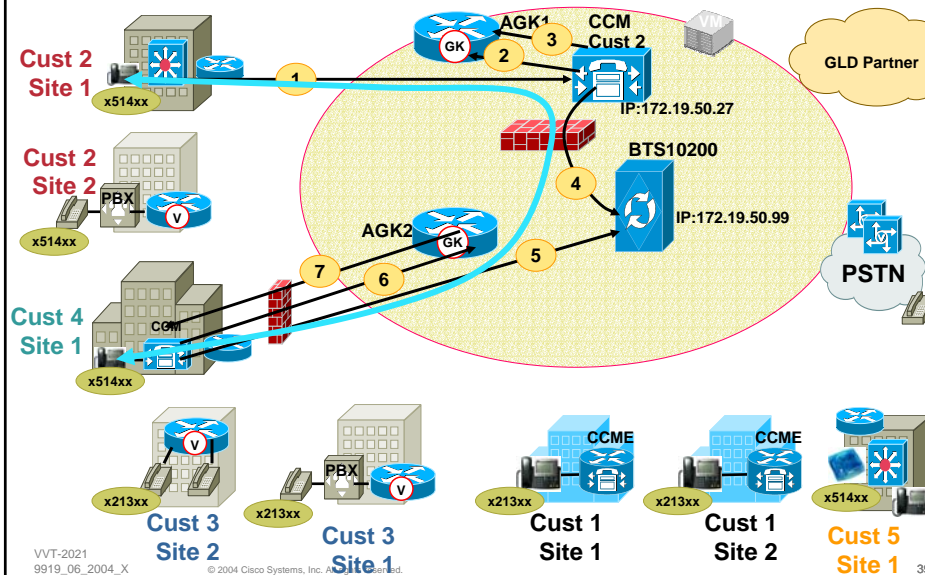
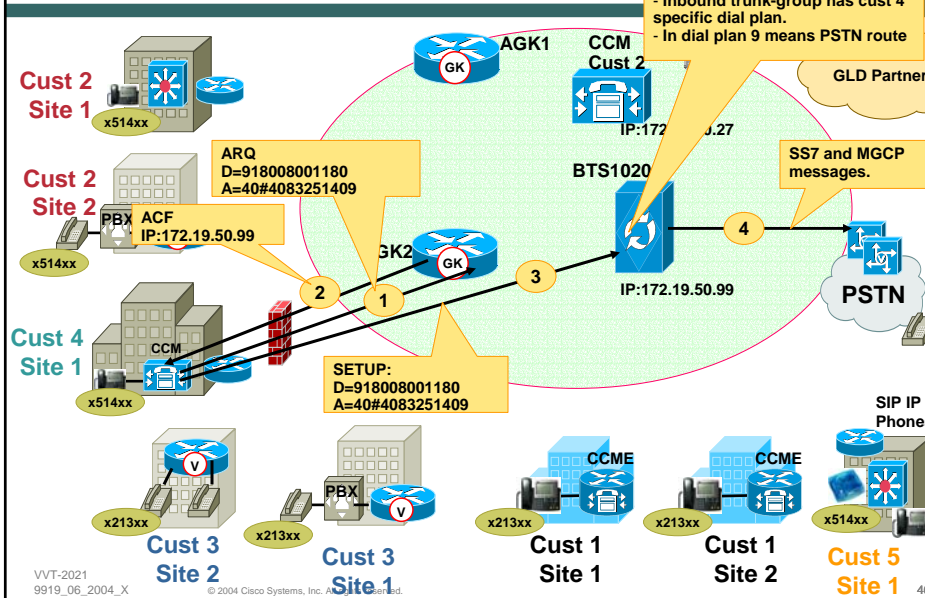


Inter-Enterprise CCMs (2 RTP Flow)

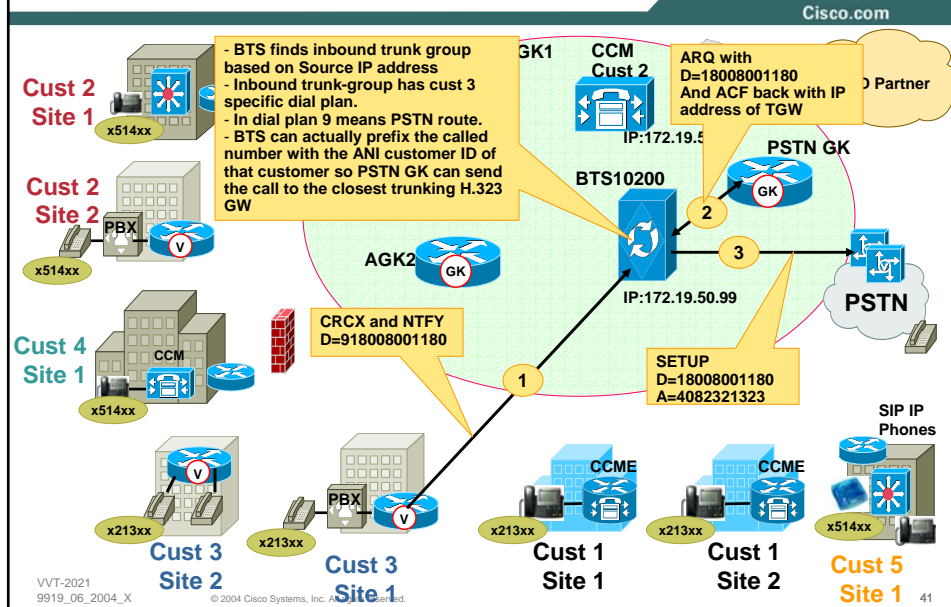
Cisco.com



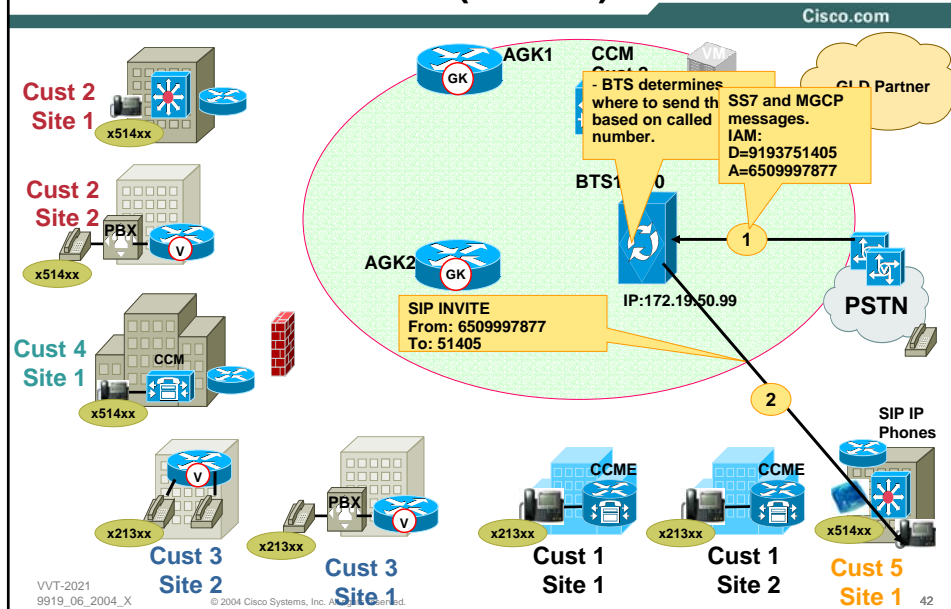
Off-Net PSTN Call (Case 1)



Off-Net PSTN Call (Case 2)



Inbound PSTN Call (Case 1)



Inbound PSTN Call (Case 2)

Cisco.com

The diagram illustrates an inbound PSTN call scenario. A PSTN cloud is connected to a central IP network. The call enters the IP network at a gateway (GK) labeled AGK2. The call path is numbered 1 through 4. The call is then routed to various customer sites:

- Cust 2 Site 1:** x514xx, connected to a PBX and a router.
- Cust 2 Site 2:** x514xx, connected to a PBX and a router.
- Cust 4 Site 1:** x514xx, connected to a CCM and a router.
- Cust 3 Site 2:** x213xx, connected to a PBX and a router.
- Cust 1 Site 1:** x213xx, connected to a CCME and a router.
- Cust 1 Site 2:** x213xx, connected to a CCME and a router.
- Cust 5 Site 1:** x514xx, connected to a SIP IP Phones and a router.

Key components and call details:

- AGK1:** GK, CCM Cust 2, VM, 9.50.
- AGK2:** GK.
- BTS:** 172.19.50.99.
- SS7 and MGCP messages. IAM:**
D=4083251433
A=6509997877
- answerCall ARQ**
- ACF**
- SETUP**
D=4083251433
A=6509997877
- PSTN**
- SIP IP Phones**
- CCME**
- CCM**
- PBX**
- x514xx**
- x213xx**

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Off-net PSTN Toll Bypass Example

Cisco.com

Sample Route Table
 Ent ID 99 (source match)

ext	ID
6....	991
2....	992
1408526....	991
1919392....	992

* "offset" (dest match)

"Offset"
 1408 PSTN GW1
 1213 PSTN GW2
 1202 PSTN GW3

Call Route Server
 BTS10200

1408 PSTN
 12135551212

1213 PSTN

1202 PSTN

EntA Site 1
 E.164: 1408526....
 Abbr.: 1...
 VPNIID: 99
 SiteID: 1

EntA Site 2
 E.164: 1919392....
 Abbr.: 2...
 VPNIID: 99
 SiteID: 2

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IP TRANSPORT SERVICE LAYER

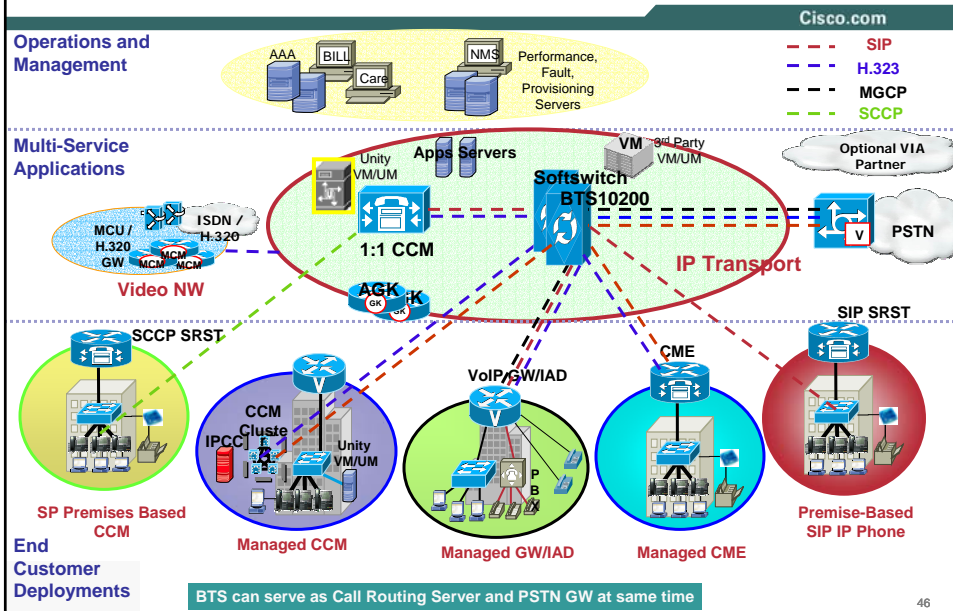


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BVS Service Provider Architecture



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IP Transport Service Layer

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Transport Methods:

- **MPLS**—MPLS VPNs provide security and QoS with shared/managed services model
- **IP “In the Clear”**—basic IP connectivity with security provided by Cisco IOS or PIX Firewall

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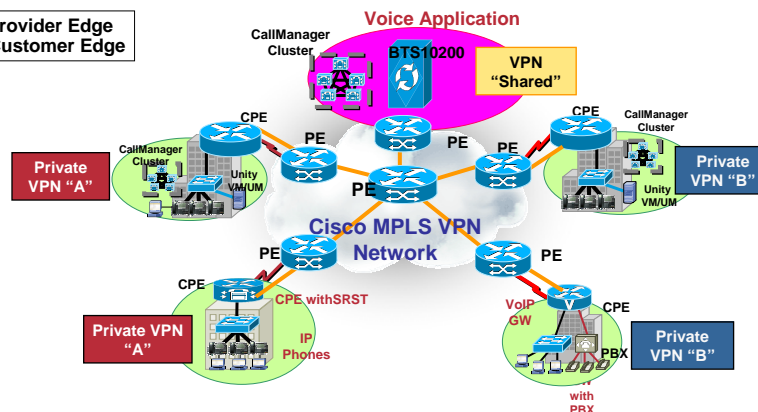
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IP Transport: MPLS

Cisco.com

PE = Provider Edge
CE = Customer Edge



- Provides the same level of security as a Layer 2 architecture
- Allows for overlapping IP address spaces
- Creates private and shared VPN architecture
- Ease of deployment

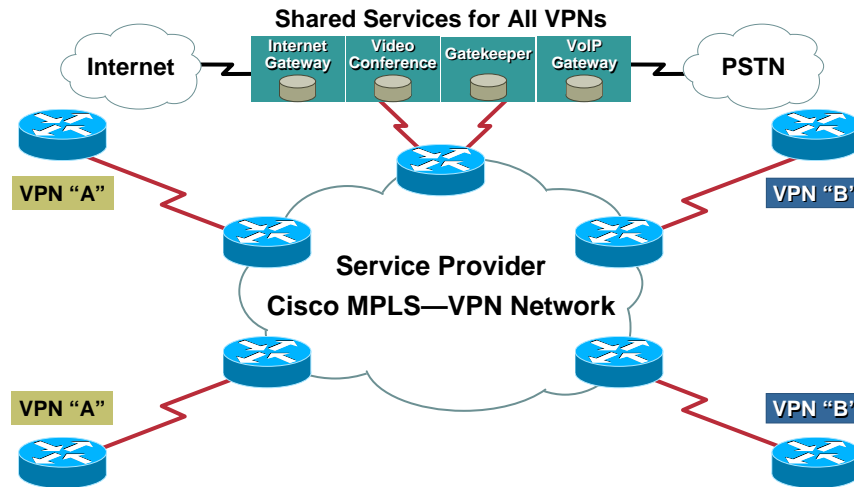
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MPLS/VPN: Supporting Shared Services

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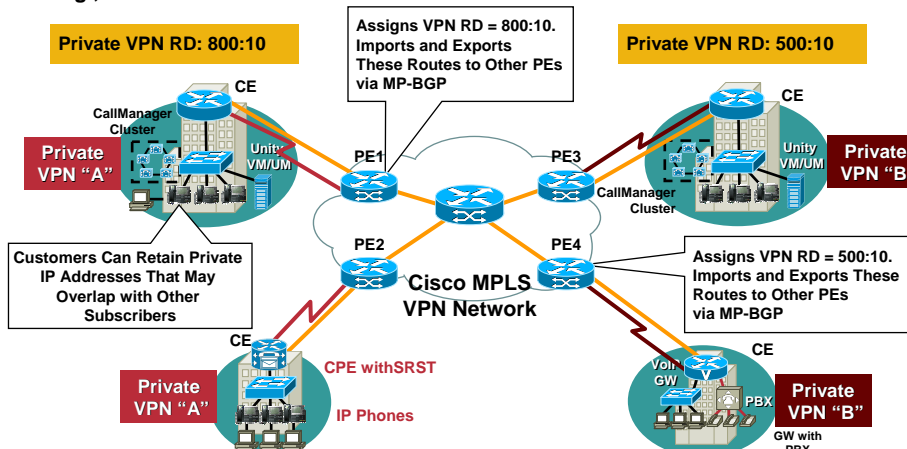
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MPLS-Based IP Transport: Private VPN per Customer

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Route Distinguisher (RD) = 800:10
Prepended to the IPv4 Route for Customer Isolation
e.g., X.Y: a.b.c.d = 800:10: 192.1.1.0



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Private VPNs with MPLS Configuration

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```

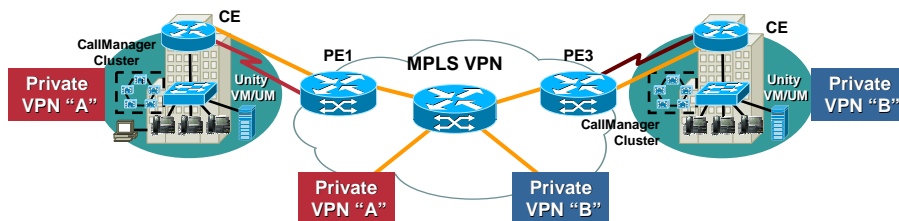
Hostname PE1
!
ip vrf customerA
rd 800:10
route-target import 800:10
route-target export 800:10
    
```

```

Hostname PE3
!
ip vrf customerB
rd 500:10
route-target import 500:10
route-target export 500:10
    
```

Private VPN RD: 800:10

Private VPN RD: 500:10



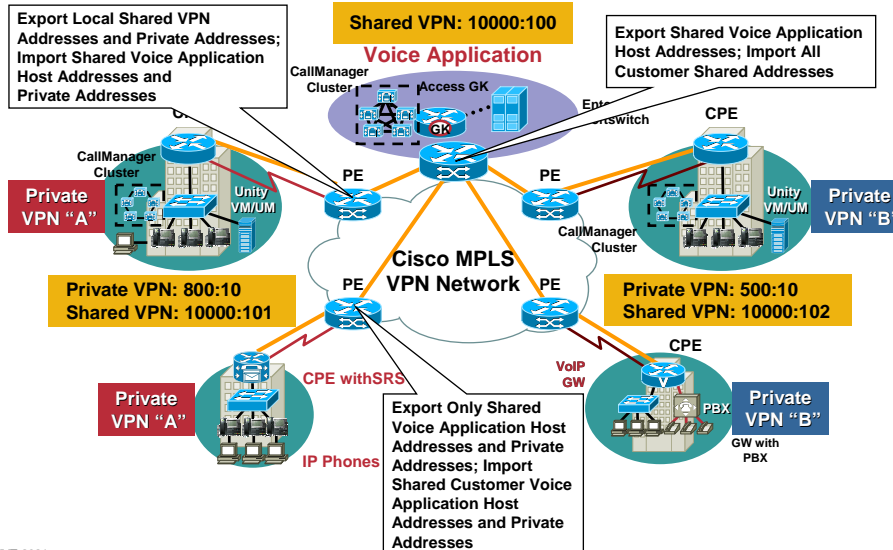
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MPLS-Based IP Transport: Private and Shared VPN VRFs

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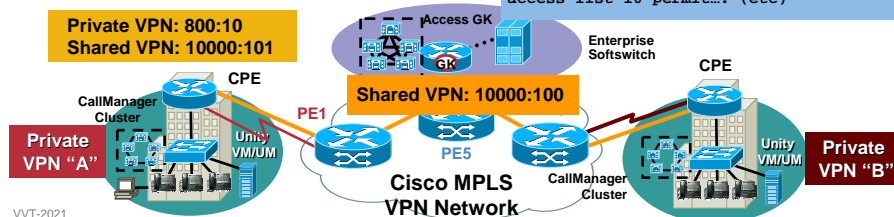
52

Private and Shared VPN VRF Configuration

Cisco.com

```
hostname PE1
!
ip vrf PRIVATE
rd 800:10
route-target import 800:10
route-target export 800:10
route-target import 10000:100
export route-map CPE-LOOP
!
route-map CPE-LOOP
match ip-access list 10
set extcommunity rt 10000:101 additive
!
access-list 10 permit 171.68.1.1 0.0.0.0
access-list 10 permit ... (etc)
```

```
hostname PE5
!
ip vrf VOICE
rd 10000:100
export map SHARED-DEV
route-target import 10000:100
route-target export 10000:100
route-target import 10000:101
route-target import 10000:102
!
route-map SHARED-DEV
match ip-access list 10
set extcommunity rt 10000:100
!
access-list 10 permit 22.22.22.15 0.0.0.0
access-list 10 permit 22.22.22.50 0.0.0.0
access-list 10 permit 22.22.22.51 0.0.0.0
access-list 10 permit... (etc)
```



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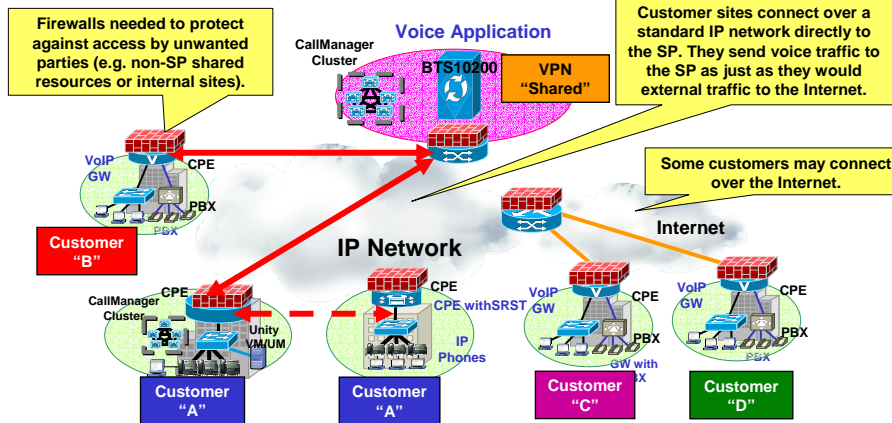
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IP Transport: "IP in the Clear"

SAS Section 2.2.2.2

Cisco.com



- Connections may be dedicated access links directly into the service provider or over the Internet
- Typical method of interconnection for single-site small business
- Increased deployment costs as Firewalls will be required

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MULTI-SERVICE APPLICATIONS SERVICE LAYER

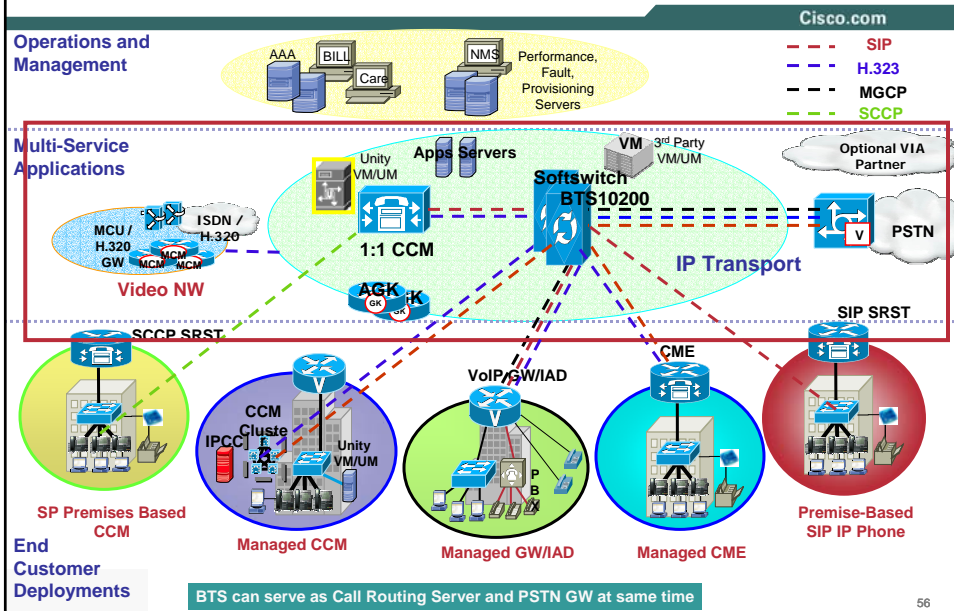


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BVS Service Provider Architecture

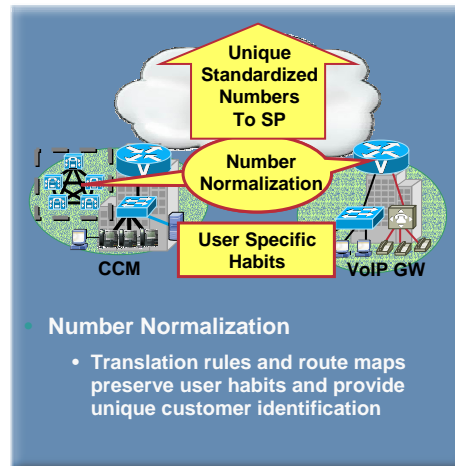


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BVS Multiservice Applications

Cisco.com

- **Feature Transparency: Preserving User Experience**
- **Phone features**
 - CCM addresses extensive PBX features
 - CallManager Express offers traditional keyswitch functionality
 - Custom API feature development through VXML and JTAPI
- **Fax, Modem, and DTMF**
 - T.38 fax relay with pass-through fallback mechanisms
 - Modem pass-through
 - DTMF-Relay (no in-band DTMF on CCME)
- **Voice mail integration**



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Multiservice Applications Layer

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- **Voice Call Routing**—On-Net and Off-Net Voice routing with PSTN interconnect (SS7 or Non-SS7 gateways)
 - PGW 2200—Largest install base is in EMEA
 - BTS 10200—Largest Interest from U.S. Based RBOCs
- **Voicemail**—Depends on Customer deployment.
 - Centralized Voicemail through Third-Party Vendors
 - IP Unity, CommVerse
 - Co-Located
 - CallManager—Unity Voicemail
 - CallManager Express—Cisco Unity Express (CUE)
- **SP Hosted CallManager**—1-to-1, N-to-1 implementation of CallManager with SRST at the Customer Site

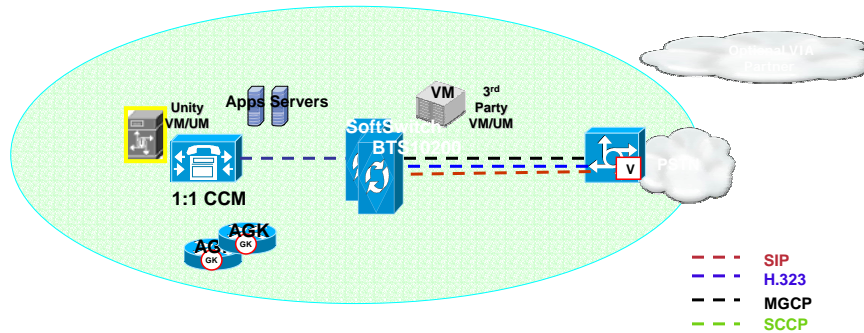
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Voice Application Functional Area

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- Enables the Voice Service Offering
- Provides the “Glue” that binds Cisco VIA Network Solution Architecture for PSTN Terminating Network Cisco
- Shared Resources Amongst Enterprise Subscribers

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Cisco SoftSwitch “BTS10200”

Cisco.com

- Call Routing: Performs Inter-Site and Inter-customer Call Routing and PSTN Connectivity using powerful routing mechanisms
- Ability to interconnect SIP, H.323, and MGCP end devices
- Modified to interconnect with Cisco CallManager
- Interface to Third-Party Equipment using standards-based signaling: SIP (RFC3261), SIP-T (RFC3372 and 3398), H.323v2/3/4, MGCP1.0/0.1
- Provides Call Control for IOS GWs, IADs, and SIP IP Phones as a MGCP CA and SIP B2BUA
- Provides centralized billing
- PSTN SoftSwitches supporting SS7, PRI, CAS signaling

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Cisco SoftSwitch “BTS10200” (Cont.)

Cisco.com

- Any-to-Any protocol conversion (SIP, MGCP, H.323)
- Operations and maintenance interfaces: CORBA, FTP, SNMP, XML, Telnet, SSH
- Congestion detection
- Enhanced Centrex Features for business users
- T.38 Fax Relay

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PSTN Interconnection

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- BTS10200 serves as SS7 call agent and Call Routing Server (CRS)
- Supports both stand alone GWs with SIP/H.323 interface and SS7 media gateways... similar to any VIA deployment
- BTS10200 can interoperate with third GWs/SoftSwitches that supports standard H.323 or SIP signaling protocols
- Provide inbound/outbound PSTN access
- Support of Announcement based on cause code mapping

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Voice Mail

Cisco.com

- **Centralized or Distributed based on the type of deployment**
- **Centralized using third-party serving IADs, CMEs, and SIP IP phones**
- **Distributed: Unity for CCM and CME; CUE for CME**
- **For Centralized, VM calls is routed always through BTS10200. MWI directly to CME or to BTS10200 for the case of SIP IP phones and IADs**

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Bearer Services Methods

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- **DTMF Relay: RFC2833, H.245-alpha, INFO/NOTIFY, RQNT/NTFY**
- **The following are the preferred mechanisms, in order of preference, to perform real-time fax transmission over IP:**
 - If an MTP is involved in the call (the enterprise site will determine this), use method # 4**
 - Negotiate T.38 fax using H.323 terminal capabilities (i.e. annex D) or SDP (see T.38 specification [17])**
 - Negotiate T.38 fax using Cisco NSEs**
 - Do fax pass-through using G.711 codec up-speed (revert to G.711, disable echo cancellation and VAD)**
- **Modem traffic sent via pass-through methods using G.711 codec up-speed**

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OPERATIONS AND MANAGEMENT SERVICE LAYER

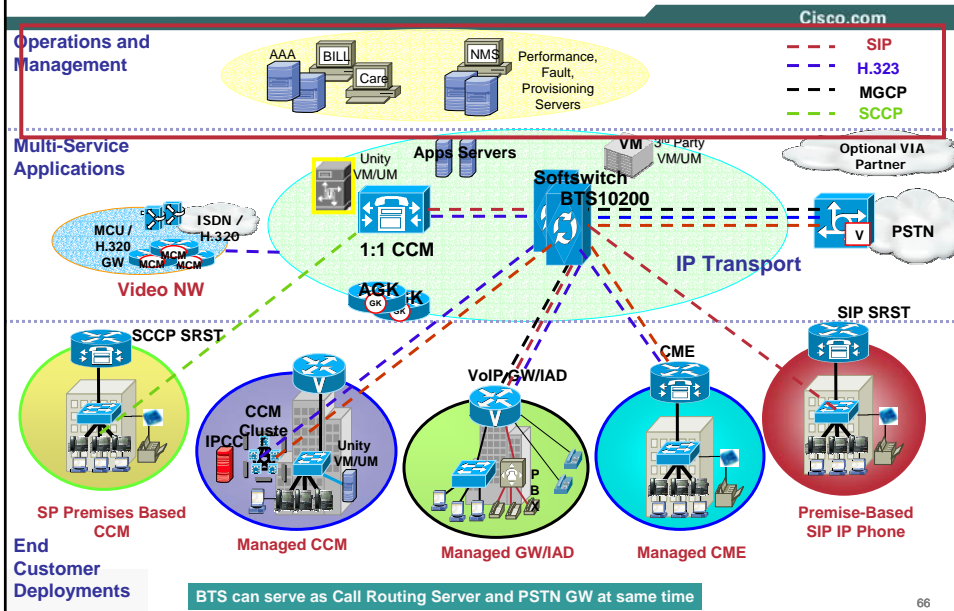


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BVS Service Provider Architecture



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MANAGING THE NETWORK



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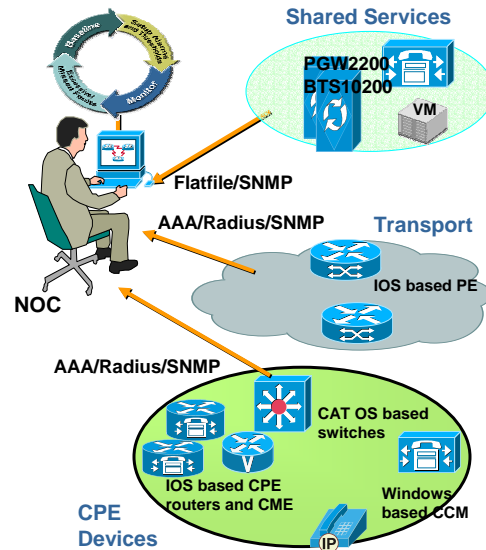
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Considerations of VoIP Device Management

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- Devices have different operating systems (IOS, Unix, Windows, etc)
- Multiple northbound interface access technologies (CORBA, xML, API etc)
- Many instrumentation protocols (AAA, RADIUS, Syslog, SNMP, TL1...)
- IP network is distributed by nature, where TDM is centralized



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Cisco Manageability: Fulfillment, Assurance, Billing (FAB)

Cisco.com

Service Fulfillment—includes provisioning of dial plans and other voice-related features, network device inventory, configuration file management, and device image management

Service Assurance—for IP telephony services includes monitoring IP telephony network faults and threshold crossing alerts, troubleshooting network and device problems, collecting performance statistics for historical reporting and trend forecasting, and data collection for measuring compliance with SLAs

Billing—and mediation applications are provided by Cisco System's billing partners. Billing plans range from time- and destination-based, to flat-rate, to combinations

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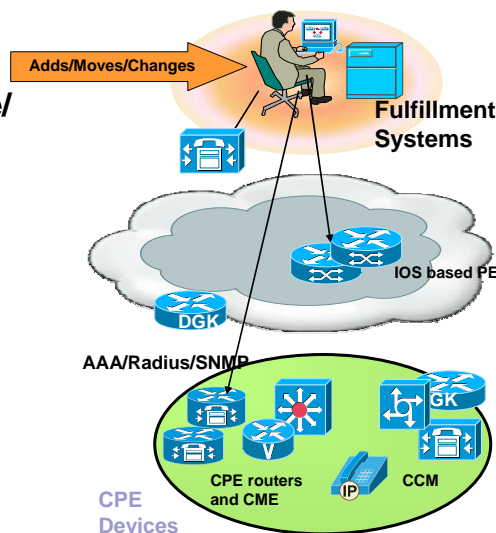
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Fulfillment

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- Provisioning, (subscriber/device/dial plan)
- Config file management
- Inventory control
- Database driven
- Interface to Fault, Performance and Billing



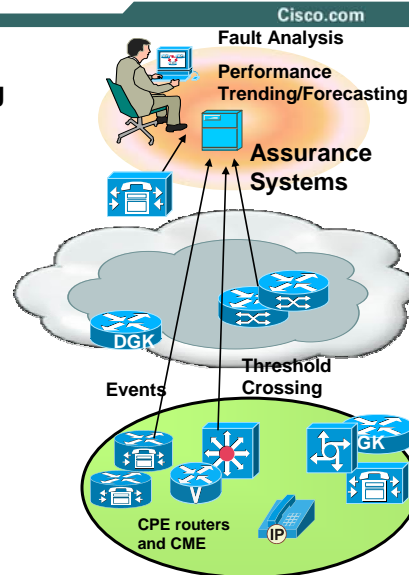
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Assurance

- **Fault Monitoring and Processing**
 - Events, (SNMP, Syslog, TL1, ...)
 - Threshold Crossing Alerts,
 - Root cause analysis
 - Predictive, proactive monitoring
- **Performance Monitoring**
 - RADIUS based CDRs
 - Trending, Forecasting
 - SLA impact



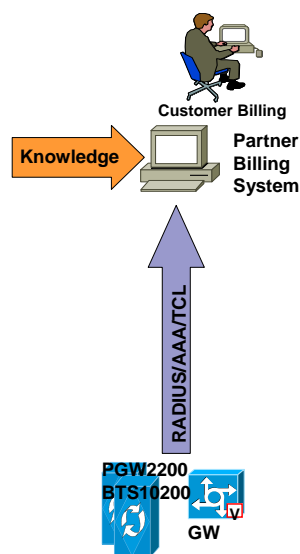
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Billing

- **Functionality**
 - Pre-paid (debitcard),
 - Postpaid (monthly), Hybrid
- **Protocols and Applications**
 - RADIUS, AAA, TCL IVR
- **Knowledge Required**
 - Cisco CDR (call leg) architecture
 - BVS call scenarios
 - VoIP network and components



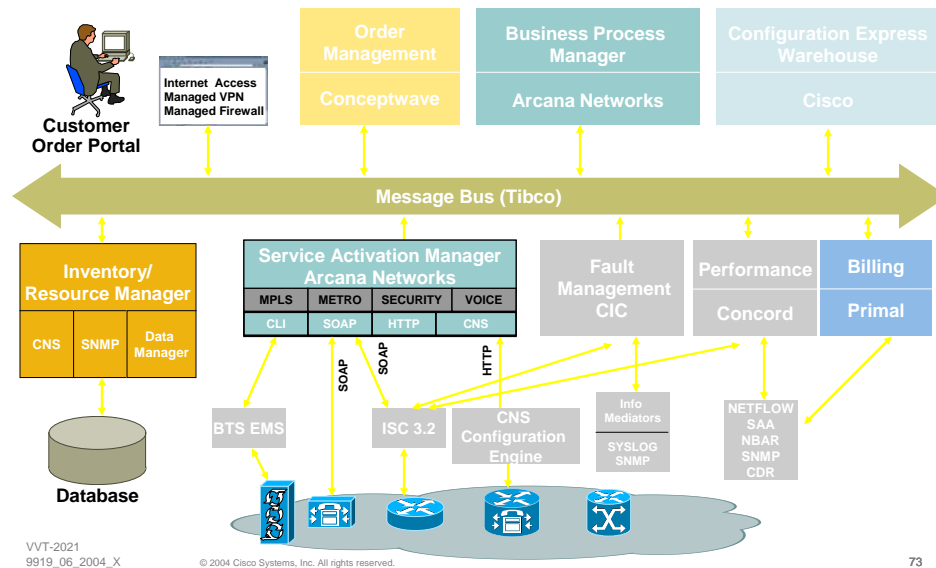
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Managed Services Demonstration Network Management Architecture

Cisco.com



Managed Cisco CallManager Express Order Screen

Cisco.com

ColumbiaNet BLISS T1 - Microsoft Internet Explorer provided by Cisco Systems, Inc.

Address: http://10.32.196.80/ColumbiaOE/ManagedCCME.asp

File Edit View Favorites Tools Help

Back Forward Stop Search Smiley Central My Info Games Customize My Button Highlight

while integrating new technologies.

IP Telephony Services using Cisco Call Manager Express

ColumbiaNet CCME Services is a seamless, consistent, feature-rich service that can link your global sites for voice, fax and voiceband data communications.

Cisco® CallManager Express is a solution embedded in Cisco IOS® Software that provides call processing for Cisco IP phones. This solution enables the large portfolio of Cisco access routers to deliver a robust set of features commonly used by business users, thereby enabling deployment of a cost-effective, highly reliable, IP Communications solution for the small office.

Customers can now scale IP telephony to a small site or branch office with a solution that is very simple to deploy, administer, and maintain. The Cisco CallManager Express solution provides customers with a low-cost, reliable, feature-rich solution for a deployment of up to 100 users.

Features

- Highly reliable
Built-in network redundancy assures high-quality service, an Intelligent Network enables unique centralized customer network management and increased reliability
- > Wide array of access
Choose from dedicated, switched and mobile access (by country)
- > Custom dialing plans and calling options
Make it easy to dial just about anywhere using a private numbering plan tailored to your needs, also, select the type of calls that best suits your dialing and savings scheme with 'virtual on-net' and 'forced on-net' call features
- > Simple pricing and flexible billing

*Fields marked with an asterisk are required

Customer Information

* CompanyName:

* ContactPerson:

* Email:

* City:

* CPE:

Voice Service

* Number Of Lines:

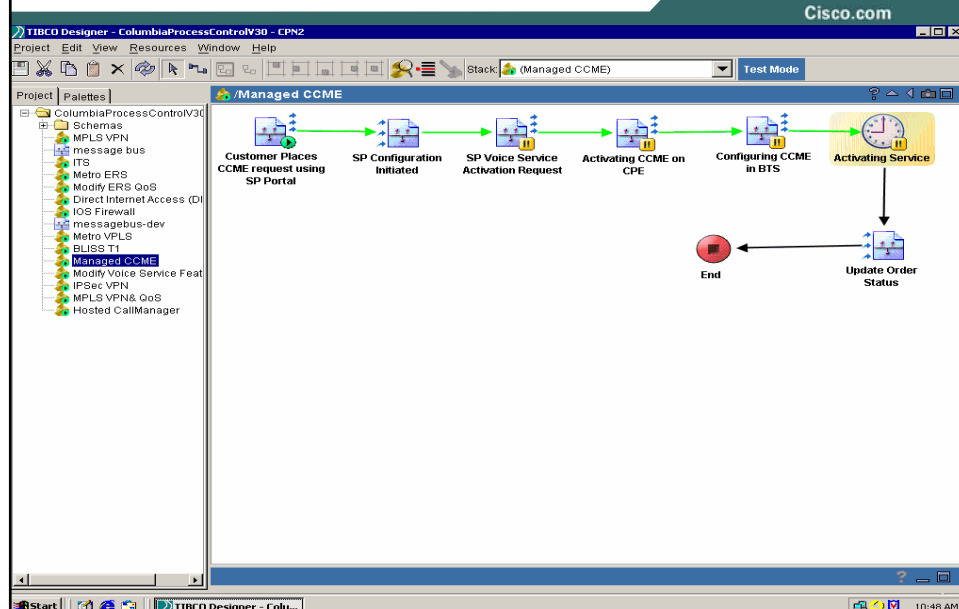
* Phone Model:

* Area Code:

* Exchange Prefix:

* Voice Service Package: [Package details](#)

Managed Cisco CallManager Express — Business Process Engine Workflow



Hosted Cisco CallManager Order Screen

The screenshot shows a web browser window displaying the 'Hosted Cisco CallManager Order Screen'. The browser's address bar shows 'http://10.32.196.90/ColumbiaOE/ManagedCCM.asp'. The page features a header with the Cisco logo and a navigation bar. The main content area is divided into two columns. The left column contains a 'ColumbiaNet IP Telephony Services based on Cisco Call Manager' section with a description and a 'Features & Benefits' list. The right column contains a form for 'Customer Information' and 'Voice Service'. The 'Customer Information' section includes fields for 'Company Name' (MACYS), 'Contact Person' (Mark), 'Email' (mark@columbianet.com), 'City' (BONN), and 'CPE' (CR-MACYS-BON-3745-609). The 'Voice Service' section includes fields for 'Number Of Lines' (1), 'Phone Model' (7970), 'Area Code' (408), 'Exchange Prefix' (902), and 'Voice Service Package' (BASIC). A 'Package details' link is provided next to the package selection.

Hosted Cisco CallManager — Business Process Engine Workflow

