



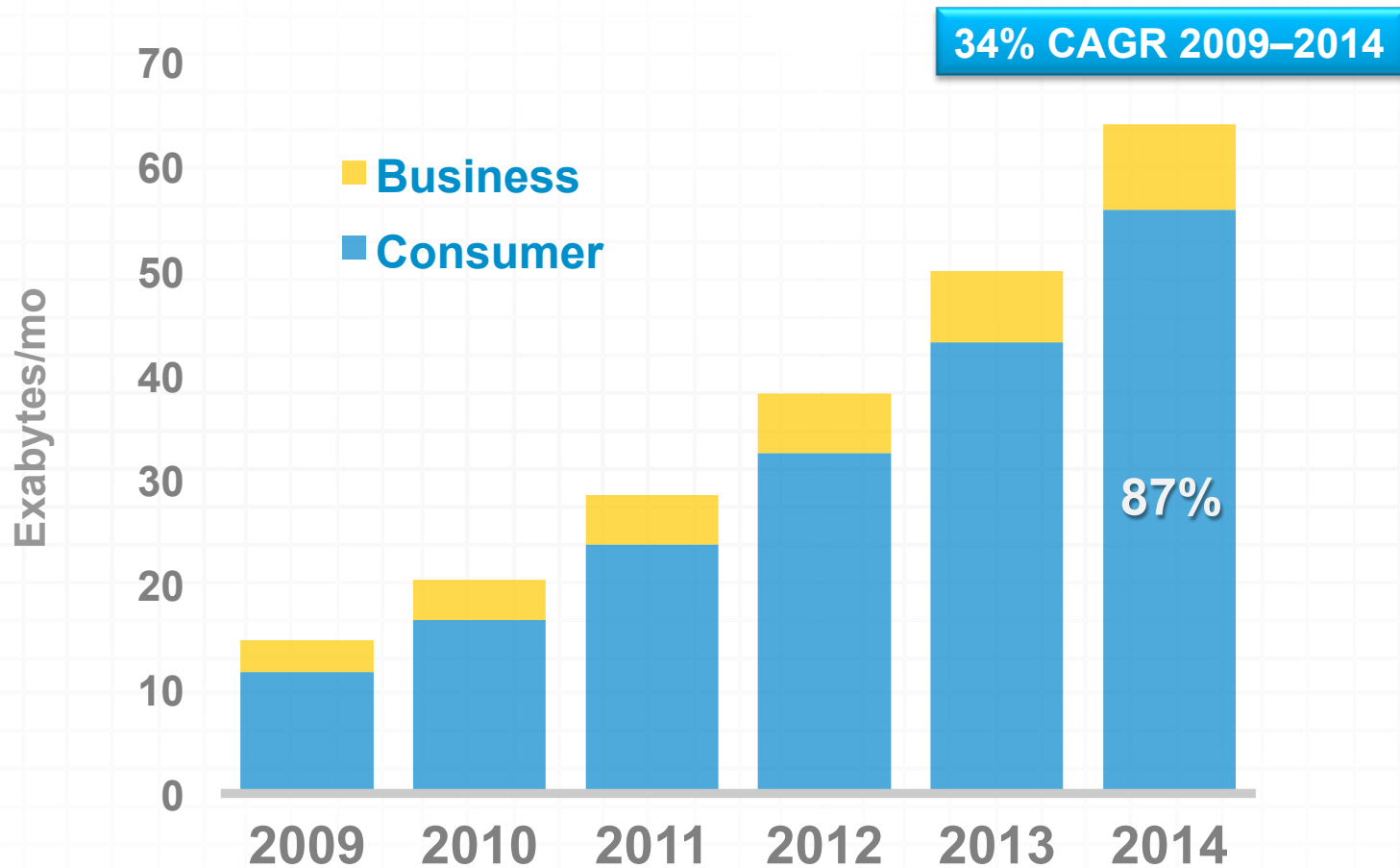
Rich Media drives Network Evolution

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Global IP traffic growth

Consumer IP traffic outpace Business IP traffic
(traffic volume and growth rate)

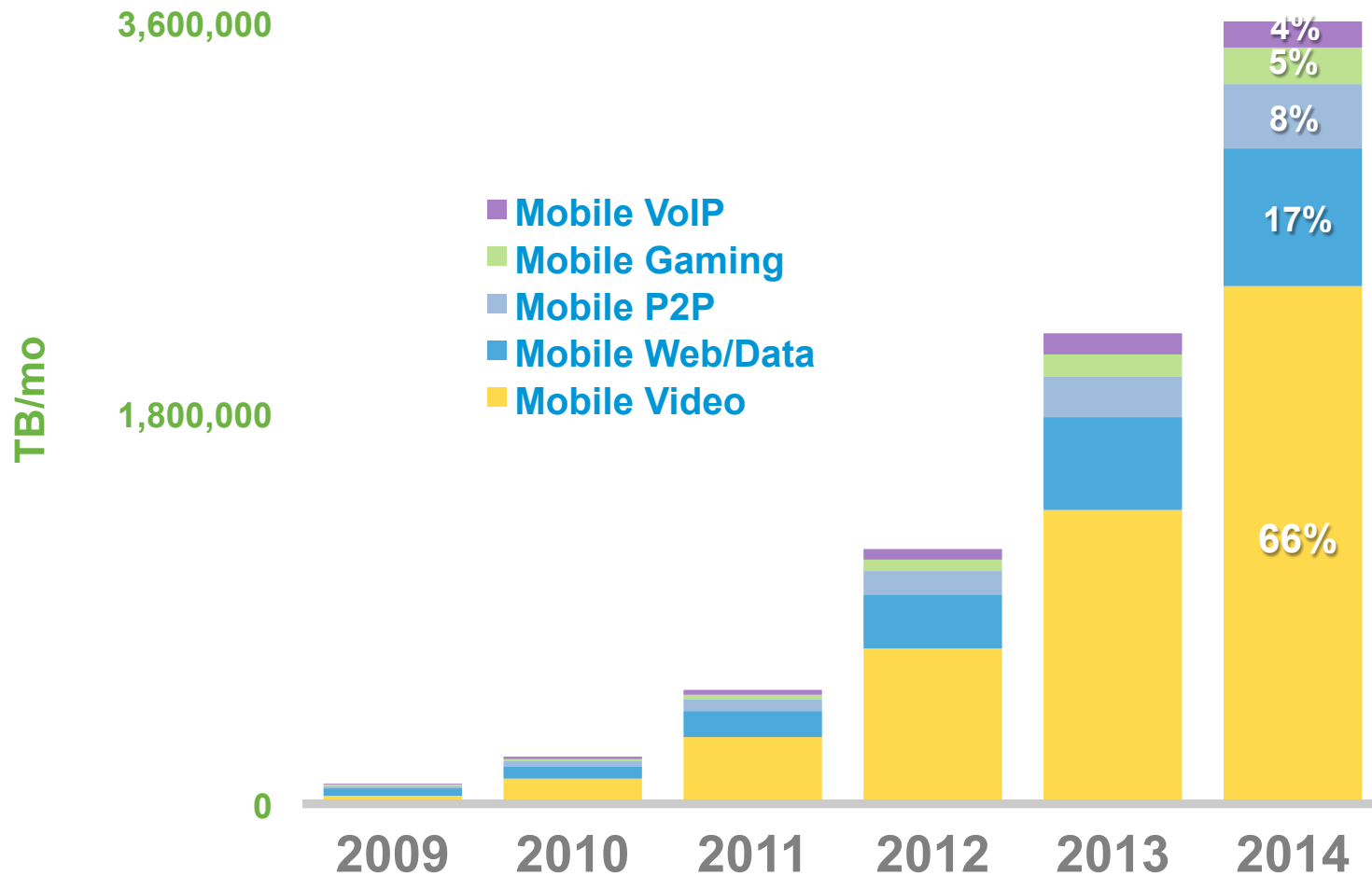


Source: Cisco Visual Networking Index (VNI) Global Forecast, 2009-2014

Global Mobile Data Traffic Growth / Content

Mobile video will be 66% of mobile data traffic by 2014

108% CAGR 2009–2014



Cisco VNI Forecast update: 2009-2014

summary - key highlights



Total IP Traffic

63.9 Exabytes per month by 2014

- Annual global IP traffic will reach 3/4 of a zettabyte by 2014

Internet

47.2 Exabytes per month by 2014

- Internet video will surpass P2P as top traffic type by end of 2010



Managed IP

13.2 Exabytes per month by 2014

- Web-based video conferencing will grow 180-fold from 2009-2014



Mobile Data

3.5 Exabytes per month by 2014

- Mobile video will increase 66-fold from 2009 to 2014

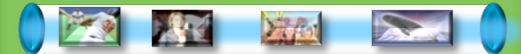


Consumer Video Market Dynamics

Consumerization is bringing transformational change to SP and Enterprise



Consumer Video



Online video subscription services have a 46% CAGR over the next 5 years



Netflix = 20% of US downstream internet traffic in peak times

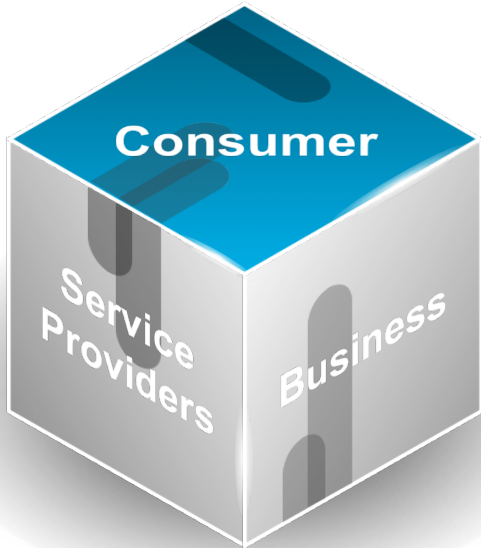


Mobile internet traffic to surpass desktop internet traffic by 2014



Consumer

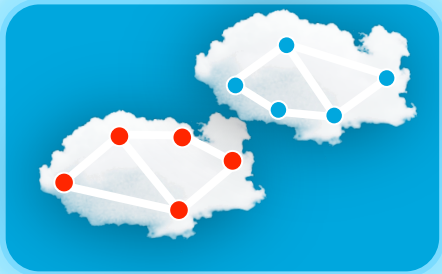
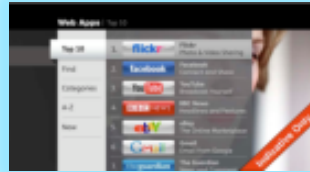
Video is the corner stone of consumer experience on the internet



- Video over Internet at Unprecedented scale
 - Multiple streams, many devices, HD
 - Real time expectation
 - From broadcast to unicast
 - Video is new Voice AND new Chat (and moving to HD)
- Complexity of home networking or personal network ?
- Content creation – Sharing
- Social media
- Multiple devices
 - Mobile, mobile, mobile
 - Specialized experience devices => multi-experiences

Service Provider Video Market Dynamics

From access providers to experience providers



Service Provider Video



Multi-screen offering becoming table stakes



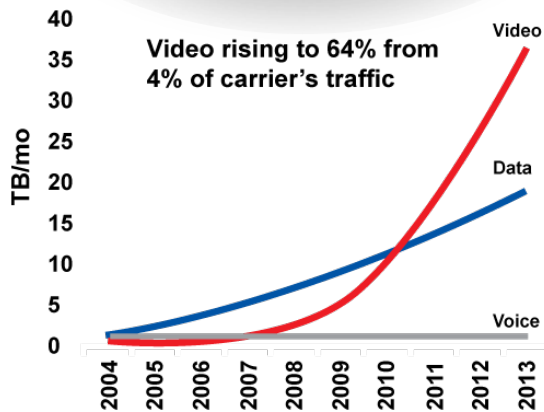
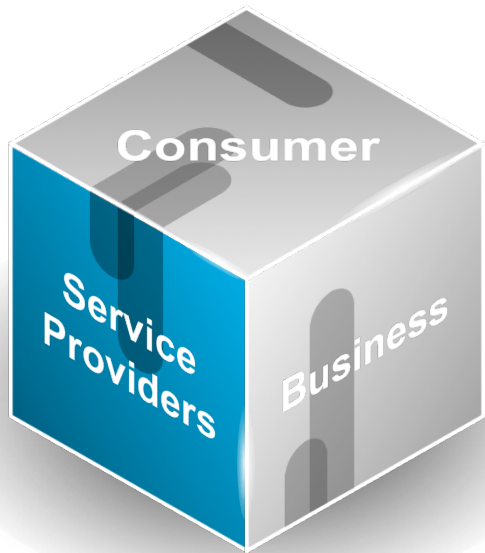
Rising churn and Subscriber acquisition cost



Partnerships & Vertical Integration

Service Providers

From Internet access providers to experience providers

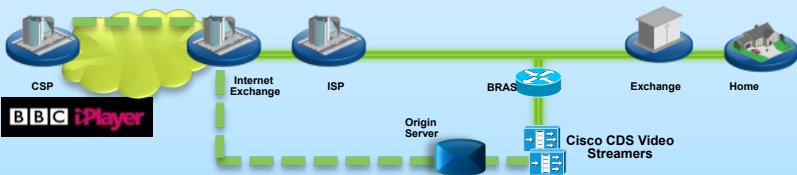


- Mobile
 - Internet and Video (offload)
 - “There is an App for that”
- Multi-experience providers
- Consumer Experience
 - Churn vs Loyalty; Net neutrality vs Service bundling
- Content shifting to SP infrastructure, \neq revenue
- Massive Scale content distribution
 - Unicast + DC + CDN
- Running out of IP address !
- Business expectation aligning with Consumers
- SLA management

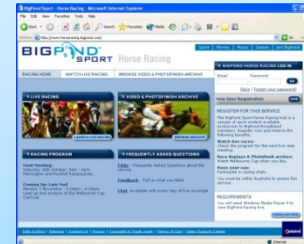
Service Providers proof points



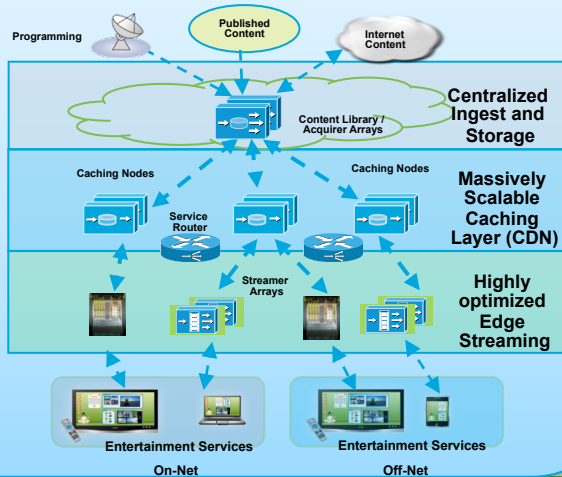
BT Wholesale selects Cisco for a Content Delivery Network (CDN)



Telstra built a Content Delivery Network for wholesale and retail services with Cisco

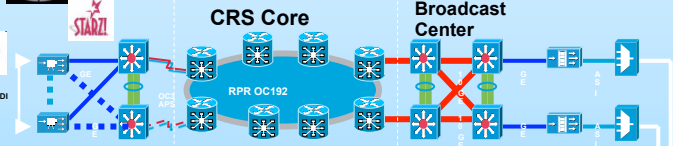
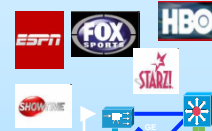


Live and On Demand video services



DirecTV leverages Cisco transport technology to provide very high quality national and local channels

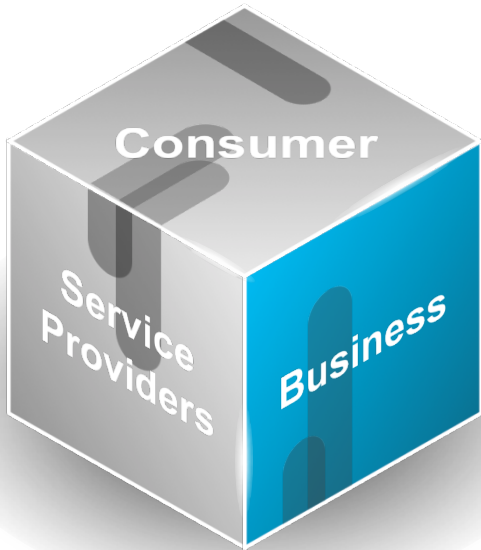
Backhaul Local Collection Facility



Encodes HD-SDI to MPEG2 IP multicast S,G

To Satellite

Business, Any Media, Any Where, Any Device



- Consumerization of IT
 - employee = consumer (experience and devices)
Collaboration – Rich Media
- Cloud / Virtualization @ every level
- Mobility (time & location)
- Immersive experience vs scale
 - Top down vs Bottom up video adoption
- Business requires Rich Media
 - More video end-point, more apps, more content ,
Improve business processes
- Scaling rich media visibility and control
 - optimized media delivery, Intelligent QoS,
User SLA, Video MOS (?)
- No downtime—planned or unplanned, period !

Scaling video is still challenging



Experience

- Fragmented solutions
- Hard to use
- User is control-plane
- TV-centric to user-centric content access
- **User SLA**



Complexity

- n-display problem
- **Network provisioning and operation**
- Delivering new experiences
- Hard to find and share video



Interactivity

- **Video is real-time, interactive and bursty**
- **Increased customer expectations**
- Bringing social experience to TV



Capacity

- Video storage
- **Bandwidth**
- **Managed & unmanaged networks**
- Content Delivery
- Rate of changes

Designing QoS for Multi-Media

Figure 2-1 P-frames and I-frames

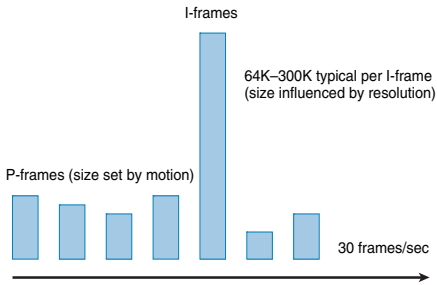


Figure 4-2 VoIP versus High-Definition Video—At the Packet Level

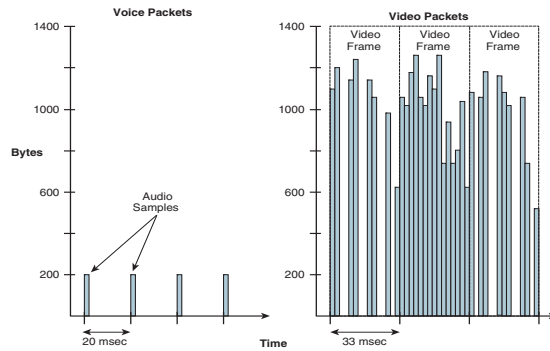


Table 2-3 Bandwidth Requirements of Common Video Streams

Video Source	Transport	Encoder	Frame Rate	Resolution	Typical Load ¹
Cisco TelePresence System 3000		H.264	30 fps	1080p	12.3 Mbps
Cisco TelePresence System 3000		H.264	30 fps	720p	6.75 Mbps
Cisco TelePresence System 1000		H.264	30 fps	1080p	4.1 Mbps
Cisco TelePresence System 1000		H.264	30 fps	720p	2.25 Mbps
Cisco 2500 Series Video Surveillance IP Camera		MPEG-4	D1 (720x480)	15 fps	1 Mbps
Cisco 2500 Series Video Surveillance IP Camera		MPEG-4	D1 (720x480)	30 fps	2 Mbps
Cisco 2500 Series Video Surveillance IP Camera		M-JPEG	D1 (720x480)	5 fps	2.2 Mbps
Cisco 4500 Series Video Surveillance IP Camera		H.264	1080p	30 fps	4-6 Mbps
Cisco Digital Media System (DMS)—Show and Share VoD		WMV	720x480	30 fps	1.5 Mbps
Cisco Digital Media System (DMS)—Show and Share Live		WMV	720x480	30 fps	1.5 Mbps
Cisco DMS—Digital Sign SD (HTTP)		MPEG-2	720x480	30 fps	3-5 Mbps
Cisco DMS—Digital Sign HD (HTTP)		MPEG-2	1080p	30 fps	13-15 Mbps
Cisco DMS—Digital Sign SD (HTTP)		H.264	720x480	30 fps	1.5-2.5 Mbps
Cisco DMS—Digital Sign HD (HTTP)		H.264	1080p	30 fps	8-12 Mbps
Cisco Unified Video Advantage	UDP/S445	H.264	CIF	variable	768 Kbps
Cisco WebEx	TCP/HTTPS		CIF	variable	128K per small thumbnail
YouTube	TCP/HTTP	MPEG-4	320x240		768 Kbps
YouTube HD	TCP/HTTP	H.264	720p		2 Mbps

1. This does not include audio or auxiliary channels.

Figure 4-8 RFC 4594 Marking Recommendations

Application	L3 Classification		IETF
	PHB	DSCP	RFC
Network Control	CS6	48	RFC 2474
VoIP Telephony	EF	46	RFC 3246
Call Signaling	CS5	40	RFC 2474
Multimedia Conferencing	AF41	34	RFC 2597
Real-Time Interactive	CS4	32	RFC 2474
Multimedia Streaming	AF31	26	RFC 2597
Broadcast Video	CS3	24	RFC 2474
Low-Latency Data	AF21	18	RFC 2597
OAM	CS2	16	RFC 2474
High-Throughput Data	AF11	10	RFC 2597
Best Effort	DF	0	RFC 2474
Low-Priority Data	CS1	8	RFC 3662

Figure 2-8 Default and Tuned Buffer Allocation

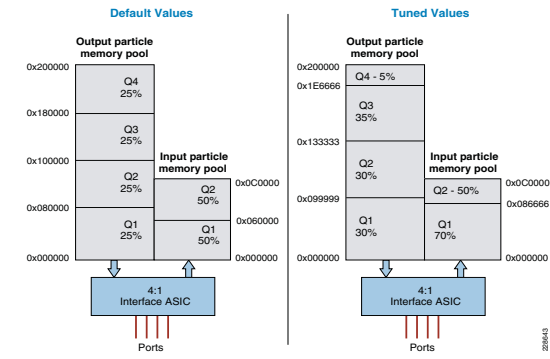


Figure 4-22 Hierarchical Shaping and Queuing Policy Example

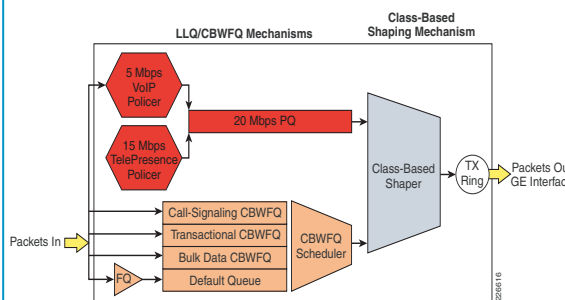
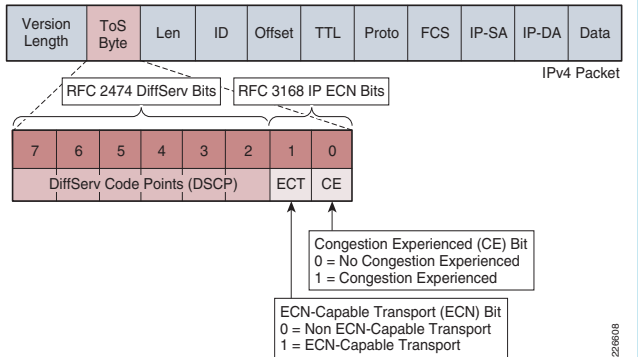


Figure 4-12 Figure 1-12 IP ToS Bits: DSCP and IP ECN



Design Zone: Medianet Reference Guide:

Designing QoS for Multi-Media

Figure 4-25 Enterprise Medianet QoS Recommendations

Application Class	Per-Hop Behavior	Admission Control	Queuing and Dropping	Media Application Examples
VoIP Telephony	EF	Required	Priority Queue (PQ)	Cisco IP Phones (G.711, G.729)
Broadcast Video	CS5	Required	(Optional) PQ	Cisco IP Video Surveillance/Cisco Enterprise TV
Real-Time Interactive	CS4	Required	(Optional) PQ	Cisco TelePresence
Multimedia Conferencing	AF4	Required	BW Queue + DSCP WRED	Cisco Unified Personal Communicator
Multimedia Streaming	AF3	Recommended	BW Queue + DSCP WRED	Cisco Digital Media System (VoDs)
Network Control	CS6		BW Queue	EIGRP, OSPF, BGP, HSRP, IKE
Signaling	CS3		BW Queue	SCCP, SIP, H.323
Ops/Admin/Mgmt (OAM)	CS2		BW Queue	SNMP, SSH, Syslog
Transactional Data	AF2		BW Queue + DSCP WRED	Cisco WebEx/MeetingPlace/ERP Apps
Bulk Data	AF1		BW Queue + DSCP WRED	E-mail, FTP, Backup Apps, Content Distribution
Best Effort	DF		Default Queue + RED	Default Class
Scavenger	CS1		Min BW Queue	YouTube, iTunes, BitTorrent, Xbox Live

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Figure 1-12 IP ToS Bits: DSCP and IP ECN



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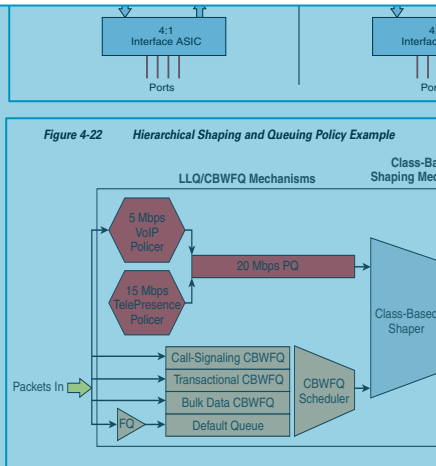
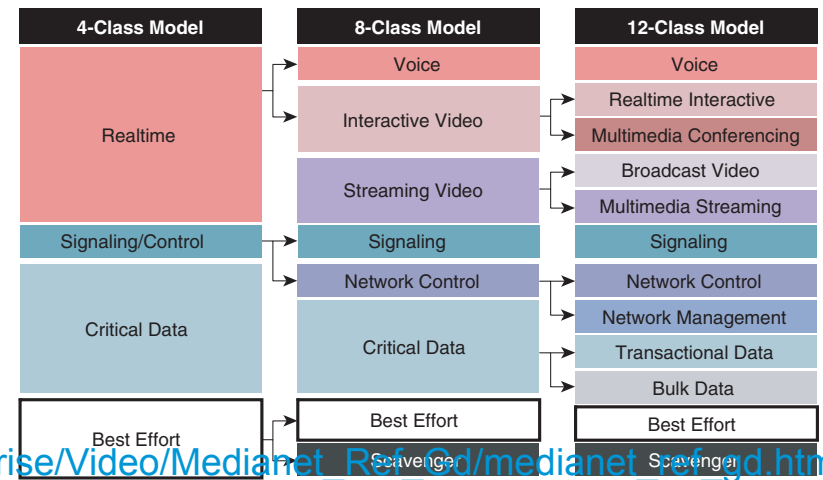


Figure 4-26 Media Application Class Expansion



Enterprise managing Bandwidth for Video:



1. Buy more bandwidth



2. Implement QOS



3. Use adaptive Codec



4. Consider admission control



Or take public transportation: Internet

Medianet, The network optimized for Rich Media



- Shared Media services
- Service Registration, Advertisement, Routing
- More flexible Network Services, More programmable
- Streams vs Packet services
- Applications-End user vs Packet services
- Context Aware network services
- Network Optimized Rich Media
- More intelligent/well behaved end-points
- More flexible/adaptive/network friendly Codec
- On path signaling (application metadata, context)
- Quality Measurement, Common criteria

Thank you.

