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Branch and Head-end of Tomorrow: Deploying Cisco ISR G2 and ASR 1000 in the Enterprise

Presented by James Weathersby



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Agenda

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- NG Network – Introducing the Borderless Routing Infrastructure
- Platform Overview
 - ISR G2
 - ASR 1k
- Enabling Technologies
 - WAN Optimization
 - Video/MediaNet
 - QOS
 - Security
- Deployment Templates – Branch and Head End



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NG Networks – Introducing BRI



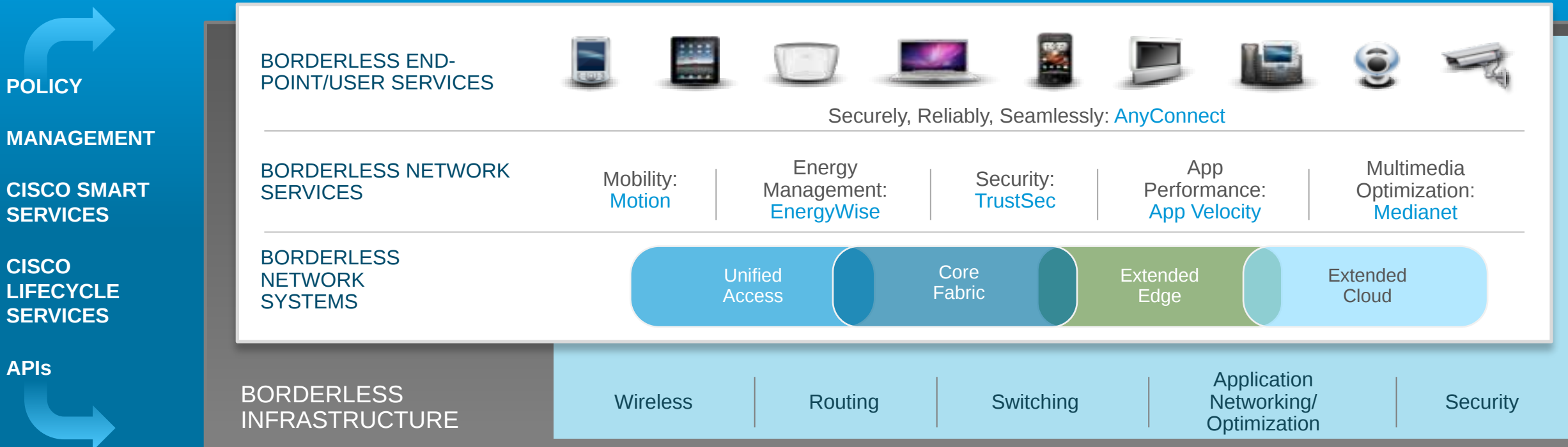
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Borderless Network Architecture

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Architecture for Agile Delivery of the Borderless Experience



PROFESSIONAL SERVICES:
Realize the Value of Borderless Networks Faster



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Borderless Routing Infrastructure

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Borderless Routing Infrastructure provides

- A **prescriptive design** to support deployment and access to enterprise and cloud resources
Not a list of all configuration options
- Focus on **Large Enterprise** and **Public Sector** organizations
- **Provides an infrastructure for adding Borderless Services**
Multi-Phase plan to support future services
- Incorporates **application awareness** and control for data, video and unified communications
IPv6
Cloud Access



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Which Reference Architecture?

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Smart Business Architecture
(SBA)

Scope

Borderless Routing
Infrastructure (BRI)

Campus
Single Regional WAN
Internet Edge

Multiple Regional WANs
Routing Core for transport
Advanced WAN Capabilities

Scale

Up to 500 remote sites
Up to 10,000 users
Fixed variants

Theater and Global WANs
Enterprise Interconnect

Complexity

Prescriptive designs
Detailed deployment guidance
Emphasis on best practices

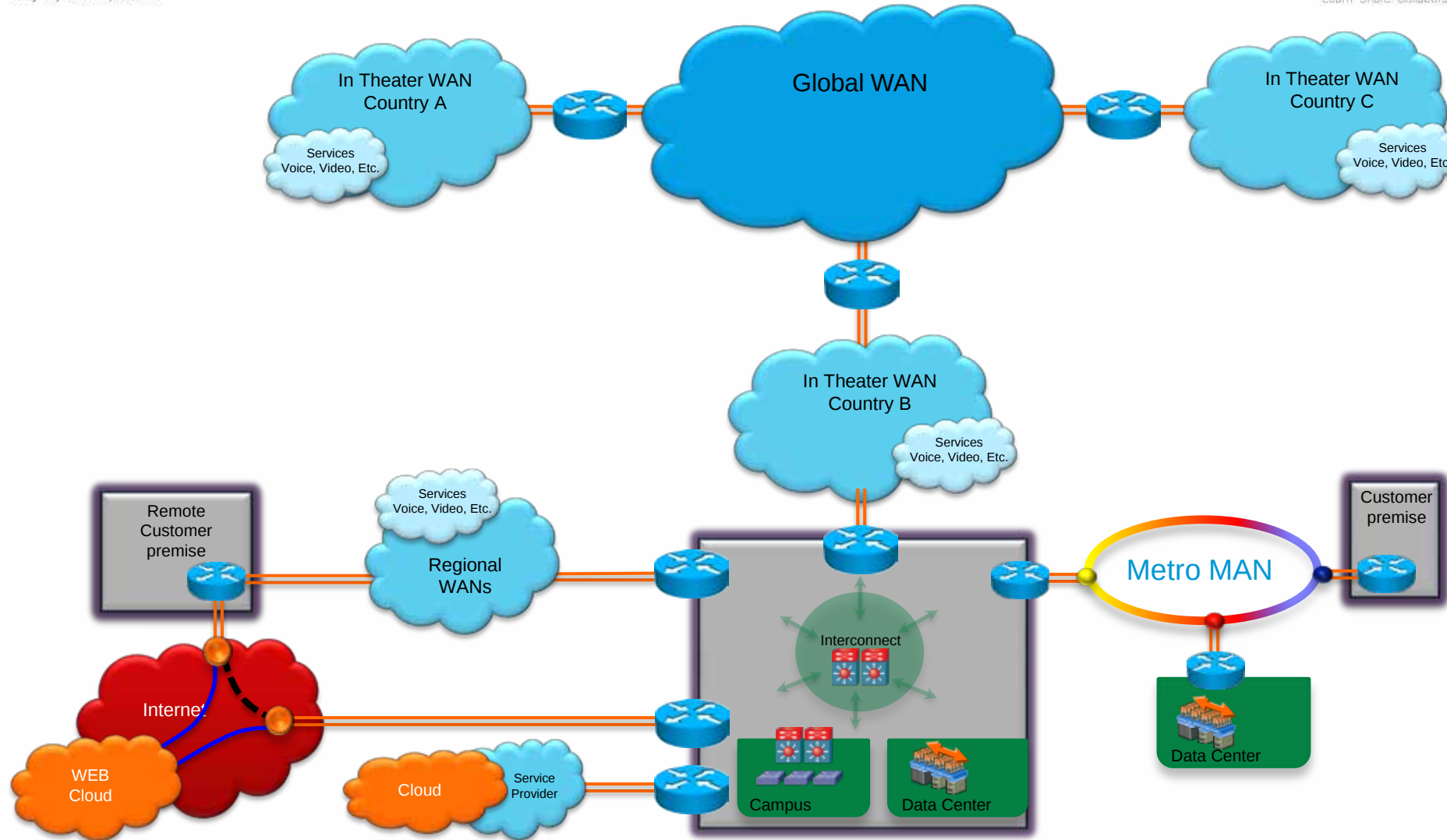
Enterprise MPLS
Multiple routing domains
Carrier-class Services



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High Level Topology – BRI

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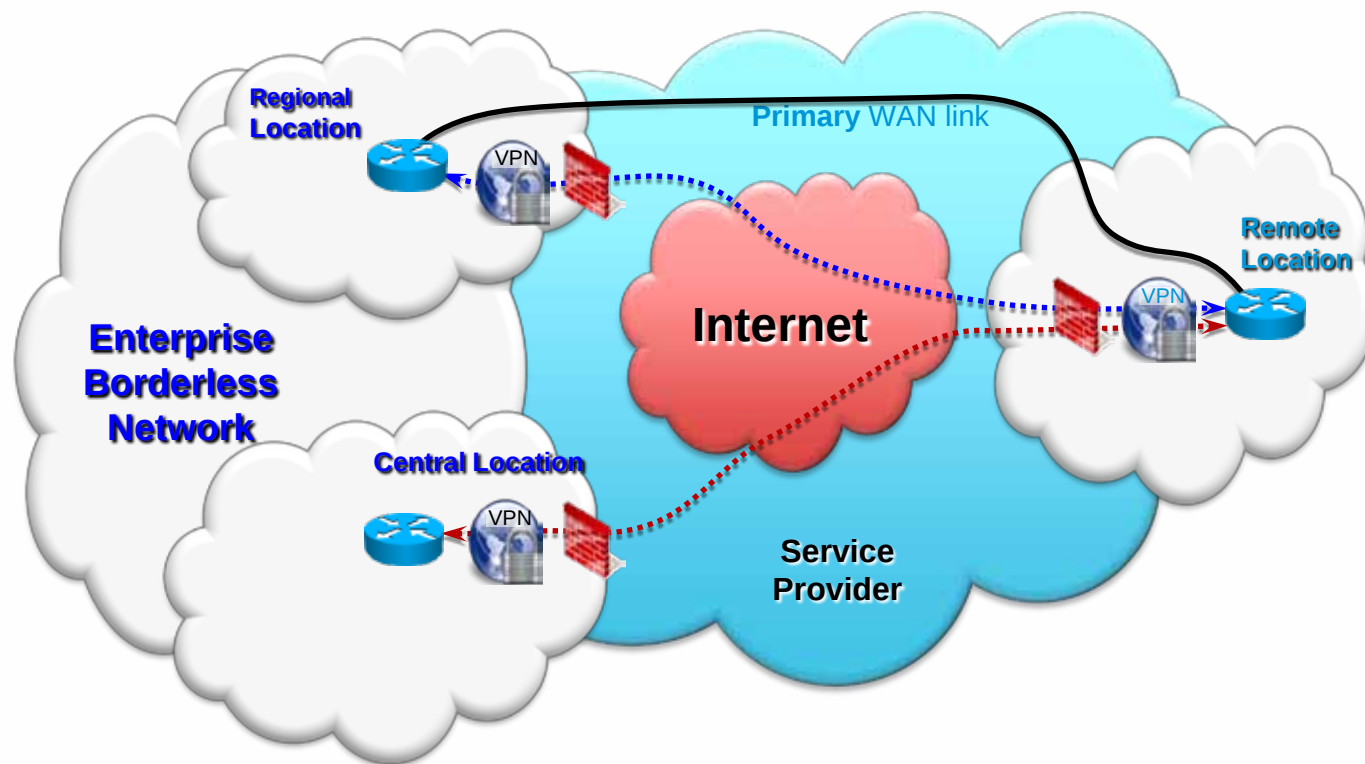




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Internet for Enterprise WAN

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- WAN link
- - - Typical flow
- - - Optional Back location

- Terminating remote networks into the Enterprise Edge
- VPN Termination, FW policies
- Allow primary or redundant links
- QOS on outbound interfaces
 - No expectation of differentiated services
- Makes Edge part of Enterprise Branch WAN design



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Enterprise Branch WAN - Overview

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Standardized Branch Profiles

- **Extensible** to any branch size
- Migration to **NG connectivity** (ethernet, WWAN)
- SP and Internet access models

Scalable WAN aggregation

- Designs to support **1500 to 15,000 branches**
- Support for specific branch QOS requirements
- **High performance** for applications data

Embedded Core Services

- **Security and Availability** pervasive throughout
- UC&C incorporated as core functionality
- Consistent **end-to-end QOS** model

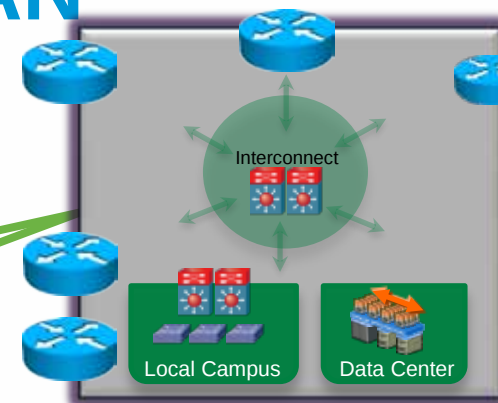
Infrastructure for Borderless services

- **Video** monitoring and troubleshooting
- **Secure Cloud** access
- IPv6



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Enterprise Branch WAN



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ASR 1k providing
WAN Aggregation



Redundant, Scalable
head-end

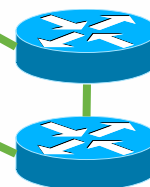


OC3, GE



Ultra High-End
Branch Office

DS3, FE



High End Branch



Internet Edge

DMVPN Head End

T1/E1, Ethernet



Standard Branch

3G/4G WWAN



MobileBranch



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Platforms Overview



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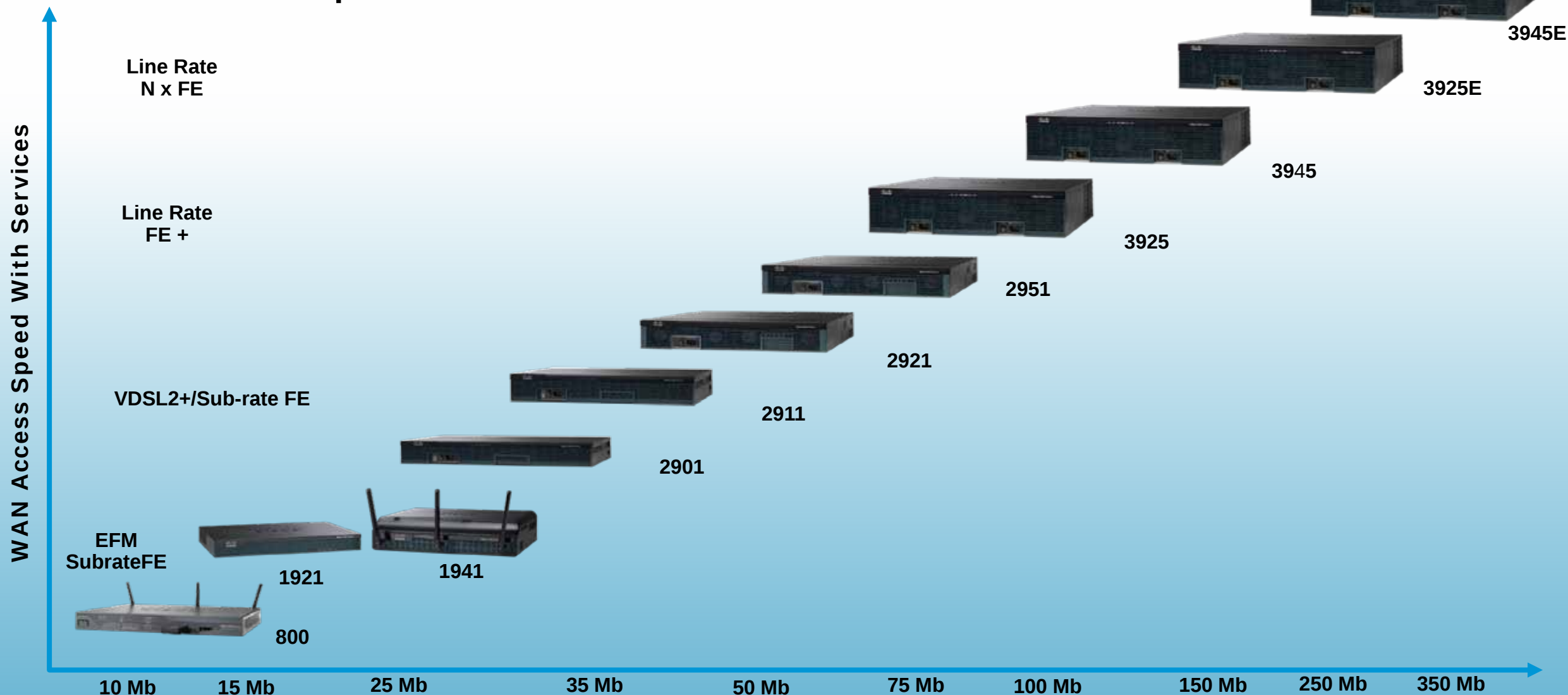
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ISR G2 Line up

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WAN Access Speeds with Services





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Integrated Services Routers G2 – Technical Overview

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Under the Covers

Services Performance Engine (3900)

- § Upgradeable engines
- § SPE-200 & SPE-250

Multi-core Network Processor

- § 5x- 7x performance increase

Multi Gigabit Fabric

- § Module to module communications
- § Packet prioritization and shaping

NG DSP Modules

- § Video ready DSP modules
- § 4x increase in audio conferencing and transcoding
- § Configurable power savings modes

EHWIC

- § 2x performance increase
- § HWIC/WIC/VWIC/VIC support natively
- § EPoE capable



GE Ports

- § 4 on 3900E
- § 3 on 2911+
- § SFP slots on 2921 and above

Service Modules

- § 3x-7x increase in service module performance
- § Existing NM support through adapter
- § EPoE capable

Internal Services Module

- § 3x increase in service module performance
- § Configurable power savings mode
- § Not available on 3900E & 1941W

USB

- § Console over USB
- § Convenience storage
- § Security credentials



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Cisco ASR 1000 Series Routers: Overview

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Compact, Powerful Router

- § Line-rate performance 2.5G to 100G+ with services enabled
- § Investment protection with modular engines, IOS CLI and SPAs for I/O
- § Hardware based QoS engine with 128K queues

Business-Critical Resiliency

- § Fully separated control and forwarding planes
- § Hardware and software redundancy
- § In-service software upgrades

Instant On Service Delivery

- § Integrated firewall, VPN, encryption, NBAR, CUBE-ENT, CUBE-SP
- § Scalable on-chip service provisioning through software licensing

Embedded High-Performance Resilient Services

ASR 1001



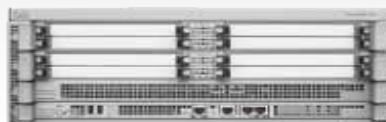
2.5 -5Gbps

ASR 1002



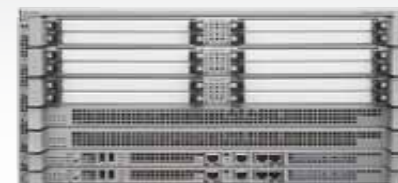
2.5-10
Gbps

ASR 1004



10-40
Gbps

ASR 1006

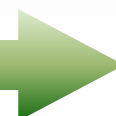


10-40+
Gbps

ASR 1013



40-360
Gbps





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ASR 1000 Series Chassis

ASR1013

Knowledge



ASR1001



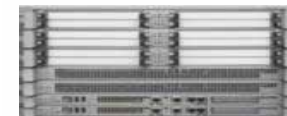
ASR1002



ASR1004



ASR1006



SPA Slots	1-slot/IDC	3-slot	8-slot	12-slot	24-slot
ESP Slots	Integrated	Integrated	1	2	2
SIP slots	Integrated	Integrated	2	3	6
IOS Redundancy	Software No ISSU	Software	Software	Hardware	Hardware
Built-in GE	4	4	N/A	N/A	N/A
Height	1.75" (2RU)	3.5" (2RU)	7" (4RU)	10.5" (6RU)	22.7" (13RU)
Bandwidth	2.5/5.0 Gbps	5-10 Gbps	10-20 Gbps	10-40 Gbps	40+ Gbps
Maximum output Power	400W	470W	765W	1275W	3200W
Airflow	Front to back	Front to back	Front to back	Front to back	Front to back



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Cisco Router Security Certifications

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<http://www.cisco.com/go/securitycert>

	FIPS	Common Criteria
	140-2, Level 2	EAL4
Cisco 880 Series ISR	ü	Aug 2011
Cisco 1900 Series ISR	ü	Aug 2011
Cisco 2900 Series ISR	ü	Aug 2011
Cisco 3900 Series ISR	P	Aug 2011
Cisco 3900E Series ISR	Nov 2011	Aug 2011
Cisco ASR 1k	P	ü





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Deploying End to End WAN Services



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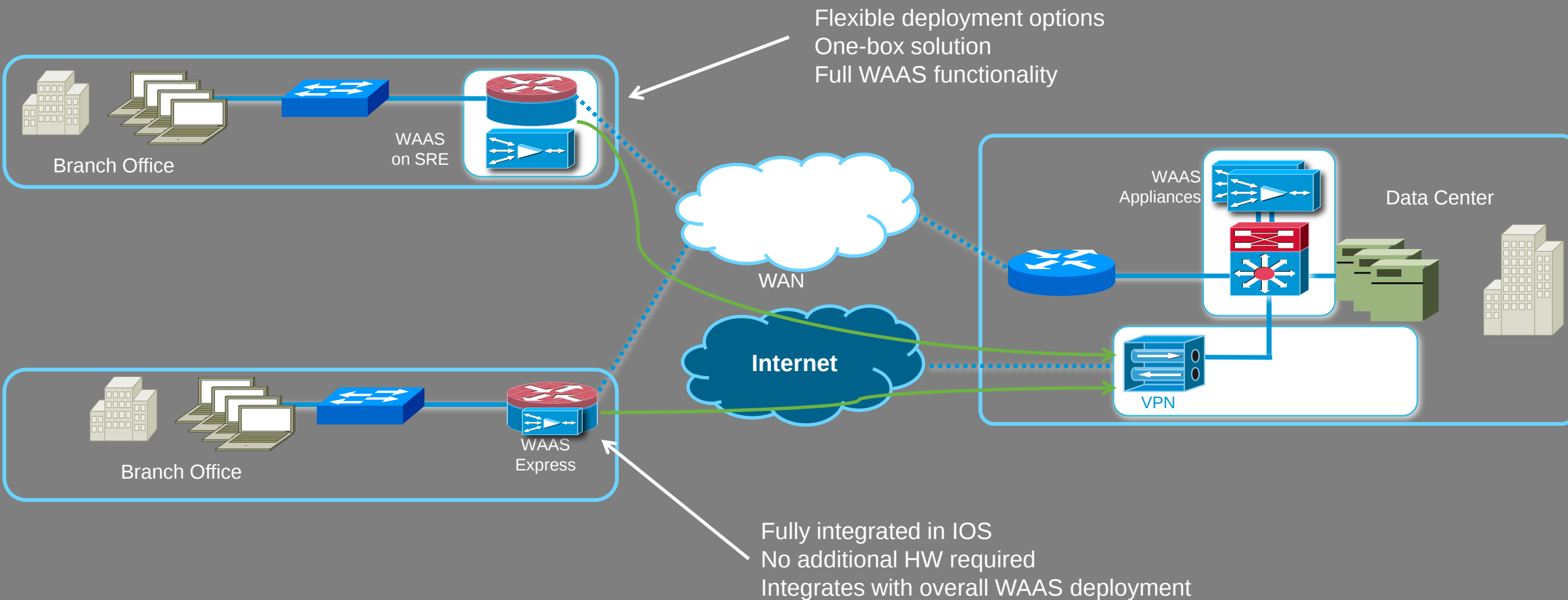
Optimization



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Cisco WAAS: WAN Optimization Solution

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Key WAAS Express Features

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§ Optimization

- § Auto-Discovery
- § TFO
- § LZ Compression
- § DRE

§ Management

- § Offers simplified CLI configuration
- § WAAS Central Manager for management and provisioning

§ Network Integration

- § Compatible with WAAS appliances
- § Inline IOS feature - Interoperates with IOS Security and QoS
- § Support for mixed devices (WAAS appliances, WAAS on SRE, WAAS Express)



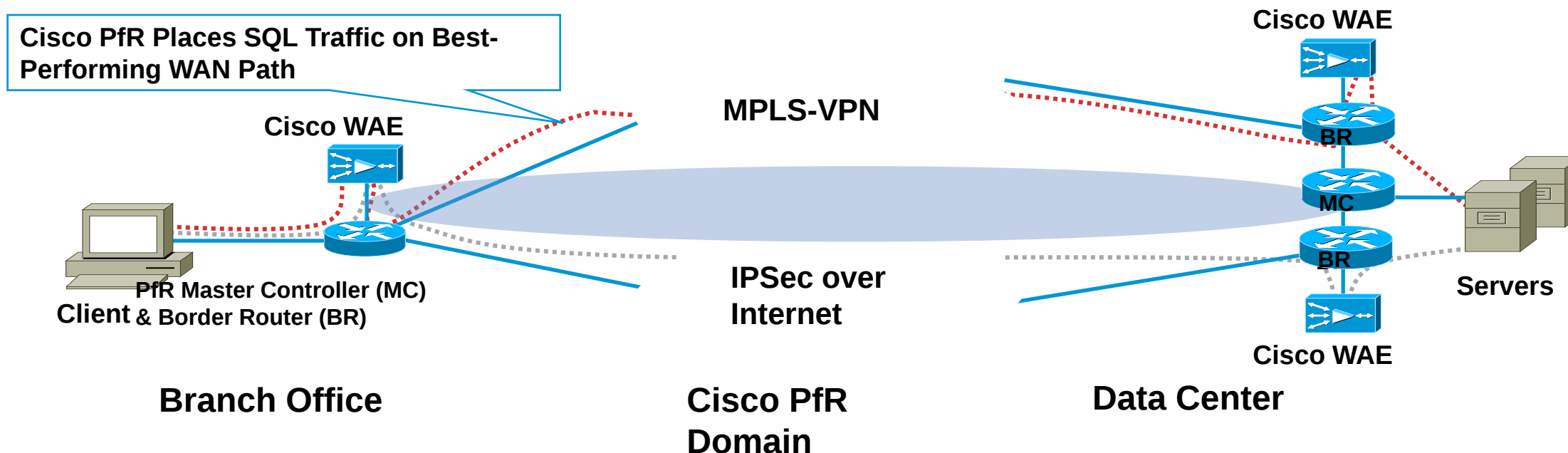
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Cisco PfR and Cisco WAAS Integration Adaptive WAN-Optimized Network

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- Cisco Wide Area Application Services (WAAS) optimizes the **TCP session**
- Cisco PfR monitors and optimizes WAN **path selection**
- Cisco WAAS network transparency allows individualized session placement by Cisco PfR over best WAN path





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WAAS 4.4 New Features and Benefits

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Application aware DRE

- Improved Performance (traditional, emerging and cloud based applications)
- Fair performance amongst branches
- Improved overall bandwidth utilization

High Availability enhancements

- Improved WCCP timers for HA
- Multiple WCCP service groups improving optimization performance



**WAAS
4.4**

4.4

Integrated APM

- Increased Visibility into Application and network performance
- Improve operational and management efficiency
- Rapid detection of application performance issues



eCDS on VB

- Complete WAN optimization + Video CDN solution
- Hierarchical CDN with advanced prepositioning and dedicated Video cache
- Scheduled events (live and multicast)





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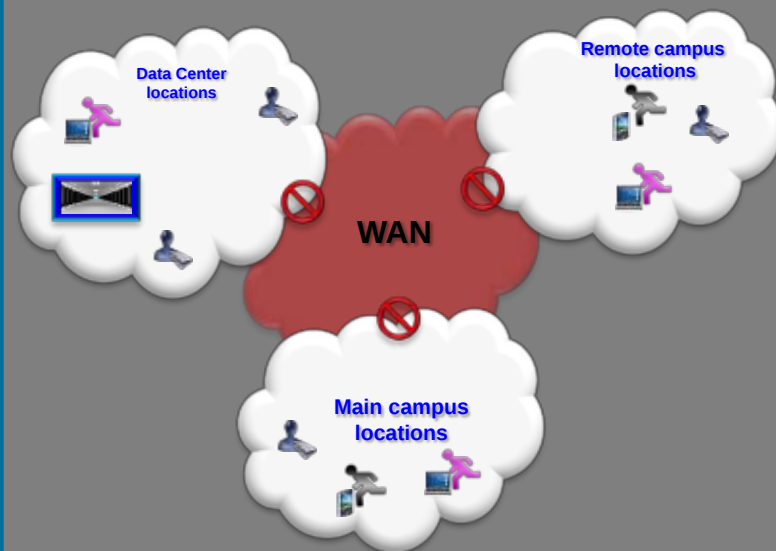
Enterprise End to End QoS Recommendation



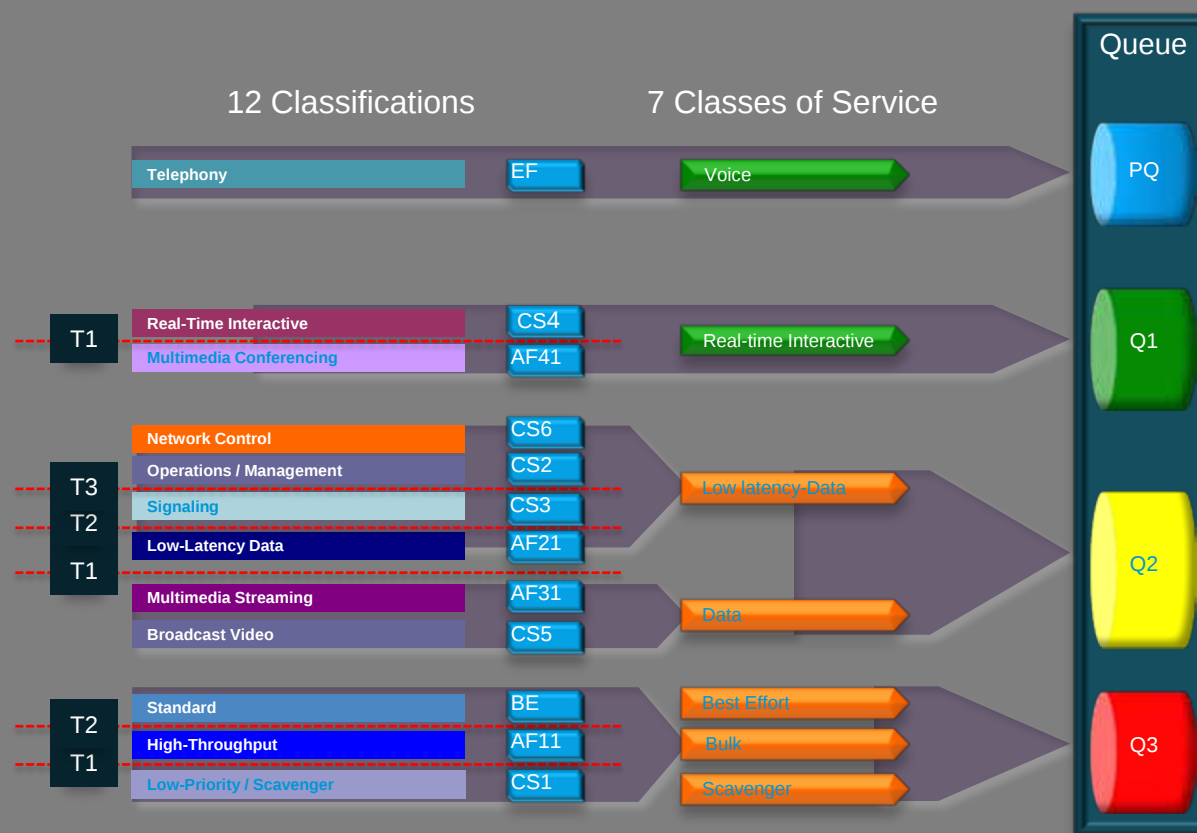
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Enterprise Campus 7 classes of service, 12 classifications

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Queuing structure
4 Queues Multiple Thresholds





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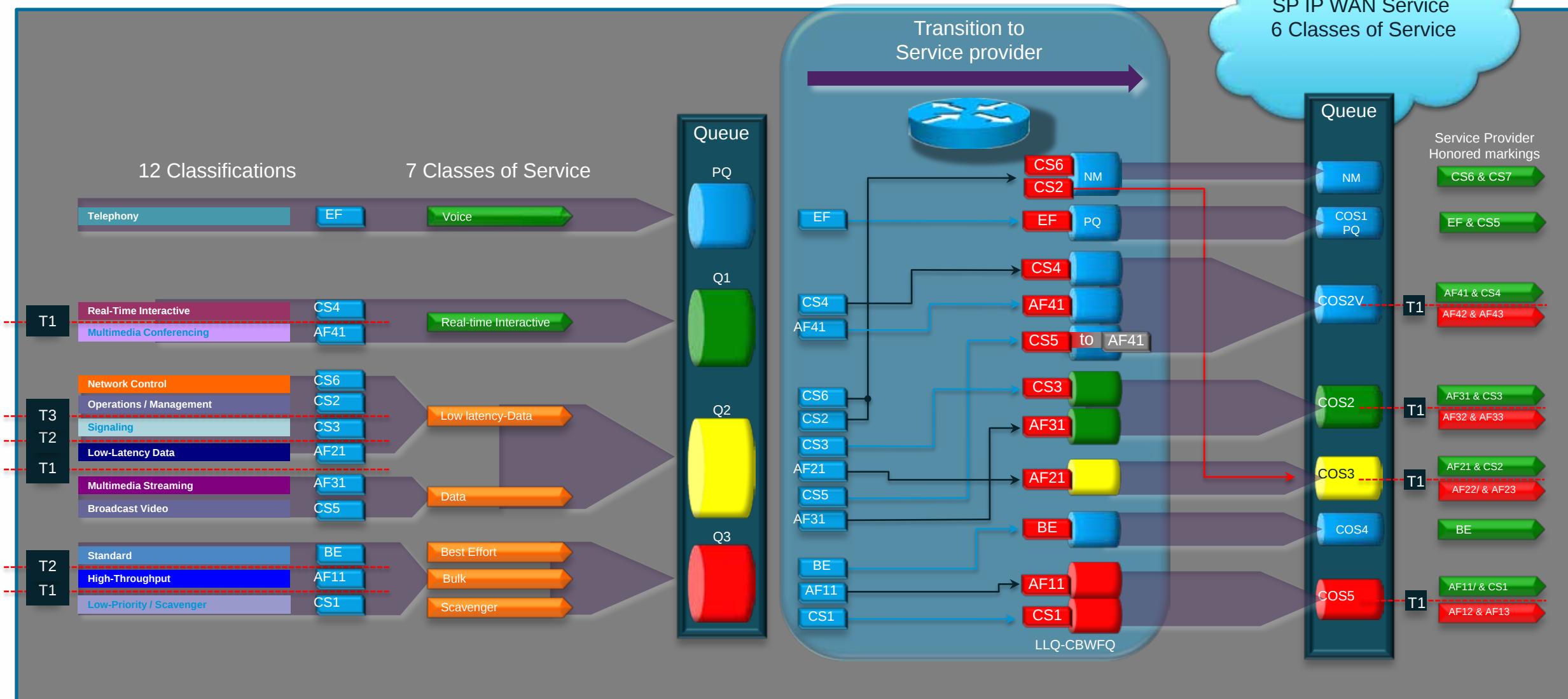
Service Provider IP WAN 6 Classes of Service

Campus to WAN

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Learn



SP IP WAN Service
6 Classes of Service

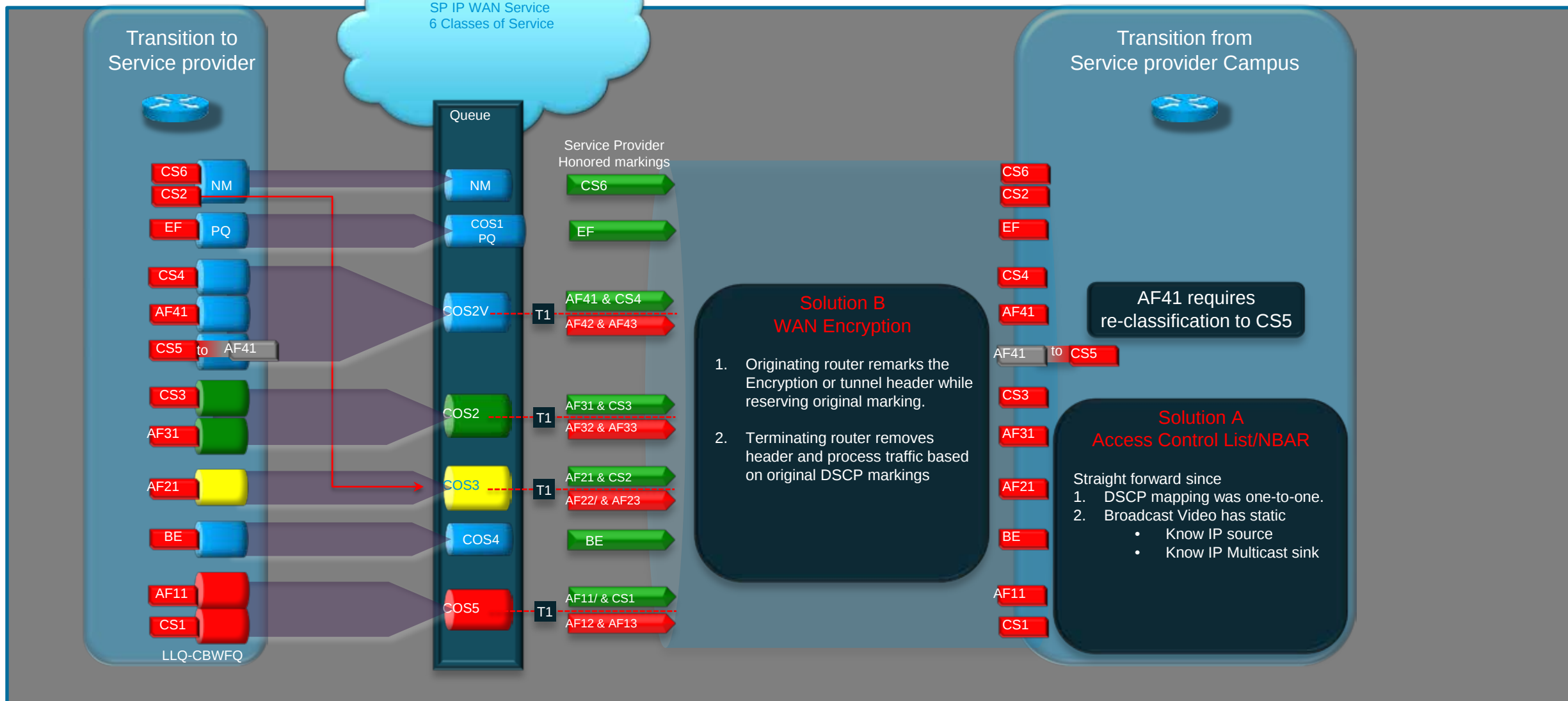




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Restoring Original Marking WAN to Campus

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QOS 12-to-6 Mapping

policy-map WAN-SP-CLASS-OUTPUT

class VOICE

priority percent 10

class VIDEO-RT-INTERACTIVE

priority percent 23

class NETWORK-MGMT-OAM

bandwidth percent 5

class BROADCAST-VIDEO

set ip dscp af41

bandwidth percent 7

class STREAMING-SIGNALLING

bandwidth percent 10

class CRITICAL-DATA

bandwidth percent 15

class BULK-SCAVENGER

bandwidth percent 5

random-detect

class class-default

bandwidth percent 25

random-detect

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Reference

class-map match-any VOICE

match ip dscp ef

class-map match-any VIDEO-RT-INTERACTIVE

match ip dscp cs4 af41

class-map match-any NETWORK-MGMT-OAM

match ip dscp cs2 cs6

class-map match-any STREAMING-SIGNALLING

match ip dscp cs3 af31

class-map match-any CRITICAL-DATA

match ip dscp af21 af22 af23

class-map match-any BULK-SCAVENGER

match ip dscp cs1 af11

class-map match-any BROADCAST-VIDEO

match ip dscp cs5

class-map match-any BEST-EFFORT

match ip dscp default



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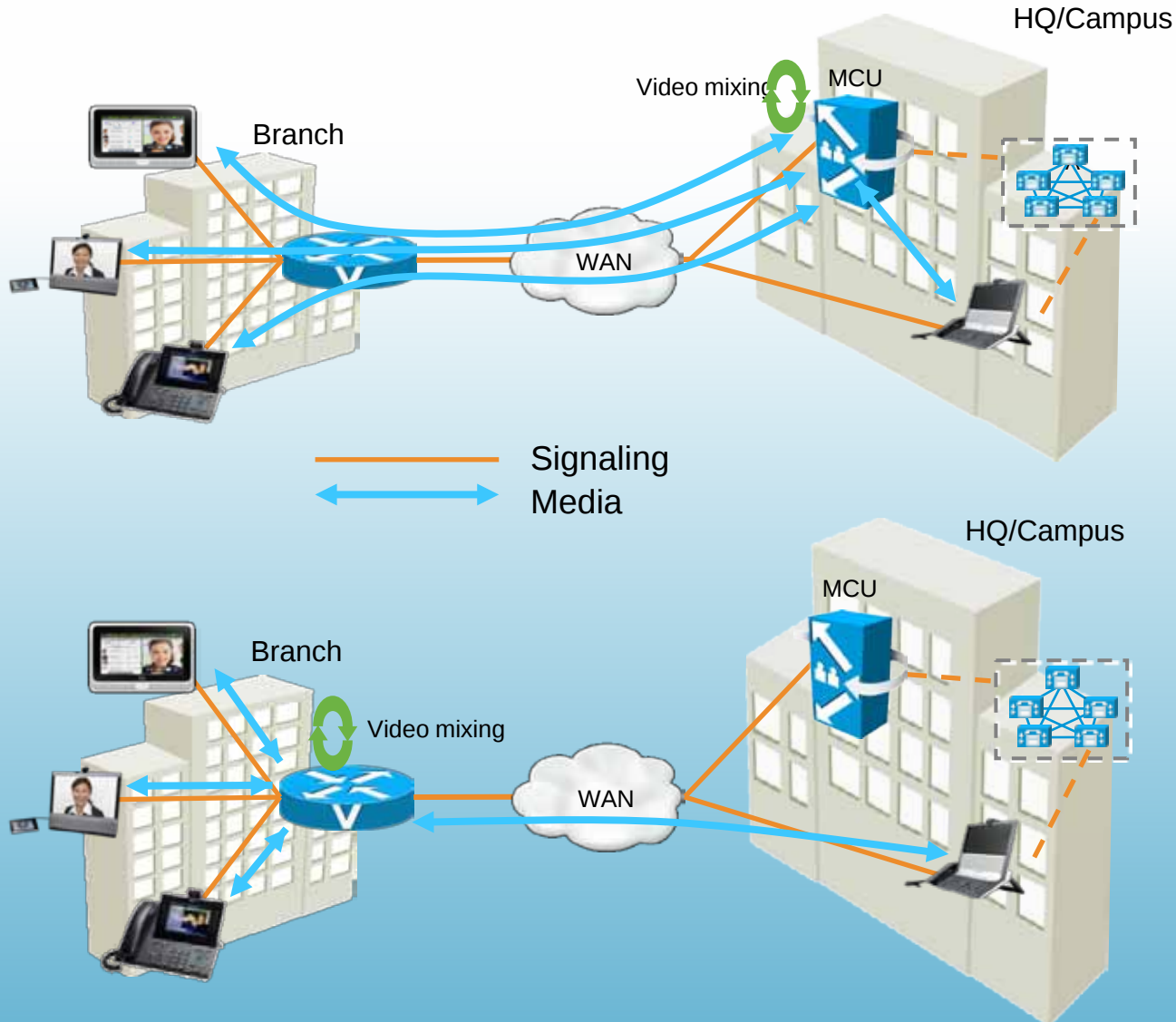
Video/MediaNet



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Video Conferencing Services

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- Multiple video streams traverse the WAN to a central MCU resource – non-optimal use of limited WAN BW
- Video is mixed by a centralized MCU controlled by CUCM

- § Video is mixed by the ISR G2 DSPs controlled by CUCM or UCME
- § Keeps traffic local in the branch if all participants are located in the branch
- § Ad-hoc and MeetMe conferences



Branch MCU on ISR



```
sccp local GigabitEthernet0/2.2
```

```
sccp ccm 10.4.200.15 identifier 1 version 7.0
```

```
sccp
```

```
sccp ccm group 1
```

```
bind interface GigabitEthernet0/2.2
```

```
associate ccm 1 priority 1
```

```
associate profile 1 register VCBc471fe671782
```

```
keepalive retries 5
```

```
keepalive timeout 10
```

```
dspfarm profile 1 conference video
```

```
homogeneous
```

```
codec g711ulaw
```

```
codec g711alaw
```

```
codec g729abr8
```

```
codec g729abr8
```

```
codec g729r8
```

```
codec g729br8
```

```
codec h264 4cif frame-rate 30 bitrate  
1mbps
```

```
maximum sessions 8
```

```
associate application SCCP
```

IP addr of CUCM or CME for
control



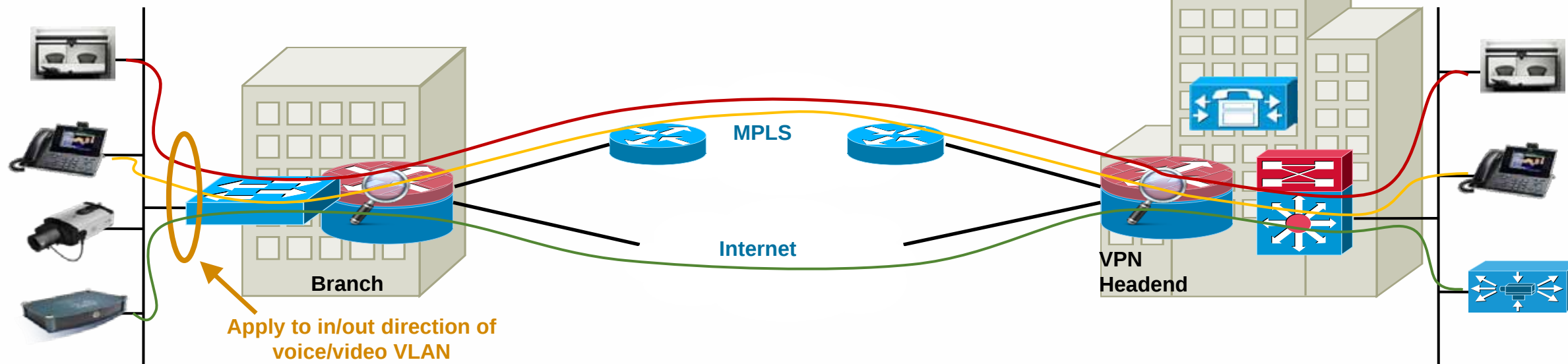
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Media Monitoring Performance Monitor

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LiveAction



- Monitor video traffic traversing different network types
- Generate alert based on user configurable threshold
- Enable on voice/video VLAN
- Provide metrics including jitter, packet loss, latency, bitrate, etc.

Performance Monitor

Sample CLI Output



```

Match: ipv4 src addr = 40.40.195.1, ipv4 dst addr = 40.40.222.1, ipv4 prot = udp, trns
src port = 31492, trns dst port = 16990, SSRC = 4075548911
Policy: video-mon, Class: video-class, Interface: GigabitEthernet0/1, Direction: input
  
```

```

*counter flow                      : 1
  counter bytes                    : 3902031
  counter bytes rate                (Bps) : 130067
*counter bytes rate per flow       (Bps) : 130067
*counter bytes rate per flow min   (Bps) : 130067
*counter bytes rate per flow max   (Bps) : 130067
  counter packets                  : 5574
  counter packets dropped           : 0
  routing forwarding-status reason  : Unknown
  interface input                   : Gi0/1
  interface output                  : NA
  monitor event                     : false
  ipv4 dscp                         : 34
  ipv4 ttl                         : 252
  application media bytes counter   : 3790551
  application media packets counter : 5574
  application media bytes rate      (Bps) : 126351
*application media bytes rate per flow (Bps) : 126351
*application media bytes rate per flow min (Bps) : 126351
*application media bytes rate per flow max (Bps) : 126351
*application media packets rate variation min ( % ) : NA
*application media packets rate variation max ( % ) : NA
  application media event           : Normal
*transport rtp flow count           : 1
  transport rtp jitter mean         (usec) : 16967
  transport rtp jitter minimum      (usec) : 9029
  transport rtp jitter maximum      (usec) : 24120
*transport rtp payload type         : 97
  transport event packet-loss counter : 58
*transport event packet-loss counter min : 58
*transport event packet-loss counter max : 58
  transport packets expected counter : 5632
  transport packets lost counter     : 58
*transport packets lost counter minimum : 58
*transport packets lost counter maximum : 58
  
```

```

transport packets lost rate        ( % ) : 1.02
*transport packets lost rate min   ( % ) : 1.02
*transport packets lost rate max   ( % ) : 1.02
*transport tcp flow count          : 0
*transport round-trip-time sum      (msec) : NA
*transport round-trip-time samples : NA
  transport round-trip-time         (msec) : NA
*transport round-trip-time min     (msec) : NA
*transport round-trip-time max     (msec) : NA
  
```

show performance monitor status

Display performance metrics of the flows such as

- Packet rate
- Jitter
- Packet loss



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Performance Monitor

Setting Threshold and Syslog Alert

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```
policy-map type performance-monitor <vidmon_policy>
class rtsp-video
  flow monitor vidmon-monitor
  react 1 transport-packets-lost-rate
    threshold value ge 5.00
    alarm severity alert
    action syslog
```

- Monitoring policy can contain threshold and action
- Syslog contains flow information and value of metric that exceeds the threshold

Feb 22 18:28:29.866 PST: %PERF_TRAFFIC_REACT-1-ALERTSET: TCA RAISE.

Detailed info: Threshold value crossed - current value 14.55%

Flow info: src ip 172.30.0.1, dst ip 172.30.102.6

src port 5004, dst port 3381

ssrc 3618346598

Policy info: Policy-map vidmon-policy, Class rtsp-video, Interface GigabitEthernet0/1,
Direction input

**React info: id 1, criteria transport-packets-lost-rate, severity alert, alarm type
discrete, threshold range [5.00%, 100.00%]**



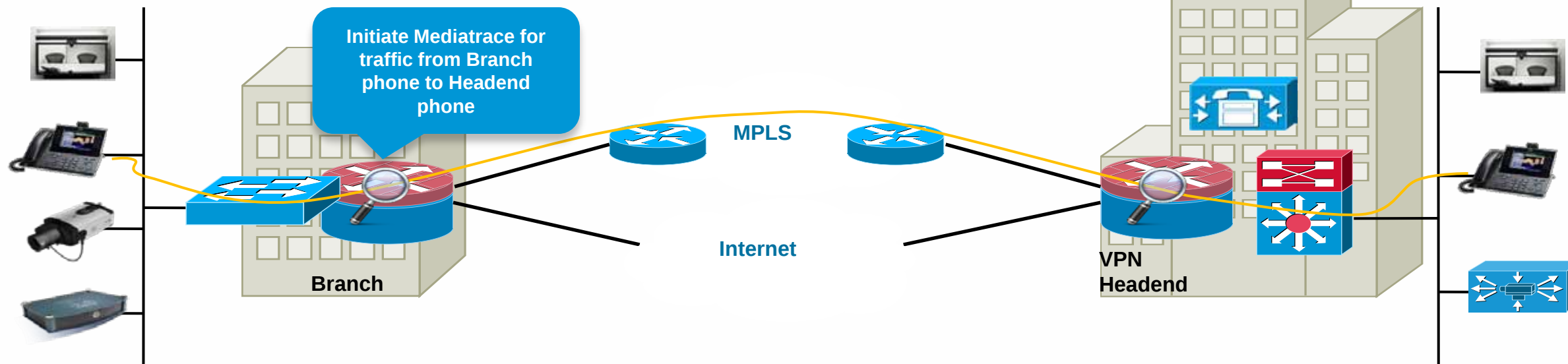
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Media Monitoring Mediatrace

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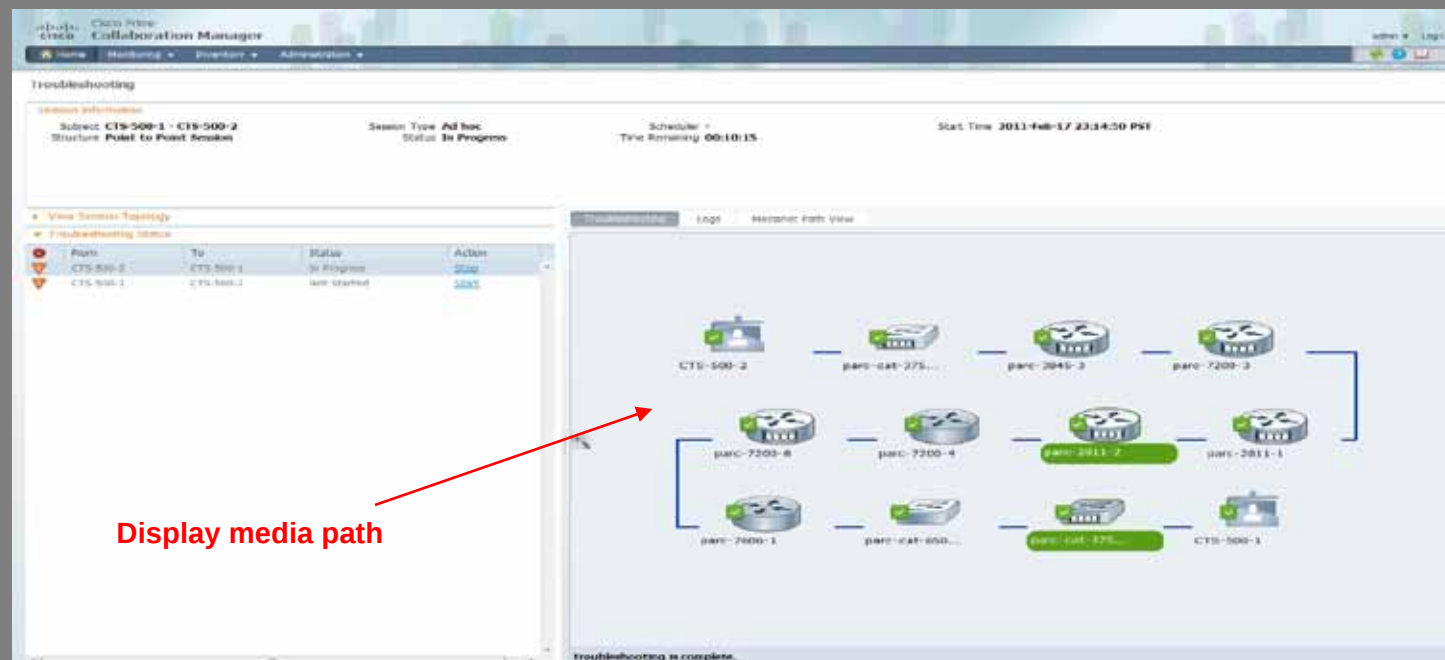


Collaboration
Manager



- Use Mediatrace to further troubleshoot media issues
- Initiate Mediatrace to discover path, system resource, or quality metrics on devices in the media path
- Mediatrace responders collect the requested metrics and return to initiator
- Works with Cisco Collaboration Manager

Mediatrace Cisco Collaboration Manager



par-2811-2
 Medianet Capable
 Mediatrace Role : Responder
 IPSLA Role : Unsupported

System Status	Interface Details	Mediatrace Flow Information	
		Video Flow	Audio Flow
DSCP		cs4 (32)	cs4 (32)
IP Packet Drop Count		0 pkts	0 pkts
RTP Packet Loss		0.98%	0.60%
RTP Packet Jitter (RFC 3550)		23.11 ms	18.54 ms
Ingress Interface		FastEthernet0/0	FastEthernet0/0
Egress Interface		FastEthernet0/1	FastEthernet0/1

Interval: 30 seconds
 Last Updated: 2011-Feb-17 23:21:43 PST

Display media flow performance statistics

Display the path taken by the media stream

Identify the device in the path where problem is seen

Display the media flow performance metrics

Mediatrace

Sample CLI Output



Two types of mediatrace profiles – system and perf-monitor

```
mediatrace profile system <name>  
metric-list cpu|intf|memory
```

```
mediatrace profile perf-monitor <name>  
metric-list tcp|ntp
```

CPU

Mediatrace Hop Number: 1 (host=branch1-router, ttl=253)
Metrics Collection Status: Success
Reachability Address: 10.1.0.128
Ingress Interface: Gi0/1
Egress Interface: Gi0/0.21
Metrics Collected:
Collection timestamp: 16:23:07.209 PST Tue Feb 15 2011
One min CPU utilization (%): 2
Five min CPU utilization (%): 2

Memory

Mediatrace Hop Number: 1 (host=branch1-router, ttl=253)
Metrics Collection Status: Success
Reachability Address: 10.1.0.128
Ingress Interface: Gi0/1
Egress Interface: Gi0/0.21
Metrics Collected:
Collection timestamp: 16:23:21.193 PST Tue Feb 15 2011
Processor memory utilization (%): 5

Intf

Mediatrace Hop Number: 1 (host=branch1-router, ttl=253)
Metrics Collection Status: Success
Reachability Address: 10.1.0.128
Ingress Interface: Gi0/1
Egress Interface: Gi0/0.21
Metrics Collected:
Collection timestamp: 16:22:49.825 PST Tue Feb 15 2011
Octet input at Ingress (KB): 388610.651
Octet output at Egress (KB): 271010.426
Pkts rcvd with err at Ingress (pkts): 0
Pkts errored at Egress (pkts): 0
Pkts discarded at Ingress (pkts): 0
Pkts discarded at Egress (pkts): 0
Ingress i/f speed (mbps): 1000.000000
Egress i/f speed (mbps): 1000.000000

Reference

Mediatrace

Sample Output (Cont.)



RTP

Mediatrace Hop Number: 1 (host=branch1-router, ttl=253)
Metrics Collection Status: Success
Reachability Address: 10.1.0.128
Ingress Interface: Gi0/1
Egress Interface: Gi0/0.21
Metrics Collected:
Flow Sampling Start Timestamp: 16:09:22
Loss of measurement confidence: FALSE
Media Stop Event Occurred: FALSE
IP Packet Drop Count (pkts): 0
IP Byte Count (KB): 1224.162
IP Packet Count (pkts): 1201
IP Byte Rate (Bps): 40805
Packet Drop Reason: 0
IP DSCP: 0
IP TTL: 125
IP Protocol: 17
Media Byte Rate Average (Bps): 40004
Media Byte Count (KB): 1200.142
Media Packet Count (pkts): 1201
RTP Interarrival Jitter Average (usec): 52808
RTP Packets Lost (pkts): 7
RTP Packets Expected (pkts): 1208
RTP Packet Lost Event Count: 7
RTP Loss Percent (%): 0.57

TCP

Mediatrace Hop Number: 1 (host=branch1-router, ttl=253)
Metrics Collection Status: Success
Reachability Address: 10.1.0.128
Ingress Interface: Gi0/1
Egress Interface: Gi0/0.21
Metrics Collected:
Flow Sampling Start Timestamp: 21:36:54
Loss of measurement confidence: FALSE
Media Stop Event Occurred: FALSE
IP Packet Drop Count (pkts): 0
IP Byte Count (KB): 2025.305
IP Packet Count (pkts): 1566
IP Byte Rate (Bps): 67510
Packet Drop Reason: 0
IP DSCP: 40
IP TTL: 125
IP Protocol: 6
Media Byte Count (KB): 1962.665
TCP Connect Round Trip Delay (ms): 4294.967295
TCP Lost Event Count: 14

Reference



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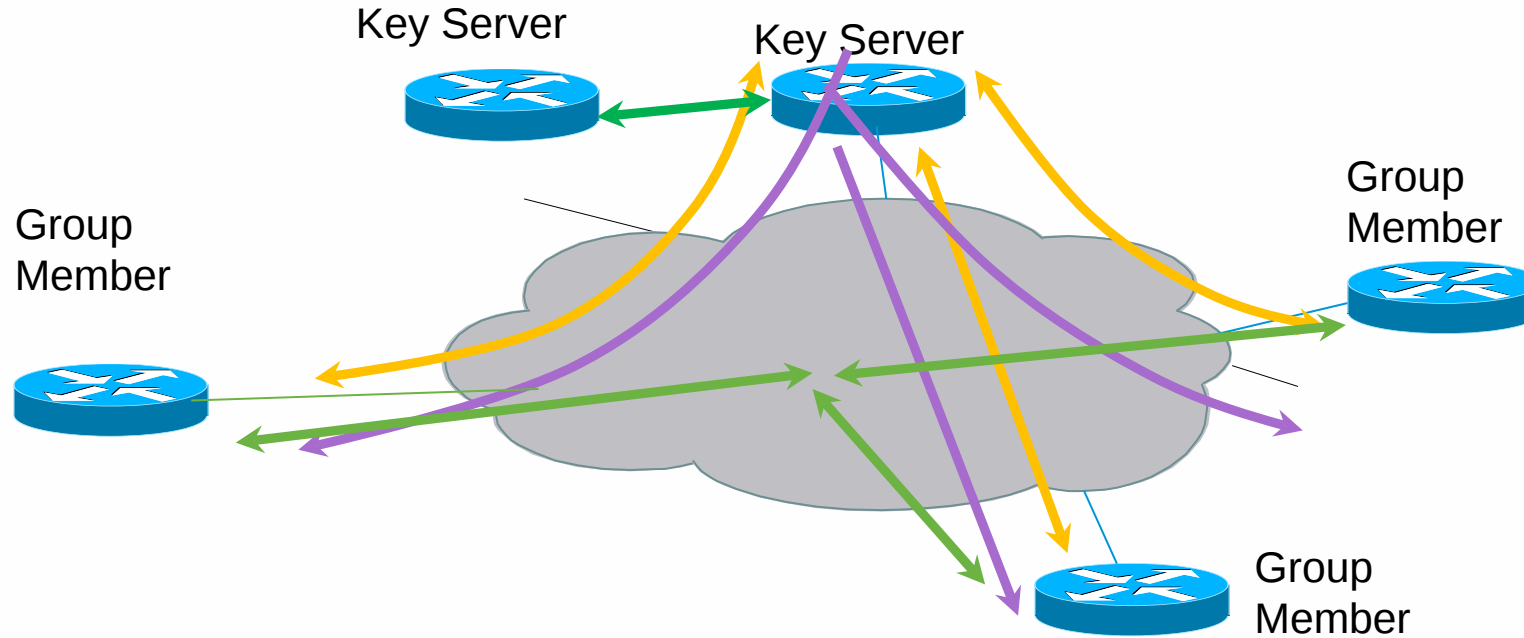
Security

GET VPN Technology



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Registration

Rekey

Encrypted data flow

COOP Protocol

IETF Standards based - Group Domain of Interpretation (GDOI)

Key Management Protocol

Group Members authenticate and register to the key server

Key Server distributes keys and policies

Periodic refresh of keys from key server

Separation of control and data plane

High Availability built into the key server protocol



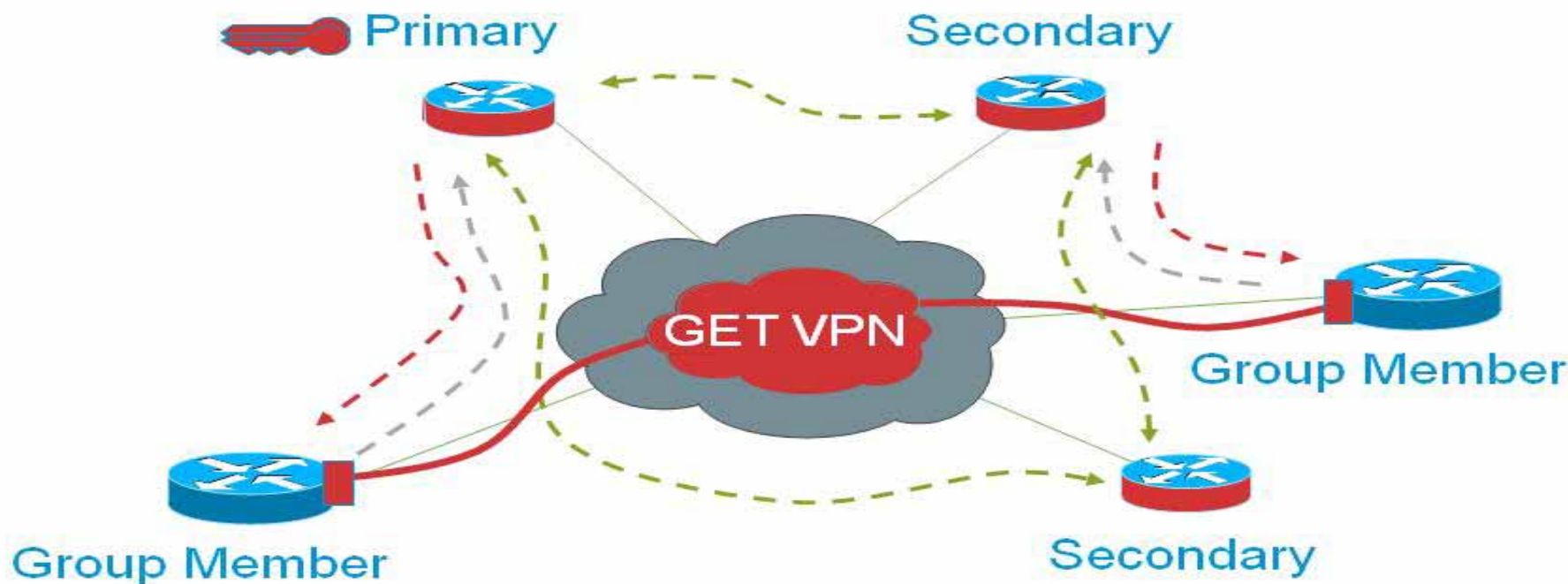
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Cooperative Key Server

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- Primary: Elected by eligible set of KS
Creates Keys, Registers GM, Distributes Keys, Notifies Secondary
- § Secondary: Eligible KS in cooperative state for a group
Registers GM, Monitors Primary, Notifies Primary of New GM

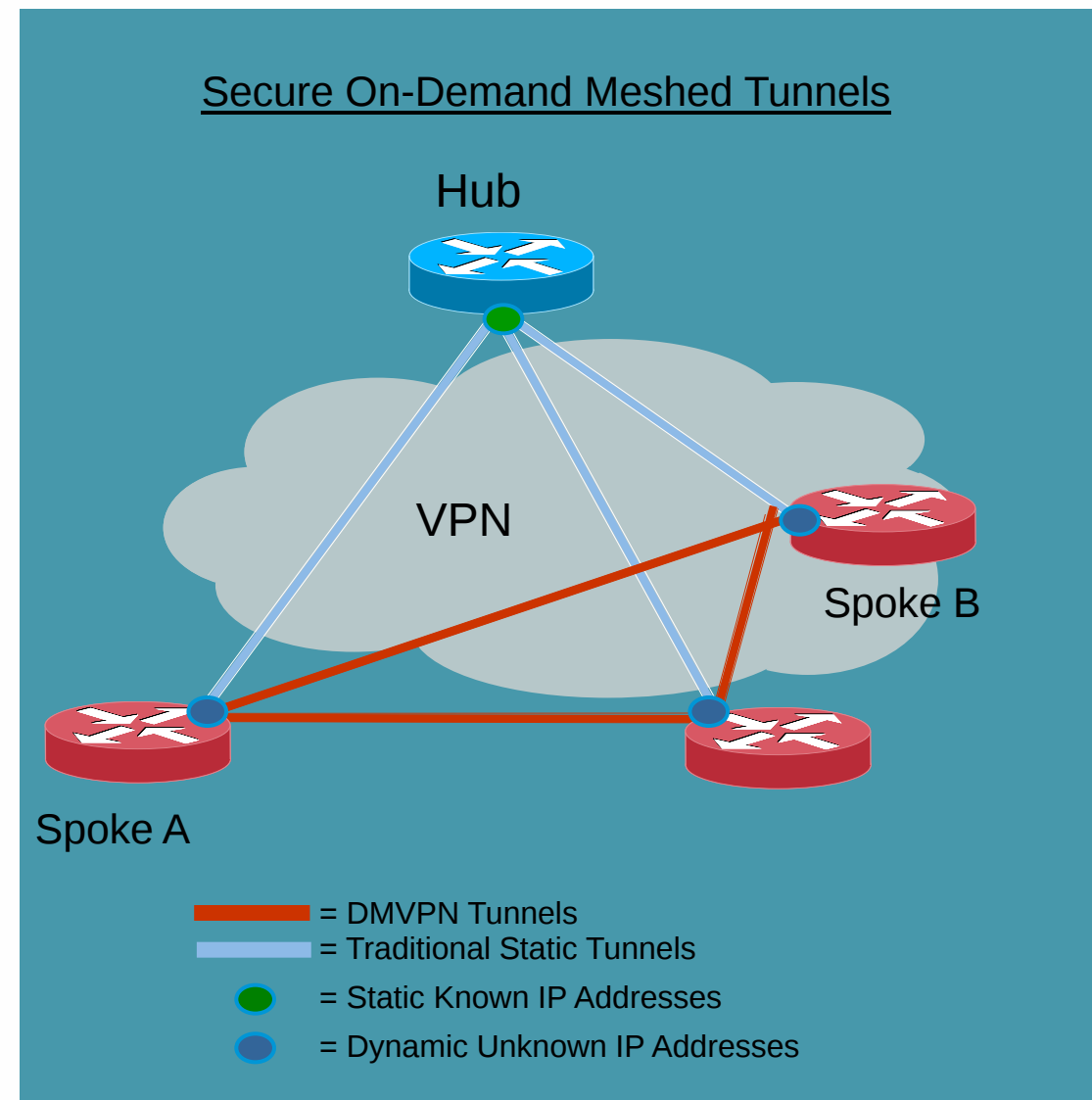


DMVPN Phase 3



- **Full meshed** connectivity w/ simple configuration of hub and spokes
- Supports **dynamically** addressed spokes
- **Zero touch configuration** for addition of new spokes

- § Hierarchical hub network design for improved resiliency and network scalability
- § Dynamic discovery of shortest path between hubs for improved resiliency for inter-hub connection
- § Route summarization for improved bandwidth utilization & reduced routing protocol load on hub and spokes
- § OSPF not limited to two hubs for improved routing protocol scalability in DMVPN





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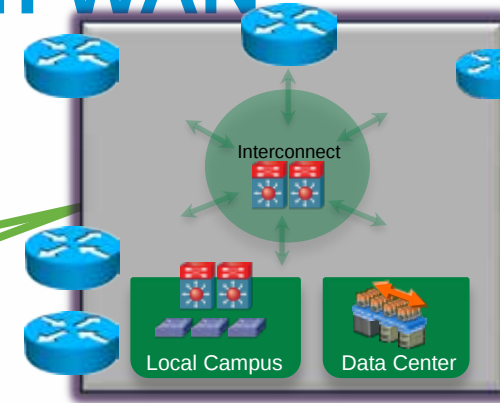


Templates – Branch and Head End



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Enterprise Branch WAN



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ASR 1k providing
WAN Aggregation



Redundant, Scalable
head-end

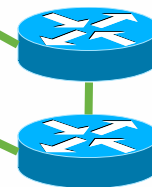


OC3, GE



Ultra High-End
Branch Office

DS3, FE



High End Branch



Internet Edge

DMVPN Head End



T1/E1, Ethernet



Standard Branch

3G/4G WWAN



MobileBranch



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Transitions in Enterprise Branch WANs

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New Access Circuits

- T1/E1 deployments diminishing
- Cheap Ethernet Bandwidth becoming prevalent
- WWAN (3G/4G) popularity

Maximize use of all bandwidth

- Broadband connections provide cheap secondary bandwidth
- Intelligent traffic shaping across all access

Cloud access

- Public cloud resources make hub & spoke WANs obsolete
- Internet edge functionality has to be distributed to multiple sites

Video

- Planned and unplanned video eats WAN bandwidth
- Support and control of wanted video traffic



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Enterprise Branch WAN – Branch Profiles

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Mobile Branch

- Prime requirement is mobility of branch
- Connection via 3G/3G or satellite
- WAN Optimization to provide best application performance
- Limited QOS now, expandable with 4G delivery

Standard Branch

- Deliver Std Def video
- BW up to 10Mb ethernet
- Migration from T1/E1 to ethernet
- SP MPLS link with Internet backup (xDSL, WWAN)
- 4 9s availability

High-End Branch

- HD video capable
- Migrate from DS3 to ethernet
- Dual SP MPLS connectivity – load balance and failover
- 5 9s availability

Ultra-High End Branch

- Very high BW (up to 1Gb), high availability requirements
- Redundancy and performance a key drivers
- Many services broken out into dedicated platforms



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BRI Management Components

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Cisco Prime LAN
Management Solution

- ü Simplifies the configuration and management of endpoints
- ü Medianet “plug-in” provides workflows for provisioning autoconfiguration and location settings and tracking of medianet endpoints
- ü More info: <http://cisco.com/go/lms>



Cisco Prime
Collaboration Manager

- ü Supports timely end-to-end visibility and isolation of video-related issues for TelePresence sessions, endpoints, and the network
- ü Provides deeper network path visibility, down to the granularity of video flow statistics, wherever Medianet-capable devices are deployed in the network
- ü More info: <http://www.cisco.com/go/cpcm>



Cisco Prime
NAM

- ü Site-based monitoring
- ü Interactive reports with advanced filters and contextual navigation
- ü Application performance intelligence



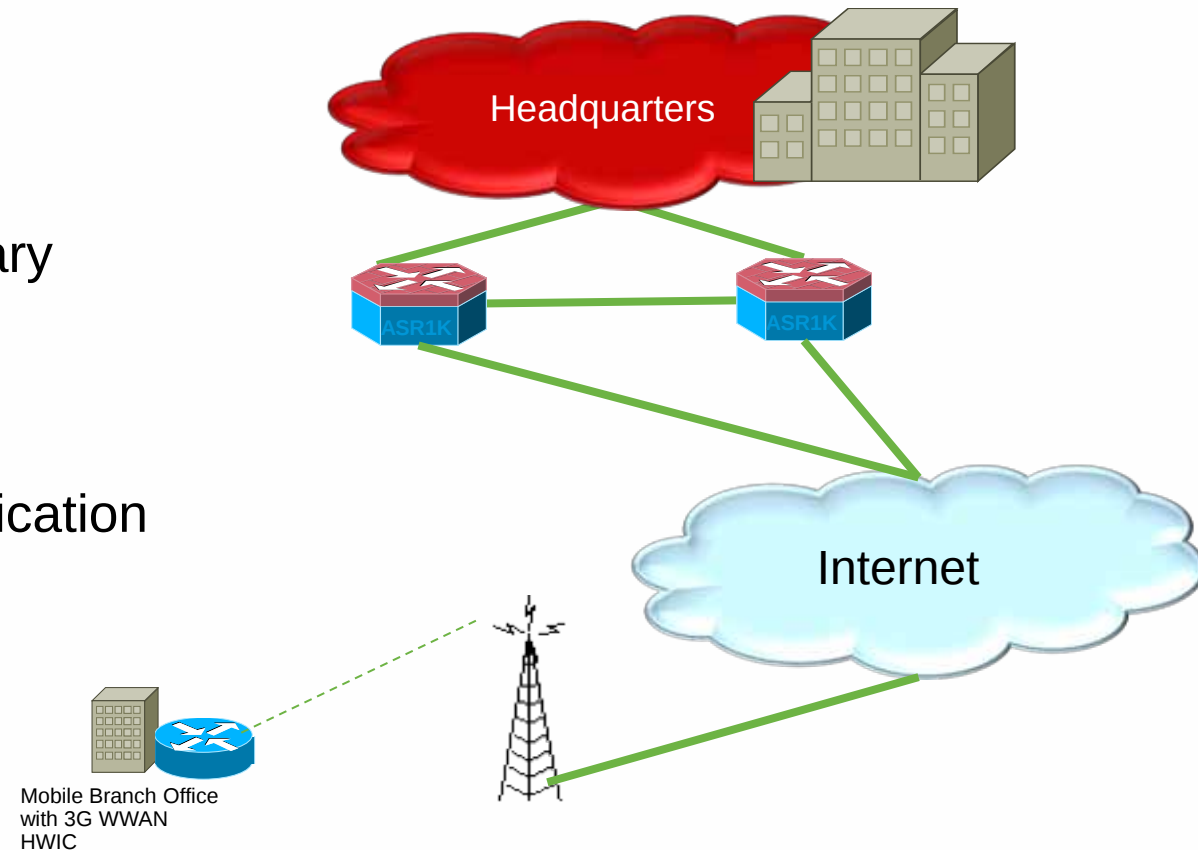
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Enterprise Branch WAN – Mobile Branch

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- Focus on flexible deployment of the branch itself
 - Retail Banking
 - Retail
 - Public Sector
 - Others
- Security enabled branch supports primary connectivity via WWAN link
 - 3G/4G
 - Satellite
- Optimized connection to maximize application performance





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Technical Details – Mobile Branch

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Platform	WAN Int	SW Releases	Services
Cisco 1941W	3G/4G	IOS 15.1(4)M	Security – ZBF, DMVPN, IPS* QOS – egress only IPv6 – 6to4 tunneling WAAS Express UC & Video – Best effort

WAAS Express

```
interface Tunnel10
bandwidth 8192
waas enable
```

← **Single IOS command on the interface**

```
sh int g0/0
30 second output rate 3731000 bits/sec, 352 packets/sec (original bandwidth)
```

```
sh int tun 10
Checksumming of packets disabled
30 second input rate 290000 bits/sec, 54 packets/sec (optimized bandwidth in the WAN)
```

```
sh waas status
Maximum Flows           : 200
Total Active connections : 29
Total optimized connections : 23
```

← **Optimization saves 800kb on cellular interface with 23 connections**

Enterprise Branch WAN – Standard Branch

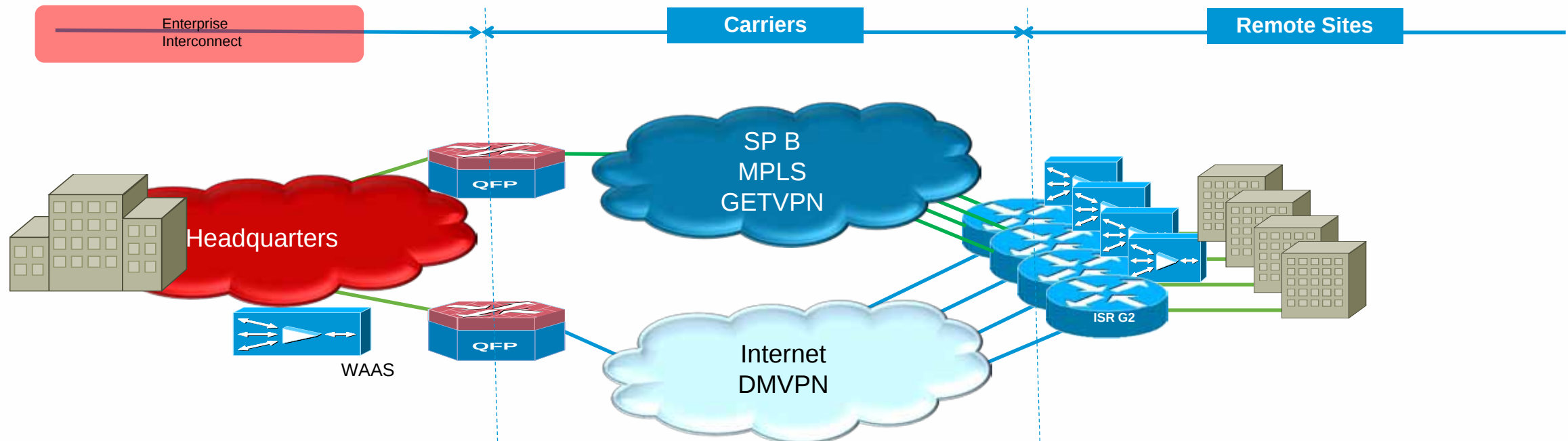


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- Most typical branch deployment across all sectors
- Load balance across redundant links with PfR
- Encrypt all traffic
- Map LAN QOS to SP QOS offering
- Service Advertisement
- MediaNet deployment





Technical Details – Standard Branch



Platform	WAN Int	SW Releases	Services
Cisco 2951	4xT1 GE (rate limited to 10Mb) DSL, WWAN	IOS 15.1(4)M WAAS v4.4 (on SRE)	•Security – GETVPN (6to4), DMVPN (6to4) •QOS – Per tunnel QOS, RSVP session control •IPv6 – Dual stack •WAAS (on SRE), PfR •UC & Video – SAF, SRST, Inline monitoring •FNF, IPSLA, Multicast, NBAR

T1 Configuration

```
controller T1 0/0/0
cablelength long 0db
channel-group 0 timeslots 1-24
!
controller T1 0/0/1
cablelength long 0db
channel-group 0 timeslots 1-24

interface Multilink1
ip address 10.4.81.114 255.255.255.252
ip virtual-reassembly in
ppp multilink
ppp multilink group 1
```

10 Mb Ethernet Config

```
interface GigabitEthernet0/1
bandwidth 10000
(bandwidth provisioned for 10Mbps)
ip address 10.4.81.114 255.255.255.252
ip nbar protocol-discovery
ip flow ingress
ip flow egress
load-interval 30
duplex auto
speed auto
```



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Technical Details – Standard Branch

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- Performance Routing

Master Controller (MC) & Border Router (BR)

```
pfr-map MAP-STD-BR1 10
match pfr learn list STD_BRANCH1_VIDEO
set mode monitor fast
set resolve loss priority 2 variance 5
set resolve jitter priority 3 variance 5
set resolve delay priority 4 variance 5
set loss threshold 50000
set jitter threshold 30
set probe frequency 4
set link-group MPLS-A fallback DMVPN

ip access-list extended DSCP_VIDEO
permit ip any any dscp af41
permit ip any any dscp cs4

ip prefix-list HQ_DATA seq 5 permit 10.4.97.0/24
```

```
pfr-map MAP-STD-BR1 20
match pfr learn list STD_DATA
set mode monitor active throughput
set resolve utilization priority 2 variance 10
set unreachable threshold 200000
set probe frequency 30
set link-group MPLS fallback DMVPN

ip access-list extended critical-data
permit ip any any dscp cs3
permit ip any any dscp af31

ip prefix-list HQ_VIDEO seq 5 permit 10.4.98.0/24
```

learn list for Data)



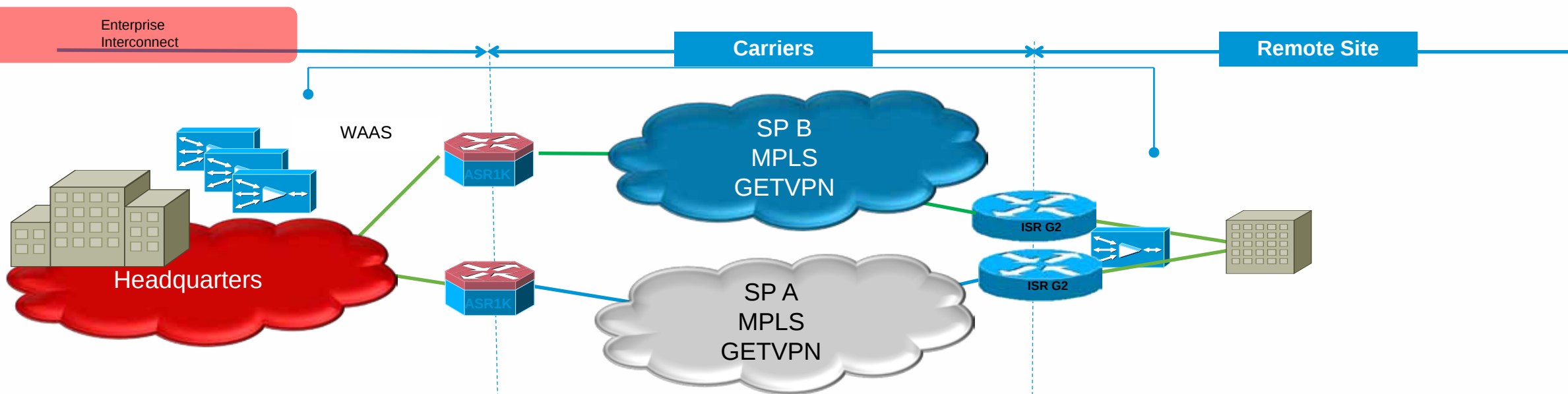
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Enterprise Branch WAN – High End Branch

- All features from Standard Branch
- HD Video ready
- Higher availability requirements
 - Redundant routers
 - Redundant MPLS carriers, no Internet WAN





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Technical Details – High End Branch

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Platform	WAN Int	SW Releases	Services
Cisco 3945E	DS3 GE (rate limited to 100Mb) to each SP	IOS 15.1(4)M WAAS v4.4	•HA – HSRP, Redundant PS •Security – GETVPN (6to4), •QOS – Per tunnel QOS, RSVP session control •IPv6 – Dual stack •WAAS, PfR •UC & Video – SAF, SRST, Inline monitoring, TP, Video streaming, Physical security, UCM int for MCU •FNF, IPSLA •L3VPN for segregation (3VRFs)

T3 Config

```
interface Serial1/0
ip address 10.4.81.10 255.255.255.252
ip wccp 62 redirect in
ip flow ingress
ip flow egress
encapsulation ppp
load-interval 30
dsu bandwidth 44210
crypto map GN2
service-policy output WAN
```

Ethernet Config

```
interface GigabitEthernet0/0
bandwidth 100000 (bandwidth configured for 100Mbps)
ip address 10.4.82.10 255.255.255.252
ip mtu 1400
ip wccp 62 redirect in
load-interval 30
duplex auto
speed auto
crypto map GN2
service-policy output WAN
```



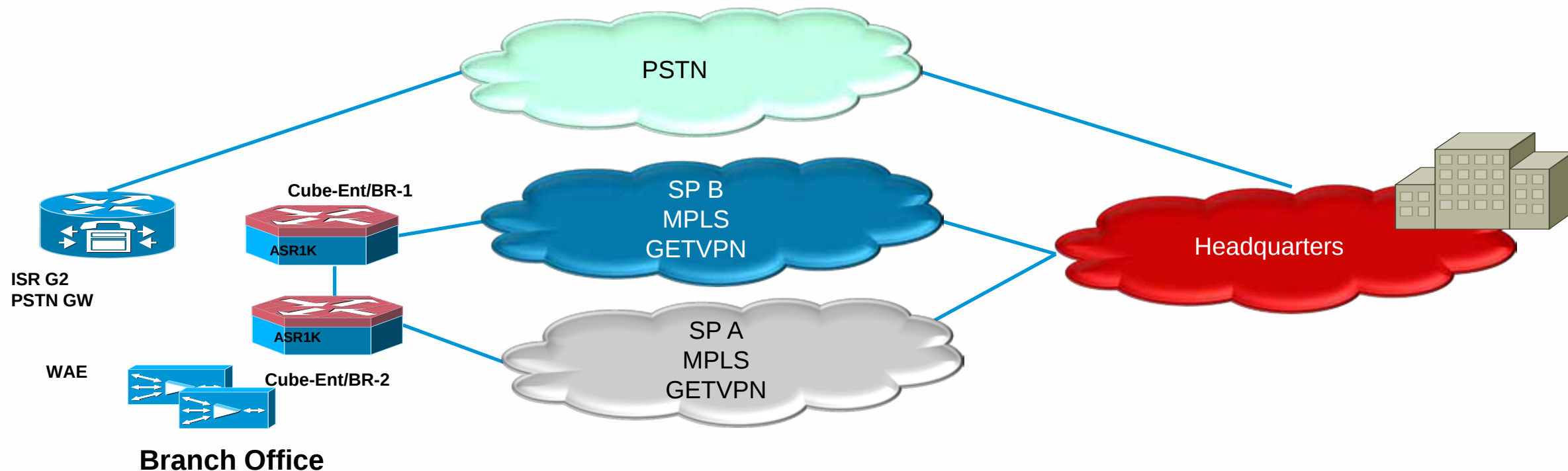
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Enterprise Branch WAN - Ultra High End Branch

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- Very high bandwidth requirements – Up to 1Gb
- Same availability requirements as high-end branch
- Services delivered on appliances or discrete platforms for scalability





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Technical Details – Ultra High End Branch

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Platform	WAN Int	SW Releases	Services
Cisco ASR1001	OC3 GE to each SP	IOS XE RLS 3.3S WAAS v4.4	•HA – HSRP, Redundant PS, ISSU, NSF, SSO, B2B redundancy •Security – GETVPN (6to4), ZBF, IPS •QOS – 12 to 6 marking, parent shaper •IPv6 – Dual stack •WAAS, PfR •UC & Video – TP, Video streaming, Physical security •FNF, IPSLA, Efficient multicast replication •L3VPN for segregation (3VRFs)

R1

```
interface GigabitEthernet0/0/1.1
description Vlan-Data
encapsulation dot1Q 61
ip address 10.5.25.1 255.255.255.0
ip wccp 61 redirect in
ip pim sparse-mode
standby 1 ip 10.5.25.100
standby 1 priority 110
standby 1 preempt
standby 1 track 1 decrement 10
```

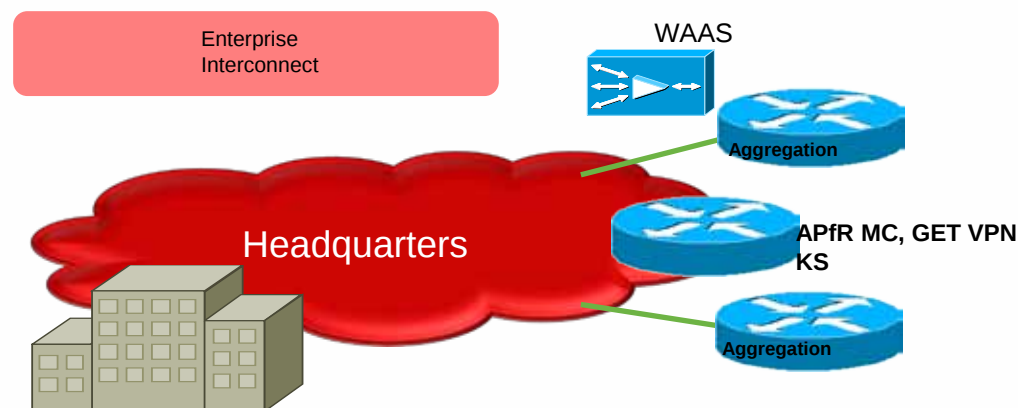
R2

```
interface GigabitEthernet0/0/1.1
description Vlan-Data
encapsulation dot1Q 61
ip address 10.5.25.2 255.255.255.0
ip wccp 61 redirect in
ip pim sparse-mode
standby 1 ip 10.5.25.100
standby 1 priority 110
standby 1 preempt
standby 1 track 1 decrement 10
```

WAN Aggregation



- ~1500/15k remote connections
- Standard model
 - Terminate traffic from Mobile and Standard branches only
 - 4-9s of availability
- High-End Model
 - Traffic from all branch types
 - 5-9s of availability
- Aggregation for private links (MPLS) as well as public links
 - GET VPN
 - DMVPN
- Add new aggregation sites as branch scale requires





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Technical Details – WAN Aggregation

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Platform	WAN Int	SW Releases	Services
Cisco ASR1006		IOS XE RLS 3.3S WAAS v4.4	•HA – HSRP, Redundant PS, ISSU, NSF, SSO, B2B redundancy •Security – GETVPN (6to4), ZBF, IPS •QOS – 12 to 6 marking, parent shaper •IPv6 – Dual stack •WAAS (on SRE), PfR •FNF, IPSLA, Efficient multicast replication •L3VPN for segregation (3VRFs)

Coop Key Server

KS1

===

```
crypto gdoi group GN2
identity number 1102
```

redundancy

local priority 250

peer address ipv4 10.4.11.211

KS2

===

```
crypto gdoi group GN2
identity number 1102
```

redundancy

local priority 1

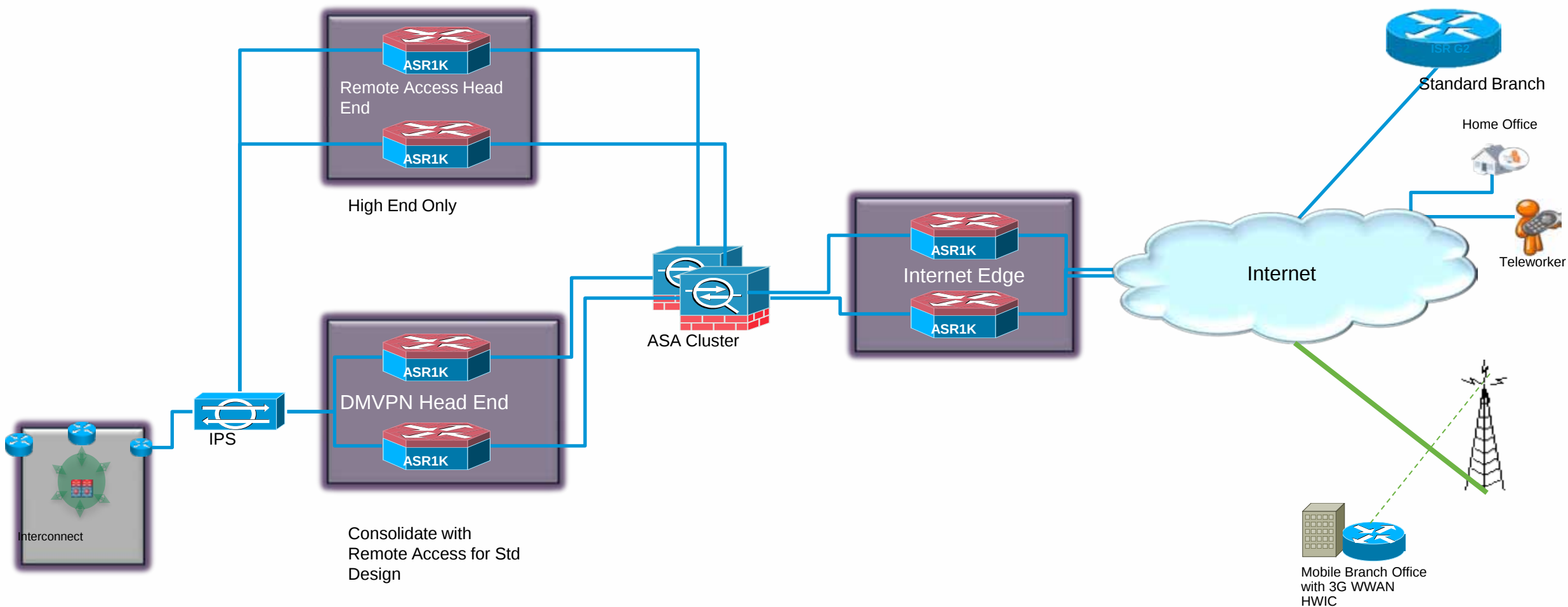
peer address ipv4 10.4.11.210



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Internet Edge – VPN Aggregation

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Branch Profile Summary

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Location Type/ Platform	Definition	Bandwidth	Services
Mobile Branch Cisco1941W	Entire branch moves	3G/4G Satellite	DMVPN, WAAS Express, 6to4 tunneling
Standard Branch Cisco 2951	Meets requirements of most customers	4xT1 to 10Mb ethernet	•GETVPN, DMVPN, Per tunnel QOS, video inline monitoring, local MCU w/CME control, PfR, WAAS on SRE
High End Branch Cisco 3945E	HD Telepresence HA, Scalability	DS3 to 100Mb Ethernet	HSRP, IPv6 dual stack, local MCU w/UCM control, MediaTrace, L3 VPN for segmentation, PfR, WAAS
Ultra High-end Branch ASR1001	Very high Bandwidth, HA	OC3 to GE	ISSU, NSF, SSO, GETVPN, Enterprise SIP, PfR, WAAS
GET VPN Aggregation ASR1006	Terminate branch traffic from MPLS		GETVPN, PfR, WAAS Head End
Internet Edge Head End ASSR1006	Terminate Internet- based VPNs		DMVPN, QOS, Easy VPN

Summary



- Borderless Routing Infrastructure provides a prescriptive migration to NG Branch networks
- ASR 1000 series provides high performance and added redundancy features in two roles
 - Head end aggregation for GET VPN, DMVPN and Easy VPN
 - Ultra high-end branch router for GE line rate
- ISR G2 provides integrated services in the branch to support voice, video, data, security and cloud access



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