Per Flow QoS.

What is a flow? It is a given type of traffic between sent between a producer device through a network to an endpoint known as a consumer. As the traffic goes through the network it, “flows” through the network, hence the term flow for the traffic action. The next question is whether the flow should be treated different than any other logical flows on the same path.

Quality of Service (QoS) consists of many facets. Its common definition is to denote that traffic of a high enough priority is forwarded over lower priority when both types of traffic are at a point of congestion in the network.

One observant in Ethernet traffic would ask what denotes the Quality of Service (QoS) of one frame or flow over another? Where is the congestion point? What are the forwarding rules?

To answer these questions the IETF, IEEE, and other Standards bodies have defined some standard methods and the industry has also allowed various methods of identifying traffic. These methods range from the IEEE definition of Class of Service (COS) bits and the DEI bit in VLAN headers, to the IETF definition of DiffServ Code Points (DSCP) bits in the IP header. These are one standard methods. However, a VLAN tag could also be used, an Ethertype, a Destination or Source MAC, an IP address either source or destination, etc. Basically, any field that is chosen that puts a flow into a class that defines the flow quality.

Once a flow has been designated, then next step is to determine how it is to be treated. It may be identified as a class that is higher or lower than other traffic. Once identified the traffic may have rules as to how it should be handled explicitly, such as the bandwidth limits for that flow. For example, VoIP traffic is higher priority over other traffic, but the operator may chose to only allow so much in the network so that a rogue device that is masquerading as a VoIP network doesn’t push more traffic of the VoIP type than what would be normally needed. This concept is called ingress policing of traffic.

A another aspect of Quality of Service is what to do when there are multiple flows that in sum require more bandwidth than can be forwarded? This is usually called the congestion point. The amount of forwarding capacity may be through physical constraints such as a 1Gbps interface or it may be enforced through a hardware metering mechanism where the rate is chosen administratively. There are several choices, where flows may be buffered into quality of service queues. Those queues may be drained relative to other quality of service queues depths, or strictly based on only the queue’s need to be serviced. A final metering of all traffic may also be done so that a forwarding path is not overloaded.

Per flow QoS can be summarized as the ability to identify a traffic flow, enable rules on how that specific flow should be treated, and finally how the flow should behave when forwarded with other traffic flows.

From a practical standpoint, most Ethernet switches can identify a flow by having the operator/administrator define the rule of what bits in the frames define a particular flow. The switches can then apply classification rules and ingress policing rules to the flow. Once those have been applied, the traffic is either discarded or placed in a forwarding queue of the defined class for the flow for egress. The egress scheduling mechanisms may apply Weighted Round Robin (WRR) where each class gets a designated amount of bandwidth for egress. Another method is called Strict Priority (SP) where the highest class of service queue, if it has any traffic in it, will receive all the available egress capacity until it is empty. Once it is empty, then the next class gets capacity until it is empty. Finally, all the queues regardless of class or scheduling as WRR or SP may be placed in a final queue for egress that may be metered.

Although this all may sound complicated, it is what help makes a VoIP phone call, an example of a flow, sound good, or a video stream, another example of a flow, not get choppy when there is someone surfing the web (yet another type of flow). If you want Quality of Service in the network to make those things happen, you need to have each step of the way be engineered to handle the traffic. Quality of Service needs to be implemented with quality devices that can perform the classification, policing, scheduling and egress metering functions that are required.