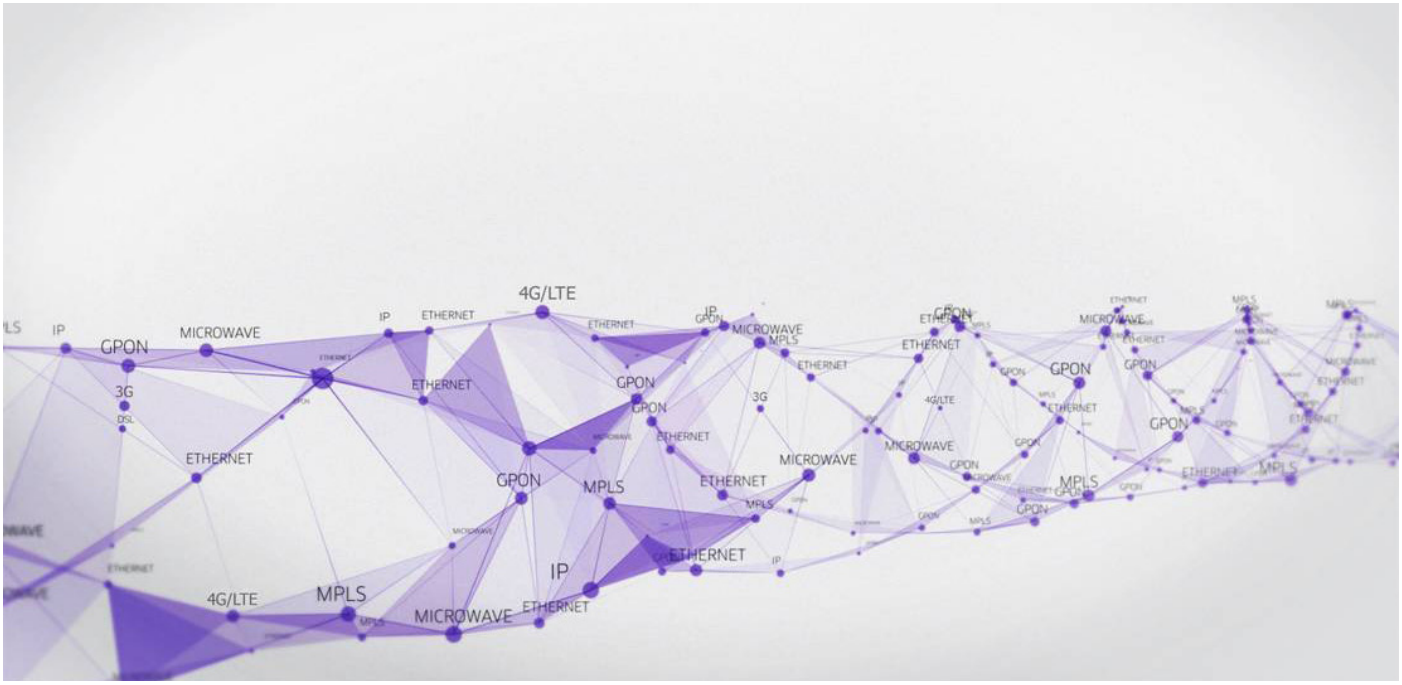


A NEW ERA OF MOBILE BACKHAUL

FLEXIBLE, SCALABLE, SIMPLIFIED BACKHAUL FOR HETEROGENEOUS NETWORKS

APPLICATION NOTE

TABLE OF CONTENTS

A new era of mobile backhaul / 1

Mobile networks evolution / 1

Metro Cell Backhaul challenges / 2
Site considerations / 3
Backhaul networking challenges / 4
Summary of backhaul requirements / 5
The end-to-end perspective / 6
Flexible, scalable, simplified backhaul for heterogenous networks / 7

Alcatel-Lucent Mobile Backhaul Solutions / 7
Packet Microwave Mobile Backhaul / 7
Wireline Mobile Backhaul / 8
Packet Optical Mobile Backhaul / 8
IP/MPLS Mobile Backhaul / 8
Service aware management for mobile backhaul / 9

Professional services / 10
Simplified planning, optimization and deployment of mobile backhaul networks / 10
Design and optimization services help simplify and reduce costs / 10

Conclusion / 11

Acronyms / 11

A NEW ERA OF MOBILE BACKHAUL

Mobile services. It is a huge market, expected to reach $1.3 trillion (in constant U.S. dollars) by 2016.[1] It is also a highly competitive market with very demanding customers. To keep customers and grow market share, mobile network operators (MNOs) must deliver an outstanding customer experience. To stay profitable, they must do so at the lowest possible total cost of ownership.

Small cells have recently emerged as a more cost-effective way for MNOs to improve the coverage and capacity of their mobile services — two of the key elements needed to enhance the subscriber experience. However, to leverage the benefits of small cells, there are some challenges to overcome. One of the most significant issues is how to provide scalable, flexible mobile backhaul to connect small cells back into the network, without breaking the small cell business case.

Alcatel-Lucent has expanded its array of highly successful and widely deployed mobile backhaul solutions to address small cell backhaul, and in particular, to address the challenges associated with backhauling metro cells. Metro cells are public access, MNO owned and managed small cells. With Alcatel-Lucent mobile backhaul, operators can rest assured that they will have the flexibility, scalability, and operational simplicity required to deliver tailored, more cost effective mobile backhaul today and into the future. They will be able to provide streamlined backhaul for both metro cells and macro cells as part of the infrastructure for heterogeneous mobile networks.

MOBILE NETWORKS EVOLUTION

In many regions of the world, mobile subscribers are demanding high-speed, reliable and seamless access to mobile data services including the Internet, a growing applications ecosystem, and mobile video. Mobile networking technology and business models have evolved to stay abreast of this demand, and there are many alternative approaches to consider.

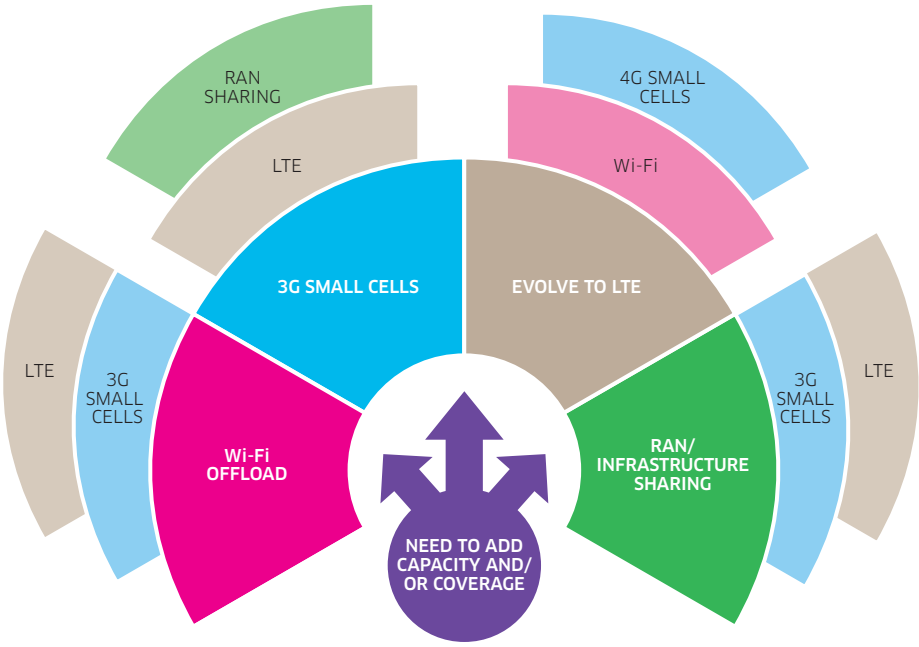
The evolution to 3G and 4G/LTE mobile networks provides a path to more efficient use of radio spectrum and progressively higher uplink and downlink speeds to each user. Wi-Fi® offload is an increasingly popular strategy for providing a mechanism to offload best-effort data onto the wireline infrastructure and conserve precious cellular network resources. Radio Access Network (RAN) and infrastructure sharing agreements enable operators to pool resources to provide better and more extensive coverage for their subscribers. Finally, metro cells have recently emerged as an alternative approach to rapidly and more cost-effectively deploy more capacity and coverage into the “hot spots” and “not spots” of a mobile operator’s network.

It is clear that every MNO will take a different path to increasing coverage and capacity in their networks. Every operator has a different set of opportunities and constraints with respect to spectrum availability and accessibility, customer demand, and availability of capital for network investment. As illustrated in Figure 1, different MNOs will pursue

[1] Mobile Services, Worldwide, 2008-2016, 3Q12 Update, Gartner Inc., September 2012

different combinations of these strategies over time. Some are pursuing data offload strategies and are considering the introduction of 3G metro cells. Others are well along on the transition to LTE, and are assessing the introduction of LTE metro cells to more efficiently address demand in dense urban locations.

Figure 1. Different paths to enhanced capacity and coverage



Each of these strategies to increase coverage and capacity will have a significant impact on the mobile backhaul network. Mobile network operators must ensure that any investment in backhaul will help prepare them for the future, regardless of the evolution path selected.

The balance of this paper explores the impact of these approaches on the mobile backhaul network, with a specific focus on the particular requirements and solutions for mobile backhaul for metro cells.

METRO CELL BACKHAUL CHALLENGES

The introduction of metro cells will drive an entirely new set of challenges for the backhaul network. The metro cell location itself presents a challenge in terms of the customization required to accommodate a range of service availability and quality of service (QoS) levels, site locations, backhaul access media types, environments, and power requirements. Network operations become significantly more complex with the introduction of new scale in the number of sites to deploy and manage, a new level of diversity in terms of cell site location, backhaul access media, and network topologies. Network synchronization and management are also more complex.

Site considerations

Site location

In an ideal world, metro cells would be located where they would offer the most benefit in terms of delivering capacity and/or coverage to underserved areas, and where ideal co-ordination with the macro network could be achieved. In reality, metro cell location will often be dictated by the real estate and site access agreements that can be negotiated with local governments, utilities and building owners. Another key decision factor will be the availability and cost of suitable backhaul access to any given site.

Service requirements

To determine the best approach for mobile backhaul, it is key to first understand what services will be offered from the cell site, the service-level objectives, and the resulting bandwidth, delay, jitter, packet loss and reliability requirements. A site being deployed for best-effort 3G data offload as an adjunct to a macro site will have different backhaul requirements than a stand-alone metro cell site being used as part of a seamless LTE service for voice and delay-sensitive mobile video applications. The need to support Self Optmizing Networks (SON) to enable radio layer co-ordination between macro cells and metro cells will also add additional QoS constraints on the backhaul. In some instances, metro cell sites will be expected to perform at the same availability levels as macro sites. In other situations, some relaxing of availability requirements is acceptable. In all, the mobile service mix to be provided through the metro cell must be understood in order to determine the capacity, QoS, and reliability requirements of the backhaul network.

Backhaul access

With metro cells being deployed on sides of buildings, on street furniture and utility poles and even within large public gathering areas such as airports and stadiums, a wide variety of backhaul access options will be used to meet service requirements at the lowest possible cost.

Fiber is considered to be an optimal access technology offering the best characteristics for capacity and QoS. There are many fiber access options including GPON, Carrier Ethernet, and dark fiber/wavelengths. However, fiber is not available to all sites, and the cost of deploying it strictly for metro cell backhaul may be prohibitive. Enhancements to xDSL technology such as multi-pair bonding and vectoring have made the use of copper plant a more viable and cost-effective alternative where available. Microwave and millimeter wave solutions are expected to be widely deployed for metro cell backhaul. Solutions for unlicensed or lightly licensed microwave and millimeter wave backhaul have been brought to market to help accelerate the deployment of backhaul links to metro cell sites. Traditional microwave links require line-of-sight (LOS). However, there are also new options that can function without LOS as long as some tradeoffs on distance, bandwidth and QoS are acceptable.

Power

In the macro cell environment, power is supplied to a cell tower site where the necessary provisions for all radio and transmission equipment are generally located in a controlled environment hut located at the base of the tower. With the shift to metro cells, providing suitable power to the radio, and the backhaul access equipment is a significant challenge, especially if the metro cell is located on a utility pole or lamp post. Does the equipment require AC or DC power? Does it require surge or lightning strike protection? Is there a requirement for holdover power in the event of a momentary loss of power? How is

power being brought to the site and distributed to the radio, the backhaul equipment and the microwave tranceiver? What if all of these capabilities are required and must be located on the utility pole itself? What demarcation is provided between the utility and the mobile service provider? Power is a key element to be considered in the planning for metro cells and metro cell backhaul.

Backhaul networking challenges

Network scale

In busy urban locations, it is anticipated that anywhere from three to ten or even more metro cells could be deployed for every macro cell. While the actual number of metro cells to be deployed is under debate within the industry, one thing is certain: the introduction of metro cells will imply a vast expansion in the scale of the backhaul network and the number of sites that must be attached and managed on an ongoing basis. Building larger networks may also entail a new or evolved network architecture, and may also be the determining point for a shift to more dynamic networking protocols including MPLS and IP. As the network scales, provisions must be undertaken to ensure that ongoing operational costs do not escalate in step with site growth.

Network capacity

The transition to 3G and 4G/LTE, and the addition of metro cells are all strategies to address growing bandwidth demand. A recent Bell Labs Research study concluded that bandwidth requirements in mobile networks will increase by a factor of 25 times by 2016. In line with this growth, the backhaul network must also scale or risk becoming a bottleneck. Backhaul access technologies from the metro cell site must be selected to accommodate anticipated future growth, and backhaul aggregation and transport must also be planned to ensure sufficient capacity for future growth.

Network topologies

The combination of increased network capacity and scale with more diverse site requirements and site locations will drive the introduction of a variety of new access network topologies into the mix. For example, in an “urban canyon” environment, several metro cells may be daisy chained together before being handed off to an aggregation site. In a situation where several metro cells are co-located on a common low-rise rooftop serving different directions, a hub-and-spoke topology could be used to aggregate multiple metro cells. In other situations, there may be a requirement for a mesh network topology that allows for optimal RAN performance under certain conditions (for example, with implementation of the X2 interface in LTE architectures). As it is clear that no single topology will be optimal for all metro cell use-cases, backhaul networking flexibility is critical to successful deployments.

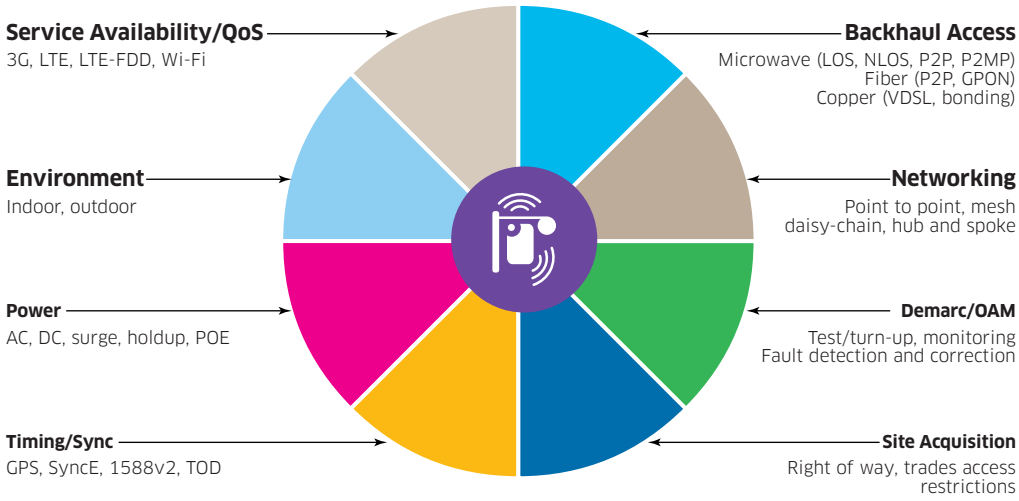
Timing/synchronization

Mobile networks require accurate and reliable clock synchronization for proper operation. Typically, frequency and time-of-day synchronization are required. Different sites will require different solutions for synchronization depending on what service is being offered, site location, and backhaul network connectivity. While GPS satellite-based systems are frequently used in macro cell network deployments, metro cell placement is not always conducive to the reception of satellite-based synchronization signals, and some locations may be susceptible to interference or jamming of satellite reception. With the transition to packet-based backhaul, packet-based synchronization options, including 1588v2 and synchronous Ethernet (SyncE), are viable alternatives.

Operations, administration, and management

Mobile network operators require proactive cell site performance monitoring across the end-to-end backhaul network independent of the cell site access mechanism used, and independent of whether the network is self-built, leased, or a combination of both. With the introduction of metro cells into the RAN, scaling operations to manage the high volumes of new equipment can become very daunting considering the dramatic increase in mobile service infrastructure rollout, including the associated assurance and monitoring requirements. In this environment, the setup of consistent operations, administration and management (OAM) tools and procedures can be a slow, cumbersome process that is often error-prone. In addition, reactive troubleshooting of network impairments is no longer a sustainable option because it introduces high risks against service level agreement (SLA) compliance and can also result in unnecessary, costly, cell site visits. OAM is a critical element in gaining visibility into the backhaul network and for assuring the appropriate mobile backhaul network level of service is delivered.

Figure 2. Summary of Metro cell Backhaul Considerations



Summary of backhaul requirements

In looking at the site and networking considerations for metro cell, the requirements for a successful mobile backhaul network can be summarized as follows:

1. Mitigate metro cell site “customization” by having the flexibility to accommodate the unique needs of metro cell site service level, location, backhaul access, power, synchronization and OAM.
2. Reduce backhaul network operational complexity by being ready to handle the impact of increasing network scale and capacity over different topologies.
3. Be ready for the future by ensuring that the renovated mobile backhaul network can accommodate not only the introduction of metro cells, but also the shift to LTE and scale without requiring a major re-build at each step.

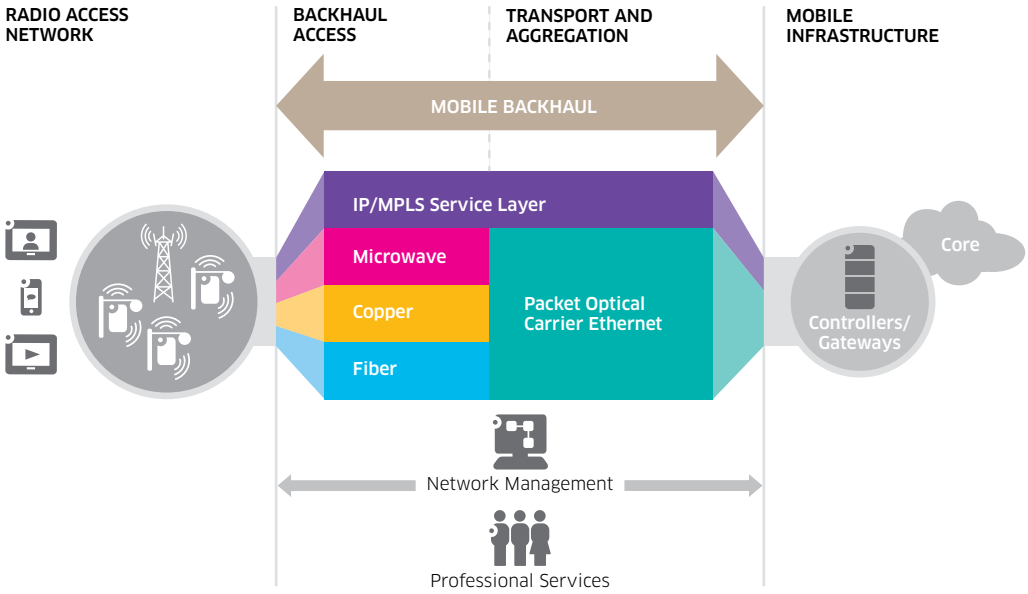
With a flexible, scalable and simplified backhaul network, mobile operators can facilitate and accelerate the delivery of mobile capacity, coverage, and QoS.

MOBILE BACKHAUL FOR HETEROGENEOUS NETWORKS

The end-to-end perspective

Mobile backhaul can be defined at a very high level as the connection between cell sites and the controller site (2G/3G) or mobile gateways (Wi-Fi, LTE). To get from the cell site to the controller or gateway site, mobile backhaul traffic will traverse a variety of access, aggregation and transport infrastructure.

Figure 3. Alcatel-Lucent mobile backhaul infrastructure for heterogenous networks



On the backhaul access side, there are a variety of alternatives. Microwave or wireless access includes licensed 6-42 GHz solutions and 80 GHz solutions in the millimeter wave band, as well as unlicensed 60 GHz millimeter wave, and sub-6 GHz orthogonal frequency division multiplexing (OFDM) and Wi-Fi solutions for point-to-point and point-to-multipoint non-line-of-sight applications. Fiber-based solutions may include Gigabit Passive Optical Network (GPON), Carrier Ethernet, dark fiber or wavelength services. Copper-based access includes Very high speed Digital Subscriber Line 2 (VDSL2) with multi-pair bonding and/or vectoring.

Metro aggregation and transport may be provided by Carrier Ethernet infrastructure, which may be owned by the MNO (or its fixed network organization), or accessed via leased Ethernet services provided by a Backhaul Transport Provider. Transport infrastructure may also be provided leveraging packet optical technology. Some backhaul services may include dark fiber or wavelength services delivered directly off of the packet optical infrastructure.

In many instances, mobile backhaul networks will also include an IP/MPLS-based "service overlay." This overlay provides adaptation and aggregation of multi-generation traffic at the cell site for packet transport over any backhaul transport infrastructure to a head-end router at the controller site. Through this layer, backhaul traffic can be

optimized for more efficient aggregation and transport over any underlying access and transport infrastructure. As well, different network topologies are supported, and end-to-end service visibility for performance monitoring and network management can be realized.

Flexible, scalable, simplified backhaul for heterogenous networks

Alcatel-Lucent is unique in its ability to deliver market-leading microwave, copper and fiber access technologies. The Company is also a leader in building metro aggregation and transport networks, and pulls from extensive experience in deploying IP mobile backhaul solutions for many of the world's largest MNOs. Backhaul solutions in the microwave access, wireline access and IP/MPLS domains have been enhanced to address the specific requirements of mobile backhaul for metro cells, enabling consistent and comprehensive mobile backhaul strategies to be developed for heterogeneous mobile networks comprised of metro cells, macro cells and Wi-Fi access.

With a strong grounding in each of the key networking domains required to build mobile backhaul networks, Alcatel-Lucent is uniquely positioned to deliver not only the right components to meet the particular needs of a given MNO's backhaul network, but also to deliver an optimized end-to-end backhaul solution. For MNOs who are looking to drive more efficiency into their backhaul networks to reduce total cost of ownership, Alcatel-Lucent offers advanced integration between the different network layers, enabling the ultimate in flexible, scalable and simplified mobile backhaul solutions.

ALCATEL-LUCENT MOBILE BACKHAUL SOLUTIONS

Packet Microwave Mobile Backhaul

Wireless or microwave connections currently account for over 50% of mobile backhaul access connections for macro cell sites worldwide.[2] Moving forward with the introduction of metro cells, microwave is expected to play an increasingly important role in providing backhaul connectivity where fiber or copper-based access is not available or not economically viable to deploy.

Alcatel-Lucent offers a full portfolio of microwave solutions for both macro cell and metro cell backhaul. The Alcatel-Lucent 9500 Microwave Packet Radio (9500 MPR) family offers solutions for tail, hub and aggregation sites, across a full range of licensed frequencies (6-42 GHz, 80 GHz). The 9500 MPR suite offers a range of unlicensed/lightly–licensed solutions optimized for accelerating metro cell deployments, including sub-6 GHz radios for point-to-point and point-to-multipoint non-line-of-sight applications and 60 GHz radios for high-capacity, short-reach point-to-point applications.

Alcatel-Lucent packet microwave solutions offer the flexibility to address differing site requirements considering location, distance, capacity and QoS. They offer a range of innovative features to maximize spectral efficiency and increase bandwidth capacity including channel bonding at the radio and packet layers, and intelligent packet compression algorithms that can reduce microwave bandwidth demands by as much as 57%. Simplified deployments are enabled through common outdoor units (ODUs) that can be deployed across all microwave applications including all-outdoor, split-mount and all-indoor applications.

[2] Infonetics Research, Macrocell Mobile Backhaul Equipment and Services, 2012

Wireline Mobile Backhaul

Fixed broadband access networks are well suited for metro cell backhaul due to their close proximity to many of the areas where wireless hot spots are expected to occur. Current broadband access nodes already meet the bandwidth and QoS needs for the backhaul of video, voice and data. Both GPON and VDSL2 can be leveraged to provide rapid and cost-effective metro cell backhaul access solutions.

The traditional challenge in leveraging GPON infrastructure for metro cell backhaul has been the lack of Optical Network Terminal (ONT) options that fit the unique needs of this application. Faced with space and power restrictions, metro cell sites require a low power, high bandwidth solution that occupies the least footprint possible. Alcatel-Lucent's extensive portfolio of ONTs includes models that are ideally suited for deployment in metro cell backhaul scenarios. These include indoor and outdoor ONTs engineered to support up to 1 Gb/s of sustained throughput to the end user. Alcatel-Lucent's GPON SFP ONT provides plug-in simplicity, further facilitating metro cell site access to fixed access infrastructure for backhaul.

On the copper side, there are a number of DSL technologies available today including ADSL2 + , G.SHDSL.bis and VDSL2. ADSL2 + and G.SHDSL can be used to provide near term bandwidth relief for 2G and 3G applications. VDSL2 with vectoring can be used to achieve downstream speeds of 100 Mb/s at distances of up to 400 m, and 40 Mb/s can be supported with loops as long as 1000 m. Pair bonding is a well-established technique that can be used to either increase bandwidth or extend the reach of a given bandwidth. With Alcatel-Lucent, up to 8 VDSL2 pairs can be logically bonded together using vectored or non vectored lines.

Packet Optical Mobile Backhaul

Packet-optical transport platforms play a key role in aggregating mobile traffic and handling the mix of circuit/TDM and IP/Ethernet traffic transport while enabling a smooth transition to an all-IP infrastructure. WDM enables operators to cost-effectively scale services by maximizing fiber utilization and performance.

As a highly integrated packet-optimized WDM solution, the Alcatel-Lucent 1830 Photonic Service Switch (1830 PSS) simplifies the aggregation and transport network by reducing the number of multiple function-specific or MSPP network elements. The 1830 PSS aggregates packet traffic from multiple access/cell sites and efficiently packs wavelengths to offer massive scalability and networking efficiency. The 1830 PSS multi-reach WDM portfolio offers right-sized platforms designed to efficiently meet traffic capacity and diversity needs ranging from access to metro/aggregation and core backbone applications. The Alcatel-Lucent solution also provides a scalable end-to-end 100G/400G solution across both IP and Optics domains, leveraging the Alcatel-Lucent 5620 Service Aware Manager (5620 SAM) management platform for further operational simplification and efficiency.

IP/MPLS Mobile Backhaul

Alcatel-Lucent IP/MPLS service router platforms provide resilient and highly scalable mobile backhauling capabilities for 2G, 3G , 4G/LTE and Wi-Fi traffic. Furthermore, they have the flexibility to operate over any type of network infrastructure whether wireline, optical or microwave-based. The principal product elements are the Alcatel-Lucent 7705 Service Aggregation Router (7705 SAR) and the 7750 Service Router (7750 SR) with comprehensive end-to-end management by the 5620 SAM.

7705 SARs are typically deployed at cell sites, both metro and macro. A range of compact and site-optimized 7705 SARs is available with varying capacity and physical characteristics, depending, for example, on whether the deployment is indoor or outdoor and what level of scalability is required. The 7705 SAR family consistently uses the Alcatel-Lucent Service Router Operating System (SR OS) software, bringing a uniform operational capability across all form factors. The larger chassis-based variants of the 7705 SAR portfolio are also deployed at higher points of concentration in the backhaul network, leading up to the controller and/or gateway sites.

Due to the pervasive nature of mobile backhaul networks, varied media types are often encountered, at a range of cost points, throughout the network. The flexibility to select the most cost-effective backhaul media available in a particular site, which still meets quality of service requirements, is a key competitive advantage. A powerful aspect of the 7705 SAR family is the ability to provide a consistent networking and operational capability over a wide range of media and infrastructure types.

At the head end of the IP/MPLS backhaul solution, the 7750 SR provides the hand-off to the RAN controllers and/or gateways in its role as an aggregation and concentration point for thousands of metro cell and/or macro cell sites over any intermediate transport. The 7750 SR with its revolutionary FP3 network processor provides comprehensive resiliency and massive, proven scalability. The 7750 SR supports high-density 10, 40 and 100 Gb/s interfaces, ensuring ample capacity for future growth requirements.

Networking resiliency is built into the Alcatel-Lucent IP/MPLS product portfolio: it is part of the foundational architecture of the SR OS software. The solution brings a strong suite of traffic engineering and resiliency capabilities via functions such as control and switch fabric redundancy, Fast Reroute and redundant pseudowires that can ensure end-to-end reliability across both leased and self-built mobile backhaul environments.

Service aware management for mobile backhaul

Alcatel-Lucent's service aware network management for metro cell backhaul offers significant OPEX savings for service providers looking to maximize operational efficiency. OAM processes can be operationalized through the Alcatel-Lucent 5620 SAM, which automates and simplifies network and service provisioning, performance monitoring and fault troubleshooting. These accelerate metro cell backhaul deployment by reducing the risk of introducing configuration errors, ensuring network-wide consistency, and enabling the MNO to proactively stay ahead of emerging network issues before they become customer impacting.

With 5620 SAM, fast provisioning reduces time and effort for deploying high volumes of metro cells and the rollout of end-to-end managed services. The 5620 SAM supports automatic discovery and provisioning features for automated bring-up and template provisioning, greatly reducing the workload required to commission new cell sites. QoS policy configuration audits, point-and-click workflows and service templates all eliminate the need to individually configure each network device in the service path from the metro cell to transport to packet core, while also controlling provisioning to ensure consistency.

Troubleshooting is fast and effective using the 5620 SAM's service-aware alarm correlation to detect and isolate the root-cause of faults across the end-to-end network. Advanced management capabilities allow the visualization of potential service impacting issues before they affect customers. For example, if a network impairment causes a service availability problem from a specific metro cell, operators are immediately alerted of the problem through the 5620 SAM service topology and fault status. They can quickly drill down into a correlated filtered alarm list to find the cause of the problem, which could be related to any network infrastructure along the backhaul service path from RAN to packet core.

In addition, automated setup of OAM diagnostics and statistics enable better SLA assurance through performance monitoring and validation for end-to-end IP-based services. Threshold crossing alerts can be pre-defined to proactively alert operators of emerging performance issues that may impact the end mobile service.

Time and effort associated with validating system interoperability with existing operator OSS systems, processes and workflows are also reduced as the 5620 SAM north-bound interface is pre-tested with industry leading OSS vendors with application integrations certified through the Alcatel-Lucent Connected Partner Program.

PROFESSIONAL SERVICES

Simplified planning, optimization and deployment of mobile backhaul networks

Alcatel-Lucent offers professional services for the design, optimization, and deployment of mobile backhaul networks, assisting MNOs to get mobile capacity and coverage to market in a faster and more efficient manner. The range of professional services includes helping to obtain site access agreements, planning power access and distribution, and integrating backhaul with cellular network planning and deployments to minimize truck rolls and streamline the deployment process.

Design and optimization services help simplify and reduce costs

Some of the key elements of Alcatel-Lucent's professional services for the design and optimization of mobile backhaul networks include:

- Determining the best backhaul access technology or technology mix given mobile service objectives, proxmity to facilities and total cost analysis
- Determining the optimum backhaul network architecture and dimensioning based on well-defined rules and best practices
- Detailed topology analysis and modeling with advanced Bell Labs algorithms to simulate traffic growth and its impact on the network
- Validation of the financial aspects of backhaul network evolution including CAPEX and OPEX benchmarks to help support the proposed evolution path

Assess both technical and financial impact of metro cell backhaul deployments
When it comes to metro cells, the right mobile backhaul strategy and design is essential to minimize costs and accelerate deployments. By assisting MNOs both on the technical aspects as well as with an investment plan, Alcatel-Lucent professional services experts help in the design and delivery of metro cell networks backed with a full business analysis and viable business case.

CONCLUSION

Through its comprehensive portfolio of backhaul products and professional services, Alcatel-Lucent brings to market the solutions and expertise to assist mobile network operators to prepare their backhaul networks to support the evolution to LTE and the transition to heterogeneous networks comprised of both macro cells and metro cells.

Alcatel-Lucent mobile backhaul solutions offer:

- The flexibility to deliver any mobile service over any access with support for 2G, 3G, LTE and Wi-Fi services with appropriate SLAs; choice of fiber, copper or microwave access; and backhaul equipment optimized for macro and metro sites, as well as indoor and outdoor locations
- The scalability to support more cell sites at higher bandwidths, with high-capacity packet microwave, fixed access and Carrier Ethernet access solutions; high-performance, scalable Carrier Ethernet and packet optical aggregation and transport; and IP/MPLS for highly scalable and reliable backhaul network architectures and topologies
- Simplified deployment and operations through a consistent approach to cell site backhaul provisioning regardless of access or location; end-to-end visibility and control to every cell site (macro and metro) for streamlined OAM; and professional services to help plan, optimize and deploy mobile backhaul networks

Alcatel-Lucent mobile backhaul solutions offer the flexibility, scalability and simplified operations required to enhance the mobile subscriber experience by facilitating the rapid delivery of increased mobile capacity and coverage with the right quality of service.

ACRONYMS

AC	alternating current
CAPEX	capital expense
DC	direct current
DSL	Digital Subscriber Line
GPON	Gigabit Passive Optical Network
GPS	Global Positioning Satellite
IP	Internet Protocol
LOS	line of sight
LTE	Long Term Evolution
MNO	mobile network operator
MPLS	Multiprotocol Label Switching
MSPP	Multiservice Provisioning Platform
NLOS	Non Line of Sight
OAM	Operations, Administration, Management
ODU	outdoor unit
OFDM	Orthogonal Frequency Division Multiplexing
ONT	optical network terminal
OPEX	operational expense
P2P	point-to-point
P2MP	point-to-multipoint
QoS	quality of service
RAN	radio access network
SFP	small form-factor pluggable
SLA	service level agreement
SON	Self Optimizing Networks
SR OS	Service Router Operating System
SyncE	Synchronous Ethernet
TDM	Time Division Multiplexing
VDSL	Very High Speed Digital Subscriber Line
WDM	Wavelength Division Multiplexing

Alcatel·Lucent