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Mobile Backhaul Providers: Why Performance Management Isn't Enough When Traffic Grows and Service Guarantees are Table Stakes

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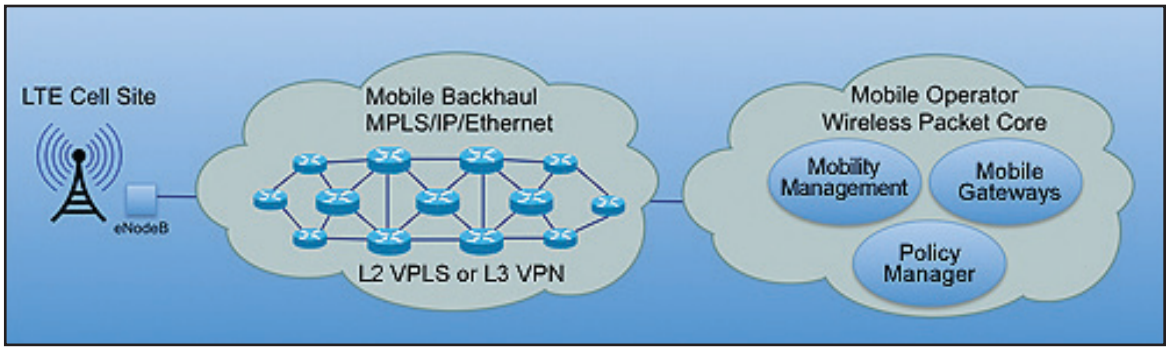
We've all seen the predictions that global IP traffic growth will continue to accelerate as cloud computing demand, mobile devices, video streaming, and machine-to-machine communications keep pumping packets onto the network. Leading the growth is mobile data traffic, accelerating at least three times faster than fixed IP traffic as consumers and businesses expect full connectivity wherever they may be.

The Rise of LTE

To cope with this explosive growth, and react to the fact that ARPU is not growing nearly so rapidly, mobile operators are looking to LTE. This technology makes it possible to extract more capacity out of the wireless channel; providing down-link peak rates of 300 Mbit/s, uplink peak rates of 75 Mbit/s and QoS provisions for round trip times of less than 10ms. LTE also offers the ability to manage fast-moving mobiles, and support for multi-cast and broadcast streams.

In an LTE world, the cost of a delivered bit of data is lower thanks to its simplified architecture (basically a flat RAN with IP core) and increased spectral efficiency. Nevertheless, there is a cost to achieving this. New equipment is required at the tower and the resulting increased traffic still has to be delivered. Juniper Research recently calculated that mobile network operators will have to spend $840 billion globally on optimizing backhaul assets and adding capacity over the next five years. Many operators simply can't afford this and will look to offload traffic to other network operators with more efficient network models.



The Challenge of the Backhaul Market

This increased demand has created a market. Competitive wholesalers, cable operators and wireless backhaul specialists are all joining the traditional carriers in competing for the backhaul business.

While each type of competitor has different advantages, all must deal with certain key requirements.

1. Rising volumes of traffic mean that legacy TDM

connections won't scale at an economic rate. Since LTE is optimized for packet networks, Carrier Ethernet is emerging as the cost-effective way to handle the growing demand over, wherever possible, fiber connections to the tower. Most players in the backhaul market are aggressively laying fiber to as many towers as possible or in the case of players like Level 3, teaming with the tower providers to build new towers close to their existing fiber network.

2. LTE demands low latency connections and mobile customers demand high service levels. Dropped calls and constantly buffering video playback will result in lost business. Backhaul SLAs need to be stringent.

3. Infrastructure is expensive. It has to be used efficiently and capacity upgrades have to be done on time. Too early means money is spent unnecessarily, too late and service levels will be missed as traffic demand outstrips available capacity. Backhaul providers are doing everything they can to win multiple customers from the same tower, thus allowing them to spread the cost of the investment. Carrier Ethernet makes provisioning capacity quicker and cheaper but successful players are still looking to ensure that the return on every dollar spent is maximized.

The Challenge of Gaining Control

To address these needs and compete effectively, network operators need help. Many are looking to traditional performance management vendors to give them the necessary visibility into their network infrastructure but they are not finding the complete answer. These solutions, when they work well, show you what is happening on the network in terms of traffic on each interface and may help you identify trends to predict when capacity has to be upgraded. But the mobile backhaul business has some distinct characteristics that reduce the value of this approach.

- New demands are asynchronous: An LTE connection should offer downlink speeds of at least 100Mbps and uplinks at 50MBps. However, the difference between the theoretical maximum and what can actually be delivered is often large. These new demands emanating from the RAN network will increase the demand on existing circuits and existing network nodes. Being able to control the route traffic takes via engineered paths, metric manipulation and QoS policy management is key to understanding and controlling your service.

Operators will have to spend $840 billion globally on optimizing backhaul assets and adding capacity over the next five years

- Planning/upgrading can take time. Laying new fiber or adding new equipment to the tower can take time for all the necessary approvals. Demands need to be forecast and accommodated on the network despite delays caused by bureaucracy. Sometimes new flows need to be accommodated without the ability to add new capacity, and that means understanding what traffic flows where and how rerouting flows may impact SLAs.

- Customer demands mean downtime and congestion are not acceptable. A backhaul provider has to manage their network proactively, understanding how the network will behave when equipment is down for maintenance or because of faults and ensuring the network design caters to maintain SLAs during such periods. Competitive backhaul providers understand which customer flows will be impacted when they take certain pieces of the network out of commission, what that impact will be and how, if necessary, that impact can be mitigated.

The Solution

Carrier Ethernet services are well suited to providing the low cost, high capacity transport that mobile operators are looking for, but the necessary service guarantees, especially for jitter and latency bounds, are far more stringent than have historically been offered. In order to build and deliver competitive services for mobile backhaul, successful network operators are streamlining and automating their design, provisioning and management processes in ways that reduce cost of operations and enable them to meet the SLA requirements.

Mobile Backhaul Service Process

Service Evaluation For any new backhaul opportunity, If

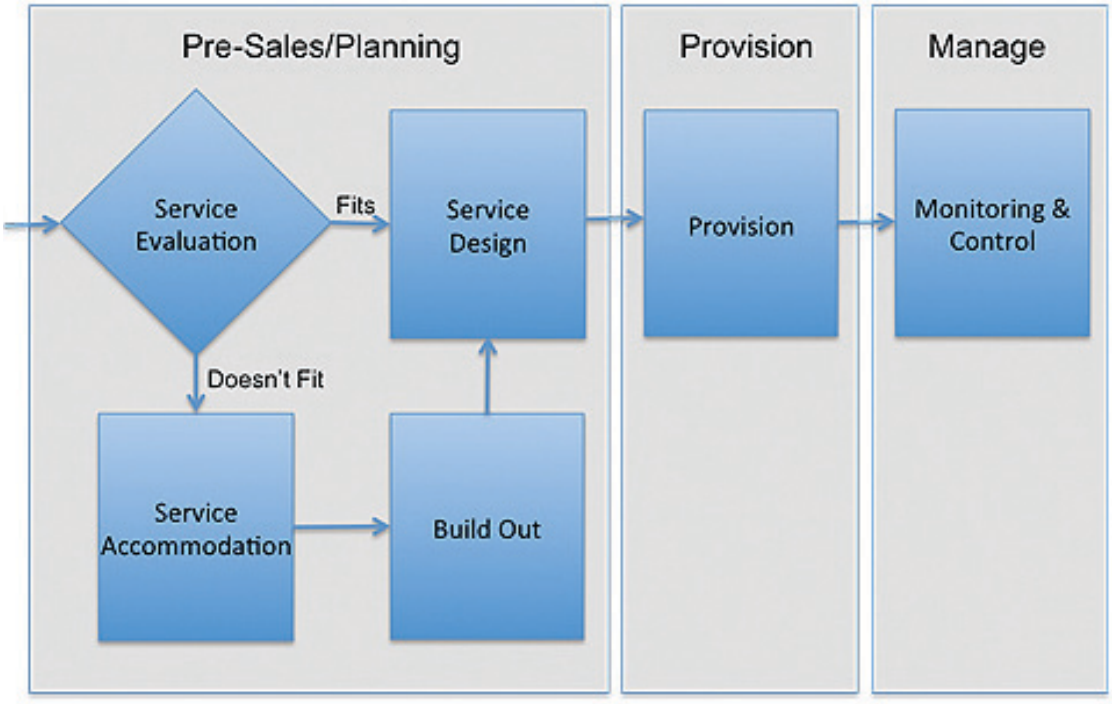


Figure 2: Service Admission and Control Process for Mobile Backhaul Services

the first thing the provider does is to see whether the service can be accommodated on their network while maintaining the desired service characteristics and providing the required service level guarantees. They check if the network can support the expected traffic flows without causing congestion and that the intended path provides resilience in the event of failures in the Layer 3 network or the Layer 1 network on which it is running. With a model of the network, and advanced simulation features, the network engineers can see where problems might arise before a new demand is placed and avoid them.

Service Accommodation

If the proposed routing for a new circuit does not fit well on the current infrastructure, the routes of existing and new flows will be examined to see if there is a better way to route the required traffic demands so it can all be accommodated without increasing capacity. In this case, the planning solution should be able to provide the necessary steps to reroute the impacted flows without causing congestion while doing so.

the required circuits do not fit into the existing network infrastructure efficiently, the provider will plan the most effective capacity upgrades for accommodating these requests and any additional forecasted growth. With an abstracted model of the network, planners can investigate alternative design choices and see which is the most cost-efficient for carrying the desired traffic. By integrating these planning and forecasting capabilities with knowledge of the assets already deployed, a full bill of materials and plans can be produced for the required network build out.

Service Design

Once assured that the network is capable of supporting the requested circuits, the provider network engineers are able to design the most efficient routing of traffic. The calculated path layouts identify optimized bandwidth utilization and how to minimize exposure to the risk of network failure through resiliency analysis that considers both Layer 1 and Layer 3 topologies. Having a model of the operating network as it is currently configured, and

being able to lay new demands onto it, allows the provider to examine the effect of moving demands through manipulation of IGP metrics or explicit LSP tunnels. This provides the opportunity to balance traffic over the network to better utilize under-used infrastructure and to move flows to avoid planned outages. Such visibility and control is vital for LTE service design as multiple flows can be introduced to

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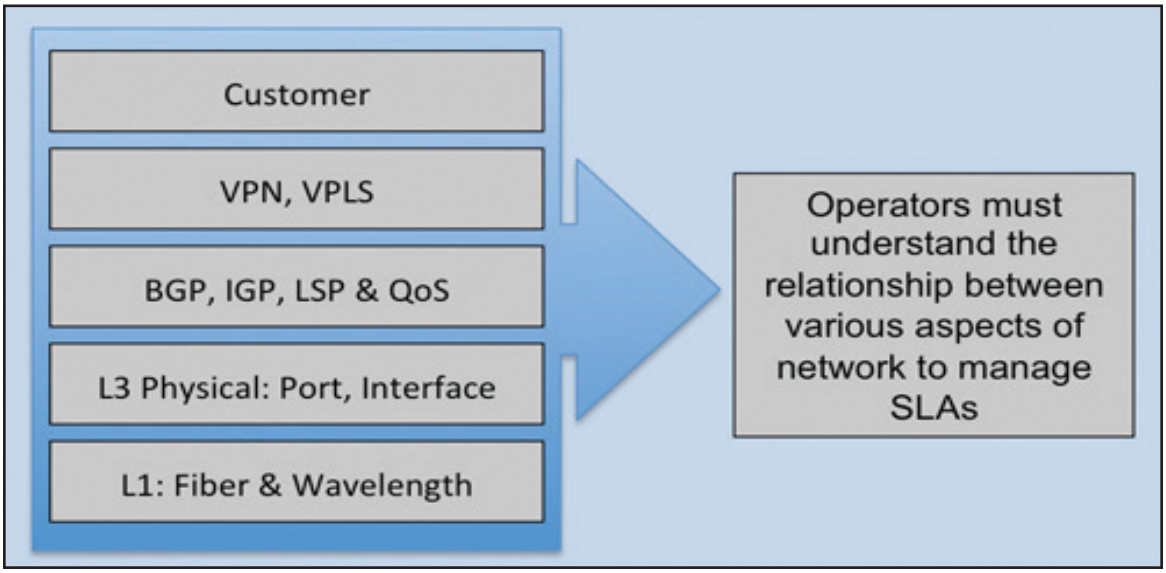

Figure 3: Managing to an SLA requires full visibility of the network

the backhaul network for each eNodeB connected.

Service Provisioning

With TDM, it was relatively straightforward to provision a T1 and start to backhaul traffic. Today, connectionless Carrier Ethernet running on multi-vendor networks can make it much harder to understand and then provision backhaul capacity correctly. Leading operators are utilizing the

network model they have for planning to also drive the provisioning systems. By integrating their planning capabilities into the service provisioning process, providers can ensure that new service roll-outs will comply with SLA requirements and then automatically provision them without the risk of introducing errors as plans are moved from one system to another. By ensuring the planning, provisioning and monitoring system is automatically updated with information from the live network, models are kept in synch so planned and deployed networks are identical.

Service Monitoring, Visibility and Control

Once backhaul services are provisioned and activated, of course, traditional performance management activities need to continue monitoring that traffic is being delivered as expected.

A classic requirement in Mobile Backhaul is for operators to know which customers traffic flows over which components within the network. Understanding the relationship between each

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layer of the infrastructure and being able to model the impact of making a change to that network enable the service provider to proactively notify their customers before their service is disrupted. Where SLAs call for customer notification before maintenance work that might impact services this level of visibility allows the task to be automated. By integrating the performance system with planning and control functionality, providers ensure changes in traffic flows, failures within the network, or topology changes do not negatively impact services. Should issues be seen, the system can be used to design remediating actions – not just tell the provider that there will be problems!

Cariden Technologies

Cariden Technologies, Inc. is a software company serving telecommunications providers worldwide. Networks serving 85 percent of the U.S. broadband customers have adopted Cariden software, as have 8 of the 11 global Tier 1 ISPs. Cariden's success is fueled by its technical innovations in delivering visibility, efficiency, and automation to networks.

For more than a decade, Cariden has been working with network operators providing planning, engineering and operational traffic management solutions. Building and operating a network efficiently isn't done by gathering an assortment of isolated tools but by building systems that support the network engineering activities throughout the lifecycle of a service. Cariden prides itself on helping our customers to build such systems.