State of the Art Packet and
Optical Networking

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Increasing the Value for Mobile Backhaul Wholesalers

Moving from Fiber to Integrated IP and Optical Transport Services for 5G

White Paper

As we started the new decade, we saw the fifth-generation (5G) mobile networks across the world slowly coming into shape. Although most of the implementation are still using the LTE core network connected by the existing transport infrastructure, we saw that there has been an aggressive upgrade of radios to support the new 5G frequencies. Much of it is driven by regulation, while the market waits for the killer 5G application to create a further push in expediting 5G deployment.

The first priority for the Mobile Network Operators (MNOs) is naturally upgrading the radio of the existing cell sites and increasing the traffic capacity. The implementation is straight forward, since the physical infrastructure and backhaul is already in place. The second priority is deploying a couple of hundreds of new 5G cell sites, usually driven by regulatory obligations. These new cell sites are the ones, which will require new backhaul connections. From here, it will take some time until a reasonable 5G coverage is in place and a 5G core is implemented. Soon enough, we will see some MNOs starting to carry out densification, reducing the unserved "white spots" in rural areas and increasing coverage in the metro areas. Ideally, fiber is the choice for new physical connections to these new cell sites, wherever it is available. For MNOs, who don't have fiber available in all corners, this brings new opportunity for transport wholesale providers, together with the unusual infrastructure providers, who have lots of spare fiber capacity to share, such as tower companies, data center operators, public utility companies, railways and highway agencies.

For Transport Wholesale Providers, is having Fiber in the 5G Era Competitive Enough?

This can be answered by first looking at the 5G transport requirements and the new traffic behavior. The older generations of mobile networks have a centralized architecture, where the traffic traverses the network from the cell site to the core and then it gets routed to the data center or to the internet. The required mobile backhaul was pretty much a static connection. Mobility and capacity are limited only to where you can get the strongest coverage, therefore we can have good estimates on where the traffic will be coming from. In 5G, this will all change. A user traffic doesn't need to go all the way to a centralized core. A distributed 5G core will enable data traffic to be offloaded at the edge, nearer to the user, or wherever the application is installed within the network. Thanks to Network Function Virtualization (NFV), 5G core components and applications can easily move anywhere in the network, where they are needed. User mobility will be enhanced with the presence of more cell sites, a wide range of frequencies and more transport capacity. The traffic behavior will also be more dynamic because users and end devices will be more mobile, accessing different types of services, which require different network requirements and destined to different locations in the network. More Fiber and optical services are needed to enable 5G, but it will not be enough to support this degree of dynamism in the network.

Why Packet Services Will Be Important?

If we look at the traffic flow, different types of traffic will converge at the aggregation, most probably delivered by various access technologies, like PON, C/DWDM and dark fiber. From the aggregation, the data traffic will be routed towards the Edge. This can be a direct connection, or it can go through several nodes to aggregate more traffic from other cells, before reaching an Edge site. Edge sites can be in multiple locations for a wholesale transport provider, because of resiliency and even more when it is servicing several MNOs.

While dark fiber and passive wavelength services will still have a big role, packet services have more flexibility and lower granularity in steering the different types of traffic to various destinations. Sure, you can also steer a wavelength, but you are steering the whole chunk to one destination. On the packet layer, different types of traffic can be steered in different paths according to the requirements, destination and purpose with the use of policies and packet attributes, like QoS markings, VLAN IDs and IP addresses. This will not be possible at the physical and optical layer in such fine granularity.

Of course, many types of services are still best delivered at the optical layer. However, for future services, it is essential for the wholesaler to have the flexibility to be able offer both packet services and optical services or a combination of both, as network requirements can vary. For example, a mobile operator is offering mobile broadband and premium low latency services. The wholesaler can provide wavelength services or dark fiber to connect a cell site towards the aggregation site. At the aggregation site, the services will be routed and treated differently accordingly to their specific requirements. We expect, routing of premium low latency services to MEC resources at, or close to, the aggregation site, or at a local data center in a private network premise. Mobile broadband services will take a different and longer route to the Edge and then towards the Internet. This requires the wholesale transport provider to evaluate the traffic as it enters the aggregation site, and then steer it towards the correct destination.

While it seems to be very complex to offer IP transport which maintains each of the service requirements, there is one new network feature which can help simplify things for the wholesale transport providers. This is called network slicing. Network slicing is an approach driven by 5G mobile networks to enable a single physical network to support varied services requiring different network performance, such as latency, bandwidth and availability, among others. This is achieved by creating corresponding network slices, each having a logical network topology, using a set of network resources from the single physical network. Therefore, we can create slice for a certain MNO and this slice is logically isolated from the slices of other MNOs on the same network infrastructure. With an intelligent multi-layer approach in network slicing, it will also be possible to view these slices as multiple layers, seeing both packet and optical layer, thus optimizing the use of network resources.

Offering IP transport services will create value for both wholesale providers and mobile network operators. However, there are hurdles. Wholesale providers, who traditionally sell unmanaged services or only optical services, will need to invest in a new generation programmable IP transport overlay network coupled with new skillsets to provide the managed services. This seems to be a daunting task but there are options to overcome these challenges. One key tool is an intelligent SDN transport domain controller, which can abstract the IP transport layer and automate the service delivery and network operations lifecycles.

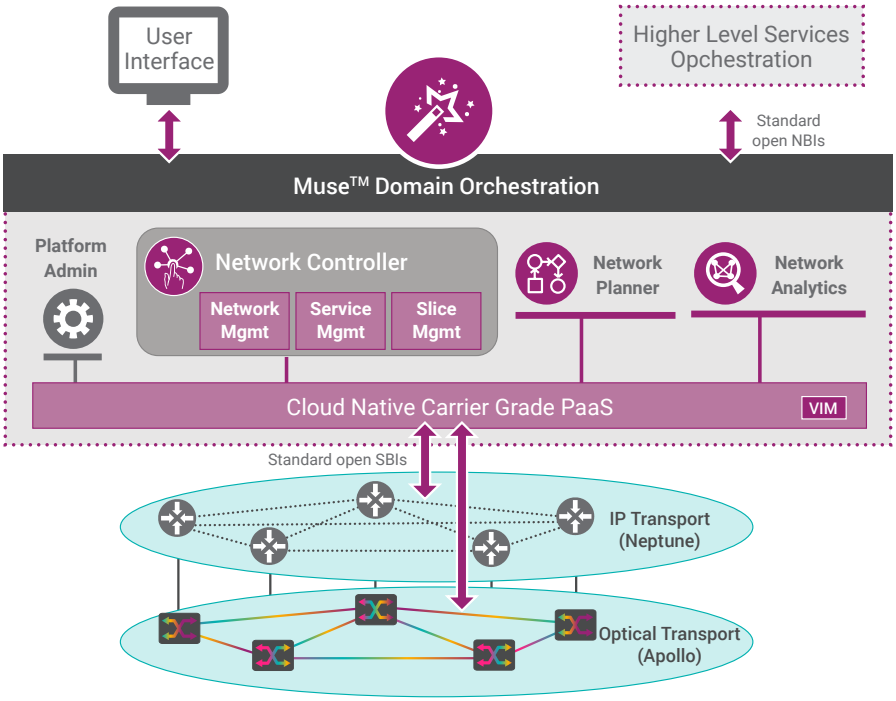
This will help wholesalers in 4 ways:

Powerful abstraction capabilities on the controller will enable wholesale providers to create connectivity configurations using easy-to-use templates. Gone are the days when network engineers have to create complex scripts to automate service provisioning on routers and switches. This can be done today with simple point-and-click feature and an intuitive GUI.

A controller's open North Bound Interfaces will enable automation to move to the next level, by easy integration to a higher orchestration level, OSS and business services.

A controller with an intelligent network slice manager can efficiently assign network resources to customers and services with appropriate traffic isolation schemes to create corresponding network slices.

A controller's advanced network analytics will aid network optimization and assure the agreed SLAs.



While technology is the main enabler in providing packet services, there are also other ways to help transport wholesaler providers to deliver new packet services on top of the existing optical services.

- Turnkey projects in deploying a programmable packet network will fast track time to market and ease the knowledge transfer from vendor to network operator.
- Outsourcing professional services can bridge the skill gap for a certain period of time.
- Partnership with IT managed services providers, who lack the physical fiber infrastructure, can complement the wholesaler's packet service solution.
- In some countries, there are government incentives offered to small infrastructure operators to actively contribute to improving mobile coverage.

Fiber and optical services are very important in 5G mobile networks. However, 5G is not all about capacity and connectivity. It is also about enhanced mobility and new deterministic services. To be able to deliver the new services and economically build the 5G network, technology transformation had to take place at the radio access network (RAN) and the mobile core. That's why we hear much about disaggregation and centralization of the RAN, as well as virtualization of the mobile core network. These new technological approaches have new connectivity and topology requirements, which a transport network has to deliver, and these have different requirements compared to previous generation of mobile networks. Additionally, the transport network has to be flexible and dynamic to support the new types of services and new traffic behaviors influenced by 5G's enhanced mobility. Certainly, it will take more than just fiber and optical connectivity. IP transport services are even more essential, as they enable the flexibility and dynamism which underpin the value offered by 5G. Transport wholesale providers must be able to offer both Optical and IP transport services as well as support new network features, such as network slicing and advanced network automation using a programmable packet network with an intelligent SDN transport domain controller. All these are needed to offer new value add services and to remain a relevant and a competitive part of the 5G ecosystem.

Contact us for more information on the 5G revenue generating opportunity at rbbn.com

About Ribbon

Ribbon Communications (Nasdaq: RBBN), which recently merged with ECI Telecom Group, delivers global communications software and network solutions to service providers, enterprises and critical infrastructure sectors. We engage deeply with our customers, helping them modernize their networks for improved competitive positioning and business outcomes in today's smart, always-on and data-hungry world. Our innovative, end-to-end solutions portfolio delivers unparalleled scale, performance, and agility, including core to edge IP solutions, UCaaS/ CPaaS cloud offers, leading-edge software security and analytics tools, as well as packet and optical networking leveraging ECI's Elastic Network technology.