ENHANCE VOICE, EMBRACE DATA, GET READY FOR LTE

RETHINK YOUR BACKHAUL STRATEGY WITH THE ALCATEL-LUCENT MOBILE BACKHAUL SOLUTION

STRATEGIC WHITE PAPER

The advent of the mobile Internet and its evolving ecosystem are driving mobile bandwidth growth and creating new usage patterns in the Middle East and Africa (MEA) region. To capitalize on this emerging opportunity and prepare for future evolution, service providers need to act now and rethink their underlying backhaul networks.

Alcatel-Lucent addresses this need with a unique native packet microwave backhaul solution that is complemented by an extensive product family and comprehensive professional services. The flexibility, scalability and simplicity offered by the Alcatel-Lucent mobile backhaul solution will enable service providers in the MEA region to enhance voice, embrace data services and evolve toward LTE at a reduced total cost of ownership (TCO).

Alcatel·Lucent

AT THE SPEED OF IDEAS™

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INTRODUCTION

The data tsunami shows no signs of abating in developed countries, but the arrival of mobile Internet service in the MEA region is what will truly drive the next wave of mobile traffic growth. Service providers in the MEA region are increasing the coverage and capacity of their mobile networks in an effort to seize this emerging opportunity. Given the fast pace of mobile technology and business model innovation, it is now an ideal time to reconsider the network architecture and ensure that the next move can address the challenges of today and tomorrow.

At a high level, mobile backhaul can be defined as the connection between the cell sites in the radio access network (RAN) and the controller site (2G/3G) or mobile gateways (Wi-Fi, LTE). To get from a cell site to a controller site or gateway, mobile backhaul traffic traverses a variety of access, aggregation and transport infrastructure. Factors such as the need to sustain bandwidth growth, the evolving mix of applications carried on the mobile network, and the desire to move toward full IP networks are pushing mobile service providers to develop new strategies for evolving their backhaul networks.

This paper examines why service providers in the MEA region need to rethink their mobile backhaul networks now, highlighting the importance of packet microwave backhaul. The paper also recommends strategies and a portfolio that service providers can use to tackle the challenges presented by mobile backhaul evolution.

MEA SERVICE PROVIDER CHALLENGES AND IMPACT ON MOBILE BACKHAUL

In the MEA region, a combination of factors is putting pressure on service providers' mobile backhaul networks. These factors include the continuous surge of subscribers, the expansion of 3G/HSPA, the ultimate evolution towards LTE, and the advent of a more sophisticated service mix. Several major trends are developing in the MEA region:

- **Subscriber growth:** No one disputes the idea that the next wave of mobile subscriber growth will come from emerging markets. In most MEA countries, fixed access is lacking or offers limited coverage and reach. Mobile communication offers accessibility and convenience. Together, these factors position mobile as the de facto means of communication for end users. Pyramid Research projects that the MEA region's 3G subscriber base will increase from 162M to 371M between 2012 and 2017, and that the LTE subscriber base will grow from 1M to 33M during the same period.[1] Service providers must start preparing their networks for the new pressures that come with mobile subscriber growth. According to Ovum, "backhaul capacity will double over the next 12–18 months as operators can expect an annual increase in traffic of 77% between 2012 and 2017 in the African region."[2]

- **The move away from voice-centric traffic further stimulates bandwidth demand:** Today, voice is the cash cow for most mobile service providers in the MEA region. Studies by Pyramid Research indicate that average revenue per user (ARPU) is US$8.96 across the region. Voice revenue accounts for $7.10, or approximately 80% of this total.[3] However, the split between voice and other sources of revenue will be reshaped

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1. "Mobile Data Africa and the Middle East, 4Q2012." Pyramid Research, December 2012.

2. "Mobile Backhaul in Africa: Impending Data Growth Will Pose Challenges (TE006000697)." Ovum, June 2012.

3. "Mobile Data Africa and the Middle East, 4Q2012." Pyramid Research, December 2012.

by 2017. Total APRU is projected to decrease to \$7.42, with voice representing about 68% of the total. In some countries, the shift from voice to data is happening at a much faster pace. In Turkey, for example, data revenue will generate approximately 42% of ARPU in 2017. The combination of pervasive mobile broadband usage, increasing availability of affordable smartphones, tablets and PCs, and a maturing market for bandwidth-hungry applications will put more pressure on the backhaul network.

- **A more sophisticated service mix forces service providers to tackle monetization and QoS challenges:** The global ICT giants are eying emerging markets. In February 2013, several vendors announced that they would develop devices adapted for the MEA region. In the same month, Mozilla expanded the reach of its Firefox OS with 18 partnerships, including one with payment expert Bango. Mozilla's HTML5-based smartphone platform will give service providers greater control over different service aspects. This increased control covers tasks like customizing home pages and adding local services. It also covers commercial activities like mobile advertising and application billing. The partnership with Bango is significant, as carrier billing will play an essential role in new business models. The potential for a more sophisticated service mix represents a great opportunity, but it also adds different QoS requirements. At the same time, the steep decline of data tariffs continues to put pressure on service providers' top line. Service providers in the MEA region have to rethink their backhaul networks, apply mechanisms that can monetize data and provide the desired QoE to their customers.

- **Heterogeneous networks call for a converged backhaul:** The MEA region shows that there are many different ways to approach LTE migration. For example, Essar Telecom Kenya has announced that it will skip the 3G network and invest in LTE. Atlantique Telecom plans to deploy a 3G network in Côte d'Ivoire. Atlantique wants to deliver up to 42Mbps HSPA technology, install modernized circuit and packet core nodes, and migrate parts of its transmission network to IP. The MEA region's service providers are also using small cells and carrier Wi-Fi to offload traffic in dense traffic zones. Offloading helps service providers avoid being held back by spectrum costs and heavy deployment burdens. Faced with new sites and a new landscape of radio technologies, service providers need an efficient and converged backhaul that can support 2G, 3G and LTE, avoid bottlenecks and optimize TCO.

- **The pursuit of operational efficiency through power and footprint reduction:** Together with site rentals, the electricity used to power and cool telecom equipment takes up a large portion of service providers' operating expenses (OPEX). The need to reduce OPEX and pursue corporate social responsibility policies puts power and footprint reduction high on the agenda for service providers. A converged backhaul network that can avoid overlay and support evolution from 2G and 3G toward LTE will play an important role in optimizing network TCO.

RETHINK THE MOBILE BACKHAUL

Addressing the challenges of a changing mobile services landscape

To address the challenges outlined above, mobile service providers need to sustain bandwidth growth, adapt QoS requirements to a new service mix, and prepare for the arrival of LTE. The backhaul is a frequent starting point for service providers seeking to move toward a full-IP paradigm. A survey conducted by Heavy Reading indicated that "there is a general interest in 3G- and 4G- enabled smartphone-driven services."

The survey also revealed that "aligned with this view is the input from mobile service providers, showing that IP in the RAN (Node B and RNC), mobile core and the backhaul feeder networks are the priorities."[4]

Service providers in the MEA region need to reassess their mobile backhaul strategies. They must carefully consider how to scale their backhaul networks to keep pace with bandwidth demand and deliver a top-notch service experience to mobile subscribers. At the same time, they need to ensure that they maintain tight control over the capital expense (CAPEX) associated with network expansion and the ongoing OPEX required to maintain an increasingly diverse and complex backhaul network environment.

The emergence of the heterogeneous network — the co-existence of 2G, 3G and LTE, together with the arrival of small cells and Wi-Fi — in the MEA region brings more complexity to the challenge of redefining backhaul strategies. Ultimately, connectivity must be provided from base station to controller, and from base station to base station. As a result, service providers will need to leverage multiple access technologies to provide connectivity to the network in the most advantageous and cost-effective manner possible. Backhaul network capacity will be measured in gigabits and be delivered by way of IP over packet transport instead of time-division multiplexing (TDM).

Requirements for modern mobile backhaul networks

To keep pace with growing bandwidth demand and support the delivery of an outstanding QoE at the lowest possible TCO, mobile backhaul networks must:

- Scale with increasing demand for bandwidth
- Provide the flexibility to deliver service level agreements (SLA) that can meet the needs of 2G, 3G or LTE traffic and provide support for desired service objectives such as 'best-effort offload' or 'seamless multiservice'
- Support network topologies that scale for large networks and provide efficient resiliency mechanisms
- Leverage the best-available and most cost-effective access technology (microwave, fiber, copper) at any given site location
- Cap deployment costs by providing a simpler and more consistent approach to site commissioning, regardless of the underlying cell site access technology, cell site size or location
- Simplify ongoing operations and reduce operating costs by providing end-to-end network visibility and control, regardless of the underlying access technology

ALCATEL-LUCENT MOBILE BACKHAUL SOLUTION AND MEA

Alcatel-Lucent is an undisputed global leader in mobile backhaul and LTE transformation. The company offers proven expertise and a comprehensive portfolio that can help service providers in the MEA region evolve their backhaul networks and address the needs of today and tomorrow. Figure 1 provides a high-level view of the Alcatel-Lucent Mobile Backhaul Solution.

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4. "IP network & service migration: Benchmarking Telco progress." Heavy reading, April 2012.

Figure 1. Alcatel-Lucent Mobile Backhaul Solution
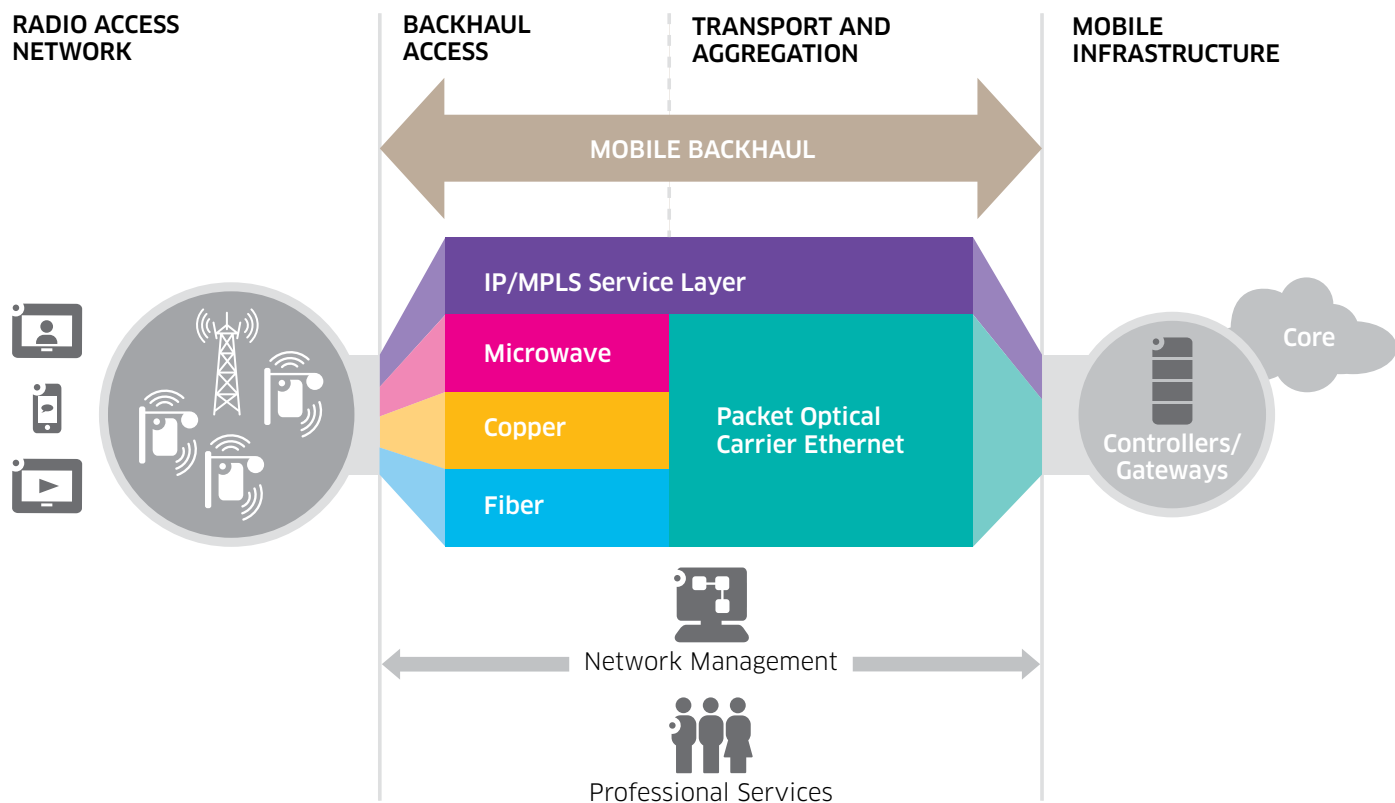
Alcatel-Lucent stands alone in its ability to provide mobile backhaul solutions that have the flexibility, scalability and operational simplicity to deliver the best possible QoE at the lowest possible backhaul network TCO. The Alcatel-Lucent Mobile Backhaul Solution offers:

- The flexibility to deliver any mobile service over any access. The Alcatel-Lucent solutions offer support for 2G, 3G, LTE and Wi-Fi services with appropriate SLAs. In addition, they offer the freedom to choose fiber, copper or microwave access, 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. Alcatel-Lucent offers 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 backhaul solutions for highly scalable and reliable backhaul network architectures and topologies.
- Simplified deployment and operations. Alcatel-Lucent offers a consistent approach to cell site backhaul provisioning regardless of access or location; end-to-end visibility and control of every cell site (macro and metro) to support streamlined OAM; and professional services that can help service providers plan, optimize and deploy mobile backhaul networks.

"… As mobile operators evolve from a mix of legacy to next-generation Ethernet in support of 3G and emerging 4G/LTE services, the Alcatel-Lucent Mobile Backhaul solution can be scaled to provide the infrastructure needed to support the required capacity and service delivery sophistication. Although there are a broad range of mobile backhaul solutions available from vendors, Alcatel-Lucent is one of just a few vendors that have the portfolio depth and organizational presence to deliver a complete end-to-end solution."

GLEN HUNT, CURRENT ANALYSIS, OCTOBER 2012

THE IMPORTANCE OF PACKET MICROWAVE MOBILE BACKHAUL

Microwave dominates the mobile backhaul market. It supported 55% of physical backhaul connections worldwide in 2012,[5] and will continue to play a prominent role as a backhaul solution. A June 2012 report by Ovum projected that "beyond the major metropolitan areas of Africa, microwave radio backhaul will be dominant but alternatives such as fiber will gain. Over the next 5 years, wireless backhaul systems are expected to account for 93% of backhaul systems due to such a geographic terrain and the ease and speed of installation."[6]

Several trends are paving the way for service providers to adopt native packet microwave solutions. For example, microwave solutions installed in 2013 must support all data network requirements. More importantly, native packet solutions have a unique ability to manage the TDM-to-Ethernet transition by ensuring that data is delivered at full capacity following transformation.

Beyond aggregation, packet microwave solutions are playing a growing role in the backbone in the MEA region. Factors such as a lack of fiber and the potential for vandalism position high-capacity and long-haul packet microwave as ideal solutions for boosting capacity, capitalizing on fast 3G/LTE network deployment and delivering packet protection mechanisms on fiber–microwave mixed rings. In this context, Sky Light Research projects that native packet microwave will account for 69% of the overall microwave market by 2016, up from 46% in 2012.[7]

ALCATEL-LUCENT 9500 MICROWAVE PACKET RADIO

The Alcatel-Lucent 9500 Microwave Packet Radio (MPR) offers service providers the flexibility to address differing site requirements while considering size, location, distance, capacity and QoS. This solution maximizes spectral efficiency and increases bandwidth capacity through innovative features such as channel bonding at the radio and packet layers, and intelligent packet compression. The Alcatel-Lucent MPR simplifies deployments and enables ongoing operational savings by supporting the use of common outdoor units (ODUs) that can be deployed across the microwave backhaul network for tail, hub and long-haul applications.

In addition, the Alcatel-Lucent 9500 MPR makes it possible to prioritize voice applications. Voice prioritization will enable service providers in the MEA region to deliver on QoS and QoE for bandwidth-hungry data applications.

Table 1 outlines Alcatel-Lucent's packet microwave value proposition and describes the key benefits offered by the 9500 MPR.

"The MPR 9500 platform enables [delivery of] a network clock at the physical layer with a good quality [that is] compliant with ITU-T G.813."

ORANGE CORPORATE

5. "Macrocell Mobile Backhaul Equipment and Services." Infonetics Research, September 2012.

6. "Mobile Backhaul in Africa: Impending Data Growth Will Pose Challenges (TE006000697)." Ovum, June 2012.

7. "Microwave Point-to-point Radio Equipment Worldwide Five-year Forecast". Sky Light Research, February 17, 2012.

Table 1. Alcatel-Lucent 9500 MPR benefits

Alcatel-Lucent value proposition	9500 MPR advantages
Packet microwave leadership	• Optimized TDM-to-packet transformation
	¬ Offers support for legacy TDM with a seamless evolution to packet backhaul
	¬ Eliminates the need to invest in legacy functions, such as TDM add-drop multiplexers (ADMs), that are required in TDM and hybrid microwave networks
	¬ Ensures TDM operation using advanced packet QoS capabilities
	¬ Enables full support for 3G and LTE packet-based backhaul
	¬ Moves from TDM to full packet operational support through a simple software configuration
	• End-to-end backhaul leadership
	¬ The 9500 MPR is part of an overall end-to-end Alcatel-Lucent packet backhaul framework. It is fully integrated with Alcatel-Lucent's IP/MPLS backhaul solution and Service Aware Management (SAM) portfolio, offering streamlined backhaul network operations in mixed microwave and fiber environments.
Efficiency and flexibility	• A single product family for all microwave applications
	¬ Reduces spares by supporting the same equipment for full-outdoor, split-mount, and full-indoor deployments
	¬ Provides integrated TDM, Ethernet and/or IP/MPLS networking support
	¬ Supports cell site networking options: direct connectively to RAN equipment, integrated indoor Ethernet networking, and/or indoor IP/MPLS networking
	• Maximized spectrum utilization to increase link capacity
	¬ Uses intelligent packet compression algorithms that can reduce microwave bandwidth demands by as much as 57%
	¬ Cost effectively doubles capacity by leveraging horizontal and vertical polarizations of the same frequency using existing standard antennas
	¬ Increases bandwidth up to 4x using multi-channel link aggregation at the radio layer
	¬ Supports multiservice aggregation that allows 2G, 3G and LTE to share a common packet-based backhaul without stranding bandwidth between TDM and packet domains
	¬ Offers high-performance adaptive modulation capabilities that maximize the use of high order modulation when adjusting to changing radio propagation conditions
	• Optimized end-to-end network management and provisioning
	¬ Simplifies network operations by offering a single management system that can control microwave, IP, and optical networks
	¬ Reduces OPEX by supporting advanced end-to-end provisioning, test, turn up, and troubleshooting functions
Rapid deployment	• Standards based network and service reliability
	¬ Supports layer 2 (Carrier Ethernet) and layer 3 (IP/MPLS networking)
	¬ Supports ITU G.8032v2-based ring topologies that allow for maximum network bandwidth utilization
	¬ Offers sub-50 ms network restoration to protect against network failures without requiring dedicated spectrum
	• Support for all 2G, 3G and 4G network synchronization methods
	¬ Dedicated E1/T1 or SDH/SONET timing
	¬ Sync-In/Sync-Out at 2.048 Mbps, 5 and 10 MHz
	¬ Synchronous Ethernet (ITU-T G.8261)
	¬ Precision Time Protocol (IEEE 1588v2)
	¬ Radio synchronization based on radio symbol rate
	• Multivendor RAN equipment support
	¬ Supports Alcatel-Lucent and third-party RAN equipment
	• Comprehensive professional services
	¬ Offers a full array of professional services that can provide third-party product integration and testing services as required

Alcatel-Lucent Packet Microwave product portfolio

Alcatel-Lucent offers one of the industry's most extensive microwave portfolios. The Alcatel-Lucent Packet Microwave product portfolio is composed of the following components:

- 9500 Microwave Packet Radio (9500 MPR), an overall portfolio of indoor and outdoor units for use in tail, hub and long-haul packet microwave applications

- 9500 MPR-e, a solution optimized for Ethernet-oriented, all-outdoor deployments. The 9500 MPR-e can also be co-located with IP/MPLS 7705 SAR (as an indoor unit) for delivering fully integrated IP microwave solutions

- 9500 MPR-s, a solution optimized for small cell site deployments in the Sub-6 GHz and 60 GHz spectrum

- 5620 Service Aware Manager (SAM), a product that provides end-to-end network and service management

Figure 2. Alcatel-Lucent Packet Microwave product flexibility
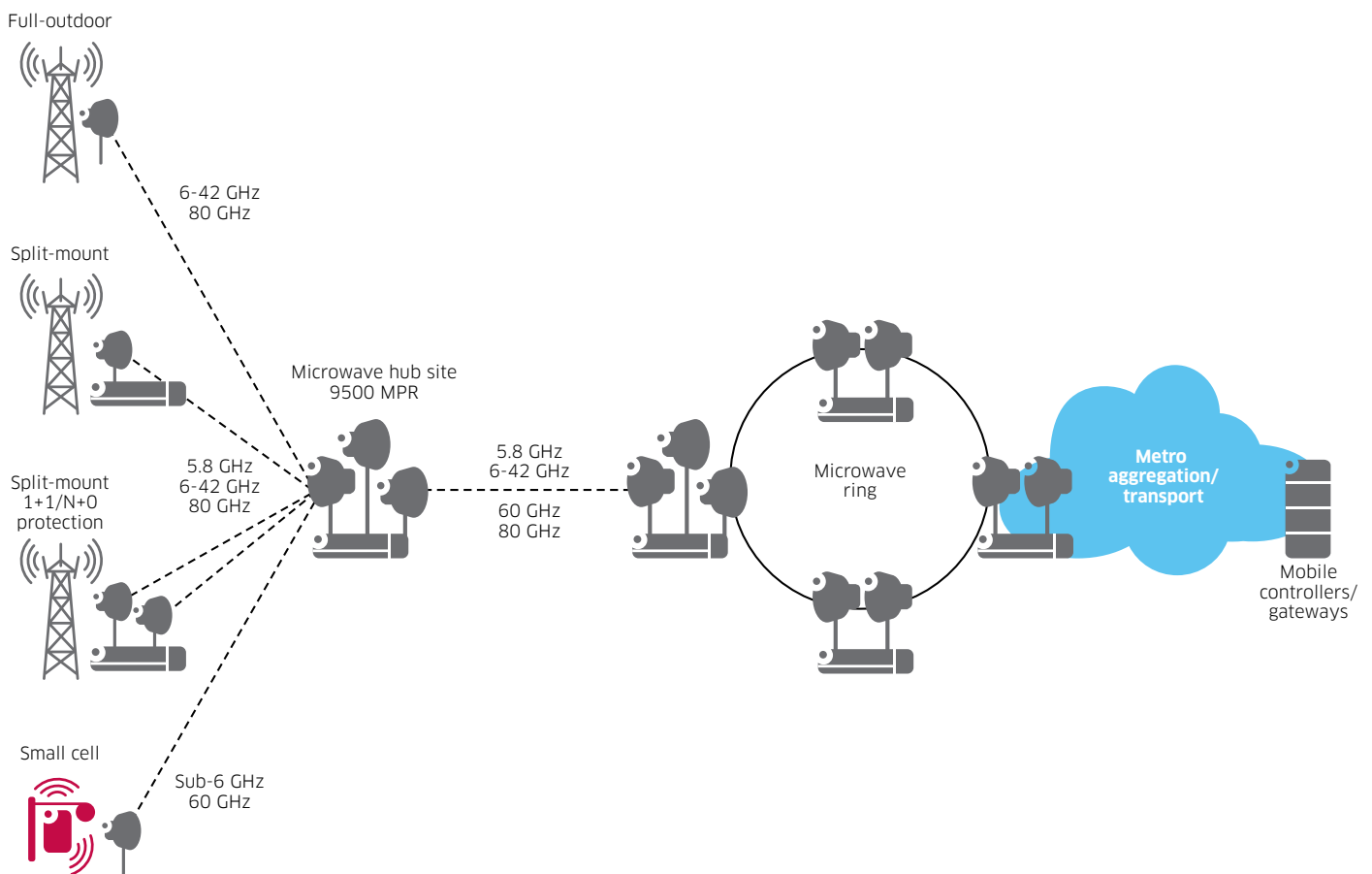
ALCATEL-LUCENT PACKET MICROWAVE RADIO CUSTOMER WINS AND REFERENCES

Customer	Region	Press Release
Saudi Telecom Company (STC)	MEA	STC and Alcatel Lucent apply LTE technology in the Kingdom of Saudi Arabia
Smile	MEA	Smile and Alcatel-Lucent pursue LTE deployment in Africa
Verizon Wireless	NAR	Verizon Wireless selects Alcatel-Lucent's mobile backhaul solution for nation's first 4G LTE network
Indosat	APAC	Indosat turns to Alcatel-Lucent to supercharge mobile broadband services in Indonesia

AUGMENT THE MICROWAVE BACKHAUL WITH THE FULL ALCATEL-LUCENT BACKHAUL SOLUTION

Alcatel-Lucent complements the 9500 MPR with a wide range of mobile backhaul solutions. These solutions feature IP/MPLS, fixed access and packet optical technologies.

Table 2 outlines how Alcatel-Lucent backhaul solutions help service providers address specific challenges.

Table 2. Choosing the right backhaul solution

Service Provider Challenges	Alcatel-Lucent Solution Offer
Are you looking to scale your 2G/3G backhaul networks while preparing for the transition to LTE? Are you concerned with keeping a lid on operational costs? Will you be leveraging multiple types of access technologies (e.g. microwave, copper, fiber)?	http://www.alcatel-lucent.com/solutions/ip-mpls-mobile-backhaul
Are you looking to leverage your fixed access infrastructure (PON, xDSL) for metro cell backhaul?	http://www.alcatel-lucent.com/solutions/wireline-mobile-backhaul
Are you looking to offer compelling wholesale backhaul or cell tower backhaul services based on Carrier Ethernet?	http://www.alcatel-lucent.com/solutions/packet-optical-mobile-backhaul

Alcatel-Lucent's professional services help service providers simplify the mobile backhaul planning and migration processes. This offer enables service providers to address the hurdles they face in evolving their mobile backhaul networks. It encompasses all aspects of planning, including market studies, traffic assessments, traffic forecasts, network design and network optimization. Alcatel-Lucent offers expert analysis that includes a customized multi-year business case and projected return on investment. This analysis shows how a CAPEX investment can bring significant OPEX savings over a multi-year period.

The Alcatel-Lucent professional services offer can also help service providers:
- Optimize TCO for the mobile backhaul architecture based on industry-proven methodologies and tool sets
- Devise the best technology, or technology mix, for enhancing performance, making use of advanced technologies to combat interference and difficult propagation conditions.
- Analyze each deployment to ensure QoS is optimized

CONCLUSION

Flexible, scalable, simplified backhaul for now and into the future

The MEA is a dynamic region that will drive the next wave of mobile traffic growth. This growth represents an unprecedented opportunity for service providers. To seize this opportunity, service providers need to rethink their mobile backhaul strategies and ensure that their networks are up to the challenges presented by the fast-evolving MEA market.

Alcatel-Lucent is unique in its ability to deliver market-leading converged mobile backhaul solutions. The company offers a broad and deep portfolio built around the 9500 MPR, a unique solution that brings outstanding capacity, performance and efficiency to the backhaul network. By combining this portfolio with unmatched professional services, expertise in end-to-end networks and field-proven experience with service providers across all continents, Alcatel-lucent can enable service providers in the MEA region to deliver the superior QoS and QoE that next-generation end users demand while reducing TCO.

Alcatel-Lucent offers flexible, scalable and simple converged mobile backhaul solutions. These solutions enable service providers to deliver enhanced voice and differentiated data services on 3G/HSPA and make a smooth transition to LTE.

"Packet radio is the future-proof solution. The 9500 MPR is much more scalable than the competition; it is a mature and future-proof solution."

T-MOBILE

ACRONYMS

ADM	add-drop multiplexer
APAC	Asia-Pacific
ARPU	average revenue per user
CAPEX	capital expense
E2E	end-to-end
GE	Gigabit Ethernet
HSPA	High Speed Packet Access
HTML	HyperText Markup Language
ICT	information and communications technology
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
ITU	International Telecommunication Union
LTE	Long Term Evolution
MEA	Middle East and Africa
MPR	Microwave Packet Radio
NAR	North America Region
OAM	operations, administration and maintenance
ODU	outdoor units
OPEX	operating expense
OS	operating system
PON	passive optical network
QoE	quality of experience
QoS	quality of service
RAN	radio access network
RNC	Radio Network Controller
SAR	Service Aggregation Router
SDH	Synchronous Digital Hierarchy
SLA	service-level agreement
SONET	Synchronous Optical Networking
TCO	total cost of ownership
TDM	time-division multiplexing
xDSL	digital subscriber line
XPIC	Cross-Polarization Interference Cancellation

Alcatel·Lucent