

flexiHaul Packet M-Series TSN Switch

Flexible Fronthaul and Backhaul Solution for 4G and Beyond



Industry's First TSN, Radio over Ethernet (RoE) xHaul Solution

With 4G LTE networks increasing capacity in parallel with ramping 5G and Ethernet services, operators around the world must evolve their RAN transport and access architectures. In the past, operators often relied on dedicated dark fiber which can be expensive and slow to deploy.

Fortunately, multiplexing packet technology can enhance fiber capacity using time sensitive networking (TSN), also known as Ethernet multiplexing. This allows blending time sensitive mobile services, such as 4G CPRI and 5G eCPRI using Radio over Ethernet with preemption alongside standard Ethernet services. HFR Networks has developed a TSN based solution to address urgent xHaul requirements, including delivering higher performance and cost effective access services on a converged Ethernet access network.

HFR Networks' M-Series TSN Solutions: CPRI, eCPRI and Ethernet Multiplexing for xHaul

The M6424 platform, HFR Networks' flexiHaul packet solution, is a cost-effective, scalable, high capacity TSN switch that delivers superior economics and enables the ability to combine RAN transport with other traffic types such as Ethernet business services on a common infrastructure. Purpose built for time sensitive networks, the M6424's state-of-the-art, high performance design enables advanced mobile networking architectures and applications with nanosecond timing requirements.

The M6424 connects radios with nanosecond timing using Common Public Radio Interface (CPRI) and eCPRI to bridge traditional mobile networks and Ethernet services, supporting modern centralized or cloud-based architectures. Encapsulating CPRI traffic, the M6424 utilizes IEEE 1914.3 compliant Radio over Ethernet mappers with integrated synchronization to provide higher performance, simplified operations and significant cost savings.

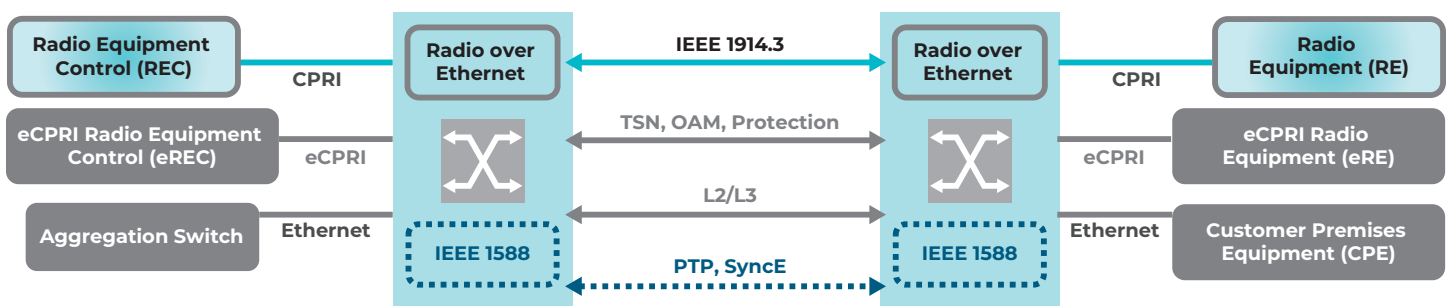
With flexible network deployment options, the M6424 is used across both central office and remote hardened environments. This includes the ability to centralize the fronthaul aggregation

of radios to baseband units (BBUs) and cloud topologies feeding a top-of-rack (TOR) configuration to virtualized baseband units (vBBUs). Hardened remote deployments enable service blending, with CPRI aggregation at the remote radio head (RRH) along with adding RRH small cell eCPRI traffic and Ethernet services.

Extending fiber capacity, HFR Networks' M6424 speeds time to market, ensures a smooth evolution to 5G, creates additional revenue streams by enabling new services, and substantially reduces the total cost of ownership (TCO).

Key Benefits:

- Significantly lowers the total cost of ownership (TCO) for fronthaul service providers: 50% lower cost, 90% turn-up time savings, 75% footprint reduction, and simplified spares inventory management compared to transponder based offerings.
- Simplifies and converges network to reduce deployment and operational costs while simultaneously supporting multiple services: 4G LTE, 5G and Ethernet services.
- Supports 800 Gbps-scale performance by aggregating and switching radio traffic as the fronthaul links continue to scale from: 2.5G, 10G, 25G and 100G. Preemption enables the support of mixed Ethernet services along with mobile traffic.
- Enables multiple carrier isolation using a shared infrastructure with independent carrier services and structure agnostic mapping mode for encapsulation and transport of radio traffic.
- Provides an open, standards-based solution to normalize operations across leading 3rd party RAN suppliers – ending vendor lock-in and eliminating interoperability problems in mixed CPRI implementations.
- Allows better utilization of deployed fiber infrastructure for remote radio head connectivity thus reducing costs and delays associated with additional fiber investments.
- Greatly reduces footprint by blending 4G CPRI using IEEE 1914.3 RoE, 5G eCPRI, and Ethernet high speed data services over a single compact 1RU hardened TSN platform.



M6424 Switch: CPRI, eCPRI, and Radio over Ethernet

System Characteristics

Dimensions (H x W x D)	44mm x 440mm x 383mm
Weight	4.5 kg (9.9 lbs)
Power Consumption	240 W (Fully Loaded)
Mounting Type	1U: 19", 21" or 23" Rack Mountable
Port Configuration	4 Ports x 100G, 24 Ports x 25G
Switching Capacity	800 Gbps
Power/Fan Slots	2 Power Slots, 2 Fan Slots
Hot Swappable FANs per Unit	4 per Module for Redundancy

Interfaces

SFP+/SFP28 Ports	24 Ports 25Gb, 10GbE, CPRI 3/5/7/8/10
QSFP28 Port	4 Ports 100GbE, 25GbE
Timing I/O	1PPS In/Out 10MHz In/Out ToD Output
Management Port	100/1000 Mbps Ethernet RJ-45
Console Port	RS-232C RJ-45

Power/Environmental

Hot Swappable DC Power Supply Unit	
Power Requirements	-48V DC (-40 to -56V DC)
Hot Swappable AC Power Supply Unit	
Power Requirements	110/220 AC (90 to 240V AC)
Environmental	Operating: -40 °C to 65 °C Storage: -40 °C to 70 °C (GR-3108 Class 2) Humidity: Up to 85% (Non-condensing)

Network Management

Operating	EMS (Server, Client), Local Craft Terminal
Protocols	NETCONF/YANG, SNMP Trap

L2 Features

Double Tagging	802.1Q and QinQ
VLAN Translation	VLAN Translation
H-QoS	Three-level H-QoS
Link Aggregation	LACP, Static LAG
Jumbo Frame	9K Bytes

L3 Features

Routing	Static, BGP, ISIS, MPLS-SR
Dual Stack	IPv4 and IPv6 Routing
LLDP	802.1AB LLDP (Link Layer Discovery Protocol)
ACL	L2 – L7

Radio over Ethernet

Structure Agnostic	IEEE 1914.3: Radio over Ethernet Encapsulations w/Structure Agnostic Mode
Tunneling	IEEE 1914.3: Radio over Ethernet Encapsulations w/Tunneling Mode
Structure Aware	IEEE 1914.3: Radio over Ethernet Encapsulations w/Structure Aware Mode

Time Sensitive Network

IEEE 802.1CM	Time-Sensitive Networking for Fronthaul
IEEE 802.1Qbu	Frame Preemption
IEEE 802.3br	Interspersing Express Traffic

Time Synchronization

Precision Timing Protocol	IEEE 1588v2 BC/OC G.8273.2 Class C/D
PTP Profile	G.8275.1: PTP Telecom Profile for Phase/Time Synchronization with Full Timing Support from the Network
Synchronous Ethernet	G.8262: Timing Characteristics of a Synchronous Ethernet Equipment Clock G.8263: Timing Characteristics of Packet-based Equipment Clocks G.8264: Distribution of Timing Information Through Packet Networks

OAM

Ethernet OAM	IEEE 802.3ah, TWAMP Reflector
Fault Control	Alarm Severity: Critical, Major, Minor
Classification Level	Unit, Module, Port
Performance Monitoring	15 MIN/24 HR
Telemetry	Telemetry Streaming gRPC
Loopback	Local / Remote
Authentication	RADIUS

Regulatory & Compliance

FCC 47 CFR Part 15 Class A, CE Mark, UL 60950-1, IEC 60950-1
IC (Canada EMI)
VZ TPR 9205, Issue 7, October 2018
EU RoHS 2: Directive 2011/65/EU, EU RoHS 3: Directive 2015/863/EU with Exemptions 6 (c), 7 (a), and 7 (c)-1
NEBS Level 3 Certified
GR-63, GR-1089, GR-3108 Class 2