5G Transport: Competitive Landscape Assessment

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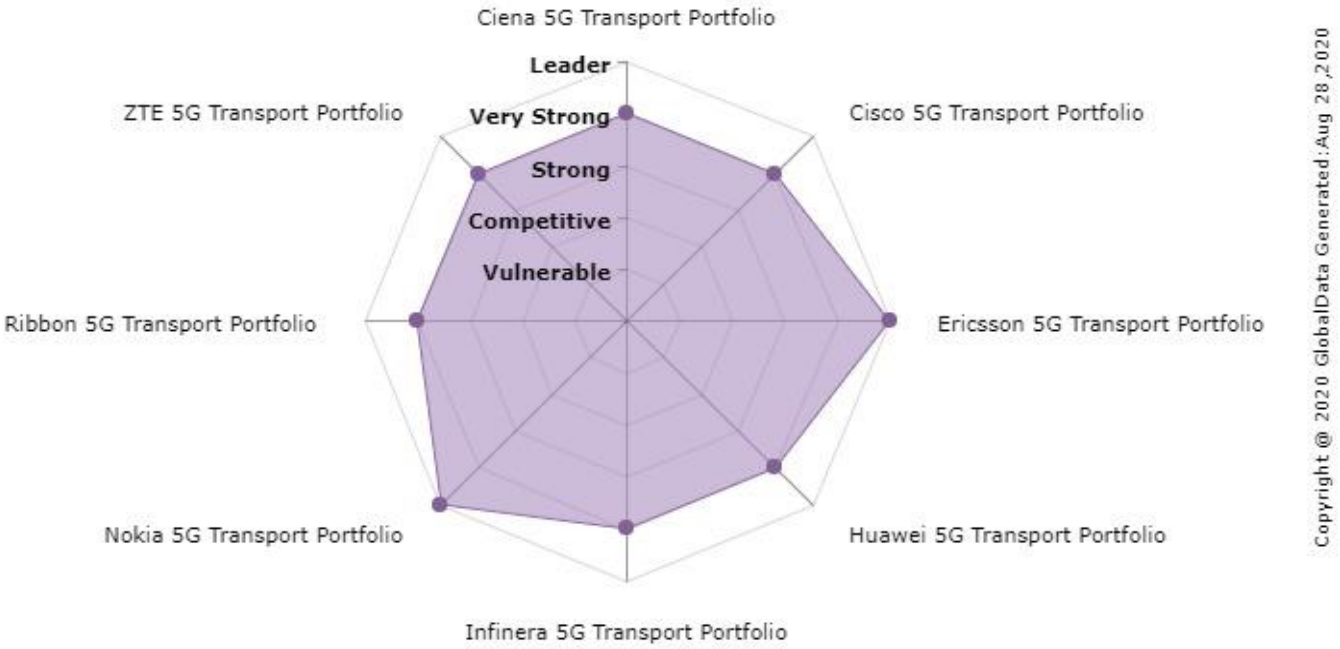
COMPETITIVE LANDSCAPE ASSESSMENT - 5G TRANSPORT

REPORT SUMMARY

5G networks require a new breed of transport technologies, providing high transport capacity, and adhering to stringent timing, latency and synchronization criteria. Compared to legacy technologies, 5G transport is also more diverse and flexible.

PRODUCT CLASS SCORECARD



MARKET OVERVIEW

Product Class	**5G Transport**
Market Definition	5G transport is an umbrella term for technologies used to transport traffic between 5G radio access and edge of the generalized transport network. It covers several different technologies, including packet-optical (Layer 2) solutions, router (Layer 3) solutions, PON, and microwave point-to-point wireless. 5G transport needs to serve a set of diverse deployment scenarios, from traditional macro base stations, to distributed cloud RAN and small cells. Depending on the deployment scenario, 5G transport networks are divided into roughly three segments: fronthaul, connecting remote radio units (RRUs) to distributed units (DU); midhaul, connecting DU to centralized unit (CU); and backhaul, connecting CU to mobile core, through generalized transport network. Since the capacity and connection quality requirements of 5G networks, especially when looking beyond the first phase of non-standalone (NSA) deployments, are significantly different from previous generations of mobile technology, transport vendors have developed a new breed of solutions to cater to these needs. This report covers all 5G transport technologies, except for microwave radio, which is covered in a separate report.
Rated Competitors	• Ciena • Cisco • Ericsson • Huawei • Infinera • Nokia • Ribbon • ZTE
Additional Competitors	• Fujitsu Network Communications • Juniper Networks
Changes Since Last Update	• Initial Report

MARKET ASSESSMENT

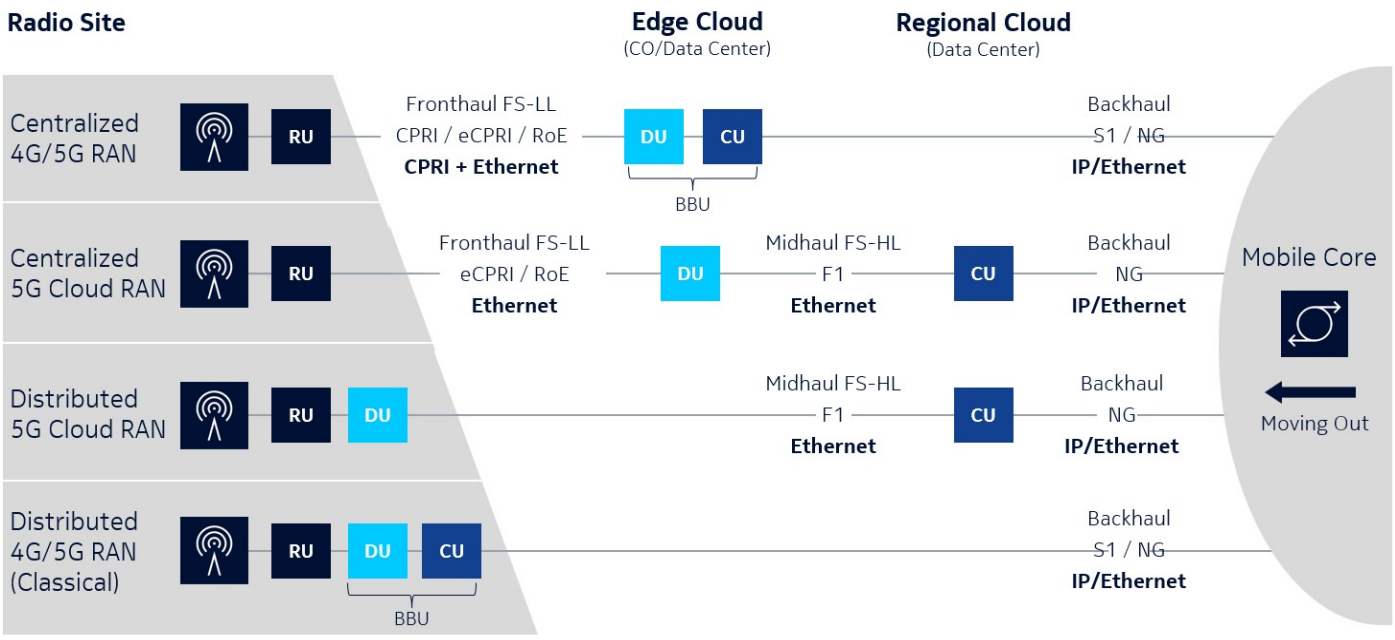
Traditionally, mobile transport has always followed radio access technology evolution, lagging somewhat behind radio access deployment. 5G deployments mostly follow the same pattern, and the development of 5G specific transport is gradually taking pace, following the first wave of non-standalone (NSA) 5G radio deployments, that usually utilize existing transport solutions, sometimes requiring extra capacity. But with standalone (SA) 5G, designed to support advanced use cases such as critical communications and IIoT, operators are preparing to deploy specific 5G transport, featuring increased capacity and much improved connection quality.

Capacity requirements are the main driver of mobile transport upgrades- each generation of mobile access has brought increased data transfer speeds to clients, and transport capacity needed to scale accordingly. With 5G, operators need to prepare for truly massive capacity scaling- initial requirements of 5G are estimated to be ten times higher than LTE-centric transport. In the future, the 5G network transport capacity will increase further, especially as the number of 5G use cases increases.

The connection quality requirements are all related to system-wide budgets for synchronization precision, jitter, and latency as defined in 5G standards- and, again, represent a quantum leap in network performance compared to previous generation solutions. The connection quality is closely related to IIoT use case support, specifically those that require deterministic connectivity, such as manufacturing automation, or autonomous driving. This is a new set of requirements that vendors traditionally did not need to deal with, because mobile access were not designed with deterministic connectivity in mind. This has led to the rise of time-sensitive networking (TSN)- a new class of IP and packet-optical platforms that usually represent a centerpiece of vendors' 5G transport portfolio.

Another key feature of 5G radio access is new levels of diversity of site types and deployment strategies available to operators, driven in part by network disaggregation and virtualization, and the introduction of new radio bands. This effectively splits the former concept of mobile backhaul connecting radio site to the operator edge into a significantly more complex 5G Xhaul (encompassing fronthaul, midhaul, and backhaul). Each of these transport segments requires specialized equipment with varying deployment characteristics- elements closer to the radio need to be more power efficient and temperature hardened; closer to the operator's metro network, high routing capacity becomes the most prominent.

5G XHAUL DEPLOYMENT TYPES



Source: Nokia, 2019

INDOOR AND OUTDOOR COVERAGE

Introducing new radio bands suitable for covering indoor and outdoor areas with short-range, high capacity connectivity- especially the millimeter wave (24 GHz and above)- brings to the fore the challenge of deploying high-performance networking devices in very small packaging, and in large numbers, in various environments. This also implies a certain modification to the 5G-specific connection quality requirements- for example, indoor fronthaul needs options for timing source, since GPS signaling is often not available.

DEPLOYMENT DIVERSITY

Network deployment diversity also implies the use of several different technologies in any given network. Most solutions covered in this report use fiber as the transport medium, however microwave radio will continue to be useful, in some areas of the network, and for some use cases. The main choice that operators face is where in the mobile transport network to introduce L3 capabilities. This is a crucial decision, and will mostly depend on fiber availability, and the type of network- multi-use, and multi-tenant networks will mostly likely bring L3 capability all the way to fronthaul, to take advantage of statistical multiplexing and segment routing.

CHANGING OPERATIONAL PARADIGM

5G transport also necessitates changes in the way the networks are operated. The software environment of 5G transport will be much more granular and dynamic, with network slicing, differentiated QoS, and traffic isolation requirements. This will greatly increase criticality of automation and SDN in 5G transport networks, requiring strong programmability support in 5G transport networking hardware.

MARKET DRIVERS

- **5G-Specific Requirements:** Due to predicted increase in traffic in 5G and use case requirements, transport needs to feature the combination of high capacity and high quality connections. Operators will require over 10Gbps capacity to the RRU (and progressively higher in midhaul and backhaul), support for varied radio-specific interfaces in fronthaul (primarily CPRI, eCPRI, and ORAN), and sophisticated timing and synchronization support throughout the network.
- **5G Network Slicing:** Most advanced 5G services will need to run in end-to-end network slices, to ensure connection quality and traffic isolation. This requirement will drive demand for networking solutions combining “hard” (hardware-based) and “soft” (logical) slicing capabilities, and associated SDN solutions allowing operators to manage slice lifecycles dynamically, and- eventually- automatically.
- **Radio Access Diversity:** Unlike LTE networks, that were in many cases built with macro cells only, all 5G networks will eventually rely on a diverse combination of deployment scenarios, including C-RAN and often indoor and outdoor small cells. This will require deploying fronthaul, midhaul, and backhaul functions in different parts of the network, and drive the demand for varied 5G transport technologies, requiring operators to increase the complexity of their 5G transport.
- **Edge Cloud:** Edge cloud deployments will distribute cloud compute and storage capacity across the edge and sometimes into (or in parallel with) parts of radio access like CU and DU installations. Operators will need to consider transport needs of edge cloud deployments in their 5G transport planning. This goes both for capacity available to edge cloud infrastructure, as well as the low latency transport required to support advanced 5G use cases.

- **SDN and Automation:** With network slicing and radio access diversity, the number of administrative and management operations required will strongly favor deployments of SDN and automation in operator 5G networks. New 5G transport network elements, with enhanced programmability, will be needed to fit these highly automated new infrastructure deployments.
- **Access Convergence:** Some operators will need to deploy 5G transport as a function of their multi-service access and edge networks. This goes especially for operators offering mobile backhaul services in parallel with other business-oriented connectivity services, or residential broadband.

BUYING CRITERIA

- **Capacity and Scale:** Vendor platforms aimed at different parts of mobile transport offer client interfaces scaling from 10 GbE to 100GbE (with 400 GbE on roadmap) with line interfaces of scaling from 25G to 100GbE, or faster DWDM line interfaces (400G-800G). Vendors have the metro core solutions either in house or from partners; however, the focus of this assessment is on access and aggregation.
- **5G Xhaul Support:** Vendor portfolio ideally needs to support multiple use cases for mobile transport across the network, including fronthaul, backhaul, and midhaul deployment scenarios. In fronthaul specifically, vendors need to support CPRI/eCPRI interfaces, with additional points awarded for ORAN support.
- **Timing and Synchronization:** 5G transport platforms need to support varied timing and synchronization protocols, including IEEE-1588/1588v2 PTP and P802.1, with class C and D precision. GPS clock support is standard, with at least one other network timing solutions required for indoor deployments.
- **Network Slicing and Programmability:** 5G transport needs to support end-to-end network slicing, from radio access, to the mobile core. Platforms need to support soft slicing as a minimum, with hard slicing together with FlexE support for leading platforms.
- **Portfolio Breadth:** Vendor's end-to-end capabilities, like offering multiple technologies for 5G transport, ability to provide radio access, IP and optical transport, and automation solutions will increase vendor's 5G transport portfolio traction with operators' preferring end-to-end approach in their network planning and deployment.
- **Physical Characteristics:** Some parts of 5G transport will likely be deployed in outdoor locations, or sparsely equipped facilities. In these deployments, but also in more traditional telco environments, operators may favor equipment featuring small footprint, low power consumption, multiple power supply options, extended temperature range, and IP environmental resistance ratings.

VENDOR RECOMMENDATIONS

- **Demonstrate Interoperability:** Current crop of 5G transport solutions brings operators the most benefits if deployed in end-to-end, single vendor environments; this is untenable in the atmosphere favoring best-of-breed, open, and disaggregated networks. Vendors need to make sure their solutions are interoperable or face disruption.
- **Future-Proof the Portfolio:** Vendors should extend future-oriented functions within their portfolio (network slicing; SRv6; FlexE; automation support). These features will likely drive the adoption of 5G-oriented networking hardware and become necessary sooner rather than later.
- **Adopt Ecosystem Play:** Vendors should explain how their products deliver key 5G transport functionality (like deterministic connectivity and network slicing) in real life end-to-end networks.

BUYER RECOMMENDATIONS

- **Demand Openness:** Although some vendors can deliver end-to-end 5G transport solutions, essential functionality, like network slicing, are deployed system-wide and in most cases cross several vendor domains. Operators should seek solutions featuring open interfaces and allowing them to build best-of-breed networks.
- **Focus on Software Functionality:** 5G transport depends on software functionality much more than the legacy transport serving 3G and 4G networks. This requires operators to seriously evaluate operator SDN, automation, and orchestration software offerings- or interoperability with operator's chosen software environments.
- **Think Multi-Service and Multi-Access:** Parts of 5G transport infrastructure will likely overlap with existing infrastructure operators use to serve fixed broadband, or other connectivity services to residential and business customers. Operators should evaluate their investment into 5G transport keeping this in mind, and demand solutions capable of supporting multiple classes of services, in addition to 5G transport.

RATED COMPETITORS

Product Name	**Ciena 5G Transport Portfolio**
Buying Criteria Rating	• Capacity and Scale: Very Strong • 5G Xhaul Support: Strong • Timing and Synchronization: Very Strong • Network Slicing and Programmability: Very Strong • Portfolio Breadth: Very Strong • Power and Physical Characteristics: Very Strong
Product Scores	**Very Strong**
Strengths	• Router offering combines FlexEthernet/G.mtn hard slicing support with SR-MPLS/SRv6 soft slicing support • Wide range of 4G/5G interface support, including CPRI, eCPRI, F1, xRAN, RoE, Ethernet optical transport, and CPRI to O-RAN fronthaul, including L1 offload processing • L1/L2/L3 low-latency switching and Time-Sensitive Networking (TSN) support • Very strong per-RU capacity of router offering; high-density 25GbE and IPoDWDM with up to 400G coherent transport interfaces • Universal aggregation, with 10G PON OLT pluggable increases diversity of options available to clients
Limitations	• Lacks pole-mounted all-outdoor fronthaul options in the portfolio • Lacks passive optical fronthaul options in the portfolio • Router offering general availability in H2 2020

Product Name	**Cisco 5G Transport Portfolio**
Buying Criteria Rating	• Capacity and Scale: Leader • 5G Xhaul Support: Leader • Timing and Synchronization: Very Strong • Network Slicing and Programmability: Very Strong • Portfolio Breadth: Competitive • Power and Physical Characteristics: Very Strong
Product Scores	**Very Strong**
Strengths	• Leading per-RU capacity for fronthaul aggregation router • IPoDWDM support in router part of the portfolio • Rich timing and synchronization options • SR-MPLS and SRv6 support
Limitations	• Lacks pole-mounted all-outdoor fronthaul options in the portfolio • Lacks optical-only or PON Xhaul solutions in the portfolio • Lacks FlexE support, limits hard slicing options for operator users
Product Name	**Ericsson 5G Transport Portfolio**
Buying Criteria Rating	• Capacity and Scale: Leader • 5G Xhaul Support: Leader • Timing and Synchronization: Leader • Network Slicing and Programmability: Very Strong • Portfolio Breadth: Very Strong • Power and Physical Characteristics: Leader
Product Scores	**Leader**
Strengths	• Rich fronthaul portfolio combining passive and active, indoor and outdoor optical options • Wide and versatile outdoor and indoor cell site router portfolio • Very strong timing and synchronization support across router and optical parts of the portfolio
Limitations	• Lacks FlexE support limits hard slicing options for operator users • Per-RU router capacity lower than other leading competitors • Lacks PON-based offering in the portfolio

Product Name	**Huawei 5G Transport Portfolio**
Buying Criteria Rating	• Capacity and Scale: Leader • 5G Xhaul Support: Very Strong • Timing and Synchronization: Very Strong • Network Slicing and Programmability: Very Strong • Portfolio Breadth: Strong • Power and Physical Characteristics: Very Strong
Product Scores	**Very Strong**
Strengths	• Leading per-RU router capacity, combined with IPoDWDM support • Strong and mature segment routing options; leading IP SDN solution • Support for hard and soft slicing, with FlexE and Segment Routing support • Class C timing support with SyncE and 1588v2 across the portfolio
Limitations	• Lacks fronthaul routers in the offering, limits customer choices • Narrower choice of optical fronthaul access options compared to leading competitors • Lacks PON Xhaul or OLT pluggable solutions in the portfolio
Product Name	**Infinera 5G Transport Portfolio**
Buying Criteria Rating	• Capacity and Scale: Very Strong • 5G Xhaul Support: Very Strong • Timing and Synchronization: Very Strong • Network Slicing and Programmability: Very Strong • Portfolio Breadth: Strong • Power and Physical Characteristics: Strong
Product Scores	**Very Strong**
Strengths	• Disaggregated IP portfolio adds flexibility to operators intending to build best of breed networks • Very strong packet-optical offering, and IPoDWDM support in router solutions • TSN support in packet-optical part of the portfolio (XTM) • Multi-layer and multi-vendor SDN control and orchestration • In-band sync distribution for layer 1 and 2 5G networks

Limitations	• Lacks pole-mounted all-outdoor fronthaul options in the portfolio • Lacks FlexE support - limits hard slicing options for operator users • Somewhat limited timing and synchronization options compared to leading competitors
Product Name	**Nokia 5G Transport Portfolio**
Buying Criteria Rating	• Capacity and Scale: Leader • 5G Xhaul Support: Leader • Timing and Synchronization: Leader • Network Slicing and Programmability: Very Strong • Portfolio Breadth: Leader • Power and Physical Characteristics: Leader
Product Scores	**Leader**
Strengths	• Broad and deep 5G Xhaul offering, covering IP, packet-optical and PON options • Leading per-RU capacity of fronthaul/midhaul routing solutions, ready for edge compute requirements • Comprehensive timing support with SyncE and 1588v2 across IP portfolio
Limitations	• Lacks pole-mounted all-outdoor fronthaul options in the router part of the portfolio • Lacks FlexE support - limits hard slicing options for operator users • No IP over DWDM support in the router part of the portfolio
Product Name	**Ribbon 5G Transport Portfolio**
Buying Criteria Rating	• Capacity and Scale: Very Strong • 5G Xhaul Support: Very Strong • Timing and Synchronization: Leader • Network Slicing and Programmability: Leader • Portfolio Breadth: Competitive • Power and Physical Characteristics: Leader

Product Scores	**Very Strong**
Strengths	• Solution portfolio providing multilayer-optimized packet and optical transport for 5G • Comprehensive hard and soft slicing technologies; including FlexE, segment routing, OTN • Comprehensive timing with SyncE and 1588v2, Class C and designed for Class D support in most platforms • Network slicing domain orchestrator and holistic security with encryption, service isolation, and secured platforms • Multilayer-optimized packet and optical transport
Limitations	• Lacks fronthaul solutions in the portfolio - combines with partner offering • Highest capacity backhaul platforms in development (GA planed for end 2021) • Per-RU router capacity currently lower than leading competitors - new 1RU platform in development
Product Name	**ZTE 5G Transport Portfolio**
Buying Criteria Rating	• Capacity and Scale: Very Strong • 5G Xhaul Support: Very Strong • Timing and Synchronization: Very Strong • Network Slicing and Programmability: Very Strong • Portfolio Breadth: Very Strong • Power and Physical Characteristics: Very Strong
Product Scores	**Very Strong**
Strengths	• Wide choice of packet-optical Xhaul products, including outdoor and indoor fronthaul • Class D timing support in packet-optical portfolio, and a part of the router portfolio • Leading capacity, scale, and interface support capabilities in PON part of the portfolio • Router offering combines FlexE support for hard slicing with segment routing
Limitations	• Lacks fronthaul routers in the offering, limits customer choices • Per-RU router capacity lower than leading competitors • Limited router midhaul options