Cisco Catalyst 4500 Series Supervisor Engine 6-E Quality of Service

How Is Quality of Service Performed on the Cisco Catalyst 4500 Series?

The Cisco® Catalyst® 4500 Series performs all quality of service (QoS) on the supervisor engine. This enables the Cisco Catalyst 4500 Series line cards to expand their QoS feature set and capabilities by simply upgrading one piece of hardware, the supervisor engine. This is investment protection at its best, enabling all line cards purchased as far back as 1999 to perform enhanced QoS capabilities built into the new Cisco Catalyst 4500 Series Supervisor Engine 6-E. QoS on the Supervisor Engine 6-E has been greatly enhanced over that on previous Cisco Catalyst 4500 Series supervisor engines. Through CenterFlex technology, the Supervisor Engine 6-E has several new functions and capabilities that enable the network administrator to provide better QoS in the same chassis construct. This flexibility is a function of the centralized architecture provided by the Cisco Catalyst 4500 Series, the most widely deployed modular Ethernet switch to date.

What Problems Need to Be Solved?

Today's networks contain a larger variety of advanced applications that require more bandwidth than ever. Unfortunately, providing more bandwidth is not the solution to the advancement and use of today's networks. Bandwidth solves only the initial problem of application starvation. It does not, however, address the requirement to prioritize these applications based on their specific needs. Certain applications require large amounts of bandwidth, but timely data delivery is not a requirement. These applications can hinder voice or video traffic, for which timely data delivery is required. The combination of proper bandwidth utilization as well as the use of QoS is needed to protect time-sensitive and delay-sensitive applications during times of congestion (for example, a worm attack).

Main QoS Features of the Cisco Catalyst 4500 Series Supervisor Engine 6-E

The Supervisor Engine 6-E with CenterFlex technology offers a rich suite of QoS features for small, medium, and large enterprise customers. In its most basic form the QoS features provide:

- Traffic classification
- Policing and marking
- Congestion avoidance
- Queueing and scheduling (based on the priority of traffic)

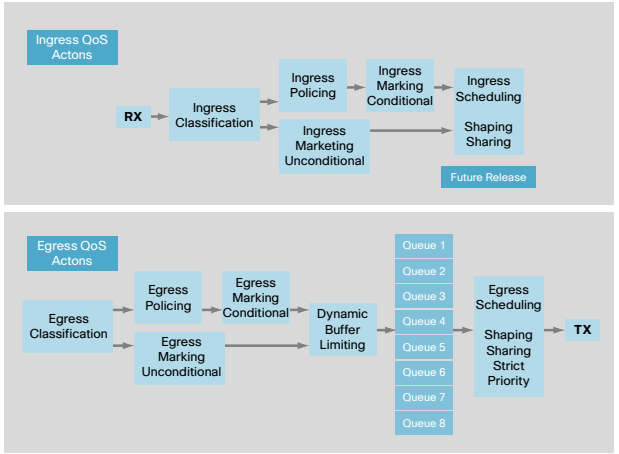
Traffic classification: The use of classification provides a way for the switch to identify specific traffic so that it can determine what level of service needs to be applied to that data. Identification can be achieved by a number of means, such as inspecting primary fields in the packet header or looking at the port of arrival. The main set of classification tools provided by the Cisco Catalyst 4500 Series Supervisor Engine 6-E includes access control lists (ACLs) and table maps. The classification can be based on several fields in an IPv4, IPv6, or Multiprotocol Label Switching (MPLS) packet. These fields include but are not limited to Layer 2 or Layer 3 fields, Layer 2 and Layer 3 fields, QoS groups, packet size, and IP.

Policing and marking: The act of policing in the switch provides a means to limit the amount of bandwidth traffic traveling through a given port, virtual LAN (VLAN), or collection of ports in a VLAN can use. Policing works by defining an amount of data that the switch is willing to send or receive. The Supervisor Engine 6-E can dynamically allocate the number of policers to either ingress or egress, unlike other platforms. It also supports several different policer types, allowing the Cisco Catalyst 4500 Series to be used for several different applications. These policer types include 1Rate 2Color, 1Rate 3Color, 2Rate 3Color, packet policers, Metro Ethernet Forum (MEF) and IETF policers.

Marking is the action of changing the priority setting of the packet. This can be incorporated with policers or table maps to modify traffic based on the actions in either the policer or table map. The overall goal is to provide the most flexible policing possible with an extremely accurate granularity.

Congestion avoidance: Managing queues and buffers is the primary goal of congestion avoidance. As a queue starts to fill up with transient data, it is important to try to make sure that the available memory in the queue does not fill up completely. If this happens, subsequent packets coming into the port will simply be dropped, irrespective of the priority that they could have received. This could have a detrimental effect on the performance of critical applications. Dynamic Buffer Limiting (DBL) is a flow-based algorithm that is used on the Cisco Catalyst 4500 Series Supervisor Engine 6-E. This algorithm inhibits belligerent flows from consuming large amounts of buffers and bandwidth. These flows typically include worm traffic, Spanning Tree loops, and denial-of-service attacks, which are all dynamically removed from your network simply by enabling DBL.

Figure 1. The Supervisor 6-E QoS Pipeline



Queueing and scheduling: Queueing is the QoS mechanism used to empty the queues of data and send the data onward to its destination. The scheduling options available in the Supervisor Engine 6-E are per port, per queue virtual time shaping and sharing (VTSS) and strict priority queuing. The per port, per queue shaping and sharing provide flexible options for enterprise networks with diversified traffic. The Supervisor Engine 6-E includes as many as eight egress queues for traffic placement, including the option of a priority queue. Dynamic buffer allocation in the Supervisor Engine 6-E provides the ability to modify buffering assignments throughout the chassis regardless of the port. Also, the scheduling algorithm provides dynamic bandwidth allocation, such that no bandwidth ever goes unused if a queue is empty.

QoS Innovations on the Cisco Catalyst 4500 Series Supervisor Engine 6-E Enabled by New CenterFlex Technology

CenterFlex technology enables many Supervisor Engine 6-E QoS enhancements, including increased configuration flexibility and ease of use with the Modular QoS CLI (MQC)-compliant command-line interface (CLI). Cisco's MQC CLI is a company standard for QoS that provides configuration simplicity for the network administrator; it is no longer necessary to understand switch-specific configurations. This CLI flexibility extends to all current chassis and line cards and provides them with a larger number of queues, configurable thresholds per queue, configurable per port buffering, dynamic bandwidth allocation, per port and per queue shaping and sharing, and configuration tools such as QoS groups, and table maps. All of these features in the Supervisor Engine 6-E provide the network administrator with a QoS toolkit far more advanced than those of the previous generation of supervisor engines in the Cisco Catalyst 4500 Series.

Deliver a Robust Network with the Cisco Catalyst 4500 Series Supervisor Engine 6-E QoS Feature Toolkit

The Supervisor Engine 6-E also provides Auto QoS, a set of Cisco best-practice predefined macro commands. The architecture helps enable all QoS features with no switching performance degradation.

These features provide what is needed in today's converged networks by allowing a highly customized QoS profile configuration applied to the ports or VLANs for maximum flexibility.