The evolution of wireless technology and the support for ultra-broadband mobile applications is having a tremendous impact on wireless networks and on mobile backhaul in particular. The migration to LTE through Coexistence 2G/3G/LTE RAN and Core Networks is only exacerbating this situation.

Mobile Backhaul refers to the transport infrastructure in a mobile operator’s network that brings traffic to and from cell sites to the network core. The backhaul footprint is extensive. It reaches all base stations and it is as ubiquitous as a wireless operator’s geographical coverage. Backhaul cost is enormous. A significant CAPEX investment is required to build out a backhaul network to support traffic demand along with a recurring OPEX cost for leased capacity. One of the main cost drivers of backhaul capacity is the requirement that it grow rapidly to cope with the drastically increasing bandwidth usage of wireless applications enabled by 3G/LTE/WiMax technologies.

Wireless Operators face a set of strategic challenges in the deployment of their backhaul networks and they are asking themselves the following questions:

- How can I gracefully and cost effectively migrate backhaul from TDM based transport to IP/Ethernet based transport?
- Should I move high bandwidth data traffic to Ethernet based transport first?
- How should I scale backhaul capacity to accommodate 3G/LTE bandwidth growth without linearly scaling up cost?
- Should I Lease, build or employ a mix and match of two?
- What technology should I deploy or build: Microwave? Or Fiber?

In addition backhaul and transport network upgrades must take place across a broad range of network layers and network elements ranging from BTS/NB/eNB to BSC/RNC/SGW-MME.

For example, backhaul technologies include:

- TDM-based (T1/E1s)
- Hybrid/Dual (T1/E1s & Ethernet)
- Ethernet-based (Ethernet, Ethernet/IP/MPLS/Ethernet)

And backhaul media may have multi-level aggregation and can including:

- Access (LRAN): Microwave, Copper, Optical, Fiber, Satellite
- Metro (HRAN): Optical SONET/SDH, WDM, High Capacity Microwave

Planning and optimization for Ethernet and legacy TDM-based services must be included as well as optimized routing and capacity planning from the EVC services through Ethernet switching network and multi-technology backhaul.

The Role of Network Analytics In An Optimal Planning Solution:

Network analytics can be used to enhance all aspects of Backhaul Planning & Optimization including:

- Planning with different technologies: TDM only, all Ethernet, or hybrid
- Planning with different media: microwave, copper (PDH, Ethernet), optical (SONET/SDH, Ethernet), WDM, Fiber
- Planning with different configuration: point-to-point, chain, tree, mesh, ring
• Planning for different types of ownership: Build, lease, or mixed
• Optimization with topology & routing: Clustering, hubbing, collocations,
• Grooming, multiplexing, routing, etc.

An intelligent planning software solution is your best bet to address these challenges and manage all of these different multi-layer technologies. It must be properly designed and optimized to:

• Reduce leasing costs by optimizing circuit, routing and intermediate multiplexing on leased capacity
• Reduce CAPEX by optimizing topology, routing, aggregation and dimensioning for growth
• Scale capacity and improve network resiliency by introducing rings and off-loading fibers
• Perform all kinds of what-if analyses

Your planning solution must be able to factor in all of the different technologies in your network which can include TDM only, all Ethernet, or hybrid. You must be able to work with different media such as, microwave, copper (PDH, Ethernet), optical (SONET/SDH, Ethernet), WDM, and Fiber. Planning must take into consideration different configurations such as, point-to-point, chain, tree, mesh, ring, and others.

Optimization must be done with topology & routing in mind, taking into consideration clustering, hubbing, collocations, grooming, multiplexing, routing, etc. And different levels of network ownership such as built, leased, or mixed will come into play. It is important to introduce multi-period growth planning and traffic protection and off-loading by introducing rings or express facilities. It is critical to conduct detailed “What-if” analyses to model different variables and outcomes in growth scenarios, technology choices, migration paths, topology changes and economics.

The ROI of Predictive Network Analytics in Mobile Backhaul & Transport Networks

If done properly and thoroughly enough, you will be able to satisfy your customer backhaul demands and QoS requirements with minimum cost by optimizing:

• Network topology
• Demands routing
• Technologies used

Rapid “what-if” analyses can be used to evaluate different configurations:

• Ethernet and TDM circuit rates
• Microwave radio channel configurations
• Offload structures
• Protection schemes

In the end you will be able to evaluate the network impact of forecasted growth on your network and to identify when and where resource shortages will occur before they occur. If done properly this will amount to a large overall cost savings, the ability to provide optimal QoS to your customers, greatly improved project timelines.

Glossary

2G/3G 2nd and 3rd generation wireless broadband services
BSC Base Station Controller
BTS Base Transceiver System
CEN CEN Carrier Ethernet Network
CES CES Circuit Emulation Service
DSL Digital Subscriber line
eNB E-UTRAN NodeB
Fiber Fiber Optics
HRAN High Radio Access Network
IP Internet Protocol
LRAN Low Radio Access Network
LTE Long Term Evolution
MME Mobility Management Entity
NB NodeB
PDH PDH Plesiochronous Digital hierarchy
QoS Quality of Service
RNCs Radio Network Controllers
SDH Synchronous Digital Hierarchy
SGW Serving Gateway
SONET Synchronous Optical Network
TDM Time Division Multiplexing
WDM Wave Division Multiplexing
WiMax Worldwide Interoperability for Microwave Access