C-RAN fronthaul case study

Operator reduces transport costs with TSN fronthaul

5G introduces flexible functional splits that can take advantage of Centralized Radio Access Network (C-RAN) architectures to enable RAN performance improvements and baseband pooling gains.

A major North American MNO wanted to unlock the benefits of C-RAN by building high-capacity and low-latency fronthaul links to connect its 5G radios and baseband equipment. The MNO chose a Nokia packet TSN fronthaul solution that enabled it to better scale its network and deliver leading-edge business and consumer services while keeping transport costs in check.

Project overview

Challenge

As part of a 5G network expansion aimed at improving service delivery nationwide, a major North American MNO wanted to evolve its transport network to keep pace with unprecedented mobile broadband traffic growth, simplify operations and reduce cost. The MNO was also looking for a long-term partner that could help support the continued evolution and expansion of its network to improve capacity and coverage.

Solution

Nokia designed and implemented a unique and innovative Optical Anyhaul solution that allowed the customer to evolve to a C-RAN architecture. With this solution, the customer can use a new generation of packet fronthaul transport to maximize its fiber and RAN infrastructure and reduce costs by simplifying its network.

The solution enables deterministic transport of 4G and 5G traffic flows with significant reductions in the bandwidth required on transport links by using innovative technologies such as Time-sensitive Networking (TSN), Radio over Ethernet (RoE) and packet aggregation.

Results

The customer now has a network solution that fits perfectly with its ambition to deliver compelling new services that meet the demands of consumers and businesses. It can pursue these ambitions by taking advantage of a lower operating cost, a more flexible network architecture, faster service deployment and greater solution stability.

With the increased speed and lower latency offered by the Nokia TSN fronthaul solution, the customer can use its 5G network to deliver advanced wireless, internet, TV, smart home and business services over a world-class wireless and fiber network.

Highlights

To keep pace with high mobile broadband traffic growth, the customer opted to implement a C-RAN architecture at urban areas throughout the city. This design helps minimize site acquisition costs and reduces space and power requirements at cell sites by moving the baseband processing to central hubs, with the added benefit that they are easier to access and service. The C-RAN architecture enables RAN performance improvements and baseband pooling gains. However, it introduces the need for high-capacity and low-latency fronthaul links to connect the radios and baseband units, which are located at sites several kilometers apart.

Implementation challenges

Previously, the customer used an OTN/DWDM transport network to connect its 3G UMTS and 4G LTE sites to the central office using a combination of lower-speed CPRI links (1.2 Gbps/2.5 Gbps/10 Gbps). However, this approach does not scale to support 5G traffic growth coming from new TDD and Dynamic Spectrum Sharing (DSS) radios, where the links reach 25 Gbps and use a new packet-based eCPRI protocol.

The customer decided to implement a TSN fronthaul solution that can support a combination of CPRI and eCPRI protocols with efficient packet aggregation onto 100G links to maximize fiber resources. With an implementation that mixes two-, three-, and four-sector sites, the solution scales to support several dozen CPRI/eCPRI links per site. To minimize fiber cost, each site is constrained to a single fiber pair. The solution avoids the need for WDM muxes by implementing RoE line code-aware mapping to keep traffic under 200 Gbps. The customer plans to use RoE structure-aware mapping to avoid having to add more fiber as cell site capacity grows.

Why Nokia?

Nokia is a world leader in packet-optical and WDM technologies. Our 1830 TPS TSN fronthaul switches played an instrumental role in helping the customer deploy a highly scalable packet optimized solution that addresses exploding capacity growth while maximizing fiber resources. The customer chose our solution because it recognizes the superior features (capacity, low latency, synchronization, reliability), quality and performance of our products. The customer also values the support we will provide as it continues to upgrade its network.

TSN fronthaul for C-RAN

Nokia TSN fronthaul switches enable the customer to easily grow capacity while leveraging its existing fiber footprint. The customer did not need additional fiber for the rollout because a combination of packet aggregation and bandwidth-efficient RoE mapping provided ample capacity to support the introduction of new 5G radios.

Capacity

The introduction of new 4G/5G DSS and 5G radios, particularly those operating in TDD spectrum, dictated the need for high-speed 10GbE/25GbE client interfaces on the transport network. The Nokia TSN fronthaul switches provide uncompromised throughput across all the ports.

Cost reduction

Nokia TSN fronthaul switches support packet aggregation with high capacity 100G uplinks. This minimizes the number of fibers required, which helps the customer reduce operating and capital costs.

Synchronization accuracy

Nokia TSN fronthaul switches (1830 TPS) support SyncE/eSyncE and PTP with Class C and D telecom boundary clock performance that meets strict fronthaul requirements for frequency and phase/time synchronization.

Interworking and bandwidth efficiency

Nokia TSN fronthaul switches support flexible RoE mapping options. Structure-agnostic tunneling or line coding-aware (LCA) mode can maximize interworking, while structure-aware mode can be used to decrease bandwidth requirements by up to 90 percent depending on the RAN configuration. The customer plans to use multiple modes as needed.

Manageability

Nokia packet-optical, WDM and TSN fronthaul systems are managed by the Nokia Network Services Platform (NSP). This allows the customer to simplify operations, administration and maintenance by taking a common approach to network and element management across the end-to-end network.

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