XipLink Class Based Adaptive Quality of Service

Traffic Priorities, Bandwidth Control, Jitter Management, Selective Optimization

ADAPTIVE QUALITY OF SERVICE (QOS) AND APPLICATION PRIORITY

XipLink XipOS offers a highly flexible and configurable Quality of Service solution that adapts to available bandwidth, ensuring optimal traffic and memory management. This is ideal for mission-critical or performance-sensitive TCP applications that require guaranteed bandwidth.

XipLink XipOS offers enterprise-class service assurance with its cutting-edge technologies. XipOS Adaptive Quality of Service (QoS) dynamically adjusts network resources to meet the demands of critical applications, ensuring optimal performance and reliability. Coupled with Realtime Link Intelligence, XipOS provides continuous monitoring and analysis of network links, allowing for immediate issue detection and resolution. Together, these advanced capabilities ensure that a network is robust, efficient, and consistently high performing.

The XipLink XipOS provides several QoS capabilities that work with both internal optimization functions as well as with network-wide QoS services.

QoS connections that meet an operator's defined Differentiated Services criteria can be given preferred access to the available bandwidth, ensuring that mission-critical or performance-sensitive applications receive the bandwidth they need.

XipLink QoS Capabilities

Bandwidth Shaping
- Guaranteed (Minimum)
- Maximum
- Shared

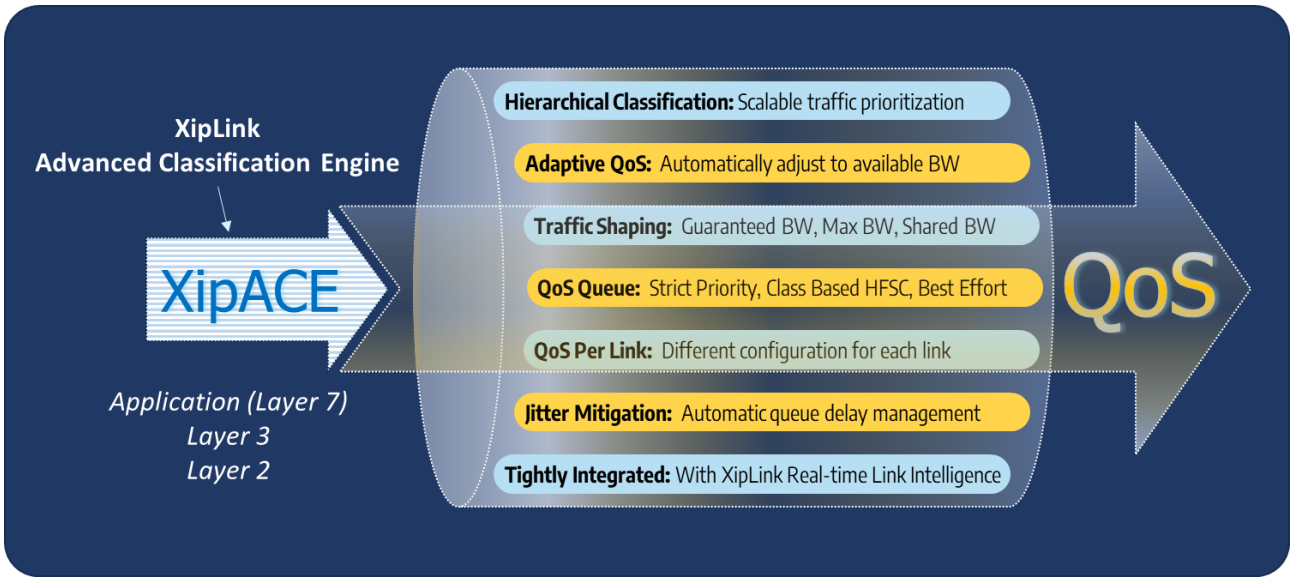
Queues
- Strict priority
- Class-based hierarchical QoS

Traffic Classification
- Advanced classification engine
- Up to Layer 7 (including service types)

Application Priority Fair Access Policy
- Prioritize applications over links with no priority settings

Jitter Management
- Advanced delay management

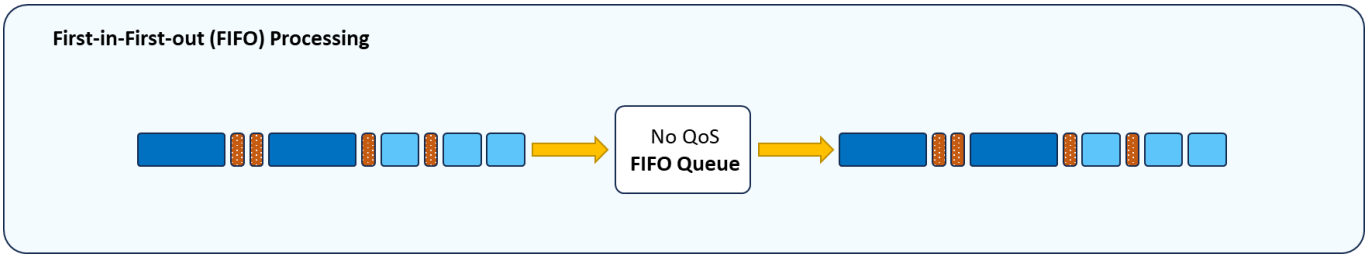
QoS per Link
- QoS setting for each WAN link

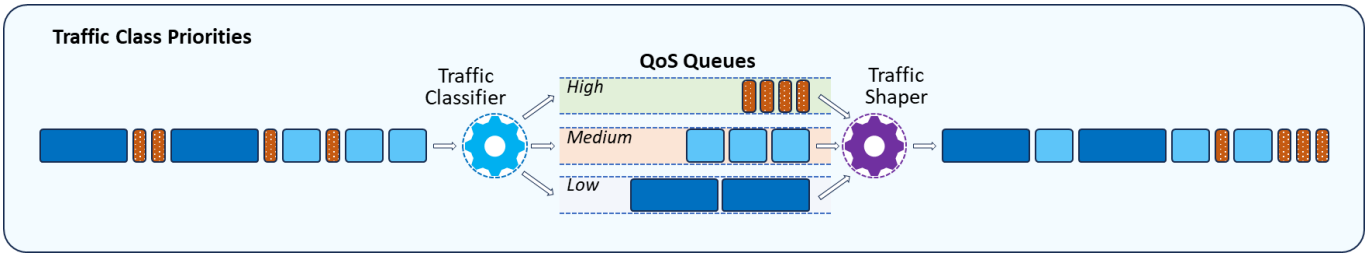


Any XipOS instance can also tag, mark or re-mark specific traffic as it leaves the device. This enables the network operator to deliver an end-to-end integrated QoS system using differentiated user classes or queues. This capability can be used to prioritize some traffic or limit the bandwidth used by others.

QOS OVERVIEW

Quality of Service allows you to classify packets that pass through the device and assign different priorities to different kinds of traffic. Without QoS, traffic passes through the device on a first-in first-out (FIFO) basis. This can degrade performance when the link becomes congested, and it also allows bandwidth-hungry applications such as P2P or bulk file downloads to overwhelm the link and prevent the timely delivery of streaming or interactive protocols. These problems are compounded on links with high round-trip times.

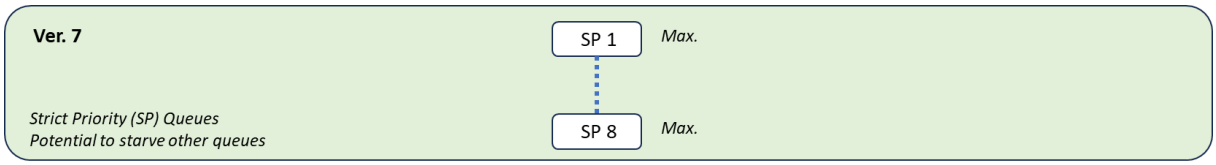




QOS QUEUES

XipOS uses the concept of QoS queues to define traffic priorities and optimization. The queues are arranged in both Strict Priority and in a Class-based Hierarchical Fair Service Curves (HFSC), where each queue has a single parent and zero or more child queues.

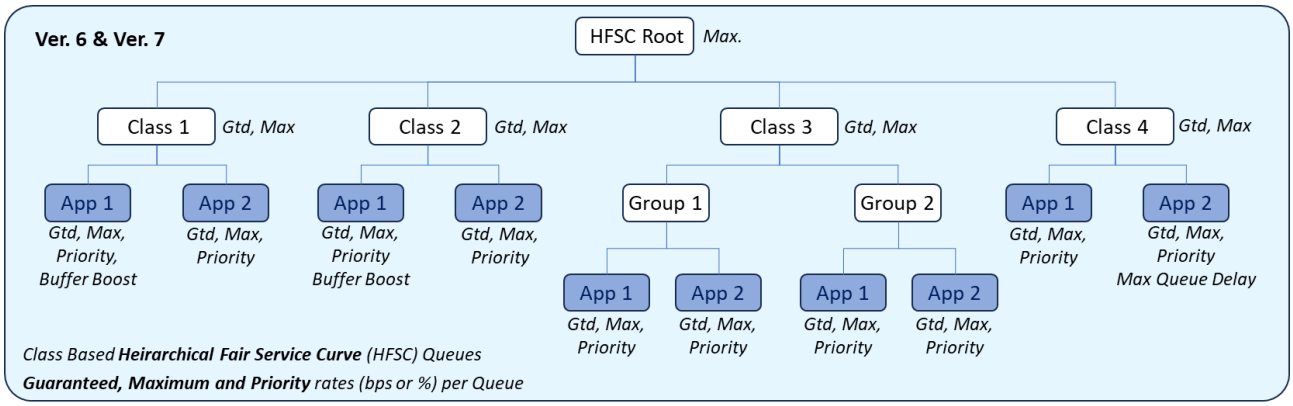
Strict Priority queuing is a Quality of Service (QoS) mechanism that involves dividing packets into separate queues based on their assigned priority levels. The highest priority queue is serviced and emptied before lower priority queues, ensuring that critical data receives immediate transmission, regardless of network traffic load or the presence of lower priority packets. XipOS supports up to 8 Strict Priority queues.



Class-based Hierarchical Fair Service Curves (HFSC) allows proportional bandwidth distribution (supporting equal or unequal bandwidth sharing) as well as control and allocation of latency. Each QoS queue can be configured with three main bandwidth transmission parameters:

- Maximum transmission rate
- Guaranteed transmission rate
- Priority transmission rate

XipOS HFSC supports multiple levels of user defined hierarchy. The hierarchy defines how bandwidth is allocated among the queues. The inviolable rule is: A queue Cannot guarantee (i.e. reserve) more bandwidth than its parent. Furthermore, the sum of all sibling queues' reserved bandwidth cannot exceed the bandwidth reserved by their parent.



All queues in the hierarchy can have a maximum and a guaranteed rate. Leaf queues, since they are the only queues that hold packets, can also have a priority rate.

The maximum rate is an upper limit on the queue's sending rate. Whenever a queue reaches its maximum rate, any additional data is buffered while the queue continues to send at that rate.

The guaranteed bandwidth is the minimum bandwidth given to a queue when the link is saturated. Separating the guaranteed and priority rates allows the system to meet priority delay times under all circumstances. It also means that a queue can send a packet to meet its priority rate even if doing so temporarily violates the guaranteed rate of one of its ancestor queues in the hierarchy. A queue's guaranteed rate can be specified either as an absolute value or as a percentage of its parent's guaranteed rate. A queue with multiple children can have some of its children specify their guaranteed rates as percentages and others as absolute rates.

The priority rate is filled first across all queues. In other words, if there is traffic available in several queues the system will first service the queues that have not yet reached their priority rates. Priority rates should not be oversubscribed. They are typically used for real time protocols like VoIP and other latency-sensitive applications. XipOS queues also have a delay parameter that limits the amount of time a packet can spend in the queue. This allows fine control over jitter and the quality of streaming protocols such as voice calls.

QOS RE-TAGGING

XipOS QoS provides the ability to tag or re-tag packets, such as VLAN ID and DSCP marking, giving operators the flexibility to ensure that traffic is handled according to specific policies that are set based on its importance or the type of service it should receive. QoS retagging allows for dynamic, context-sensitive adjustments to the handling of network traffic, ensuring that resources are allocated appropriately based on current conditions or specific service requirements.

APPLICATION PRIORITY FAIR ACCESS POLICY

A key benefit of XipOS QoS is its ability to prioritize applications over Low Earth Orbit (LEO) services. Typical LEO services treat all applications equally, which can lead to performance issues with critical traffic, such as voice signaling and control, especially during congestion or service degradation. In contrast, XipOS' can bypass LEO service provider's FAP and give control to XipOS' QoS to prioritize critical traffic, ensuring consistent application performance even in a consumer grade network service.

MULTI-PATH NETWORK CAPABILITIES

In a multi-path or multi-orbit networks, QoS configurations can be applied per link in each direction, enabling separate queues and bandwidth management options such as Guaranteed Bandwidth, Maximum Bandwidth, and Shared Bandwidth. XipOS will automatically apply traffic shaping to applications as they failover from one link to another. This enables optimum use of the links and ensures service level agreement compliance.

ADVANCED QUEUE DELAY MANAGEMENT

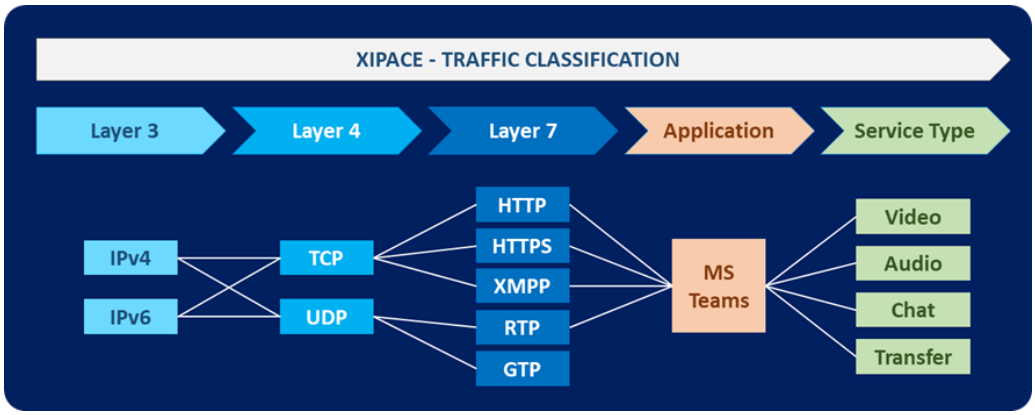
XipLink's sophisticated delay management minimizes jitter, significantly enhancing the user experience for jitter-sensitive traffic. This is extremely important especially in networks carrying traffic such as voice, mission-critical data and any signaling traffic.

TRAFFIC Classification

Traffic classification within the XipLink solution depends on the implemented firmware. XipLink's XipOS has supported classification up to Layer 4 for many years now. XipACE, XipLink advanced classification engine, that has been recently introduced classifies traffic up to Layer 7.

XipACE – Advanced Classification Engine (Deep Packet Inspection)

XipLink's XipACE technology is an industry leading advanced protocol and application classification engine with metadata extraction for application-aware networking. XipACE provides real-time IP network traffic visibility up to layer 7 and beyond. XipACE, based on R&S PACE 2 technology, can identify and classify thousands of applications and protocols and extract metadata in real time, even if traffic is encrypted or obfuscated. R&S PACE 2 uses Machine learning (ML) and deep learning (DL) capabilities to enhance classification accuracy and provide weekly signature updates resulting in the best application detection capability.



Traditional XipOS Traffic Classification

XipOS traditional classification engine can classify traffic up to Layer 4 of IPv4 and IPv6 packets. The options available are.

- **Protocol** – identify a packet according to its Protocol
- **Source Address –** IP address or IP subnet (IPv4 or IPv6)
- **Source Port –** IP Port or Port range
- **Destination Address –** IP address or IP subnet (IPv4 or IPv6)
- **Destination Port –** IP Port or Port range
- **DSCP Mark –** DSCP Mark it has been tagged
- **VLAN Tag –** VLAN Tag it transmits from and to
- **VLAN Priority –** VLAN Priority set
- **MPLS Label –** MPLS Label assigned