

Ethernet QoS Features in FibeAir® IP-MAX

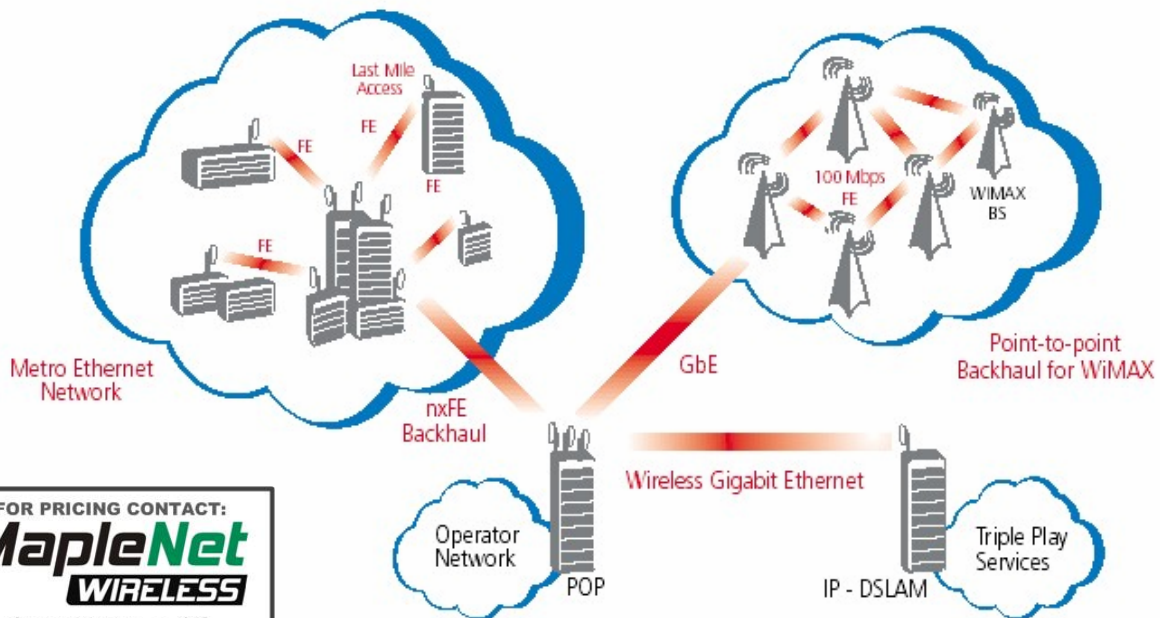
General

FibeAir IP-MAX enables native Ethernet transmission with multiple frequencies, software selectable capacities, modulation schemes and configurations for various network requirements using the same hardware and state-of-the-art technology. The system supports high-capacity data services as well as traditional voice services, with both Ethernet and TDM interfaces.

This innovative platform uses an “on-the-fly” upgrade method, whereby network operators only buy capacity as needed, benefiting from savings on initial investments and OPEX.

The IP-MAX IDU (Indoor Unit) can host up to two carriers, each delivering up to 400 Mbps, optimizing the solution for different network topologies and configurations.

Traffic capacity throughput and spectral efficiency are optimized with the desired channel bandwidth. For maximum user choice flexibility, channel bandwidths can be selected together with a range of modulations, from QPSK to 256 QAM. Two independent hot swappable Indoor unit modules (IDM) can be used for hot-standby HW protection, diversity, East-West configuration or double capacity (2+0).



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QoS in Fast Ethernet IDMs

Quality of service can be defined based on:

- Physical Port - in 2xFE systems only
- L2 VLAN priority bits (802.1p priority bits) - Class of Service
- L3 IPV4 Type of service bits in the IP header
- L3 IPV6 Traffic class bits in the IP header

Packet Classification

The system examines the incoming traffic and assigns the desired priority according to the marking of the packets (based on the user port/L2/L3 marking in the packet). In case of congestion in the ingress port, low priority packets will be discarded first.

Ethernet packets with VLAN tag which do not carry IP (Ethernet management protocols) are prioritized according to VLAN priority bits

Ethernet packets with no VLAN tag which carry IP will be prioritized according to L3 IPv4 TOS or IPv6 TC bits.

Ethernet packets with VLAN tag which carry IP will be prioritized according to user configuration option:

- VLAN (802.1p) - the VLAN tag priority bits
- IPv4/IPv6 - IPv4 TOS or IPv6 TC bits

STP (Spanning Tree Protocol) Frame Prioritization

In radio links that are used to connect switches running spanning tree protocols, it is important to ensure that the BPPU frames (that are transmitted periodically from the switches) are passed with the highest level of priority. If BPDU frames are not received for a certain period of time it will cause the STP to decide that the link is not active (even though there are no problems) due to the fact that BPDU frames were discarded because they did not get the highest priority.

In order to ensure the smooth operation of STP, the system automatically gives the highest possible priority to BPDU multicast frames. Right below this priority are user defined highest priority frames.

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Queuing and Scheduling

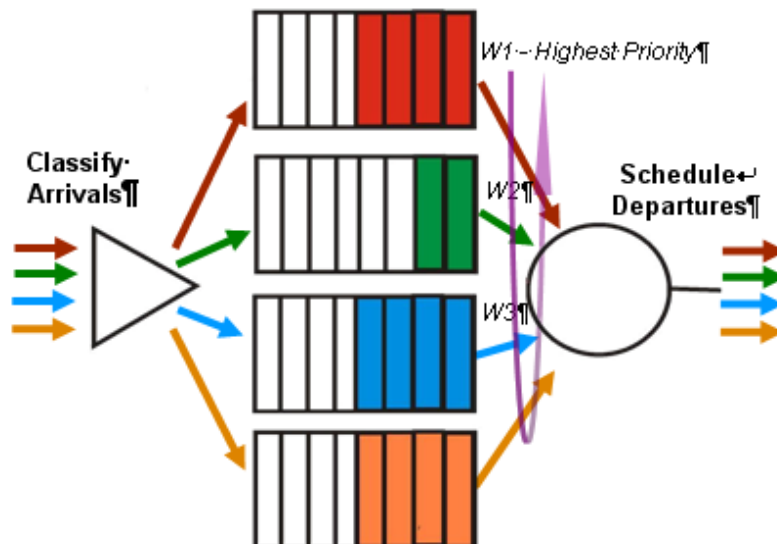
The system has four priority queues which are emptied according to two types of scheduling:

1. Strict priority queuing:

In fixed priority, all top priority frames egress towards the radio until the top priority queue is empty, then the next lower priority queue's frames egress, and so on. This approach may cause low priority frames to be starved out and prevent them from being transmitted, but also ensures that high priority frames are always transmitted as soon as possible.

2. Weighted fair queuing:

In this approach, an 8:4:2:1 weighting is applied. This prevents low priority frames starvation while having minimal affect on high priority frames.



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QoS in Gigabit Ethernet IDMs

Quality of Service is based on:

- External header
- VLAN 802.1p
- TOS / TC - IP precedence
- MPLS experimental field
- VLAN ID
- UDP packets
- Short packets

Packet Classification

The system examines the incoming traffic and assigns the desired priority according to the marking of the packets (based on the user port/L2/L3 marking in the packet). In case of congestion in the ingress port, low priority packets will be discarded first.

The user has the following options:

- Priority bits Designated VLAN IDs source: None/ External Overhead / VLAN 802.1p / IP TOS/TC / MPLS
- Prioritized VLAN IDs: VLAN IDs numbers and priority for each number.
- First priority override: TCP, UDP, and IP packets shorter than 100 bytes.

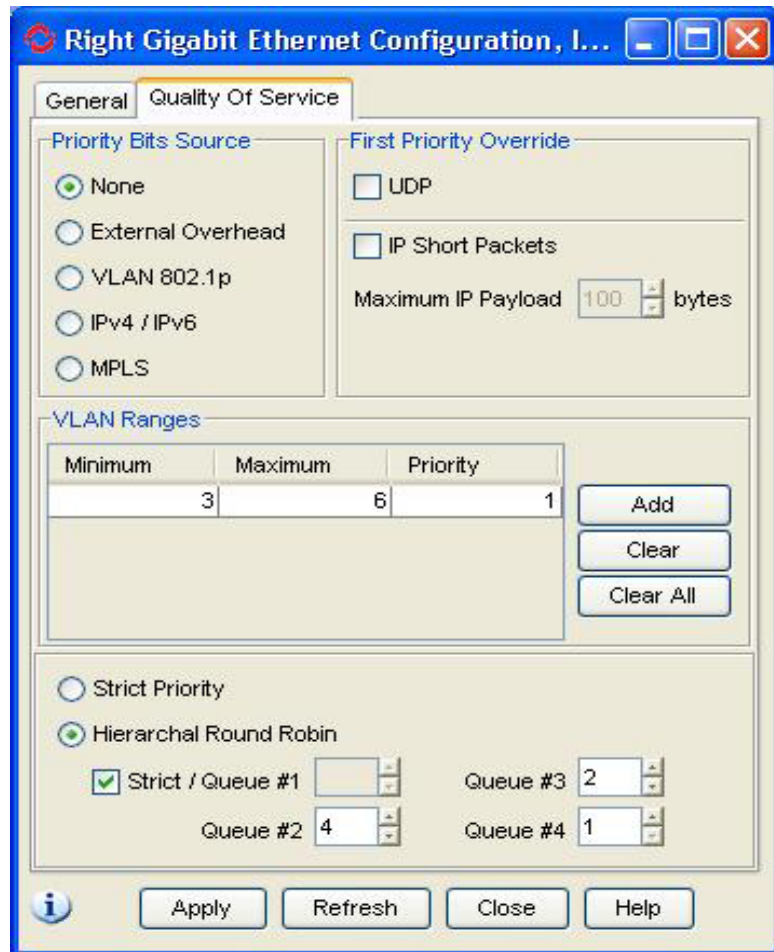
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CeraView Ethernet Configuration

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The following table describes the default priorities defined in the system:

Packet Type	Priority Bit Source			VLAN ID	First Priority Options			Remarks
	VLAN 802.3 p	IP TOS / TC	MPLS		TCP	UDP	Short IP Packet	
VLAN, no IP no MPLS	x	-	-	x	-	-	-	
VLAN, VLAN no IP	x	-	-	x	-	-	-	Outer VLAN
IP	-	x	-	-	x	x	x	
MPLS	-	-	x	-	-	-	-	
VLAN, IP	x	x	-	x	x	x	x	VLAN/IP according to configuration
VLAN, VLAN IP	x	x	-	x	x	x	x	Outer VLAN/IP according to configuration
VLAN, MPLS	x	-	x	x	-	-	-	VLAN/MPLS according to user configuration
Other	-	-	-	-	-	-	-	Last queue

STP (Spanning Tree Protocol) Frame Prioritization

In radio links that are used to connect switches running spanning tree protocols, it is important to ensure that the BPPU frames (that are transmitted periodically from the switches) are passed with the highest level of priority. If BPDU frames are not received for a certain period of time it will cause the STP to decide that the link is not active (even though there are no problems) due to the fact that BPDU frames were discarded because they did not get the highest priority.

In order to ensure the smooth operation of STP, the system automatically gives the highest possible priority to BPDU multicast frames. Right below this priority the user defined highest priority frames are located.

Queuing and Scheduling

The system has 4 priority queues which are emptied according to three types of scheduling:

- Strict priority (8:4:2:1)

In fixed priority all top priority frames egress towards the radio until the top priority queue is empty, then the next lower priority queue's frames egress, and so on. This approach may cause low priority frames to be starved out and prevent them from being transmitted, but also ensures that high priority frames are always transmitted as soon as possible.

- Configurable Hierarchical Weighted Round Robin (16-1 weights) - each queue can be assigned with a user configurable weight form 1 to 16.
- First queue as "strict" and the other three according to Weighted Round Robin (4:2:1)

Supported Ethernet Standards

All Ethernet systems

Link standards:

- 802.3ad - link aggregation - transparent
- 802.3ac - Ethernet VLANs - transparent

LAN standards:

- 802.1ad - provider bridge - transparent
- 802.1Q - Virtual LAN - transparent

Fast Ethernet System

Link standards:

- 802.3 - 10 Mbps
- 802.3u - 100 Mbps

LAN standards:

- 802.1p - Class of Service

Current Gigabit Ethernet System:

Link standards:

- 802.3z - 1 Gbps - optical SFP
- 802.3ab - 1 Gbps - electrical SFP

Q3/07 Gigabit Ethernet System:

Link standards:

- 802.3 - 10 Mbps - electrical board
- 802.3u - 100 Mbps - electrical board
- 802.3z - 1 Gbps - optical SFP
- 802.3ab - 1 Gbps - electrical SFP/ electrical board
- 802.3x - Flow control

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When flow control is enabled, the system pauses the Ethernet egress as “pause” frames are received. Preemptively, when packets are going to be dropped, the system sends “pause” frames to the line egress.

LAN standards:

- 802.1p - Class of Service

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Document Notes

- This document contains preliminary data.
- All specifications are subject to change without prior notification.