

Introduction to Traffic Management and Quality of Service Technology

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Agenda

- Why Traffic Management Is Important?
- What Is QoS?
- How to Deploy QoS for Traffic Management?
- What Are Some of QoS Enabled Services?



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High Cost of Non-Responsiveness



Brokerage Operations = \$6.45 Million

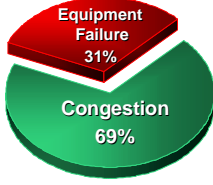
Credit Card Authorization = \$2.6 Million

Airline Reservations = \$89,500

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The Cost of Congestion

Costs of Productivity Loss Due to Network Downtime



Congestion 69%

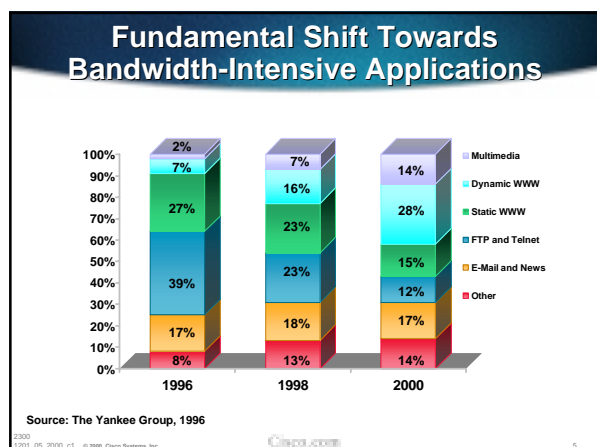
Equipment Failure 31%

“ Congestion-related performance degradation has been found to cause the majority of network downtime costs ”

Michael Howard
President, Infonetics Research

©1997 Infonetics Research, Inc.,
Business-Centric Network Management and Downtime Costs 1997

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Not All Traffic Is Equal

| | Voice | FTP | ERP and Mission-Critical |
|------------------------------|-----------------|------------------|--------------------------|
| Bandwidth | Low to Moderate | Moderate to High | Low |
| Random Drop Sensitive | Low | High | Moderate To High |
| Delay Sensitive | High | Low | Low to Moderate |
| Jitter Sensitive | High | Low | Moderate |

Traffic Is Grouped into SLAs

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What Is Quality of Service?

“ Collection of technologies which allows applications/users to request and receive **predictable service levels** in terms of data throughput capacity (**bandwidth**), latency variations (**jitter**) and **delay** ”

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QoS Models

- Provisioned QoS
Differentiated services
- Signaled/dynamic QoS
Integrated services(RSVP)

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Step 1: Identify Traffic and its Requirements

- Network audit
What is running and when?
- Business audit
How important is it for business?
- Application audit
What are its requirements from network?
- Service levels required

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Network Audit

- NetFlow
Provides information on various traffic flows in the network
- Protocol discovery
Discovers what bandwidth intensive applications are running on the network
- Sniffer

How much bandwidth should I guarantee to my mission-critical applications?

Are there any non-mission-critical applications I should police?



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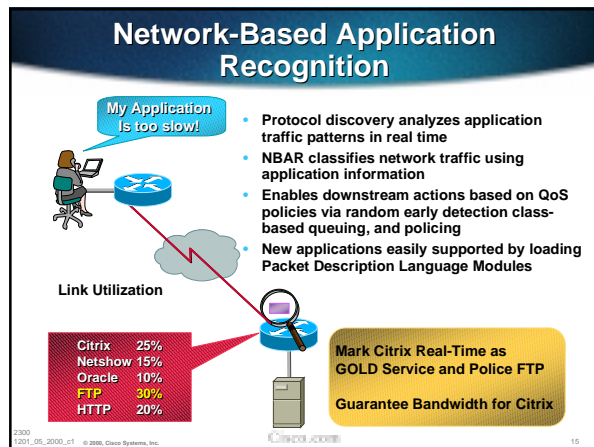
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What Is a Class?

- **Single user**
Mac address, IP address...
- **Department, customer**
Sub net, interface...
- **Application**
Port numbers, URL...

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What Is Coloring?

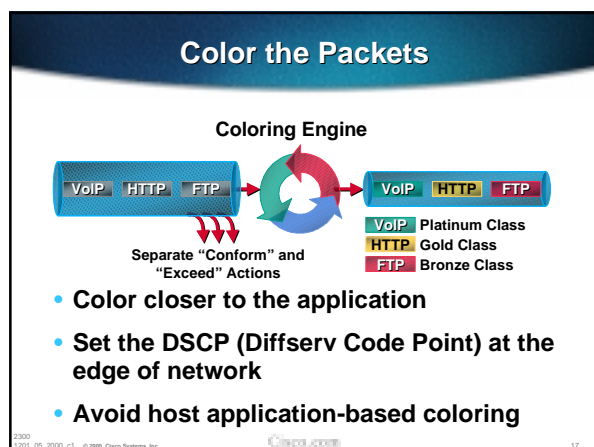
Standard IPv4: Three MSB Called IP Precedence (DiffServ Code Point Uses Six MSB's)

Layer 3 IPv4

| | | | | | | | | | | |
|----------------|------------|-----|----|--------|-----|-------|-----|-------|-------|------|
| Version Length | ToS 1 Byte | Len | ID | Offset | TTL | Proto | FCS | IP-SA | IP-DA | Data |
|----------------|------------|-----|----|--------|-----|-------|-----|-------|-------|------|

- Use this information to define QoS policies

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Step 3: Define Policies for the Classes

- **Minimum bandwidth guarantee**
This is the minimum guaranteed bandwidth to the class all the time
- **Give priority to the class**
Class is treated in a strict priority manner
- **Maximum bandwidth limits**
This is the maximum amount of bandwidth class will ever get
- **Congestion management**

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Minimum Bandwidth Guarantee/ Priority for a Class

“

Policy required:

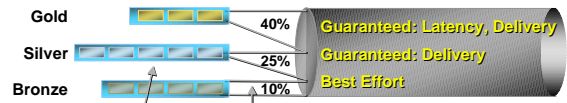
Make sure my platinum class gets a priority treatment and gold class gets a minimum bandwidth guarantee”

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Scheduling



Step 1: Define Buffering
Step 2: Define Bandwidth

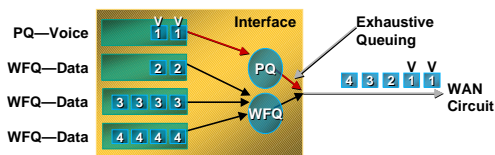
- Weights guarantee minimum bandwidth
- Buffering controls latency
- Unused capacity is shared amongst the other classes
- Each queue can be separately configured for QoS
- Benefits:
 - Maximize transport of paying traffic
 - No loss of service class guarantees
 - No wasted bandwidth as with PVCs

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Low Latency Queuing

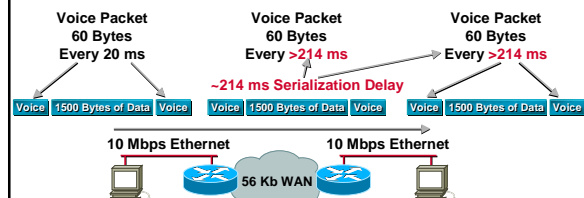


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Large Packets “Freeze Out” Voice



- Large packets can cause playback buffer underrun, resulting in slight voice degradation
- Jitter or playback buffer can accommodate some delay/delay variation

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Fragmentation Recommendations Assuming 10 ms Max Blocking Delay “Rules of Thumb”

10 ms/Time for 1 Byte at BW = Fragment Size

| Link Speed | Frag Size |
|------------|------------|
| 56kbps | 70 Bytes |
| 64kbps | 80 Bytes |
| 128kbps | 160 Bytes |
| 256kbps | 320 Bytes |
| 512kbps | 640 Bytes |
| 768kbps | 1000 Bytes |
| 1536kbs | 2000 Bytes |

Fragmentation Not Needed if Max Frame Size Is 1500 Bytes

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Link Fragmentation and Interleave(LFI)



- Fragment large packets and interleave with voice packets over WAN links
- Reassemble at other end of link
- Reduces voice delay and jitter

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RTP Header Compression

- Header is 2x size of voice data (40 vs 20 bytes)
- RTP Header Compression (CRTP) reduces header to 2–4 bytes
- Used hop-by-hop on slow links



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Maximum Rate Limiting

Policy required:

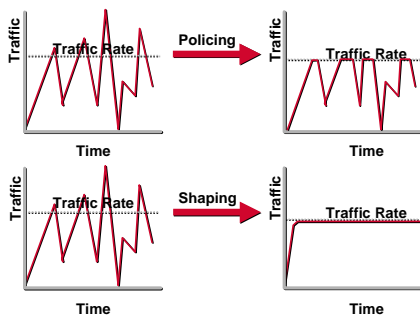
Make sure my bronze traffic does not get more than x kbps of bandwidth at any time

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Traffic Policing vs. Shaping

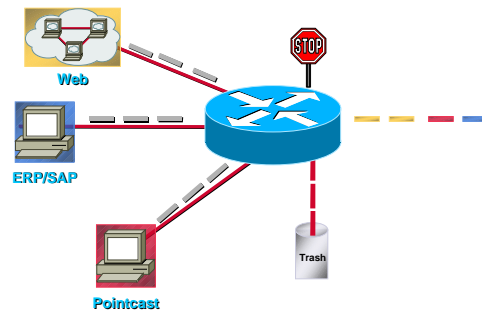


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Policer



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Shaper



- Reduces outbound traffic flow to avoid congestion (via buffering)
- Eliminates bottlenecks in topologies with data rate mismatch
- Provides mechanism to partition interfaces to match far-end requirements

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Congestion Avoidance

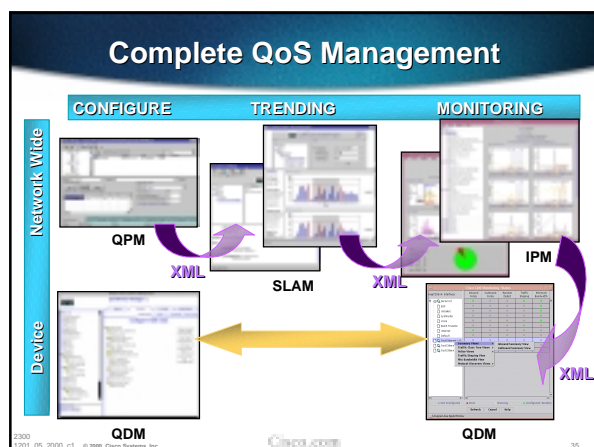
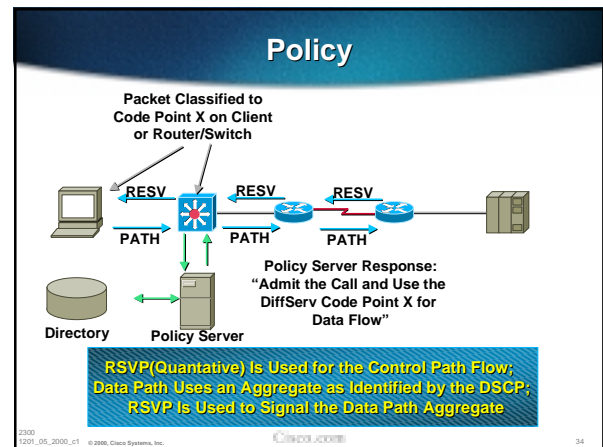
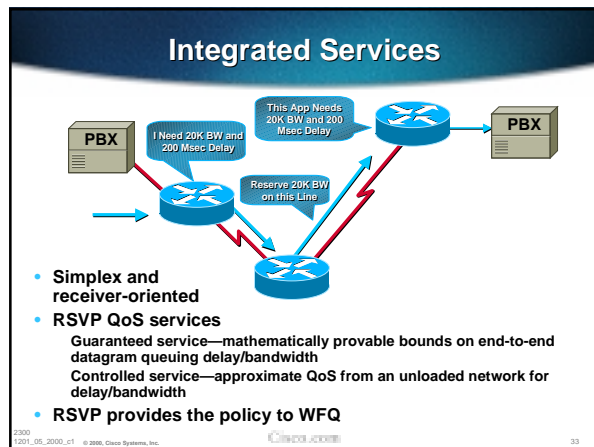
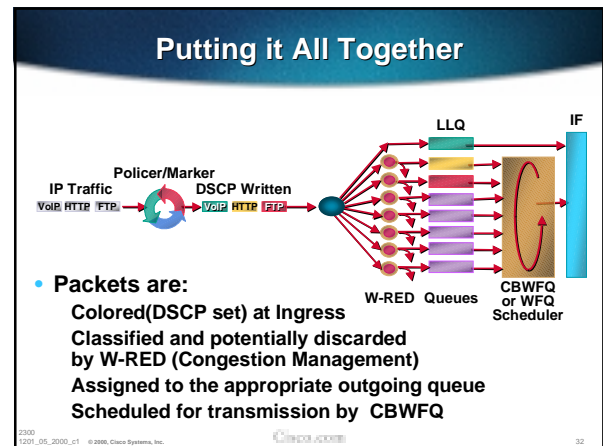
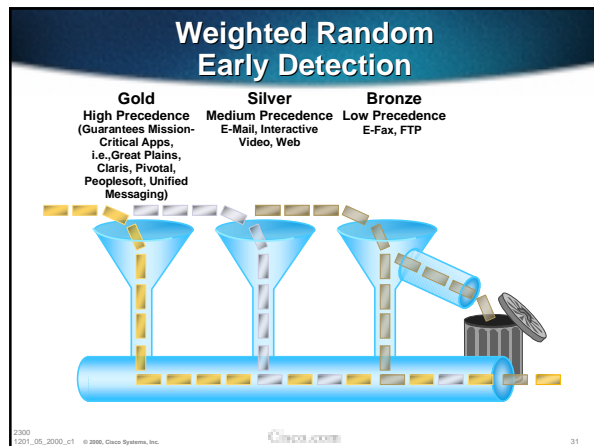
Policy required:

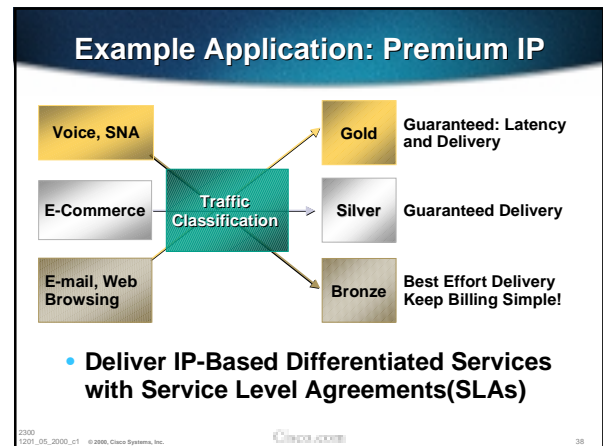
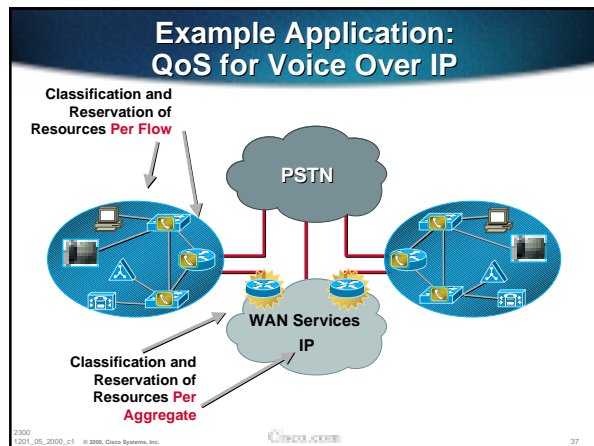
Make sure my bronze or silver traffic gets dropped when there is congestion and not gold traffic

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Summary

“ QoS Is Managed Unfairness ”

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