How to Keep Video From Blowing Up Your Network

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Agenda

- **Types of Video**
- The Impact of Video
- Identifying Video
- Handling Video
  - Video you want
  - Video you don't want
- When You Must Add Bandwidth
- Monitoring Video

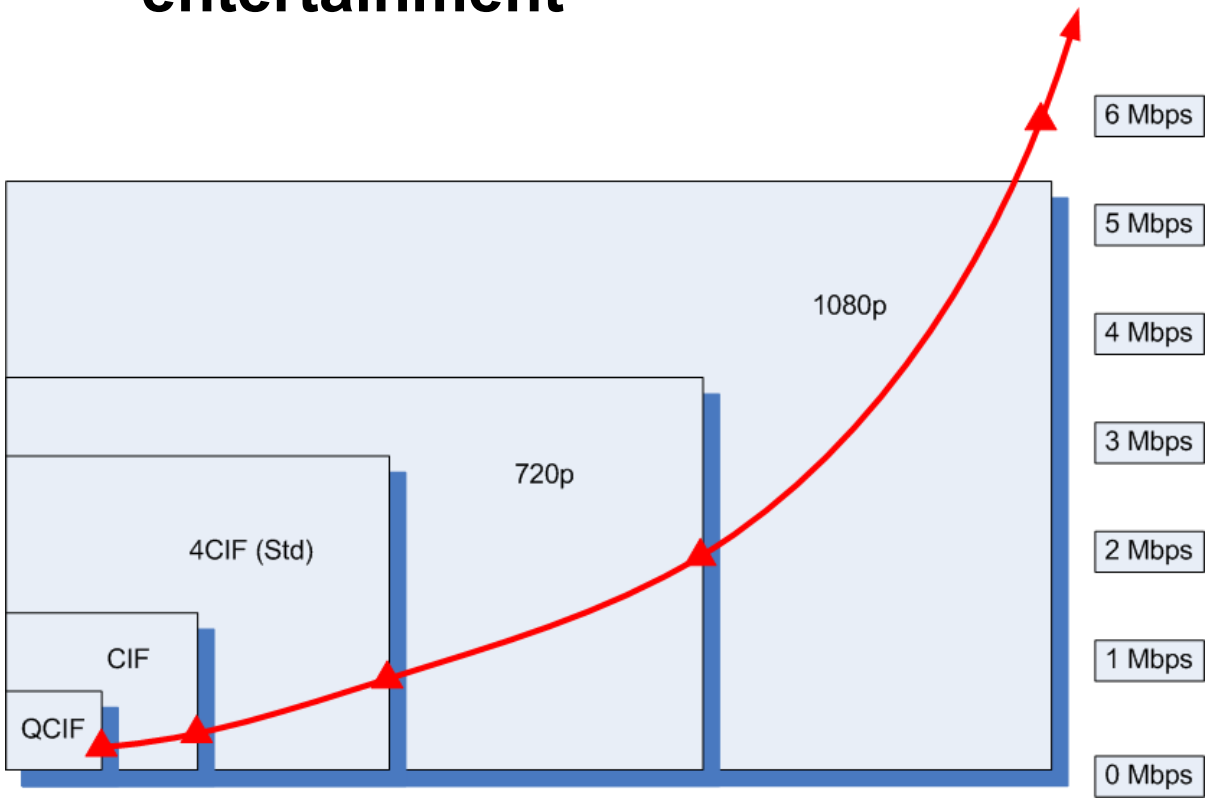
Types of Video

- **Interactive video**
  - Telepresence
  - Video conferencing
  - WebEx
- **Streaming video**
  - Training videos
  - Security cameras
  - Executive presentations
- **Entertainment**
  - Netflix
  - YouTube
  - Internet broadcasts
- **Video volume is increasing**

FaceTime

Video Bandwidths

- **Transport protocol influences the impact**
  - **UDP has no flow control; used for interactive video**
  - **TCP has flow control; used for most streaming and entertainment**



CIF: Common Intermediate Format

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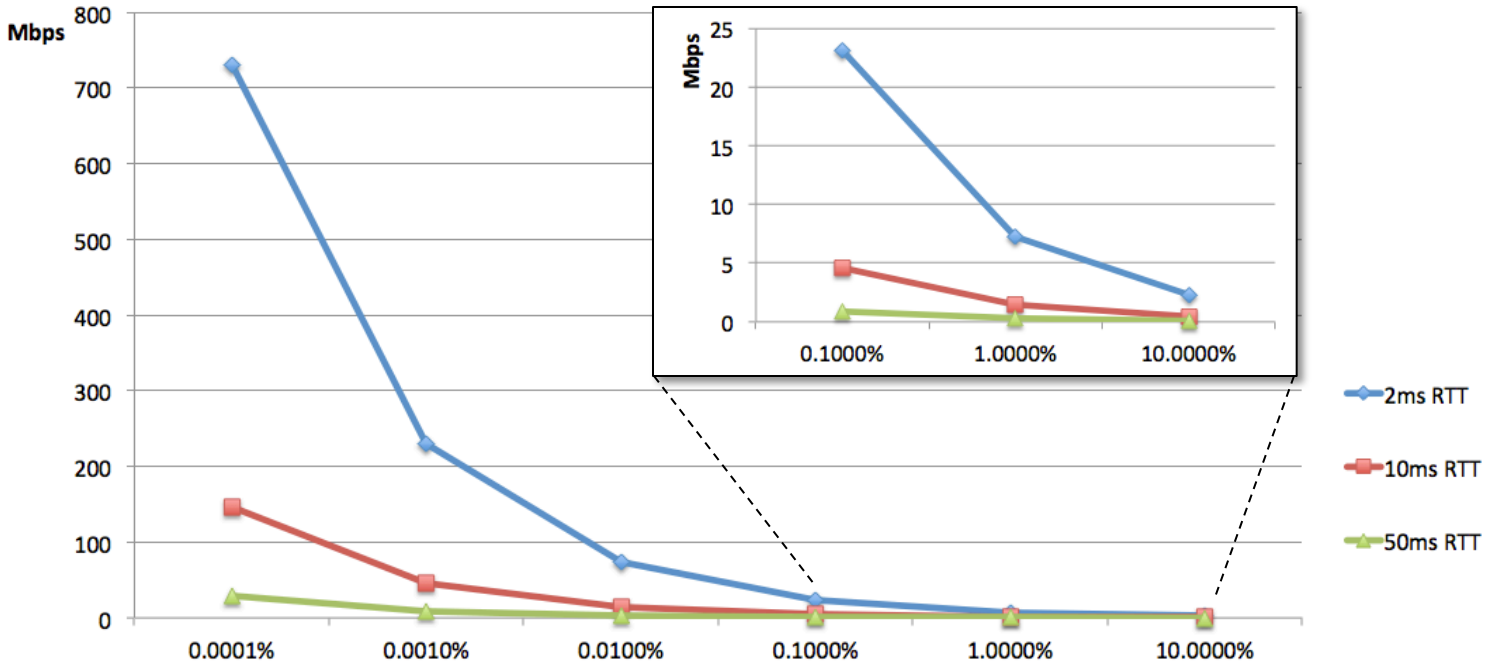
Blowing Up Your Network

- **Congestion**
  - Forces egress drops on interfaces
  - Reduced bandwidth for other applications
- **TCP throughput is affected by packet loss**
  - 0.0001% loss TCP affects *goodput*



Video Impact on Wireless

- **Congestion causes significant reduction in throughput**
- **Wireless retransmissions are typically at a slower speed (5Mbps vs 11Mbps)**
  - **Result: ~3x the bandwidth is consumed**
  - **First packet, experienced a wireless collision**
  - **Retransmitted packet, sent at ½ the speed of the first, takes 2x the time to transmit**

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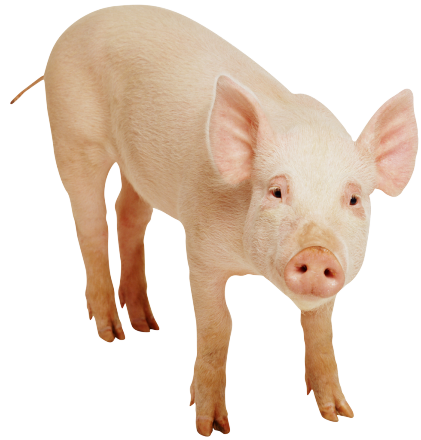
Identifying Video

- **Interactive**
  - UDP transport
  - Typically the highest bandwidth 300Kbps – 5Mbps
- **Streaming**
  - Bandwidth depends on the encoding and frame rate
  - UDP: fixed data rate
  - TCP: flow controlled
- **Downloads**
  - TCP: flow controlled



- **TCP will try to use as much bandwidth as it can**

Identifying Video on the Network

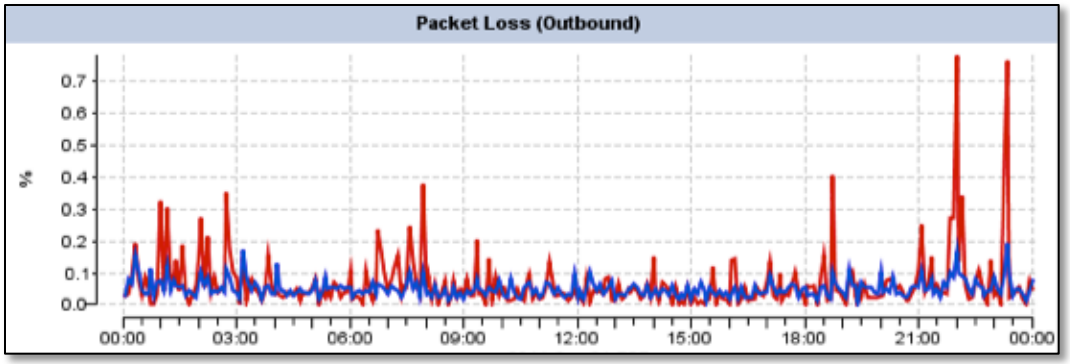
- **Packet captures**
- **NetFlow**
  - **Constant packet flow, relatively steady data rate**
  - **IP addresses involved**
- **Application analysis tools (Opnet ARX)**
- **Who has time to go look for video?**

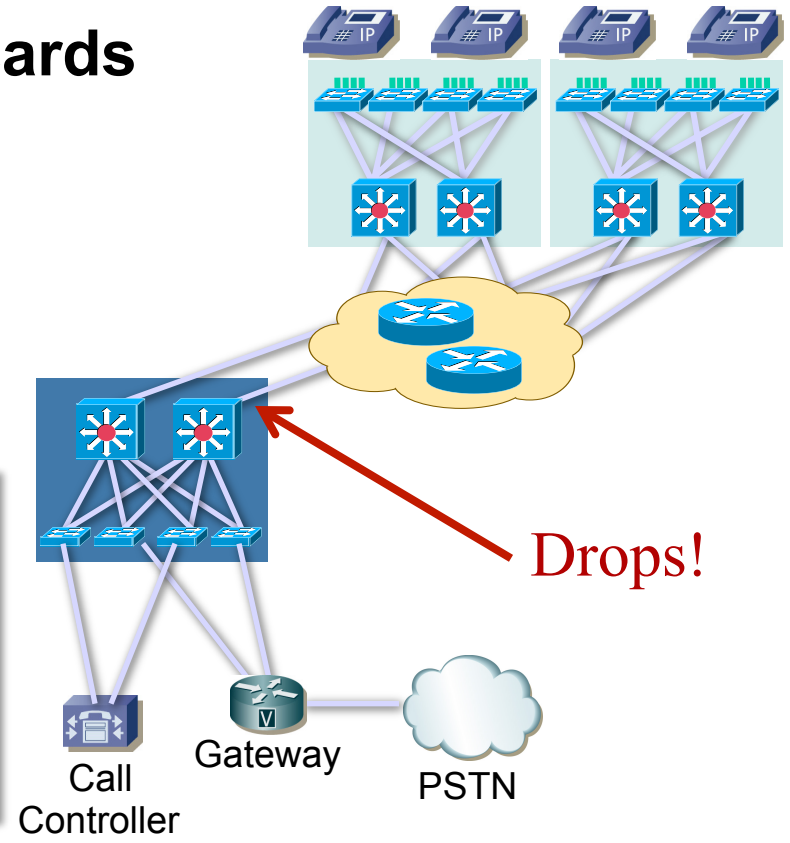
Practical Approach to Identifying Video

- Look for congested links
  - Top-N 95th percentile utilization is best
  - Top average utilization
  - Packet capture on the top links
- Source/Dest IP address
  - Compare with known video sources and content providers
- UDP port number ranges
  - Vendors publish the port ranges used
  - Still need to verify actual use
- Monitor network choke points
  - Internet access points
  - Corporate LAN->WAN routers

Monitor the LAN?

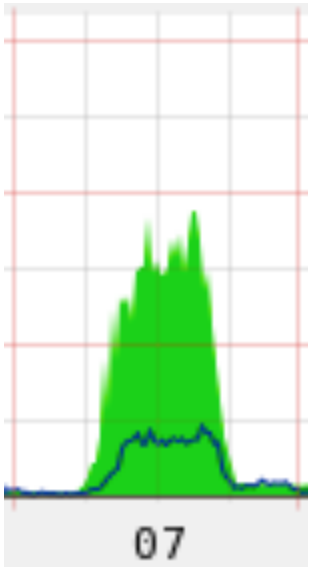
- **Depends on link speeds**
  - **It's easy to oversubscribe a 1G metro Ethernet link between two big facilities**
  - **Interfaces showed high discards**
  - **Shaping just increases jitter**
- **You won't often be told of new video deployments**





Example “War Story”

- **The situation**
  - T3 link
  - Complaints about application performance
  - Traffic volume increased on weekday mornings
  - Traffic volume decreased at quitting time
- **Application analysis: TCP/HTTP**
- **Half the traffic from three sources:**
  - Pandora.com
  - Akamai
  - LimeLight Networks



24-hour utilization
5 Mbps Units

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Handling Video That You Want

- **Use QoS to handle it**
  - Set bandwidth limits
  - Protect the other apps
  - Drop excess data
  - Do not mark down to lower DSCP value
- **Size links to handle the expected load**
  - Monitor link utilization – 95th percentile
  - Set thresholds to provide advanced notification
- **Use Call Admission Control (CAC)**
  - Better than relying on QoS, which can't distinguish between calls
  - Prevents the N+1 call from affecting all calls

Handling Video That You Don't Want

- **Packet filtering**
  - Content identification (look for products that do this)
  - Be careful of blocking OS updates
- **QoS to de-prioritize traffic**
- **Configure undesirable video to:**
  - Use remaining bandwidth
  - Use an allocated small percentage of bandwidth
- **"War Story" outcome**
  - Implemented QoS, using remaining bandwidth

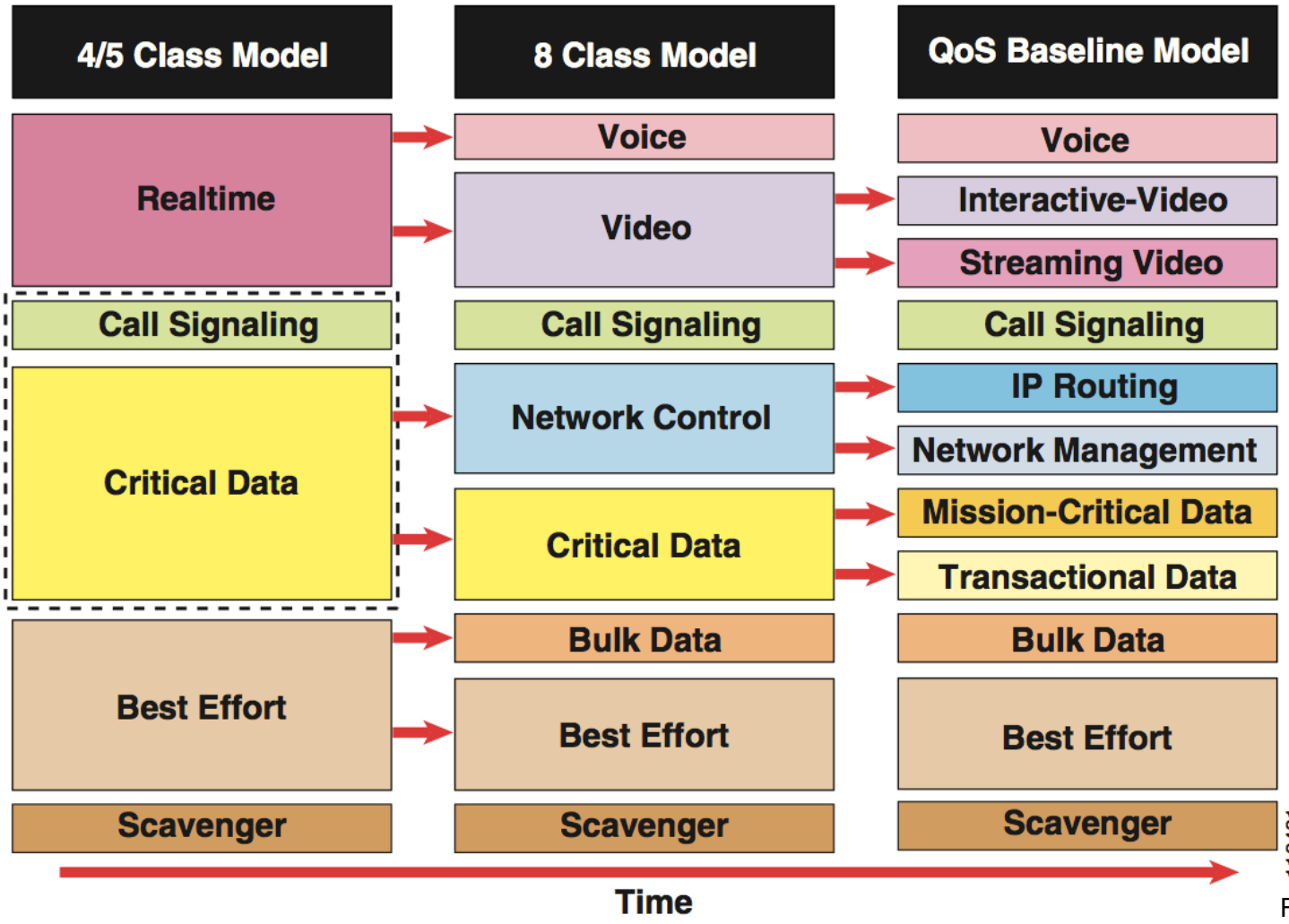
An Approach to Handling Video

- **Design QoS with CxO buy-in and support**
  - Everyone thinks their traffic is the most important
- **Questions to answer:**
  - Which video apps get priority over other video apps?
  - How much bandwidth to allocate to video?
  - Is video limited to a maximum bandwidth?
  - Are some data apps more important than some video?
  - Should access control (CAC) be used?
- **How will video be identified?**

Quality of Service (QoS)

- **Prioritize different types of network traffic**
  - Allocate bandwidth for each traffic type
- **QoS mechanisms**
  - Classification: identify the traffic types
  - Marking: mark each traffic type with L2 or L3 tags
  - Queuing and forwarding: handling the data
- **QoS design can be challenging**
  - Competing interests for network bandwidth
  - Everyone thinks their traffic is the most important
  - Determine traffic classes and bandwidth allocations
- **QoS is only used when congestion occurs**

QoS Traffic Classes

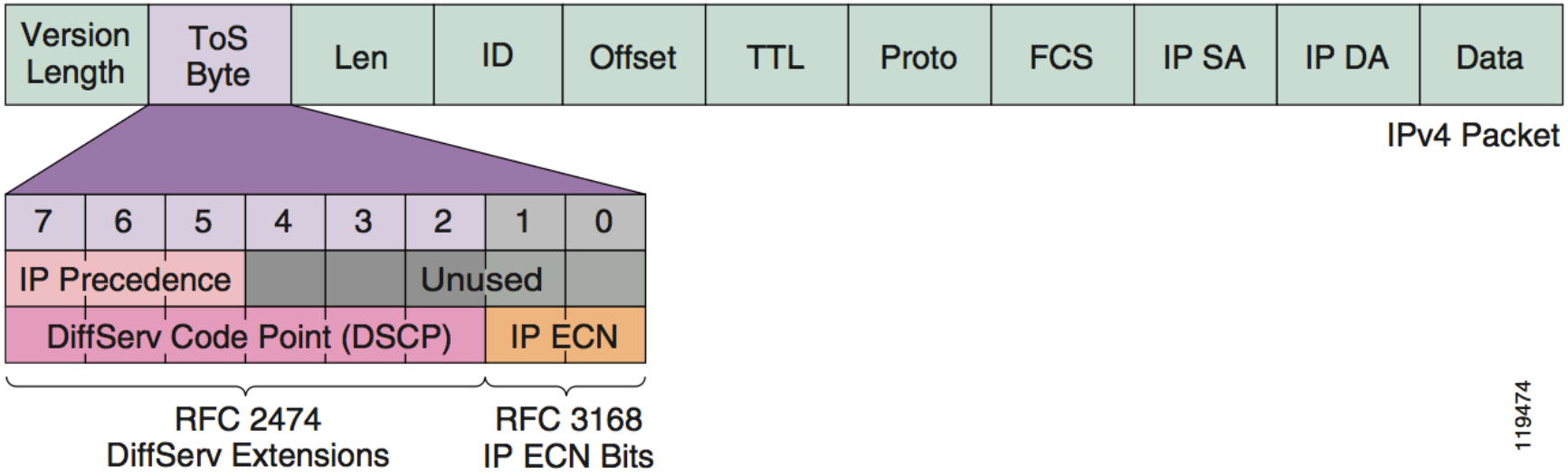


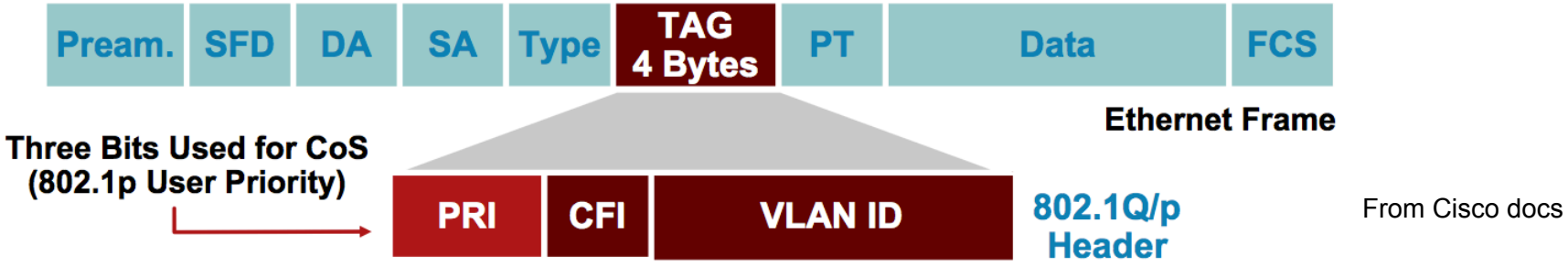
From Cisco docs

QoS Classification and Marking

- **Classification and marking at network ingress**
- **Packet type is identified by its characteristics**
  - **IP address (Access Control List)**
  - **TCP/UDP port number (Access Control List)**
  - **Packet inspection (Network-Based App Recognition)**
- **Add Markings**
  - **Layer 3: Differentiated Services Code Point**
  - **Layer 2: Class of Service**
- **Markings are used by other devices to determine forwarding behavior**

QoS Marking





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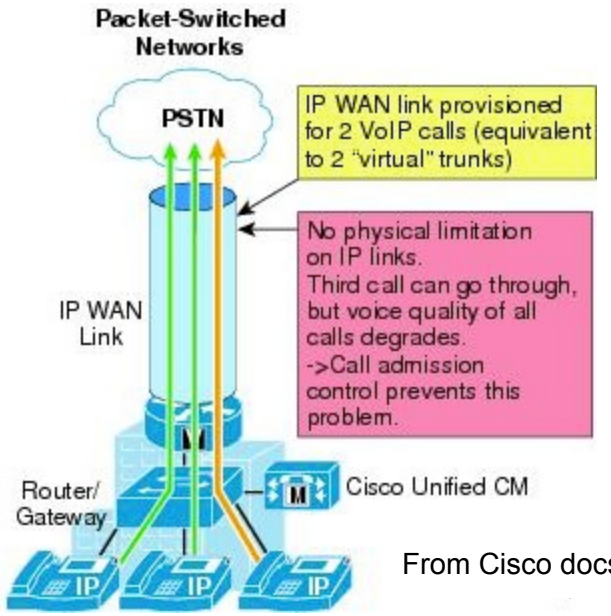
QoS Example: Healthcare

QoS Classes / Applications	Recommended Layer 3 QoS Markings		IPP / CoS	
	PHB	DSCP		
Network Control	CS6	48	6	
Voice / IP Telephony Clinical Life Critical	EF CS5	46 40	5 5	5 %
Multimedia Conferencing Real-Time Interactive	AF41 CS4	34 32	4 4	10 %
Multimedia Streaming Call Signaling	AF31 CS3	26 24	3 3	10 %
Low-Latency Data OAM (Net Mgmt)	AF21 CS2	18 16	2 2	15 %
High-Throughput Data Low-Priority Data	AF11 CS1	10 8	1 1	50 %
Best Effort	0	0	0	

- QoS only applies when congestion exists!

Call Admission Control (CAC)

- Don't allow a call when bandwidth is insufficient
- CAC Methods
  - Local determination
    - Counting calls
    - Measuring bandwidth
  - Measurement
    - Based on brief tests
    - E.g., Cisco IP SLA
  - Resource Reservation Protocol (RSVP)
    - Verifies sufficient path bandwidth
  - CAC Reference: http://www.cisco.com/en/US/docs/voice_ip_comm/cucm/srnd/8x/cac.html



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Network Engineering

- Identify the potential congestion points
- Design sufficient network capacity at the congestion points
  - Be careful where MCUs are located
- Don’t put more traffic in a queue than the queue’s bandwidth can handle
- On-going monitoring of queue stats

Adding Network Bandwidth

- More bandwidth is sometimes the answer
- Applications are slow even after QoS
  - Are links in the path oversubscribed?
  - More bandwidth may be required
- Business requirements change
  - The network must adapt
  - Challenge: identify the need before it is critical

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Continuous Monitoring

- **Packet loss in audio/video endpoints**
  - **RTCP data**
  - **CDR/CMR data (Call Detail Record/Call Maintenance Record)**
- **Application server TCP retransmissions**
  - **Quantity depends on your network**
  - **Part of TCP's flow control**
  - **Look for excessively large counts**
  - **Use *netstat -p tcp***

Summary

- Video volume is increasing
  - Controlling the sources is difficult
- Identify the video in your network
- Handle all video with QoS and CAC
  - Both wanted and unwanted
- Network monitoring to detect video's impact
- Be prepared to add bandwidth when needed

Questions?

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