

Managing QoS – Overview

Presented by:
Dr. Peter J. Welcher



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About the Speaker

- **Dr. Pete Welcher**
 - Cisco CCIE #1773, CCSI #94014, CCIP
 - Network design & management consulting
 - Stock quotation firm, 3000 routers, TCP/IP
 - Second stock quotation firm, 2000 routers, UDP broadcasts
 - Hotel chain, 1000 routers, SNA
 - Government agency, 1500 routers
 - Teach many of the Cisco courses
- **Enterprise Networking Magazine articles**
 - <http://www.netcraftsmen.net/welcher/papers>



Objectives

- **Upon completing this chapter you should be able to:**
 - Describe the various kinds of data available from Cisco devices
 - Describe how these provide information useful in monitoring QoS
 - List the various Cisco and other network management tools useful for QoS
 - Describe what each can do

Topics

- **Device Instrumentation**
 - What numbers can we get from the devices?
- **Management Tools**
 - How can we easily obtain and report on QoS-related information?

Cisco IOS Show Commands

```
router#show policy int ser 0/1
Serial0/1
Service-policy output: LowLatency_policy
Class-map: Video (match-all)
  568 packets, 34299 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
Match: access-group 20
Weighted Fair Queueing
  Strict Priority
  Output Queue: Conversation 264
  Bandwidth 480 (kbps) Burst 30000 (Bytes)
  (pkts matched/bytes matched) 89/5721
  (total drops/bytes drops) 0/0
```



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Cisco IOS Show Commands – 2

```
Class-map: CitrixTraffic (match-all)
  11732930 packets, 984749687 bytes
  5 minute offered rate 9000 bps, drop rate 0 bps
Match: protocol citrix
Weighted Fair Queueing
  Strict Priority
  Output Queue: Conversation 264
  Bandwidth 128 (kbps) Burst 64000 (Bytes)
  (pkts matched/bytes matched) 1514981/144665671
  (total drops/bytes drops) 493/651164
```



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Cisco IOS Show Commands – 3

```
Class-map: class-default (match-any)
  115679537 packets, 50257153828 bytes
  5 minute offered rate 1211000 bps, drop rate 0 bps
Match: any
  Weighted Fair Queueing
  Flow Based Fair Queueing
  Maximum Number of Hashed Queues 256
  (total queued/total drops/no-buffer drops) 0/6/0
```

SAA

- **Cisco Service Assurance Agent (SAA)**
 - Former Response Time Reporter (RTR) with extensions
 - SAA sends simulated traffic and measures round-trip times, and frame loss rates
 - Single packets or now scripted transaction sequences (as of 12.2(2)T)
 - Bounce traffic off real host or another router
 - *You already have it: included in every post-12.0 IOS image!*
 - No need to buy and maintain separate Windows/Linux boxes and software to do this
 - SAA can send SNMP traps if the round-trip time exceeds a threshold (single time, repeatedly, or other variants)

SAA: What It Can Measure

- **SAA can send and measure round-trip times or server response times using:**
 - SNA PU/LU echo, or SSCP-RU echo, DLSw+
 - ICMP path echo
 - TCP or UDP to a port
 - Simulated VoIP, repeated measurements w/ jitter
 - DNS or DHCP
 - HTTP Get of a URL
 - FTP

SAA in 12.2(2)T Adds...

- **Scripted transaction round-trip times for:**
 - Frame Relay
 - IP/TV
 - LDAP
 - Lotus Notes “send email”
 - NNTP
 - Arbitrary Ascii/Binary/Hex pattern
 - POP3 email retrieval
 - SAP (several activities)
 - SMTP send email emulation

Class-Based MIB

- **The Class-Based Quality of Service MIB stores information about Modular QoS CLI.**
 - CISCO-CLASS-BASED-QOS-MIB
 - CISCO-CLASS-BASED-QOS-CAPABILITY-MIB

CB MIB – Per-Policy Entry Info

- **For each Class in a CBWFQ configuration, CB QOS MIB tracks:**
 - HC packet counts, byte counts, and bit rates
 - For each of these, statistics are available pre-policy, post-policy, and for drops

CB MIB – Other Statistics

- **Statistics tables for:**
 - Matches to each rule (packets, bytes, bit rate)
 - Policing
 - Queuing
 - Shaping
 - WRED
- **Where have we seen this sort of information before?**
- **This information is reported on by QDM, QPM (later)**

DSMON

- **The Differentiated Services Monitoring (DSMON) MIB monitors network traffic usage of DSCP values (RFC 2474).**
 - Determine network throughput for traffic associated with different DSCP values.
 - This data can be analyzed to "tune" DSCP allocations within a network, based on the QoS policies for that network.
 - Network managers can also guard against QoS policy violations by monitoring DSCP usage by applications other than the designated ones.

NetFlow Export

- **A NetFlow data record includes:**
 - Source and destination IP address
 - Source and destination TCP/User Datagram Protocol (UDP) ports
 - **Type of service (ToS)**
 - Packet and byte counts
 - Start and end timestamps
 - Input and output interface numbers
 - TCP flags and encapsulated protocol (TCP/UDP)
 - Routing information (next-hop address, source autonomous system (AS) number, destination AS number, source prefix mask, destination prefix mask)



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QoS Data Export – Per Class Info

- **For data from a physical port:**
 - Export type ("4" for a classmap and port)
 - Class map name
 - Direction ("in")
 - Slot/port
 - Number of in-profile packets
 - Number of packets that exceed the CIR
 - Number of packets that exceed the PIR
 - Time stamp
- **Per-VLAN and Port Channel data is similar**



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PFC QoS Export – Policer Info

- **For a named aggregate policer:**
 - Export type ("3" for an aggregate policer)
 - Aggregate policer name
 - Direction ("in")
 - PFC or DFC slot number
 - Number of in-profile packets
 - Number of packets that exceed the CIR
 - Number of packets that exceed the PIR
 - Time stamp

Basic RMON

- **RMON version 1 probes collect Layer 2 info:**
 - [Statistics \(frames, bytes, collisions, errors, unicasts, multicasts, broadcasts, etc.\)](#)
 - [History \(short-term, long-term\)](#)
 - Hosts (observed MAC addresses)
 - Host TopN (top N hosts for various statistics)
 - Matrix (Conversations by MAC address)
 - [Alarm / Event \(thresholds and SNMP traps\)](#)
 - Packet Filter / Capture
- **Mini-RMON in Cisco switches provides just the groups shown in [red](#)**

Advanced RMON

- **RMONv2: similar groups for Layer 3, 4, 7 protocols**
- **SMON: counts by VLAN or switch port**
 - Standard multi-vendor MIB
- **ART (Application Response Time) MIB: NetScout version of this**
- **APPMON: round trip times per application**
 - Standard MIB for retrieving RTT data
 - From either SAA or ART probe as a data source

Which Devices Do What?

Routers	SAA, RMON thresholds NetFlow export, CB MIB
Switches	Mini-RMON, NetFlow export PRC QoS data export (esp. in IOS for switches), TopN reports
NAM and NetScout probes	CB MIB (NAM only) RMONv2 SMON, DSMON, ART MIB

Topics

- **Device Instrumentation**
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Managing QoS: Cisco Products

- Cisco **QoS Policy Manager (QPM)**
- Cisco **QoS Device Manager (QDM)**
- Cisco **Internetwork Performance Manager (IPM)**
- Cisco **Service Management Solution (SMS)**
 - Service Level Manager (SLM) and Collection Managers
- Cisco **Network Analysis Module (NAM)**

QoS-Related Cisco Partners

- **Concord**
- **InfoVista**
- **Others**
- **See also** http://www.cisco.com/pcgi-bin/ecoa/Search?choose_category=EMBU&the_examples=Select%20All&the_examples1=Select%20All



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QPM

- **Cisco QoS Policy Manager (QPM)**
 - Graphical interface (GUI) for configuring QoS across many of the Cisco routers and switches
 - Manages QoS across the network
 - Sends configurations out to devices
- **QPM 2.0 includes and can use a multi-vendor standard — COPS (Common Open Policy Server) Protocol**
 - COPS dropped from QPM 2.5
 - QPM 3.0 (Win2000) now available
- **QPM 3.0 can report based on CB MIB**



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QDM

- **Cisco QoS Device Manager (QDM) version 2.1**
 - FREE!
 - Download from CCO, put into flash on 7200, 1700, 2600, 3600, 7100, 7200, 7500 VIP, 7600, 6500*
 - Point your browser, configure or monitor (graph) QoS on that one device
 - Graphs similar to CB MIB reports
 - “*Training wheels for QoS*”
 - But **VERY** useful!
- [See also PDM, which manages PIX configuration similarly]



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IPM

- **Cisco Internetwork Performance Manager (IPM)**
 - Comes bundled with CW2000 RWAN bundle
 - You may already have it and just haven't looked at it
 - Configures the SAA feature in multiple routers (using SNMP sets)
 - Doesn't set up the scripted SAA monitoring, yet
 - SNMP-configured SAA does **NOT** show up in running configs!
 - Collects historical or real-time SAA round-trip time data and graphs it
 - Multiple samples from multiple routers collected
 - View one at a time
 - Good ad hoc reporting and troubleshooting tool, fine for small to intermediate networks



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SMS/SLM

- **Cisco Service Management Solution (SMS)**
 - Service Level Manager (SLM) and Collection Managers
 - “Industrial strength” configuration, data collection, reporting of SAA data
 - Can supplement the SMS/SLM reporting with Concord or InfoVista if their reports add enough value to be worth the money to you

Summary

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Questions

Any Questions?



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A Word From Us ...



- **We can provide**
 - Network design review: how to make what you have work better
 - Periodic strategic advice: what's the next step for your network or staff
 - Network management tools & procedures advice: what's right for you
 - Implementation guidance (your staff does the details) or full implementation
- **We do**
 - Small- and Large-Scale Routing and Switching (design, health check, etc.)
 - IPsec VPN and V3PN (design and implementation)
 - QoS (strategy, design and implementation)
 - IP Telephony (preparedness survey, design, and implementation)
 - Call Manager deployment
 - Security
 - Network Management (design, installation, tuning, tech transfer, etc.)



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Cisco Certifications

Chesapeake Netcraftsmen
is certified by Cisco in:



- IP Telephony
- Network Management
- Wireless
- Security
- (Routing and Switching)



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