Light Reading Megatest
Cisco IP Video Infrastructure

Carsten Rossenhövel, Managing Director
European Advanced Networking Test Center

LIGHT READING

EANTC
EUROPEAN ADVANCED NETWORKING TEST CENTER

Agenda

- Introduction and Project Background
- Cisco and Spirent Equipment
- Results: IP Video Service Delivery Network
  - Converged Network
  - Video Contribution Scenarios
  - Distribution Scenarios
- Results: Experience and Monetization
- Results: Data Center
- Conclusion

About EANTC

European Advanced Networking Test Center

Providing independent network quality assurance since 1991

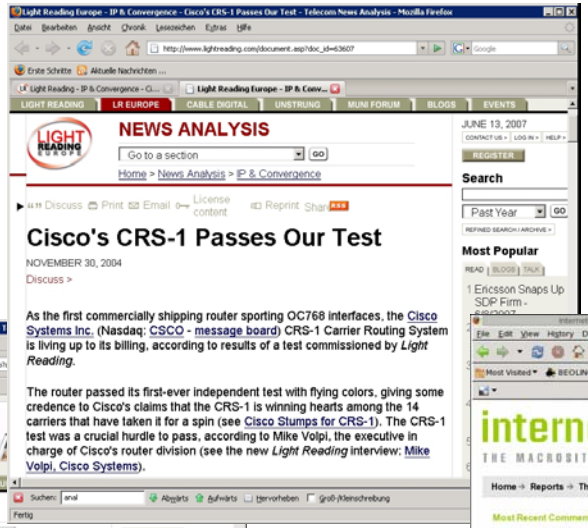
EANTC Berlin, Germany

- Test and certification of network components for manufacturers
- Network design consultancy and proof of concept tests for service providers
- Request for Proposal (RFP) support and life cycle testing for large enterprises and government organizations

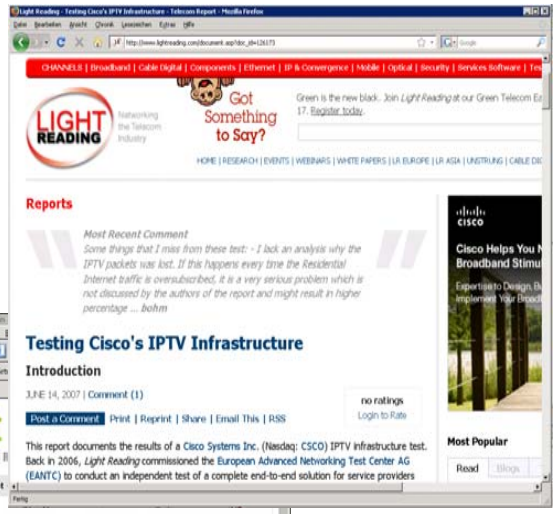
EANTC's Past Light Reading Test Projects

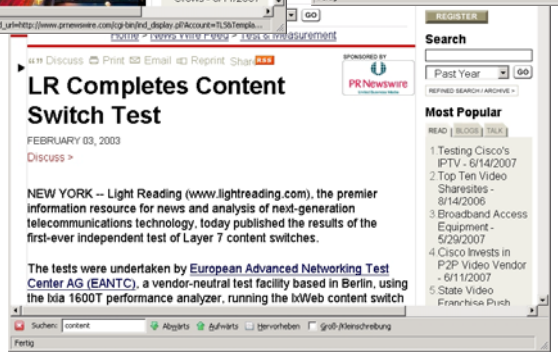
2002-Alcatel

2004-Cisco



2007-Cisco





2003-Extreme Networks

2008/2009 - Arbor, Cisco, ipoque, Procera

Cisco: "Approaching the Zettabyte Era"

Cisco's Visual Networking Index Research

- In 2013, annual global IP traffic will exceed two-thirds of a zettabyte (667 exabytes) in four years.
- By 2013, the sum of all forms of video (TV, VoD, Internet Video, and P2P) will exceed 90 percent of global consumer traffic.
- Internet video will generate over 18 exabytes per month or 60% of consumer traffic in 2013.

Source: Cisco Visual Networking Index: Forecast and Methodology, 2008-2013

Why Was The Test Conducted?

IPTV Landscape matured since our 2007 test

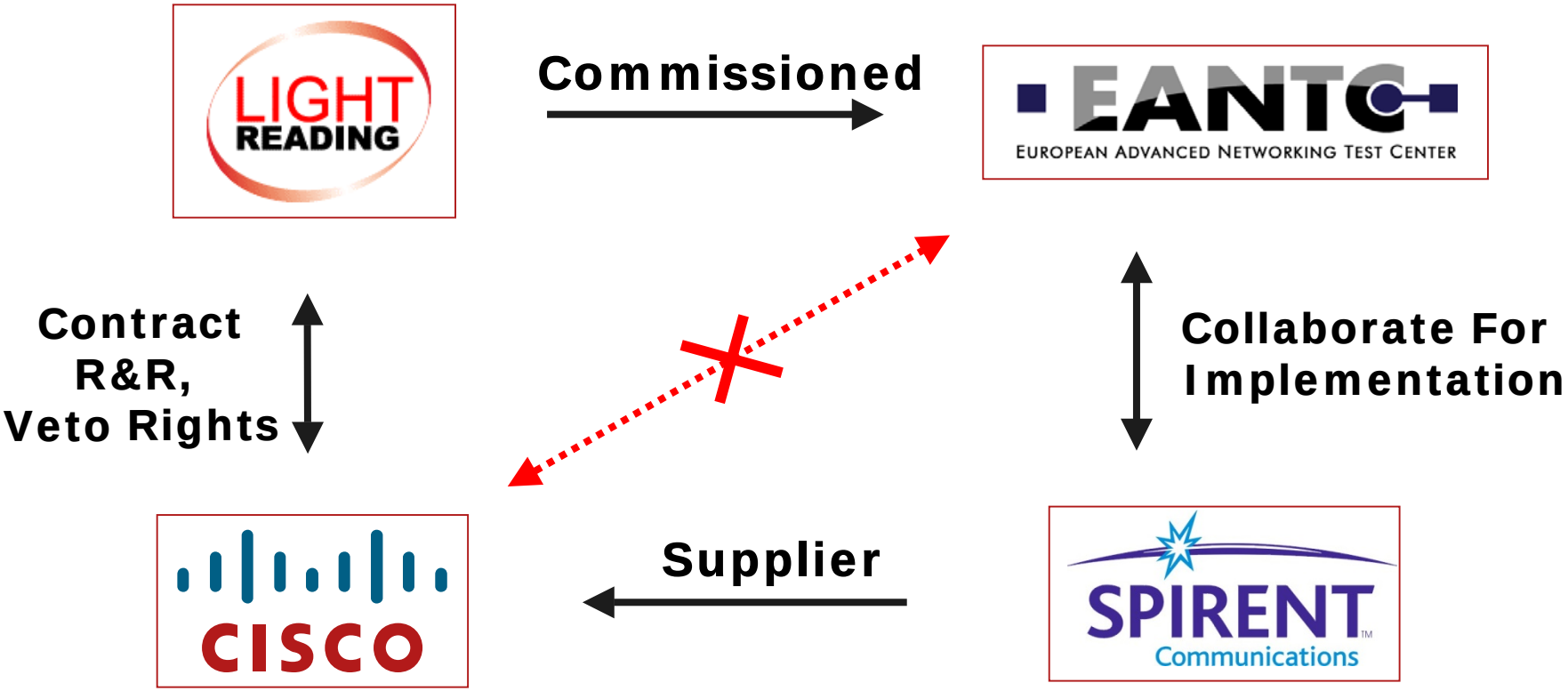
How do vendors support service providers today

- … to differentiate from the IPTV competition?
- … to create profitable advanced IP video services?
- … to implement scalable networks and data centers?

How much of Cisco's vision of a medianet* is available today?

* Cisco refers to a network that is optimized for video as "medianet"

Who Paid?



No financial relationship between Cisco and EANTC for this test

Cisco Gear

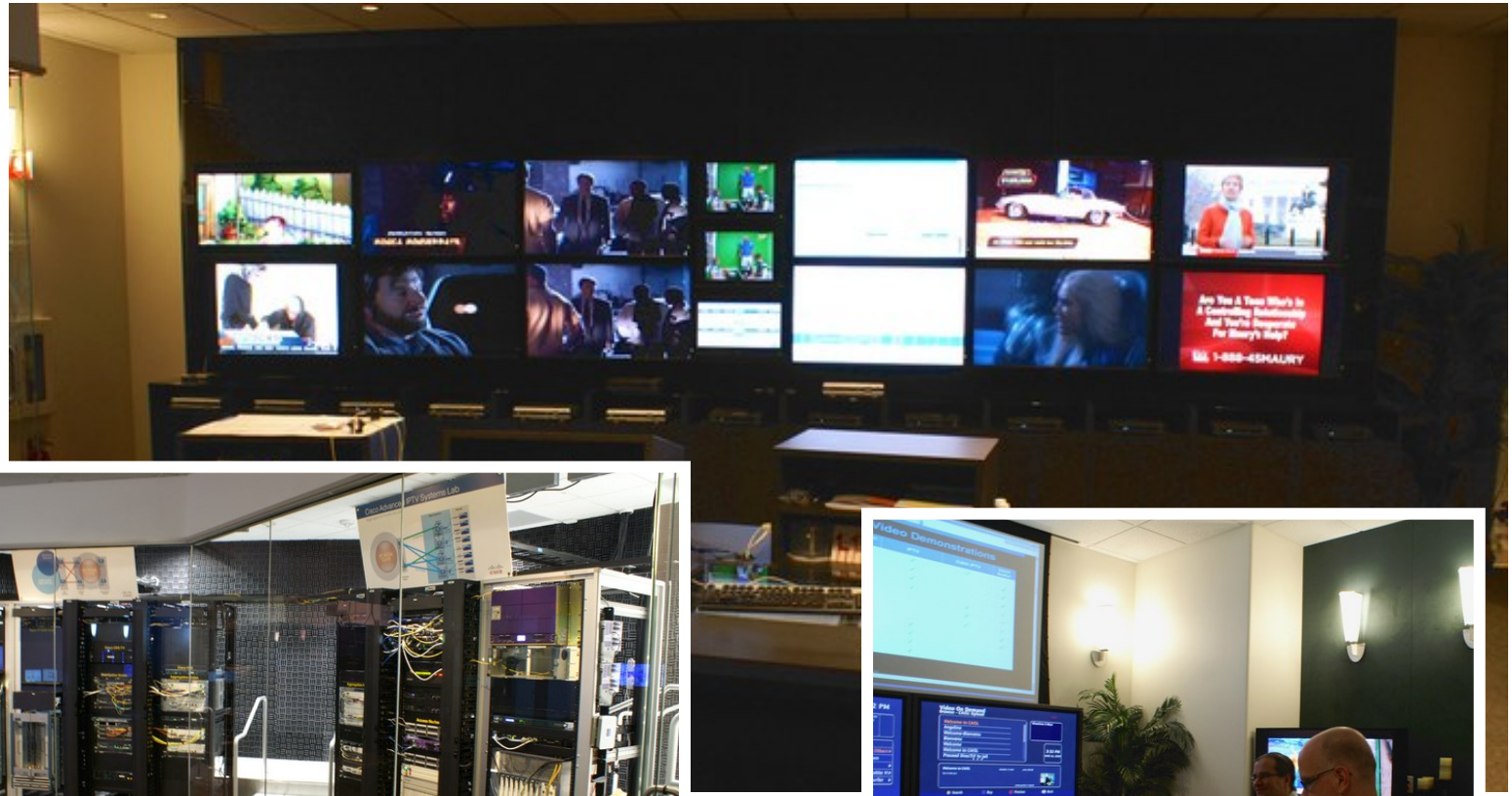
Service Delivery Network:

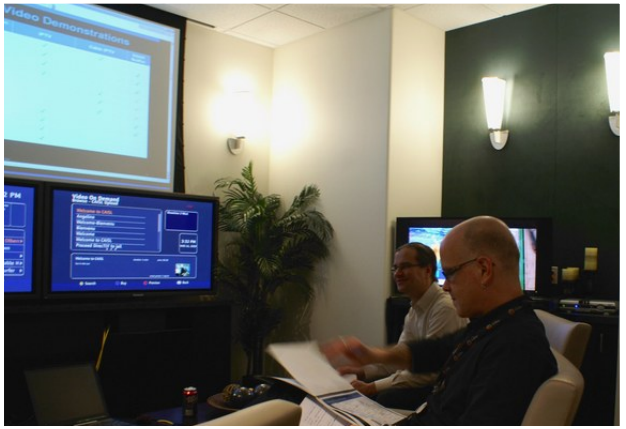
CRS-1
ASR 9010
7609-S
ONS 15454

Data Center:

Nexus 1000V
MDS 9509
DCM 9900
Nexus 7010, 5040

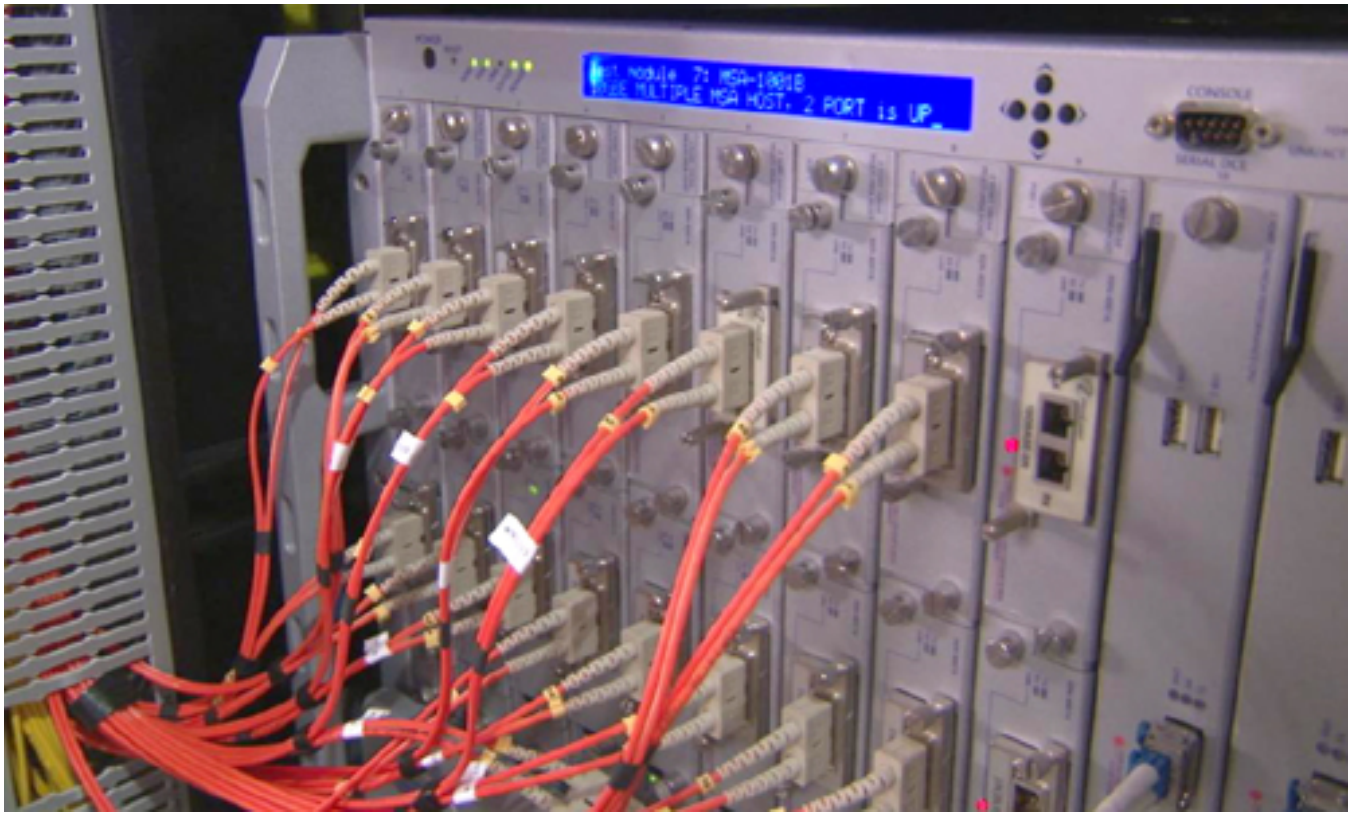
Cisco Demo Lab for Video Applications





"CAISL" Lab, San Jose, CA

Test Equipment: Spirent Communications



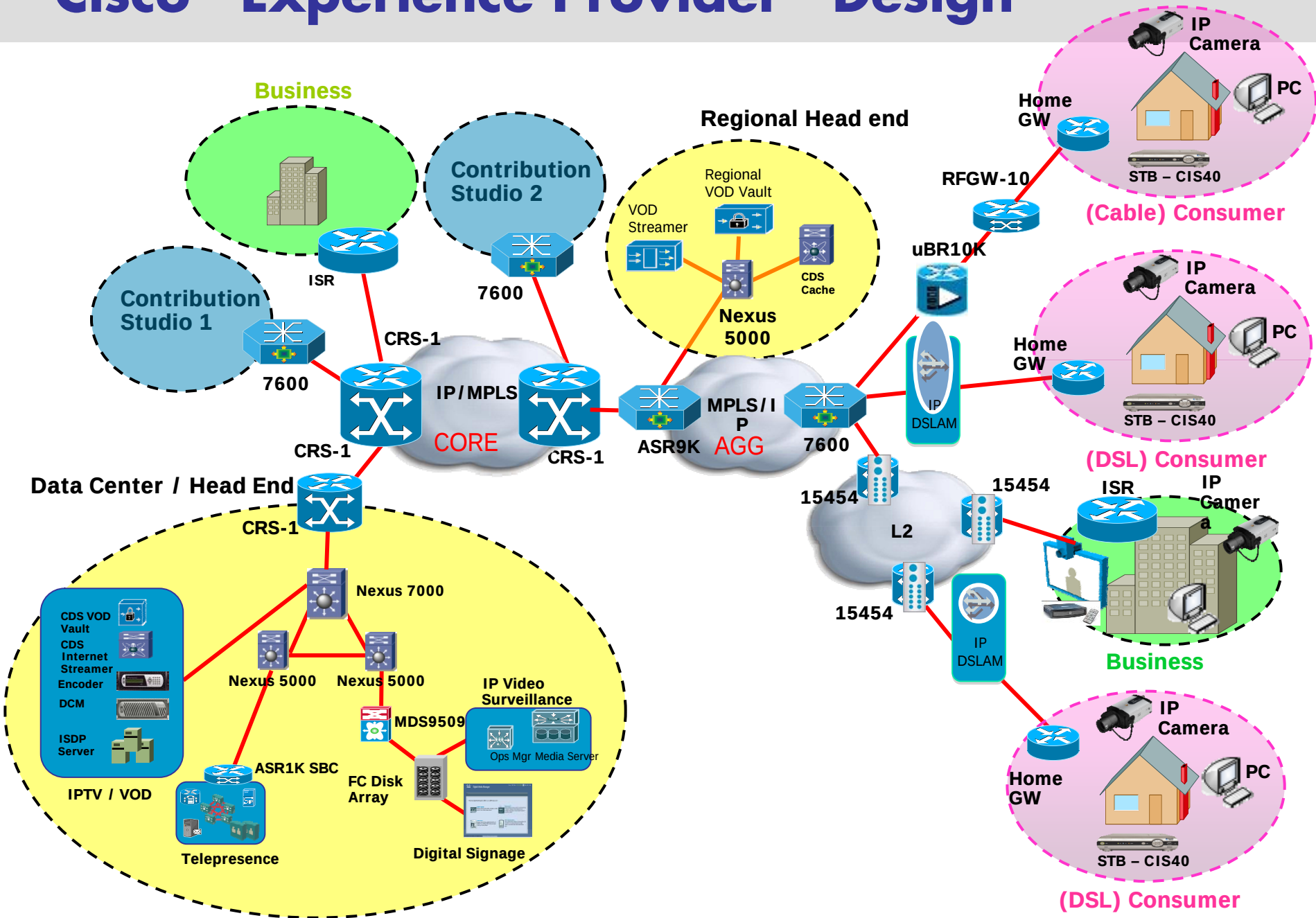
5 TestCenter Chassis

260 x GigE Ports

46 x 10GigE Ports

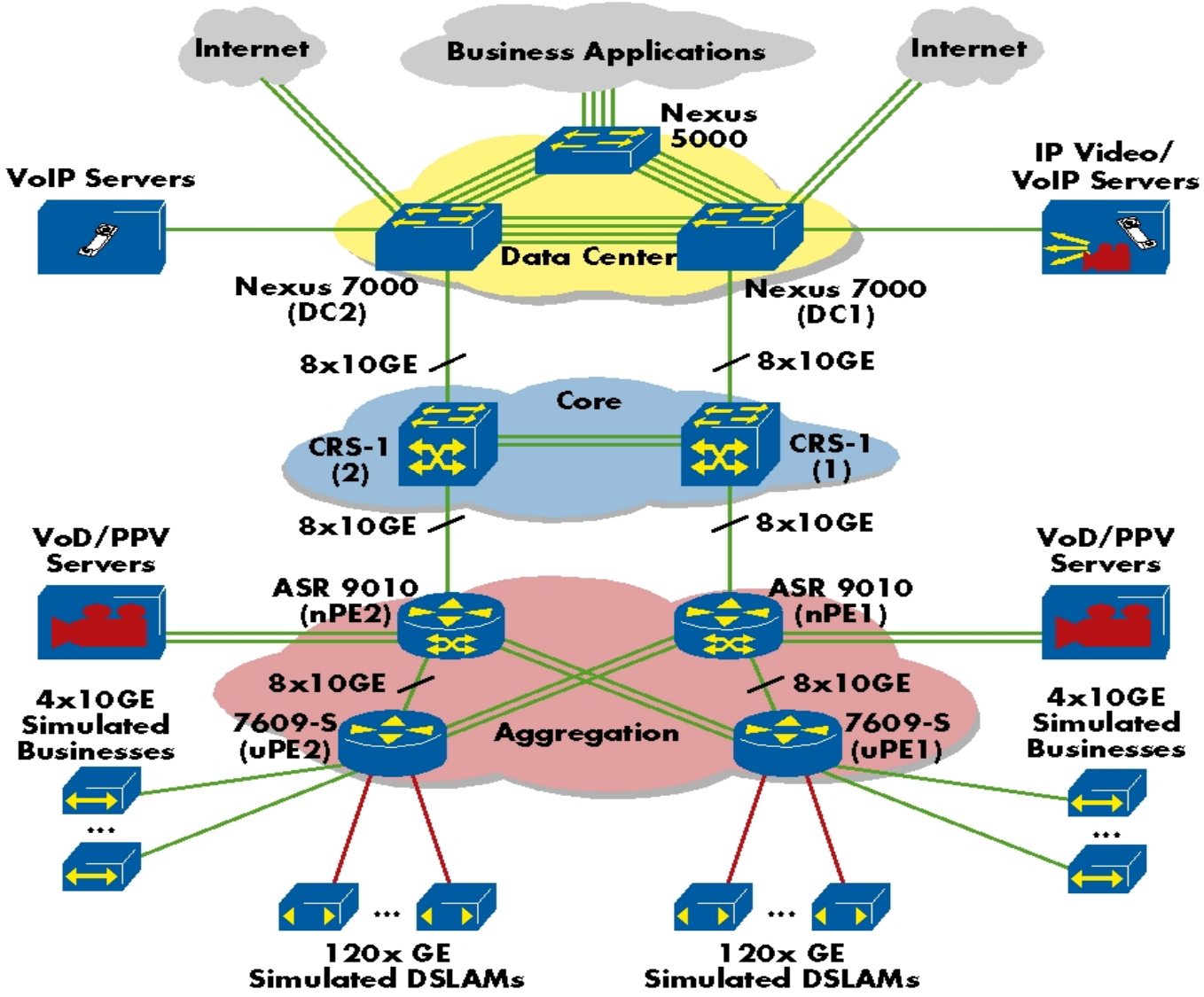
ANUE XGEM Impairment

Cisco "Experience Provider" Design



Agenda: Areas of Testing

Cisco's IP Video Service Delivery Network Design



Scale of Test – The Full Deal

2 M Video Subscribers

World's largest IPTV deployment is ~ 1.85 M subscribers (France Telecom)

340 Gbps Traffic per PoP

BBC iPlayer's peak traffic is less than 100Gbps for whole of UK

20,800 Video Surveillance Streams

Every Starbucks in 49 countries (17,000 stores)
Every nuclear power plant in the world (400 plants, 50 per plant)

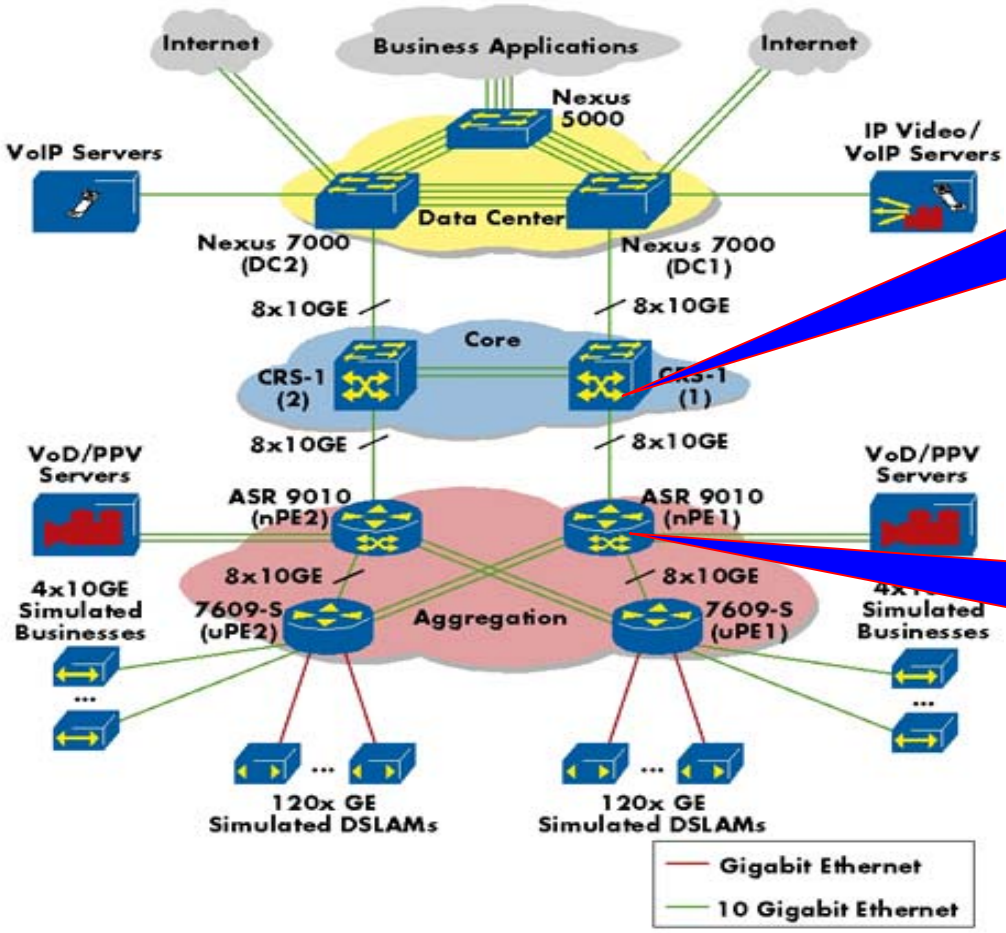
10,400 Digital Signs

1,000 Wal-Mart stores with 10 signs each
Every European airport (450 airports, 20 signs each)

3,120 Telepresence Sessions

100 concurrent sessions in each of 30 DJIA companies
DJIA = Dow Jones Industrial Average

NGN: Route Processor Failover (RP)



3 Failures / Re
CRS-1 RP and DRP

Core Layer

3 Failures / Recoveries Aggregation ASR9010 RSP

Aggregation Layer

NGN: Route Processor Failover Results

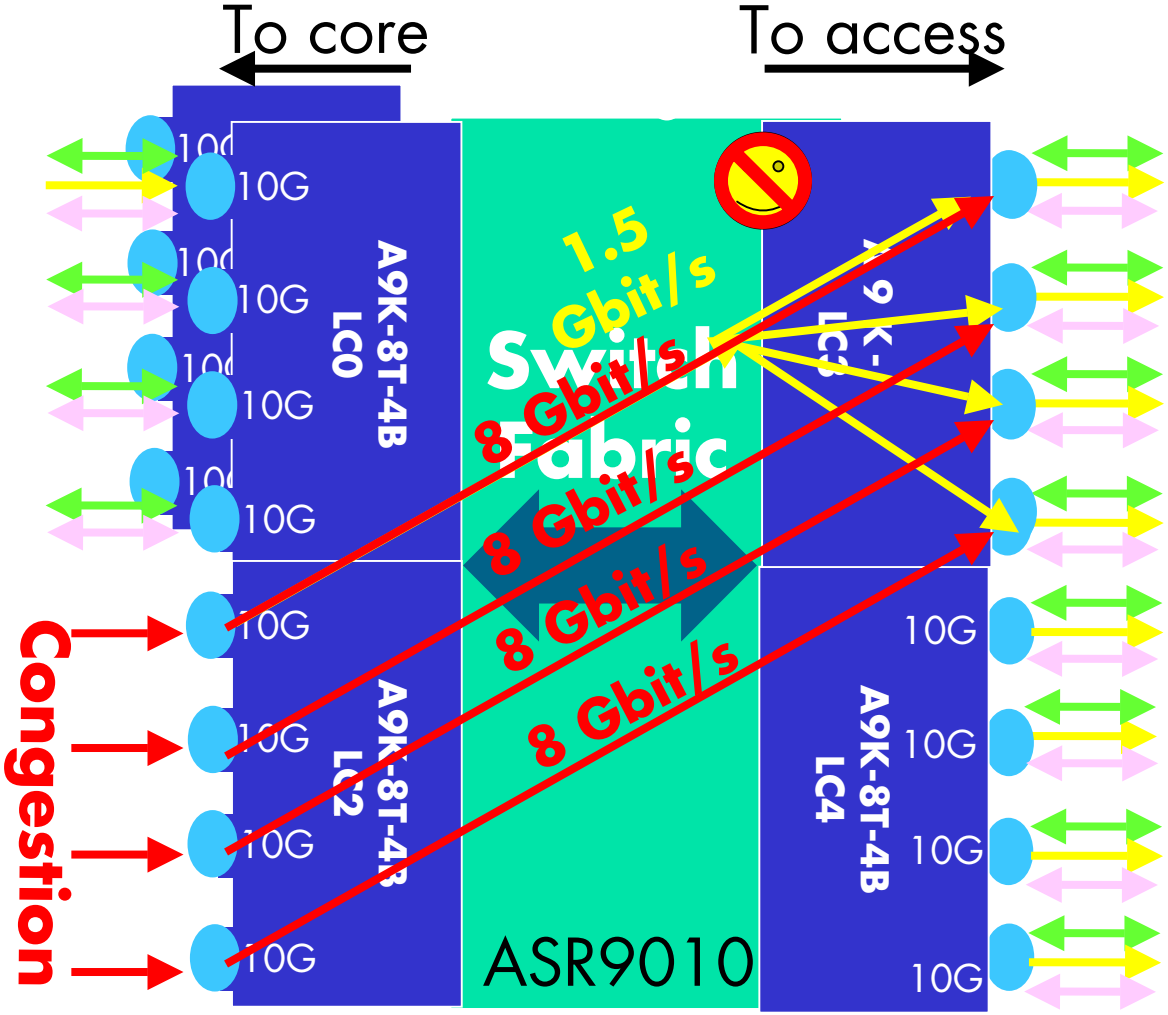
Product	Pull RP Switchover (ms)	Insert RP Recovery (ms)
CRS-1 RP	0	0
CRS-1 DRP	0	0
ASR9010 RSP	0	0

Key Findings

- The ASR 9010, CRS-1 RP and CRS-1 DRP all showed hitless RP failover (zero lost packets in MPLS network)

NGN: Test Setup – ASR 9010 Fabric QoS

- Single Device Stress Test: Fabric Output Queuing



Legend

- **"Hi-Priority Protected"** VoIP 382Mb/s per 10G
- **"Hi-Priority Protected"** IPTV & PPV 660Mb/s per 10G"
- Rest of Baseline 8 Medianet Services

Congestion Setup:

1. Add 8 Gbit/s low-priority unicast traffic per port
2. LC3 port BW = 17.4 Gbit/s
3. LC3 line card BW = 69.6 G
4. Loss of low-priority streams

NGN: ASR 9010 QoS – Fabric QoS Results

Service Type	Frame Loss	Latency (ms)		Jitter (ms)	
		Idle	Congested	Idle	Congested
Multicast (IPTV + PPV)	0	0.037	0.112	0.017	0.045
Unicast VoIP	0	0.012	0.072	0.035	0.067

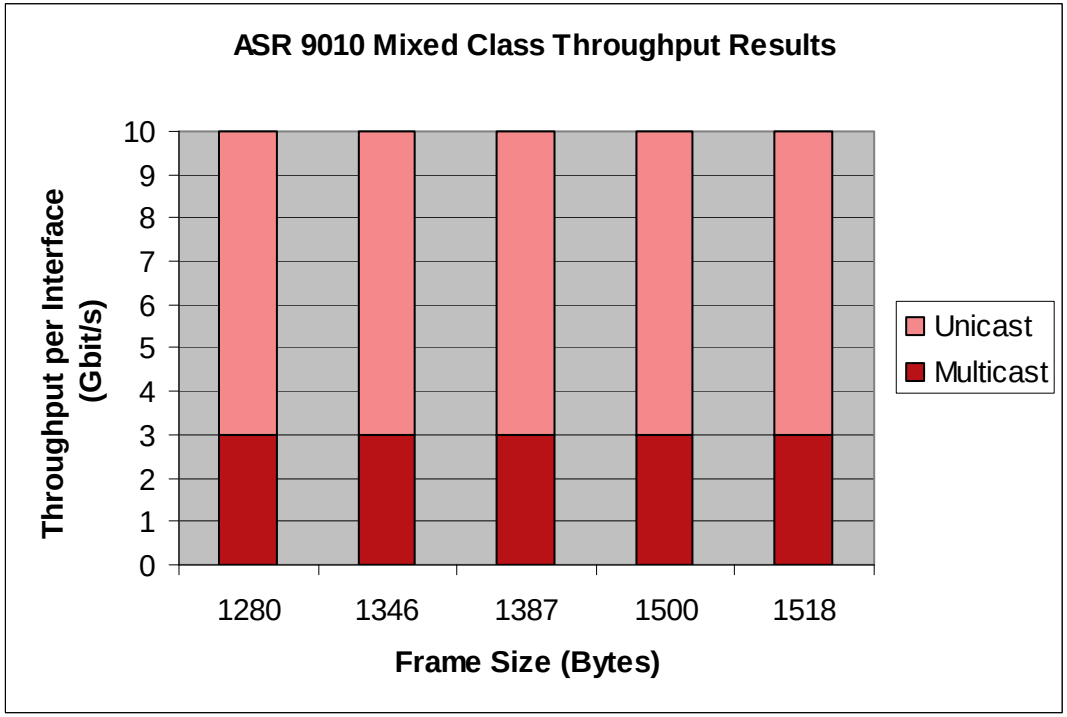
Key Findings

- The ASR 9010's "A9K-8T-4B" card (8 port 10 GbE) maintains proper prioritization on the line card and fabric level for up to 69.6 Gbit/s (40 Gbit/s non-blocking) egress traffic

NGN: ASR 9010 Mixed Class Throughput

Single component

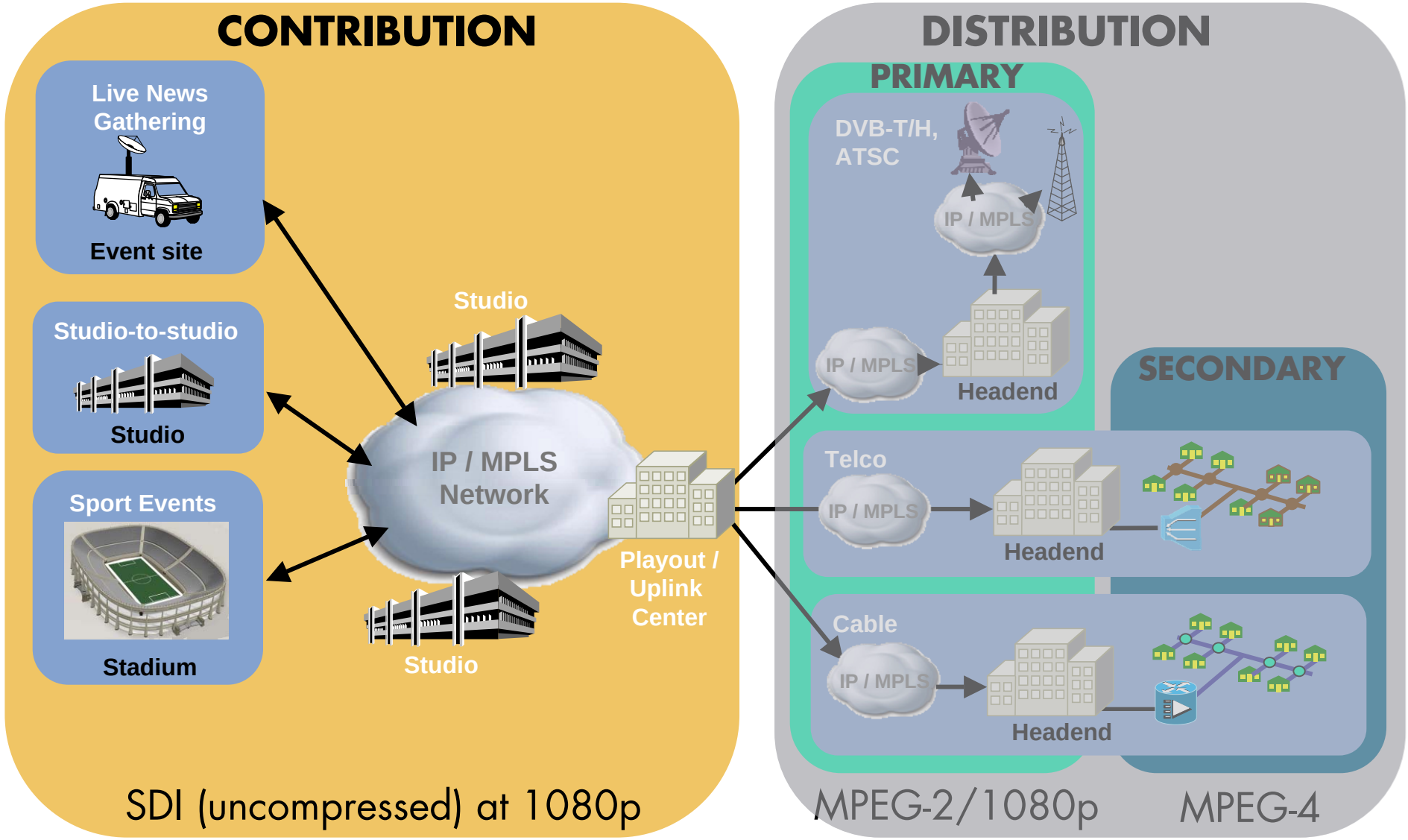
- Procedure based
- Realistic frame
- Unicast to



Key Findings

- The ASR 9010 delivered 160 Gbit/s of multicast and unicast traffic per slot (80 Gbit/s in each direction)

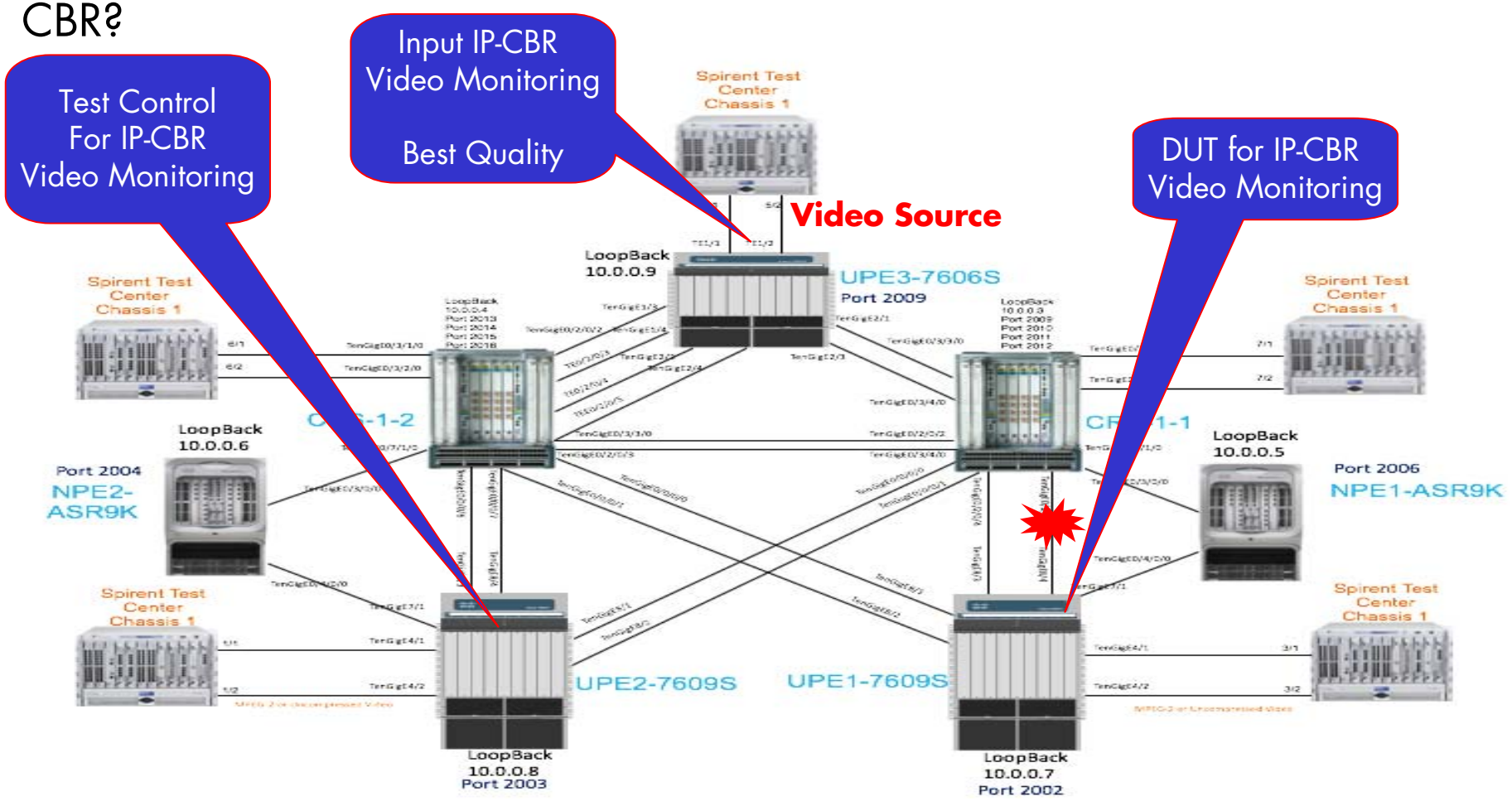
Video Contribution Network Tests



IP-CBR Video Monitoring Test

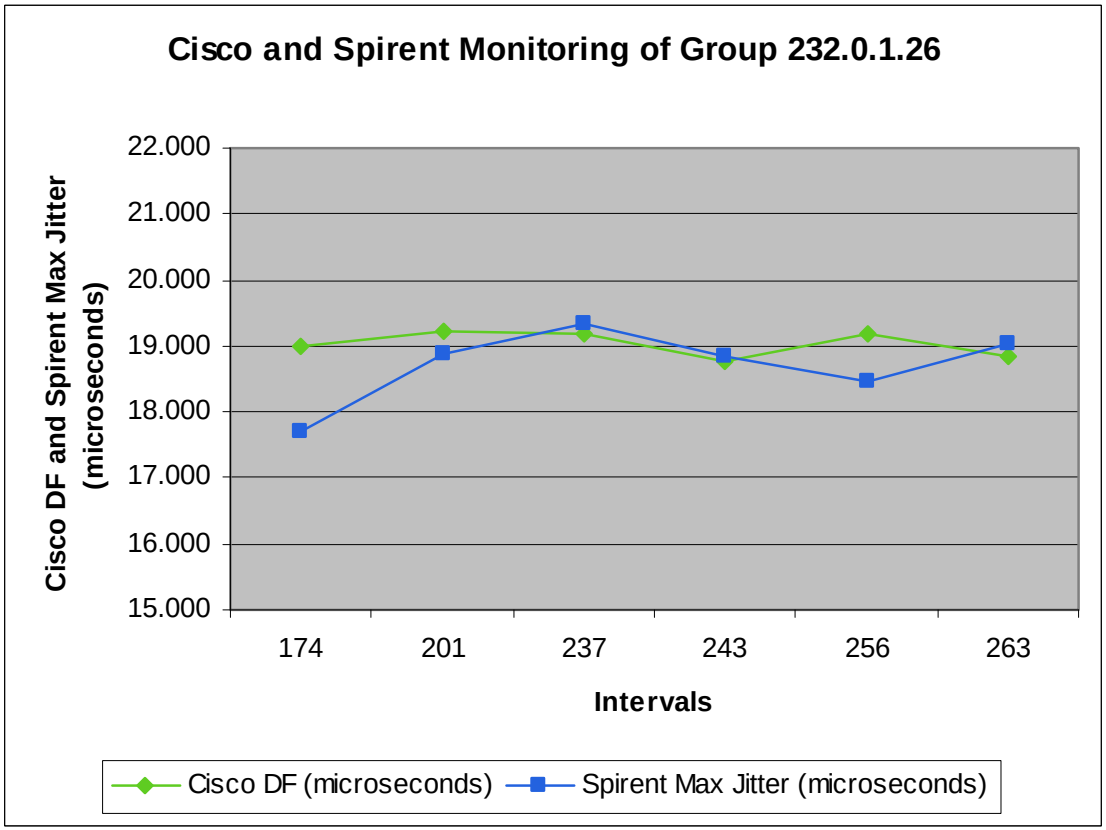
Delay Factor (DF) – How much time to drain the buffer?

Media Rate Variation (MRV) – How much do we vary from the configured CBR?



Delay Factor Comparison Cisco and Spirent

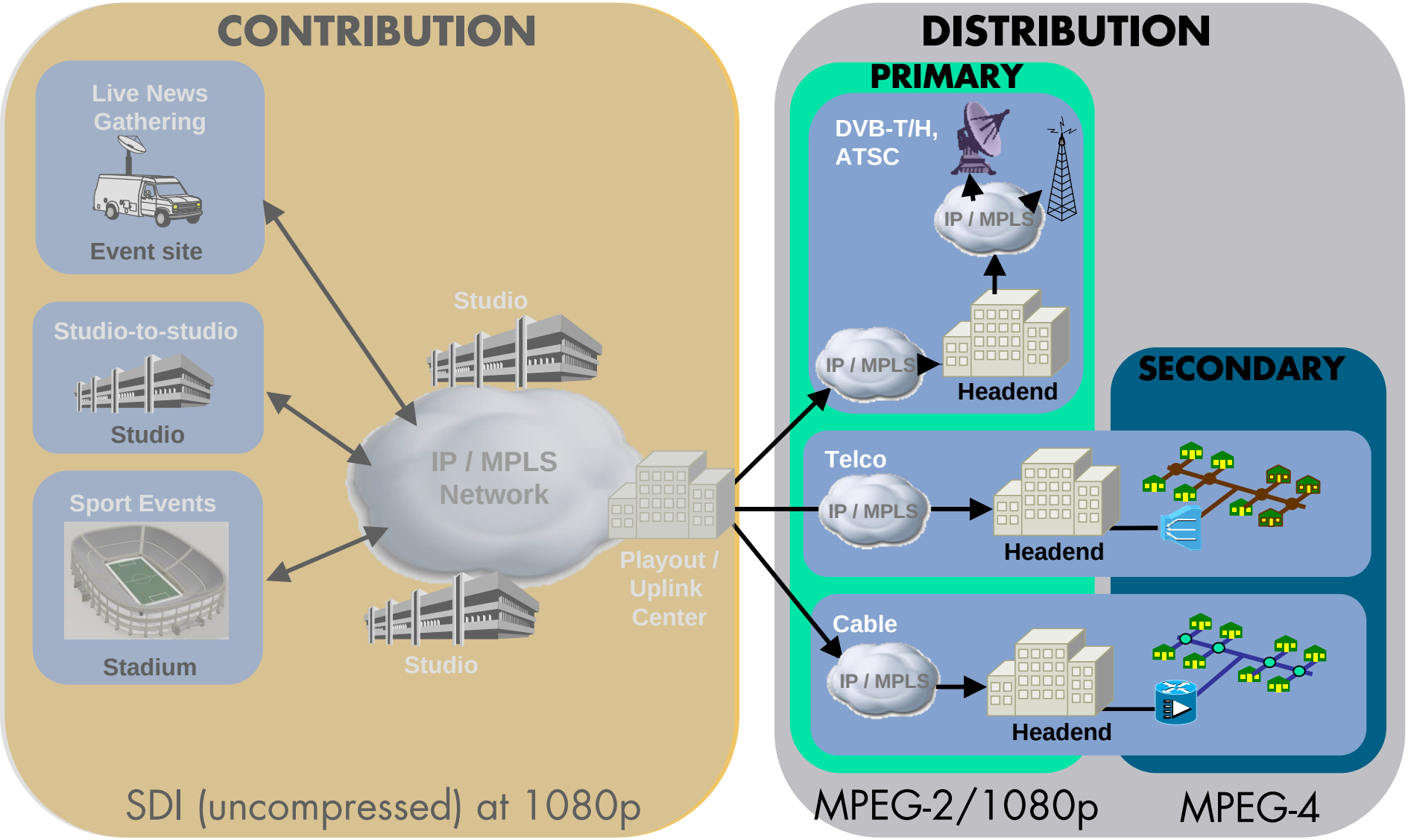
- Spirent XGEM induced periodically (Gaussian) distributed delay from 75 to 125 ms



Key Findings

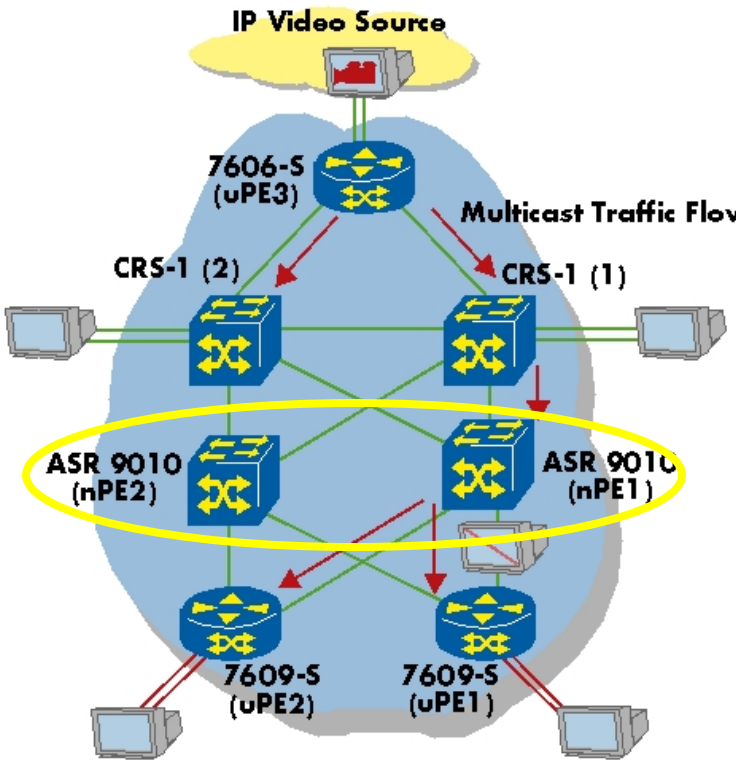
- Cisco 7609-S router accurately detects and reports impaired uncompressed video streams using Cisco IP-CBR
- Performance tested up to 40 Gbit/s per slot

Video Distribution Network Tests

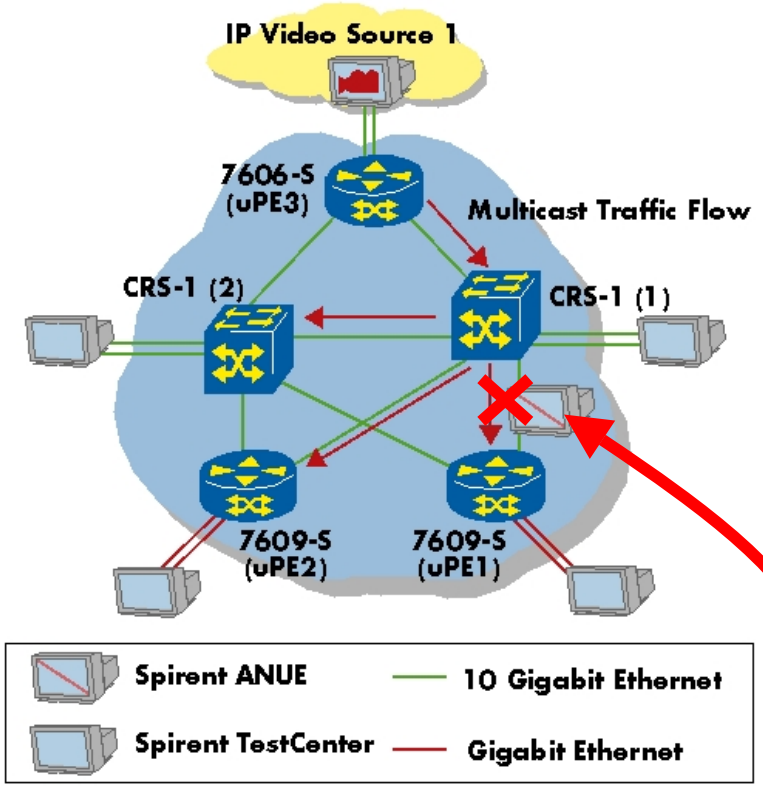


Cisco's Video Distribution Topologies

PIM-SSM



Point-to-Multipoint
RSVP-TE



- Cisco offered two solution designs – IP and MPLS based multicast

MPLS Fast Reroute used for Link Failure tests

Video Quality Monitoring (VidMon)

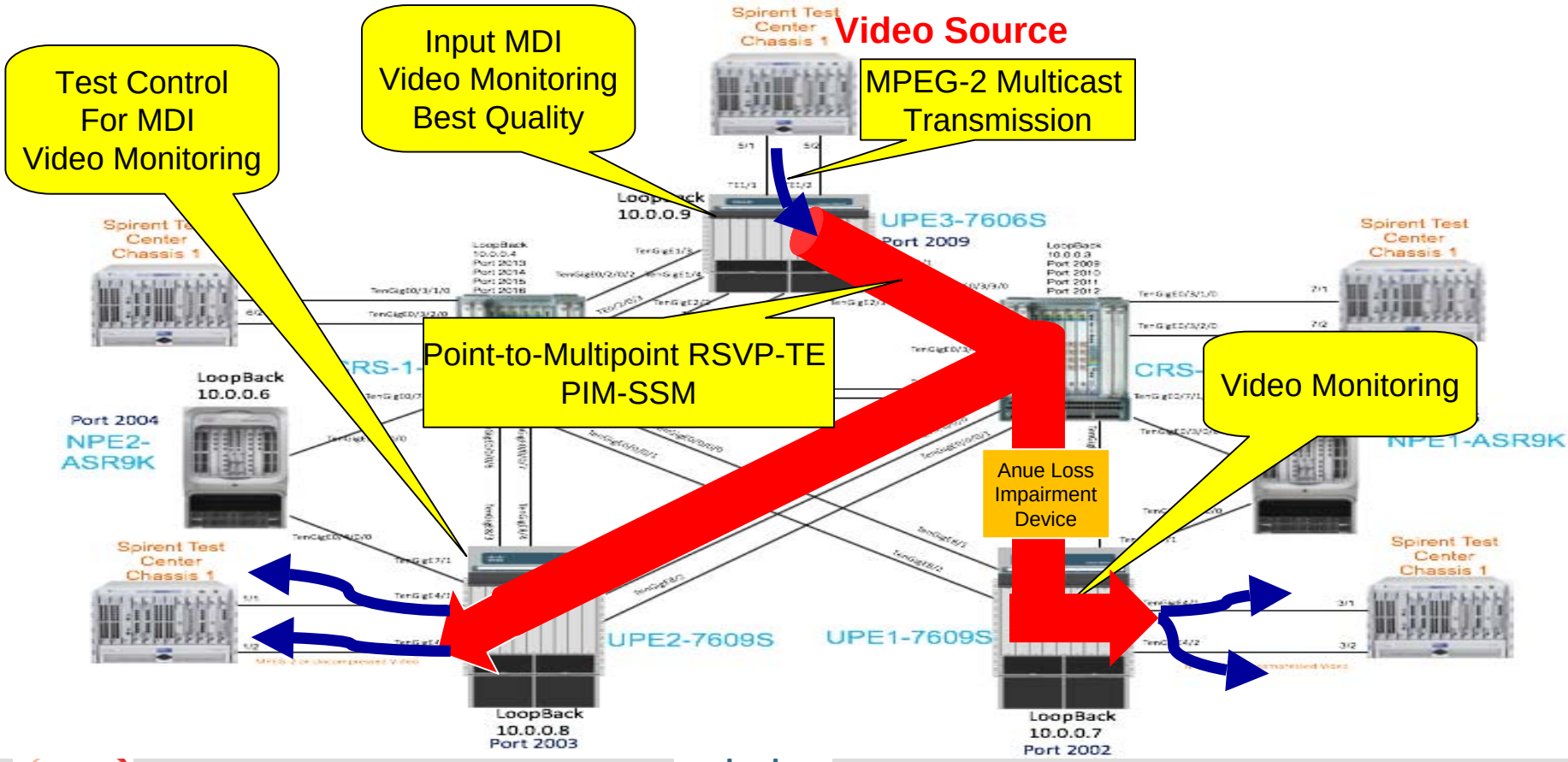
Cisco 7609-S with ES+40 cards tested for MPEG-2 video quality monitoring

Based on Media Delivery Index (MDI, RFC 4445) - Media Loss Ratio (MLR)

- Cisco reporting compared to Spirent TestCenter's Continuity Error (ETSI standard TR 101 209)

Video Quality Monitoring Test Setup

First look at Cisco 7600 upcoming software with HW-based inline *VidMon:* Monitor MPEG-2 stream quality at egress 7600 ES+ cards



VidMon Test Results

PIM-SSM Topology	Groups 1-25			Groups 26-50		
	Total uPE1 Card 3 MLR Values	Total Spirent Continuity Errors	Difference	Total uPE1 Card 2 MLR Values	Total Spirent Continuity Errors	Difference
Run1	1139	1141	2	1181	1183	2
Run2	972	973	1	935	924	11
Run3	1279	1279	0	1273	1274	1

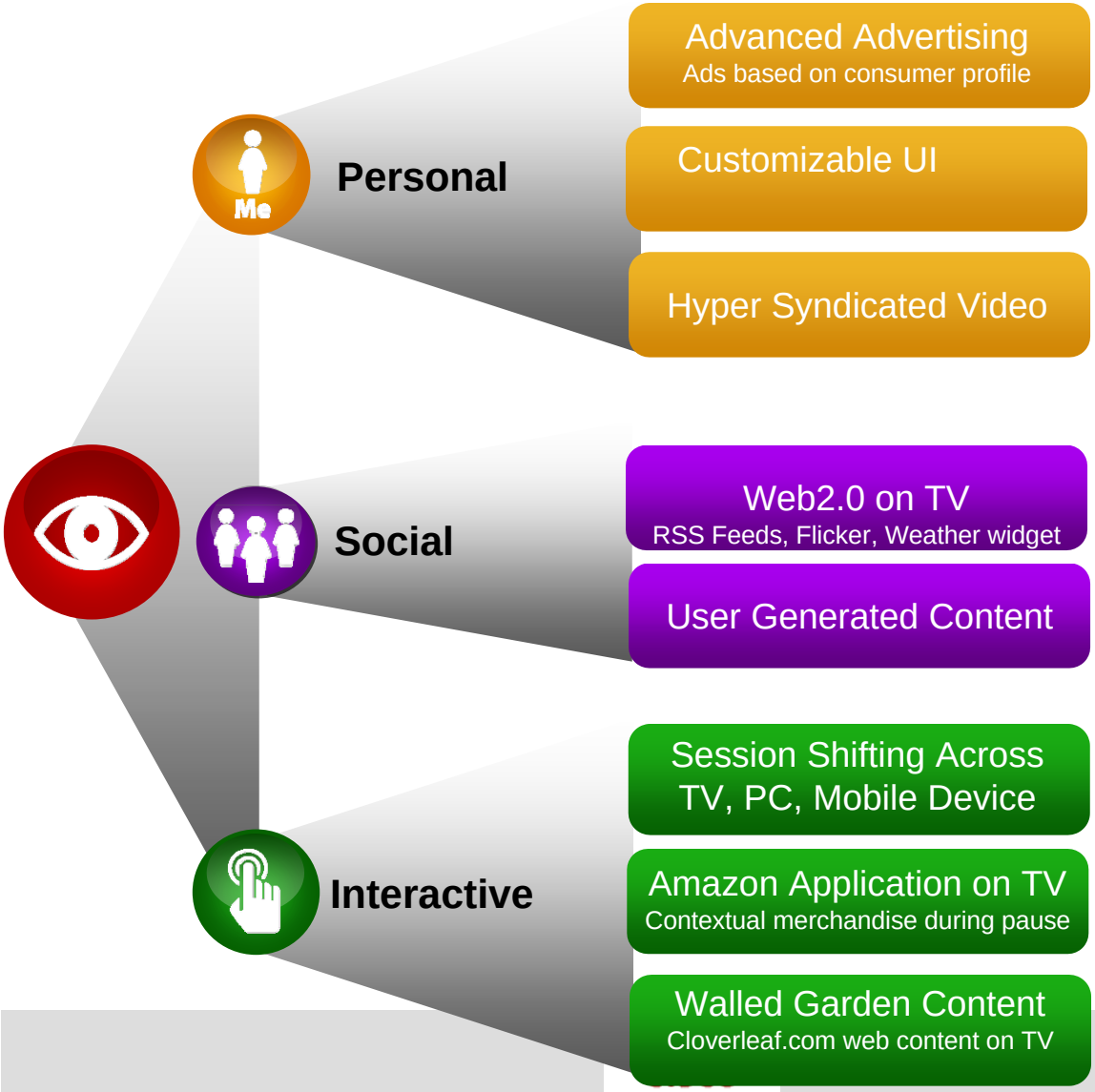
Point to multipoint RSVP-TE	Groups 1-25			Groups 26-50		
	Total uPE1 Card 3 MLR Values	Total Spirent Continuity Errors	Difference	Total uPE1 Card 2 MLR Values	Total Spirent Continuity Errors	Difference
Run1	947	948	1	931	931	0
Run2	1083	1096	13	1085	1082	3
Run3	1286	1284	2	1331	1329	2

Key Findings

- Cisco's 7600 routers accurately reported on MPEG-2 MLR on both PIM-SSM and P2MP RSVP-TE topologies

Agenda

IP Video Applications Demonstrated



Amazon Application on TV

- Idea: Associate shopping opportunities with video content on TV
- Transaction-based monetization opportunity
- (Hopefully) shop owners will share profit with service provider
- Cisco example: Amazon shopping application on TV

Amazon Application on TV

TV Program / Video on Demand movie paused by subscriber.
Set-top box generates note about related shopping opportunities:

Subscriber consents to search

Selects a shopping option and completes purchase

Session Shifting

Cisco IP Set-top Box IPN430 MC

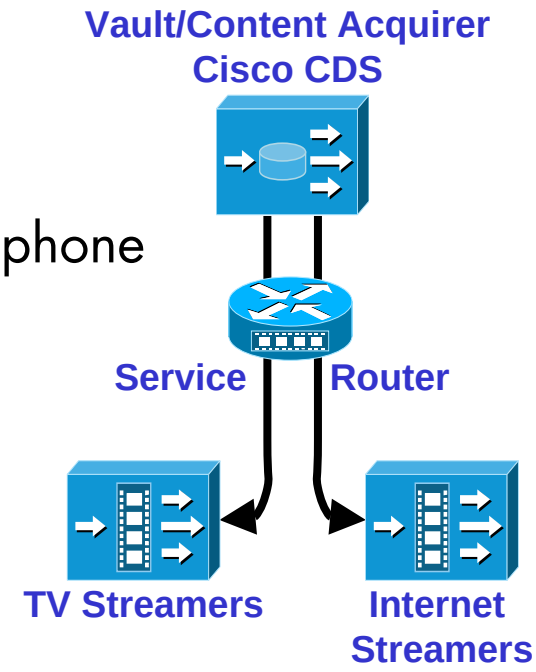
PC

Nokia E61i

- Start watching a film on TV, pause
- Resume watching the same content on a PC where you left off
- … and then do the same on a mobile phone

Benefits:

- Enables continuous media experience across devices
- Creates synergies for SPs across service offerings



Hypersyndicated Video

User Generated Content (UGC)

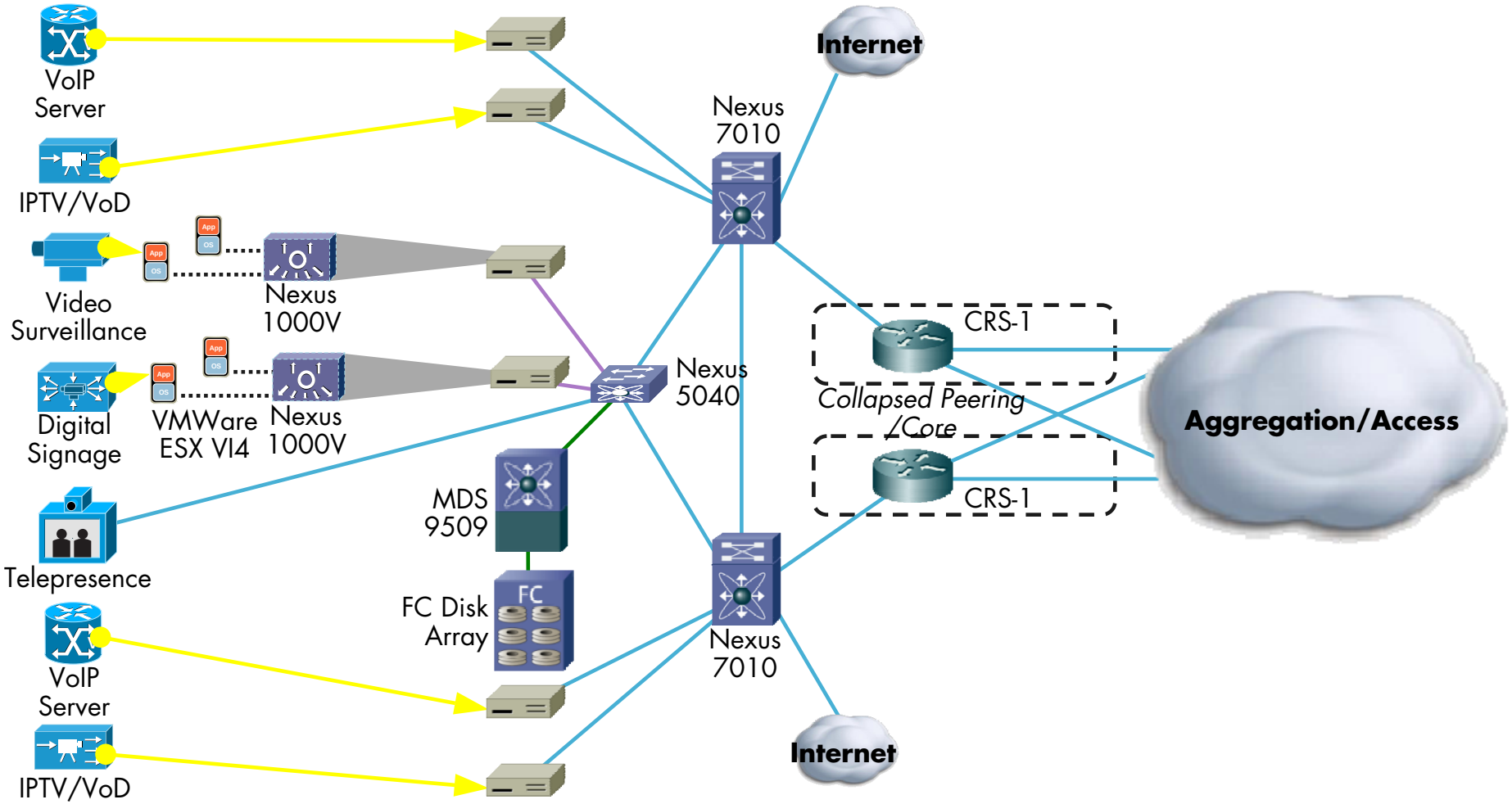
Over-the-top (OTT)

hulu

YouTube
Broadcast Yourself

Agenda

The Data Center In Detail



Data Center Results Summary

Unified Fabric

Nexus 5040 properly forwards FCoE/Eth traffic mix from a single port

Video apps run fine; zero frames lost from line rate traffic between two ports

In Service Software Upgrade

Providers can make major and minor Nexus 7010 code upgrades without taking it out of service

0 frames lost (full traffic profile with VDC)

Virtual Machine Relocation

Nexus 1000V relocates virtual machine with new physical Ethernet port without operator reconfiguration

Data Center Resiliency

Using full medianet traffic profile, Nexus 5000/7000 recover from link failure in under one second using Virtual Device Contexts (VDC)

Conclusions - Results

What can we take away?

- Cisco is working to bring new ways for providers to create revenue streams through new products
- Cisco is serious about the virtualized data center
- Cisco's IP Video Service Delivery Network infrastructure can support the needs of
  - Video Contribution and Distribution networks
  - Providers offering the full catalog of residential and business services

Thank you for your interest!

For further information, please contact us:

EANTC AG
Carsten Rossenhövel
Einsteinufer 17
D-10587 Berlin /Germany

Phone: +49.30.318 05 95-0
Mobile: +49.177.2505721
Fax: +49.30.318 05 95-10
E-mail: cross@eantc.de
www.eantc.de