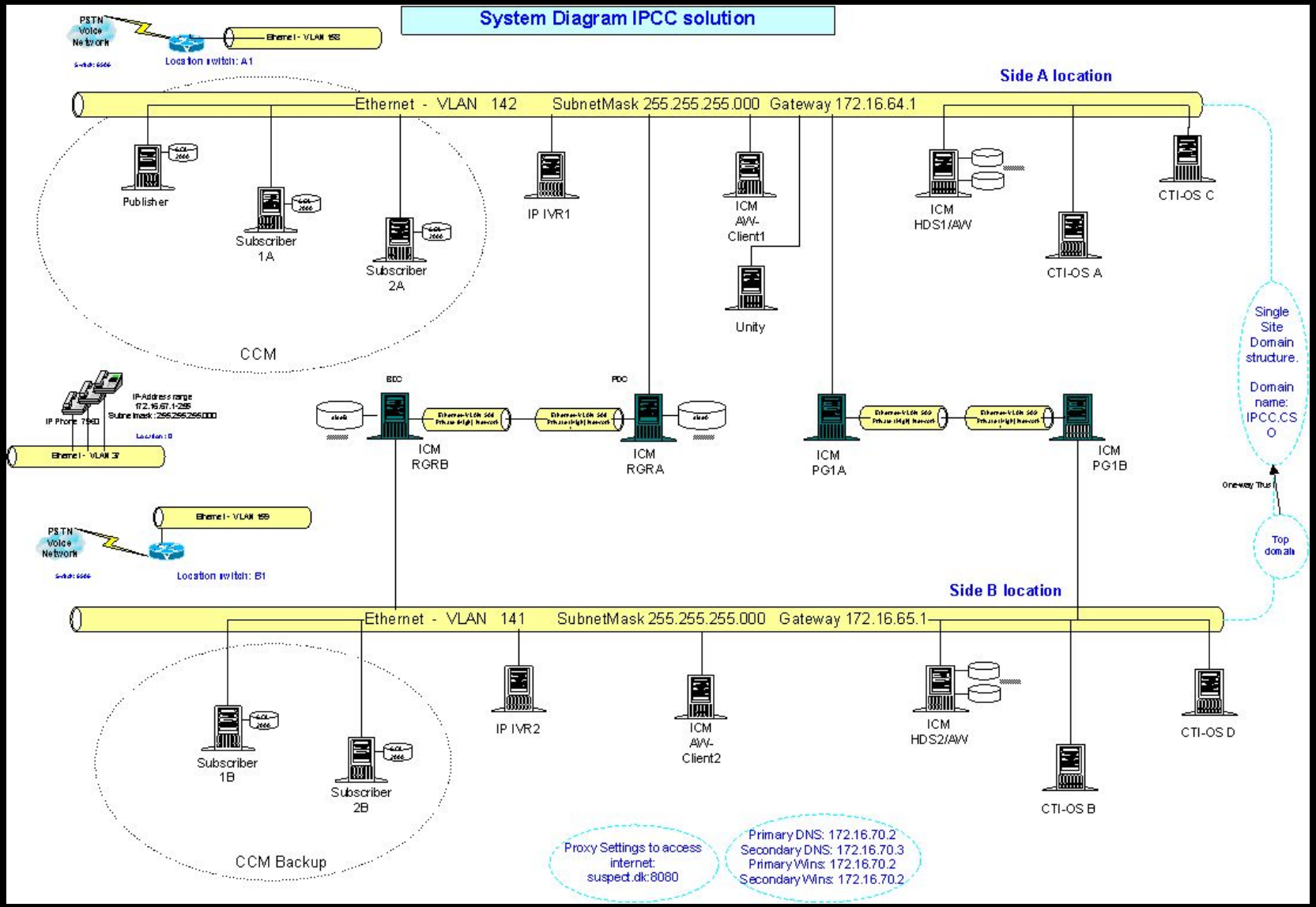
System / netværksdiagram



Og ’så ?

- Account Manageren har siddet på sine tommelfingre
- Du skal aflevere om 3 dage
- Du har få eller ingen krav at læne dig op a’

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Back to basics

- Start med et baseline design
- Gå udfra hvad du har af systemer
- Tænk FCAPS
- Næsten alle systemer har en korresponderende Element Manager eller ”System” Manager komplex
- Du er nødt til at tænke i system / vendor vertikaler
- Husk altid at Release Notes er din ven
- En anden ven er Cisco Press Books
- Du kommer altid langt med CW LMS 2.5 Deployment Guiden

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Dokumentation

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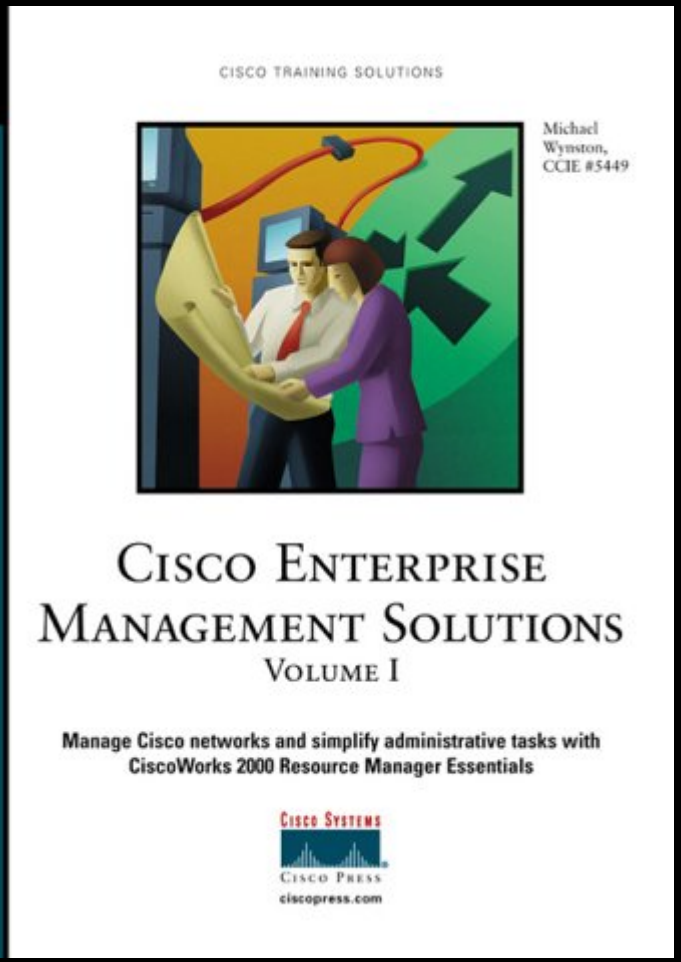
Cisco Enterprise Management Solutions



Michael Wynston
ISBN 1587050064

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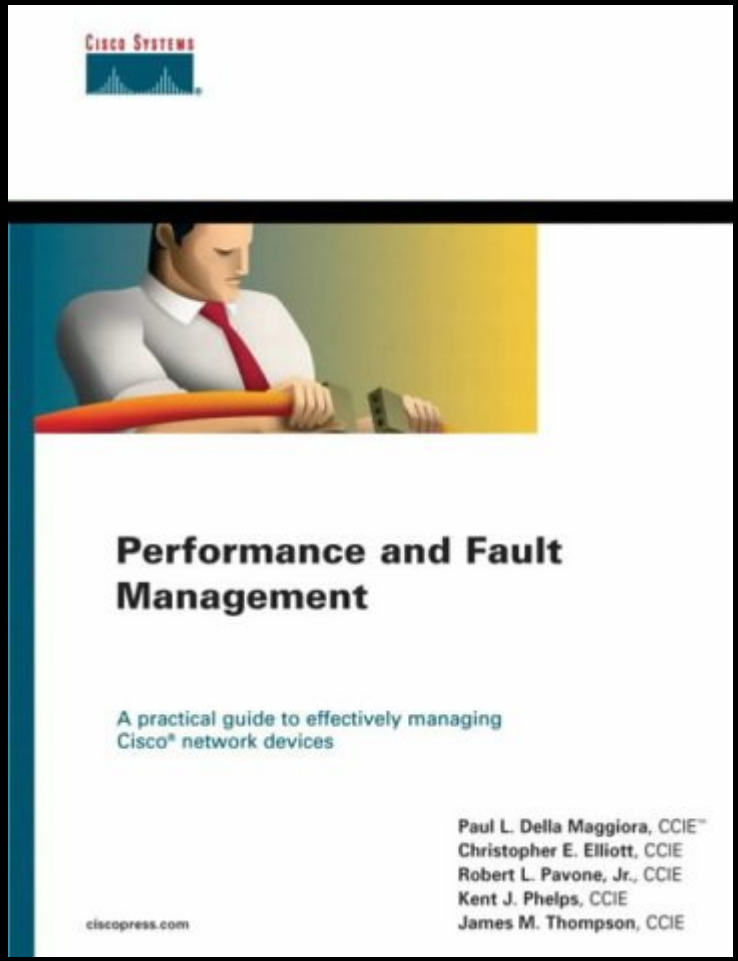
Performance and Fault Management



Della Magiora
ISBN 1578701805

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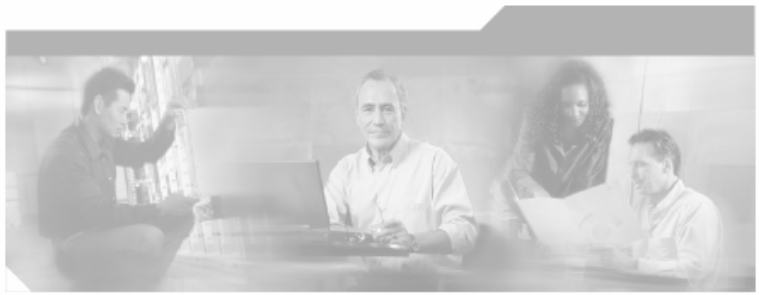
CiscoWorks LMS 2.5 Deployment Guide(s)

Cisco.com



Cisco LAN Management Solution 2.5 Deployment Guide

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LMS 2.5 Large Scale Deployment

Overview

Network managers are often faced with having to manage very large networks. Networks continue to grow in size, and the number of different management tools and products is often large as well. How can network managers effectively manage networks in this situation?

Cisco Systems® offers many CiscoWorks product bundles, each of which typically has a documented system recommendation and size limitation (for a single-server installation). Nonetheless, customers often need additional information about how to manage large networks (larger than the recommended limit for a single CiscoWorks installation).

This paper provides information and recommendations for these issues. It is important to understand that dealing with large-scale concerns is a complex problem, with many factors affecting the result. The most common question, "What size server do I need for CiscoWorks LMS to manage x number of devices?" is difficult to answer in a meaningful way. The following points must be considered:

- The number of devices is at best a vague way to estimate needed system resources—different devices can have vastly differing numbers and types of managed objects.
- What components and functions of the products are most important to the network managers?
- How many users will the network management tools have, and how many of them will use the tools simultaneously?
- In the case of very large networks, what are the administrative groupings of the network devices and network management users?

Answers to these questions, combined with the information contained in this document, will allow users to make informed decisions about how to deploy CiscoWorks LMS for managing their networks.

LAN Management Solution (LMS) 2.5

LAN Management Solution (LMS) 2.5 is the current LMS offering by Cisco and includes the following components:

- Common Services (CS) 3.0 (Includes CiscoView 6.1)
  Common Services 3.0 provides a set of shared application services that are used by all LMS applications. CiscoView 6.1 is a graphical device management tool that helps monitor, and troubleshoot devices across your network.
  Integration Utility 1.6 is an integration module that supports integration with third-party Network Management Systems (NMS).
- Resource Manager Essentials (RME) 4.0
  RME provides the ability to manage device inventory and audit changes, configuration files, software images and Syslog analysis, helping in lifecycle management.
- Campus Manager (CM) 4.0
  CM provides tools to visualize network topology, manage VLANs, detect network discrepancies and best-practice non-compliance, perform Layer 2/3 data and voice traces and report on end-host user information.
- Device Fault Manager (DFM) 2.0
  DFM provides the ability to monitor device faults in real-time and determine the root cause by correlating device level fault conditions. DFM can notify you of critical network conditions via email or pager. Fault

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CiscoWorks LMS Quick Start Guide

Cisco.com

Cisco Systems

Quick Start

Quick Start Guide for LAN Management Solution 2.5

1 SUPPLEMENTAL LICENSE AGREEMENT
2 LAN Management Solution 2.5 Overview
3 Server and Client System Requirements
4 Installation Paths
5 Upgrade Options
6 Installing LAN Management Solution 2.5
7 Installing CiscoWorks Common Services 3.0
8 Installing Resource Manager Essentials 4.0
9 Installing Campus Manager 4.0
10 Installing Device Fault Manager 2.0
11 Installing Internetwork Performance Monitor 2.6
12 Getting Started with LMS
13 Post-Installation Tasks
14 Where to Go Next
15 Related Documentation
16 Obtaining Documentation
17 Documentation Feedback
18 Obtaining Technical Assistance
19 Obtaining Additional Publications and Information

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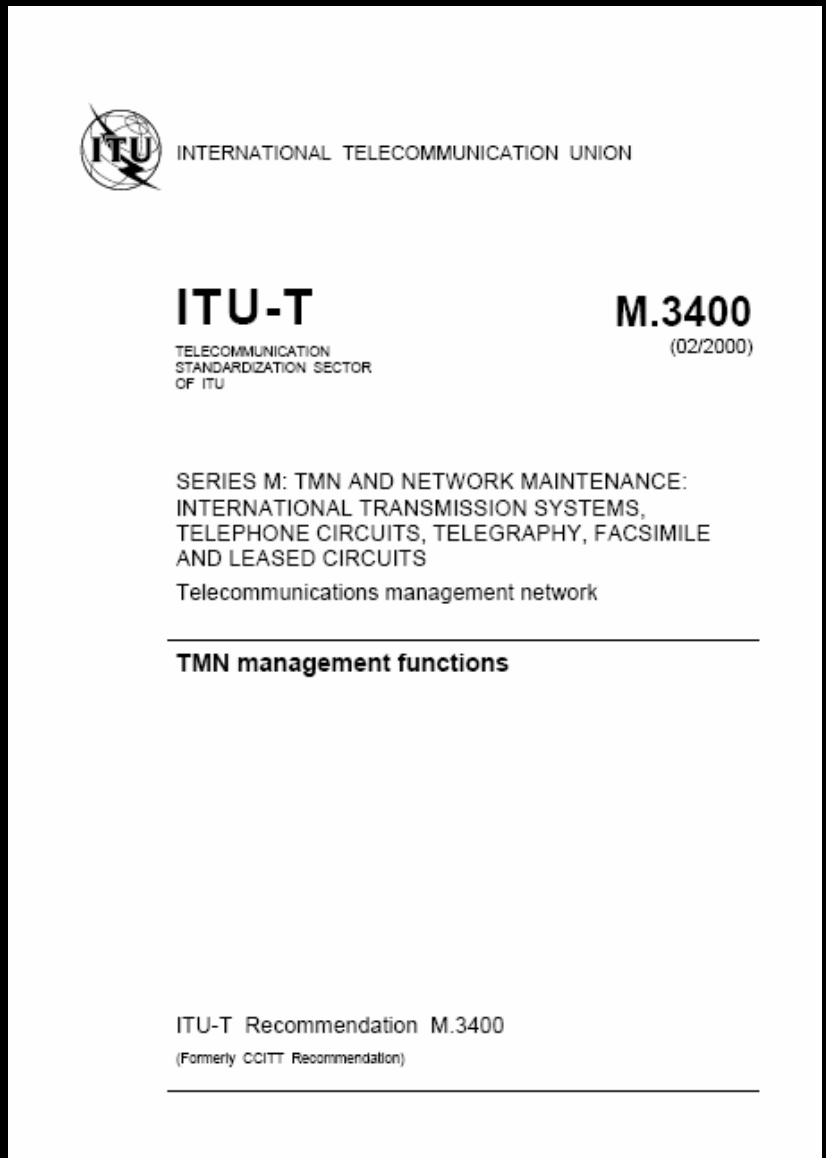
ITU-T M.3400 TMN management functions



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T **M.3400**

(02/2000)

TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU

SERIES M: TMN AND NETWORK MAINTENANCE: INTERNATIONAL TRANSMISSION SYSTEMS, TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE AND LEASED CIRCUITS

Telecommunications management network

TMN management functions

ITU-T Recommendation M.3400

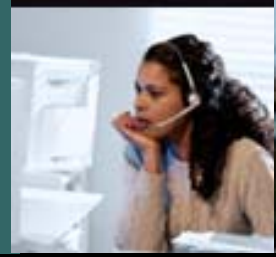
(Formerly CCITT Recommendation)

FCAPS

- Fault
  - Topology
- Configuration
  - Provisioning
  - Configuration
  - Inventory
  - Archiving
- Accounting
- Performance
  - SLA
- Security
  - Identity
  - AAA
  - ...

Baseline design

CiscoWorks LMS 2.5



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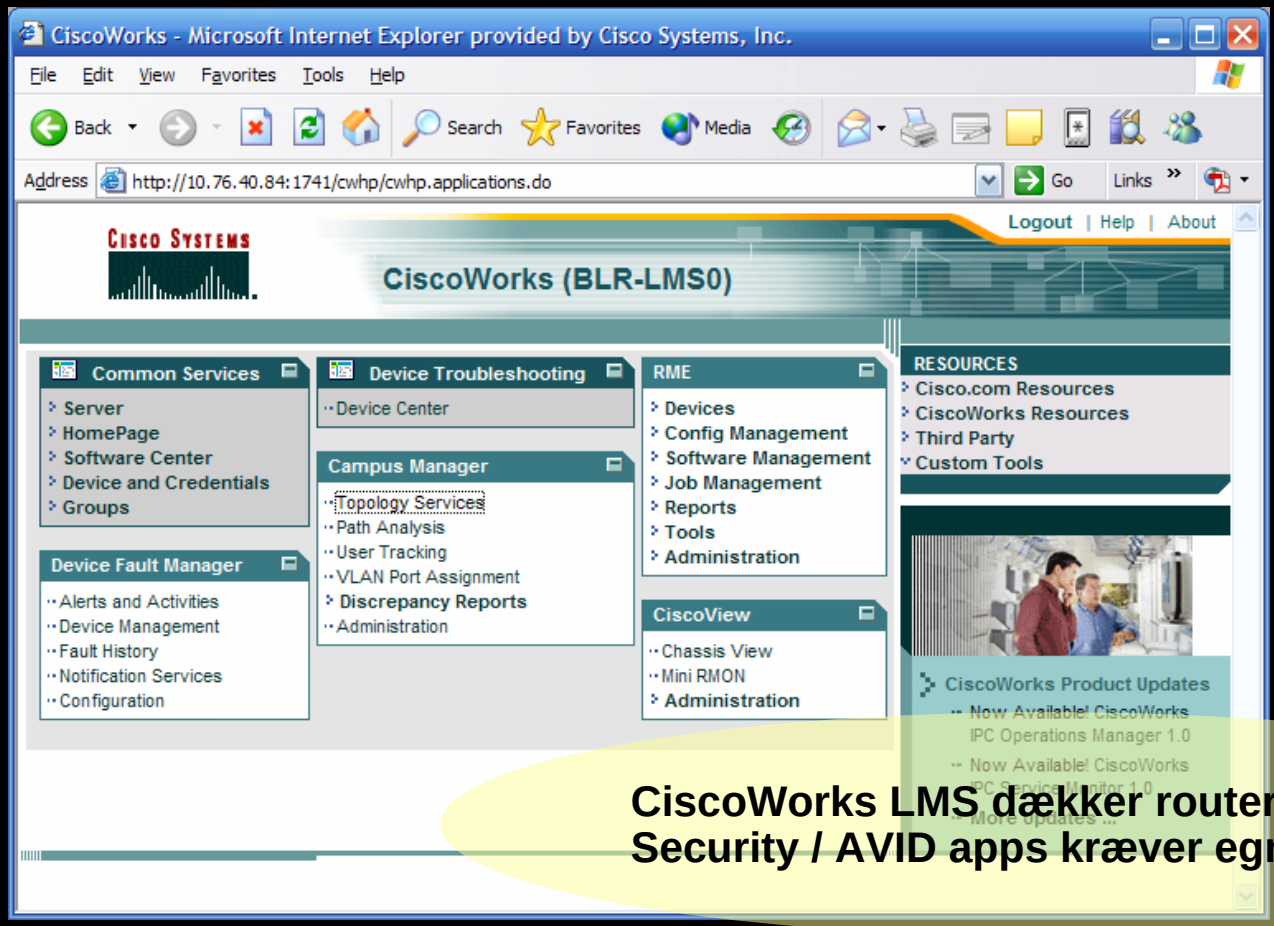
Baseline design

- **CiscoWorks LAN Management Suite**



CiscoWorks LMS dækker routere / switches
Security / AVID apps kræver egne apps

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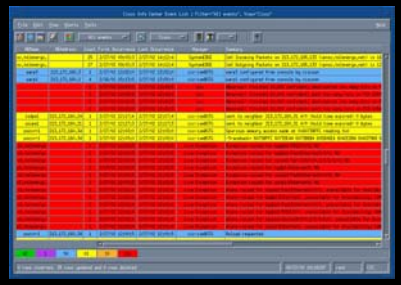
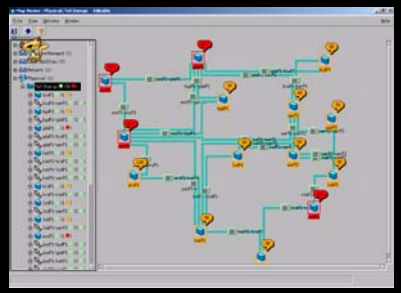
Baseline design





Events

Topology

HP OpenView
IBM NetView

Norhtbound Event Integration
SNMP Trap Forwarding

CiscoWorks
LMS

Operations
Configuration
Provisioning
Service Assurance
Performance

Cisco ITP

Netværk: Cisco router / switches o.a

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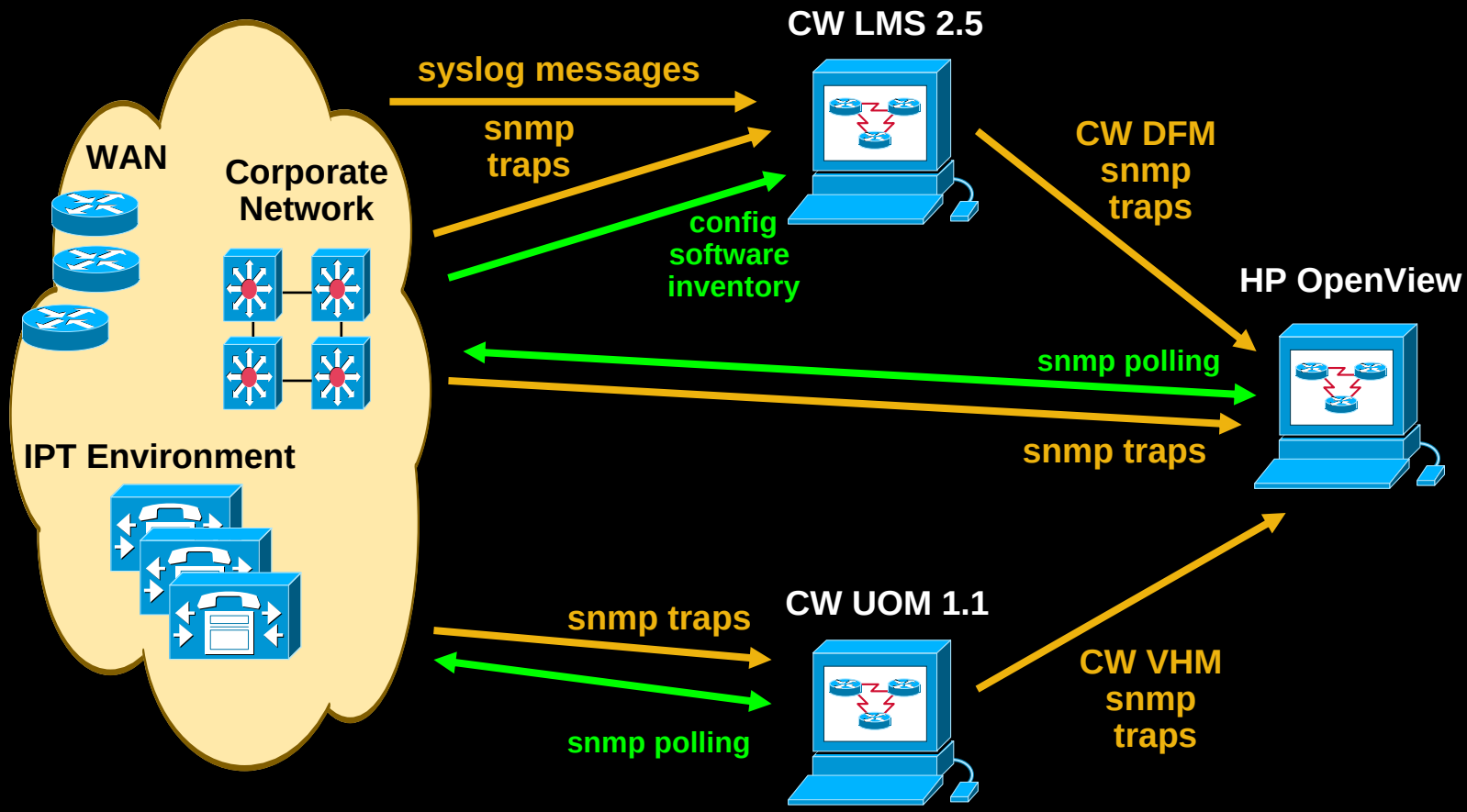
Baseline design – Fault Management



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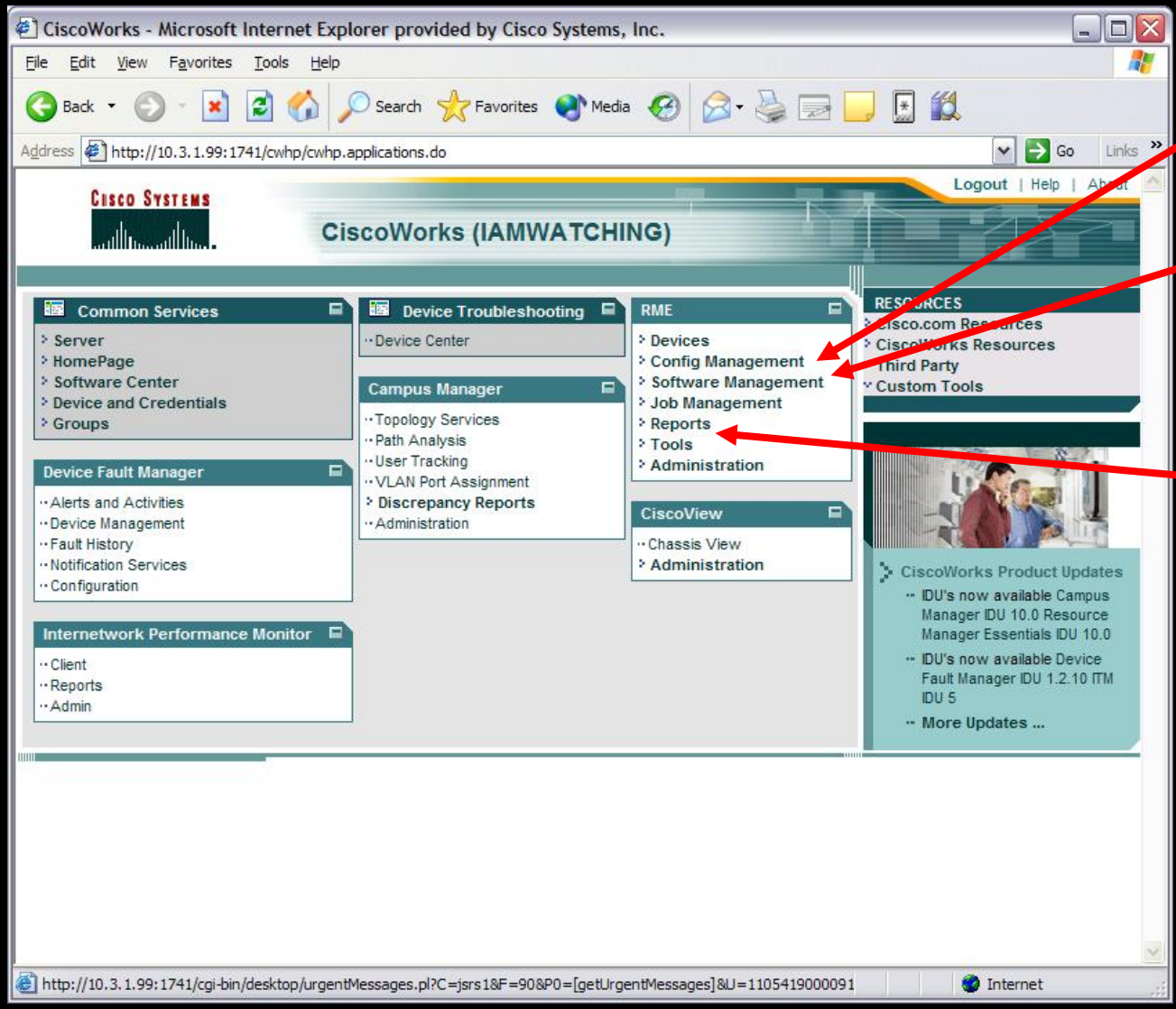
Baseline design
CiscoWorks 2000 LAN Management Suite



Device Configuration Management

Device Software/Image Management

Device Configuration Software/Image Auditing Management

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Baseline design
CiscoWorks LMS 2.5 indeholder

- **Network discovery, display, configuration and visualization of Layer 2 network configuration (topology, VLANs, ATM).**
- **Recognizes common network problems without forcing users to configure filters or polling intervals.**
- **Automates software distribution, change audit and authorization, device inventory, and syslog analysis for campus networks with switched infrastructures.**

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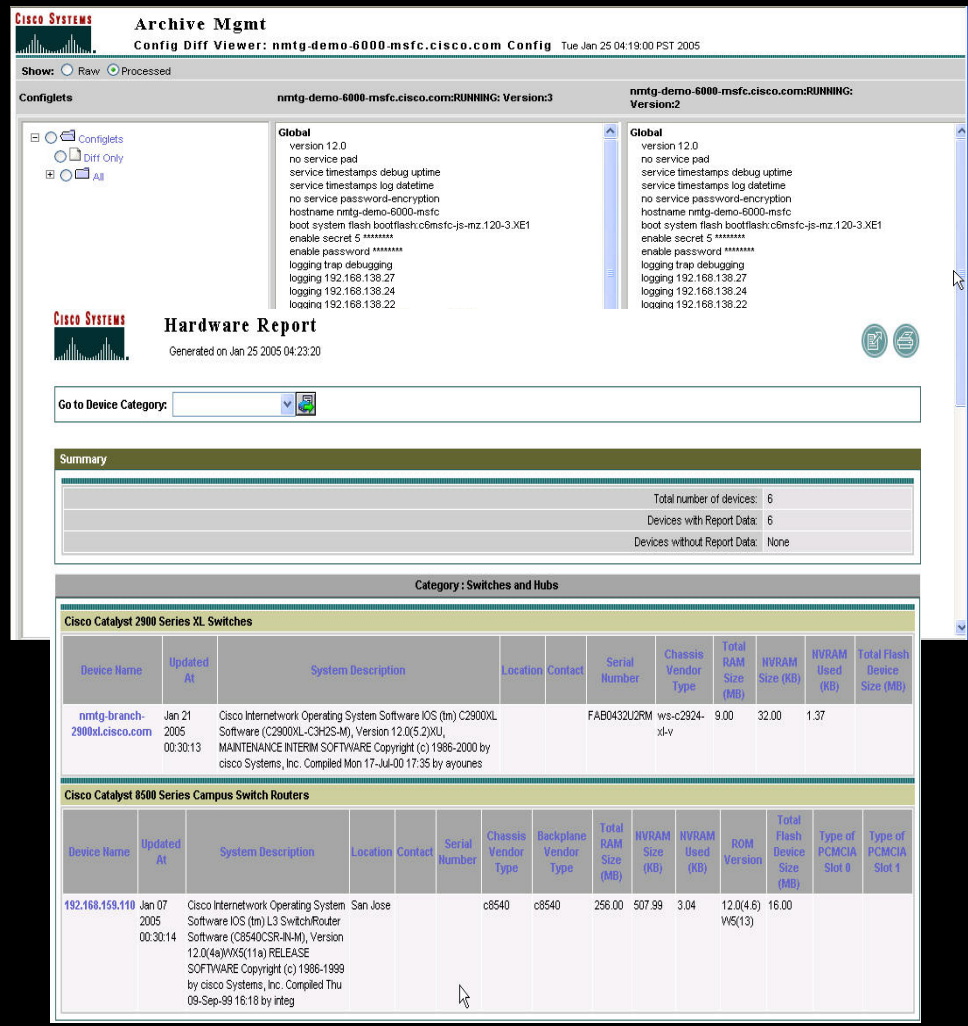
Baseline design
LMS Resource Manager Essentials (RME)

- Inventory Manager
  - Complete Cisco asset management
- Software Image Manager
  - Software lifecycle management of Cisco hardware
  - Improved browse bug by device
- Configuration Manager
  - Version control, archival, editing and reporting of device configurations
  - Network-wide config changes
- Change Audit Services
  - Single interface for all hardware, software, and configuration changes



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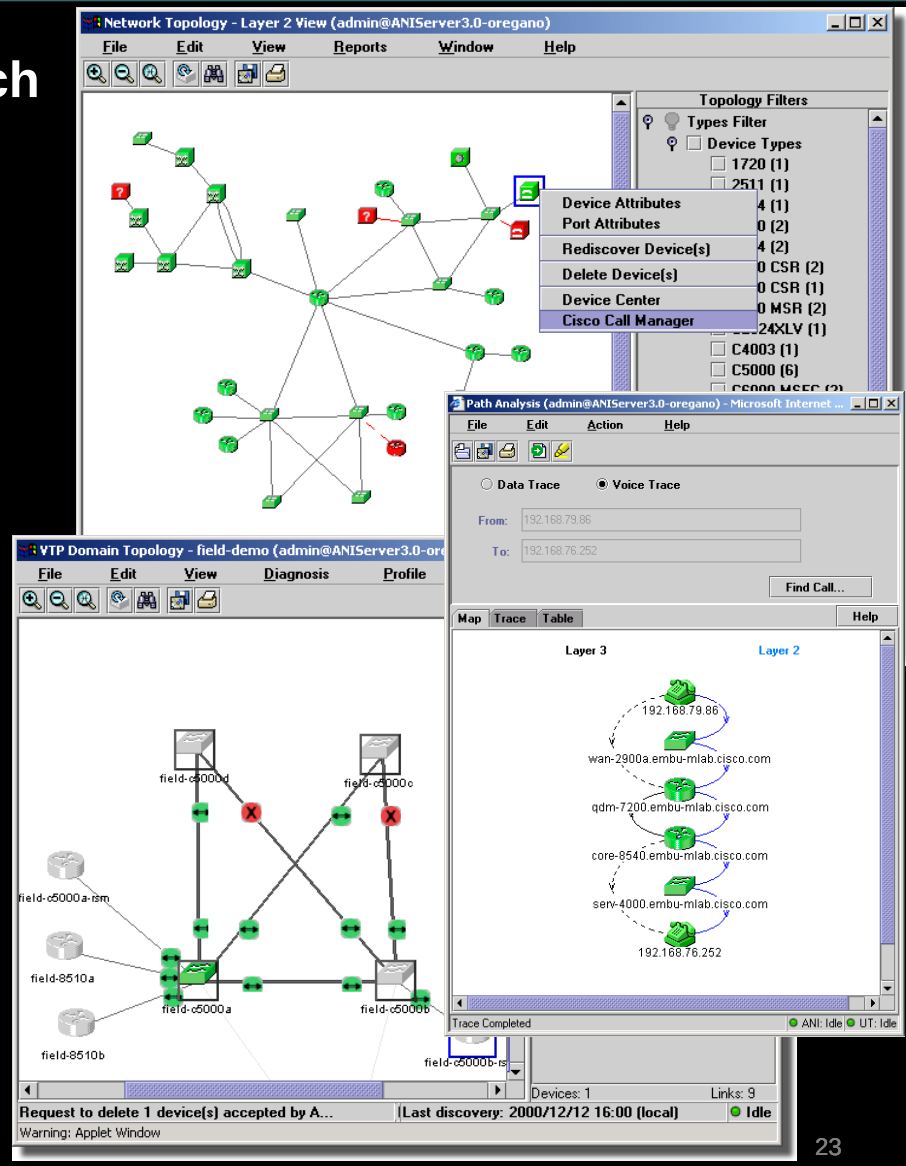
Baseline design
LMS Campus Manager (CM)

Network based management of switch services and traffic performance

- Enhanced network discovery and topology mapping
- Auto Network Discovery
- VLAN Management
- Extended ATM Management
- End-station mobility and tracking
- Path Trace Analysis



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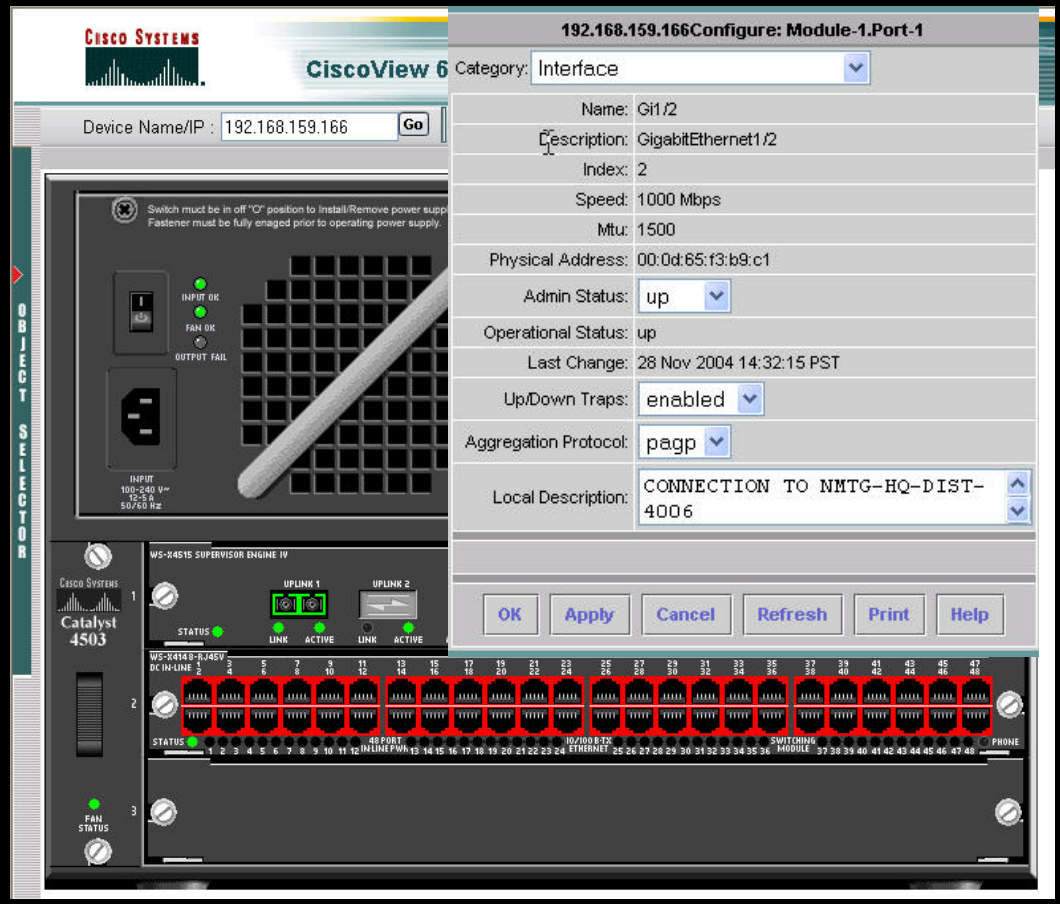
Baseline design
LMS CiscoView (CV)

- SNMP-based device management tool – all monitoring and configuration capabilities based on MIB support
- Monitor real-time statistics for interfaces, resource utilization, and device performance
- Simple point and click to configure multiple ports and chassis parameters
- Currently supports entire range of switches and routers.



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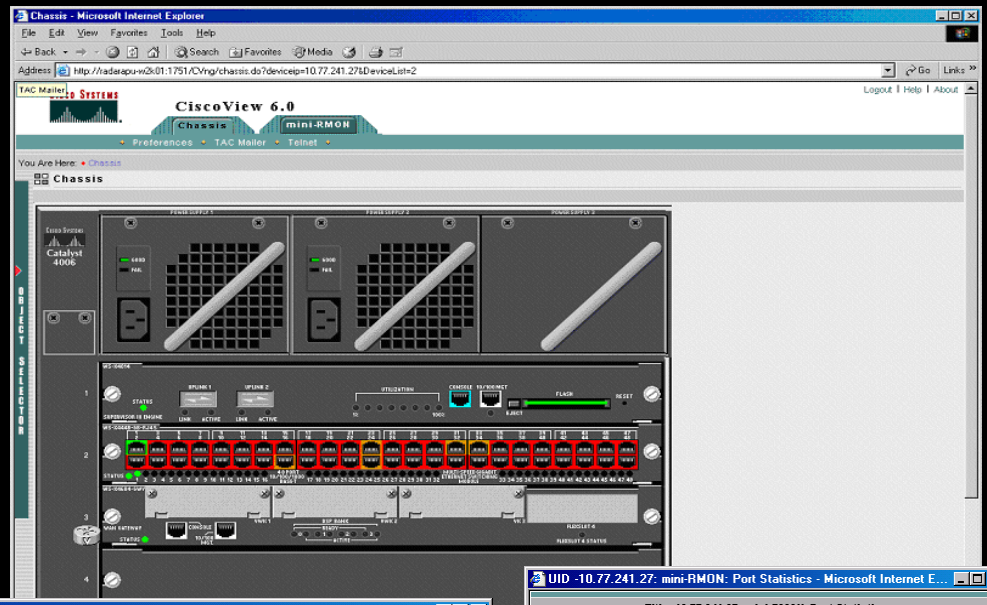
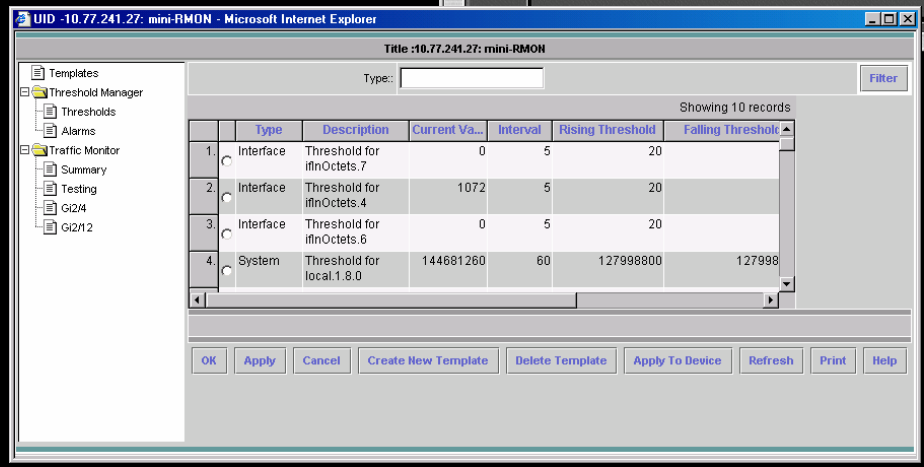
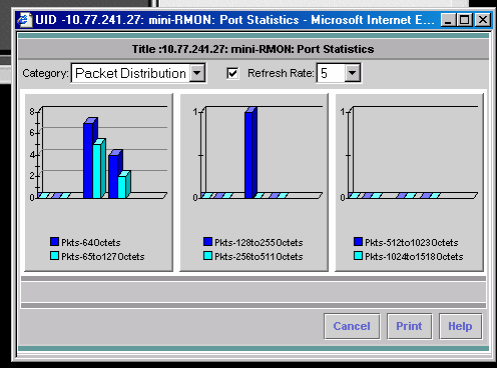
Baseline design
LMS CiscoView (CV)

- New lightweight HTML interface
- IPv6 compliance
- Mini-RMON support
- SNMPv3 (AuthNoPriv)
- More granularity in user-roles through the ability to integrate with an ACS server







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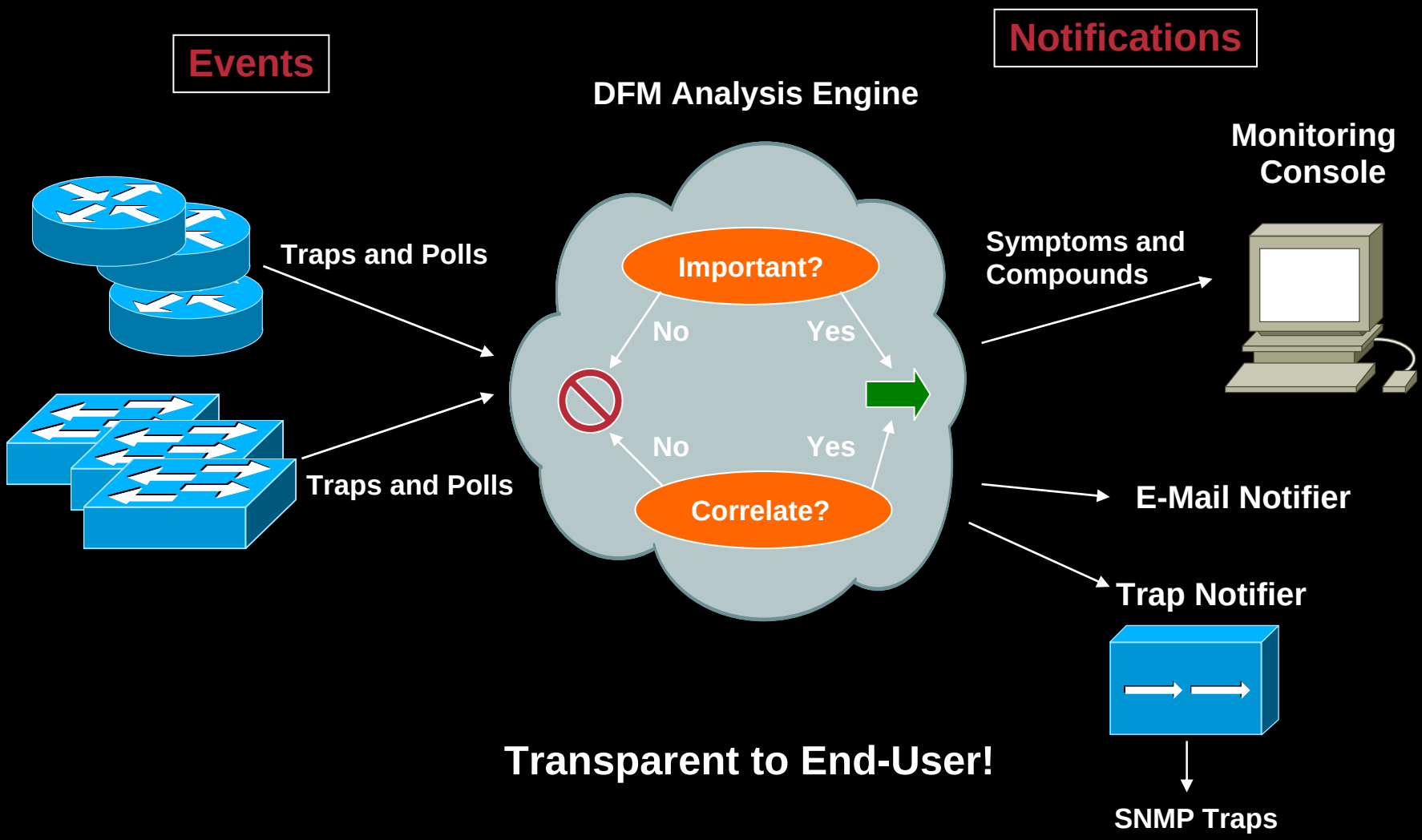
Baseline design
LMS DFM Fault Analysis



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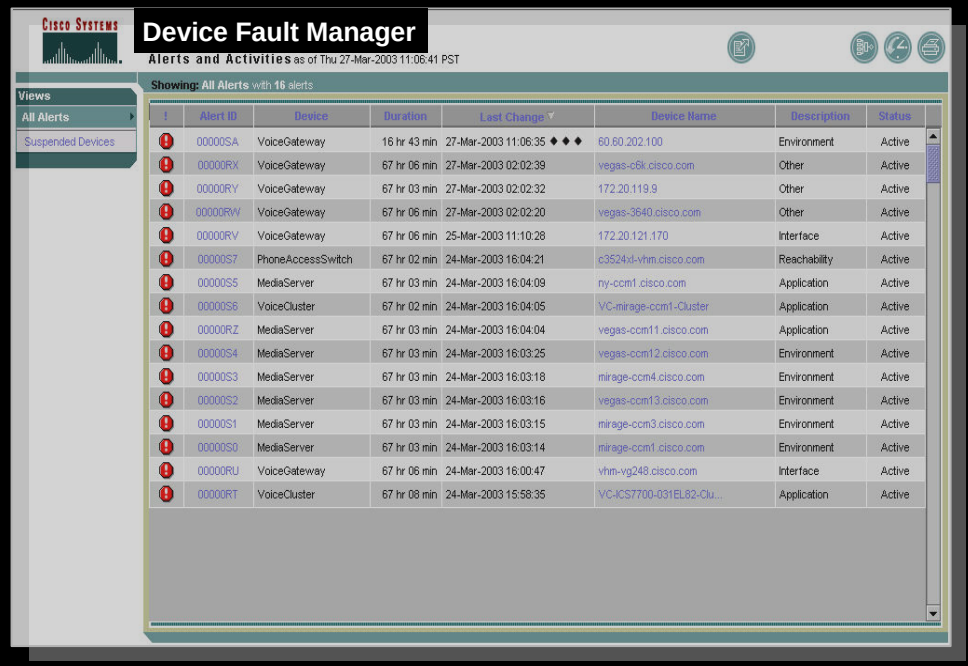
Baseline design LMS - DFM Event Management GUI

- New lightweight Active Alarm Display
- Device Grouping
  - "Random" grouping – pick what devices you want for any group
- Improved Integration
  - Synchronization with Common Services Device Credential Repository
  - Launch Fault History, CiscoView and Device Center from AAD
  - Common Groups shared from Common Services



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Baseline design – LMS DFM System Elements Monitored

	Routers	Switches	Hubs	Exception
Connectivity				
IP polling				Operational
SNMP polling				Operational
Excessive Restarts				Operational
Environmental				
Temp state				Temperature
Relative temp				Temperature
Voltage state				Power Supply
Relative voltage				Power Supply
Fan state				Temperature
Power supply state				Power Supply
Processor & Memory				
Backplane utilization				Resource
Free memory				Resource
Memory buffer misses				Resource
Memory buffer utilization				Resource
Memory fragmentation				Resource
Processor utilization				Resource

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Baseline design – LMS DFM
Port & Interface Elements Monitored

Cisco.com

	'Managed' Switch Port Groups		'Managed' IP Addressable Interfaces						
	Ethernet	ATM	Ethernet	ATM Serial	TR FDDI	Others	Dial on Demand	Backup	
Broadcasts	●	●	●	●	●	●			Performance Exception
Collisions	●		●						Performance Exception
Discards	●	●	●	●	●	●			Performance Exception
Errors	●	●	●	●	●	●			Performance Exception
Queue Drops	●	●	●	●	●	●			Performance Exception
Utilization	●	●	●	●	●	●			Performance Exception
Port Flapping				●		●			Operational Exception
Backup Activated								●	Operational Exception
Maximum Uptime							●	●	Operational Exception
Oper Down	●	●	●	●	●	●			Operational Exception

default DFM settings, can be changed by admin

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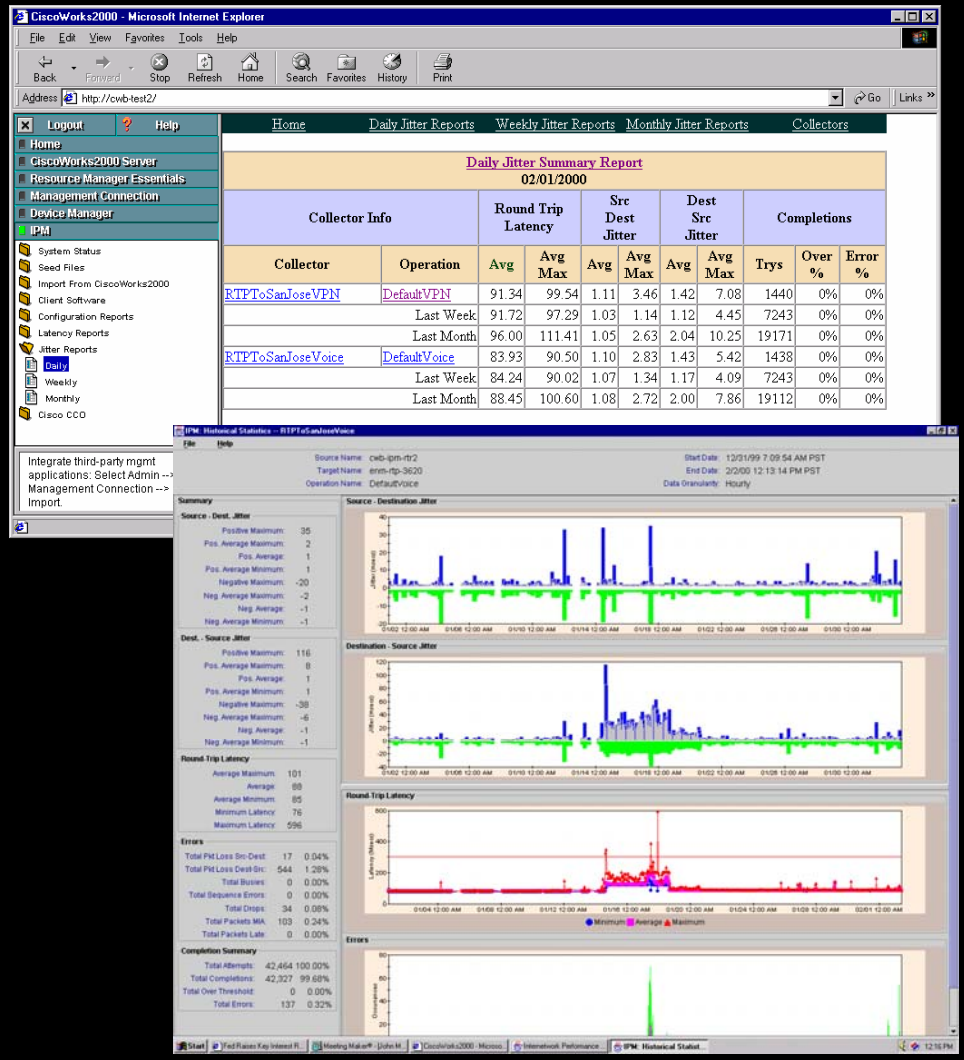
Baseline design – LMS IPM Internetwork Performance Monitor

- **WAN Troubleshooting**
  - Measures hop-by-hop response time, availability, jitter, and drops
  - Provides real-time and historical reports
- **Utilizes IP SLA (previously known as Cisco's Service Assurance Agent) embedded in Cisco IOS**
  - Validates & measures TCP, UDP, HTTP, VoIP, DNS, ICMP with QoS awareness



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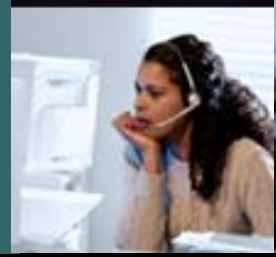
Valg af applikationer til support af andre systemer



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Valg af applikationer

- Du har Cisco routere og switches
  CiscoWorks LAN Management Suite → Operations, Configuration, Provisioning, Service Assurance, Performance
- Du har en Cisco IPT løsning
  CiscoWorks Unified Operations Manager → Operations, Configuration, Provisioning
  CIscoWorks Unified Service Monitor → Service Assurance, Performance
- Security
  Cisco Security Manager (ASA / PIX) → Operations, Configuration, Provisioning
  CiscoSecure Access Control Server (TACACS+) → Operations, Configuration, Provisioning
  CiscoWorks Security Info Management Solution → Service Assurance, Performance

Tænk FCAPS!

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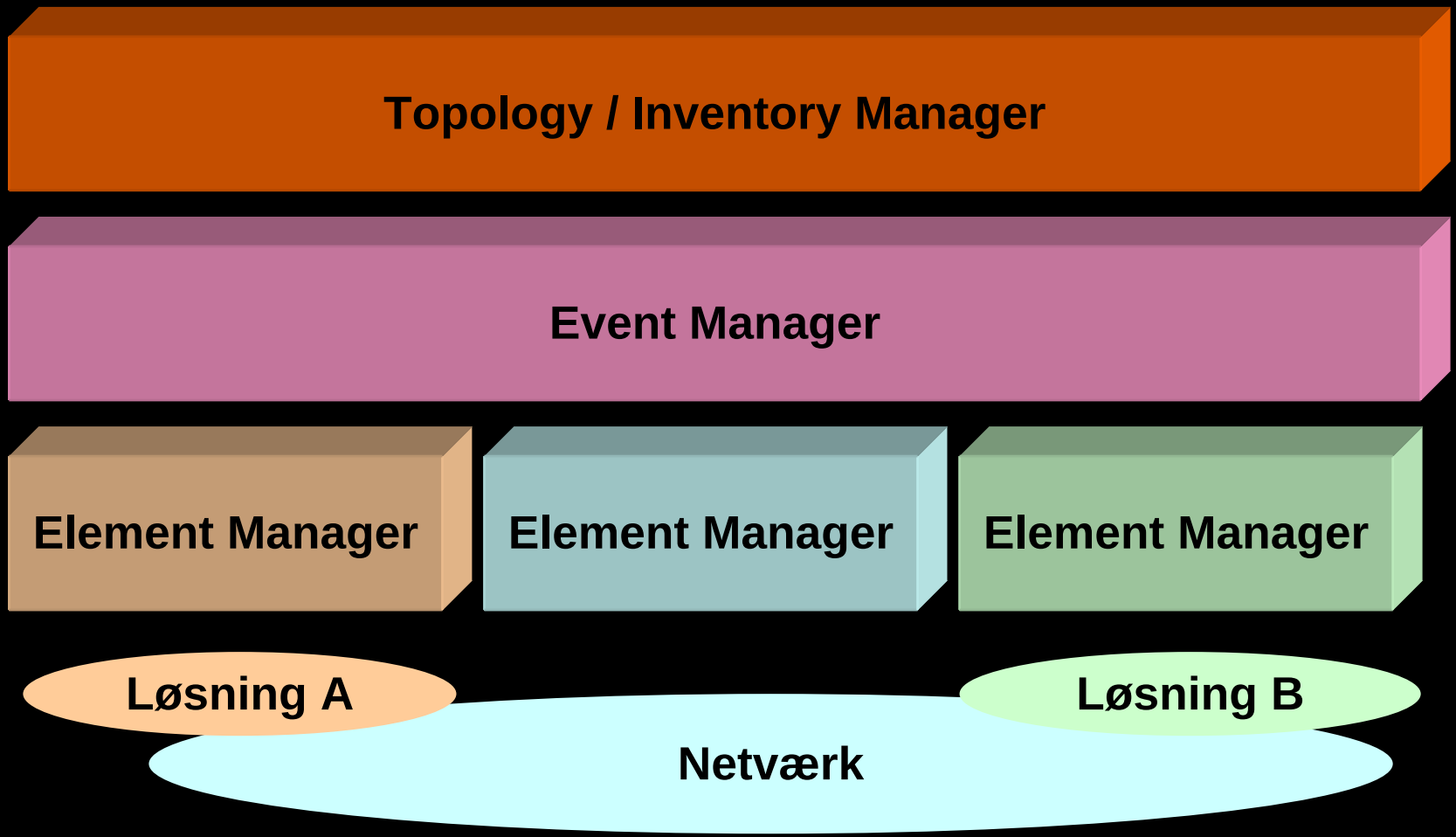
Hvad er system / vendor vertikaler



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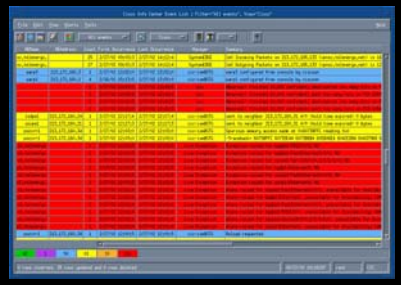
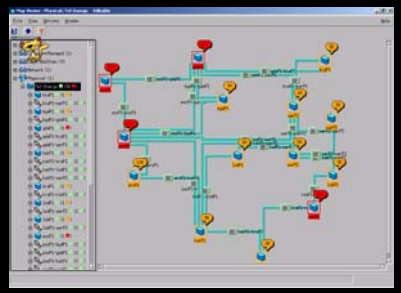
Hvad er system / vendor vertikaler (pratisk)





Events

Topology

HP OpenView
IBM NetView

Norhtbound Event Integration
SNMP Trap Forwarding

CiscoWorks
Operations Manager

CiscoWorks
Service Monitor

CiscoWorks
LMS

3.Party

Operations
Configuration
Provisioning
Service Assurance
Performance

Operations
Configuration
Provisioning

Service Assurance
Performance

Cisco ITP

Netværk: Cisco router / switches o.a

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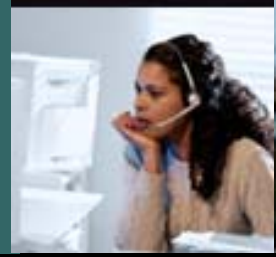
CiscoWorks IPT Solution
Voice Monitoring & Management

CiscoWorks UOM
Unified Operations Manager



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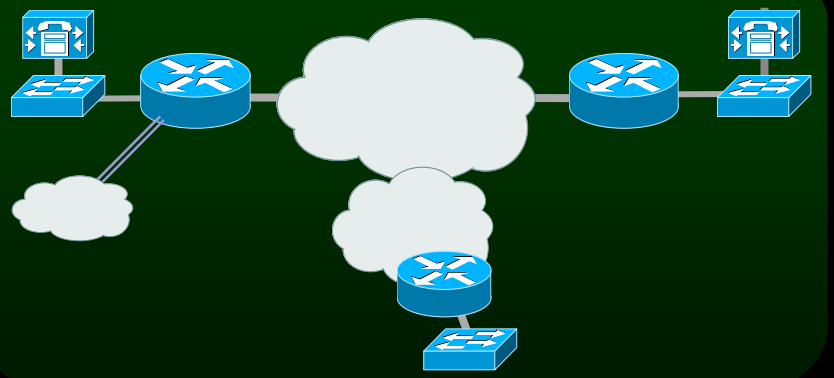
CiscoWorks Unified Operations Manager

Cisco.com



‘helpful’
User Interface

Device discovery

Logical relationships

Polling & Traps

Synthetic testing
(Skinny, IP SLA)

Fault Status
Service Impact
Performance

Data Store

AAD & DDV

Topology Views

Launch other CW tools

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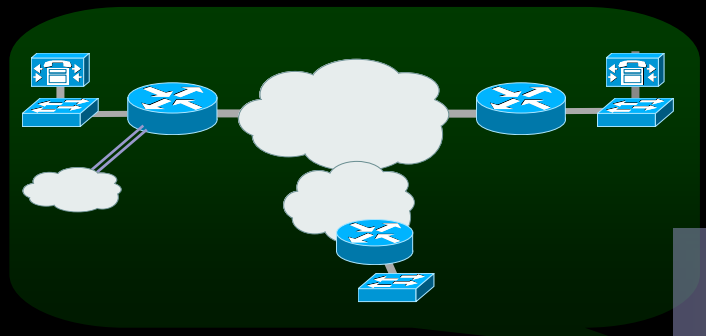
CiscoWorks Unified Operations Manager Product Overview/System Architecture

Cisco.com

- Actionable, service level View of full IP Communications implementation
- Real-time alerting on IP Communications and IP devices in the deployment
- Integrated Service quality alerting and reporting
- Extensive Phone and device inventory reporting
- Integrates with other CiscoWorks tools like LMS, ACS etc



'intuitive'
User Interface

Real-time Alerts

Service level views

Launch other CW tools

Device discovery

Logical relationships

Polling and Traps

Synthetic Testing

Fault Status
Service Impact
Performance

Data Store

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CiscoWorks Communications Operations Manager Startup GUI

Cisco.com

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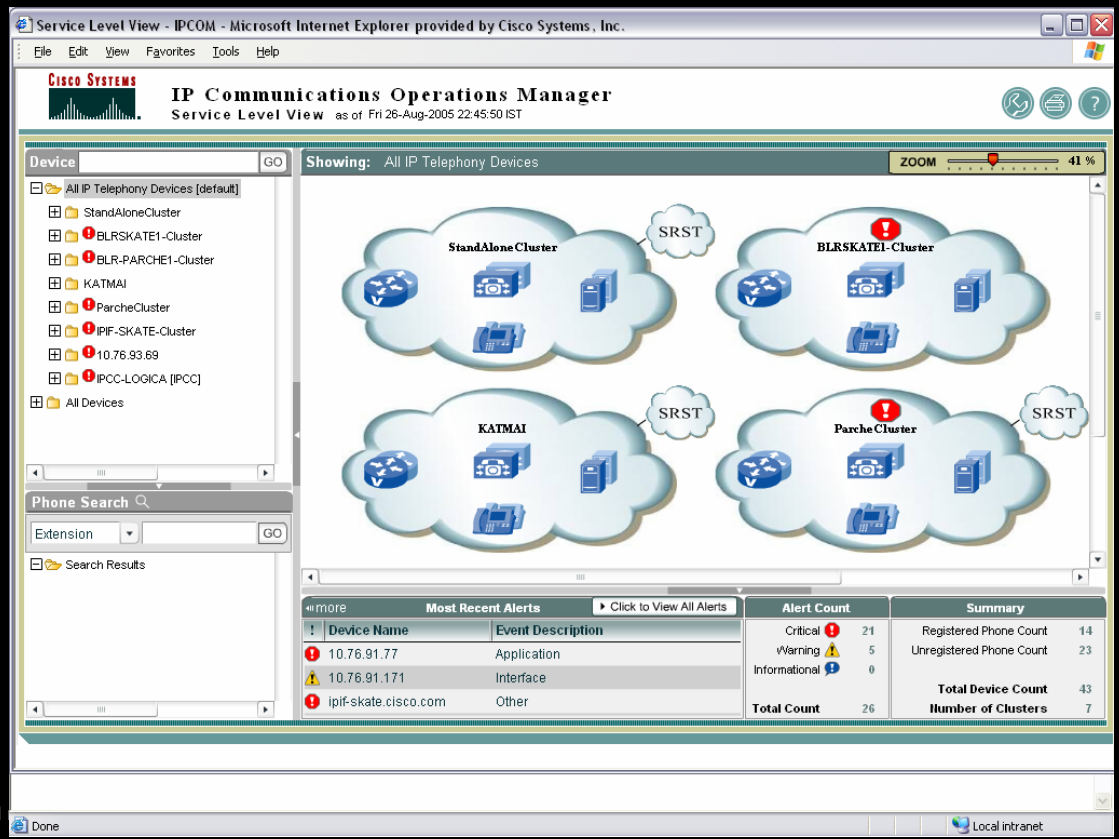
CiscoWorks Unified Operations Manager Service Level View

- **Actionable, service level View of full IP Communications implementation**
  - **Correlation of device and IPC application fault status to endpoint and service availability**
  - **Service Level reports**
- **Support for CCM, Unity, CME, CUE, IPCC, IPCCE, Gateways, Routers, Switches, Phones and Applications**



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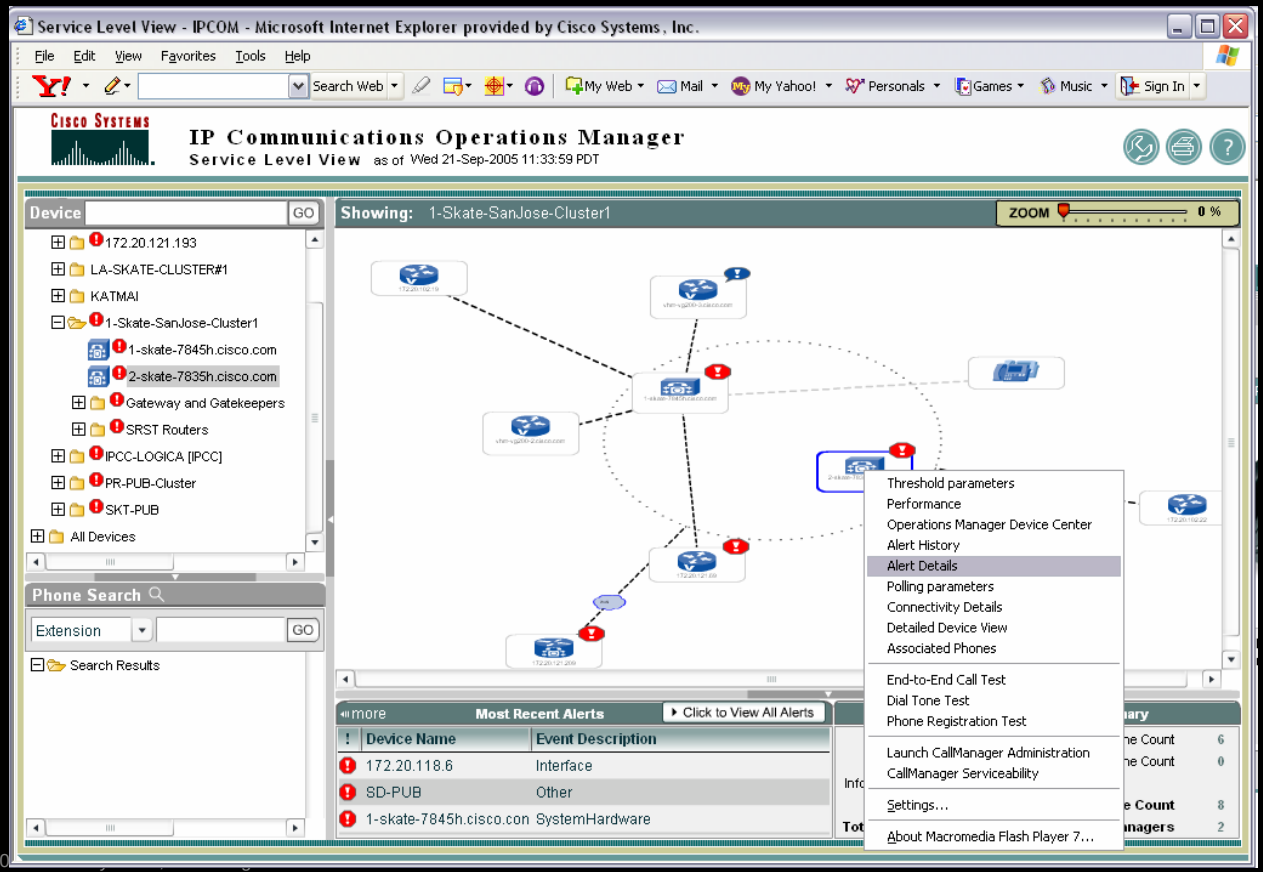
CiscoWorks Unified Operations Manager Service Level View

- Comprehensive monitoring and alerting with intuitive work flow and ease of use
- Integrated Diagnostic Tools for monitoring and active testing (end-to-end, node-to-node; signaling, transport)
- Physical and logical topology views of IPC implementation
- Real-time phone status display and path trace between phones / devices



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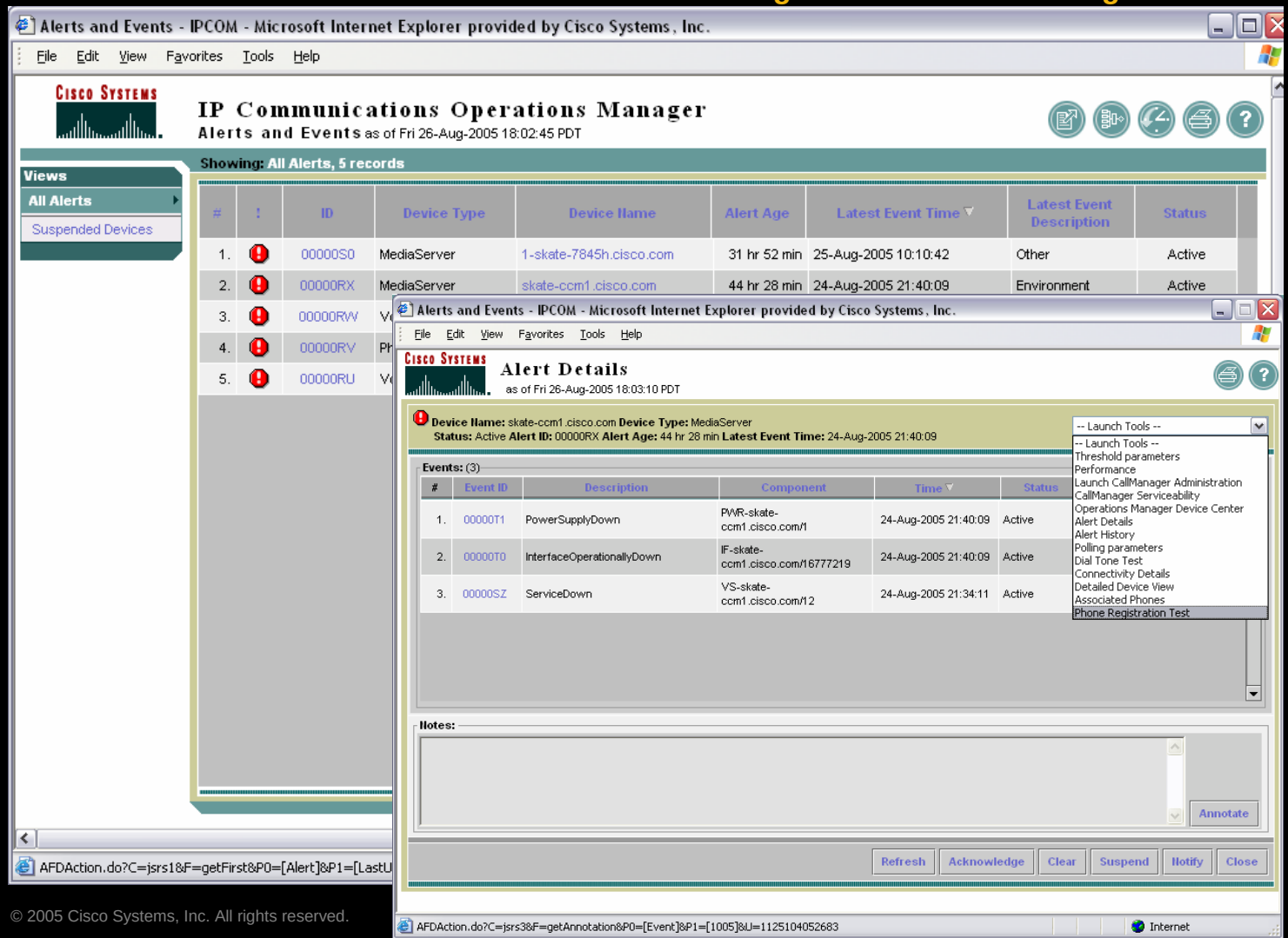
CiscoWorks Unified Operations Manager Alerts & Events

Cisco.com

- Real time alerts on transport as well as IP Communications devices
- Drill down views for detailed information and diagnostic/troubleshooting tools



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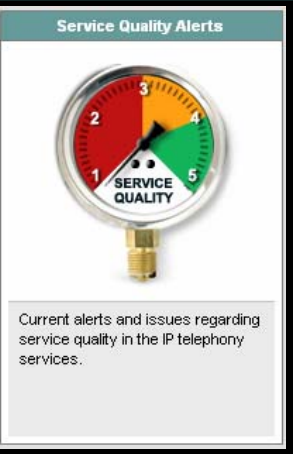
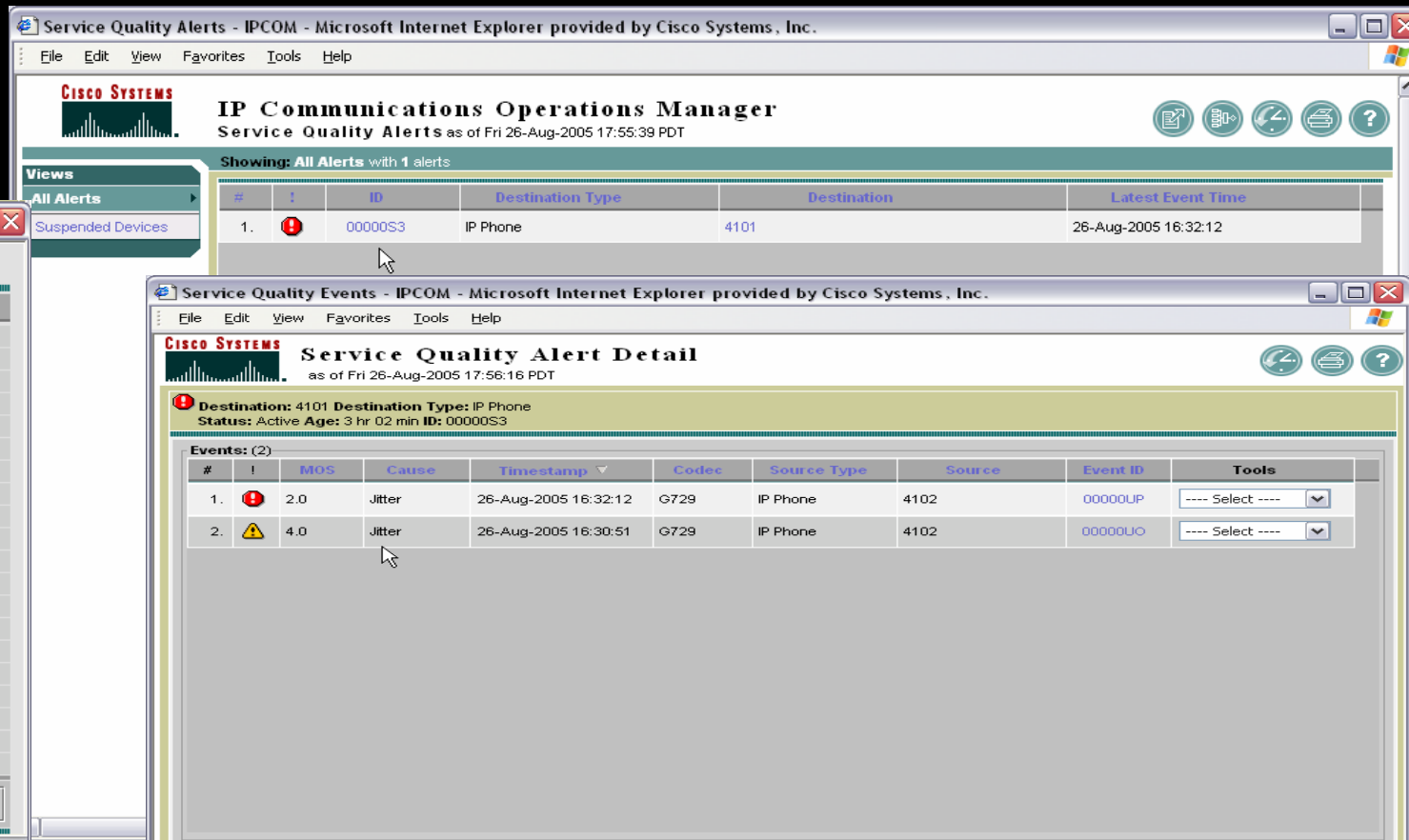
CiscoWorks Unified Operations Manager Service Quality Alerts

Cisco.com

- Real time alerting on service-quality issues (detected by IPC Service Monitor)
- Identification of endpoints (IP Phones, gateways, messaging/conferencing systems) involved in the call segment
- MOS score and other detailed information about the cause of the service quality issue
- Drill down views for detailed information and diagnostic/troubleshooting tools





CiscoWorks Unified Operations Manager
Ip Phone Stations

Cisco.com

IP Phone Status

List of IP phones that are experiencing outages in service.

- **Auto discovery of IP Phones in the network**
- **Phone status, and status change reports (Moves, Adds, Changes)**

IP Communications Operations Manager - Microsoft Internet Explorer provided by Cisco Systems, Inc.

Cisco Systems

IP Communications Operations Manager

All IP Phones Report

Showing 1 - 4 of 4 records

		Extn	User	IP Address	MAC Address	Model	Protocol	Regd	CCM	CCM/CME Name	CCM/CME Address	Switch Name	Switch Address	Port	Port Status	VLAN Name	VLAN ID	SRST mode	SRST Router
1.	☐	4104	Susan	172.20.119.62	00137f7aa882	7960	SCCP	yes	CCM	skate-ccm1.cisco.com	172.20.119.43	172.20.119.161	172.20.119.161	Gi1/0/23	up	default	1	_	_
2.	☐	4102	Manoj	172.20.119.28	000a412b7aec	7940	SCCP	yes	CCM	skate-ccm1.cisco.com	172.20.119.43	172.20.119.161	172.20.119.161	Gi1/0/24	up	default	1	_	_
3.	☐	4101	John	172.20.119.106	0009e8812655	7960	SCCP	yes	CCM	skate-ccm1.cisco.com	172.20.119.43	172.20.119.161	172.20.119.161	Gi1/0/26	up	default	1	_	_
4.	☐	4103	Bill	172.20.119.65	00137f7aa8aa	7960	SCCP	yes	CCM	skate-ccm1.cisco.com	172.20.119.43	172.20.119.161	172.20.119.161	Gi1/0/25	up	default	1	_	_

Rows per page: 10 Go to page: 1 of 1 Pages Go

<-- Select an item then take an action -->

Launch

CiscoWorks Unified Operations Manager Product Feature-by-Feature Benefits

Cisco.com

Features	Benefits
Service level views	Provides network managers the ability to visualize their IPC deployment. Enables them to identify details about different CCM and IPC clusters deployed along with the current status and composition of each of these clusters. Display serves as the central point to initiate different functions that are available in the CiscoWorks IPC Operations Manager.
Proactive monitoring, **Performance and capacity monitoring**	Constantly polls the devices and applications in the IPC implementation and identifies potential issues that might lead to outages. Ability to poll performance and capacity metrics on IPC network elements such as CallManager, Unity, IPCC, CallManager Express, Unity Express and different gateways to aid in diagnostics and troubleshooting. These metrics can be polled on demand and graphed over a 72 hour rolling window.
Real-time alerts	Any threshold violation or fault on a device/application is notified on a real-time basis through the Service level views, Alerts displays and North-Bound interfaces
Diagnostic tests	Runs synthetic testing simulating end-user behavior (such as off-hook, end to end calls, voice mails etc), phone status monitoring as well as simulated network traffic tests (through IP SLA)
IP Phone Status	Automatic discovery of every single IP phone deployed in the network. Provides current registration status, switch connection details etc. Enables network managers to get instant access to IP Phone outage information. Two types of outages are monitored; signaling related outages as well as IP connectivity related outages.

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CiscoWorks Unified Operations Manager Product Feature-by-Feature Benefits

Cisco.com

Features	Benefits
Northbound Interfaces	Syslogs, SNMP traps and Emails can be sent out whenever IPC Operations Manager diagnoses a fault
	Notifications also contain context sensitive links
Reports	Historical alert, event and service quality reports
	IP Phone inventory and Phone status reports (Moves, Adds, Changes)
	Personalized reports.
Service quality alerting	Leverages IPC Service Monitor
	Real-time service quality alerting
	Identification of endpoints (IP Phones / gateways / messaging systems)
	MOS scores for call segments that violate user defined threshold
	Contextual diagnostic functions (historical information, probable path trace, IPSLA tests)

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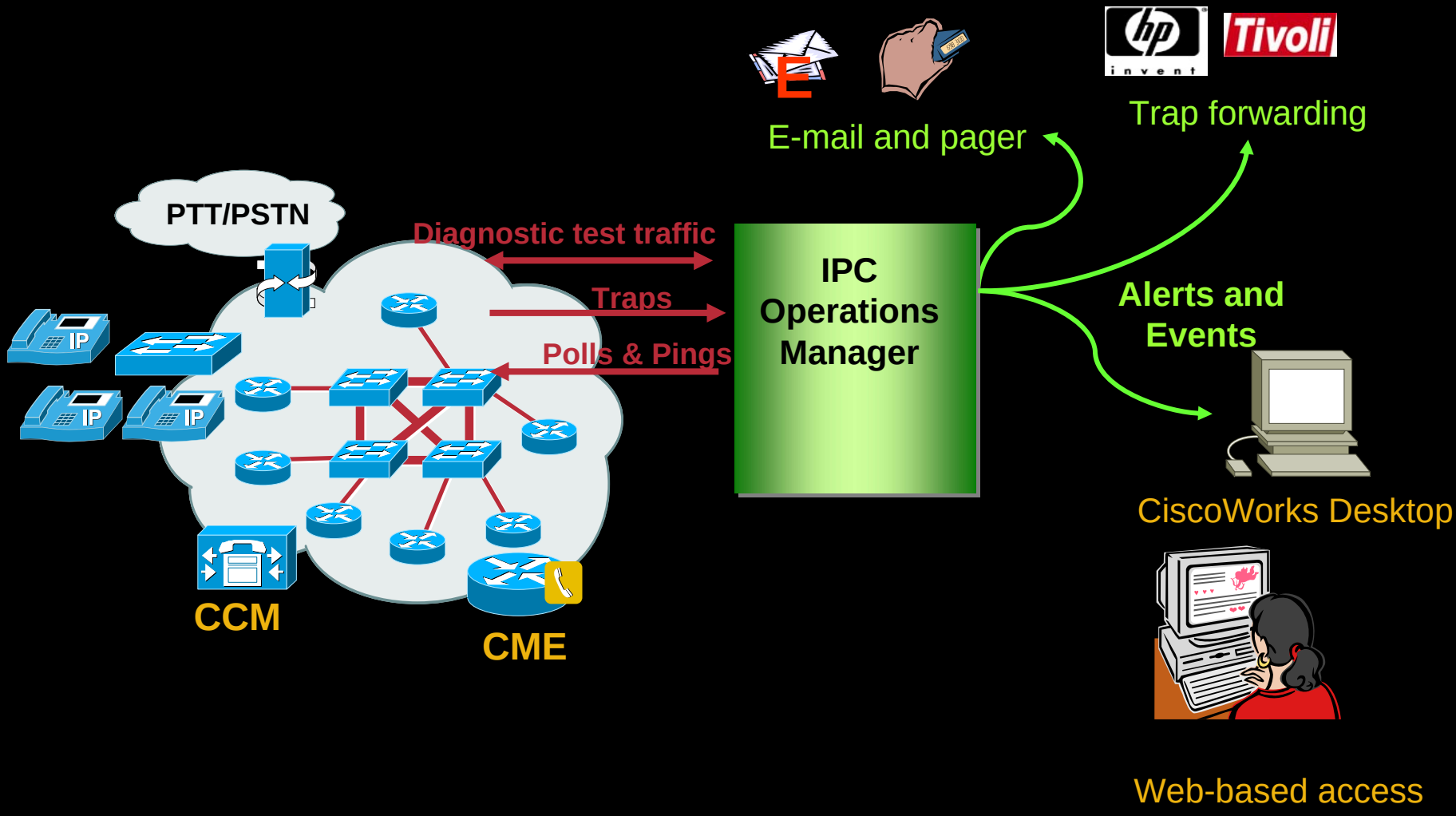
CiscoWorks Unified Operations Manager Deployment Scenario



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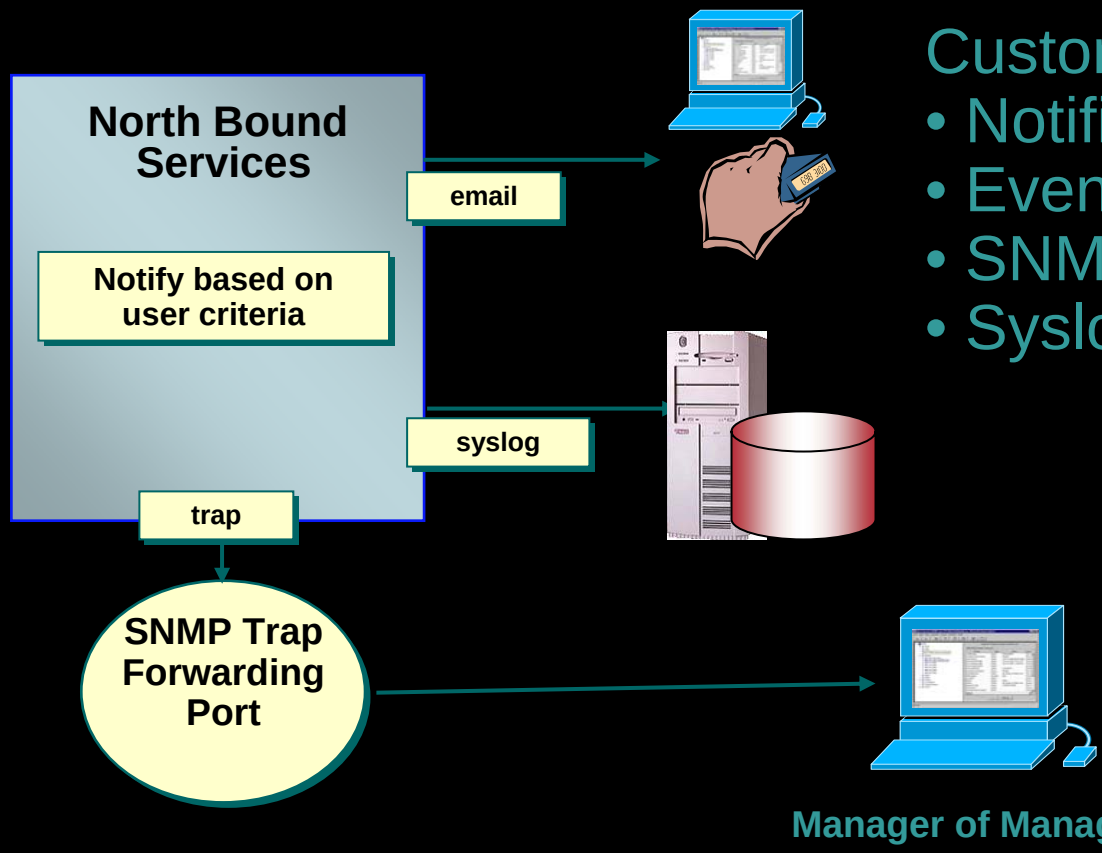
CiscoWorks Unified Operations Manager Northbound Interfaces



Customize NB messages with:

- Notification Groups
- Event descriptions
- SNMP trap customization
- Syslog Messages

E-mail/syslog/trap contains context sensitive links to detailed information

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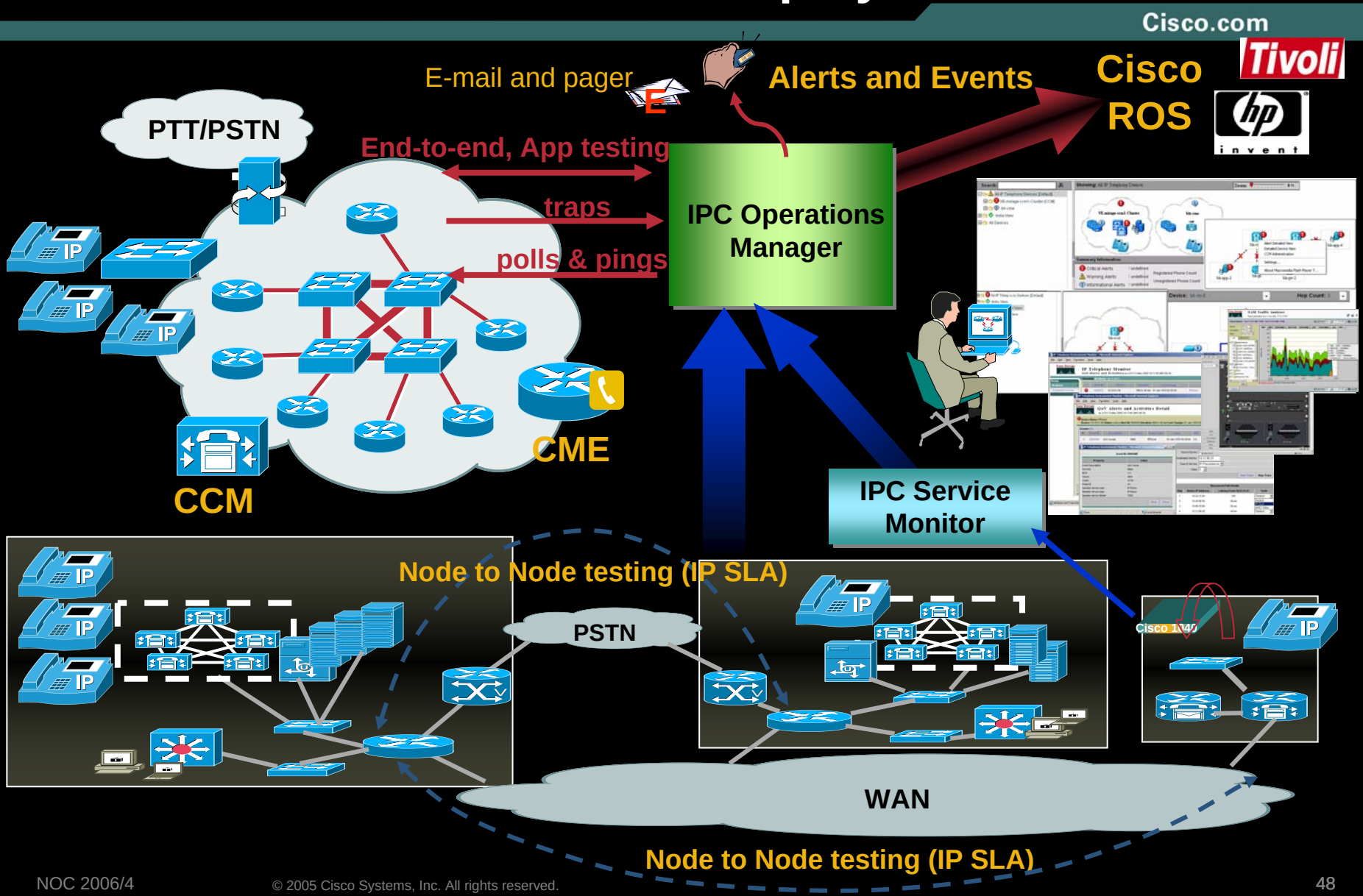
CiscoWorks Unified Operations Manager & Unified Service Monitor – Deployment Scenario



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CiscoWorks Unified Operations Manager Summary

- Actionable, service level View of full IP Communications implementation
  - Correlation of device and IPC application fault status to endpoint and service availability
  - Service Level reports, logical and physical topology views
- Real-time alerting on IP Communications and IP devices in the deployment
  - CallManager, CallManager Express, Unity, Unity Express, IPCC, IPCC Express, Routers, Gateways, Switches, IP Phones and IPC Applications
- Integrated Diagnostic Tools for monitoring and active testing (end-to-end, node-to-node; signaling, transport
- Integrated Service quality alerting and reporting
- Real-time phone status display and path trace between phones / devices
- Extensive Phone and device inventory reporting
- Integrates with other CiscoWorks tools like LMS, ACS etc
- Flexible N-B interfaces with context sensitive links to detailed information

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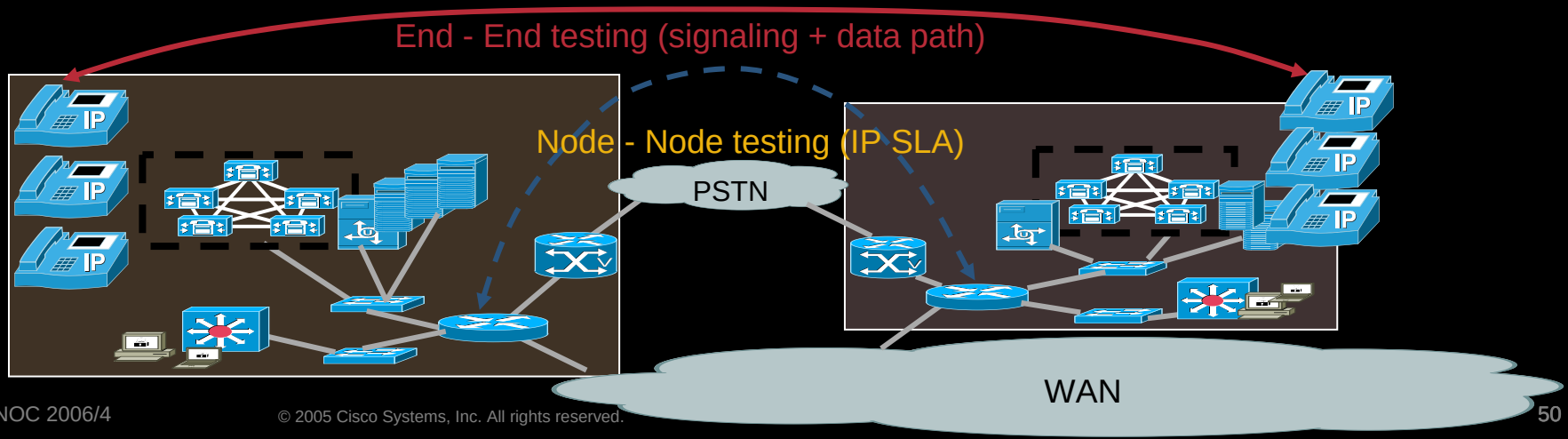
CiscoWorks Unified Operations Manager Integrated Diagnostics

- **Integrated diagnostics linked to monitoring and proactive testing**
  - **Replicate end user activities**
    - **End to End Call (Signaling and RTP)**
    - **Phone Registration**
    - **Dial-tone**
    - **Message Waiting Indicator**
    - **Conference**
    - **Emergency Call**
  - **Replicate voice traffic (IP SLA/SAA based)**
    - **Quality/Latency/Jitter/packet loss**
    - **Gateway registration**



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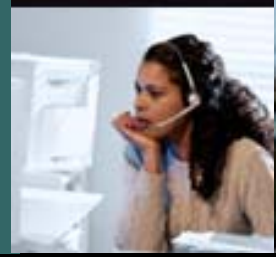
Voice Quality Monitoring Solution

CiscoWorks USM
Unified Service Monitor



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CiscoWorks Unified Service Monitor - Overview

Cisco.com

- Real-time monitoring of voice quality for actual calls
- R-factor MOS for every 60 second interval
- Built-in system-level availability and redundancy
- Easily installs and configures itself just like a Cisco IP phone
- Uses switch SPAN port

- Real-time alerting with details
- Analysis and archival-based on MOS thresholds
- Integrates with IPC OM or Manager of Managers

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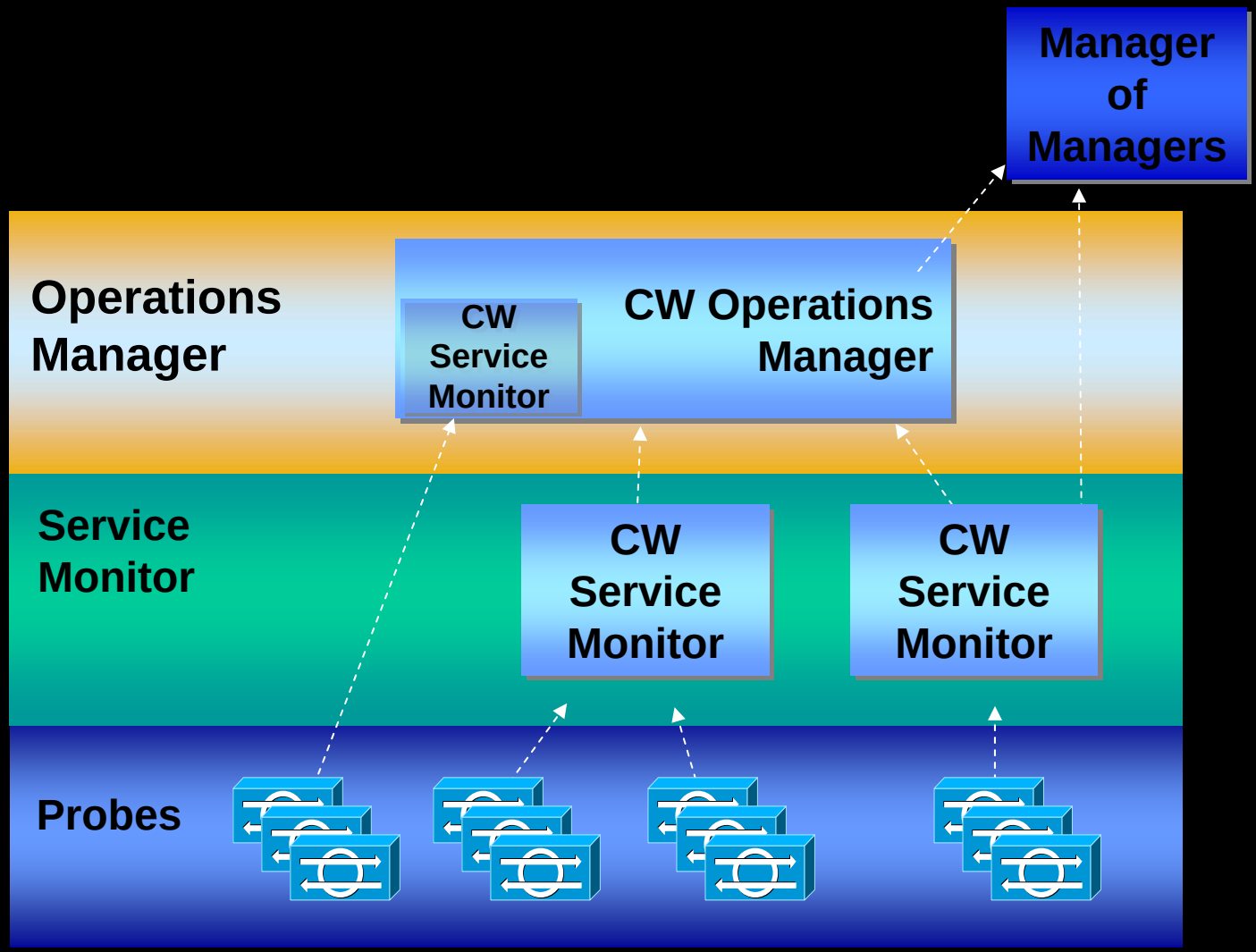
IPT Solution Overview: Unified Operations Manager and Service Monitor

- Multiple Service Monitor can talk to IPCOM

- 10 probes per Service Monitor
- Support IEEE 802.3af PoE



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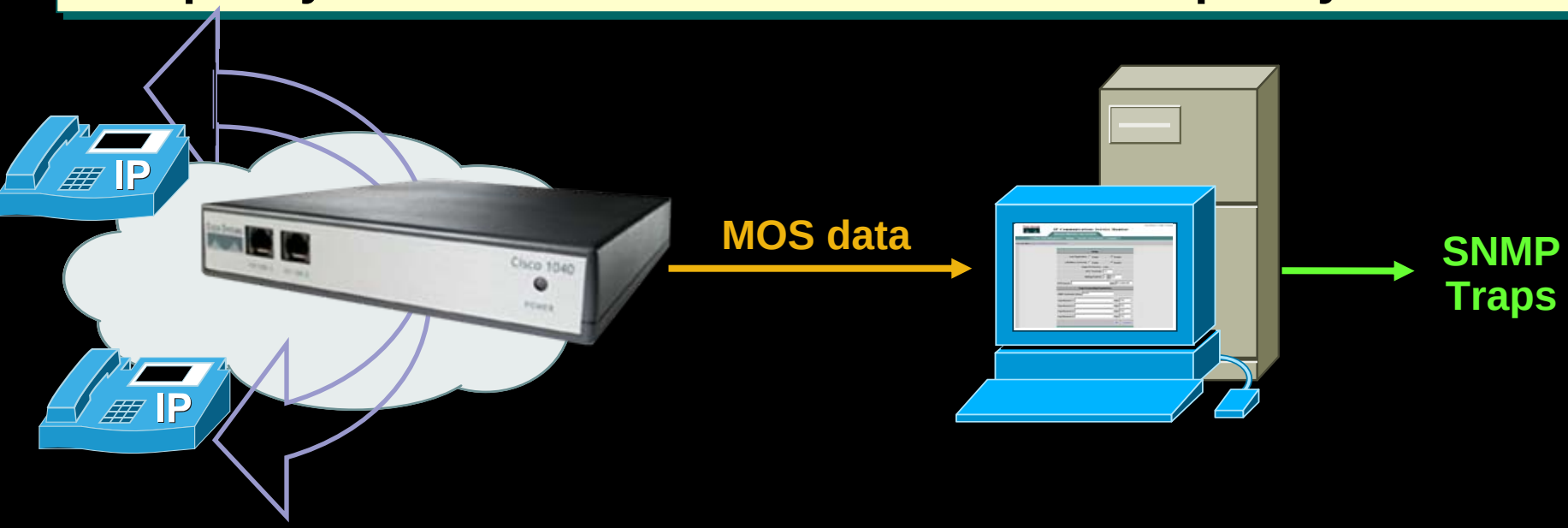
Unified Service Monitor - Product Overview
Two Component Solution

CiscoWorks IP Communications Service Monitor is a two-component solution that monitors, evaluates, and reports quality of voice metrics about active IP telephony calls



Cisco 1040 Sensor

- Evaluates up to 80 RTP streams per second
- Calculates a Mean Opinion Score (MOS)
- Forwards results to IPCSM software component every 60 seconds

CW USM Software Component

- Compares incoming MOS to user-defined threshold
- Sends SNMP trap for MOS below threshold
- Optional data archive
- Manages Cisco 1040 Sensors

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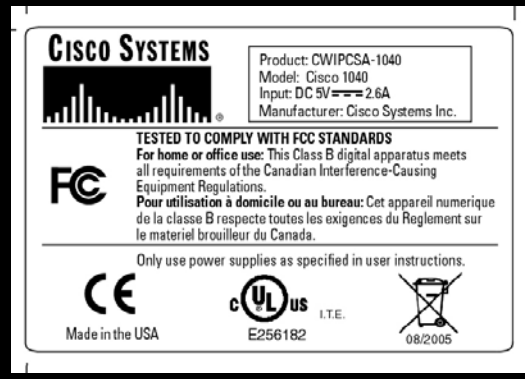
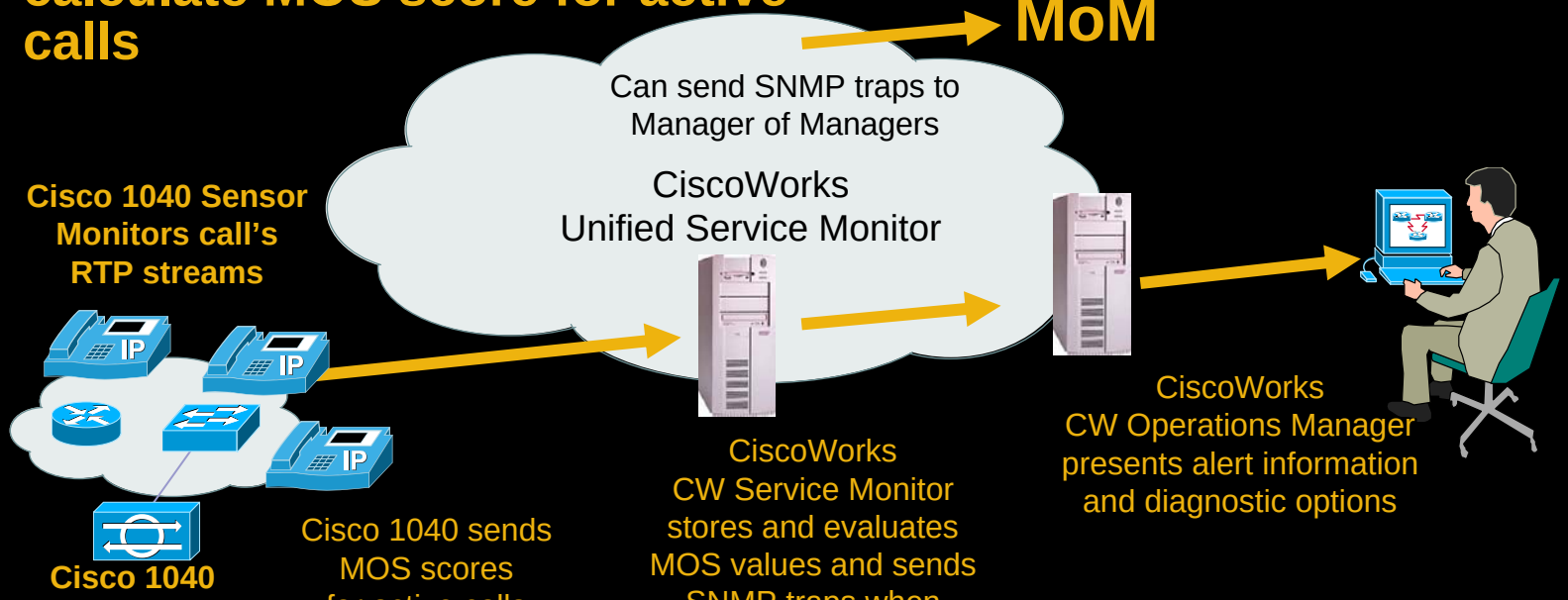
CiscoWorks Unified Service Monitor

- **FCC Class B certified for desktop or wiring closet deployment**
- **PoE (IEEE 802.3af)**
- **Uses ITU G.107 R-factor to calculate MOS score for active calls**





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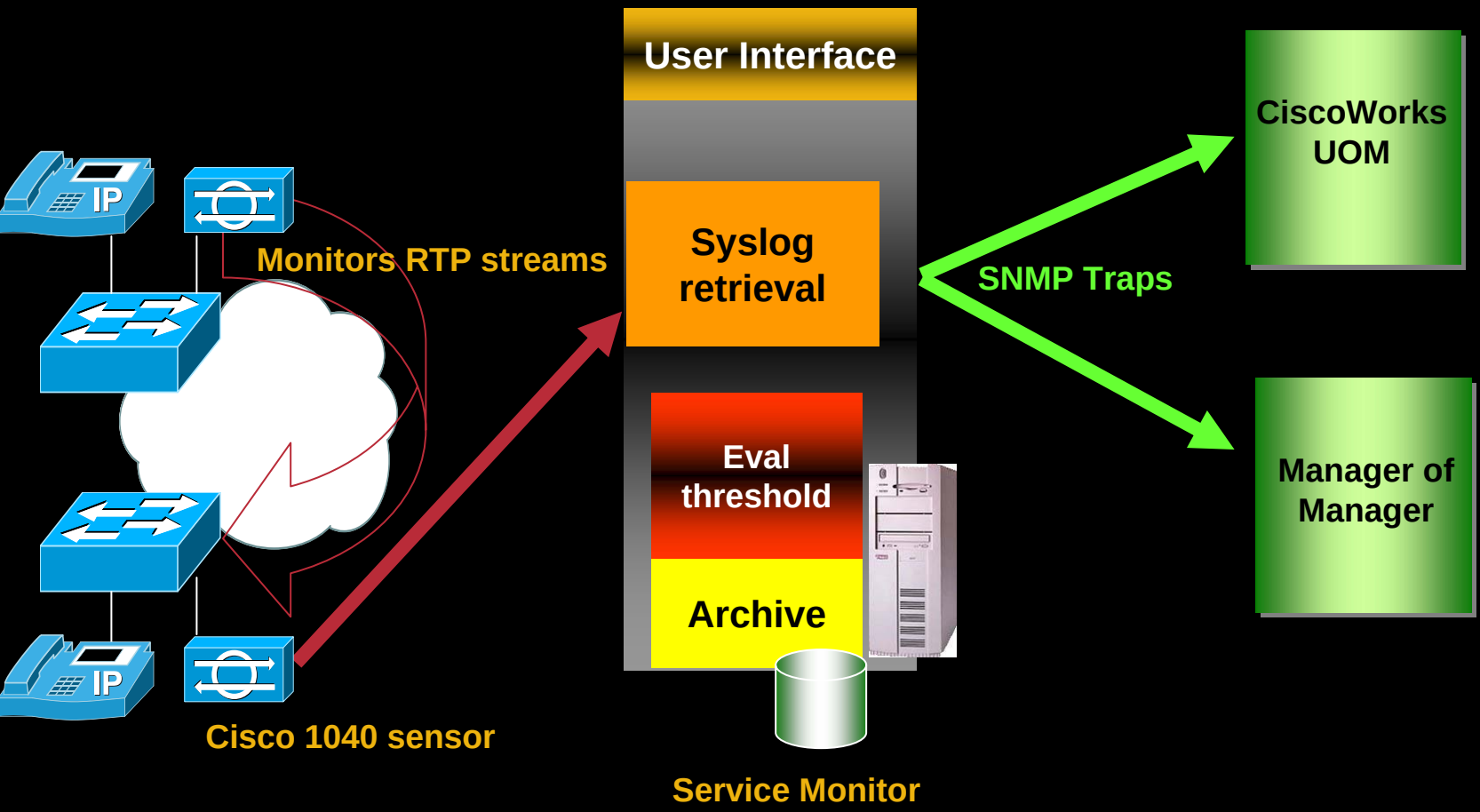
CiscoWorks Unified Service Monitor Architecture



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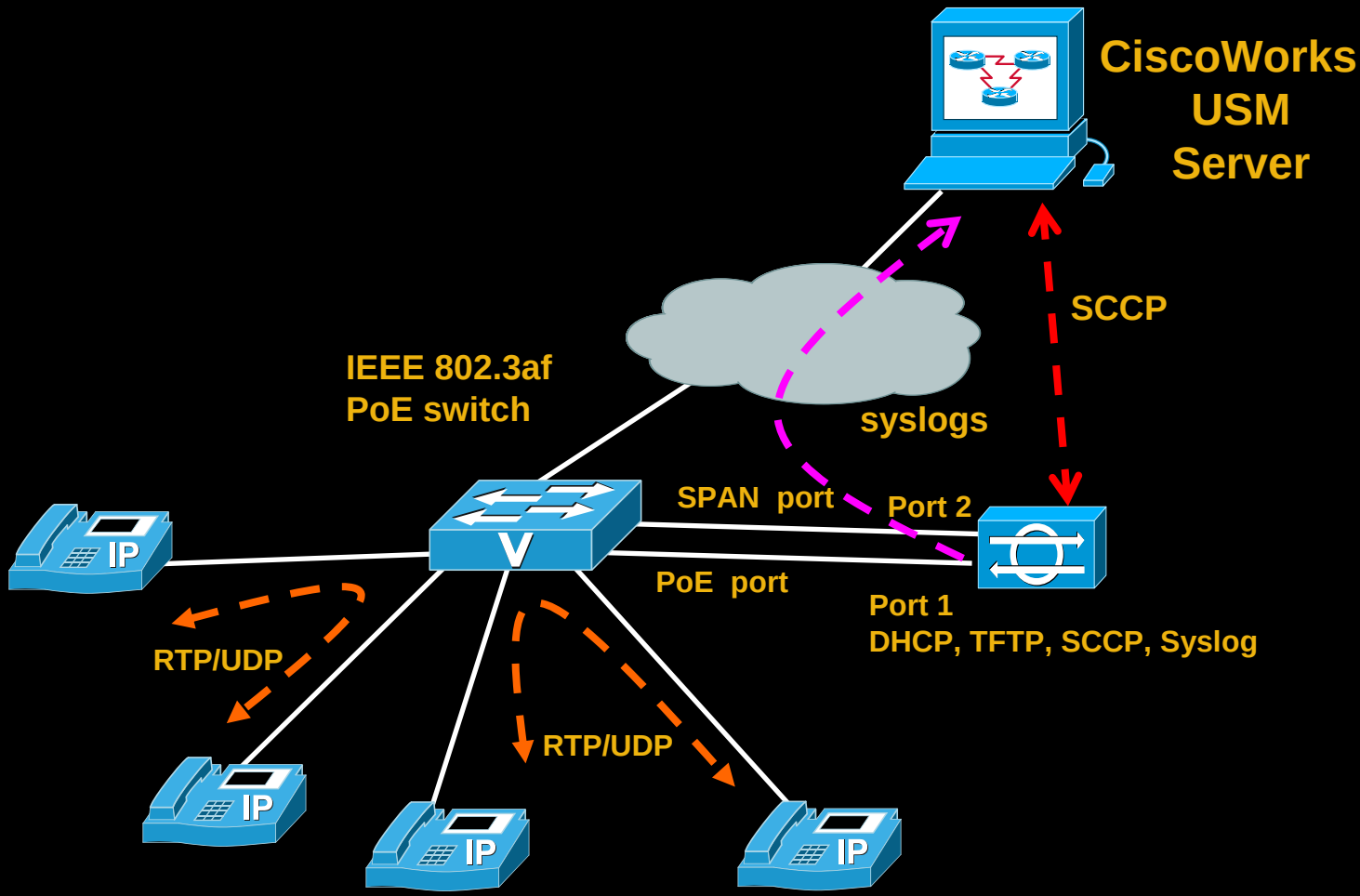
CiscoWorks Unified Service Monitor Flow diagram



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Cisco 1040 Port Usage

Protocol	Port Number	Service Name
UDP	53	DNS
UDP	67 and 68	DHCP
UDP	69	TFTP
UDP	514	Syslog
TCP	2000	SCCP
TCP	80	HTTP

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Understanding MOS Scores

MOS Quality Rating

Quality Scale	Score	Listening Effort Scale
Excellent	5	No effort required
Good	4	No appreciable effort required
Fair	3	Moderate effort required
Poor	2	Considerable effort required
Bad	1	No meaning understood with reasonable effort

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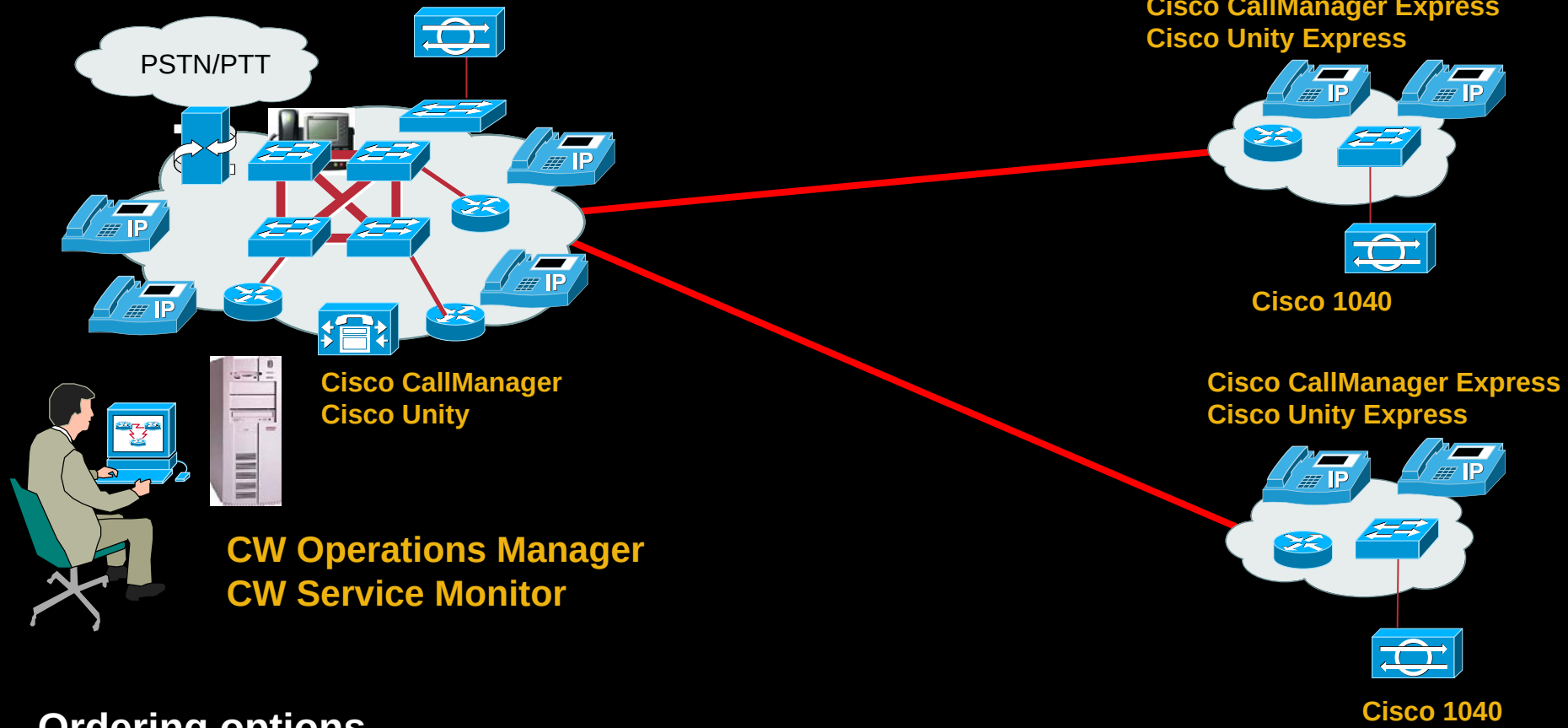
CiscoWorks UOM and USM
Small and Medium Enterprise Deployments



Ordering options

- **CiscoWorks IPC Mgmt Bundle OR**
- **CiscoWorks IPC OM + 6 pack IPCSM bundle**

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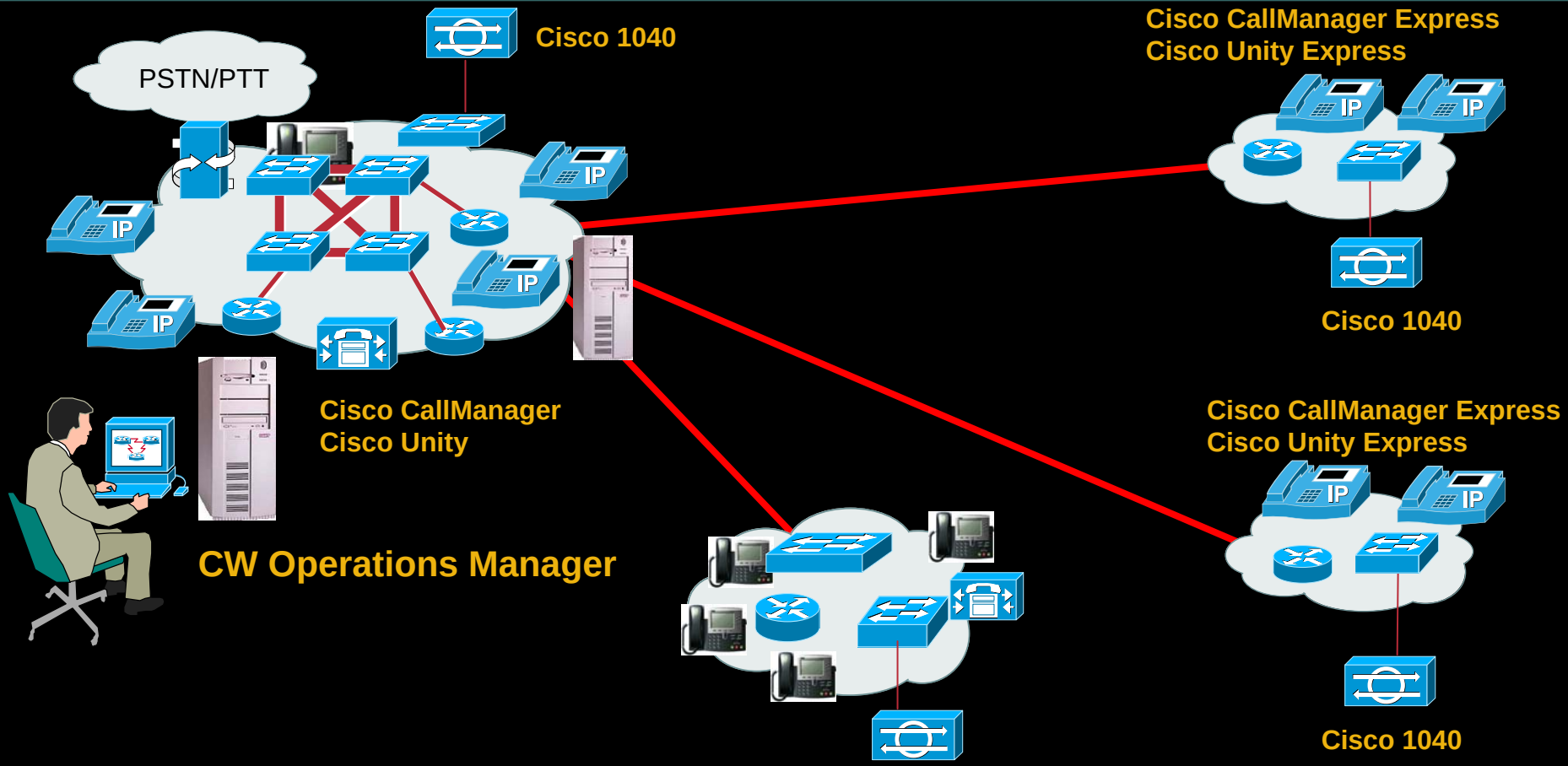
CiscoWorks UOM and USM
Large Enterprise Deployments

Cisco.com



CiscoWorks IPC OM (w/ appropriately sized license)
+ multiple 6 pack IPCSM bundles

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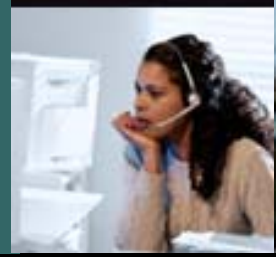
Opsummering



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“Der findes *ingen* do-it-all Network- eller System Management applikation

- Start altid med et baseline design og byg videre derfra

- Tænk i systemer

- Del netværk og løsninger op i vertikaler

- Læs applikationernes Release Notes”

Christian Binow (cbinow@cisco.com)

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“Network Management er ikke Rocket Science.”

Christian Binow (cbinow@cisco.com)

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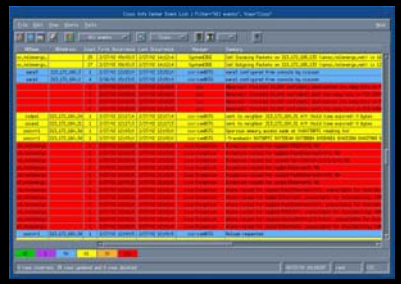
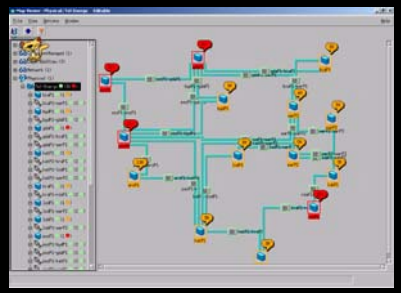
NOC Design - Opsummering





Events

Topology

HP OpenView
IBM NetView

Norhtbound Event Integration
SNMP Trap Forwarding

CiscoWorks
Operations Manager

CiscoWorks
Service Monitor

CiscoWorks
LMS

3.Party

Operations
Configuration
Provisioning
Service Assurance
Performance

Operations
Configuration
Provisioning

Service Assurance
Performance

Cisco ITP

Netværk: Cisco router / switches o.a

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NOC Design – Cost Calculation

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CiscoWorks LAN Management Solution

CWLMS-2.5-UR-K9	LMS 2.5.1 Large Ent WIN/SOL Dev UnRestricted - Rev Dec05	S	$24,995

CiscoWorks IP Communications Operations Manager

CWIPCOM-1.0-2K-K9	CiscoWorks IPC Operations Manager 1.0 - Max 2K Phones	N/A	$24,995
CWIPCOM-1.0-K9	CiscoWorks IPC Operations Manager 1.0	N/A	$100

CiscoWorks IP Communications Service Monitor

CWIPCSA-1040	CiscoWorks IP Communications Service Monitor	N/A	$100
CWIPCSA-1.0-6PK-K9	CiscoWorks IPC Sensor A 1.0 - 6 Pack 1 IPCSM SW	N/A	$17,995
CWIPCSM-1.0-K9	CiscoWorks IPC Service Monitor 1.0	N/A	$8,995

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Q and A

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