

Cisco IP Solution Center ISC and MPLS Traffic Engineering

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Agenda

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- **ISC Positioning**
- **System Features**
- **MPLS/VPN Services**
- **Managed Security Services**
- **L2VPN and Metro Ethernet Services**
- **Policy Based QOS**
- **Auto-Discovery Feature**
- **Northbound API & OSS Integration**
- **Traffic Management**

IP Solution Center

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- **Building on VPNSC: Cisco's defacto Service Management platform for IP VPN technology offerings**
- **Extending the Service representation to include Internet Access, Managed Security, L2VPN, Metro Ethernet and Traffic Management services**



**Next Generation Domain Manager
for Converged Networks**

IP Solution Center: Full Service Life Cycle Management

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- **Automate Topology Creation**
- **Activate the Service**
- **Verify Logs and Activation is Error**
- **View Topology of the Service**
- **Audit and Verify Service is Active and Functional**
- **Monitor the SLA for the Service**
- **Collect SLA data and report for the Service**
- **Modify and Change the Service without error**
- **Decommissioning of Service– Roll back**



IP Solution Center

MPLS VPN, L2VPN, Managed Security and TE

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OSS

Fault Management

- o CIC

Accounting Management

- o C-Perf
- o Digiquant IMS
- o Portal

Performance Management

- o Concord
- o InfoVista
- o Visual Network

Others

- o SI: HP, CGE&Y, KPMG, Dimension Data

>120 Customers WW

Service Provisioning/Activation and VPN aware SLA measurement
IP Solution Center

Services

MPLS VPN

L2VPN

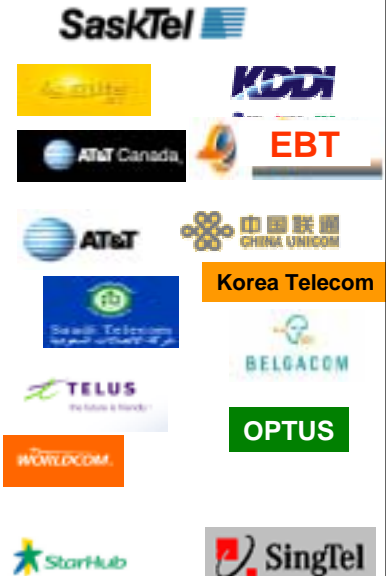
- o AToM
- o Metro Ethernet

Managed Security

- o IPsec VPN mgmt
- o Firewall Mgmt
- o Nat Mgmt

Traffic Management

- o TE Activation – Cisco MPLS Tunnel Builder

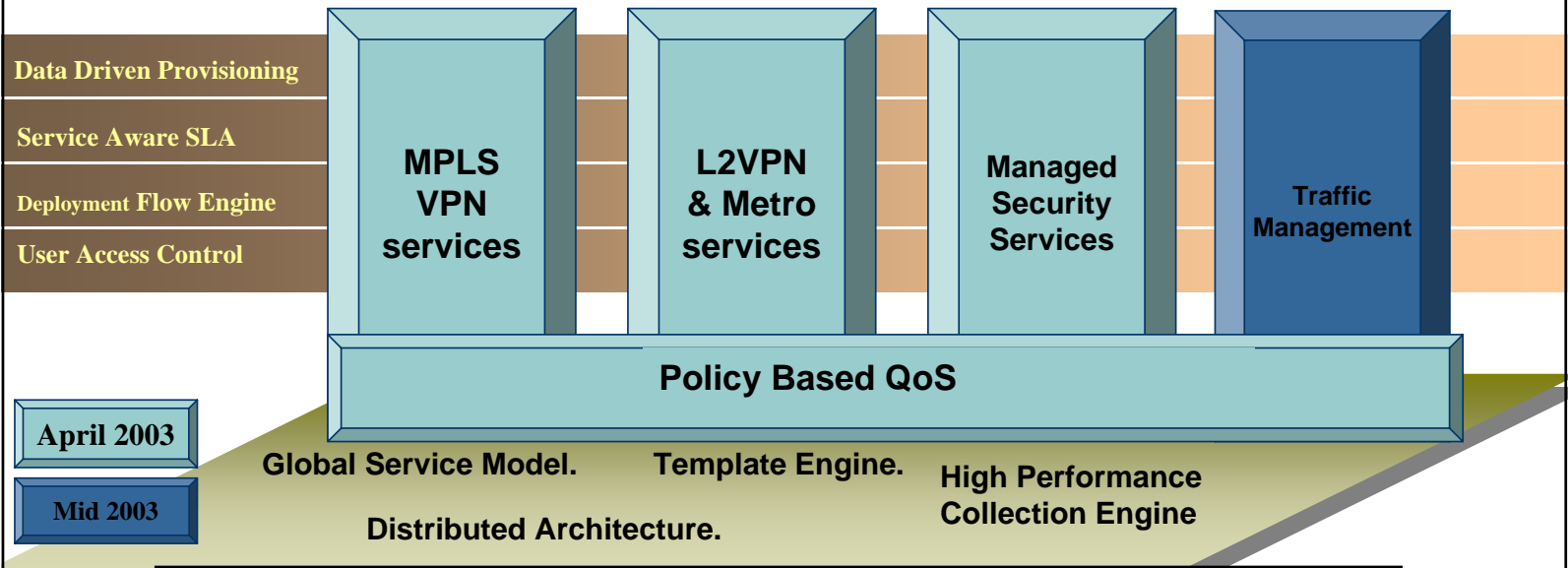


Provision VPN (L2, L3), QOS and MPLS DS-TE with one Application

Comprehensive Managed Security Services Support

ISC Service Blades

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- ❖ **Integrated Management for Cisco's VPN, Security and Metro Ethernet Services**
- ❖ **Adding support for Traffic Engineering**
- ❖ **One-Stop Shop for all Services for Cisco's IP Core solutions**
- ❖ **Support 100% Cisco L2 and L3 VPN equipment – new IOS based equipment could be supported in lab in two weeks.**

System Features

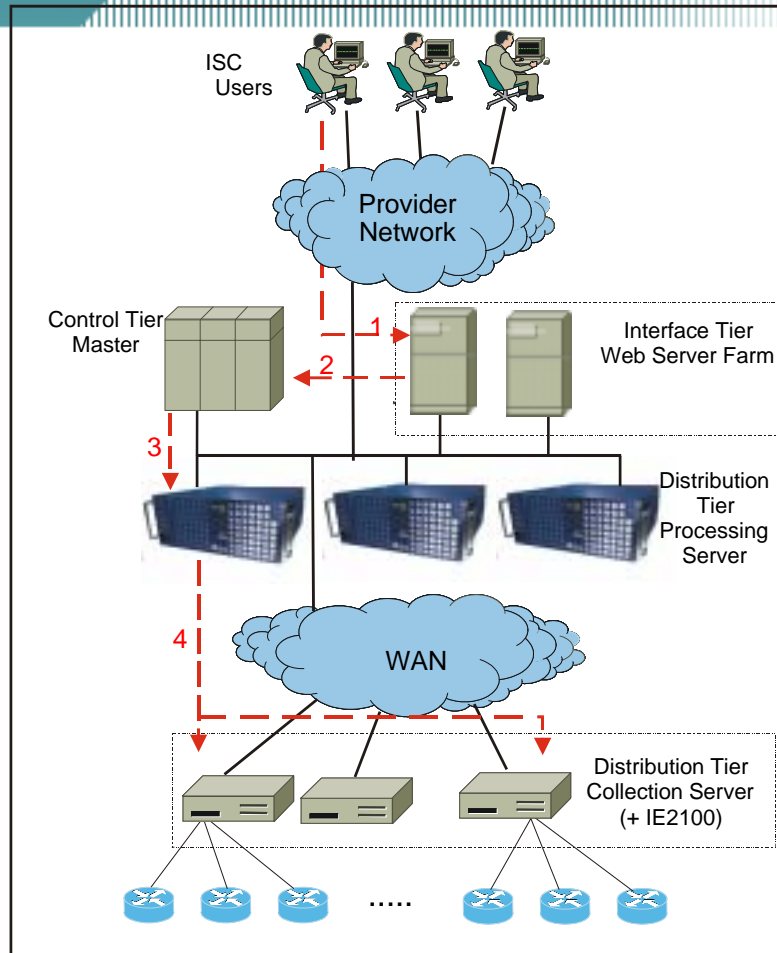
IP Solution Center System Features

Cisco.com

- **4-tier distributed architecture**
- **Support for 200+ simultaneous user access and 1M managed CPE**
- **Web based GUI**
- **Role Based Access Control user model support**
- **CNM views**
- **RDBMS (bundled with Sybase) option to use Oracle**
- **Standardized on Sun Netra – standalone and HA configuration**

ISC 3.0 Distributed Architecture

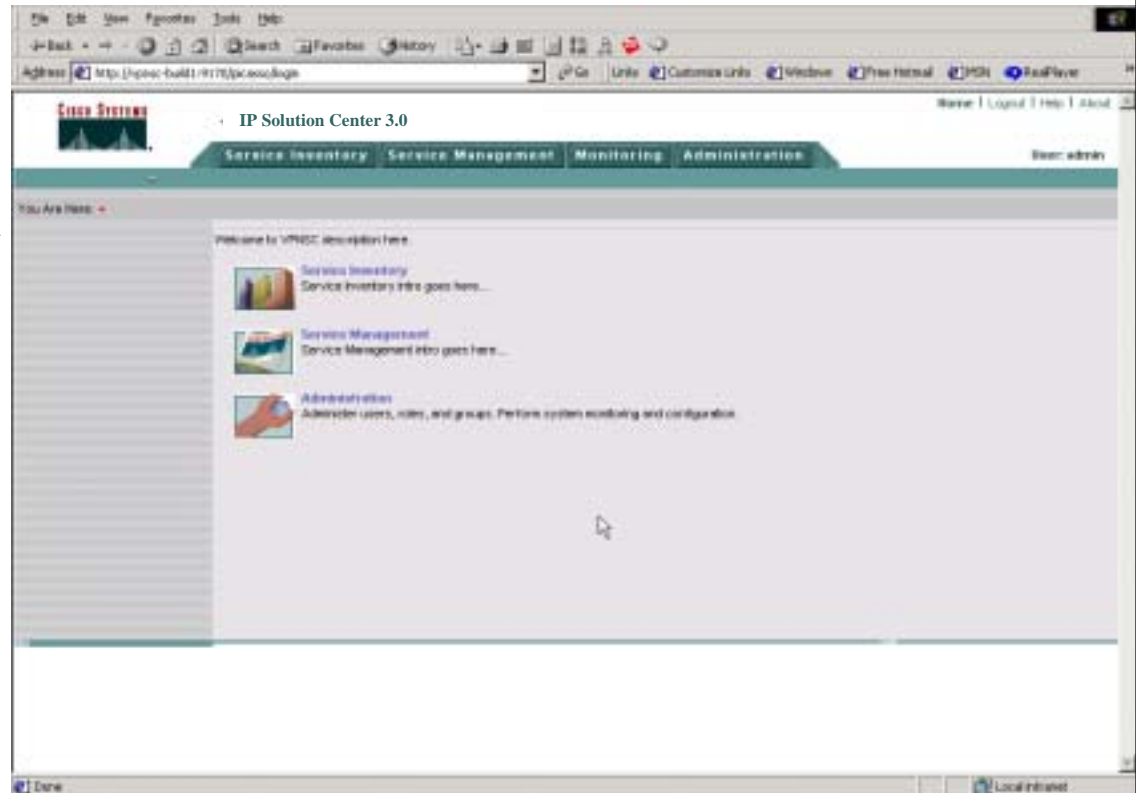
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GUI - Top Level Organization

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- **Universal access through web based GUI**
- **Four major functional groups under four tabs:**
 - **Service inventory**
 - **Service management**
 - **Monitoring**
 - **Administration.**



MPLS VPN Services

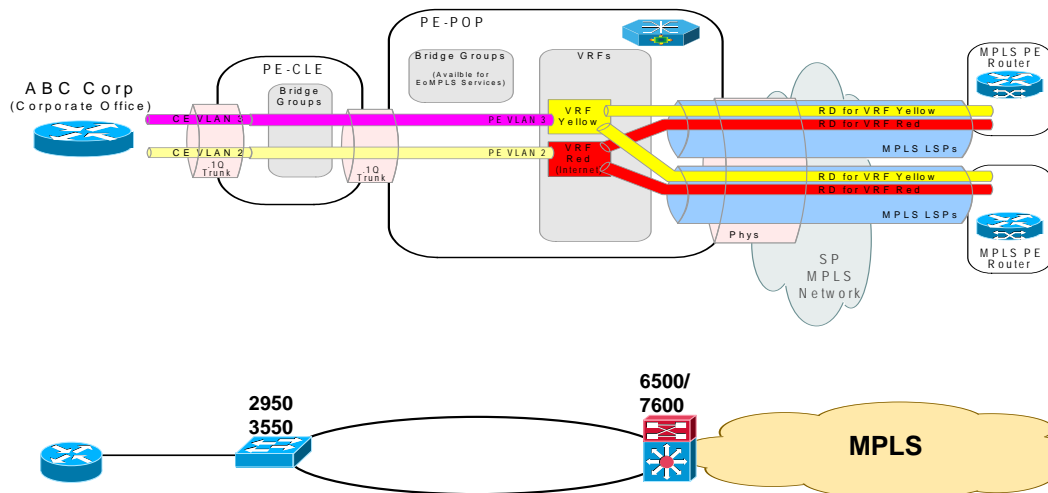
MPLS VPN Service

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- **Enhance the VPNSC2.x MPLS VPN Provisioning Engine's Flexibility And Scalability With The New Customizable Service Delivery Engine**
- **No Longer Just One CE-PE Link At A Time. It Is A Collection Of CE-PE Links Per Service Request. Makes Provisioning Much More Scalable And Productive**
- **Following Major New Enhancements:**
 - **Multicast MPLS VPN**
 - **Multi-VRF Support**
 - **Site Of Origin Support**
 - **L2 Ethernet Access Into MPLS VPN**
 - **PE Only Provisioning**

MPLS VPN Service

Cisco.com



- **Ethernet L2 Access To MPLS With Multiple L2 Switches Between CE-PE Will Be Supported**

MPLS VPN Provisioning

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- **MPLS VPN Provisioning Starts With Defining A Policy.**
- **Policy Will Be Applied To Multiple CE-PE Links Through Service Requests.**
- **Service Request Can Overwrite Default Values In Policy If Marked User Editable**
- **Network Operator Defines The Policy, Service Operator Uses It To Create SRs.**

The screenshot displays the Cisco Systems VPN Solutions Center 3.0 web interface. The main content area is titled "MPLS Policy Editor" and contains a table with columns "Attribute", "Value", and "Editable". The table lists various attributes for defining an MPLS policy, including "Policy Name", "PE Information", "CE Information", and "Interface Addresses".

Attribute	Value	Editable
Reset all Attribute editable flags:		
Policy Name 1	Coke_MPLS_Policy	<input checked="" type="checkbox"/>
PE Information		
Interface Type	Ethernet	
Interface Format		
Interface Description		<input type="checkbox"/>
Shutdown Interface	<input type="checkbox"/>	<input type="checkbox"/>
Encapsulation		<input type="checkbox"/>
CE Information		
Interface Type	Ethernet	
Interface Format		
Interface Description		<input type="checkbox"/>
Encapsulation		<input type="checkbox"/>
Interface Addresses		
IP Numbering Scheme	IP Numbered	<input type="checkbox"/>
Extra CE Loopback Required	<input type="checkbox"/>	<input type="checkbox"/>
Automatically Assign IP Addresses	<input checked="" type="checkbox"/>	

MPLS VPN Provisioning

Cisco.com

- **Service Operator Creates SR (service request)**
- **Each SR Contains A List Of CE-PE Links.**
- **Operator Only Sees And Enters Information Requires By The Policy. All Other Information Will Be Automatically Filled In From The Policy.**
- **Such Scheme Greatly Simplifies The Life Of The Service Operators**

The screenshot shows the Cisco VPN Solutions Center 3.0 web interface. The browser address bar displays `http://vnc-bld19170/cisco/index.jsp?tab=mplc_sr_editor`. The page title is "VPN Solutions Center 3.0" with tabs for "Service Inventory", "Service Management", "Monitoring", and "Administration". The "Service Management" tab is active, showing the "MPLS SR Editor" form.

The form includes a sidebar with a tree view of the system hierarchy, including "Service Requests", "Inventory Manager", "Device Groups", "Customers", "Providers", "Resource Pools", and "VPNs".

The main form area is titled "MPLS Service Request Editor" and contains the following fields and table:

SR Job ID: 0 SR ID: SR State: REQUESTED

Policy: Core_MPLS_Policy

MPLS Link ID	Select	CE	PE	Link Attribute	Logical Link
0	<input type="checkbox"/>	Select CE	Select PE	Link Attribute	Select Logical Link
0	<input type="checkbox"/>	Select CE	Select PE	Link Attribute	Select Logical Link
0	<input type="checkbox"/>	Select CE	Select PE	Link Attribute	Select Logical Link

At the bottom of the table are buttons: "Add Link", "Select Link", "Save SR", and "Cancel".

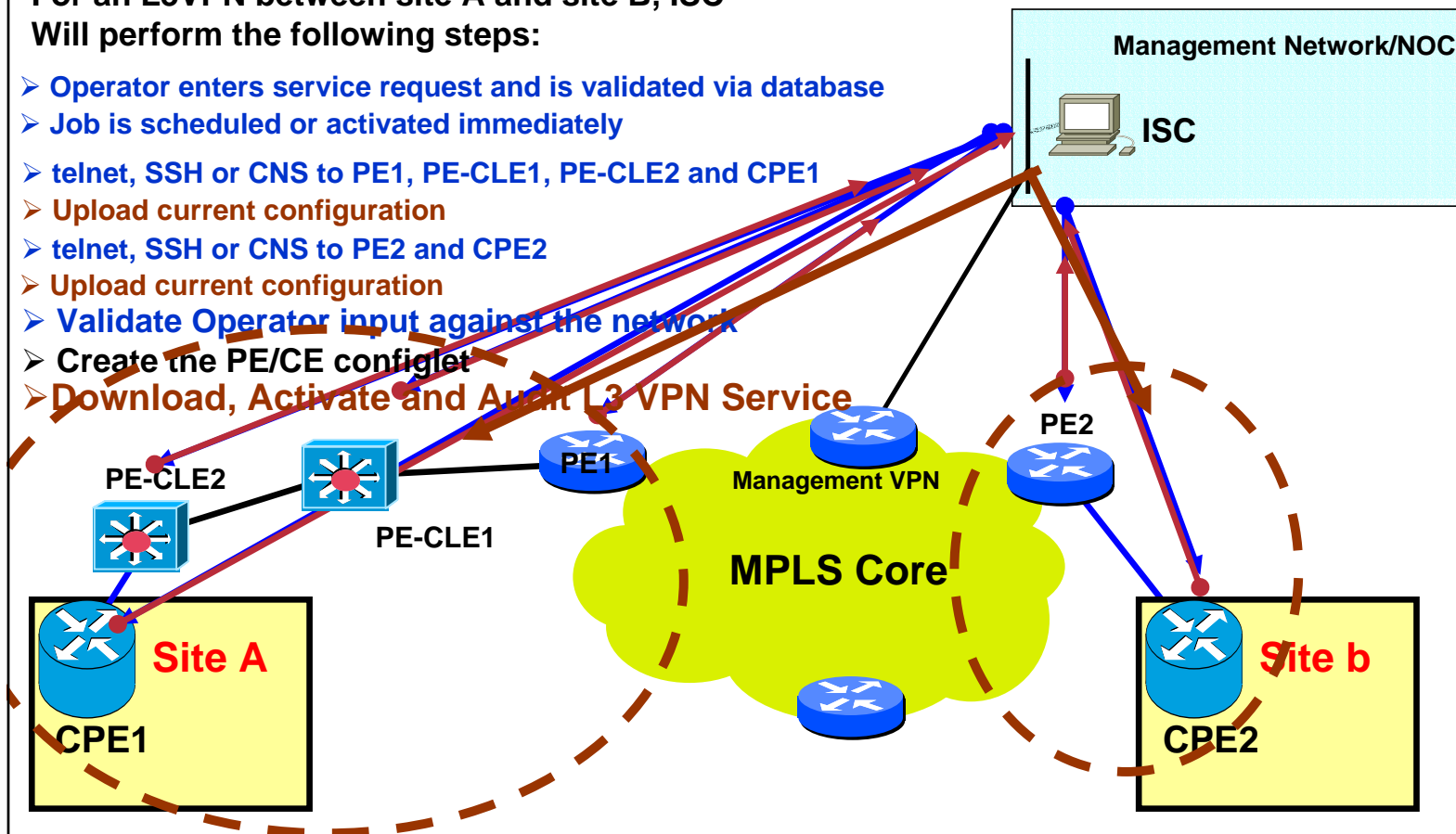
MPLS VPN Provisioning

Cisco.com

For an L3VPN between site A and site B, ISC

Will perform the following steps:

- Operator enters service request and is validated via database
- Job is scheduled or activated immediately
- telnet, SSH or CNS to PE1, PE-CLE1, PE-CLE2 and CPE1
- Upload current configuration
- telnet, SSH or CNS to PE2 and CPE2
- Upload current configuration
- Validate Operator input against the network
- Create the PE/CE configlet
- Download, Activate and Audit L3 VPN Service



L2VPN and Metro Services Support

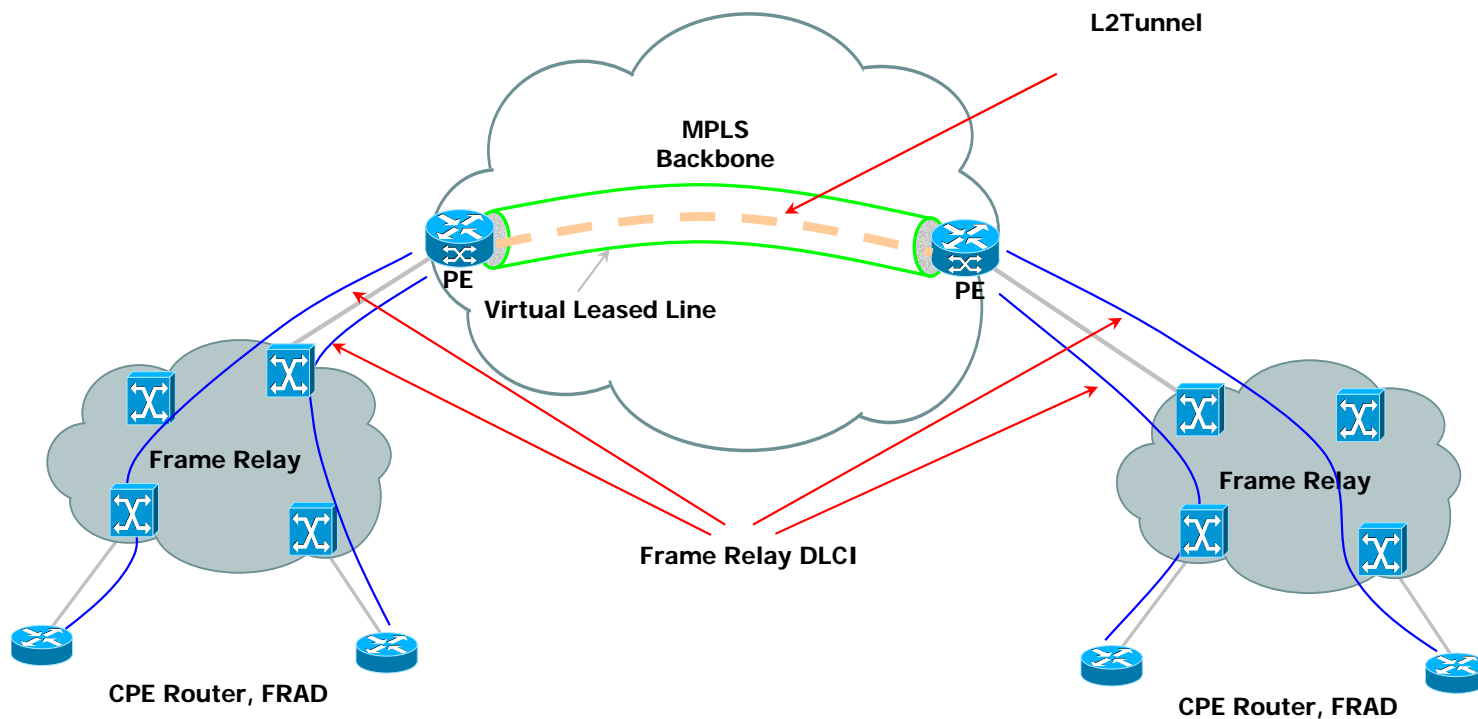
L2VPN Service – Supported Services

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- **Like-To-Like Services With MPLS Only**
 - **ATM Virtual Circuit Service (ATMoMPLS)**
 - **Frame Relay Virtual Circuit Service (FRoMPLS)**
 - **Ethernet Virtual Circuit Service (EVCS or ERS- EoMPLS)**
 - A VEC that acts as if the Ethernet Frames have crossed a Switched network
 - **Transparent LAN Service (Point-to-Point TLS or EWS - EoMPLS)**
 - A VEC that appears to act as an Ethernet Wire
- **Multi-Point TLS over L2 Core**

L2VPN Service – Virtual Lease Line (VLL)

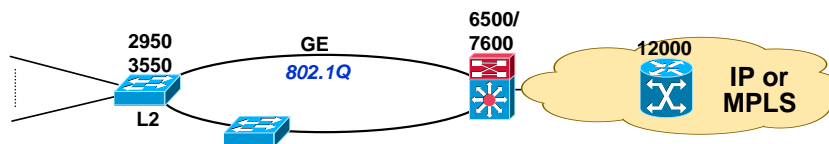
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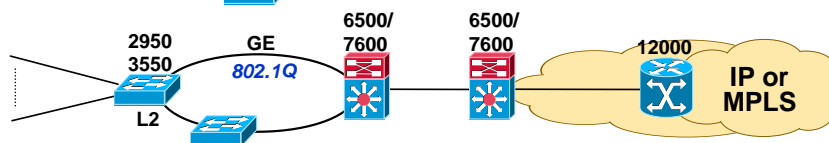
Ethernet Access Supported Architectures

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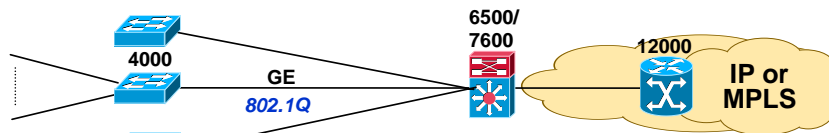
**L2 Ring Architecture
(L2 Access, no Mini-POP)**



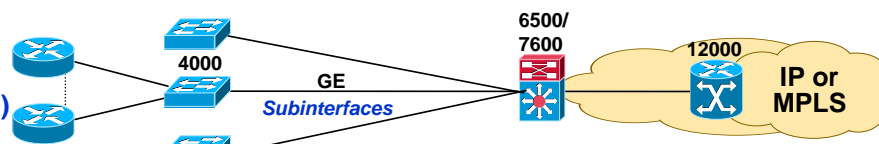
**L2 Ring Architecture
(L2 Access, with Mini-POP)**



**Star Architecture 3
(L2 Access, no Mini-POP)**



**Star Architecture 3
(L3 Access, no Mini-POP)**



**L3 Ring Architecture
(L3 Access, no Mini-POP)**



Access

Mini-POP

POP

Core

L2VPN Service – Provisioning

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Define A L2VPN Policy – Step 1 of 2

- Available policy profiles:
 - Ethernet – EVCS
 - Ethernet – TLS
 - Frame Relay
 - ATM

Attribute	Value
Policy Name *	L2VPN Policy
Policy Desc *	Cisco L2VPN Policy
Service Type *	<input checked="" type="radio"/> Ethernet - EVCS <input type="radio"/> Ethernet - TLS(PointToPoint) <input type="radio"/> Frame Relay <input type="radio"/> ATM
Conn Type *	MPLS

Note: * - Required Field

Back Next Cancel Done

L2VPN Service – Provisioning

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Define A L2VPN Policy – Step 1 of 2

- Available policy profiles:
 - Ethernet – ERS
 - Ethernet – TLS (EWS or EMS)
 - Frame Relay
 - ATM

IP Solution Center 3.0

Service Inventory Service Management Monitoring Administration

Policy Manager Tenant Manager Line and Manager Profile Manager Service Manager

You Are Here: Service Management > Policy Manager

L2VPN Policy

Attribute	Value
Policy Name	L2VPN Policy
Policy Desc	Cisco L2VPN Policy
Service Type	<input checked="" type="checkbox"/> Ethernet - SVCS <input type="checkbox"/> Ethernet - TLS(PointToPoint) <input type="checkbox"/> Frame Relay <input type="checkbox"/> ATM
Core Type	MPLS

Note: * - Required Field

- Step 1 of 2 -

Done Next Cancel

L2VPN Service – Provisioning (Cont.)

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Define A L2VPN Policy – Step 2 of 2

- Specify CE/PE Interface Type
- Specify CE Encap:
 - DEFAULT = Untagged
 - DOT1Q
- Specify VLAN ID Autopick

Attribute	Value	Editable
PE Information		
Interface Type	Port-Channel	
Interface Format		
CE Information		
Interface Type	Port-Channel	
Interface Format		
Encapsulation	DOT1Q	<input checked="" type="checkbox"/>
VLAN Information		
VLAN Autopick	Yes	<input checked="" type="checkbox"/>

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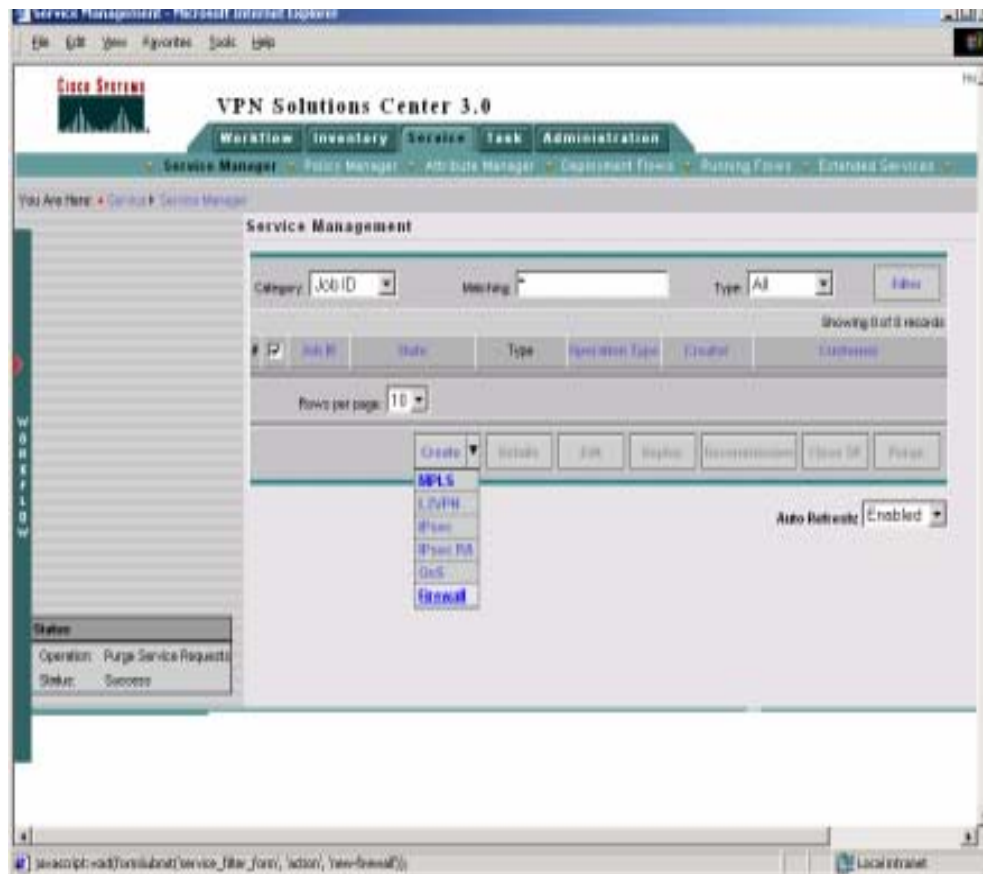
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Managed Security Service

ISC 3.0 IPsec VPN New Feature Overview

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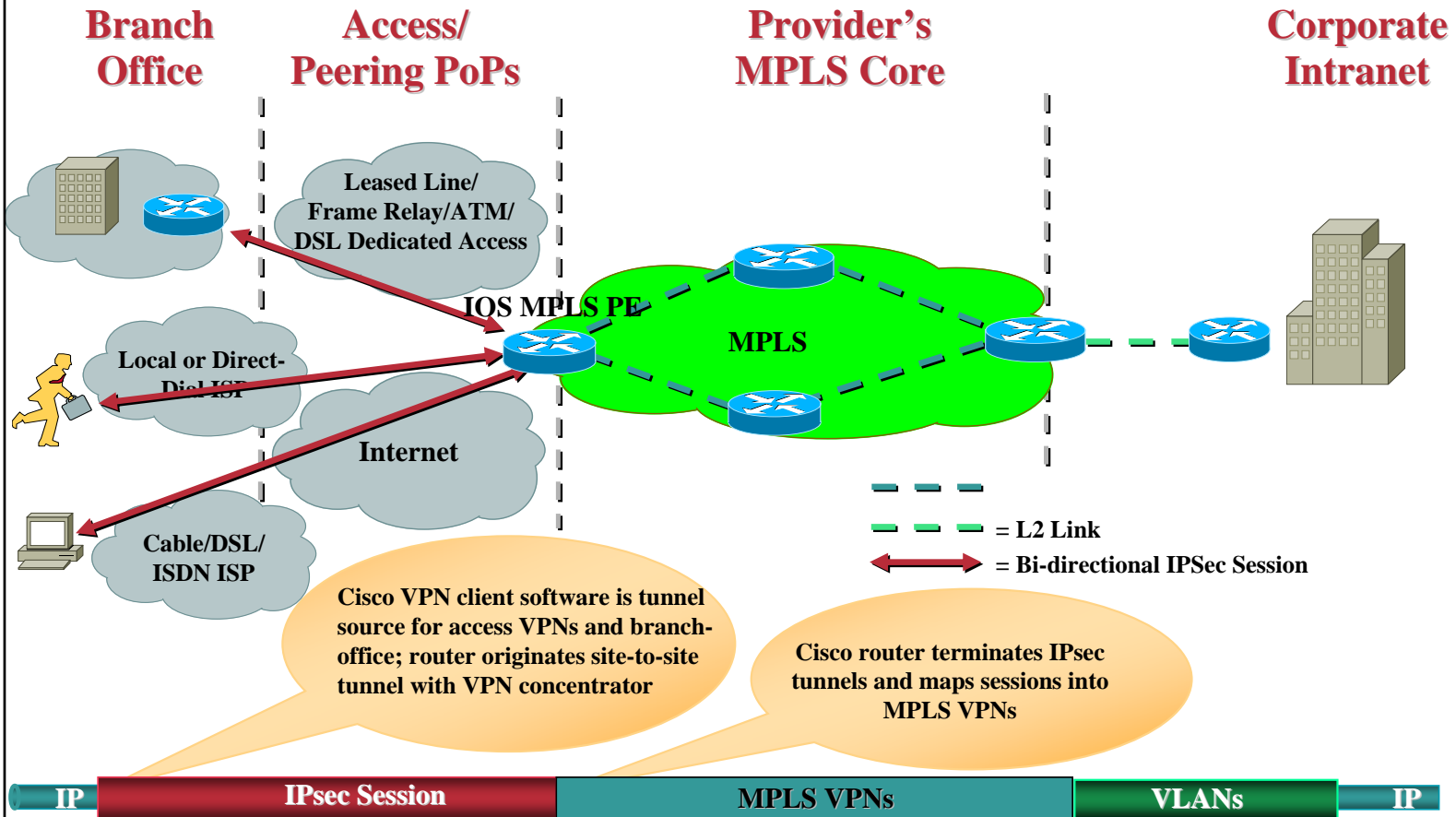
- Remote Access IPsec for IOS & PIX
- IPsec Policy Mgmt enhancements: e.g. AES
- Pre-shared key Mgmt
- Cert auto-enrollment template support
- Support for mGRE + NHRP
- EZ-VPN support
- VPN QoS, e.g. QoS preclassify
- IOS 7160,7200 Remote Access support
- IPsec to MPLS mapping (Aswan)



IPsec VPN Service - Aswan: IPsec to MPLS Mapping

(Single-Box: IOS As An IPsec Aggregator and MPLS PE)

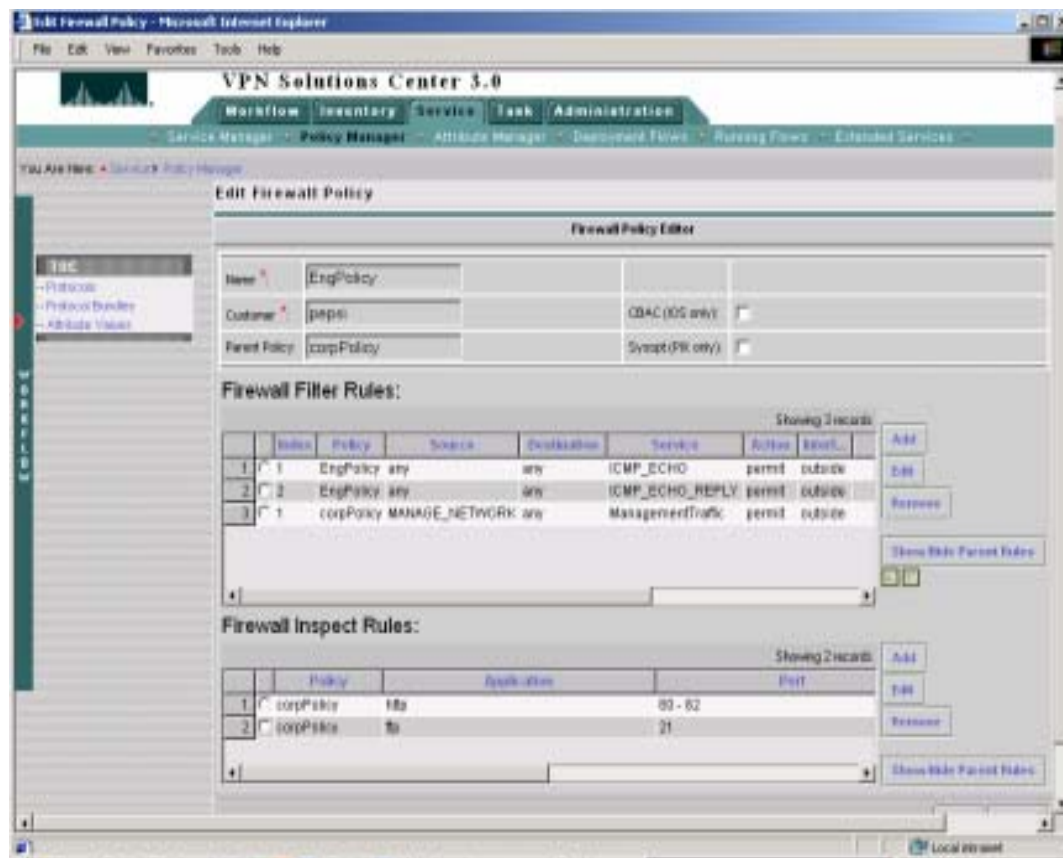
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Corporate Intranet



Release 3.0 Feature Enhancements – Firewall

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- **Policy-based management of firewalls**
 - High-level policy rules
 - No device specific information
 - Both access-lists and inspect rules
 - Inheritance in device containment hierarchy
 - Common firewall policy for heterogeneous devices: IOS & PIX
 - Expansion of policy rules to device specific commands
- Can be used as an independent service or in conjunction with another service such as IPsec VPN
- Rule example:
 - permit **ManagementTraffic** from **ManagementNet** to **vpnRouter** on **outside** interface



Policy Based QOS

Policy Based QoS

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- **QoS On Access Circuits**
- **QoS Based On DiffServ Architecture**
- **QoS Implemented Using MQC And Non-MQC**
- **Cisco IOS 12.0 And Above, T, E, ST, Main line**
- **Platforms Supported Include 17xx, 26xx, 36xx, 2400, 3810, 71xx, 72xx, 75xx, 7600 OSR, 7300, 7400, 10k, GSR, Cat 29xx, Cat 35xx, Cat 65xx**

QoS Service - Provisioning Primitives

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- **Traffic Classification**

- Protocol ID, Src/Dest Addrs., Src/Dest Ports, Port Ranges, DSCP, IP Prec, L2 CoS

- **Marking**

- DSCP between 0 & 63
 - IP Precedence between 0 & 7
 - MPLS Exp between 0 & 7 (when core has MPLS network)

- **Rate-limiting**

- Class-based Single/Dual Rate Policer (MQC) and CAR (non-MQC)
 - Mark traffic and re-mark to downgrade out-of-contract traffic

- **Shaping**

- CB-shaping (MQC), Interface-based GTS (non-MQC)
 - FRTS in the context of Frame-Relay
 - ATM Shaper (vbr-rt, vbr-nrt, abr, cbr ubr)

QoS Service - Provisioning Primitives (Cont.)

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- **Congestion Management**
 - CBWFQ (for Data) + PQ (for voice)
 - WFQ (for Data) + PQ (for voice)
- **Congestion Avoidance**
 - WRED with DSCP & IP Precedence
- **Link Efficiency**
 - LFI over MLPPP
 - LFI over Frame-Relay
 - cRTP

QoS Service - Support for MPLS

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- **IP QOS based on DSCP/IP Precedence before MPLS network**
- **Map DSCP/IP Precedence to MPLS exp at ingress router to MPLS network (PE)**
- **PHB in MPLS backbone based on MPLS EXP**
- **IP QOS based on DSCP/IP Precedence continues after MPLS network**

QoS Service – Provisioning Scenario

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- **Managed CPE**
 - CPE only
 - CPE & PE (popular scenario)
- **Unmanaged CPE**
 - PE only
 - CPE & PE

QoS Provisioning

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IP Solution Center 3.0

Service Inventory | Service Management | Monitoring | Administration

Policy Manager | Template Manager | Link QoS Manager | Profile Manager | Attribute Manager

You Are Here: Service Management > Policy Manager

Edit QoS Policy

Policy Name: [] Customer: Cde

☒ Map DSCP / Pre to MPLS EXP ☐ Pre-marking and Rate-Limiting at Provider Ingress

Showing 1-5 of 5 records

#		Service	Class of Service	Bandwidth (%)
1.	<input type="checkbox"/>	VoIP *	VoIP	1
2.	<input type="checkbox"/>	Routing Protocol *	Routing Protocol	1
3.	<input type="checkbox"/>	Management *	Management	1
4.	<input type="checkbox"/>	Business Data *	Data	1
5.	<input type="checkbox"/>	Best Effort *	Best Effort	1

Records per page: 10

Add Bulk CoS | Edit CoS | Delete CoS | Save | Cancel

- Create QoS policy by defining a set of classes of service
- This policy will be applied to the selected set of access circuits via QoS service request.
- QoS service request can be tied to VPN provisioning or deployed on its own.

QoS Provisioning

Cisco.com

The screenshot shows the 'Edit Service Class' window in the Cisco IP Solution Center 3.0. The window is titled 'Service Attributes' and contains several sections:

- General:**
 - Service Name: Business-Delta-1
 - Traffic Description: http, ftp, telnet, smtp, sip, rtsp, https
- Marking:**
 - Enabled: ☒
 - DSCP: n41
 - IP Precedence: none
- Shaping:**
 - Enabled: ☒
 - Shape: Average
 - Rate (Kbps - 15440000 bps):
- Rate Limiting:**
 - Enabled: ☒
 - Min Rate (Kbps - 200000000 bps):
 - Peak Information Rate (Kbps - 200000000 bps):

Buttons for 'OK' and 'Cancel' are at the bottom right.

- The QoS service class defines how each QoS mechanism will be applied.

- Specifications include:
 - Marking
 - Shaping
 - Rate Limiting
 - Congestion Mgmt
 - Congestion Avoidance

QoS Provisioning

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IP Solution Center 3.0

Service Inventory | Service Management | Monitoring | Administration

Inventory and Connection Manager | Deployment Flow Manager

You Are Here: Service Inventory > Inventory and Connection Manager > Service Requests

QoS Service Editor

Job Kit New State: REQUESTED

Policy:

Select	Self Link ID	Link Op. Type	CE Link Endpoint	PE Link Endpoint	Link Param Set	Bandwidth (Mbps)
<input type="checkbox"/>	New	ADD	Select Endpoint	Select Endpoint	None	
<input type="checkbox"/>	New	ADD	Select Endpoint	Select Endpoint	None	
<input type="checkbox"/>	New	ADD	Select Endpoint	Select Endpoint	None	

Select MPLS SR | Add Link | Delete Link | Save SR | Cancel

Note: * - Required Field

- Create a QoS service request to apply the selected policy to a list of attachment circuits.
- This list of attachment circuit can come from a Service Request, or entered by user

Auto-Discovery

Auto-Discovery Function

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- **Mechanism to Auto Discover the state of the network. This provides the following advantages to ISC users:**
 1. **Minimal user data entry while creating service especially the services involving multiple physically connected devices.**
 2. **services provisioned by non-ISC can be discovered and subsequently managed by ISC.**

Auto-Discovery - Features

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- **Device Discovery**

Discovery network devices by giving a seed router and scope

- **Device Inventory Discovery**

Device inventory information such as interface list, IP addresses, IOS version, platform, etc.

- **Connectivity Discovery**

Connectivity Information between the devices existing in the ISC Device Repository.

- **Service Discovery**

Services managed by ISC but already provisioned by the Service Providers. ISC 3.0 provides L2VPN and MPLS VPN service discovery.

Northbound API and OSS Integration

NBI: API Functionality

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- **QoS Service**
- **L2VPN Service**
- **MPLS VPN Service**
- **Inventory**
- **IPsec VPN Service**
- **FireWall Service**
- **NAT Service**
- **SLA**
- **Deployment Flow Engine**
- **Discovery**
- **Workflow**

NBI: Overview/Benefits

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- **XML-based management interface**
- **Web-based**
- **Human-readable encodings**
- **Initial transport support is HTTP or HTTPS/SOAP**

Cisco Info Center Event List : Filter="MPLS PE", View="MPLS PE"

PE	VPNs	PE Interface	Summary
nms7500-2	GreenVPN	Serial3/1	Interface Serial3/1, state changed to down
nms7500-1	GreenVPN	Serial3/1	Interface Serial3/1, state changed to down
nms7500-1	RedVPN	Serial3/3	Interface Serial3/3, state changed to down

Cisco Info Center Event List : Filter="MPLS CE", View="MPLS CE"

Customer Site	Customer	VPNs	CE Name	PE Interface	PE	Summary
SiteX2	CustomerX	GreenVPN	nms3010-2	Serial3/1	nms7500-2	PE interface on nms7500-2 down, all
SiteX1	CustomerX	GreenVPN	nms3010-1	Serial3/1	nms7500-1	PE interface on nms7500-1 down, all
SiteZ1	CustomerZ	RedVPN	pnm4000-1	Serial3/3	nms7500-1	PE interface on nms7500-1 down, all

VPN
Inventory

Cisco Info Center Event List : Filter="MPLS VPN", View="MPLS VPN"

VPN	Customer	Total #CE	#CE Down	Summary
GreenVPN	CustomerX	2	2	100% CEs affected for VPN GreenVPN
RedVPN	CustomerZ	2	0	0% CEs affected for VPN RedVPN

0 rows inserted, 1 row updated and 0 rows deleted

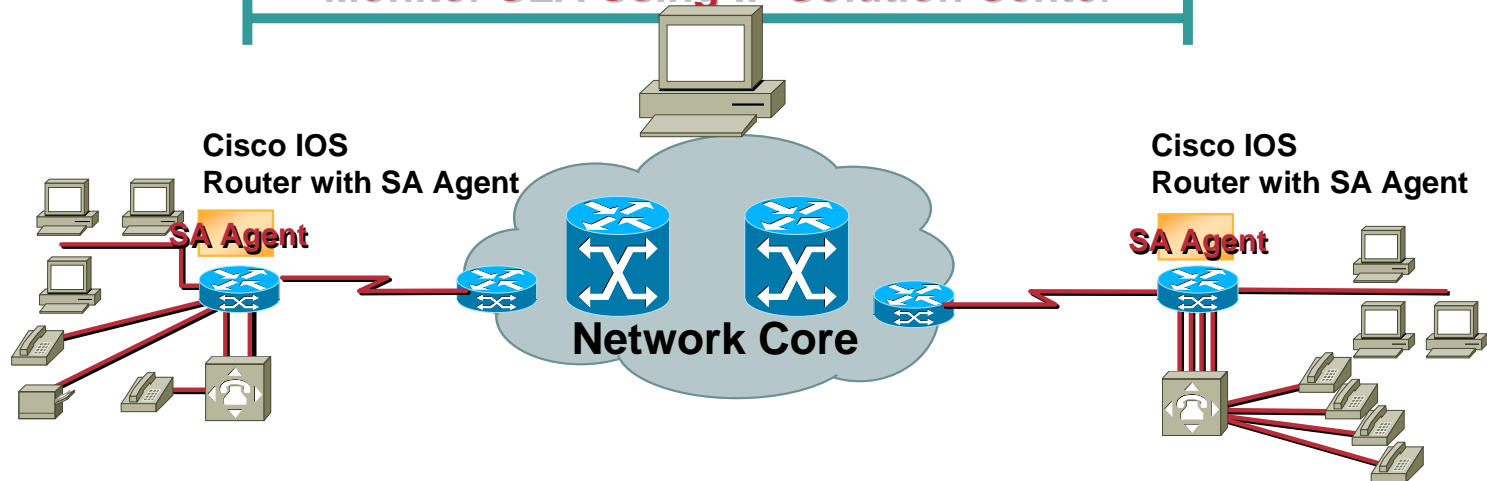
08/10/01 16:46:01 root INFO SERV

VPN Service Assurance

SLA - Monitoring via ISC

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Monitor SLA Using IP Solution Center



SLA Metrics Measured

- Response time
- Availability
- Threshold Violations
- Jitter
- Packet loss

VPN Service Assurance

SLA –monitoring via ISC

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❖ Customer Statistics per VPN

- ❖ Monitor customer is within SLA for packet delay
- ❖ Monitor customer is within SLA for packet loss

❖ Core Statistics per VPN (MPLS)

- ❖ PE router to PE router packet delay
- ❖ PE router to PE router packet loss

❖ Provision SAA probes to produce Traps

- ❖ Timeout trap
- ❖ Connectivity Loss trap
- ❖ Threshold trap

❖ Setup SAA history bucket for 15 minutes on router – collection and correlation hourly

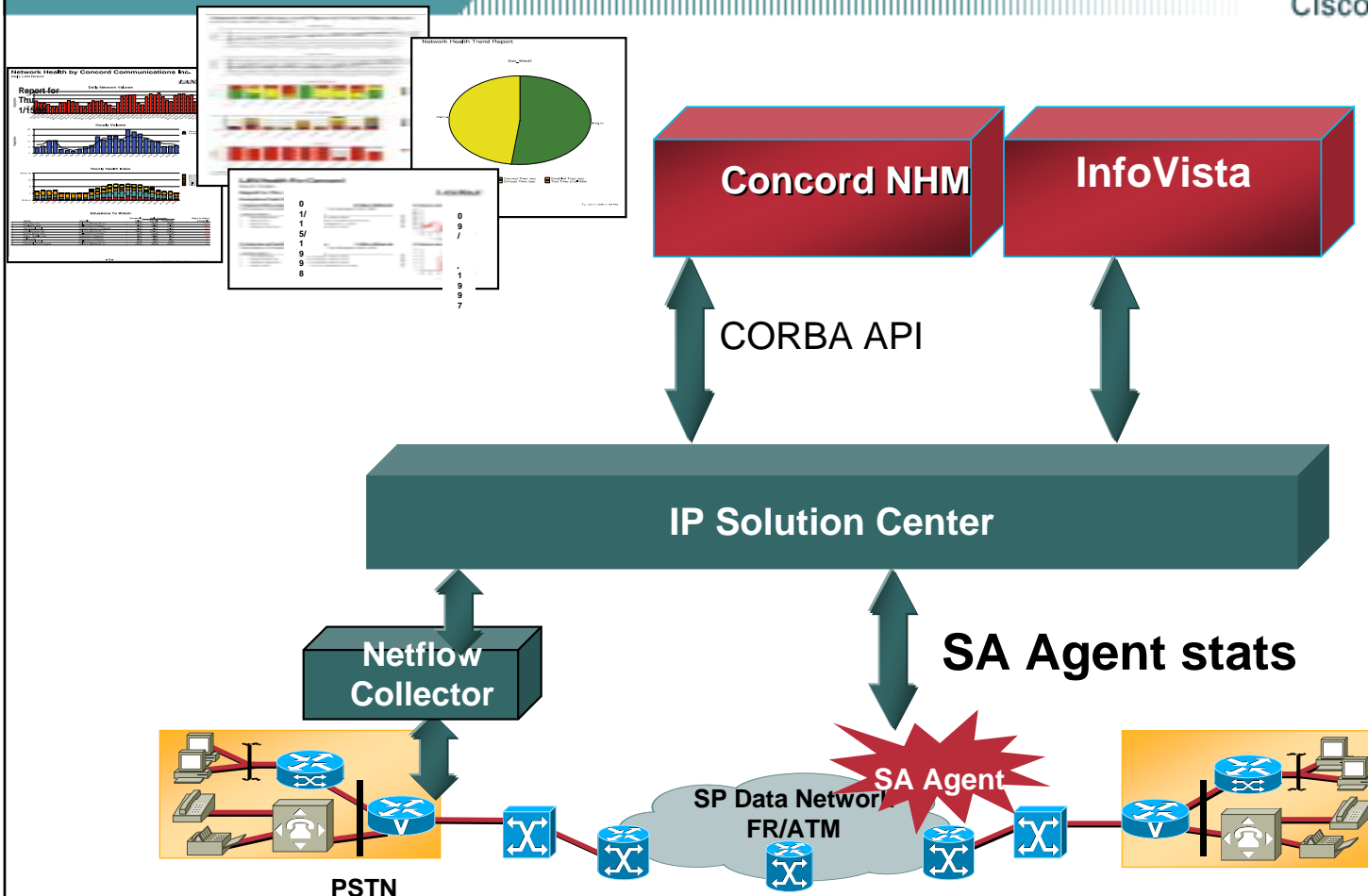
❖ Mib2 Interface Statistics Collection

❖ Car Mib Stats Collection

VPN Service Assurance

SLA – reporting via partner integration

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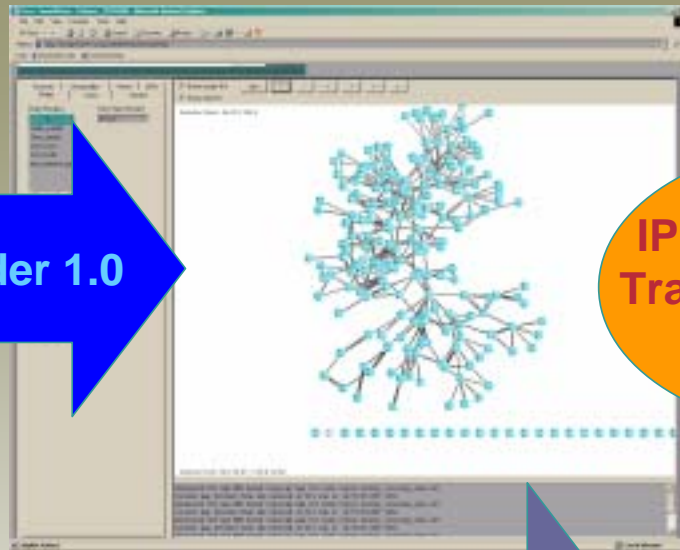
Traffic Management

Cisco Traffic Engineering Management Evolution

Cisco.com

MPLS Traffic Engineering

Tunnel Builder 1.0



Mid 2003

IP Solution Center
Traffic Management
Module

Tunnel Builder Pro

Available Today

Traffic Engineering – Tunnel Builder

Cisco.com

•Activation Features

Create Tunnels: with explicit paths; dynamic paths,
set bandwidth, priority, affinity

Tunnel Discovery

Delete and Modify Tunnels

Static routes configuration: manual, Autoroute

Multiple Path options

Link configuration

Batch tunnel creation

Auto bandwidth, Affinity configuration

•Features

Views: CDP Discovery, MPLS topology of Tunnels,
Highlight links, nodes, tunnels

Tunnel status: *Up/down, load, uptime, LSP path*

Link status: *Total b/w, b/w by priority, affinity*

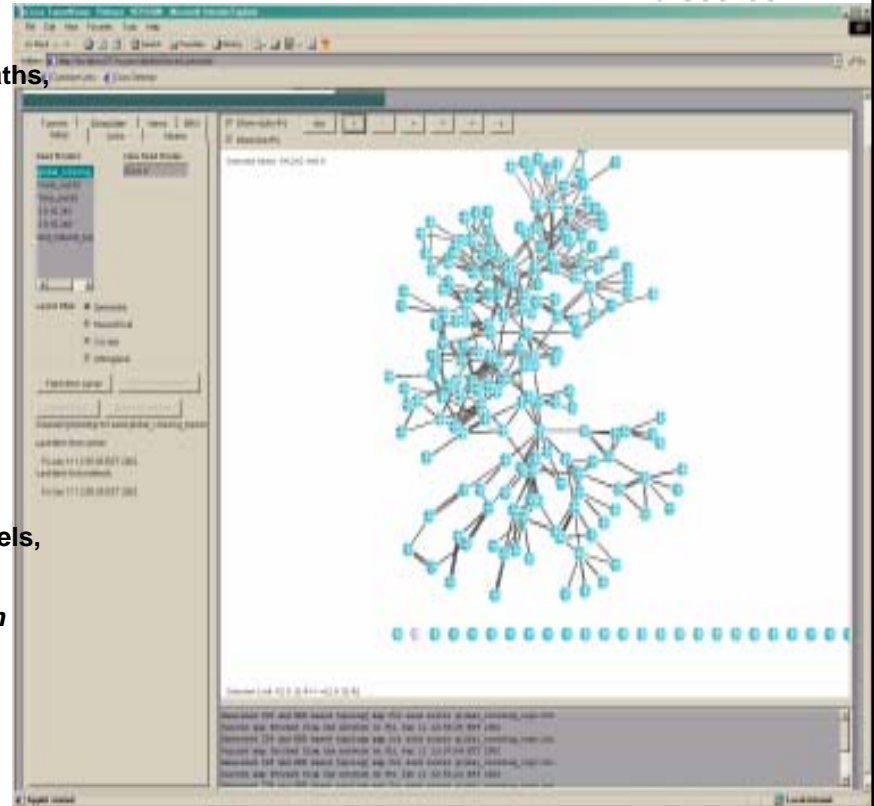
Monitor link interface Traps

Measure Delay/Jitter

Tunnel & Link Utilization displays

Use metrics to color links: utilization, #tunnels

“Available bandwidth” displays



Tunnel Builder Pro Enhancements

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Proprietary Backup Route Generation Algorithms for Path and Node Protection

- **Verify which paths are Bandwidth Protected in the current network**
 - Report and verify unprotected Elements in the Topology
- **Recommend and Install Fast Reroute Backup Tunnels based on Bandwidth Constraints**
 - Recommendation calculation with minimal perturbation to current topology
- **Protection for Link Failure or a Set of Links Failing**
- **Protection and Calculation of Paths for Node Protection**
- **Load balancing Options, multiple backup tunnels to cover primary bandwidth.**

Traffic Management

ISC 3.1

Cisco.com

Builds on the capabilities of TunnelBuilder Pro

- **Adds ISC framework features**
 - **persistence of data**
 - **logging of user intent**
 - **service state management**
 - **service auditing**
 - **integration with existing ISC products**
- **QoS management capacities provided by existing ISC QoS application**
- **Extension of the algorithm to handle primary tunnel placement**
- **Use powerful hypothetical change evaluation capabilities prior to deployment**
- **Invoke fix capability to resolve problems encountered with proposed changes**
- **Reconcile differences between the planned network and the actual network**

Traffic Management Cont.

ISC 3.1

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BW Protection Planning

- identifies placement of FRR backup tunnels to protect critical network elements
- protect against link, node, or SRLG failures
- interactive GUI provides user with ability to evaluate hypothetical changes and fix protection problems

DS-TE tunnel placement planning

- identifies tunnel paths that meet user-specified constraints
 - existing constraints supported in IOS PCALC (BW pool, affinity, etc)
 - delay
 - protection level (none, best-effort, NHOP, NNHOP)
- proposes fixes to meet user-specified constraints for new tunnel demands
 - existing tunnels may need to be moved
 - resources may need to be added
 - constraints may need to be relaxed
- deployment of multiple tunnels with "make-before-break" semantics

Traffic Management Cont.

ISC 3.1

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Resource modification planning

- identifies ramifications of changes to network resources (BW pools, link attributes, administrative shutdowns)
 - disruption of existing tunnel
 - violation of existing tunnel constraints
 - loss of element protection
- proposes fixes to identified problems with attempted changes
 - existing tunnels may require rerouting
 - resource pools may need to be changed

Conclusion

Conclusion

Cisco.com



Thank You

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