STRATEGIC WHITE PAPER

Mass-market broadband in high-growth markets

Broadband provides a fast, always-on connection necessary for high-growth economies to reap the social and economic benefits of Information and Communication Technologies. To increase broadband penetration in a market, telecom service providers must deliver broadband services beyond the profitable hotspots of advanced business users and high-income residential users to reach the mass market. Bringing broadband to the mass market in high-growth markets requires a comprehensive end-to-end solution that combines wireless and wireline technologies to deliver a single, high-speed, open network. With the Network Evolution to Mass Broadband solution, the telecom service provider can deliver broadband to subscribers with monthly ARPU as low as US $10, greatly increasing revenues and winning significant market share.

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1 Bringing broadband to the mass-market in high-growth markets

Broadband provides a fast, always-on connection necessary for high-growth economies to reap the social and economic benefits of Information and Communication Technologies (ICT). High-growth countries are increasingly prioritizing the rollout and uptake of broadband services to address today's low penetration rates, which average less than five percent of households. Low penetration rates indicate that broadband usage is still in the early adoption phase with telecom service providers primarily targeting advanced business users and high-income residential users in profitable hotspots. The result of this selected approach is weak broadband coverage, a lack of local content, low computer penetration and expensive devices.

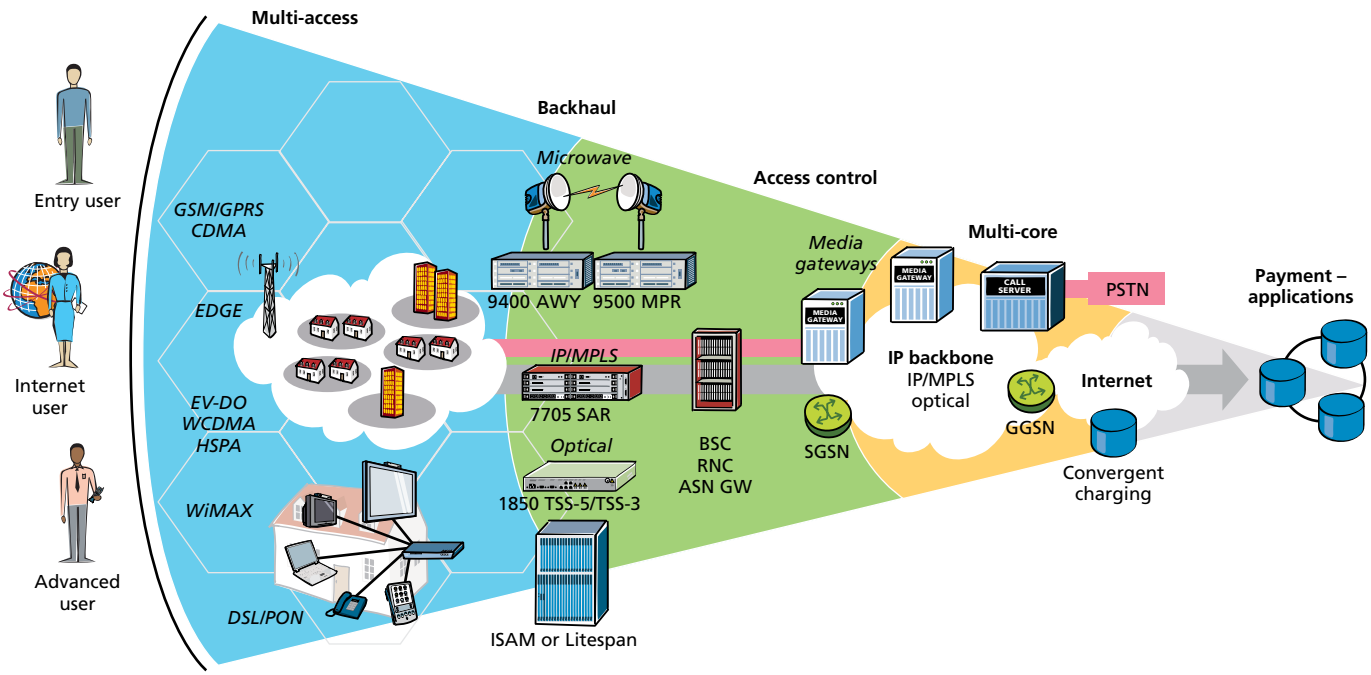
A comprehensive solution to help accelerate broadband uptake

To accelerate deployment and uptake of broadband services to the mass market, Alcatel-Lucent offers telecom service providers a comprehensive approach, combining wireless and wireline technologies, and leveraging the latest broadband-enabled technologies adapted for economical coverage and capacity. Densely populated and easily accessible areas can be connected with wireline solutions, while wireless solutions provide economically viable broadband connectivity to smaller villages and remote regions.

The Alcatel-Lucent Network Evolution to Mass Broadband (NEMB) solution enables this network transformation with a complete, end-to-end approach. As shown in Figure 1, the solution combines access, transport and core networks with applications and wide-ranging managed services. This "one-stop" solution provides telecom service providers with the cost-effective tools and capabilities they need to accelerate broadband uptake in high-growth economies.

Designed for all types of networks, including multi-technology and multivendor, this best-in-breed solution provides the building blocks for top-level performance. Whenever appropriate, the solution is pre-tested in Alcatel-Lucent IP Transformation Centers worldwide prior to full network deployment. In this step, the solution can be customized to deliver the desired broadband services with the appropriate quality of service (QoS) for the operator's business requirements. Testing evaluates network performance end-to-end, including premises equipment, network equipment, applications and operations support systems. The Alcatel-Lucent NEMB solution interworks with all major infrastructure vendors and gives service providers the flexibility to choose their preferred best-of-breed components.

Figure 1. Overview of the Network Evolution to Mass Broadband architecture



A trusted partner in broadband with unmatched experience in high-growth markets

The Alcatel-Lucent NEMB solution leverages the company's extensive experience in high-growth economies, as well as our market leadership in broadband technologies. It cost effectively combines multiple wireless and wireline technologies to deploy a single, ultra-high-speed, open network, which can provide broadband services to all residents and businesses in a region. It also helps telecom service providers transform their business and network models to apply relatively low broadband tariffs, enabling a significant increase in revenues and market share.

The following sections of this paper provide additional detail on how the Alcatel-Lucent NEMB solution helps service providers accelerate mass-market broadband adoption in high-growth economies.

High-growth economies include countries in South and Southeast Asia, India, Russia, CIS, Middle East and Africa, and Latin America and the Caribbean.

Mass market is a general business term describing the largest group of customers for a specified industry product. (It is the opposite of a "niche market.")

Broadband is defined as "always on" Internet connections with bandwidth greater than 128 kb/s.

2 The broadband market today

As broadband provides the fast, always-on connections high-growth economies need to reap the social and economic benefits of Information and Communication Technologies (ICT), many countries consider the uptake of broadband to be a national priority and are planning to:

- Interlink networks between countries to decrease the price of bandwidth
- Generate greater broadband access with wireless (WiMAX/3G) as well as wireline (DSL/FTTx) technologies
- Invest cost effectively in IP network transformation to offer more bandwidth at a lower cost
- Capitalize on end-user demand with attractive and affordable content and applications.

Figure 2. Global broadband and PC penetration forecasts

	Broadband penetration		PC penetration	
% pop	**2008**	**2012**	**2008**	**2012**
Brazil	6%	9%	27%	37%
Mexico	6%	11%	17%	21%
US	26%	31%	90%	96%
India	1%	3%	3%	8%
Vietnam	3%	9%	13%	15%
China	7%	13%	16%	23%
Russia	4%	10%	26%	32%
Australia	29%	44%	88%	103%
South Africa	2%	7%	15%	21%
Egypt	1%	2%	15%	16%
France	29%	39%	70%	84%

Source: Pyramid, September 2008

2.1 Mass-market broadband potential

Alcatel-Lucent conducts end-user surveys across multiple high-growth markets to understand the market demand for broadband services. A July 2007 survey of over 2000 respondents in Brazil, Russia, Egypt, Kenya, India, Indonesia, Malaysia, China, Vietnam and the Philippines revealed a large, untapped demand for personal broadband services among subscribers who currently use dial-up connections at Internet cafés or at work.

Seventy-five percent of Internet users — with connections at work or Internet cafés — would be interested in subscribing to an affordable broadband at home.

SOURCE: ALCATEL-LUCENT END-USER SURVEY, JULY 2007

End-user surveys conclude that broadband penetration levels would be stimulated by new entry-level broadband packages, low-cost PCs and devices, and local content development. Innovative broadband applications could also help increase loyalty and ARPU among the most advanced users to avoid cannibalization between income groups.

2.2 Current broadband market in high-growth markets

In high-growth economies, however, the following issues hinder broadband penetration rates:

- *Low penetration rates* – Internet broadband penetration rates rarely rise above 5 percent of households, and they are significantly lower than PC penetration rates in the same countries which generally range from 15 percent upwards.
- *Higher tariffs* – Broadband prices are higher than elsewhere, resulting from a lack of economies of scale, the high cost of international bandwidth and high taxes and duties. In Nigeria, for example, a broadband connection typically costs 125 US dollars per month for a downlink rate of 384 kb/s (year-end 2007).
- *Quality of Experience* – High-growth economies also present challenges to the end user's quality of experience, resulting from frequent power outages, IT security issues and an effective bandwidth far below the rate promoted by Internet carriers.

2.3 Next steps toward a broadband-connected world

Telecom operators providers have three major issues to tackle to deliver broadband to the mass market with a guaranteed Quality of Experience:

Connect to international backbone networks – by rolling out submarine cables or satellites. This crucial milestone for a region can help provide high-bandwidth connectivity and capacity at affordable cost.

Build national backbone networks – by rolling out Internet exchange points, fiber and microwave between the main cities countrywide. This step is mandatory for affordable broadband connectivity and capacity.

Provide last mile access – by selecting the most economical technologies to reach end users, their building or enterprise. For example:

- Wireline access technologies, such as copper (DSL) or fiber (FTTx) can economically connect dense populations with easy access to copper plant and national backbone.
- Wireless access technologies, such as GPRS/EDGE/GERAN, CDMA 1xRTT/EV-DO, W-CDMA/HSPA, WiMAX and tomorrow LTE can provide economically viable broadband connectivity for remote, sparse populations — or where copper plant is unavailable or located far from the national backbone.

GLOBACOM: ACCELERATING UPTAKE OF BROADBAND SERVICES IN NIGERIA… AND IN WESTERN AFRICA

Globacom, the second largest national service provider in Nigeria, has begun a smart network transformation to deliver mass-market broadband services quickly and cost effectively. With a population of 140 million, Nigeria has the third largest economy after South Africa and Egypt. The country's strong business segment is demanding high-quality broadband services that are essential for business activities. As of September 2007, eight million people were using Internet services, mostly at Internet cafés (source ITU). However, broadband access is still at early stage with penetration of less than one percent.

"Our 3G Plus network will revolutionize the way Nigerians access the Internet, as it enables a much faster transmission of data, broadband Internet and multimedia services."

MOHAMED JAMEEL, DEPUTY COO OF GLOBACOM

To deliver affordable, "always-on" broadband to Nigeria and surrounding markets, Globacom is completing the following three major steps:

- *Connecting to the international backbone* – A 9200 km submarine cable project, supplied by Alcatel-Lucent, will connect Nigeria to the international backbone by 2009. This secure link will support explosive growth for mobile voice and broadband traffic at competitive rates.
- *Building a national backbone* – To backhaul traffic for 14 million mobile subscribers and 500,000 fixed subscribers, Globacom has already deployed a comprehensive transport network from Alcatel-Lucent including: a full ATM/IP broadband data network, radio systems totaling 5000 kilometers of microwave routes and the largest optical network in Africa with 40 cities in Nigeria. Globacom is now increasing network switch capacity to accommodate 35 million subscribers before the end of this year. The company launched its own fiber-optic cable backbone in March 2008, in a move that will make bandwidth costs the lowest in the West African region.
- *Providing last-mile access* – Globacom was the first operator in West Africa to leapfrog to the newest broadband technologies including W-CDMA/HSPA and DSL. With its 3G Plus network supplied by Alcatel-Lucent, Globacom is creating mobile broadband momentum with a quality of experience that targets mass-market broadband in the near future.

Globacom's primary criterion for choosing a telecom vendor is a company that it can be a true partner with; a vendor who can provide an end-to-end solution coupled with a vision and execution plan for business development. Globacom selected Alcatel-Lucent as its telecom partner due to its recognized experience deploying telecom networks in high-growth markets and its market leadership in both broadband and wireless.

"… Nigeria has experienced tremendous growth in voice-mobile services but we cannot boast of being a very modern state if we don't have broadband and Internet penetration that is much higher than what we have today. … By December 2009… we should have broadband Internet and broadband services in all the state capitals and major commercial centers."

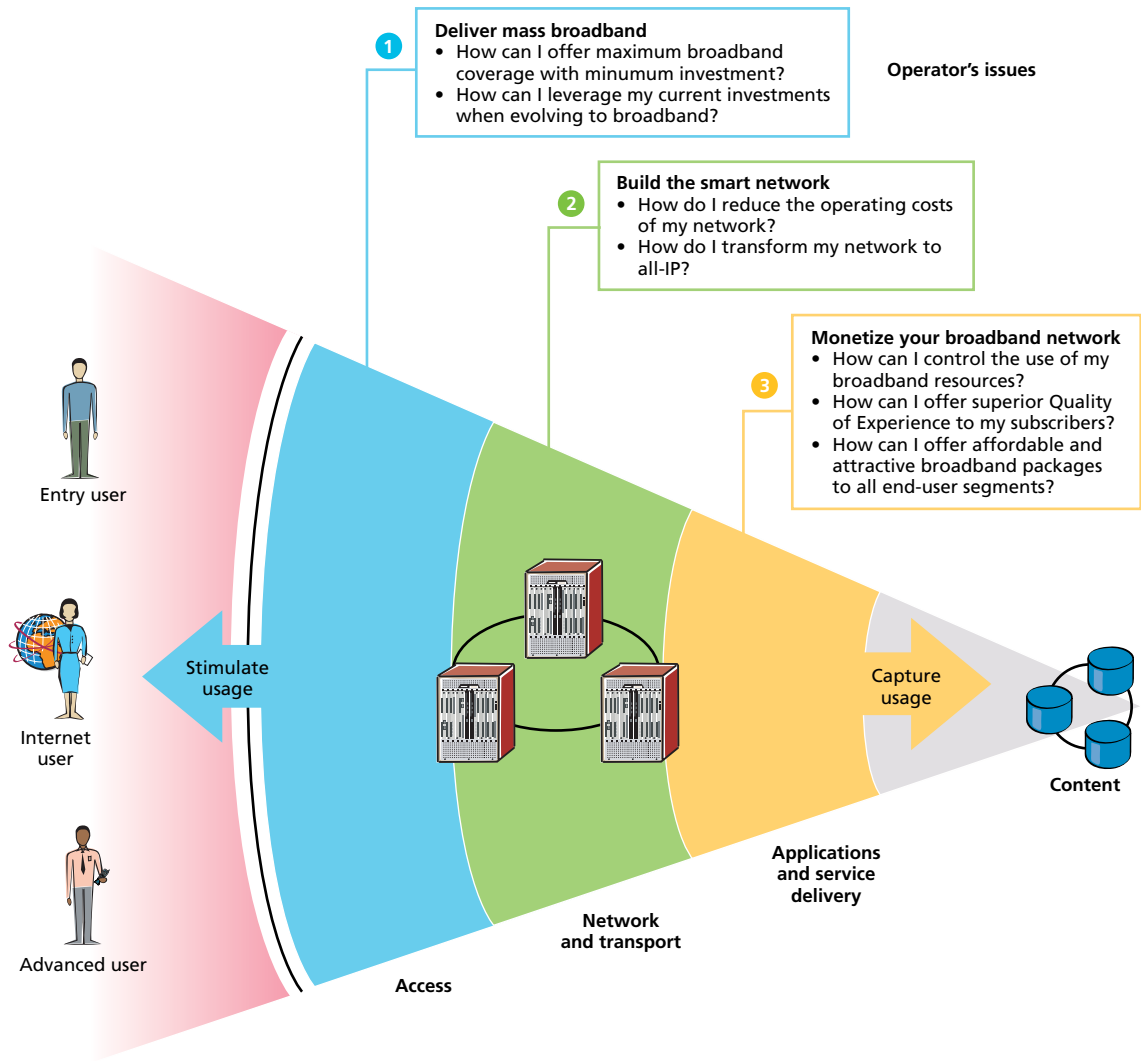
ERNEST NDUKWE, EXECUTIVE VICE CHAIRMAN OF THE NIGERIAN COMMUNICATIONS COMMISSION (NCC) 2008

3 Alcatel-Lucent solutions for telecom service providers in high-growth markets

To deliver affordable broadband services to diverse user segments, telecom service providers need to transform their business and network models. For sustained, profitable revenue growth, service providers need smart networks, with the bandwidth, speed, capacity and intelligence required to deliver bandwidth-intensive services quickly, simply and efficiently. The Alcatel-Lucent Network Evolution to Mass Broadband (NEMB) solution meets these needs by providing wireless and wireline access networks as a single, seamless network that cost effectively shares core, transmission, radio and application resources.

This integrated approach enables operators to address the key issues of delivering mass-market broadband. This section explains how Alcatel-Lucent can help operators respond to each issues highlighted in Figure 3.

Figure 3. Addressing the issues of delivering mass-market broadband



BUSINESS CASE: BLENDING ACCESS TECHNOLOGIES TO DELIVER MASS BROADBAND

The following business case is based on field experience in the Middle East/North Africa region to illustrate how the Alcatel-Lucent Network Evolution to Mass Broadband solution can cost effectively combine multiple broadband access technologies to provide broadband services to all residents and businesses. The business case demonstrates that if a telecom service provider transforms its business and network models to offer relatively low broadband tariffs for monthly ARPU starting at US $10, the carrier can ensure a significant increase in its revenues and quickly win a significant market share by delivering broadband services to the mass-market.

Network model:

- Use of the Local Loop Unbundling (LLU) where copper already exists
- Fiber rollout in dense residential areas and in hotspots (business centers, shopping malls, airport, smart cities and new cities)
- Deployment of WiMAX Rev-e
- Broadband services offering voice, data and Internet and video services

Market scenario:

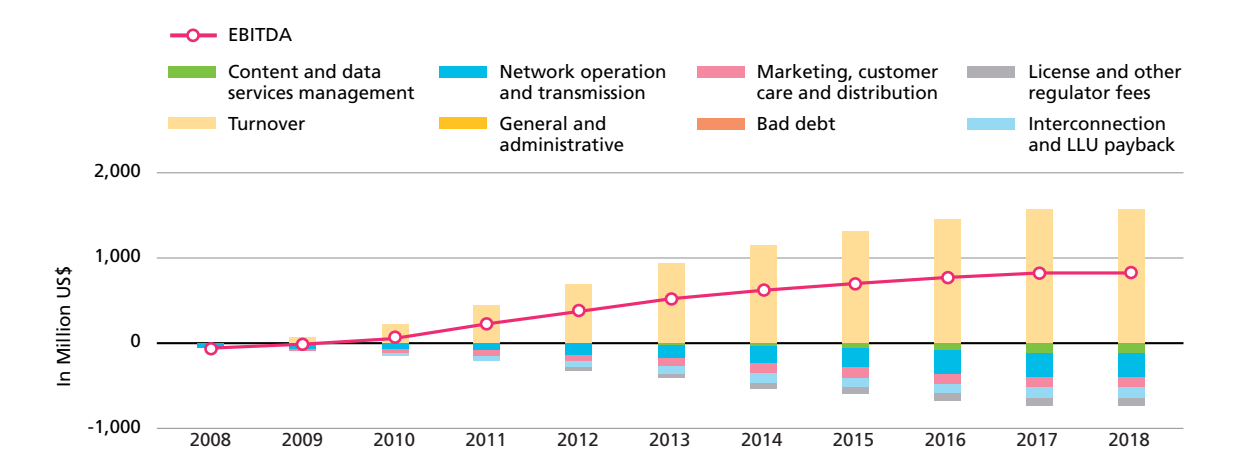
- License delivery (fee USD $100 million)
- Commercial opening by mid-2008
- National forecast by 2011: rollout of 3 million of residential broadband lines and 1.1 million of enterprise subscribers
- Operator target: 20 percent market share of national forecast

Total cumulated revenues over 10 years will be close to US $6 billion with the volume of mass-market with 50 percent coming from broadband subscriptions. Increasing broadband penetration to the mass-market also generates additional revenue opportunities from small and medium businesses who now have broadband coverage, and from nomadic users benefiting from ubiquitous wireless broadband eservices.

Key business indicators:

- IRR: 32 percent over the 10-year period
- NPV with a weighted average cost of capital (WACC) of 12 percent, is USD $534 million
- Payback period is 5.2 years (from 2008), with a break-even point in 2013
- 51 percent of operating profit after 10 years

Figure 4. Rapid profitability from mass broadband



The Alcatel-Lucent Bell Labs Business Modeling and Consulting team provides economic modeling and business case development for telecom service providers to define strategic objectives and develop the underlying business models and financial business cases that will accelerate the uptake of broadband services in high-growth economies.

3.1 Delivering mass-market broadband

How can I offer maximum broadband coverage with minimum investment?

All broadband access technologies, both wireline and wireless, offer distinct advantages and disadvantages based on the telecom service provider's market strategy. No one technology can address the broadband needs of every deployment scenario. Carriers are increasingly combining wireline and wireless access technologies or multiple wireless access technologies to efficiently expand their broadband coverage. Alcatel-Lucent offers the widest broadband access portfolio in the industry enabling it to play the role of trusted neutral technology advisor to telecom service providers when selecting the broadband access technology that best fits a given market. Alcatel-Lucent partners with over 150 carriers worldwide to understand and solve strategic problems linked to the rollout and the operation on their broadband services as part of its network business consulting program.

The Alcatel-Lucent Broadband Integration Service (BBIS) is a complete service-lifecycle solution that helps carriers quickly launch, operate and maintain broadband services over large diverse geographical regions. BBIS addresses the time-to-market, technical, operational and marketing challenges associated with deploying a mix of technologies, often from different vendors. This end-to-end, open solution runs in a multivendor, multi-technology environment. It interworks with all major infrastructure vendors, and individual components can be integrated within any carrier network. Alcatel-Lucent has field-proven experience provided integration of multiple access technologies for the following carriers operating in high-growth economies to enable them to launch broadband services to the mass market:

- *Globacom Nigeria* – integrated wireless (GSM, W-CDMA, HSPA) and wireline (DSL) access
- *Orascom Pakistan* – combined GSM and WiMAX
- *MTS Connect Ukraine* – CDMA EV-DO to deliver broadband services over GSM networks

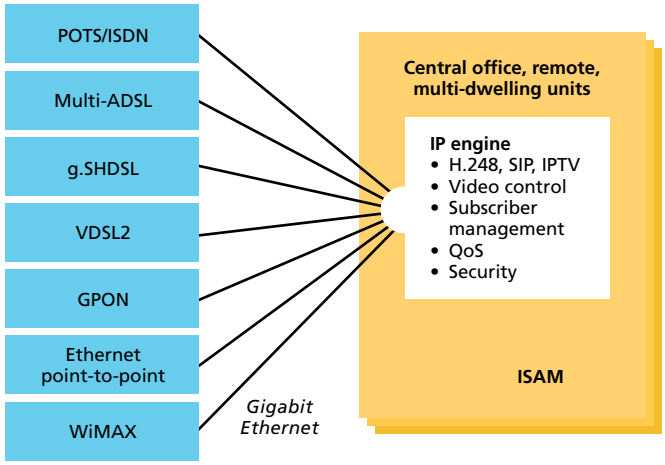
How can I leverage my current investments when evolving to broadband?

Telecom service providers can preserve their current and future investments while introducing the latest broadband technologies. Alcatel-Lucent answers this expectation with a true multi-standard solution.

In the mobile infrastructure, Alcatel-Lucent deployed 500,000 multi-standard base stations in 100 countries since 1999 to support all wireless access technologies on one platform. The multi-standard base station allows the telecom service provider to reuse existing equipment with shared resources, including common transport, site reuse and open interfaces when moving to new mobile broadband technologies in EDGE, GERAN, UMTS/HSPA+, WiMAX or LTE technologies.

Existing assets can also be leveraged when combining wireless and wireline broadband access technologies. For fixed operator moving to wireless, Alcatel-Lucent offers the possibility to extend the current ISAM wireline solution with wireless access technologies such as WiMAX. This allows a more efficient deployment to support a broad range of services and shortening time-to-market of new broadband services.

Figure 5. Multi-technology access for flexible broadband service extension

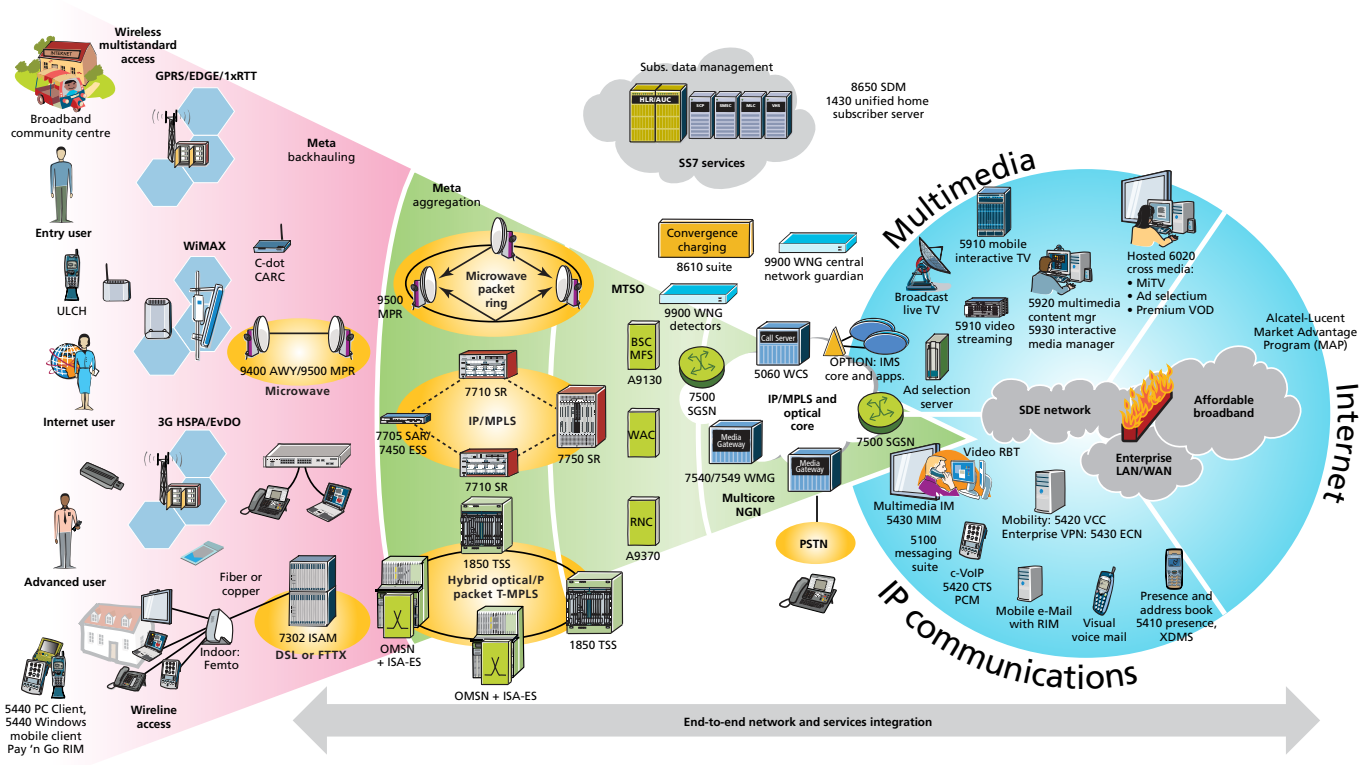


3.2 Building smart networks

How do I reduce the operating costs of my transport network?

With the ramping increase in broadband traffic, operating costs are soaring and need to be sharply reduced. Today's transport is largely based on costly leased lines which do not scale effectively to meet broadband service demand. To reduce increasing transport costs today and for future services, carriers can transform their network to all-IP. The Alcatel-Lucent NEMB solution helps carriers build service-aware, converged, smart transport networks that support all-IP service delivery at the lowest cost with the best quality of experience leveraging both the Alcatel-Lucent Mobile Evolution Transport Architecture (META) and Triple Play Service Delivery Architecture (TPSDA) field-proven architectures that deliver best-of-breed wireless and wireline innovations as shown in Figure 6.

Figure 6. Detailed Network Evolution to Mass Broadband Architecture



Mobile Evolution Transport Architecture (META)

META achieves TCO savings of up to 44 percent, compared with traditional leased line transport.

SOURCE: BELL LABS MODELING

Delivering a multi-technology solution, Alcatel-Lucent META enables the reliable transport of all-IP traffic over optical, microwave, IP/MPLS, or DSL/GPON packet networks. To ensure the continuity of services as the network evolves to packet, it allows advanced traffic management and processing, and full separation and prioritization of different service traffic, to deliver guaranteed end-to-end, managed QoS. Carriers can consolidate CAPEX and OPEX through a more scalable, flexible, resilient and secure transport network.

Triple Play Service Delivery Architecture (TPSDA)

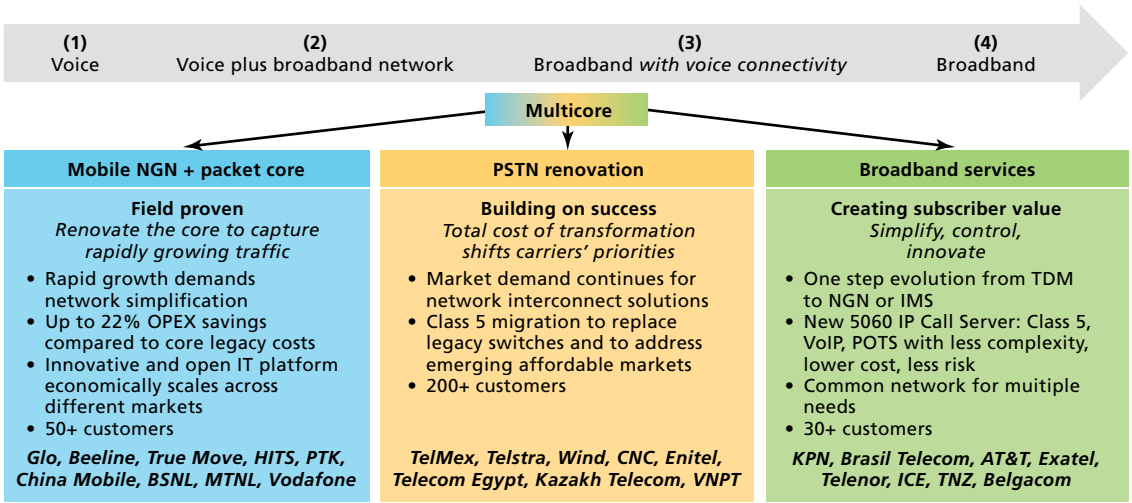
Alcatel-Lucent TPSDA is the blueprint architecture to accelerate wireline IP network transformation for delivery of video, voice, data and entertainment services. Alcatel-Lucent TPSDA represents a significant upgrade from first-generation broadband network solutions. Whereas past solutions tunnel "best effort" Internet traffic across the network, TPSDA provides distributed, fine-grain policy enforcement with centralized policy control to deliver multiple services to subscribers, including both unmanaged services such as High Speed Internet (HSI) and managed services such as IPTV, voice and managed online services. Alcatel-Lucent TPSDA is unique in using all parts of the network to deliver and enforce policy end-to-end.

How do I reduce the operating costs of my core network?

To support continuous broadband traffic growth and new broadband service launches, telecom service providers need flexible, scalable, efficient network solutions that make service innovation and roll-out simple and fast to market. At the core of the network, these solutions must cos t effectively contend with more bandwidth–intensive applications and prepare for a converged, flat all–IP architecture. Combining IP and IT technologies, the Alcatel-Lucent multicore distributed architecture allows telecom operators to cost effectively manage the high growth of broadband traffic by moving the traffic switching closer to the end user. In addition, integrated subscriber management enables a seamless user experience.

Legacy technology replacement can sometimes be easier during times of explosive growth, since it represents only a fractional increase in capacity requirements, but this approach yields major operational costs. Whereas traditional network services rely on dedicated control solutions to support each type of service (which often creates separate islands sharing a common transport – such as leased lines, TDM for voice services and IP or ATM for data services), network transformation introduces a common IP routing and control layer that supports all communication services, including voice, data and video. This unified control core facilitates service evolution, while significantly reducing the OPEX associated with delivery of more traditional service offerings.

Figure 7. Multicore strategy for cost-effective IP transformation



3.3 Monetizing broadband networks

By leveraging intelligence in the network, telecom service providers can realize new revenue opportunities, including new applications and business models. However, with growing broadband demand, resource protection becomes crucial. The Alcatel-Lucent NEMB solution opens up new ways to monetize broadband networks by helping service providers address the following key questions.

How can I control the use of my broadband resources?

Regulating broadband usage is essential for widespread broadband adoption in high-growth economies, where resources are limited. With the Alcatel-Lucent NEMB solution, operators gain end-to-end control using applications that monitor and manage scarce network resources. The following sections explain how these capabilities help service providers deliver affordable mass-market broadband.

Delivering different packages at different prices all with Quality of Experience

With full end-to-end manageable Quality of Service, the Alcatel-Lucent NEMB solution allows application differentiation to be applied on a per-user basis. For example, service providers can offer:

- Voice service only for entry users
- Premium bundled packages of broadband applications for advanced users
- Broadband Internet service only for Internet users

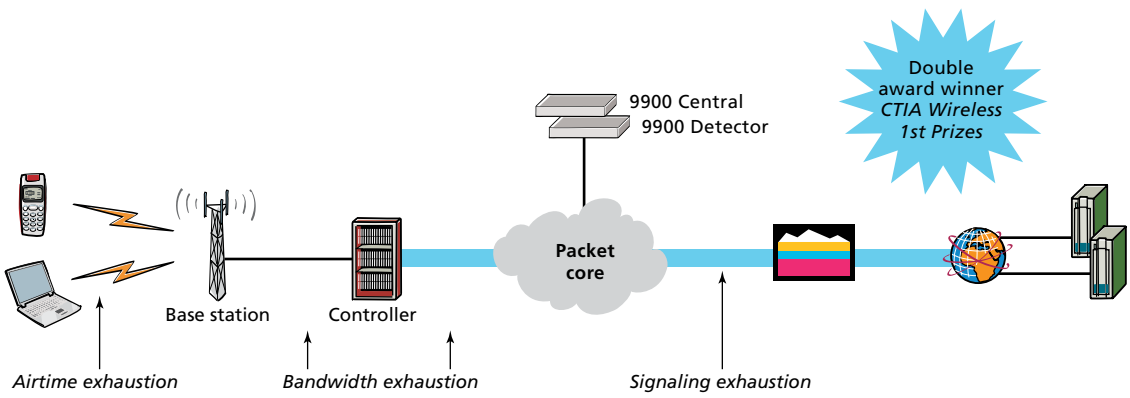
This differentiated model supports lower entry subscription prices that can attract new low-income subscribers. As a result, revenues can be increased without affecting high-ARPU users — and without additional investment in capacity.

The Alcatel-Lucent 8610 Instant Convergent Charging suite enables telecom service providers to fine tune broadband usage, by supporting differentiated broadband packages. The suite allows customers to select the services they want most, within the price they can afford to pay. For example, a user with a 1-GB download limit can download two or three movies per month, and any additional videos can be charged appropriately. The payment suite supports any combination of virtual or real payment method, including the prepaid services that are widely used in high-growth economies. As a result, service providers can seamlessly launch packages adapted to changing market dynamics, adjusting their offers with revised rating plans, packaging, promotions and discounts, bonus and loyalty plans, as well as Web-based self-care.

Enabling cost-effective quality of service

For wireless broadband – the Alcatel-Lucent 9900 Wireless Network Guardian integrates network monitoring, traffic analysis, behavioral analysis and traffic management, as shown in Figure 8. With these streamlined capabilities, operators can optimize network performance, efficiency and profitability over wireless, while ensuring that the network is not congested by non-value added or wireless-unfriendly traffic.

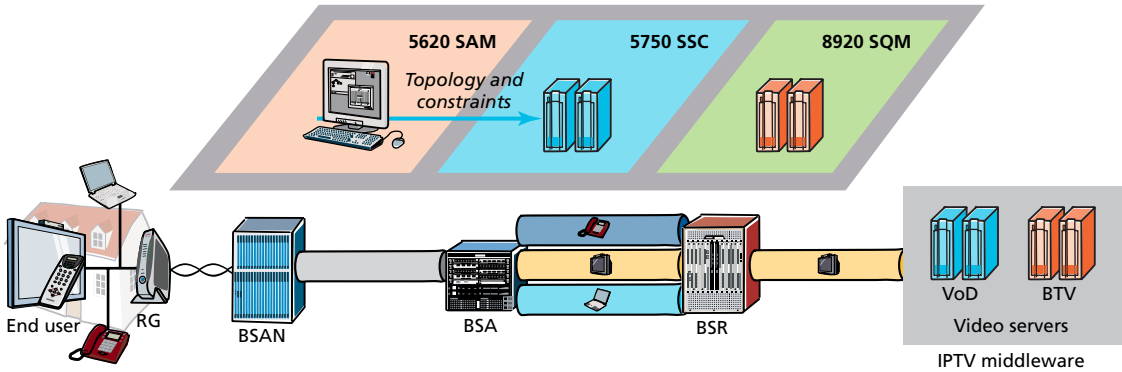
Figure 8. Alcatel-Lucent 9900 Wireless Network Guardian



For wireline broadband – The Alcatel-Lucent TPSDA service assurance and control framework offers improved control of bandwidth resources end-to-end while ensuring a superior Quality of Experience (QoE) for end-users. As shown in Figure 9, this framework incorporates the following products:

- *For assurance* – The Alcatel-Lucent 5620 Service Aware Manager (SAM) includes commissioning devices, building topologies, provisioning capacity and performance monitoring.
- *For control* – The Alcatel-Lucent 5750 Subscriber Services Controller (SSC) efficiently allocates network resources, enables subscriber access and applies the appropriate QoS for each subscriber application.
- *For planning* – The Alcatel-Lucent 8920 Service Quality Manager (SQM) monitors end-user quality of experience.

Figure 9. Alcatel-Lucent TPSDA service assurance and control framework



Evolution of Internet traffic and impact of peer-to-peer traffic on transit and peering

Reducing the international traffic costs is one of the key challenges in high-growth economies. It is done naturally by motivating local content creation but it can be accelerated by optimizing the international peer-to-peer IP bandwidth with intelligence in the network. Bell Labs is working on innovative applications that have been proposed to the P4P workgroup of DCIA and the standardization activities in the IETF, so operators can take an active role in delivering broadband with better international Internet and video over IP connectivity across existing available international bandwidth. Or alternatively, carriers can deliver an acceptable quality with a lower international interconnect volume. Thus telecom service providers can enjoy lower capital expenditures for IP connectivity at the international level.

How can I offer affordable, attractive broadband packages for all income groups?

Accelerating broadband uptake by all user groups requires attractive and affordable services that are priced correctly for the target segment, reach the end-user's expectations for Quality of Experience, and do not cannibalize each other. Business and high-income residential users are often the first segments targeted with broadband services so operators should nurture the loyalty of these high-revenue customers. But the mass-market is also a strategic market to target with broadband services – and if done correctly can be profitable to the service provider.

- *Business communications* – Alcatel-Lucent addresses the needs of this consumer segment with a rich set of enterprise communication solutions combining state-of-the-art CPE and network-based services. The enterprise communication solutions enable advanced calling services from traditional calling devices, as well as PCs, in both fixed and mobile environments. Advanced enterprise solutions are supported by the Alcatel-Lucent 5340 ECN application server.

- *High-end residential users* – Consumers are looking for a highly personalized communication experience that leverages advanced devices and networks. To address this need, telecom service providers can make a single investment in IMS and associated applications to enable delivery of the widest possible range of advanced communication services plus basic phone services for entry-level users. This single investment addresses a full spectrum of customer needs.
- *First-time broadband users* – Operators in Egypt have made use of volume download limits and prepaid subscriptions. In July 2007, the Minister of Egyptian Telecommunications announced a broadband offering designed for users who could not afford an unlimited package. At a starting price of $8 USD, it offers rates of 256 Kb/s or 64 Kb/s, with a 2 GB download limit. According to the Egyptian regulation authority, this is considered one of the lowest rate offerings worldwide. Following introduction of this package, Telecome Egypt Data's data subscribers increased by 60 percent in one month, with 35 percent of new subscribers choosing the new limited download package.

To ensure that the service provider will deploy broadband services aligned with its strategy and consistent with its competitive position in the country, Alcatel-Lucent supports the operator's marketing team to analyze the local market, identify target market segments and optimize the broadband offer, taking the maximum benefit of our solution. Key to successful uptake of broadband service by the mass market is the correct packaging, pricing, communication and distribution. The Alcatel-Lucent Market Advantage Program works with telecom service providers to optimize broadband service launches based on primary market research of customer behaviour and demands.

4 Next steps to accelerate broadband uptake in high-growth markets

The Alcatel-Lucent Network Evolution to Mass Broadband solution (NEMB) enables telecom service providers in high-growth economies to accelerate broadband service uptake to end-user segments beyond the first wave of uptake and reach the mass-market. The solution builds sustainable broadband networks by offering the appropriate broadband access technology across wireless and wireline to complement the service provider's existing network assets, market demands and business strategy, and providing affordable and attractive services to target all customer segments from entry-level to advanced broadband users.

Alcatel-Lucent has extensive experience and history with broadband service deployments in high-growth markets around the world. This expertise is invaluable to telecom service providers for building their business model, reducing the commercial and technical risks associated with launching new services, and by optimizing service revenue through rapid service time-to-market.

For more information visit www.alcatel-lucent.com/massmarketbroadband.

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