

Cisco Bandwidth Quality Manager 4.0

Product Overview

Cisco® Bandwidth Quality Manager (BQM) 4.0 is a next-generation network performance management product that helps enable customers to monitor and provision their network for controlled levels of latency and loss performance. The control of network latency and loss is a vital ingredient in delivering maximum performance for networked applications.

- Data centers hosting desktop virtualization applications like Citrix and Web 2.0 services often exhibit poor performance if the network exhibits uncontrolled or intermittently high levels of latency.
- Collaborative applications like Cisco TelePresence require consistent delivery of controlled latency and low jitter in the network.
- Algorithmic trading and distributed grid computing require ultralow levels of network latency and loss (typically less than 5 milliseconds and no packet loss).

Cisco BQM 4.0 implements a broad set of patented and patent-pending traffic measurement and network analysis technologies that give the user unprecedented visibility and understanding of how to optimize the network for maximum application performance.

Cisco BQM is part of the Cisco Network Application Performance Analysis Solution. This solution is a set of tools and services that help customers quickly isolate application performance problems and optimize their networks for current and future applications to help ensure that they meet their information technology performance and cost objectives.

Cisco BQM is now supported on the product family of Cisco Application Deployment Engine (ADE). The Cisco ADE product family is the platform of choice for Cisco network management applications.

Product Benefits

The principle benefits of the BQM solution are:

- Unprecedented visibility of network events that affect application latency and loss increases confidence in the network's ability to handle latency-sensitive applications.

Cisco BQM microvisibility is the ability to detect, measure, and analyze latency, jitter, and loss affecting traffic events down to microsecond levels of granularity with per packet resolution. This helps enable Cisco BQM to detect and determine the impact of traffic events on network latency, jitter, and loss. It is critical to measure at this level of granularity as a traffic microburst on a data center Gigabit Ethernet LAN, lasting only tens of milliseconds, can easily cause hundreds of milliseconds of queuing latency and thousands of lost packets on the WAN.

- Rapid troubleshooting of network congestion issues reduces the time, effort, and uncertainty involved in resolving issues.

Cisco BQM detects network quality performance (congestion) violations against user-specified thresholds in real time on all interfaces. Simultaneously Cisco BQM operates a background rolling packet capture. Whenever a threshold violation or other potential

performance degradation event occurs, it triggers Cisco BQM to store the packet capture to disk for later analysis. This allows the user to examine in full detail both the application traffic that was affected by performance degradation (“the victims”) and the traffic that caused the performance degradation (“the culprits”). This victim/culprit analysis is vital to understanding what is really happening during performance outages and what needs to be done about it.

- Understanding how to provision the network for the desired level of latency and loss cuts the cost and time to support latency-sensitive applications on the network.

Cisco BQM monitors per packet network performance against user-specified quality targets for delay and loss to provide definitive early indication of network performance degradation. Because it operates at the network layer, Cisco BQM is then able to provide detailed bandwidth and quality of service (QoS) policy provisioning recommendations, which the user can directly apply to achieve desired network performance.

For additional information of how Cisco BQM is applicable to various environments, please refer to the White Papers located at <http://www.cisco.com/go/bqm>

Product Description

Cisco BQM is available on the entire range of the Cisco ADE product family, from low-end remote-office appliances to high-end data center appliances. The appliances are deployed using either one or more Switched Port Analyzer (SPAN) mirrored ports, or passive optical/electrical taps. The appliances support a range of Fast Ethernet, Gigabit Ethernet, and 10 Gigabit Ethernet monitoring port options.

All monitoring, analysis, reporting, and configuration functionality is available through an intuitive Web interface. Secure Shell (SSH) Protocol and Telnet access to a Cisco IOS® Software-like command-line interface (CLI) is also supported.

Please see below for a detailed specification of the supported appliances.

Cisco BQM 4.0 is deployed at IP traffic locations of interest, and the traffic to be monitored is sent to the Cisco BQM appliance through SPAN ports or passive taps.

Cisco BQM Functions

- Network Service Quality: Cisco BQM measures the loss, latency, and jitter experienced by the actual application traffic between any two BQM appliances in the network. By passively observing the packets at two or more locations and sending “out-of-band” timing information to a designated BQM appliance, extremely precise information on how long each packet was delayed (and whether it arrived at all) is presented to the user.
 - Microsecond end-to-end measurement of latency, jitter, and loss of application packets
 - One-way measurement in both directions
 - Passive – does not affect the application traffic
 - Supports all IP traffic – UDP, TCP, multicast
 - Layer 7 Deep Packet Inspection (DPI) and automated application discovery and recognition
 - Optional GPS time synchronization interface supported
 - Programmable 1 in n packet sampling (n = 1 – 1000) per class
 - Full multiple QoS class support

- Zero configuration for remote appliances
- Reroute detection for support of dynamic routing, for example, MPLS VPNs
- Expected Quality: Cisco BQM calculates in real time the level of loss and queuing delay expected to be induced by observed traffic as it encounters downstream low speed (bottleneck) links or QoS shaping in the network. It allows the user to understand the amount of performance degradation due to traffic-induced congestion versus performance degradation in the network cloud. Traffic induced congestion can be eliminated by adding the appropriate amount of bandwidth to the identified bottleneck point in the network. If the Expected Quality is a small contributor to the overall end-to-end network service quality, then the addition of local bandwidth is unlikely to help. Expected Quality is also used to estimate the network service quality characteristics from a “one-sided” deployment, that is, in situations where it was not possible or desirable to place a BQM appliance at the remote end.

Expected Quality is computed per packet, and distributions for packet delay and loss are available every five minutes. Supported QoS mechanisms in Cisco BQM 4.0 include:

- FIFO
- Class-Based Weighted Fair Queuing (CBWFQ)
- Low-latency queuing (including traffic policing)
- Link efficiency mechanisms (LFI, cRTP)
- Event Analysis: Cisco BQM allows users to set thresholds for network service quality (loss, latency, jitter), Expected Quality (delay and loss), Corvil Bandwidth (delay protected, loss protected), and Traffic Insight (microburst rate, packet rate, and so on) measurements. These thresholds define bounds of normal or expected levels of performance on each managed connection. If any threshold is violated, Cisco BQM triggers a 10-second leading and trailing trace capture around the event, and a quality violation alert is raised (optionally causing e-mail notification or a Simple Network Management Protocol [SNMP] trap). The event traces record every packet on a managed interface including:
 - Packet-size and hardware-resolution time stamp
 - IP source and destination addresses and ports
 - Recognized application
 - Measured end-to-end delay
 - Expected bottleneck delay, and whether dropped or policed
 - Corvil Bandwidth (bandwidth required to protect the packet)

Cisco BQM provides postevent analysis capabilities at the site, class, application, conversation, or even packet level. The GUI presents all statistics measured during the event including:

- Time series and distributions
- Top-N tables (talkers, listeners, applications, and flows)

The user can zoom into any subinterval of interest during an event down to submicrosecond resolution, supporting:

- Fine timescale inspection of critical phases of events
- Detailed “victims” and “culprits” analysis to identify key traffic sources and sinks during events

- **Bandwidth Sizing:** Cisco BQM uses a technology called Corvil Bandwidth to determine the bandwidth required by application traffic to be protected from exceeding user specified quality thresholds. Bandwidth sizing policies for classes or interfaces are expressed using a:
 - Threshold for queue delay (1 millisecond to 1 second) and queue size (1 packet to 2000 packets)
 - Percentage of packets to be protected (1 percent to 100 percent, in 0.0001 percent increments)
 - Period for which protection policy applies (5 minutes; 1, 2, or 4 hours; 1 day; or 1 week)

For example

- **Delay Protected Corvil Bandwidth** – the bandwidth required to protect traffic from experiencing more than 50 ms of queuing delay for 99.99 percent of packets every 5 minutes.
- **Loss Protected Corvil Bandwidth** – the bandwidth required to protect 99 percent of packets from exceeding a queue limit of 128 packets every hour.

Cisco BQM computes Corvil Bandwidth in real time per class or per interface (FIFO) and uses the results to make specific bandwidth and QoS policy recommendations to deliver the required levels of network performance. Specific recommendations include:

- Link bandwidth sizing
- Class bandwidth sizing
- Policer settings
- Queue limit settings
- **Traffic insight:** Cisco BQM contains a Layer 7 Deep Packet Inspection (DPI) engine that operates at microsecond granularity. This provides unprecedented traffic insight and gives a detailed real-time view of how network resources are being used to support the network application environment. Cisco BQM traffic insight includes the following:
 - Autodiscovery of network applications with Layer 7 signatures – approximately 350 signatures built-in, and can be easily expanded
 - Microburst detection of programmable duration from 1 millisecond to 1 second with rate shape analysis
 - Top talkers, listeners, and conversations
 - Reports average link use, packet rate, and packet size distribution
- **Quality Alarms:** Cisco BQM provides for detection and analysis of various events to external systems through fully configurable SNMP traps, syslog streaming, and e-mail alerts. Cisco BQM alarms can be based on violations of the following thresholds:
 - Network Service Quality (end to end loss, latency, jitter)
 - Expected Quality (delay and loss)
 - Corvil Bandwidth (delay protected, loss protected)

Key Features

Table 1 lists the key features and benefits of Cisco BQM 4.0.

Table 1. Features and Benefits of Cisco Bandwidth Quality Manager 4.0

Feature	Benefit
Cisco CLI compatibility	Allows network managers to use current knowledge and existing Cisco router configurations to program CorvilNet
Network Service Indicator	By providing a highly summarized view of network performance end to end, allows network managers to rank links according to congestion status
Corvil Bandwidth	Converts performance requirements into bandwidth and provisioning recommendations
Data center deployment option	Provides a low-operating-cost solution; a single installation can monitor hundreds of remote sites and thousands of classes and estimate delay and loss on hundreds of remote service provider routers
Comprehensive performance event analysis	Provides views into events down to the single packet and provides time stamps with microsecond granularity
End-to-end network performance	Uses patent-pending Passive Network Quality Monitoring (PNQM) technology to measure accurately end-to-end latency, loss, and jitter
Expected Quality	Analyzes the amount of delay and loss that traffic to the remote site will experience based on the bandwidth of the link and the QoS policy implemented; this feature also takes into account bandwidth sharing between classes
Export packet capture (optional)	Captures traffic and exports it to other analysis tools without the need for an additional network probe; standard Packet Capture (PCAP) format provides compatibility
Microburst detection	Sees traffic bursts as they are being injected into the network; detects microbursts from 1 millisecond to 1 second of duration
Multiprotocol Label Switching (MPLS) and VLAN support	Provides visibility for any traffic flow of interest including MPLS and VLAN traffic
Multiclass support	Supports monitoring of advanced networks that use QoS mechanisms such as class-based weighted fair queuing and low-latency queuing to optimize network performance
Multiport appliances	Four 10/100/1000 Ethernet ports or two 10G Ethernet ports provide easy support for redundant router configurations
Custom network-monitoring dashboard	User-activated and configurable dashboard provides at-a-glance performance monitoring of interfaces and classes in the network
QoS alarms	Provides alarms to report network performance degradation in real time and integrates with existing SNMP network management systems to provide correlation with other alarms
QoS-sensitive capacity planning	Integrates application requirements of delay and loss, not just bandwidth, into the capacity planning cycle
Remote-site monitoring	Through its logical network model and remote BQM deployment, allows detection of quality alerts in the service provider network
System alarms	Provides warning and alarming mechanisms for system problems related to hardware failures, disk capacity, and use
Top talkers, listeners, and conversations	Provides insight into network use by hosts without the need to configure hundreds of IP addresses or ports
Triggered event traces	Captures event traces according to programmed thresholds of bandwidth, microbursts, latency, and loss; event traces can be used to perform comprehensive congestion analysis and eliminate the need to store terabytes of packet captures

Hardware Requirements

Cisco BQM 4.0 is offered on the Cisco Application Deployment Engine (ADE). Cisco ADE is a high-performance platform for Cisco network management applications. Customers can select the ADE platform that meets their application needs. Additional information can be found at <http://www.cisco.com/go/ade>.

Cisco BQM 4.0 is available on the Cisco ADE 1010, Cisco ADE 2120, Cisco 2130, and Cisco 2140 Series. Cisco BQM 4.0 is also supported on the Cisco BQM 1180 engine. Full details about availability and ordering of the required hardware platform are available from your Cisco sales representative.

Table 2 summarizes the hardware specifications for Cisco BQM.

Table 2. Hardware Specifications

Description	Specification
System	
Maximum monitored throughput	Cisco ADE 1010 Series: 100 Mbps Cisco ADE 2120 Series: 2 Gbps Cisco ADE 2130/2140 (and BQM 1180): 2 Gbps
Maximum number of remote sites monitored	Cisco ADE 1010 Series: 20 Cisco ADE 2120 Series: 350 Cisco ADE 2130/2140 (and BQM 1180): 500
Maximum number of classes monitored	Cisco ADE 1010 Series: 100 Cisco ADE 2120 Series: 1000 Cisco ADE 2130/2140 (and BQM 1180): 2000
Network monitoring interfaces	Cisco ADE 1010 Series: <ul style="list-style-type: none"> • Copper: One 10/100/1000 Mbps port (unaccelerated) Cisco ADE 2120 Series: <ul style="list-style-type: none"> • Copper: One 10/100/1000 Mbps port (unaccelerated), or four 10/100/1000 Mbps ports or • Copper and fiber mix: Two or Four 1000 Mbps ports Cisco ADE 2130 (and BQM 1180): <ul style="list-style-type: none"> • Copper: Four 10/100/1000 Mbps ports, or • Copper and fiber mix: Four 1000 Mbps ports Cisco ADE 2140 Series <ul style="list-style-type: none"> • Copper: Four 10/100/1000 Mbps ports, or • Copper and fiber mix: Four 1000 Mbps ports • Fiber: Two 10 Gbps ports
GPS	Trimble Accutime Gold GPS supported on all platforms
Management	
Management access	Web browser interface, SSH, Telnet, and console
SNMP	Version 2
Syslog	Yes
Out-of-band management	10/100/1000 baseT Ethernet (RJ-45)
Software upgrades	FTP and Trivial FTP (TFTP), or through SSH command to CLI
Deployment	
Deployment options	<ul style="list-style-type: none"> • Switched Port Analyzer (SPAN) mirrored port • Passive tap

Service and Support

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco services help you protect your network investment, optimize network operations, and prepare the network for new applications to extend network intelligence and the power of your business. For more information about [Cisco Technical Support Services](#) or [Cisco Advanced Services](#).

For More Information

For more information about Cisco Bandwidth Quality Manager, visit <http://www.cisco.com/go/bqm>, send an e-mail to bqm-product-info@external.cisco.com, or contact your local Cisco sales representative.



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