Case for IP NGN

Network Content Positioning & Video Monitoring

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Agenda

- IP NGN – Cisco story?
- Network Positioning
- Video Monitoring
- Q&A

IP NGN

Service Provider Business Challenges

Value Shifting from Simple Access to Service Enablement

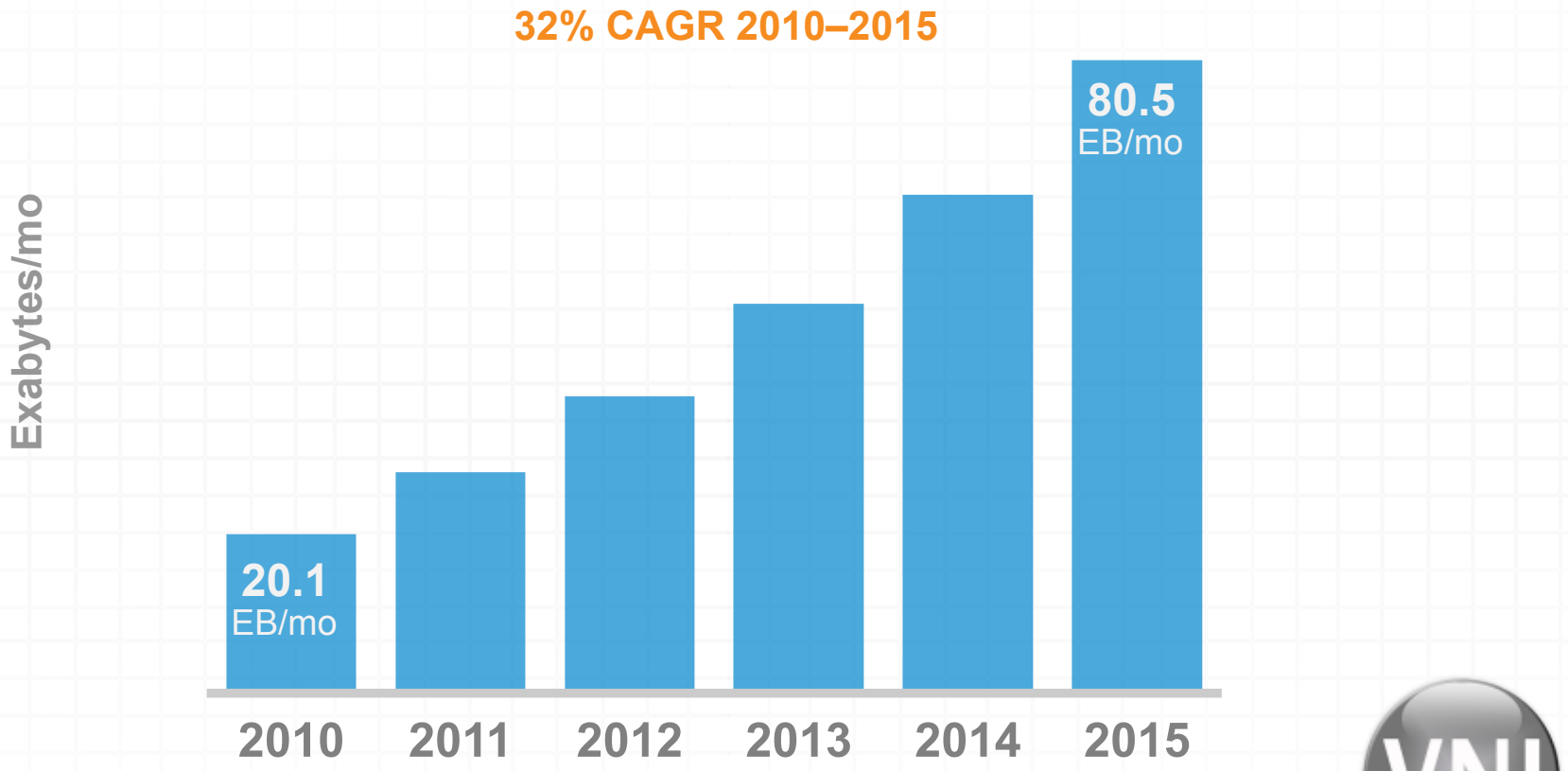
Innovate in Rapidly Changing Environment

Monetize Infrastructure Investments

Optimize Costs

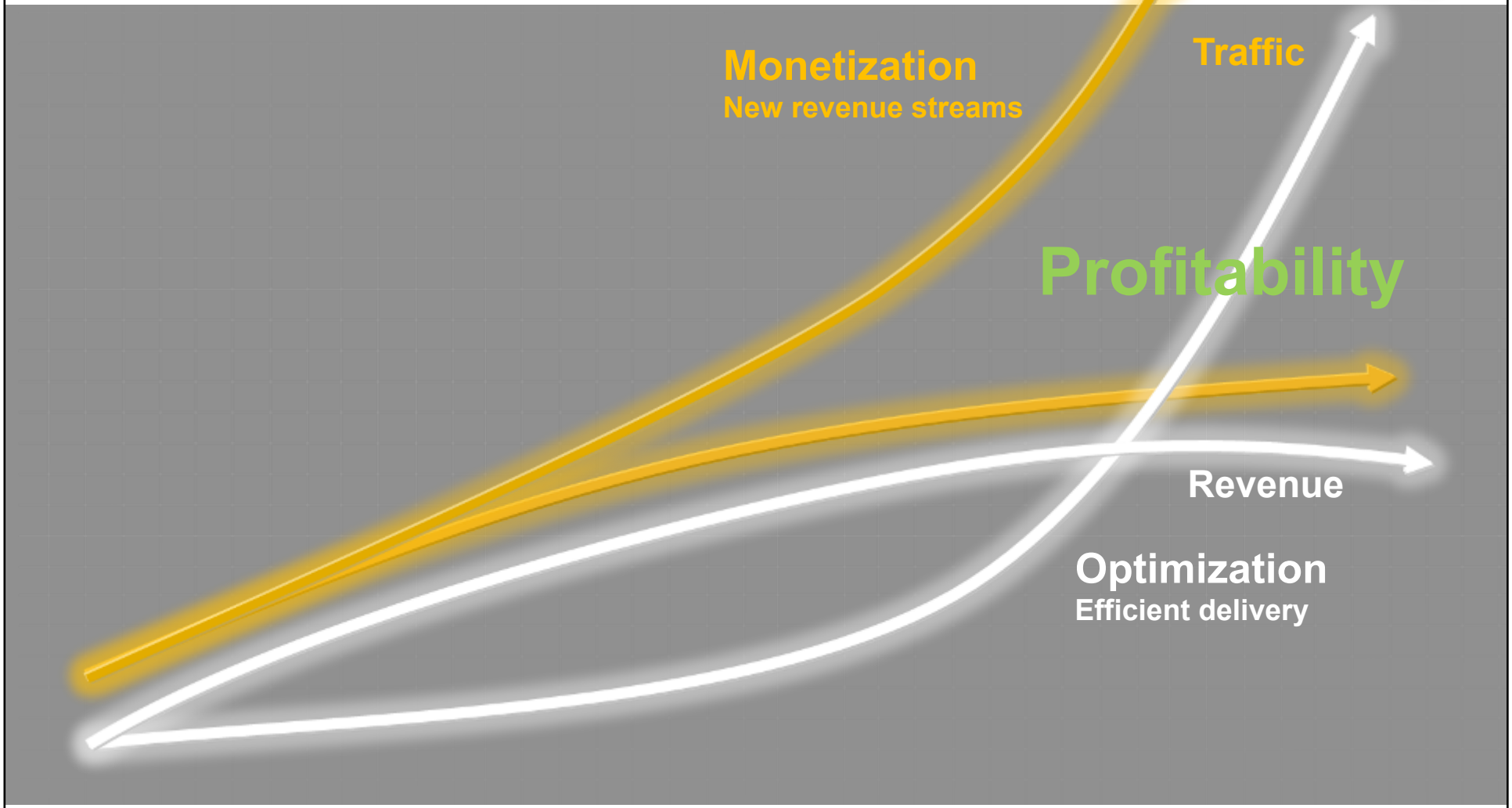
Reduce Operational Complexity

Global IP Traffic Growth

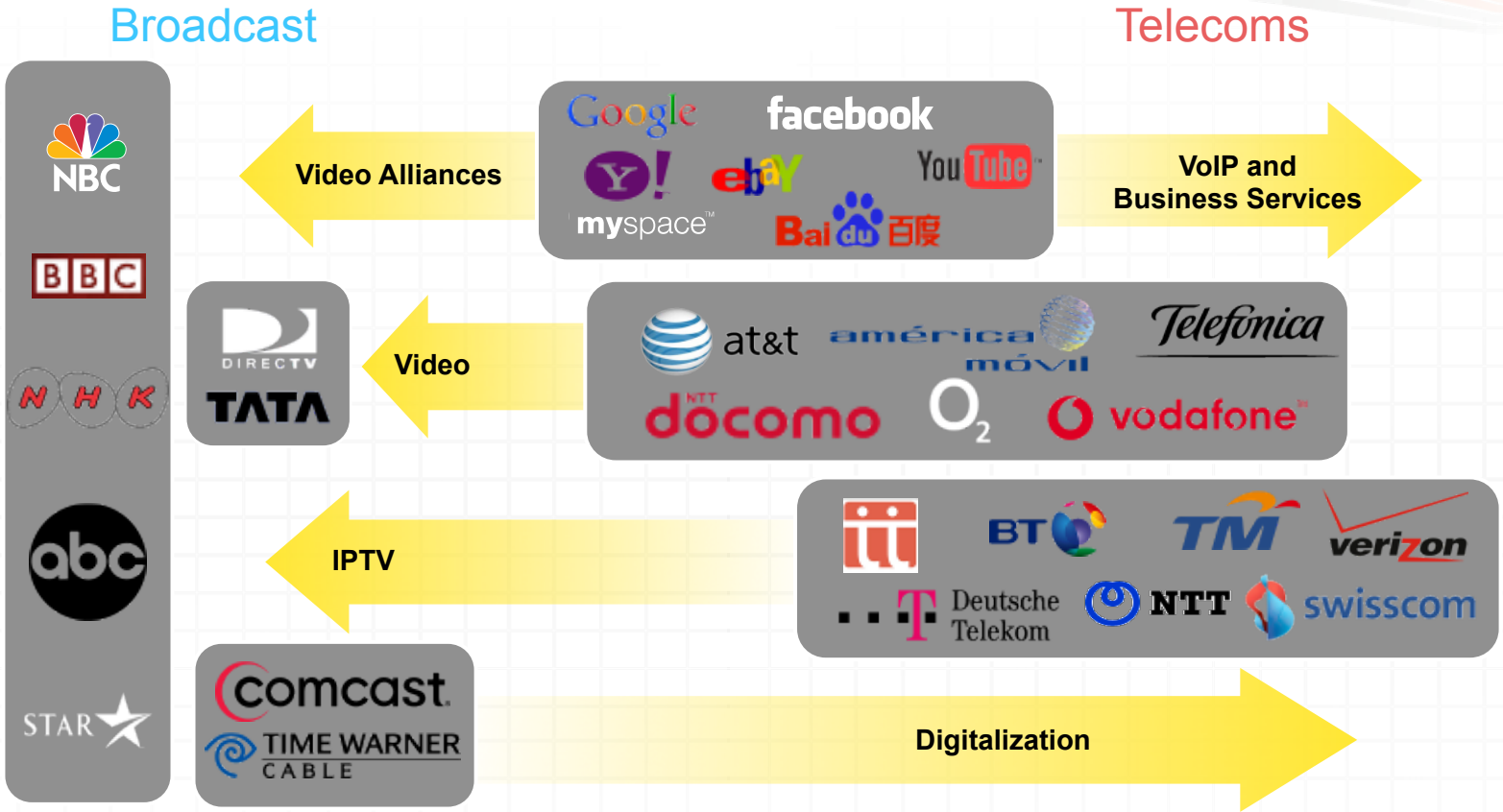


Source: Cisco Visual Networking Index (VNI) Global Forecast, 2010–2015

Challenge of Shifting Environment



Service Provider Industry Trends



Providers are no longer defined by the access they provide, but by the experiences they provide

Cisco Service Provider Strategy

Focus on Key Market Transitions

Video/ Connected Life

Mobile Internet

Managed and Cloud Services

IP NGN Architecture

Video Everywhere

Mobility & Connected Life

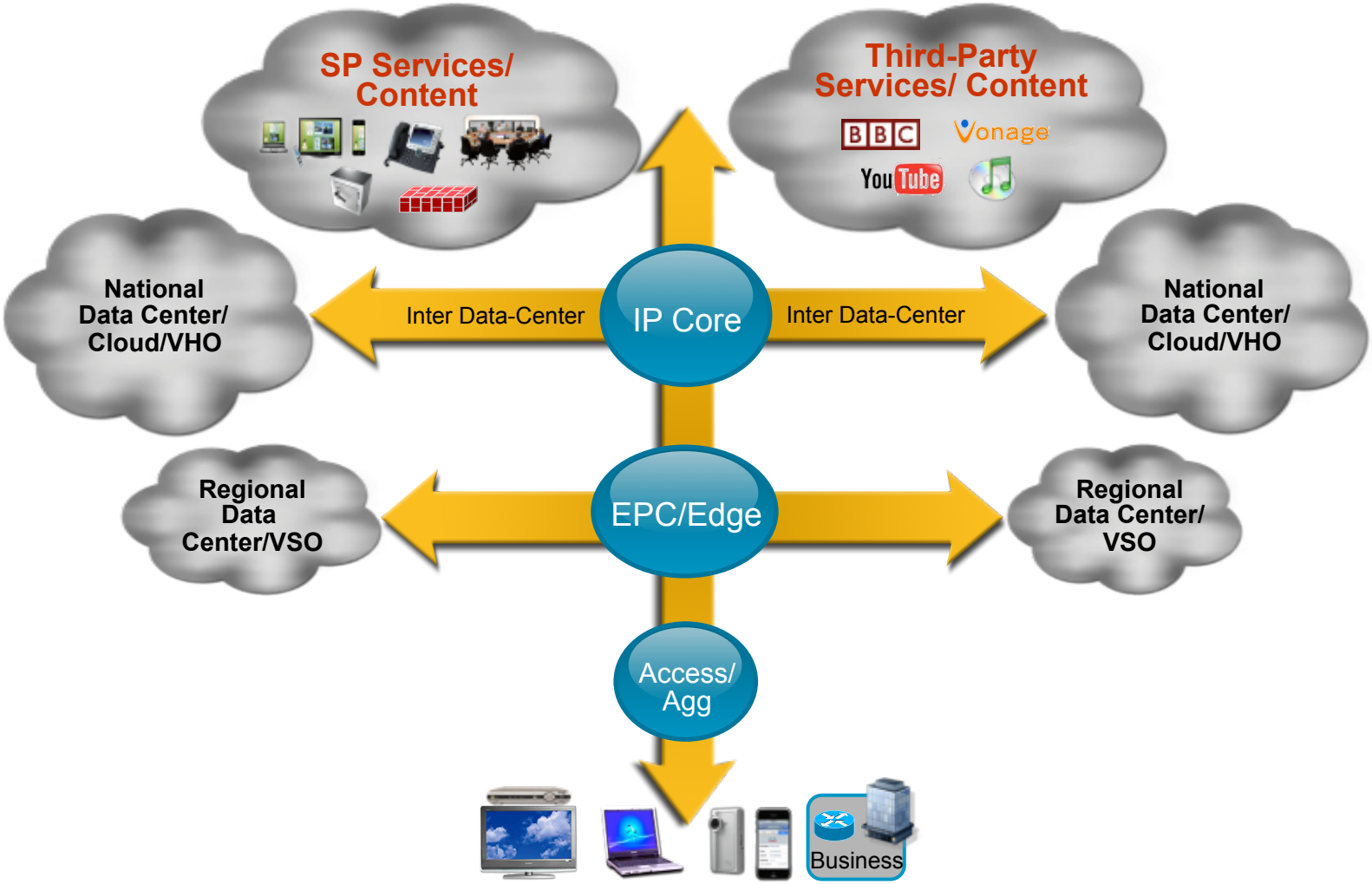
Infrastructure as a Service (IaaS)

TelePresence and Managed Services

Hosted Software Services

Multidirectional Network Architecture

Linking the Next-Gen Network, Mobility, Video, and Cloud



Network Positioning System

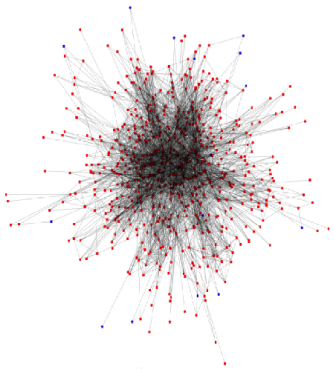
Benefits of coupling peers

Why it makes sense?

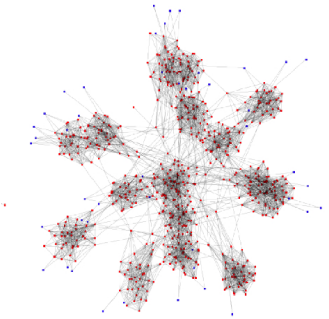
- When the overlay topology is network aware, it is highly correlated with the underlying network topology; the nodes within an AS form a dense cluster, with only a few connections going to nodes in other AS*
- Comcast's experience**:

  "... reduced outgoing Internet traffic by an average of 34% at peering points."

  "... reduced incoming Internet traffic by an average of 80% at peering points."



Network Unaware



Network Aware (Overlay-underlay Topology Correlation)

- * Aggarwal, V., Feldmann, A., and C. Scheideler, "Can ISPs and P2P systems co-operate for improved performance?", ACM SIGCOMM Computer Communications Review (CCR), 37:3, pp. 29-40.
- ** C. Griffiths, J. Livingood, L. Popkin, R. Woundy, Y. Yang, "Comcast's ISP Experiences in a Proactive Network Provider Participation for P2P (P4P) Technical Trial", RFC 5632, September 2009

Enabling technology: ALTO

Where does Cisco NPS fit?

- ALTO (being defined in the IETF)

  Application Layer Traffic Optimization (ALTO) defines an interface through which an application can request guidance from the network, e.g. which can be used for service location or placement

  - No need to know atomic topology details
  - Need to preserve confidentiality between layers

  ALTO does not define the mechanisms used for deriving network topology/infrastructure information or preference

- NPS

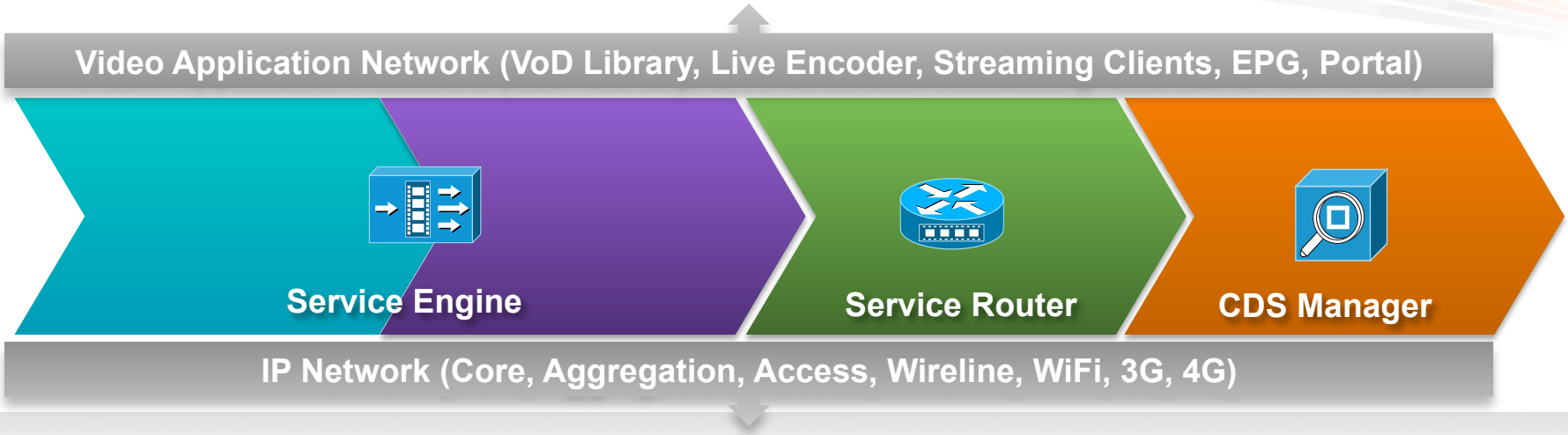
  Network positioning system (NPS) is a specific implementation of mechanisms and algorithms leveraging routing and IP/MPLS infrastructure layer database (such as ALTO), performance, and policy information

Demand engineering

Own your network

- ALTO / NPS enable network aware demand engineering
  - Overall goal is to improve application Quality of Experience while optimising resource consumption in the underlying network infrastructure
- Ensures that SLA requirements for these services can be met
  - Network cost
  - Network performance {delay, jitter, loss, availability}
  - Network capacity {admission control}
  - Geo-location derived from network location
  - Network policy
- Maximises the demands that can be serviced by placing demands where there are available network resources
  - Goal: minimise situations of maximum utilisation
  - Enables optimisation beyond what can be achieved with traffic engineering alone

CDS Functional Components



Content Streamer

- VoD Streaming
- Live Streaming
- Concurrent Multi-Protocol
- Stream HTTP, RTSP, RTMP
- HTTP Download & PDL
- High Performance
- Detailed Reporting

Content Acquirer

- Ingest to Hierarchical CDN
- VoD Library Ingest
- Live Streams Ingest
- VoD Prepositioning
- Vod Dynamic Cache-Fill
- Live Dynamic Stream Split
- HTTP, FTP, NFS, CIFS, RTSP

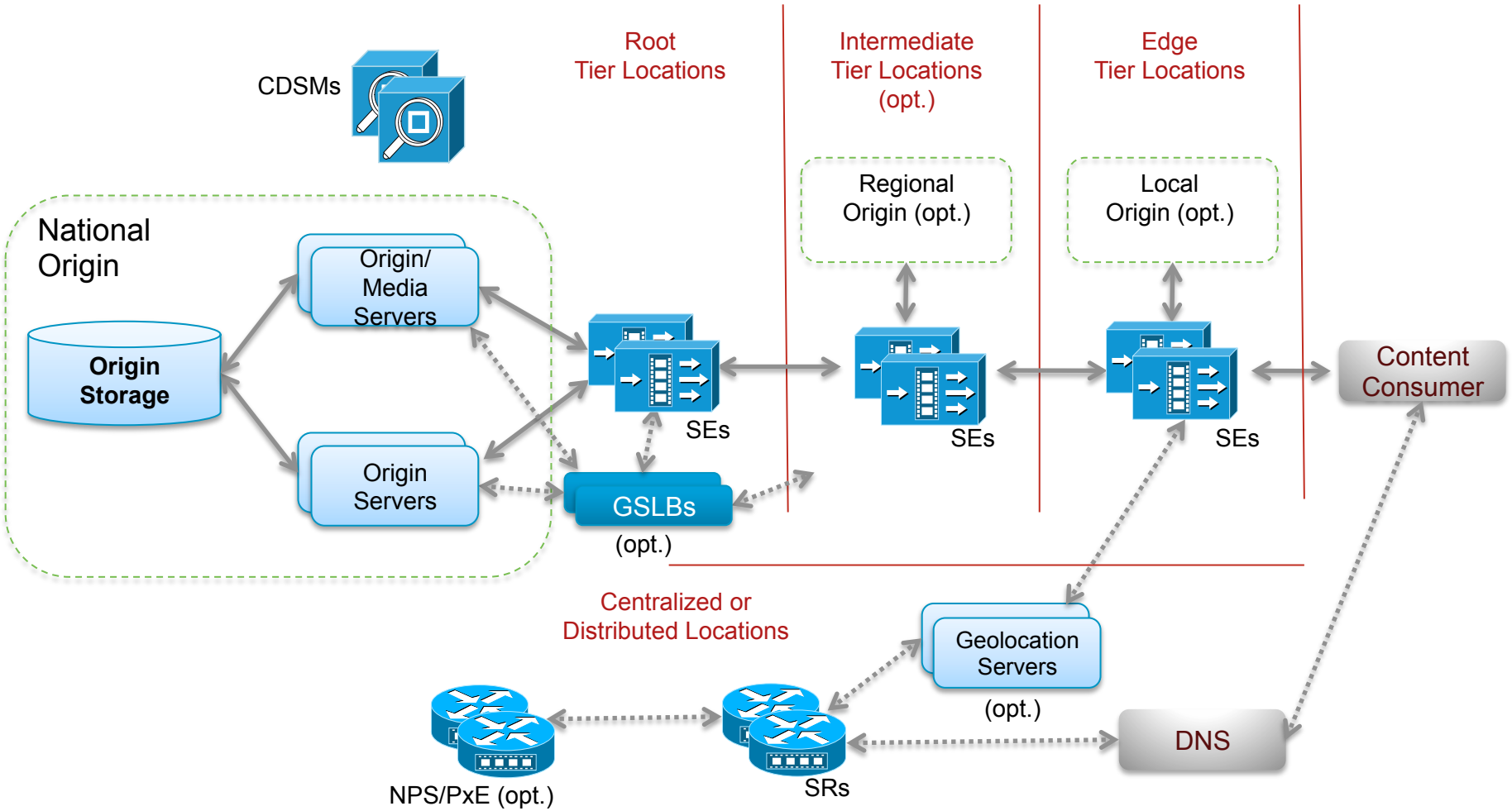
Service Router

- Content Request Routing
- Global Load Balancing
- HTTP, RTMP, RTSP, DNS
- Content and Load Aware
- Subscriber & Network Aware
- Integrates with BGP, OSPF, ISIS

CDS Manager

- Centralized Element Mgmt
- WebGUI and HTTP API's
- VoD Delivery Service Mgt
- Live Delivery Service Mgt
- System Monitoring
- Capacity Monitoring
- AAA Server Integration

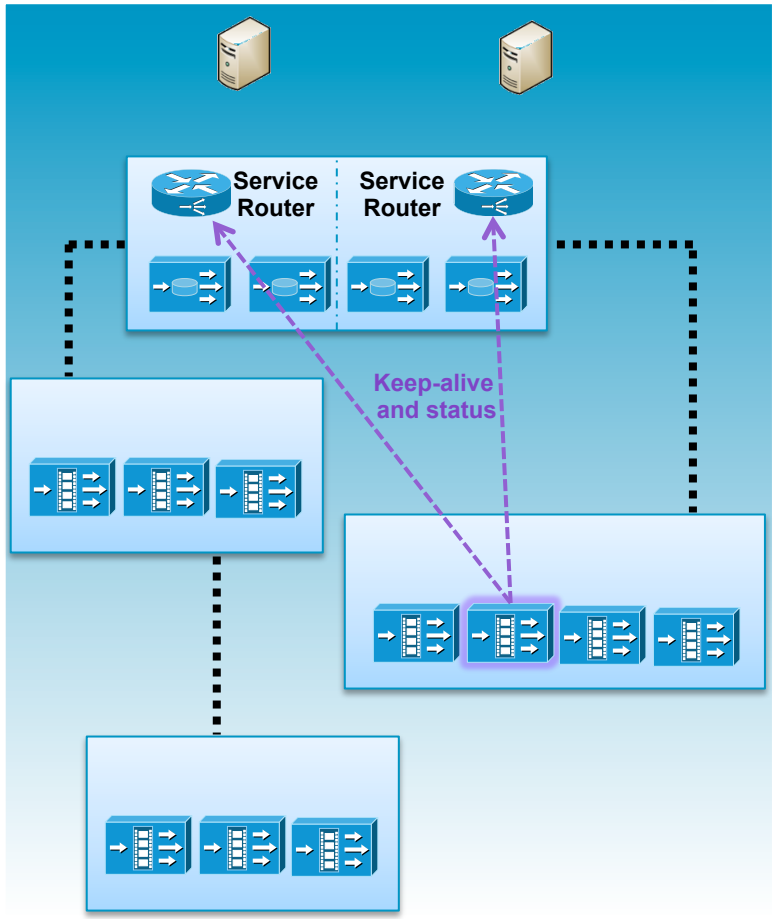
CDS Network Overlay



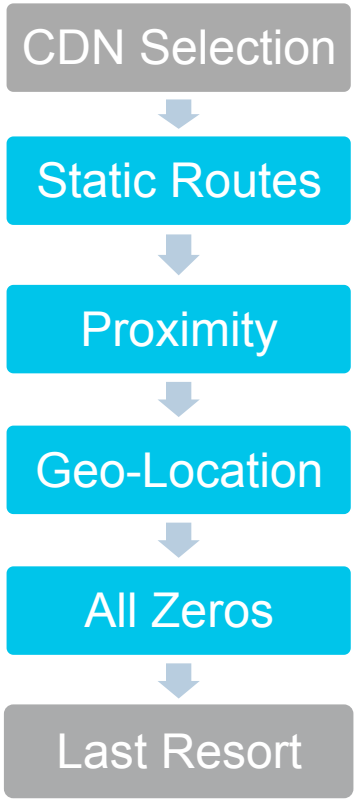
Service Routing

SR Functions

- Directs clients to most appropriate streaming resource
  - Stateless HTTP, RTSP, RTMP Load-balancing and Redirection
- Using:
  - Client IP address and/or location
  - Requested Content
  - Availability and Performance Information from Streamers
  - Streamer
- Streamer Keep-alive
  - Configurable/2-second default
  - Utilizations and thresholds – network, engine, memory, etc.



Routing Methods and Sequence

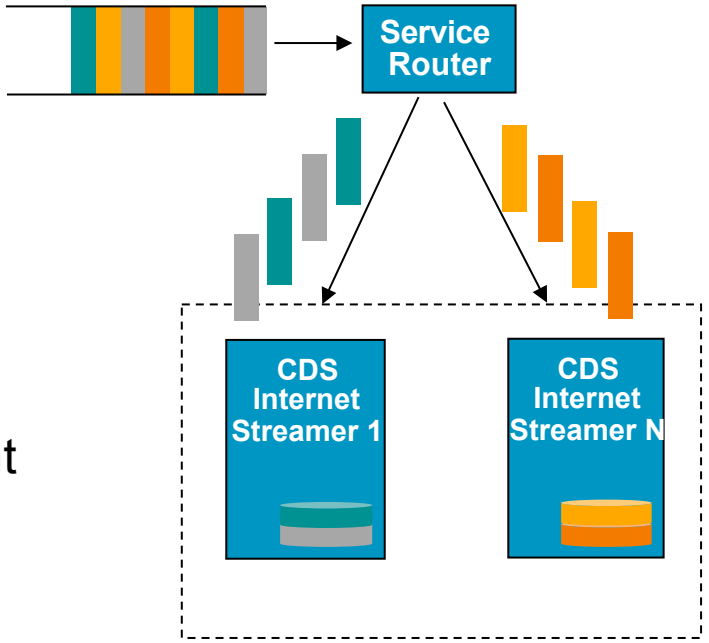


- CDN Selection (CDN Federation)
- Location-Based/Coverage-Zone Routing (on net)
  - "Short-list" based on client subnet/zone metrics
  - "All Zeros" Special Case handled after Proximity/Geo-Loc.
- NPS/Proximity-Based Routing (on/off net)
- Geo-Location-Based Routing (off net)
  - Requires external geo-location server
- Service-Aware Routing
  - Delivery Service, Engines, CPU load, stream/session counts, NIC bandwidth, memory usage
- Load-Based Routing
  - Round-Robin, Least-Loaded
- Content Affinity Routing
- Last-Resort Routing

Content Affinity Routing

Advanced Service Routing

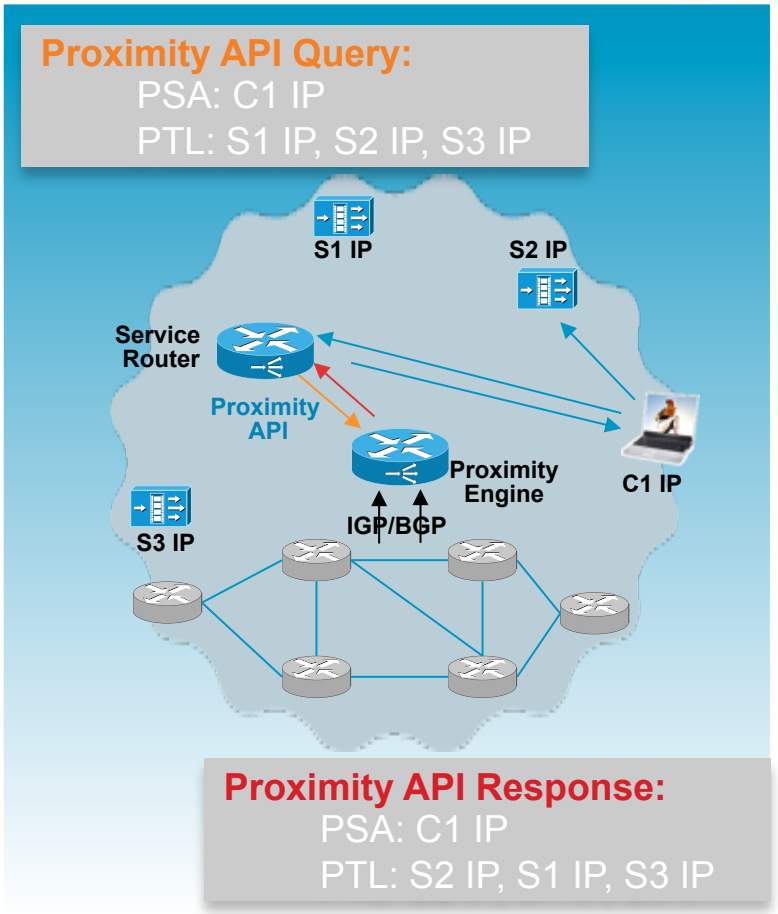
- Requested URI based routing method
- Preference for same URI's, same set of Streamers
  - Used in conjunction with other criteria's such as load, service status, etc.
- Higher Storage Utilization of CDS system
  - Streamer serves only subset of content
  - Local Storage and RAM utilization
- Linear scaling of CDS Storage for Incremental Capacity
  - "Long-Tail" use cases
- Better System Performance
  - Higher in-memory cache hit ratio
  - Deterministic resiliency for failure/ overload



NPS/Proximity-Based Routing

Advanced Service Routing

- Integration of IP Least Cost Routing with CDN Application Service Routing
- Optimizes Client-to-Streamer Routing Dynamically, simplifying Service Routing Coverage Zone Configurations
- Integrates with CDS Service Router for Request Routing based on OSPF, ISIS, BGP
- API to rank the order of candidates by network distance to a point of interest (client)
  - Location of IP objects
  - Distance between IP objects
  - Cost rating IP objects distance
- NPS has the access to network topology and resource information



PSA = Proximity Source Address
PTL = Proximity Target List

Cisco NPS

Current status

- NPS computes the location of and distance between endpoints
  - CDS-IS Service Router (appliance/VM and ASR 9000 LC)
  - Routing nodes: CRS (CGSE) and ASR 1000 - soon
- Real-life use example: locate and then push toward customer nearest copy of a movie, or closest instance of a service among several available resources
  - taking into consideration customer status, package, network status not only underlying network topology (real or engineered)

Cisco NPS

Possible use cases

- NaaS – NPS as a Service – SP is selling the NPS features to customers for own integration
- NaaT – NPS as a Tool – SP is using the NPS as a tool to optimize traffic distrubution
- CDN integration – optimize and enable additional services on existing CDNs and in future cloud-based CDN services
- P2P – optimize the traffic within own network and maximize the potential of sharing distrubuted information among participating nodes
- NaNPS & NPSv6 – NPS service is used as a means of communicating in optimal way customer across private/public address space and across different address families

Video monitoring

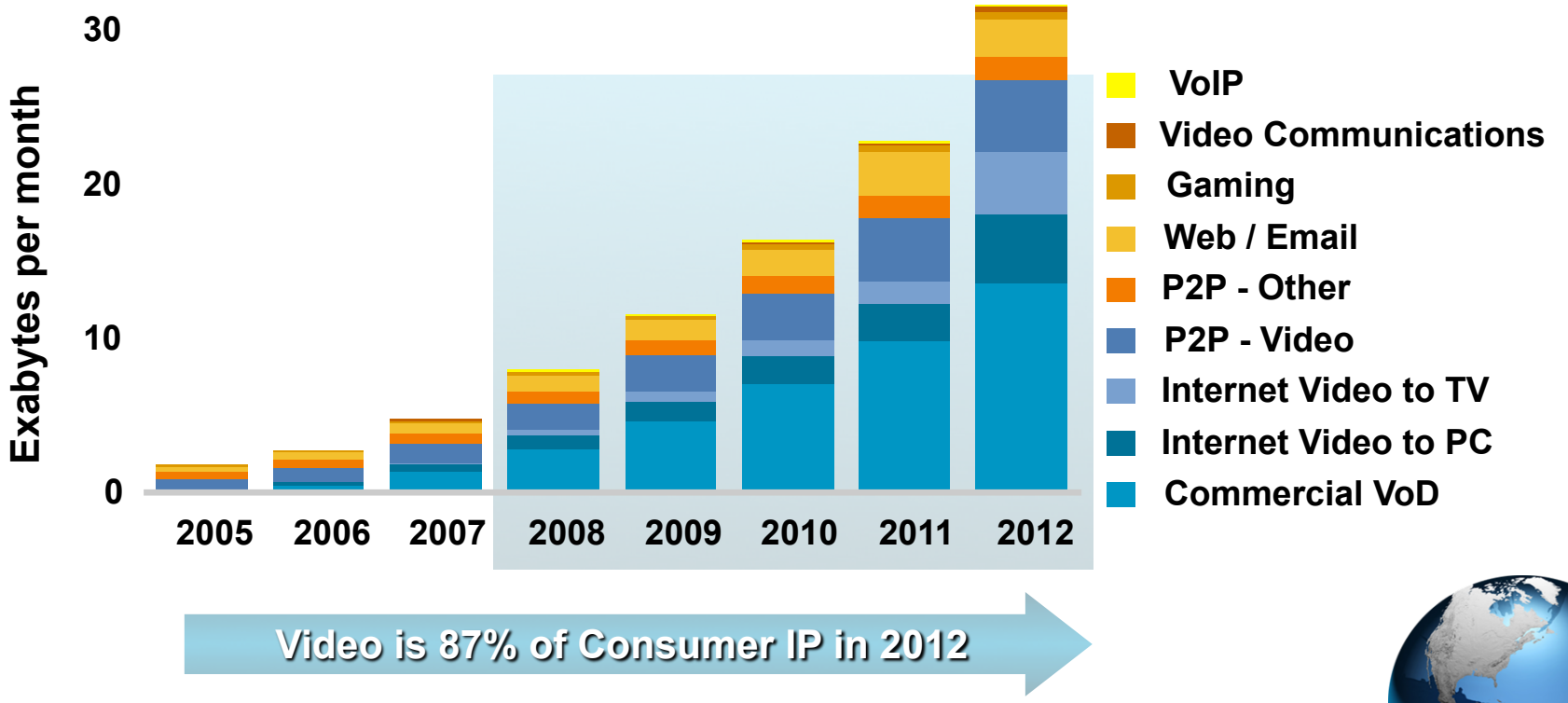
Where is my video?

- Video transport is becoming major force to drive bandwidth upgrades among SPs
  - true also (surprise surprise) for Polish SPs
- The video transported in the networks is not always SP-controlled:
  - IPTV services deployed are still below 45% penetration rate
  - most of the video trafic is still Youtube, Skype and other video-enabled communicators/software

Video Apps Approach the Zettabyte Era

Global Consumer IP Traffic Growth

Without Video - Consumer IP Doubles by 2012
With Video - Consumer IP Quadruples by 2012



Source: Cisco Visual Networking Index – Forecast, 2007-2012, http://ciscovni.com

From Totally Best-Effort to Fully-Managed Offerings

The video aspects of modern SP

1/2

- The transport itself

  how do we provision for video transported to our customers in the most efficient way

  can we/do we use multicast technology to lower the bandwidth/response time

  can I use and control video transport in the network I have - mVPNs

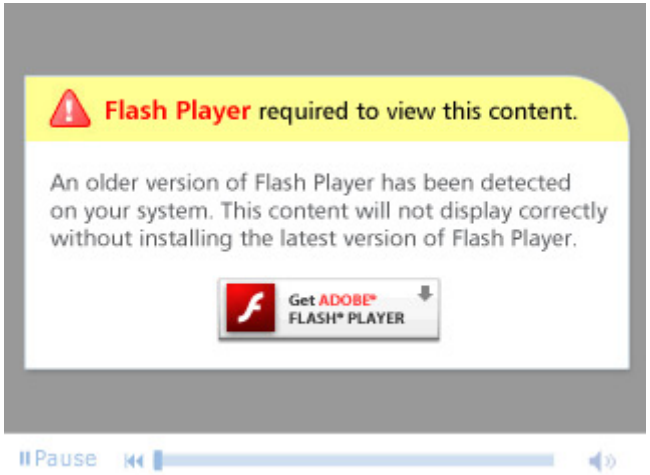
- Meeting SLAs

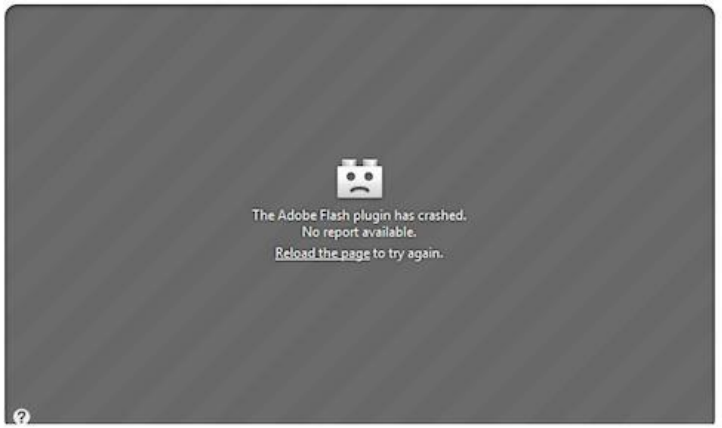
  can we deliver video with SLAs?

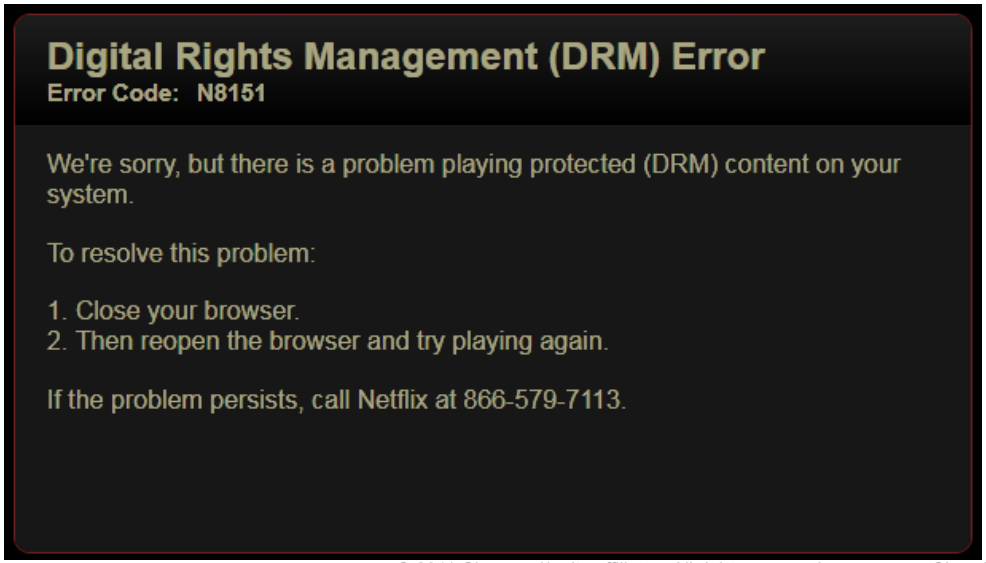
  can we optimize delivery and still give high user QoE?

Common Annoyances in Streaming

Stalls, Slow Start-Up, Plug-In and DRM Issues







The video aspects of modern SP

2/2

- Monitoring & Management

  can we verify our network is within SLA?

  how can we troubleshoot and isolate problems?

  how to provision and activate video transport services without interrupting existing service?

Multicast-only Fast Reroute (MoFRR)

Truly Resilient Multicast

- **Assumption**

  Disjointed physical network topology. Can be extended to ring topology

  Same IPTV stream is delivered over the two disjointed network plane

- **How does it work?**

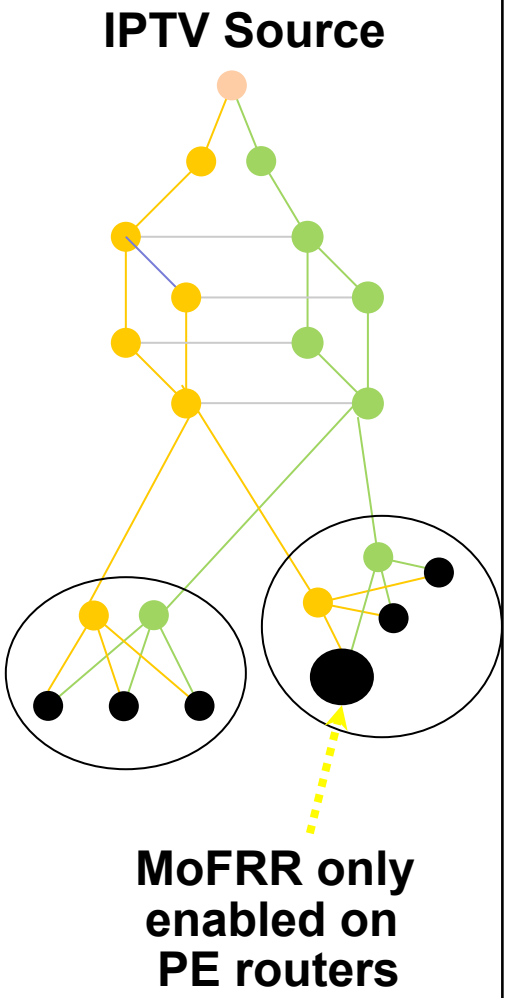
  PE send PIM join on both uplinks to build multicast tree.

  However, when PE receive the multicast packet, it will only accept on RPF interface, and drop the packet on the other link

  When the primary path fail, it can switchover to the other path much faster since the PIM tree has been built already

  Failure detection can be based on IGP/PIM control plane or data path monitoring like in-line media monitoring mechanism

  For Live-Live solution, both multicast streams can be accepted and merged into same Video device



http://tools.ietf.org/html/draft-karan-mofrr-01

ASR 9000 Flow-based MoFRR

Video Aware Resilient Multicast

- **ASR 9000 flow-based MoFRR Overview**

  Linecard microcode monitors per multicast flow counters on both primary and backup interfaces

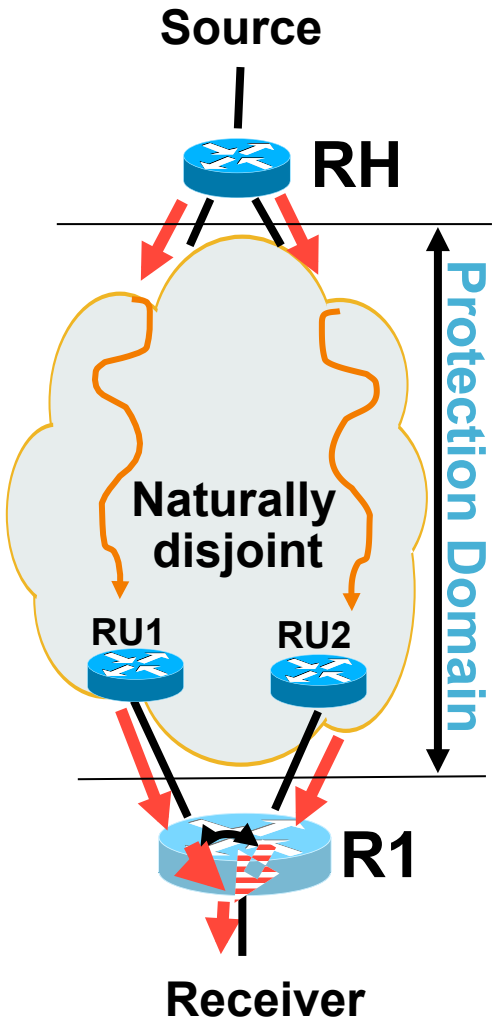
  If the system doesn't receive multicast packet on the primary path over certain period of time, multicast flow will switch over to the backup path

- **Advantages**

  Per multicast flow monitoring and switch over; for example, enable it only for premium channels

  50msec convergence time for both link and node protection

  Native IP multicast solution without the complexity of MPLS P2MP TE/FRR

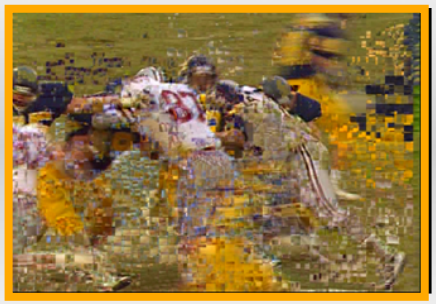


Video SLA with ASR 9000

Any Single Un-recovered Video Packet Loss May Result in an Impairment

Excess Delay *Congestion* *Network Re-Convergence* *PHY-Layer Errors*

Slice error



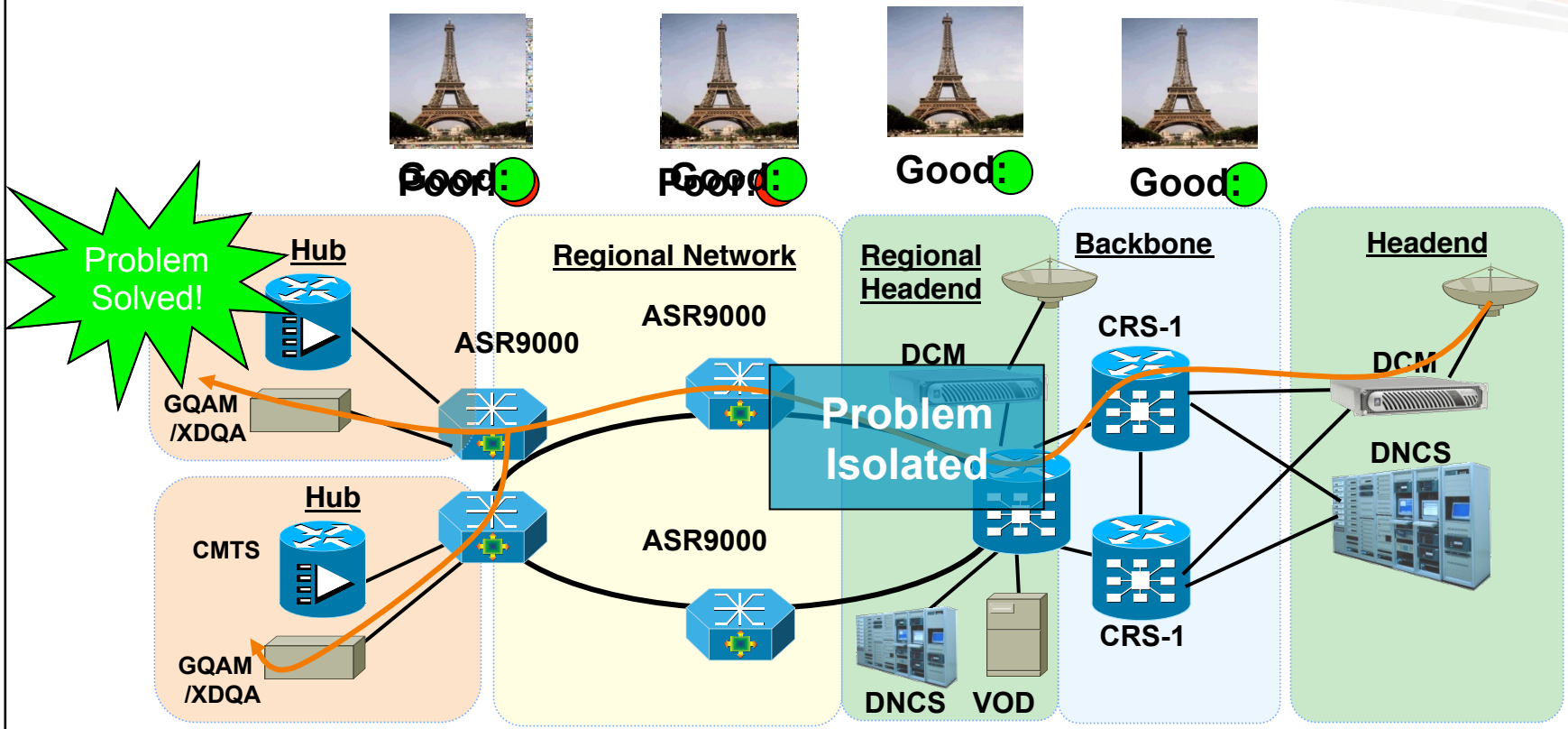
Pixilation

Ghosting

Must Manage Loss at Network & Application Layers

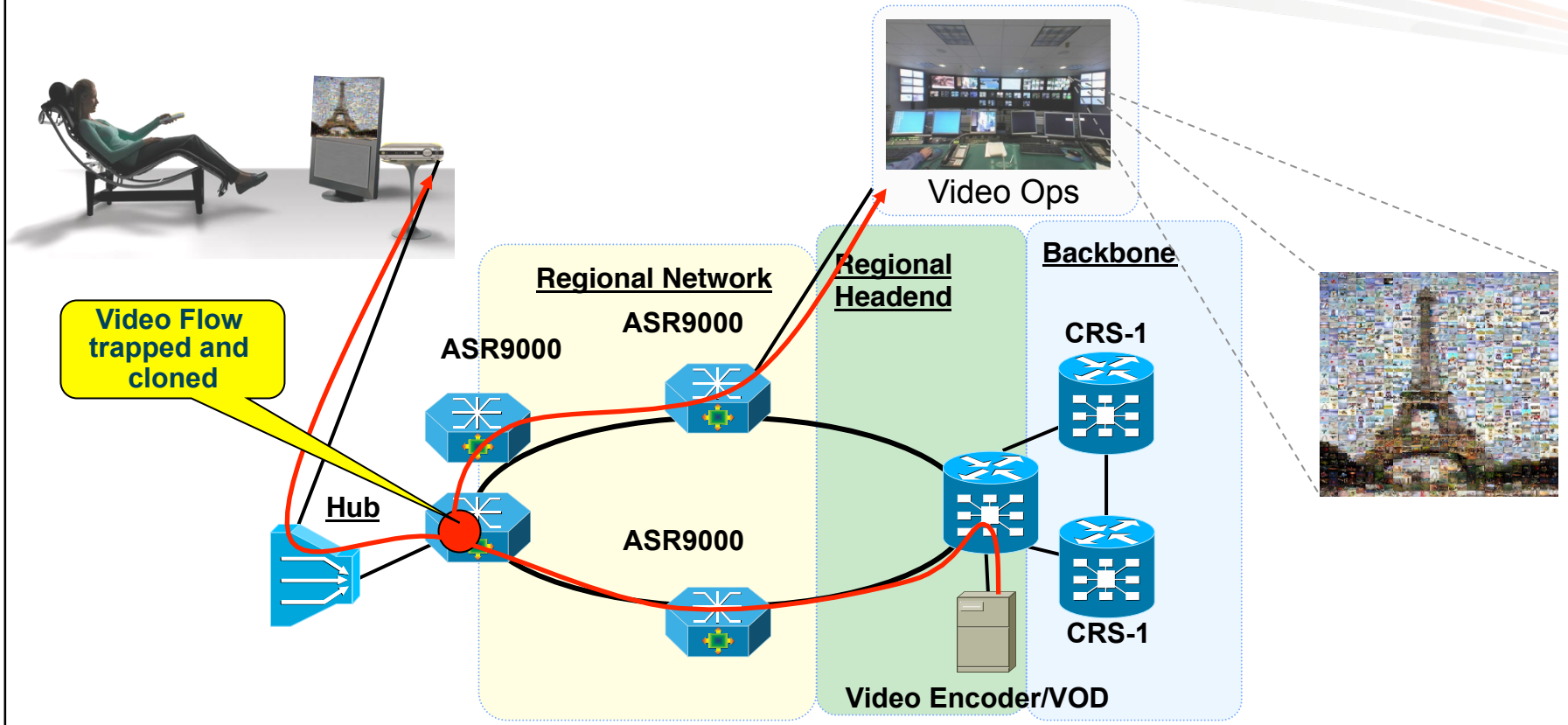
Fast Convergence & Fast Re-Route:	Call Admission Control:	Forward Error Correction:	Live-Live Lossless Video:
IP/MPLS/MoFRR	Multicast CAC	Network FEC	Temporal Redundancy
Integration into Media Monitoring	RSVP - VOD CAC	Physical Layer EFEC	Spatial Diversity

ASR9000 Quality of Subscriber Experience:
Integrated Video Quality Monitoring



1. Video quality problem detected & Reported to Video Mgmt System
2. Compute Video Quality at each system between receiver and source
3. Troubleshoot location where Quality first degrades
4. Correct the problem and restore video quality

ASR9000 Quality of Subscriber Experience:
Trap and Clone*



- Vidmon Trap or Customer calls in and opens trouble ticket
- Ops/Cust. Service personnel trap the Video flow and clone it
- Video Flow transported to Video Operations Site for detailed Analysis / Troubleshooting

Cisco Service Provider Strategy

Summary

Video/ Connected Life

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Managed and Cloud Services

IP NGN Architecture

Video Everywhere

Mobility & Connected Life

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Hosted Software Services

Q&A

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