Application Note

Smart xHaul Hybrid Active Passive Solution for Small Cell Transport

In the US, an estimated 800,000 small cells will be deployed by 2026. Small cells are crucial to the success of 5G. They densify the cellular network, thereby increasing network capacity and coverage, and improving the customer experience. Fiber connects the small cells to the 5G distributed unit/central unit (DU/CU) or 4G baseband unit (BBU) to provide fronthaul transport for eCPRI and CPRI traffic.

Small cell radios are deployed at non-traditional cell sites such as streetlamps, utility poles and sides of buildings. Small cell radios can be concealed at these sites but transport of the service channels to the core network is a difficult task. A transport aggregation solution at these sites will help mitigate the limitations in fiber access. However, footprint, power and remote visibility still present challenges to network operators providing service to these sites.

Limited space at the cell site

Given aesthetic concerns, the need for concealment, and city ordinances, the amount of space available at the small cell site is quite limited. Cabinets are a luxury that many sites cannot afford. Hence, the cell site equipment footprint should be kept to a minimum.

Power concerns

Since small cell sites were not designed for radio and transport equipment, power availability comes at a premium. Therefore, power consumption needs to be examined and minimized.

Need for Operations, Administration, and Maintenance (OA&M)

Less space and less equipment imply sacrificing some features. Certain trade-offs are unavoidable. For transport, link monitoring and diagnostics at the optical layer are core capabilities that cannot be sacrificed. Without these, network health becomes a highly reactive pursuit. Finding and fixing faults will incur more truck rolls – an expensive and time-consuming process.

Time to market

The scale and speed of small cell rollouts will tax the limits of technicians. In fact, a shortage of experienced staff could well become the bottleneck and impact network activation timelines. Simplifying installation procedures and reducing installation time is vital:

- For experienced installers, productivity (number of jobs completed) improves
- For novice installers and new contractors, mistakes and subsequent trouble-shooting delays would be reduced
A hybrid solution – active at the hub/central office, passive at the cell site

Hybrid Active Passive solution

The Hybrid Active Passive solution is a member of the Fujitsu Smart xHaul family of platforms. It is a hybrid fronthaul solution – active at the hub/central office, passive at the cell site – that is optimized for small cell transport. Self-tuning optics automate and simplify turn-up; an in-band supervisory channel provides remote visibility. Remote visibility from the active hub to the passive cell site offers optical performance monitoring and diagnostic features, despite being passive at the cell site.

Passive: Minimal footprint at the small cell site

Only two components are required at the cell site:
- flexiHaul Smart Tunable Optics are self-tuning DWDM SFPs (10/25 Gbps) that plug into the cell site radio. The radio supplies power to the SFP. No additional footprint or power is required.
- Passive OSP (outside plant) or indoor rack mount enclosures with integrated DWDM filters.

Active: DWDM at the central office/hub

The flexiHaul HSN8000 series is a fronthaul/backhaul platform that supports wavelength aggregation. The flexible, pay-as-you-grow architecture of the HSN8000 product line has plug-in service cards that enable customers to choose any combination of supported services. Point-to-point, multi-point and linear chain topologies are all supported, as are CPRI, eCPRI, and Ethernet interfaces.

Link visibility and automation features

Despite its minimal footprint, the solution preserves OA&M features for optical link monitoring and troubleshooting, and adds automated wavelength tuning to significantly reduce installation time.

OA&M features via in-band supervisory channel

The flexiHaul Smart Tunable Optics are self-tuning and utilize an in-band channel to offer remote OA&M features on the optical link from the active hub to the passive cell site for every radio port, providing:
- BERT (Bit Error Rate Testing) to test link integrity and perform loopbacks
- DDM (Digital Diagnostic Monitoring) to monitor transceiver power and temperature, and trigger alarms for failure and out-of-range conditions
- OTDR (Optical Time-Domain Reflectometer) for fault isolation and troubleshooting of fiber impairments

The flexiHaul system remote OA&M to passive cell sites using Smart Tunable Optics is an efficient solution for providing remote visibility to the NOC without incurring additional space or power. Keeping core fault isolation and failure prediction tools in place improves service availability and reduces costly truck rolls.
Simplicity, speed, remote visibility and OAM functionality

Automated, smart SFPs reduce installation time
It takes just 5 minutes for the smart SFP to self-tune to the correct wavelength, without any technician intervention. This automation eliminates calls to coordinate with the NOC and manual fiber tracking. A technician can provision the wavelengths in parallel, instead of working on each one sequentially. With automated self-tuning optics, the installation time can be reduced to minutes.

The Smart Tunable Optics span 40 DWDM channels in the C-band (1530 nm-1565 nm). Being tunable, technicians need to stock just one SFP model (or SKU). Simplifying spares and inventory management further reduces OPEX and makes this solution scalable and truly plug-and-play.

Summary
The Fujitsu Smart xHaul Hybrid Active Passive solution for small cell transport significantly simplifies and expedites cell site installations with automated self-tuning SFPs, while preserving remote visibility and OA&M functionality for each optical link out to the cell site radio. The footprint required at the cell site is minimal and no additional power is needed. Such advantages make this an efficient and mass scalable solution.

References