You want to transform your business.

She just wants to transform her score.
Dear Customers,

From boomer-generation office workers to multi-tasking Millennials, from Apple’s iTunes™ to Google’s YouTube™ to mobile TV, and all the possibilities in between – our world and the applications we use at work, at home and at play are on the move.

Today the mobility industry is a dynamic and growing market. We see growth from first-time users, such as in India where more than six million people a month sign up for mobile service, to the sophisticated multimedia sessions happening in Korea where savvy consumers are enjoying multi-user mobile gaming and video calling. As SK Telecom’s Dr. Jay Ihm noted in his article, the introduction of these types of services marks an important transition for his company as it moves from a voice-based business model to one contingent on monetizing data services. We are only beginning to capitalize on the versatility and potential of these ever-advancing technologies and business models.

Consumers and enterprises are using mobile services differently from the way they did just a few years ago, and the underlying technology is evolving rapidly, which inevitably means change is coming to how we all operate in this new mobile market.

To be successful, all along the value chain we will need to transform ourselves to embrace new business models that can capitalize on these market dynamics and adopt operational processes that improve both top line and bottom line results.

This edition of Enriching Communications frames and explores this mobile transformation from a 360-degree view, looking at it from the perspective of users, market strategies, technologies and business models. We hope it offers you insights into our industry that will be helpful to your company.

Alcatel-Lucent is proud of our technological leadership, market understanding, world-class global employee skill base as well as the robust eco-system that we create and maintain to support our customers to be the winners in this mobile transformation. You, our customers, are at the center of our eco-system, and we are grateful for you, who inspire, drive and guide us in our mutual goal to make the exciting future communication possibilities a reality for the 6.4 billion people of the world.

We enjoy bringing you Enriching Communications and appreciate the numerous comments, ideas and thought-provoking feedback we receive from many of our 80,000 readers. Thank you, and please keep them coming.

So ‘till we meet again Anywhere, Anytime… enjoy!

Sincerely,

John Giere
CMO, Alcatel-Lucent

www.alcatel-lucent.com
Dear Customers,

The growth in the global wireless market is set to continue with increases in subscribers, network usage and bandwidth. End users expect broadband data services on their mobile devices, and this will be driven further by the continued adoption of social-networking and online gaming in the wireless environment. A new generation of users is mixing the domains of telecom, media and the Internet to get the personalized services and applications they desire, anytime and anywhere, and at the price they are willing to pay. The next generation of wireless technologies will need to be faster, simpler and cheaper to cope with these new demands. Additionally, in high-growth economies, wireless is becoming an essential method for communications where there is no existing wireline infrastructure.

This issue of *Enriching Communications* focuses on how we are helping customers, regardless of their existing technology and market position, to leverage and extend their assets to deliver the high-speed always-on mobile services that are in increasing demand. To see this in practice, read about AT&T’s launch of their new Video Share service, ONEMAX’s green field WiMAX deployment and SK Telecom’s successful W-CDMA/HSDPA deployment. Also witness how the Visiting Nurse Association of New Jersey is increasing productivity and maintaining high levels of patient care with its CDMA/EV-DO network coupled with a product that ensures the security of the data on the wireless network.

Also in this issue we look toward the future evolution of wireless communications and the expertise Alcatel-Lucent can offer in transforming networks using the key fundamental building blocks. Our expertise in OFDM (Orthogonal Frequency Division Multiplexing), MIMO (Multiple-Input/Multiple Output) and All-IP can help to cost-effectively deliver evolution paths from and to any technology. You can also learn about our innovative flat-IP femtocell solutions that lower the total cost of ownership, provide comprehensive in-building coverage and have great potential for new revenue generation opportunities.

Regardless of your market position, background or future strategy, I hope this issue sparks you with ideas on how to take advantage of the continuing growth.

Sincerely,

Mary Chan
President of Wireless Networks, Alcatel-Lucent
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Evaluate

anywhere, anytime communications technologies
The Worldwide Reality of Anywhere, Anytime Communications

By G. Rittenhouse, J. Gauthier

The telecommunications industry has witnessed explosive growth over the past decade.

New technologies such as high-speed wireless data, Internet Protocol television, smart devices, as well as new business models, have created entirely new high-value service offerings. As a result, the promise of anywhere and anytime communications across a wide range of access technologies and services is becoming a reality. The implications of this are profound. Service providers must fully comprehend how new technologies like IP Multimedia Subsystem (IMS), Internet services and wireless broadband affect their market position. Those who do not, risk losing ground to new market entrants who do offer these high-value, personalized services.

The good news is that service providers are adapting and, as a result, are unleashing the willingness-to-pay for these advanced services. In this edition of *Enriching Communications* we explore how this continued growth fuels the innovation that enhances the way people communicate, creating new challenges and opportunities for the service provider community. Our trends and market perspective articles – *Accessibility of Services and Networks* and *Mobile Broadband Matures* – provide a quantitative analysis of the key market forces that are changing the demand patterns and disrupting existing business models. Further, the piece on *Combining Web 2.0 and IMS: The Road to New Services and Business Models*, explicitly analyzes just how radical these changes
can be as carriers join the Internet economy. We also take a close look at key imperatives that carriers should address in our article Realizing the Converged Broadband Service Provider.

End users today are looking for the ability to have personalized content delivered to them in a way that is intuitive, seamless and at the lowest cost, anywhere and at anytime. Indeed, the latest generation of users – the so-called Millennials – is rapidly changing the nature of the consumer base. You will see in the trends article Millennials: The Future is Now, just how disruptive this new user community can be, as they mix and match hardware, applications and network resources to get precisely the service that they want at the price they are willing to pay. This is driving the convergence of media, the Internet and telecommunications. It is also dismantling market boundaries that have existed across these different domains.

Even with these advances, however, there are still significant gaps of broadband coverage and places in the world where people cannot even make a simple phone call. In these regions, first time participation in anywhere and anytime communications is a real challenge. But these locations also represent a huge opportunity to create and develop a brand new customer base. One of the most exciting examples of this opportunity is India. To get a better idea of how this vibrant market is developing we chat with Frederic Rose, President of our Europe, Asia and Africa region, to shed light on how India’s mobile subscriber base grows at a rate of more than 80%.

In this issue of Enriching Communications, we also examine the technical solutions that make the anywhere, anytime experience available for all, in a way that truly brings value to the end user. We are pleased to present several articles that describe next-generation services such as remote healthcare (our case study on the Visiting Nurses Association of New Jersey) and mobile video applications for consumers (as we profile AT&T’s innovative Video Share solution). We also look at the success of Korea’s SK Telecom and its high-speed packet access (HSPA) network and the recent WiMax deployment by the Santo Domingo provider ONEMAX.

In addition, there is a comprehensive summary of Fourth-Generation wireless in Mapping the Wireless Technology Migration Path: The Evolution to 4G Systems. This article takes a hard look at how next-generation wireless access technology will finally move the network to IP-centric access at much higher data-rates than today’s networks.

Even as these technologies become available, the end user still does not enjoy a seamless, personal and intuitive anywhere and anytime experience. So the articles Beyond Transport – Delivering Unique Network Operator Value to End Users and Simplifying the User Experience while Enabling the Profitable Evolution to All-IP Mobile Transport describe the inclusion of personal presence and preferences that make the user experience truly unique with the combination of subscriber data management, unified transport and IMS.

To broaden the discussion further we describe an entirely new service class based on sensor networks. Sensors have the potential to simplify the way end users interact with the network, and this article provides several life examples of how these networks are likely to appear.

In the final analysis, this dizzying array of trends in technology, changing consumer demand patterns and the acceleration of globalization, puts a serious premium on innovation. Those organizations that can quickly integrate technology and rapidly develop new business models, while forging partnerships around the world, appear to be best-positioned to serve this brave new world of telecom. It is a call to action that we at Alcatel-Lucent are very excited about.

We hope the articles in this issue of Enriching Communications serve as the basis for ongoing dialog on how to tap into these trends so that we can jointly deliver on the great promise of global anywhere, anytime communications.

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Several years ago, I was chairing a telecommunications conference in Hong Kong where I had the privilege of hearing James Murdoch speak on his vision of the convergence of media and telecommunication. James, who is Rupert Murdoch's son, was at that time the CEO of Star TV, one of the region's premiere content providers. Together with James was a panel of speakers hailing from some of Asia's most innovative mobile service providers, including such stalwarts as NTT DoCoMo and PCCW. During the Q&A session, I asked James and the panel members, “When would I be able to see Ally McBeal (then a rather popular primetime U.S. TV show) anytime and anywhere? I want on a portfolio of relevant devices, such as a mobile phone and laptop? Wasn’t this, after all, the vision behind convergence?” A mobile network able to deliver this would imply an infrastructure sufficiently powerful and ubiquitous that it would open the floodgates to a plethora of applications and services that could truly change, by several orders of magnitude, the value and utility of the mobile network.

Indeed, what has changed the most in the last seven years is wireless technology itself. The IT transformation of the telecommunications industry has resulted in unprecedented economies of scale and pace of innovation that have vastly improved the price to performance metrics of wireless infrastructure. In many respects, Metcalfe’s Law – that the value of a network is proportional to the square of the number of users of the system – has met Moore’s Law – that the number of transistors in an IC doubles approximately every two years (this has implications for such items as processing power and capacity). The result today is an emerging portfolio of wireless technologies that are at the cusp of delivering on the vision that the industry has held for a long time. Wireless base stations continue to get smaller, lighter and less costly to procure and deploy. This is what makes these times a particularly dynamic and interesting period for the industry. Technology was not ready for the vision back in December 1999, but it is today.

From the competing third generation (3G) standards, to WiFi and the much hyped Worldwide Interoperability for Microwave Access (WiMAX), comes a portfolio of wireless broadband technologies that serve as the foundation for delivering on the vision of media and mobile communications convergence. 3G cellular technologies already bring broadband connectivity, while their evolutions, such as Evolution-Data Optimized Rev B, Ultra Mobile Broadband, HSPA+ and Long Term Evolution, promise even greater bandwidth. Both WiFi and WiMAX deliver multi-megabit access rates, with each also possessing roadmaps toward higher performance (802.11n and 802.16m). Looking further down the road, in fact likely in another seven years, the real fourth generation (4G) mobile technology will

Mobile Broadband Matures: At the Cusp of a Revolution

By Godfrey Chua, Research Manager, Wireless and Mobile Infrastructure, IDC

The answer to the second part of my question was a consistent and resounding “yes.” However, there was also a unanimous caveat. Despite what some advertisements may have been showing at that time in Asia and in the rest of the world, the mobile technology available at that time could not deliver on such a vision. It could not furnish the necessary bandwidth, let alone bring it at compelling price points. This was true for other elements of the mobile network, including limitations to device functionality and capabilities. Mobility and broadband were not synonymous with each other. The panel cautioned that it was thus important to manage customer expectations, challenging their technology providers to help them in delivering the vision while at the same not “hyping” up the potential. This was, after all, during the height of the dot-com frenzy. This was December 1999.

Seven years and a dot-com crash later, I find myself thinking once again about the vision James and the panelists imparted. What is remarkable is that it has, fundamentally, not changed. Both the media and mobile communications industries are, more than ever, pursuing convergence. In fact, we are now on the verge of achieving the previously unimaginable milestone of three billion mobile subscribers across the globe.
emerge via IMT-Advanced. IMT-Advanced is the standards that will specify the fourth generation of mobile communication. Ultimately though, it will not be about one standard winning it all, but rather ubiquitous connectivity will come by way of the co-existence of, as well as the competition among, these differing wireless access technologies. The investments in these technologies will be enormous. Over the next five years, IDC expects that an excess of $50 billion will be spent annually on wireless infrastructure (Figure 1). The majority will be spent on 3G. WiFi and WiMAX will comprise a small portion but will nonetheless exhibit some of the most rapid growth.

The rest of the network has evolved, too. IMS (IP Multimedia Subsystem), despite the disappointment around the lack of market opportunity thus far, is an important development at the core of the network that provides the architectural framework within which rapid service creation, delivery and convergence itself is and will be enabled. Mobile devices have seen processing power, screen resolutions, battery life and form factors improve substantially since 1999. This all happened while costs also came tumbling down. Of course, no discussion of mobile devices would be complete without mentioning Apple’s iPhone. The iPhone, ironically, is not even a 3G phone. However, its user interface, form and function have further heightened the competitive environment, creating innovative new approaches to the way in which users interact with multimedia applications on a handheld device. In essence, the ecosystem behind mobile broadband infrastructure has also advanced significantly.

Finally, an equally important element defining the market context today is that customers themselves have also changed, and rather significantly, over the last seven years. Web 2.0 and the proliferation of the Internet have primed the customer base for adoption. In addition to widespread familiarity with the Internet, broadband connectivity is worth much more today because of the specific applications and services the additional bandwidth enables. Dial-up access is insufficient, and ubiquitous connectivity, the same notion that made emerging markets leapfrog from and essentially forgo fixed telephone lines for mobile phones, is becoming increasingly important. That this is coupled with regulators across the globe advocating and enabling broadband connectivity adds to the momentum. In fact, it was also around seven years ago that I participated in studies related to the global “digital divide.” Regulatory authorities as well as multi-lateral organizations such as the World Bank continue to be highly concerned with this issue. This concern has, however, smartly shifted from basic connectivity to one of inclusion in the digital revolution enabled by broadband access.

Having said all this, it is of course important not to fall prey to unnecessarily “hyped up” the mobile broadband market. Perhaps this enthusiasm is colored somewhat by having just observed the first commercial launch of an 802.16e 3.5 GHz network in the CALA region and successfully “road-testing” it via a video Voice over Internet Protocol call in a moving vehicle. The carrier, ONEMAX, a competing carrier in the Dominican Republic, noted that while initial launch focused on a value proposition premised on broadband connectivity, it also envisioned that down the road applications such as IPTV and the availability of more devices would further enhance the utility of the mobile broadband network. The vision is thus not held exclusively by service providers in the OECD (Organization for Economic Co-operation and Development) markets. Still, mobile broadband networks cannot be built overnight. The complexity in building a network is enormous. The challenges span issues such as regulatory policies on spectrum allocation and planning, to local zoning and construction laws that can impede the construction of new cell sites. Networks will need to be optimized and some of the newer technologies will certainly have growing pains as they scale. It also takes time for users to adapt to new services, behaviors and usage patterns. The mobile broadband revolution is something that cannot and will not happen overnight. In fact, it won’t even happen in the next year or two. Rather, what exists today is the technological foundation and a vision that will take us there.

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IDC is a global provider of market intelligence, advisory services, and events for the information technology, telecommunications, and consumer technology markets. For more info, please visit: www.idc.com.

Figure 1: Worldwide wireless broadband* infrastructure spending

<table>
<thead>
<tr>
<th>$ Billion</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
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<tr>
<td>0</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
</tbody>
</table>

* Wireless Broadband includes spending in 3G cellular as well as WiMAX

Source: IDC

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2 Caribbean/Latin America
Millennials: The Future is Now

How to position services to establish customer loyalty among Millennials

By J. Giere
To understand what the future holds for telecommunications service providers around the world, look no further than teenagers with iPod earbuds in their ears, cell phones in their pockets and laptops under their arms. While previous generations of consumers would be happy for content and applications to stay in their discreet environments (songs on iPods, voice on the phone and data on laptops) the new “Millennial” generation – generally speaking those born after 1980 – is insisting on two critical requirements to satisfy their hunger for new technology and their willingness to pay for it:

- Interoperability
- Integration

Unlike previous generations, Millennials do not take a passive approach to technology. They want to be able to add, subtract and change key elements of technology offerings and find new ways of using their tools to advance their personal and professional objectives. As a result, they expect their phones, music players and notebook PCs to share data and applications (interoperability), and they will reward any player in the market who helps them organize and manage their different technological investments from a centralized platform (integration).

This is a generation of natural-born technologists. They are willing to create their own mash-ups of services, and as a result are simply looking for someone to provide a venue or platform over which they can support their lifestyle. As a group, they are specifically interested in service providers that let them harness technology in a way that allows them to get their work completed quickly and access their entertainment in short segments. For this reason, Millennials are sometimes referred to as the “snack” generation for their desire to work and play in short intense segments.

Because of this, Millennials are a very different type of consumer. But this also makes them an exciting opportunity for service providers wishing (or needing) to move away from “minute-based” business models and toward more lucrative value-added services. Successful service providers of the future will ensure that they are in a position to shape, drive and monetize the future value of Millennial demands.

The Millennial Perspective

Millennials view consumer goods and services – especially technology products and telecommunications services – as commoditized means to an end. Brand loyalty, for this market, is barely a consideration. According to a study conducted in the summer of 2007 by Survey U, the decision to purchase the much-hyped iPhone was influenced most by its performance (92%), price (93%) and ease of use (92%). Surprisingly, the Apple brand, according to respondents, was rated as the least important factor (47%). Nonetheless, Millennials contributed to a significant portion of the demand for the iPhone. According to iSuppli, by September 4, 2007 “57% of iPhone purchasers were under 35.”

What these studies (and the general market success of the iPhone) seem to show is that Millennials want products that will simultaneously work with different media types (voice, data, video) and mediums (wired and wireless) to support their lifestyle and interactions with friends, family and co-workers.

So, what does all this mean for service providers?

First of all, it strongly implies that future business success will depend on a service provider’s ability to address the Millennials’ lifestyle needs by delivering content, communication and applications anywhere, at any time, on any device.

At Alcatel-Lucent, we believe this “mash-up environment” of devices, communications capabilities and delivery options is giving rise to a rapidly growing market for what we are calling “blended lifestyle services.” These services seamlessly combine elements of existing offerings with completely new, user-centric services. In short, we believe that it is imperative for service providers to rapidly create new business models that offer businesses and consumers highly personalized offerings in a highly profitable manner.

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1 ©July 2007, iPhone Update, Survey U
This is important because one thing we do know about Millennials is that when they find something they like, they broadcast their approval and that the power of their amplification is extensive. For instance, the Millennials surveyed maintain large IM and texting lists that average 37 people (compared to just 17 for the overall sample). As a result, when Millennials find a particular television show they like, a website they enjoy, or a device they covet, they tell an average of 18 people, compared to only 10 people for all other age groups.

According to the survey, this digital-word-of-mouth is the most common reason cited by Millennials when they visit a website.

**Millennials are the Future**

Like the post-World War II Baby Boom generation that has influenced and shaped market and technology trends over the past 30 years, the Millennials’ promise to wield incredible market power over the next 30 years. Alcatel-Lucent primary research defines the age group as consisting of people between the ages of 11 and 25. They number 55 million people in the United States; 51 million in Western Europe (France, Germany, Italy, Spain, UK) and 99 million in Asia (Japan, China, Korea).

But beyond their quantity, the quality of Millennial demand is fundamentally different from previous generations, and is a direct result of how their formative years have defined their perception of the world and their role in it. This group has experienced:

- The emergence of the global culture and 24/7 economy, made possible by the Internet and digital technology that allowed them to research school projects using a global library of virtual knowledge sites as their information sources.
- More structured and scheduled social lives, with a host of pre-arranged activities, both in the real world and online.
- A shift in focus from individualism to family and community, as social and family interaction become more virtual, viral and “hyper-connected.”
- Greater access to broadband connections as well as technology that enables global, instantaneous and spontaneous communications.

**Alcatel-Lucent Worldwide Lab Taps into Millennial Mindset**

Alcatel-Lucent has an extensive database of blended lifestyle market research data from around the world collected over the last three-plus years. Additionally, Alcatel-Lucent continually acquires insight into how Millennials perceive mobile services through the work of the Alcatel-Lucent Worldwide Lab.

Established in the spring of 2006, the lab conducts qualitative research, which is not intended to provide results that can predict behavior (like an election poll). Rather, it provides insights into useful trends that set the stage for doing additional research like focus groups or deep quantitative research.

Members of the lab are drawn from our customers’ and executives’ children. They are Millennials who are also early adopters, to whom their friends look for advice on new products and services.

Research conducted by the lab helps Alcatel-Lucent:

- Learn about the user experience from the end user’s point of view
- Help operators create better services
- Generate ideas to help build better products

Moreover, as we anticipate the bandwidth-hungry world of 4G networks, it is important to note Millennials’ passion for user-generated content and remote multiplayer gaming, and their willingness to broadcast what they think or like. According to a separate study by Deloitte, 62% of Millennials and 41% of Xers watch YouTube or other video streaming sites, and 46% of Millennials embrace their cell phones as an entertainment device.
Millennials: Creating their Own Content and Buzz

Millennials significantly influence the adoption of new services. For example, they keep tabs on the world around them by getting the news and information they want whenever they want it and wherever they want it, rather than being tied to a publisher’s or broadcaster’s schedule. According to Comscore, in May 2007, nearly 75% of U.S. Internet users watched an average of 158 minutes of online video during the month.4

Furthermore, Millennials are increasingly becoming personal content publishers themselves and consumers of the personal content published by others.

This new generation of consumer turns to online sources for information, and uses online venues to share viewpoints on news, products and services through social networks that operate independently and outside of “company-sanctioned” sites. This web “word-of-mouth” can make or break a product or service within days of it being introduced in the market. Indeed, it has created a whole new marketing category, referred to as “buzz marketing.” If contributors have bad experiences, they are not shy about reporting them to their network to make sure others don’t have the same experiences. Likewise, a good experience is quickly relayed so that everyone can benefit.

As a result, Millennial reliance on online information and networks is driving growing demand for web-based communities and the hosted services that facilitate collaboration and information-sharing among users.

Tapping into the Millennial Market

Millennials want communications experiences that are richer, portable and integrated. They want to download and play songs and videos, send text messages, conference with colleagues and friends and exchange pictures or videos on whichever device they are using. And they don’t want to be tied to any one location to do it.

For Millennials, services and applications must:

- Give them the freedom to work from anywhere and at anytime.
- Allow them to get their work completed quickly and access their entertainment in short segments.

In short, Millennials expect converged telecommunications services to be a component of every type of personal and business communications experience.

Millennials Provide a Great Source of New Revenue

Alcatel-Lucent’s primary research confirms that end users in these groups have a strong interest in blended, user-centric services. But service providers need both the interest and the end users’ willingness to pay to enable the service provider to achieve a return on their investment for the development and delivery of these new blended services. The good news is that the research also shows that Millennials are willing to pay more for blended services in all the countries surveyed.

The total opportunity for providers of these services in the researched Western European countries of France, Germany, Italy, Spain and the UK is a projected revenue of US$2.8 billion per year by 2011, supported by 2.1 million subscribers. Similar results were found for users in North America and Asia, where revenue projection is estimated at $1.1 billion and $6.1 billion respectively by 2011 (Asia research conducted in China, Japan and Korea). (Table 1)

Worldwide, Alcatel-Lucent primary research shows that the total addressable market in these countries could reach more than 200 million people and represent more than US$10 billion by 2011.

With the right network and service delivery environment in place, service providers can enable and deliver the personal, blended

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### Table 1: Millennial market for blended services by 2011

<table>
<thead>
<tr>
<th>Region</th>
<th>Subscriber base</th>
<th>Revenue (cumulative)</th>
</tr>
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<tbody>
<tr>
<td>North America (US and Canada)</td>
<td>1.5 million</td>
<td>$1.1 billion</td>
</tr>
<tr>
<td>Western Europe (France, Germany, Italy, Spain, UK)</td>
<td>2.1 million</td>
<td>$2.8 billion</td>
</tr>
<tr>
<td>Asia-Pacific (Japan, Korea, top 12 markets in China)</td>
<td>5.1 million</td>
<td>$6.1 billion</td>
</tr>
</tbody>
</table>

Source: End-user Demand for Blended Services, Alcatel-Lucent Market Research, Q2 2007
service solutions that address the needs of Millennials. This requires a network and service infrastructure that can support and blend end-to-end Triple Play services and deliver high-performance video and gaming, high-speed data and voice offerings over fixed and mobile infrastructures, with a high level of service reliability and seamless transparency across devices and networks, enabling service innovation and operational agility.

**Conclusion**

Service providers who do not pay attention to the new demand patterns presented by Millennials do so at their own peril.

- Millennials are a force to be reckoned with because of both their huge numbers and the nature of the new services that they are demanding. This generation of consumers (and future workers) expects service providers to adapt technology and services to their needs, not the other way around.

- Millennials want their telecommunications services to be highly personalized and flexible. They want to be able to create, mix and match content, content types and applications.

- Service providers that expect to be successful in attracting Millennial demand will have to manage significant change in both their technology infrastructure and their business models.

In short, Millennials will redefine what it means to be a service provider, and what information and communications technology will be called upon to meet their wants and needs. This is a segment of the market that Alcatel-Lucent is studying very carefully. We are working with our service provider clients and partners to continue to amass information that will advance our understanding of this emerging demographic segment of the market. Through our constant focus on and analysis of this dynamic, critical group, we are developing a new generation of blended communications services that will account for the lion’s share of revenue generated by the communications industry by the end of the decade.

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John Giere  
CMO, Alcatel-Lucent
Trends in Accessibility of Services and Networks

By P. Tournassoud

Anytime, anywhere communications services depend on ubiquitous network availability. Unfortunately, many markets remain underserved, particularly with respect to broadband capabilities. This applies not just to developing countries, but also to developed economies, where truly universal access to broadband services remains elusive.

While the challenges faced by service providers in developing and developed economies may differ in scope and focus, there is a range of wireless solutions emerging that, together, form a toolkit that can be adapted to the very different circumstances of these diverse environments.

A New Toolkit

The broadband wireless “toolkit” of the next few years will consist of third generation (3G) systems – UMTS1 and CDMA2 2000 – in the already deployed bands and WiMAX3 at 2.5 GHz and 3.5 GHz to support higher bitrates, along with the extension of these systems into new, lower bands to improve rural and indoor coverage. In addition, new “femto” systems, i.e. small-form-factor base stations, will be deployed indoors where fixed broadband is available, to deliver both higher bitrate and improved coverage for indoor domestic service.

Lower-frequency bands are an important part of the economic equation. Coverage depends on the geographical, regulatory and economical constraints on the deployment of base stations, with the most important factor being the frequency of the carrier. The lower the frequency, the larger the cells for a given waveform and emission power. To limit the investment required to deploy new cells, rural coverage will only be improved by radio systems deployed at low frequencies (UHF), liberated by the migration of broadcast TV services from analog to digital – the so-called “Digital Dividend.” Simulations show that low UHF frequencies cut investment in half. They can also reduce the minimum subscriber base penetration rate needed to guarantee profitability by a factor of 2.5.

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1 Universal Mobile Telecommunications System
2 Code Division Multiple Access
3 Worldwide Interoperability for Microwave Access
UMTS at 900 MHz systems and CDMA at 450 and 800 MHz will be a first stage, but their capacity remains limited by technology and available spectrum. Wireless broadband services will then be further enhanced with the allocation of additional bandwidth below 1 GHz (700-800 MHz), permitting the deployment of new-generation Orthogonal Frequency-Division Multiplexing systems – WiMAX 802.16e and, later on, Long Term Evolution or Ultra Mobile Broadband.

Developing Economies Require Cost-effective Solutions

The world’s developing regions generally face huge challenges as they attempt to find cost-effective solutions for offering simple dial tone to their populations: it should be no surprise, therefore, that these areas lag behind in broadband deployment. For example, only 1% of the world’s broadband subscribers are located in Africa or the Middle East. This is significant, because economic development correlates strongly with broadband penetration. For every 1% increase in broadband penetration, there is an approximate $2,000 per capita GDP benefit (Figure 1).

Consumers and businesses in high-growth markets in Africa, the Middle East, Southeast Asia and Latin America are eager for broadband connectivity. Recent Alcatel-Lucent research shows that 73% of Internet Café users in Southeast Asia are very interested in personal broadband services and intend to subscribe when available.

In Venezuela, 86% of enterprises with broadband were willing to pay a premium for new blended services running over that connection. Nearly one third of the enterprises surveyed were willing to pay 30,000 VEB (approximately 14 USD/10 Euros) per month for these services over broadband. Of the Venezuelan enterprises surveyed, 71% indicated making the purchase decision within 6 months. Micro-sized businesses (1-10 employees) were most likely to be in the early adopter population.

In Africa, where price sensitivity concerns were expected to hamper the introduction of mobile services, mobile networks are being deployed by a growing community of operators to provide ubiquitous voice and basic broadband services. These trends will in turn create the need for increasingly high-performance wireless broadband communications, ensuring both urban and rural coverage at optimal cost.

Alcatel-Lucent is convinced that this will enable presently under-served markets.
to leapfrog to new personal multimedia communications, as well as e-health, e-education and e-business services. The vision is of a broadband service bundle including PC and network connectivity for around $100.

Applying the toolkit mentioned above to developing markets should enable the deployment of cost-effective wireless solutions for widespread coverage of their populations.

In suburban and rural areas, the greatest improvement in coverage should come from the deployment of WiMAX in the lower 700-800 MHz bands. Alternatively, rural areas should experience great improvements from UMTS in 900 MHz and CDMA in 450 and 700-800 MHz bands. For sparsely populated areas, fixed installations with external antennas (“fixed wireless”) would deliver much higher levels of service when the terminal is located in the zone of coverage.

New business models will soon emerge to help finance the expansion of wireless services in developing countries. For example, a high-rise building in a high-density urban or suburban area could contain hundreds of small businesses. Collectively, they could afford excellent broadband connectivity. Other business models abound: service could be subsidized by advertising; its costs shared between members of a community; or even publicly funded. Regardless of the technology deployed, profitable business models will emerge.

Believing in the positive economic and social impact of broadband access, Alcatel-Lucent has developed an initiative for pilot deployments of wireless broadband access in association with local stakeholders in developing countries. These offer services aimed at improving local economic and social conditions. One example is the use of simple applications using short messaging services (SMS) to help farmers and fishermen obtain current market prices for their produce. Alcatel-Lucent also developed a way to use SMS certificates as payment to encourage e-commerce in populations which do not own credit cards. These applications, which can have a significantly beneficial effect on local communities and economies, only require inexpensive, high-density, high-bandwidth services and a reliable mix of wireline and wireless communications to be made available to all.

**Broadband Access Gaps in Developed Economies**

Even developed countries have two sets of users with limited service accessibility – those in rural areas and those within buildings. In the United States, the Government Accountability Office reported that cost of broadband service remains a barrier to some and that rural populations are underserved. A June 2007 report (Figure 2) shows home broadband penetration in rural areas at 31%.

Indoor accessibility can be poor even in dense urban areas. We expect that as data usage increases through devices such as Blackberries, indoor coverage will become more important. Also, given that 30% of 911 emergency calls in the United States are made from cell phones, accessibility and coverage everywhere become significant concerns.

Urban and suburban areas in developed countries will see the massive deployment of fiber for fixed connectivity, as well as an increase in the density of 3G and WiMAX networks. Wireless deployments will piggyback on fiber plant, thus changing the way wireless solutions are deployed: from large cells optimized for coverage and reduction of backhaul cost, to small grids designed for very high capacity hot zones. In rural areas, sub-1GHz bands freed by the Digital Dividend will also be a major enabler to ensure nationwide wireless broadband coverage, eventually facilitated by Private-Public Partnerships initiatives.

These same sub-1GHz frequency bands will also improve urban indoor coverage. However, the best solution to improve indoor service is femto base stations in domestic cases where fixed broadband networks are widely deployed and the use of small “pico” cell sites and distributed antenna systems in public areas and enterprises.

Mobile operators are actively seeking ways to deliver a compelling mobile broadband service inside homes and other indoor environments. This increased focus on in-building services has precipitated the growth of a potentially large market for small-form-factor base stations such as femtocells and picocells that can – in effect – ensure that subscribers enjoy a “five-bars” mobile experience in their living room, with a favorable tariff plan and some additional fixed-mobile-convergent services while at home.

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7 ©2006, Broadband Deployment Is Extensive… GAO.
8 ©2007, Home Broadband Adoption 2007 Pew Internet and American Life Project.
From a home coverage perspective, ABI Research projects that 102 million people worldwide will be on home base stations by 2011, and that some 36 million femtocells access points will ship in 2012, compared with just 50,000 in 2007.¹⁰

**Thinking Out of the Box**

Given end-user pressure for universal broadband access and the obvious economic benefits that connectivity can offer, now is the time for operators worldwide to start examining how they too can think out of the box to offer affordable services profitably to the under-served communities of the world – in both the developed and developing nations.

These applications argue for inexpensive, high density, high bandwidth and a reliable mix of wireline and wireless communications to be made available to all (Figure 3).

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**Figure 3**: Expanding access capabilities to deliver new and affordable services in cities while expanding coverage footprint across the entire country

Alcatel-Lucent continues to be committed to the goal of extending broadband access to unserved and under-served communities around the world. It offers a wide range of wired and wireless solutions that offer cost-effective deployment scenarios to service providers – both fixed and wireless – seeking to widen their geographical coverage and penetration.

Furthermore, the company has devised a number of innovative business models that enable service providers to offer networks and solutions according to their needs: from fully-hosted scenarios to pay-as-you-grow schemes that scale to match business expansion.

With today's technologies, plus business models adapted to network expansion in all areas of the world, the time is right to start filling in the gaps in the coverage map.

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¹⁰ ©2007, Femtocell Market Challenges and Opportunities, ABI Research.
Public Safety Use of Commercial Broadband Wireless Technologies

By Dr. K. Budka

Many existing public safety networks in the United States, Europe and other parts of the world are plagued by interoperability problems. The inability for first responders (police, firefighters and other emergency response personnel) to communicate seamlessly in times of crisis is an issue that strategic planners around the globe are trying to address.

Access to sufficient radio frequency spectrum is the foundation for interoperable and unfettered high-quality communications systems in the public safety arena. Recent action by the U.S. Congress and U.S. Federal Communications Commission has provided public safety agencies access to highly valuable 700 MHz spectrum, capable of economically serving wide areas with broadband speeds.

This is a major step forward for public safety organizations. Wide area wireless data services, if they exist at all, often operate at speeds of less than 10 kilobits per second, far too low to support the multimedia applications needed by first responders to meet the challenges they face today.

Armed with this new segment of spectrum, Alcatel-Lucent and LGS, a subsidiary of Alcatel-Lucent focused on the U.S. federal government market, are working to bridge the interoperability gap and provide public safety agencies with new broadband data tools supported by commercial broadband wireless technologies. As a result of these efforts, Alcatel-Lucent and LGS launched the first 700 MHz public safety wireless broadband network in the U.S. in Washington, D.C. and surrounding areas, based on CDMA2000.

The Alcatel-Lucent solution enables the National Capital Region (the area in and around Washington, D.C.) to deliver multimedia content, mission-critical data and collaborative capabilities into the hands of first responders. Broadband tools can support remote surveillance, distribute helicopter video transmission and push

“An incident commander makes 90% of a fire assessment within 15 seconds of arriving on the scene. If we can see a fire before we arrive via helicopter, traffic cameras, civilian picture phones or the media – then our response time can mean the difference between life and death and can turn a major fire into a much shorter event by getting the right people and equipment to the scene sooner.”

– Major in Prince George’s County Fire/EMS, Maryland, USA

mug shots of suspects to the field. This technology will also play a major role in chemical and biological weapon detection, bomb squad support and other activities that prevent or mitigate attacks or enhance the ability to respond to emergency situations.

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SK Telecom Adopts HSPA Technology to Strengthen its Mobile Data Strategy

By Dr. J. T. Ihm
Over the past two years, SK Telecom – South Korea’s largest mobile operator – has aggressively deployed one of the world’s first handset-based, next-generation High-Speed Packet Access (HSPA) networks in cities across southern Korea. Our company is considered one of the most innovative service providers because of its rich offer, composed of innovative mobile lifestyle services. Because of this, SK Telecom is considered a model for the telecom industry in terms of its end-user focus and ability to stay ahead of its competitors.

The HSPA network is a new-generation mobile technology that leverages the standards associated with the Universal Mobile Telecommunications System (UMTS). It significantly accelerates data transfer speeds, with current support for 7.2 Mbit/s on the downlink and 1.4 Mbit/s on the uplink.

Our company launched the world’s first HSPA network in May 2006 and achieved complete nationwide coverage by the first quarter of 2007. We characterize the launch of our 3G+ brand (HSPA network) as the starting point for a new category of services for customers, which yields important new revenue streams. It also marks an important transition point as our company moves from a voice-based business model to one that is contingent on monetizing data services.

The services HSPA enables include not only high-definition video-on-demand and music streaming, but also multi-user mobile gaming, video calling, multimedia messaging and a host of other high-bandwidth services.

**Broadband Mobile Data Delivers New Revenue Streams**

Our company has been successful in profitably growing our business this year with significant subscriber adoption of Wideband Code Division Multiple Access (W-CDMA), from around 148,000 users in December 2006 to more than 2 million in November 2007.

This migration to HSPA provides our network with high spectral efficiency (up to three times better than UMTS Release 99) as well as high-throughput mobile data (with the ability to deliver up to 14.4 Mbit/s on the downlink and 5.7 Mbit/s on the uplink in the future). In parallel, it offers the capacity to offer a large choice of W-CDMA handsets at affordable prices.

Meanwhile, Alcatel-Lucent’s HSPA technology is helping us deliver high-quality communications through more efficient use of the UMTS network and spectrum. The technology is a key component of our “3G+” services because it ensures the bandwidth and quality of service required to support such new service offerings as “high-quality video calls” and “ultra-speed data transfers”.

“[The launch of our 3G+ brand] also marks an important transition point as our company moves from a voice-based business model to one that is contingent on monetizing data services.”

Dr. Jay T. Ihm, Vice President, Mobile Device & Access Network R&D Center, SK Telecom, Korea
Alcatel-Lucent Answers Korean Market Requirements

Alcatel-Lucent has been helping our company perfect its network requirements by developing specific innovative features and products such as the Remote Radio Head (RRH) and Operations, Administration and Maintenance (OAM) functions.

All these refinements now benefit the worldwide market, and Alcatel-Lucent's portfolio has been enriched with functions in OAM, network supervision and fault and performance management. The company has also achieved the most significant deployment of RRH-based distributed Node B to date.

SK Telecom Develops HSPA Service Delivery Concepts

In rolling out our HSPA-based services, SK Telecom has developed a comprehensive strategy for engaging and attracting subscribers, leveraging its significant experience in offering Code Division Multiple Access (CDMA)-based services.

The rapid evolution of technology and deployment of various convergence services has created different levels of sophistication in the market. As a result, it is necessary to provide an array of services that match different consumer needs, devices and capabilities.

Our major HSPA services are:

- Video telephony and related value-added services: Phone-to-Phone, Web-to-Phone, Fixed-to-Phone, Image Coloring, Image Message Call
- High-speed data services: T-Login/High-speed Internet Access, Full Browsing, User-Created Content
- Global: International roaming

SK Telecom believes that, by taking a strategic approach to integrating and optimizing different network technologies, we can serve the needs of existing subscribers, while laying the technological groundwork for future services in a cost-effective manner. To that end, our company plans to establish HSPA as a service platform for developing four key business “concepts” or market opportunities.
**Visual Concept.** Our company is developing a series of HSPA technologies that deliver high-quality video calls, enable customer-created content, and expand the array of options for mobile gaming. Specifically, we plan to leverage 3G+ technology to shift the mobile phone user's experience from being a “listening” activity to a “watching” activity (Figure 2). In addition to changing the orientation of the user interface, we expect to see a significant shift in how users access network resources. The availability of affordable bandwidth in a mobile environment creates opportunities to offer services that are based on “always-on” usage models. Consumers will be able to use their mobile devices to participate in video conference calls, monitor closed-circuit TV cameras that (for instance) can keep them in touch with their children while away from home, or let users watch video-on-demand programming.

**Internet Concept.** SK Telecom also plans to expand the ability of mobile devices to access Internet services directly and create an experience that is more like that offered over fixed-line access points. HSPA technology will bring a “full browser” experience to the mobile device. As a result, we expect the mobile platform to compete with desktop and laptop PCs to become a major wireless Internet access point.

Indeed, the mobile device platform may offer greater opportunities to spur the growth of user-created content on the Internet (Figure 3). However, we are not limiting our mobile Internet vision to hand-held phones, smart phones or other communications devices. Our company is moving aggressively to develop its T-Login technology. The T-Login concept is based on making HSPA USB modem technology, which offers high-speed wireless data service capabilities available to a wide variety of consumer electronic devices, including notebook computers, portable media recorders, digital cameras, MP3 players and game players.

**Global Concept.** Our business leaders believe our long-term success will be highly contingent on our ability to expand our presence beyond our national borders. Executives note that the importance of “global roaming” has never been greater, as operators around the world form alliances to provide a seamless communication and entertainment experience for frequent international travelers. By moving past the CDMA infrastructure and adopting new W-CDMA platforms, SK Telecom is no longer limited in its ability to tap into revenue that may well originate from outside South Korea. The new 3G+ environment creates a whole new opportunity to establish global relationships and gain the benefits of economies of scale that transcend its current national scope of opportunity (Figure 4). Our recent investment in Helio in the United States is a good example of how we are moving to enhance our global position in the telecom marketplace.

**Convenience Concept.** With the availability of new, higher-bandwidth capabilities in the mobile network infrastructure, SK Telecom believes it is important to place greater focus on the “convenience” aspects of the user experience. Until recently, “convergence” has been one of the central organizing principles for delivering wireless data services. While convergence will continue to play an important role in designing new services, we plan to concentrate on providing a unified set of “convenient” solutions that are customer-oriented. By making mobile data services more intuitive from a design and integrated-support standpoint, our company expects to see faster adoption of new technologies.
by subscribers. As a result, we are making significant investments in developing Universal Subscriber Identity Module technology. This is an application for UMTS-based mobile technologies that allows a smart card, which stores user and subscriber authentication information, to be inserted into a 3G mobile device. This will make it much easier – and convenient – for consumers to use their mobile devices in a secure manner to access an array of financial services, entertainment offerings and other applications that require strong authentication because they involve the exchange of personal information.

Conclusion
To support the rapid and cost-effective build-out of this network infrastructure, SK Telecom has worked closely with the important regional partnership between Alcatel-Lucent and LG-Nortel. The companies are working together to manage current and projected increases in mobile data traffic.

Our company is preparing to launch next-generation mobile data applications that will be deployed on top of our High-Speed Uplink Packet Access (HSUPA) technology. The new technology will enable content (large video files, etc.) to be uploaded to mobile devices as well as personal broadcasting services. Typically, through the HSUPA platform, SK Telecom will be able to promote interactivity and launch network-based games that make the most of reduced latencies. Indeed, the Korean games market is one of the most dynamic in the world, with distinct preferences such as multi-player games. Interactivity and community are key factors in creating successful mobile games in the Korean market.

To assist us in further strengthening the success of these services, Alcatel-Lucent has upgraded our existing nationwide optical network with a Metro Core Connect backbone. This roll-out will allow our company to reduce total cost of ownership and enjoy a reliable end-to-end architecture, delivering high-quality services in response to Korean market demands.

Looking ahead, the collaboration between SK Telecom and Alcatel-Lucent will secure both companies’ market leadership in one of the most competitive wireless marketplaces in the world.

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AT&T Video Share Gives Wireless Callers Streaming Video Capability

IMS-based end-user service is first of its kind in the United States

By N. Mercouroff, B. Dyer

The last few years have seen a global race by major telecommunications carriers to field new services to supplement traditional revenue streams. As a result, the industry has staked high hopes on the promise of IP Multimedia Subsystems— or IMS.

This technology has established itself as a framework for a common infrastructure that supports enhanced communications services by integrating multimedia service bundles for premium content and entertainment services. Although some fixed-service providers have already rolled out IMS-based fixed applications (see Side Bar), the promise of IMS for mobile applications has been mostly theoretical. This is because of the absence of commercially deployed mobile services that are fully based on this technology. But the theoretical benefits of IMS are about to become more concrete.


Video Share enables one-way, live streaming video feeds that can be seen by users during a two-way conversation. Beginning with a normal wireless phone call, customers can add a live video stream to a session by clicking on a single button (Figure 1). Once a Video Share call is initiated, the service allows customers to switch the direction of the video stream during the same phone call. The service is the first of its kind in the United States.
Video Share a Key Development in AT&T’s Mobile Data Services

Video Share is an important milestone in AT&T’s strategy to attract new subscribers interested in unique communications features. It holds a great deal of promise in driving increases in traffic to AT&T’s 3G mobile data network. It also will serve as a key differentiator, distinguishing AT&T’s network offerings from those of its competitors.

Today there are ten handsets from Samsung and LG Electronics that support Video Share services. Because of how easy it is to use, and the range of terminals already available to support the service, AT&T expects subscribers to be rapidly attracted to a new category of service that delivers a unique user experience superior to alternatives such as Multimedia Messaging Service (MMS) or 3G video-telephony.

With this application, AT&T now can differentiate itself from the competition. AT&T can use its core network infrastructure and 3G UMTS/HSDPA network to deliver a service that other mobile service providers cannot match.

The most important element – and what makes this service unique – cannot be seen by the end users. It is the IMS platform put in place by Alcatel-Lucent for AT&T. IMS is a standardized network architecture that enables the delivery of an unlimited number of multimedia communication services. By deploying the first true IMS-based end-user service, AT&T can deliver attractive and differentiated service to its subscribers and position itself to quickly roll out more services, providing Video Share with new potential features (such as combined multi-screen TV/PC/mobile phone service delivery). The company also has an opportunity to leverage these capabilities to extend service offerings to other domains (by combining the capability with vertical applications, social networking sites, user generated content, etc.).

The flexibility and openness of IMS allows AT&T to blend multiple services to create a wide range of new, innovative IP-based applications over the next several years.

On June 19, 2007, AT&T announced services like Video Share will be accessible over mobile, TV and Internet screens to “enable AT&T customers to seamlessly access services and content over both wireless and wireline network connections.”

IMS a key weapon in the battle for customer ownership

The ability to launch new profitable services is critical for service providers, which must rapidly and effectively counter competitive threats, reduce customer churn and compete for customer ownership.

IMS paves the way for the introduction of carrier class Voice over Internet Protocol (VoIP) services, a critical element in the convergence of fixed and mobile domains. It also provides he connectivity that enables Session Initiation Protocol (SIP)-capable terminals and multimedia devices to establish IP sessions among one another.

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to support a wide variety of advanced IP multimedia services. These include video sharing and other applications such as content sharing, push to talk, push to view, instant messaging and active phone book with presence.

IMS brings a unique application environment that can provide services to the end users independent of the access that is used (e.g., DSL, 3G, WiMAX). New services can be developed, implemented and deployed once and can then be delivered independently to a variety of access methods and devices. In addition, all services and applications developed with IMS can share the same service delivery environment, including application servers and a unique set of back-office systems such as subscription and subscriber data management and payment platform.

Originally developed for mobile service providers by the Third Generation Partnership Project (3GPP) standards body, IMS has been adopted and endorsed by the European Telecommunications Standards Institute/Telecoms & Internet Converged Services & Protocols for Advanced Networks (ETSI/TISPAN) standards body, which focuses on developing the definitions and interfaces necessary to support fixed world service delivery requirements. This standardization guarantees interoperability of the networks and offers a viable response to alternative service providers (such as Skype, MSN, Yahoo, Google, etc.) who threaten traditional operators' value propositions.

What does this mean for the end user? IMS' unique technology, which relies on IP and SIP, offers end users an unlimited set of innovative applications featuring rich multimedia and multiparty communications. In addition, end users have access to the same consistent set of applications and services regardless of the access and device used. They can thus choose to communicate according to their own needs and are not limited by the capacity of their access network and terminal. In short, IMS enables the type of true user-centricity that is so critical to success in the rapidly developing communications marketplace.

With respect to a user's reach-ability, end users can communicate (voice, video, share data) with their friends using a mobile phone, a PC connected via DSL or laptop with WiMAX. All correspondents are connected with the device and access of their choice.

IMS is thus the key enabler to accelerate services transformation.

Alcatel-Lucent at AT&T
Video Share is the first AT&T service to be delivered on the company's next-generation network platform, which is based on Alcatel-Lucent's IMS solution, the exclusive provider to AT&T of this technology.

AT&T has deployed Alcatel-Lucent's Session Manager, including 3GPP's functions Call Session Control Function (CSCF), Breakout Gateway Control Function (BGCF) and Smart Common Input Method (SCIM) and the 1430 Unified Home Subscriber Server (HSS) for subscription management. Most of these elements are involved in the Video Share service, with the HSS performing authentication and the session manager performing the SIP session control for video streaming and for the billing.

In addition, the Video Share service leverages the mobile broadband capabilities of AT&T's 3G UMTS/HSDPA network, for which Alcatel-Lucent is a major supplier.

BT delivers innovative end-user applications enabled by Alcatel-Lucent IMS technology
In the last two years, BT has launched several innovative residential applications for its customers: BT Broadband Talk, BT Broadband Talk Softphone and BT Broadband Talk Video. These three services allow consumers to access Voice over Internet Protocol (VoIP) services using their PC, their residential phone or a video-enabled residential terminal. Thanks to IMS technology from Alcatel-Lucent, BT can deploy innovative services that are competitive with leading Internet-based services, while offering users significantly more functionality. For example, BT Broadband Talk Softphone offers more than just PC-based VoIP. It provides a truly converged multi-media communication experience that allows consumers to make free phone calls to other BT Broadband Talk Softphone users, while also allowing them to connect webcams and use instant messaging.
Alcatel-Lucent is participating with AT&T as a supplier and system integrator for AT&T’s U-Verse IPTV roll out. As service providers begin testing the market with Triple Play offerings, many are realizing they will need to offer innovative new user-centric applications to compete and win. Alcatel-Lucent’s Triple Play applications and IMS platforms are designed to enhance the end-user experience, bridging the social and communications potential of Triple Play more tightly with the entertainment potential of IPTV.

These applications are important examples of Alcatel-Lucent’s IMS solution for fixed service providers in action. The applications are designed to address consumer demand for:

- More personal content
- The ability to share community content, and
- The opportunity to communicate with friends or family in remote locations

With the power of IMS, the Alcatel-Lucent solutions allow service providers to quickly develop, test and launch innovative user-centric applications over a range of access methods. It not only helps generate new revenues from new services, but also keeps costs in check with a staged migration from today’s circuit-based Public Switched Telephone Network to a full packet-based network.

Communication anywhere, anytime with AT&T’s Video Share and beyond

AT&T is now in the unique position to offer an attractive service that enables consumers to freely stream videos anywhere, anytime with other subscribers of the service.

Video Share for Vertical Applications

While the consumer segment is the initial target for the launch, SIP protocol brings the flexibility to extend services to other segments. Business applications are the next logical step. As it is, a video sharing-enabled handset can find its place in the pocket or the briefcase of real estate or insurance agents, plumbers, mechanics, retailers and others.

Should AT&T choose to add more features for business markets, IMS offers an unprecedented platform for developing attractive vertical applications, combining video sharing with presence, messaging, convergence of fixed-mobile voice communication, reach-ability management and more. These services offer AT&T opportunities to attract more users, develop new revenues and reduce churn by using IMS to develop both general purpose applications and tailored offerings for specific vertical industries.

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Introduction
At the Visiting Nurse Association of Northern New Jersey (VNANNJ), we take tremendous pride in our history and traditions; we started out more than 100 years ago as a pioneering mobile workforce. We developed effective management and supervision for our organization before widespread use of telephones or motor vehicles. Today, we are using state-of-the-art communications technology to continue to refine our mission.

The Business of Mobile Healthcare
Our services are structured around a detailed plan of care for each of our patients. Typically, we begin to formulate this plan of care when primary-care providers or hospitals refer patients to us, often when that patient is still hospitalized. We have found that early planning and close coordination with primary-care providers is essential to developing an effective plan of care and ensuring a seamless transition between relatively intensive hospital care and less intensive home care. The culmination of our initial care planning process occurs with the first visit, when our visiting nurses finalize the plan of care. The visiting nurses work with patients and their families on scheduling and other logistics issues and, of course, complete the paperwork necessary for insurance and liability protection.

On a typical visiting nurse's workday, she will make six visits to patients in their homes. Each visit generates data related to patient care, principally a summary of therapeutic and patient care activities, and a brief report on the patient's medical condition.
Mobile Nursing Service Challenges

We are facing the same organizational challenges as many other health care enterprises. Home care for the aging is increasing in demand as the Baby Boom generation advances into its 60s. Staffing for this increased demand is another challenge. Growing and maintaining a skilled, motivated workforce is clearly integral to VNA’s business model. The U.S. job market for qualified nurses is extremely competitive, which has caused us to rethink how we equip our people for success, seeking to ensure that they can focus on the most rewarding part of their job: providing top-quality home medical care. And, as a non-profit organization with limited resources, we must consider our human resource and capital investments very carefully.

A significant challenge for us is to consistently maintain up-to-date data on our nurses’ visits. We want our nurses to focus on patient care, not on paperwork. And because our nurses already spend a significant portion of their working day on the road between visits, we also want to keep their time spent visiting our management offices to an absolute minimum or eliminate it all together.

Prior to our pilot projects with Alcatel-Lucent, our nurses relied on the U.S. Postal Service for transmission of their reports and paperwork back to our management offices. Use of the mail introduced time lags into reporting that hampered our management of our nurses and diminished our supervision of individual patient care plans. In addition, primary-care physicians could only access visit data that was a week or so old, degrading their ability to maintain up-to-date care and diagnoses.

Our procedures and policies must visibly add value to the nurses’ duties, not add layers of stress and bureaucracy. For example, the Health Insurance Portability and Accountability Act of 1996 (HIPAA) stringently requires all U.S. medical personnel to protect patients’ personal and medical information. This requirement presents our mobile medical workforce with a significant logistical challenge: How would our visiting nurses maintain physical control over patient medical information, such as reports and case files, as they move? Fortunately, VNA was able to partner with Alcatel-Lucent to build a solution that not only protected our patients’ sensitive data, but also improved the quality of patient care and quality of life of our workforce, and implemented better control over VNA’s workflow management and back office business processes.

Remaining Competitive, Efficient and Secure

Improving on-the-job quality of life for our visiting nurse workforce by reducing administrative workloads and improving access to central VNA information and management resources is an area we saw could improve our ability to attract and retain top nursing talent. We also want to improve the accuracy, consistency and security of our recordkeeping – not only to elevate our quality of care, but
also to cost-effectively remain in compliance with data privacy laws and cope with the increasingly complex bureaucracies of insurance and government payments on which our patients rely.

Building on the third-generation (3G) mobile high speed data pilot program we initially leveraged to meet some of these challenges, the Visiting Nurse Association again partnered with Alcatel-Lucent to develop a secure, flexible, mobile point-of-care (POC) system for our visiting nurse workforce. The mobile POC hardware – the front line of our system – is a commercial off-the-shelf laptop equipped with the Alcatel-Lucent OmniAccess 3500 Nonstop Laptop Guardian (NLG) solution. The actual NLG device is an always-on Personal Computer Memory Card International Association card that combines 3G wireless Internet connectivity with a variety of data encryption, communications encryption, global positioning system (GPS) and remote administration functions. For productivity, our mobile POC laptops are loaded with an e-mail client, web browser and VNA’s patient management client, which securely communicates with VNA’s 20,000-patient database server, as well as with VNA’s management intranet.

VNA considered other security solutions, but chose NLG because it was the best all-around solution, providing robust data encryption, high-speed connectivity and a complete suite of remote access and control features. We decided against using a satellite-based GPS service for laptops; while it might facilitate the recovery of a stolen laptop, it would not necessarily protect patient data. We also rejected a USB dongle solution because experience has shown that users tend to leave dongles in computers and to be recovered, the laptops would have to be connected to the Internet – something an experienced identity thief would not likely do.

**Gaining Employee Support**

In our pilot project, our test group of visiting nurses began to enjoy the benefits of the POC devices after overcoming initial misgivings about the learning curve and perceived pitfalls of the new systems. Employees were concerned about accountability for an expensive piece of gear that would be in constant transit between their vehicles and patients’ homes. They were also worried that patient information – which they feel a professional duty to protect in compliance with HIPAA – would not be completely secure while POC machines were communicating via 3G wireless or if a POC machine were stolen. Misgivings about losing control of patient data were allayed after the IT department demonstrated how swiftly – and completely – the POC laptops could be disabled via NLG’s remote administration.

In a short time, nurses saw the benefit of instant access to the most up-to-date patient data. Primary-care physicians and other care providers also learned the value of up-to-date patient data. Web surfing has turned out to be an unexpectedly valuable tool for our nurses, who can use it to help shut-in
patients get information they need for their treatment or well-being. Our nurses also appreciated the virtual elimination of time-consuming paperwork and mailing chores, as well as less frequent visits to VNA's main office. The NLG technology also enables secure Internet access for our visiting nurses. Secure e-mail communication among VNA employees, as well as online access to VNA intranet information and services such as employee benefits enrollment, have saved time and enhanced the quality of life of our professional staff.

**Streamlined Remote Administration**

From the IT management standpoint, the NLG/laptop solution has saved countless man-hours and has enabled VNA to keep its full-time IT support staff relatively lean. In particular, the remote administration and maintenance capabilities of the NLG technology have allowed the VNA IT staff to effectively maintain a complex, wide-area network with minimal additional manpower and capital investment. In addition to facilitating real-time, remote tech support to POC machine users, maintenance and patching of both the overall system and individual POC machines, the NLG's remote administration capabilities also give VNA's non-IT managers important new tools for supervising and managing the visiting nurse workforce. For example, a nurse who has not been compliant with our requirement to periodically synchronize visit data with the main VNA patient database can be prompted, via the remote-shutoff feature, to report back to the main office to update data in person and report to supervisors. Also, by using the system's GPS capabilities, we can pinpoint the location of each laptop in the field, which has proven beneficial in tracking the progress of our traveling professionals and in disablement and recovery measures in the event of a security breach.

The automation of patient visit reporting has also given VNA managers new ways to gauge individual nurse performance and fine-tune assignments to improve productivity of visits. In that vein, VNA has also begun to chart improvements in standards of care. For example, the accessibility of near-real-time visit reports to other visiting nurses and attending physicians has reduced medical mistakes and redundancies.

**Mitigating Risk in a Mobile Environment**

The general data management processes of VNA have realized measurable benefits from the VNA/Alcatel-Lucent POC deployment. The system has improved VNA's compliance with HIPAA by applying state-of-the-art protection to patient data. The remotely controlled management of encryption keys exceeds current requirements under the HIPAA privacy rules.

It has also provided VNA managers with much-needed peace of mind. When you consider the estimated cost to monitor and protect one individual from loss of personal data is approximately $50 and the loss of a single VNA laptop could compromise up to 20,000 patient records, that's a $1 million exposure if not properly secured.

So far, VNA has not had the misfortune of having a POC laptop stolen, although we believe it is only a matter of time and scale before we suffer such a loss – thefts have already occurred at other home care provider enterprises around the United States. The NLG solution also provides an audit trail in the event of a data security lapse. The application of NLG encryption to internal VNA e-mail offers further assurance that VNA employees can share information about individual patient care without risking an inadvertent disclosure.

**Key Learnings Along the Way**

- Anywhere and Anytime PC upgrades and data retrieval is more efficient for a highly mobile workforce who can remain in the field performing their duties while the IT professionals achieve their goals remotely.
- Administrative tasks can be easily automated and executed remotely, increasing efficiency and productivity.
- GPS enabled laptops identify a computer's location, which helps track the progress of our mobile workforce and helps with asset disablement and recovery in a security breach condition.
- Truly securing patient data in a mobile environment is a competitive differentiator for our visiting nurse business and a comfort to our clients.

**Conclusion**

The Northern New Jersey VNA's joint effort with Alcatel-Lucent has been a success, not only from the IT management perspective, but also because it has helped us forge a vision of how our proud tradition can carry on into the 21st century as a modern, competitive health care enterprise. Improved connectivity and data processing are helping us refine quality of care and better focus increasingly scarce resources. State-of-the-art security technology allows VNA and its visiting nurses to use and transmit patient information confidently in the field.
while giving it all the protection our patients deserve. For the long-term viability of VNA, we are using technology investments to leverage our most valuable investment: our people, without whom we couldn’t serve our patients.

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ONEMAX Launches World’s First WiMAX Rev-e Network in the 3.5 GHz Spectrum

By A. Méchaly, J.-C. Girma

The Dominican Republic is a country experiencing rapid growth. In 2006, the country of almost 9.4 million citizens expanded the economy by 10.7%, with solid growth (8%) expected to be posted by the end of 2007.

Nonetheless, the country has its development challenges. Parts of the country remain unserved by wireless phone providers, and a significant percentage of the population has no access to telephone service at all. Both enterprises and the general population want more access to basic telephony as well as broadband service; however, there is little fixed infrastructure in place capable of satisfying these demands.

In response to this challenge, Indotel, the Dominican Republic’s regulatory body, has advocated increased competition and instituted efforts to bridge the digital divide through the use of wireless technologies. To that end, Indotel has offered a broad spectral bandwidth to provide broadband services throughout the country. One of the companies that has been engaged to fulfill this objective is Santo Domingo-based broadband service provider ONEMAX – which teamed up with Alcatel-Lucent to develop a service platform based on Worldwide Interoperability for Microwave Access (WiMAX) 802.16e-2005 (Rev-e) – one of the wireless broadband standards.

Six months after the contract was signed with Alcatel-Lucent, ONEMAX launched the world’s first WiMAX 802.16e-2005 (Rev-e) network in the 3.5 gigahertz (GHz) spectrum, connecting its first customer in October 2007.

A Fitting Solution

According to Raoul Fontanez, CEO of ONEMAX, “The Dominican Republic is an ideal market for WiMAX technology because of its strong economy and relatively large population of more than nine million people, whose rapidly growing demand for broadband services needs to be met cost-effectively. At our launch, there were approximately 200,000 Internet subscriptions, yet over 5.5 million mobile subscribers.”
With ONEMAX, subscribers and visitors can now access wireless broadband applications such as high-speed Internet access, multimedia applications and Voice over Internet Protocol (VoIP) services. This is generating a new stream of revenue for the company and has created new opportunities for enterprise growth and social interaction.

WiMAX Leapfrogs Infrastructure Gaps
The network, deployed in the 3.5 GHz spectrum band, represents a significant milestone in the commercial introduction of WiMAX services and highlights the opportunity that WiMAX represents for operators worldwide.

Given the wide variety of applications envisaged by ONEMAX, the company defined a new role for itself beyond that of a simple mobile operator. “We introduced a new concept, that of the Mediacom provider: Internet, telephony and new communications services from one service provider. With this concept, information technology and entertainment are fully integrated in our customers’ daily experience,” explained Fontanez.

This led to the selection of Alcatel-Lucent as ONEMAX’s partner in the deployment. Alcatel-Lucent delivered an end-to-end solution designed to integrate multiple device partners and radio features such as Multiple Input, Multiple Output (MIMO) and beam forming.

These features enable ONEMAX to reduce the number of radio sites needed to provide coverage and to maximize bandwidth usage in urban areas and hotspots. Beam forming, for instance, enables a service provider to reduce the number of radio sites needed to provide coverage – in some instances by as much as 40% – while reducing interferences and ensuring better indoor penetration of the radio signal. MIMO helps make radio links more robust, nearly doubling the capacity delivered in dense urban environments.

Flexible Deployment and Rapid Time to Market
WiMAX’s capabilities offered several advantages during the system’s rollout. “With WiMAX, the rollout could be done quickly, at a competitive capital expenditure per subscriber, and it is very easy to target the specific geographic zones where there is strong demand,” said Fontanez. “We initially focused on the capital, Santo Domingo, which we covered with a network from scratch in a few months. WiMAX enabled us to extend our network easily out of the affluent central district, which meant that we could cover low-income communities which are underserved by the existing infrastructure.”

Rapid deployment is one of WiMAX’s key benefits for service providers. ONEMAX took just six months to connect its first customer, thanks in part to the close working relationship which developed with Alcatel-Lucent, according to Fontanez. “Through the initial trial phase and the first commercial deployment, Alcatel-Lucent’s
teams worked the engineering issues with us on-site, resulting in a high-performance network with excellent coverage.” Rapid time-to-market in this case also means rapid return on investment. “We plan on becoming EBITDA\(^1\)-positive quite quickly,” said Fontanez.

ONEMAX offers services to both enterprises (fixed IP, Centrex, Extension dialing, virtual private network, hosting, etc.) and individual consumers (Internet, telephony, multimedia and communications services). The WiMAX service is using Quality of Service to support its VoIP services and to ensure low latency to enhance the communications experience for end users. This has emerged as a key selling point for both consumers and businesses, on top of the general benefits of broadband access services.

### Innovative Solutions

ONEMAX has taken advantage of the maturity of Alcatel-Lucent’s WiMAX Rev-e solution and the company’s Open Customer Premises Equipment (CPE) Program.

The Open CPE Program is designed to promote an open device ecosystem and supports a wide range of terminals from various CPE partners to ensure customers have access to the widest possible range of interoperable end-user devices.

Using Open CPE, ONEMAX is able to offer a wide variety of CPE for delivering mobile, nomadic and fixed services to end users and enterprises.

Beyond human access to the service, ONEMAX is also using WiMAX for Machine to Machine communication. An interesting example is the Automated Teller Machine (ATM) connection. By connecting ATMs via WiMAX, rather than the fixed wired network, banks can deploy terminals anywhere within network coverage, not just inside a bank branch. An extra benefit of a WiMAX connection on these machines is its “always-on” nature. Compared to a usual dial-up connection, a WiMAX connected ATM will offer quicker transactions for people using the ATM, ultimately leading to an increase of the ATM’s throughput.

### Bright Future for WiMAX

Alcatel-Lucent has long believed that WiMAX is an effective solution for rapidly developing countries, where access to voice and broadband services is often restricted due to lack of infrastructure or geographical constraints. These markets can benefit greatly in terms of social and economic development from access to voice and broadband access (in the 3.5 GHz band), which can be quickly and cost-effectively deployed through WiMAX.

“WiMAX will be to broadband wireless what Global System for Mobile communications is to telephony. By that, I mean that, in my opinion, the next billion Internet connections, connecting unserved and underserved populations around the world, will be provided by WiMAX,” said Fontanez.

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\(^1\) Earnings before interest, taxes, depreciation and amortization.
The ONEMAX experience in the Dominican Republic is proof of the benefits WiMAX can deliver to carriers in developing economies. Access to dial tone is an enabler of increased economic and social interaction; access to broadband opens up the possibility for enterprises to expand the market for their products and to trade more easily beyond national borders.

ONEMAX and WiMAX will continue to contribute to the development of the local economy, and the example of the Dominican Republic will demonstrate to other developing markets not only that voice and broadband services can be deployed cost-effectively to underserved populations, but also that economic and social development can be accelerated by improving access to communications services.

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**Dominican Republic**

**Location**
Caribbean, eastern two-thirds of the island of Hispaniola, between the Caribbean Sea and the North Atlantic Ocean, east of Haiti.

**Area**
Total: 18,815 sq. mi. (48,730 sq. km.); land: 18,680 sq. mi. (48,380 sq. km.); water: 135 sq. mi. (350 sq. km.).

**Population**
9,365,818 (July 2007 est.)

**GDP (purchasing power parity)**
$77.09 billion (2006 est.)

**GDP (official exchange rate)**
$20.55 billion (2006 est.)

**GDP – real growth rate**
10.7% (2006 est.)

**GDP – per capita (PPP)**
$8,400 (2006 est.)

**GDP – by sector**
agriculture 11.6%; industry 28.6%; services 59.8% (2006 est.)

Source: CIA World Factbook
Realizing the Converged Broadband Service Provider

By E. Festraets, H. Bolande, S. White
The telecom arena is changing rapidly. The traditional, fixed, incumbent service-provider model – offering classical telephony and broadband DSL for Internet access – is becoming outdated and lagging far behind trends in end-user demand. End users are growing more and more dependent on broadband applications such as web-based social networking, multimedia messaging and online music and gaming. As a result, they want the convenience of being able to access them freely, “anywhere, anytime.” Only by converging fixed access with broadband wireless access technology can service providers hope to offer always on, broadband services on a continuous basis (Figure 1).

Reinforcing this “converged” service provider model is the fact that, in many countries, the traditional incumbent is under attack from various competitive market players whose main weapon is the bundled offering. Traditional mobile operators are also looking to move beyond telephony (pure voice) to engage in this battle for the end customer, adding fixed residential offers to enhance their competitiveness. So, what does the future service provider model look like?

This article will take a closer look at the “converging” market trend and how it is driving service providers across the fixed/mobile boundary. It also will provide a look at some future bundled services (designed to meet a variety of customer demands) and offer a snapshot of new service provider business models with a focus on their potential role as mediator for the variety of communications devices inside or outside the home.

Figure 1: Moving to the “converged” service provider model

This mix of bundled service offerings, technologies and new business models will help this new breed of converged broadband service providers flourish.
Setting the Scene

Fixed and mobile boundaries are blurring. In Germany, for example, Deutsche Telekom, the traditional fixed operator, faces competition from mobile operators such as Vodafone and O2, whose “Zuhause” and “Surf@home” services emulate fixed broadband through third generation (3G) mobile connections. Conversely, fixed operators are increasingly looking to wireless technologies as a way to extend their broadband services beyond their home/office stronghold to “on-the-go” usage.

Figure 2 describes how both fixed and mobile operators will extend their offerings, with fixed service providers adding mobility to their standard set of services and mobile service providers coping with the need to deliver more bandwidth. Today, this “convergence” is mostly happening at the level of commercial service bundles, as opposed to the integration of technologies and network infrastructure, although we have seen some notable moves in that direction. The next step will be a more profound re-architecting of the network to deliver fixed and wireless services side by side.

What will this step toward full fixed/mobile integration look like?

The answer is fixed/mobile (wireline/wireless) service integration and blending. Some examples of these integrated service packages are:

- Dual Mode (WiFi – 2G/3G) mobile voice terminals and femtocells
- Single number/agenda for fixed/mobile terminals, single voicemail box
- Videoconference between 3G mobile terminals and PCs
- Remote home surveillance through 3G mobile terminals
- Remote access to multimedia files in the PC from a 3G mobile terminal
  - Content streaming to mobile terminal overcomes memory limitations

Figure 2: The move to “anywhere, anytime...”

- Convergent fixed/mobile TV package
  - TV on mobile terminal and home screen
  - Access to TV listings and PVR programming through mobile terminals

In order to make these blended service offerings a reality, the right network infrastructure needs to be in place, encompassing the IP/Multi Protocol Label Switching (MPLS) core, edge and aggregation network and various fixed and mobile access technologies.

Converging the Access Network Technologies

Fixed and mobile service providers intending to become converged broadband service providers face both challenges and opportunities. Zooming in on the access network, several complementary technologies can be utilized to realize full convergence (Figure 3).

Challenges for the Mobile Service provider

The traditional mobile service provider has a number of barriers standing in its way as it contemplates moving toward a broader, more universal role in connecting all aspects of the end user’s life. Winning a role as a provider of broadband services in the home and office is greatly desired, as it offers the potential for incremental top-line revenue and a way to reduce churn.

However, the infrastructure must be powerful enough to offer broadband throughput. In mature economies, end users have already become accustomed to the high bitrates they enjoy on xDSL, cable or fiber-based networks: therefore they are unlikely to use wireless technology — either as complement or substitute — if it means falling back to a narrowband quality of experience. At a minimum, they expect megabit-per-second speeds. The evolution of existing mobile networks to High-Speed Packet Access (HSPA) and Evolution-Data Optimized (EV-DO) Rev. A have brought that goal within reach, and some wireless service providers are positioning themselves on this basis as an alternative to fixed-line broadband.
The idea of converged broadband services, however, typically bespeaks a symbiotic collaboration between fixed and wireless infrastructures. One new technology that leverages the strength of wireless and wireline technology to offer a converged experience is the femtocell, also known as the home base station. This device combines the compact size and easy installation of a consumer-electronics device with the performance benefits of carrier-grade network equipment: it extends the full power of the wide-area mobile network through a compact, plug’n’play box. Because the femtocell provides a strong wireless signal in the home or office, it can support clearer voice conversations and offer optimal bitrates for broadband wireless access, thus allowing the end user to reap the full potential data rates of HSPA or EV-DO Rev. A, whether they are using a handheld device or a PC with card adapter.

Traditionally, mobile subscribers have suffered from much-reduced signal strength in most indoor situations, since physical structures impede connection to the nearest outdoor base station.

The femtocell device also leverages the high bandwidth of the home’s fixed connection, using that link to backhaul traffic, further improving the performance and quality of experience. The Holy Grail of fixed/mobile convergence is the notion of seamlessness, i.e. the ability of the end user to switch between different access types and networks without any noticeable inconvenience. Here, too, the femtocell has a role to play, because it enables the end user to move from outside to inside the home (and vice versa) without changing phones.

Another major benefit of the femtocell is the tight integration of this technology into a residential gateway to incorporate the mobile phone fully into the home network. This will enable content to be shared across different devices in the home, giving the service provider tight control over many home-based applications.

The ultimate level of fixed/mobile convergence would enable truly user-centric services that would be access-agnostic and centrally managed; this would require an end-to-end IP network architecture with multiple access networks sharing a single core. This is a longer-term goal, as most mobile service providers lag behind their fixed counterparts in the evolution to full IP. However, IP transformation often proceeds in stages, starting with, for example, the transport level, as mobile providers seek efficiently to ramp up capacity to cope with the fast-rising levels of traffic that non-voice services are bringing.

**Challenges for the Fixed Service Provider**

Fixed service providers suffer huge churn in their customer base due to competition from a variety of alternative players, whether mobile service providers bundling their offers, or “network-less” service providers such as Google and Skype, who threaten to “own” the end user by extending services to them using third-party network infrastructure.

The traditional fixed service offerings (classical fixed voice, Internet access) cannot respond to the end user’s evolving service demands and are thus insufficient to counter these aggressive market players.

The emergence of new technologies such as Worldwide Interoperability for Microwave Access (WiMAX) and femtocell represents a definite growth opportunity. However, they are also part of a deeper trend toward fully converged broadband services, which give the service provider an opportunity to more deeply intertwine itself and the services it provides in the fabric of the end user’s life. This is one of the most important defense strategies against dis-aggregation, i.e. the threat of becoming the proverbial “big dumb pipe” that application providers such as Google, Yahoo! and Microsoft exploit to own the customer and dominate the highest position in the value chain.

The best defense against the threat of being relegated to the role of a faceless, brandless intermediary is the ability to provide seamless, always on, anytime/anywhere broadband services to any individual. Service providers who already possess both mobile and fixed
networks are in the best position to become a converged service provider. They face a twofold challenge, to transform both their internal organization and their network.

The first challenge should not be underestimated, as fixed and mobile branches of service providers have typically been operationally autonomous, co-existing under a corporate roof but sharing very little in terms of leadership, hierarchy and culture. A complex merger is required which, in the case of companies such as Telefonica and Verizon, began with the CTO organization.

The second challenge, the merger of existing networks, is itself a project that can require significant investments in time and money. Thankfully, network transformation to a unified, all-IP architecture pays off not only in terms of new services (as described above) but in cost efficiency, as reduced network complexity drives down operational expenditure dramatically.

Operators with an exclusively fixed or mobile focus face a challenge that is more technical in nature. Fortunately for them, there are unprecedented technical opportunities for rounding out their capabilities. For fixed service providers, WiMAX in particular offers a compelling opportunity. Well-suited to their practices and current network deployments (as an access technology, it interoperates seamlessly with existing back-end infrastructures), WiMAX answers two different kinds of consumer needs: first, the desire, largely in urban areas and among business users, for high throughput on the go; second, the desire for broadband access in rural areas where the economics of extending wireline networks can be prohibitive.

In both scenarios, WiMAX complements fixed-access offerings rather than competing with them. It expands a fixed service provider's service portfolio and – in the rural case – provides a cost-effective way of responding to the often mandatory, regulator-driven requirements to serve rural customers.

Creating Converged Services – the “Anytime/Anywhere” Experience

Converged broadband services anticipate changing consumer behavior and the ever-evolving “hunger” for an advanced user experience. The ultimate service offering can be found at the intersection of three underlying concepts:

- **Personalization** (I want my stuff, when I want it)
- **Interactivity** (I want to communicate, when I want to)
- **Optimized access** (I want uninterrupted service, irrespective of access technology)

The latter concept covers the fixed/mobile convergence discussion, in terms of handing over a particular

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**Figure 4: Converged end-user services**

- **Optimized Access**
  - Personal broadcasting
  - Film and photo sharing
  - Next generation IPG
  - Videoconference feed in live TV
  - Community VPN

- **Personalization**
  - Film and photo sharing
  - Next generation IPG
  - Videoconference feed in live TV
  - Community VPN

- **Interactivity**
  - Personal broadcasting
  - Film and photo sharing
  - Next generation IPG
  - Videoconference feed in live TV
  - Community VPN

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- **“Nomadic Entertainment”**
  - Cell phone as remote device
  - Mobile video content
  - SMS-to-TV
  - Follow-me-Content
  - Content-2-Go

- **“Immersive Exchange”**
  - TV/mobile chat and (micro)blogging
  - Tangible media
  - TV access supplementary services
  - Remote video surveillance
  - Video telephony and mailbox
  - Call handling

- **“Life Vaulting”**
  - Personal broadcasting
  - Film and photo sharing
  - Next generation IPG
  - Videoconference feed in live TV
  - Community VPN
service (movie, sporting events, live performance) from wireline to wireless access networks and vice versa, depending on the location of and applicability for the consumer (Figure 4). In principle, these brand-new service offerings require higher bandwidth, generate additional revenue, and differentiate the proposal from the competition.

Conclusion
Fixed/mobile convergence is a hot topic today, and all service providers have the opportunity to evolve beyond the fixed/mobile boundary. Those providers who best realize the converged broadband service provider model will be most successful in their markets and win the battle for the end user.

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Combining Web 2.0 and IMS: The Road to New Services and Business Models

The missing link between legacy and Internet-based communication services

By G. Dorbes, H. Amossé

The rapid rise of IP Multimedia Subsystem (IMS) and Web 2.0 technologies has, in many ways, lowered the barriers to market entry for organizations that want to compete with traditional telecommunications providers. As a result, a growing number of service providers now must consider companies like Google as significant competitors for consumer and business subscriber revenues.

Service provider organizations that operate in even the slightest competitive environment are under intense pressure to rapidly move away from rigid network infrastructures and service delivery platforms. Replacing these environments at some point in the future will be a standard, open and more flexible IP network infrastructure that can accommodate:

- Multiple traffic types (voice, data, video)
- Variety of access types (wired and wireless)
- Various quality of service (QoS) performance requirements
- A variety of new and emerging business models

In the meantime, incumbent telecom operators must develop a hybrid migration strategy that leverages existing network infrastructures to enable a new generation of services. Meeting new demands will increasingly require service providers to offer consumers and businesses the ability to mix and match capabilities (voice, data, video over broadband wired or wireless infrastructures) at will. In so doing, the fundamental nature of the industry is changing, as telecom takes on many of the economic characteristics associated with the Web, to form a new Telco 2.0 business model.
This transformation must be executed while designing an end-to-end architecture that will cost-effectively guide carriers toward an optimal next generation networking environment.

**Back to Basics: Understanding the Internet and its Services**

To understand the service domains available on the Internet, it is useful to look at the Internet service landscape being divided into the following X and Y axis configuration (Figure 1). In this model, Internet services are either synchronous or asynchronous and can involve either person-to-person communication or person-to-machine interactions.

The axes create four service quadrants:

- **The Synchronous Person-to-Machine quadrant** includes Media Services such as IPTV or Video-on-Demand (VoD). These services require real-time capabilities to deliver multimedia content.
- **The Asynchronous Person-to-Machine quadrant** includes Web-Based Services such as portals, eStores or blogs and the majority of services using a web browser.
- **The Asynchronous Person-to-Person quadrant** includes Messaging Services such as e-mail, Short Message Service (SMS) or voicemail.
- **The Synchronous Person-to-Person quadrant** includes Conversational Services such as Voice over Internet Protocol (VoIP), Instant Messaging (IM) or conferencing.

Many Internet services cover more than one of these domains and technologies. The combination of these configurations contributes to the development of mashups that provide new end-user-centric experiences for fixed and mobile Internet devices. This results in a “double-edged sword” situation that at once creates new revenue generating opportunities, while opening the door to new agile competitors.

**Consequences for Telecom Operators**

It used to be that the only competition for telecom operators came from other telecom operators. Now traditional service providers are in competition with Internet players who have developed conversational services (IM, VoIP) based on the Internet architecture.

As a result, a greater number of players are competing in the domain of conversational services, including:

- Google talk-based on Jabber/Extensible Messaging Presence Protocol (XMPP) open protocols
- Telco standards-based IMS
- Microsoft Live Messenger + Yahoo Messenger proprietary services
- Skype Person-to-Person (P2P) proprietary services

In some cases, these new players are offering services and rolling out business models that have not been seen before from traditional telecom players.

**IMS in the Context of the Internet**

But this is where IMS can come in and re-level the playing field for traditional telecom operators. Because IMS and Web technologies are not in the same quadrant, they can coexist to offer blended services. For instance, protocols such as Session Initiation Protocol (SIP) and Real-time Transport Protocol (RTP) are designed to work in more traditional telecom network environments. They do not have the same purpose as Hypertext Transfer Protocol (HTTP) and Hypertext Markup Language (HTML), which are standards that have been developed for the Web. And because IMS is a set of standard technologies that allow conversational services to coexist with the more proprietary telecom networks, it provides a platform from which telecom service providers can offer Internet (or Internet-like) services over their existing telecom networks.
Understanding Web 2.0

Web 2.0 encompasses both new uses and services on the Internet (e.g., Flickr, Gmail, Soapbox, Orb, Netvibes, YouTube, LinkedIn, Wikipedia) as well as specific technologies involved in delivering such services as Representational State Transfer (REST), Asynchronous JavaScript and XML (AJAX), Really Simple Syndication or Rich Site Summary (RSS) and COMET (HTTP-based push technology). These services have the common denominator of using HTTP protocols and being displayed in standard web browsers. All of these services and technologies contribute to improving the end-user experience of Internet services, using web browsers as the ultimate application client.

With Web-2.0-based technologies, a new content and information publishing paradigm is created where end users no longer perceive the Web as static information pages but rather as a platform for accessing highly interactive applications that can be easily blended with other services, applications and content. Similarly, IMS creates a new paradigm for service creation and service delivery. Web 2.0 can be seen as just one platform that can deliver IMS-based services, even as other traditional platforms continue to exist.

The compatibility between IMS and Web 2.0 technologies creates opportunities for cross-fertilization that can result in new, converged IMS-Web services that generate new streams of revenue.

Mixing Internet Technologies: A Standard Way of Thinking About New Services

A few major Internet service providers have adopted the global approach of proposing key Internet services for the four domains of Internet services in support of their core businesses (Table 1).

In this context, it is interesting to note that:

- All players have adopted a combination of conversational and Web 2.0 services.
- Most providers propose interconnections with legacy voice services either with their own brand (e.g., Skype) or in combination with operators who provide the interconnection capabilities on a regional basis (e.g., Microsoft + Verizon in the U.S.).
- All have a worldwide strategy. (This differentiates them from traditional operators who may cover one or several countries but rarely the world-as-a-whole.)

Conversational services – such as IMS services – are part of the strategy of all major Internet service providers, who create their own communication services with more-or-less proprietary technologies and link with legacy services.

These new players generally have business models that mix paid communication services (e.g. interconnection with legacy communication systems) and free services (that generate ad-based revenue) in their Web 2.0 business strategies.

Telecom operators can respond to these “new competitor” moves by:

- Partnering with Internet service providers to manage legacy communication services. The risk here is that the traditional service provider becomes a commodity for another branded service.
- Bundling services from major Internet players (e.g. IM) to associate their two brands with one service. The question is: Who will cannibalize whom?
Providing key communication services (e.g., IM, VoIP, Multimedia Push/Share, Personal Address Book, etc.) and proliferating them to the largest possible audience by using IMS and Web 2.0 technologies to leverage the traditional proprietary telecom network.

A case can be made for each option. But if telecom operators want to keep their brands strong and profitable in the domain of communication services, they will have to build on their assets (use of standards, existing base of fixed and mobile legacy service users) and extend their service coverage to the Internet and all its applications.

This is why Alcatel-Lucent has integrated IMS and Web 2.0 into its product strategy; it gives operators the ability to deploy their fixed or mobile communication services to support traditional offerings or deploy new Internet-based services.

Building an IMS/Web 2.0 Strategy

The point is not how to replace Web 2.0 with IMS, or vice versa, but to determine how Web 2.0 can help telecom operators introduce their communication services into the web environment using their existing infrastructure and IMS.

Below are three examples of how Alcatel-Lucent can help our customers harness IMS to enable the deployment of new multimedia communication services in Web 2.0 environments.

Integrate IMS communication into operator Web portal

Here, IMS services are accessed through a standard web browser compatible with JavaScript. This can include:

- Address Book Management: display, modification, synchronization
- Share Presence with Contacts: display, modification, invitation
- Instant Messaging for one-to-one conversation with contacts
- Click to Dial to set up a call by the server
The benefits to using Web 2.0 interfaces for these applications include:

- No software installation is required and updates are automatic.
- Applications run on a wide variety of operating systems and browsers.
- Applications run not only on PCs, but on all types of terminals such as mobile devices and set-top boxes.
- The browser becomes a graphical user interface for all communication services.

**IMS communication Web 2.0 Widget**

Web widgets are pieces of code that can be deployed in separate HTML web pages and executed without any additional programming. Service providers can offer a set of IMS services by using these “widgets” to integrate different types of functionality into any Web 2.0 web portal such as iGoogle, Netvibes or Microsoft Live.com. The advantages of a Web 2.0 widget are that:

- It is a portable chunk of code that can be installed, embedded and executed within any HTML-based web page without additional compilation.
- Developers can write not only in HTML, but also in JavaScript, flash and other scripting languages.
- It allows users to create personalized web portals by blending services supported by various widgets in a single web page.

Web widgets provide an opportunity to introduce IMS-based communication services into any existing portal that supports this kind of mechanism (Figure 4).

**IMS-enhanced Web pages**

Existing web pages can be enriched with IMS services capabilities to deliver added value. A typical application would offer communication-related services such as Yellow Pages (Figure 5), enabling users to place calls by clicking a dynamically loaded IMS widget associated with the page or significant tags in the page. The widget can also support other services such as links to personal address book, presence and IM.

These examples illustrate opportunities to mix web and IMS services using Web 2.0 technologies and services. There are many other possibilities to cross-fertilize web and communication services such as VoIP, voice call and IM.

**New Business Models**

Web 2.0-based blended services create opportunities for telecom operators to embrace different business models. Legacy communication services are generally based on price/unit or on flat fees, while ad-based revenue models are popular on the Web. The right mix between these two depends on the objectives of the provider and the combination of content and communication services.

By itself, the combination of IMS and Web 2.0 does not introduce new business models, but because it represents a link between two different worlds, it may introduce operators to new business models which can stand alone or be used in various combinations. They include:

- **Wholesaling** – An agreement between a “TRUE” operator (wholesaler) and a service provider in which the wholesaler owns and operates the access network and offers connectivity to one or more service providers. This is not unlike the model developed to support mobile virtual network operators (MVNOs) such as in the relationship between US operator Sprint and Virgin Mobile.

- **Outsourcing** – Reduce infrastructure costs, mitigate network evolution risks and focus effort on developing new services for defined customer segments.

- **Aggregation and Brokering** – Shift from the connectivity/transport services to content creation/application aggregation activities. Broker content to multiple operators and direct user information to multiple third parties.
Advertising – Grow advertising-based activities by selling branded items through sponsored services. An example of how this is enabled by IMS and Web 2.0 is context-aware advertising that delivers specific promotional information to user handsets based on their location.

User Generated Content and Communities – Establish a trusted, powerful consumer brand for personal and community information. Leverage consumer-generated content and add value to peer-to-peer applications.

Asset Sharing – Establish relationships with other “TRUE” operators that have: access, core and application assets. For example in 2007, Vodafone and Orange announced they would share their 3G radio access networks (RANs) in order to reduce costs.

Fulfillment – Team with content owners, producers, developers, terminal vendors and media buyers to bundle and blend media, entertainment and communication services.

E-Commerce and M-Commerce – As value shifts from the platform to the applications, e-commerce and m-commerce offer service providers the ability to cash in on transactions performed by users running these different applications.

These business models will be covered more extensively in the next edition of Enriching Communications.

Conclusion
Alcatel-Lucent has developed a strong IMS-Web 2.0 solution strategy, as part of our Service Delivery Environment, because we believe this convergence offers opportunities for telecom operators by:

- Allowing operators to disseminate IMS-based support for legacy or multimedia communication services on web pages through web widget mechanisms.
- Positioning IMS as a credible approach for enabling IP conversation services over traditional proprietary telecom technologies.

While Web 2.0 and AJAX-based services are currently available on PC web browsers, there is a clear trend toward adoption of AJAX-compatible browsers on mobile phones and PDAs.

Alcatel-Lucent actively supports the Web 2.0/IMS convergence strategy and has developed a Web 2.0 front end for the IMS Application Server Suite in order to provide operators with the strength of the IMS standards open to web technologies and uses. The ability of service providers to efficiently and cost-effectively develop and deploy new services is essential to advancing the further development of the Telco 2.0 era. For service delivery, Alcatel-Lucent proposes an IMS+Web 2.0 Service Delivery Environment in which operators can deliver, aggregate and manage converged communications services for subscribers, regardless of networks or devices. It is an opportune time to capitalize on these marketplace and technology dynamics by embracing new business models to improve performance within these new paradigms.

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Beyond Transport

Delivering unique network operator value to end users

By C. Mills, P. Carden

Introduction

As connectivity becomes a commodity, the challenge for network operators is to emerge as an essential part of the new revenue chain by using network-based capabilities to provide unique value. Network operators must focus on differentiation, using a service and technology paradigm the industry (including the largest mobile telecoms body, the Global System for Mobile communications [GSM] Association) refers to as Telco 2.0.

Differentiation through Service Mashups for Blended Services

Telco 2.0 is based on the concept of the service mashup – the creation of new services by innovative combination of existing service elements and network capabilities.

Consider, for example, a working-age consumer, Jo, who subscribes to a Triple-Play service consisting of IPTV, Internet access and fixed phone service. Jo also subscribes to a mobile phone service from a different service provider. She is an experienced user of digital media, especially digital photos, movies and music.

How can we enhance her service experience using the Telco 2.0 service mashup approach? In a Web 2.0 scenario, we might expect Jo to organize digital photos and publish them on a community web site for others to see. In a Telco 2.0 scenario we can go much further, making the photos available on a private channel on the IPTV service so that Jo can show visitors her photos on the living room TV rather than having to go to another room to boot up the PC. Other IPTV subscribers can view her photos by going to her private channel. Either the network operator or a third-party application developer can create this new service, assuming the operator provides access to the service components it controls.
At this point Jo has invested significant time and effort to arrange her digital heritage, significantly decreasing the likelihood that she will change providers. She has perhaps also influenced her parents to choose the same provider to get their own Triple-Play offering. When looking for a new mobile phone, she discovers that if she takes the mobile phone from her existing Triple-Play service provider, she can save photos directly from her mobile phone to her private channel and display them on her mobile phone, courtesy of additional service mashups. These blended services are illustrated in Figure 1.

For business communications, there are several parts of the user experience where service mashups make a difference, even before a call starts.

- **Call Initiation.** Enterprise users want their own contact information to be available and consistent regardless of the location or device from which the communication comes. So contact lists should be network-based (as opposed to device-based) and lookups need to be able to access the corporate directory. Mashups are also needed to leverage network-based recent/missed call lists (accessible from any device), presence-enabled team lists and virtual meeting rooms.

- **Incoming Calls.** Putting a service mashup into call center applications, we can display extensive customer information on a salesperson’s mobile phone. We can also provide call handling options, either on-demand or pre-arranged, based on parameters such as the calling party's identity, time-of-day and recipient's calendar.

While the presentation is different depending on whether the business person is using a mobile phone, deskphone or soft-phone client on a PC, the functionality of the service mashup should be consistent. As Figure 2 highlights, business-related service mashups require integration with enterprise systems such as databases, mail, directories and IT presence solutions.

Now we can mash in a new service element consisting of a WiFi-enabled electronic picture frame. Today's electronic picture frames, which are beginning to gain popularity, typically rotate through the pictures on a memory card or are uploaded via USB. But Jo's new WiFi-enabled picture frame connects to her private channel, and she has sent another one to her parents as a Christmas gift.
New Technology Capabilities in Telco 2.0

Figure 3 shows a combination of WiFi devices (e.g., laptop, picture frame) and Ethernet-connected devices (e.g., IPTV set-top box) inside the home connected via a home gateway over broadband to our IP backbone. In addition to the network, operators have service enablers and service operations/billing systems, as well as their own applications. Enterprise services and data access may also be involved.

As mobile networks move to an IP Multimedia Subsystem (IMS) for voice services, the flexibility of mashup services and cost effectiveness will further improve, but it is worth noting that none of the mashup scenarios described so far depend on a full IMS infrastructure being in place; in particular, the mobile phone can use the circuit-switched network for voice calls, while using its packet-data capabilities for service mashups. This adds significant service value even where the phone or network constraints don’t support simultaneous transmission of data and circuit-switched voice (e.g., this is true for most GSM handsets). Many of the highest value service mashups occur before or after a call – for example, directory or contact list lookup, incoming call context and photo capture.

The main characteristics of Telco 2.0 and the technology capabilities required to implement it across existing fixed and mobile technology sets include:

• **Developer Communities.** Service mashups may be created in-house by the service provider, by third-party external service developers or by customers themselves.

• **Service Oriented Architecture.** To expose the service elements that can be combined by these different developer communities, it is necessary to provide a consistent, widely understood mechanism to locate and execute the different service elements. This is achieved using web-services interfaces in a Service-oriented Architecture (SOA), containing elements such as a service registry and activity logger.

• **Client and Server Applications.** Mashups combine the different service elements, exposed via SOA, to create new value. This can occur either on the client or server, or both.

• **Java Service Creation Environment.** The selection of Service Creation Environment is important since it should be, where possible, consistent across client and server-side applications as well as between the different development communities to facilitate re-use of code. The development technology most consistent across the Web 2.0 and enterprise development communities is Java.
Now let us look at some examples of differentiating Telco 2.0 capabilities that enable the creation of services with unique value to customers. The resulting service mashups may or may not be developed in-house by the network operator, but they do rely on Telco 2.0 capabilities exposed by the operator to realize the value created.

**Virtual Real Estate.** While the browser connects the PC to an Internet world that is very open, television and mobile services remain less open. The network operator controls this virtual real estate and can expose it to internal and external development communities. For example, the operator may provide a web service that pops up a window on the IPTV screen or gives control of an advertising pane in the electronic program guide. Variations on these web services might equally allow pop-ups on the mobile phone screen or give control of the mobile idle screen for advertisements.

**Profiling and Preferences.** Advertisements can be delivered by the operator themselves – as a way of improving affordability for younger customers – or by external parties that pay to do so. In either case, the value of each ad is increased if the service provider offers enhanced information about the customer, based on profile and preferences, to achieve targeted advertising. The operator has access to an extensive amount of data about each subscriber’s preferences and habits, based on IPTV activity, web purchases, calling patterns and contacts, community memberships and self-care preference databases.

**Presence and Location.** Another way to add value to advertising is by leveraging location information. While some profile and presence information may be obtained without involvement of the network operator, others are unique – for example, the current IPTV program viewed, or mobile phone state (on/off, roaming, busy) and location.

**Mobile Inclusion.** Operators can deliver significant value by improving a user’s level of control over incoming calls, especially for enterprise users who have several communications devices and work closely with other staff members. The operator can deliver significant network-based differentiation by extending traditional Private Branch eXchange (PBX) features – like Manager-Secretary, Ringback-When-Free and Dual-Ringing – to include mobile phones via network-based service logic.

**Smart-Call Routing.** We can further enhance control over incoming calls through “Personal Assistant” and “One Number” services allowing users to create rules for handling incoming calls – which calls go to fixed, mobile, voicemail or a secretary, at what times of day – and rapidly change these settings from the mobile or deskphone. Such capabilities become even more powerful if combined with presence information, since the rules can now take into consideration the user’s state. For example, this would enable a rule such as “If I am talking on my mobile,
calls to my mobile phone number go to my voicemail, except my VIP-list, which goes to my secretary.” This presence-enabled “Smart-Call Routing” capability can itself be a separate Telco 2.0 service capability exposed to other applications.

• Billing, Subscription and Prepay. If third-party developers wish to deliver a new service to customers of the network operator, one choice is to sell and charge for the service separately from the network operator. This may be fine for network operators if they are in turn charging the developer for use of the Telco 2.0 services capabilities. However, in most cases it is probably more convenient for both users and developers if the operator takes care of offering the service on its portal and handles the billing.

• Network Characteristics, Events and Quality of Service. For optimal user experience, an application should be able to use a web service that describes the current network connection of a device and be notified when the characteristics of that connection change. A desirable extension is for an application to be able to request a higher-priced quality-of-service (QoS) for a particular session.

• Enterprise Premises Integration. The integration of enterprise premises services and databases can work two ways: by enabling network-based services to securely interact with enterprise systems and by enabling enterprise application developers (in-house either to the enterprise or its solution suppliers) to access operator-based Telco 2.0 capabilities. An example of the first scenario would be a network-hosted enterprise mobility service that allows lookups in the enterprise directory and interworks with PBX-attached deskphones. An example of the latter is a corporate intranet whose directory lookup returns the mobile presence and location of employees.

It is important to put in place the Telco 2.0 foundations of SOA and a Multi-Tiered Service Creation Environment that includes Java Service Creation capabilities. These will expose services in an efficient manner and support rapid service development in an environment that provides the optimal combination of speed, flexibility and performance. Once this is established, the next step is to build capabilities that provide the strongest differentiation of service mashups.

Although this can be done solely with a combination of web services and legacy telecommunications environments, there are distinct advantages to building the Telco 2.0 environment on IMS. IMS provides a common session control architecture that includes support for global roaming between different mobile service providers. In addition, IMS provides significant operational expenditure reductions for a high volume of applications, which is a Telco 2.0 goal; and over the long-term it can reduce capital expenditures by eliminating redundant systems found in a silo technology approach.

Enabling New Business Models
Telco 2.0 speeds up the rate of innovation while providing control over which internal and external parties have access to specific differentiated network capabilities. Telco 2.0 may be used to support a range of business models – from a “total telecommunications provider,” cross-leveraging Internet, television and mobile assets, to a focus on pure Telco 2.0 network and enablers that only use external application development communities.

The development community can range from “no restrictions,” including small “garage shop” developers as well as large independent software vendors and mobile virtual network operators, to a focus on a small number of key partners. Another business model dimension to be considered is whether or not to offer Managed Services, which can offer economy-of-scale advantages and flexibility in contract options.
Conclusion

While there is no single path to success that meets the needs of all operators, Alcatel-Lucent has found the following elements to be essential:

- Clarify business goals and priorities. Until key stakeholders are aligned, the transformation project risks having people operate under different assumptions and drivers.
- Establish the end-vision and then a phased approach to getting there. It is fine if the end-vision changes over time, as long as each step produces measurable business success and moves the operator to the current end-vision.
- Consider the people, process, metrics and systems aspects of each phase.
- Add capabilities in a way that allows them to be blended with other services.
- Establish common, shared enablers (including data) as early as possible to gain flexibility, consistency and cost efficiencies.
- Establish a governance program and executive sponsorship. Moving from a silo approach to a converged, SOA approach requires an established governance framework – including best practices, tools, naming/segmentation conventions and review teams – plus consistent executive support.

The next few years promise to be exciting. Users will be able to have a single contact number, contact list and voice mailbox and access from anywhere to advanced applications. We’ll see a rise in the Mobile Enterprise, where users are optimally productive no matter where they are. We can combine these capabilities with an easy-to-use interface that simplifies security with single-sign-on across multiple services, provides an intuitive and consistent interface across devices (e.g., phone, PC and television) and offers preference-driven services. Make it easy to access, easy to use and worth the price, and they will come.

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Espoo City Embraces Fixed/Mobile Convergence: Optimizes Costs and Enhances Services

By Marke Kaukonen
CIO, Director of the City of Espoo Information Management Center
and Marketta Ripatti, System Manager of the City of Espoo Information Management Center

Finland has long been a pioneer in both mobility and digital literacy. The Nordic country of 5 million citizens has perhaps the highest penetration of both mobile phones and Internet access. So it should not be surprising that municipalities in the country are held to high standards in how technology is harnessed to reduce cost structures and optimize the productivity of the employees who serve our citizens.

Espoo City is a suburb of Helsinki (which, with 235,000 residents, is the second largest municipality in the country) that can trace its history as a community back 550 years. This is a milestone that has been recently celebrated, and a reminder to all city employees of how important it is to provide the tools and support our residents need to meet the dynamic requirements of a vibrant community. Espoo, after all, serves as the headquarters for many of the country’s leading corporations.

Meeting High Citizen Expectations
As the CIO of Espoo, I am acutely aware of just how high public expectations are for performing effectively. Finnish people are among the most connected and available people in the world; they have come to expect all aspects of their communications (personal, professional, and public) to be seamless, effective and clean.

For that reason, the city has made a strategic commitment to remain at the forefront of key Internet and mobile technologies. We are early adopters, and we have been able to gain many benefits from pursuing this strategy.

We were among the earliest municipalities to roll out a major implementation of a Multi-Protocol Label Switching (MPLS)-based Voice over IP (VoIP) network when we replaced our legacy PBX systems in 2005. It was a project that was built on the OmniPCX Enterprise technology offered by Alcatel-Lucent. The implementation was facilitated by TDC Oy, a service provider and systems integrator who designed and delivered the MPLS IP-VPN network and the IP communication solution with mobility features. We rapidly moved 8,300 telephone subscriptions to the new system to gain the cost benefits of operating an IP network, while enhancing our ability to provision different types of telecommunications resources – both shared and individual – to those of our 14,500 city employees who need a phone for their work.

Flexibility and Availability an Imperative in Espoo
Flexibility is particularly important for us in Espoo, because we have an unusual geographical layout. Rather than having a central downtown area, Espoo has a decentralized suburban structure. There are five different ‘boroughs’ in Espoo, and our city services are delivered to residents from a variety of offices, centers and clinics throughout the city. Moreover, to serve the needs of our residents, a high percentage of our employees must be extremely mobile.

Indeed, one of the main reasons we were interested in moving to the MPLS/VoIP network was that the city was absorbing high costs associated with employees...
forwarding their office calls to their mobile devices. Another challenge faced by our employees was that they often had to keep track of multiple phone numbers (office, mobile, etc.), which delayed the ability of citizens and colleagues to establish contact quickly with the appropriate city official.

The network infrastructure was also complex. We had separate campus networks, wide-area networks and mobile networks that needed to be maintained in a highly siloed manner. The complexity contributed to an overhead cost structure that we felt was unnecessary given the promise of the emerging information and communications technologies (ICT).

**Consolidating Infrastructure**

We made it a strategic priority to consolidate our infrastructure from separate data, phone and mobile networks into a single, robust, integrated ICT environment. We moved our voice service operations under the authority of our Data Administration Services, and installed security measures that are stringent, yet easy to use for our mobile employees. The mission objective, of course, was to directly connect these investments in technology resources with our ability to deliver cost-efficient, high-quality services to our citizens.

Espoo city has some 10,000 employees using our PBX services, 4,000-5,000 of whom use Alcatel-Lucent's Advanced Cellular Extension solution. Each employee has only a single mobile phone with a single number. The mobile phone is regarded by the system as an extension, so an employee can easily make an internal call just by dialing an extension number. When the employee places an external call from his mobile, the person receiving the call sees the caller's fixed-line number (the office number), rather than a mobile number. This is a good example of how fixed/mobile integration is helping us maximize efficiency and flexibility across a significant mobile workforce, while reducing costs.

Just as importantly, the city is gaining significant financial returns on its investment in next-generation networking technologies. We are projecting 15-25 percent savings per year from both voice and data networking operations. And our employees are indeed more available to their constituents.

Our “reachability” targets (the time and effort it takes to connect with an employee) have also been achieved. We have been able to reduce the number of telephone calls it takes to reach any given employee. As a result, whether or not an Espoo official is in the office or on the road is completely transparent to the caller; they just have one number to call, and it follows any given employee wherever he or she goes.

**Concluding Thoughts**

Technology is a critical element in the City of Espoo’s commitment to delivering excellent levels of service to our constituents. The infrastructure we have deployed has extended our abilities and introduced new levels of flexibility that allow us to address emerging needs, without making corresponding increases in our budgets. Our mobility strategies – and the IP network infrastructure over which they run – have served as a force multiplier in our efforts to meet the high performance our sophisticated constituents expect.

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With Mobile TV Projected to Take Off, are Service Providers Ready?

An assessment of key success variables to harvest impending demand

By H. Mittermayr
Service providers harboring any doubts about the future of mobile TV should take a hard and sober look at current forecasts. The numbers cited by multiple sources make it clear that mobile TV is not only poised for rapid growth, but also for global penetration. This creates an entirely new set of challenges and opportunities for service providers around the world. The implications for infrastructure investment, new business model development and strategic planning are significant. Consider the following:

- Analysts at IMS Research forecast that nearly 500 million people will be watching TV on cellular phones by the end of 2011. This growth, say the researchers, is driven primarily by the adoption of broadcast-based services; mobile digital TV will experience 50% year-on-year growth through 2010.1
- ABI Research is even more upbeat about the future of mobile TV. Analysts there expect mobile video services to produce a compound annual growth rate of nearly 60%, amounting to $10 billion in 2012.2 Moreover, by early 2010, they project even quicker growth in digital broadcast services to overtake cellular network-based mobile TV. By then, more than half of the world’s mobile TV subscribers will receive their video via a mobile digital broadcast. ABI reports that mobile video messaging services are at the center of a technology convergence that is helping mobile customers realize greater levels of self-expression and online community participation.
- In April 2007, consultants at Canalys in the UK surveyed more than 2,000 employed, adult mobile phone users in France, Germany, Italy, Spain and the UK.3 Among their more interesting findings were:
  - 51% of those surveyed expressed some interest in mobile TV.
  - Consumers are more open to advertising-supported services related to location and communication rather than to TV.
  - 62% said it would be useful to have satellite navigation built into their mobile phones.

Most industry observers agree that the industrialized areas of the world with high concentrations of advanced video devices will see the greatest uptake of mobile video services. However, a growing number of analysts expect a significant proportion of this demand to come from developing economies. A new generation of users is expected to leverage relatively inexpensive devices and ubiquitous wireless infrastructure to access content services that have traditionally been restricted to consumers of wired broadband resources.

The rapid growth of this market – expected to double in size every two years through the early part of the next decade – is prompting many telecom service providers to examine their current infrastructures, business partnerships and business strategies to determine if they are in a position to harvest this impending wave of demand.

The size of the mobile TV opportunity – and the rapid speed with which this market is already developing – has prompted the development of a dedicated Alcatel-Lucent team that is:

- Studying key business and technology trends
- Understanding in detail end-user needs in relation to TV consumption
- Identifying possibilities to leverage existing infrastructure to secure synergies and therefore cost savings
- Working with both the global service provider community and the broadcast community to develop fulfillment strategies and business plans to monetize these rapidly unfolding developments

2 Mobile Video Communications Services, ABI Research
3 ©2007, The Consumer Mobility Analysis Service, Canalys
In so doing, the Alcatel-Lucent team has identified a set of variables and best practices that will determine the extent to which service providers will be able to harvest the mobile TV opportunity.

**Simplifying the Delivery of Mass-market Mobile TV**

One of the keys to achieving success with mass-market mobile TV is to develop offers that simplify the delivery of new services. Today, end users want high-quality access to their favorite channels anytime, anywhere. They want mass-market channels (sometimes called the “fat tail”) as well as niche channels (the “long tail”). As a result, Alcatel-Lucent is advising service providers to look for ways of delivering a diversified set of mobile TV-based offerings that integrate a mix of mainstream broadcast channels (one-to-many transmissions) with the ability to support unicast transmissions (video communication between a single sender and a single receiver over a network).

Service providers that create a successful mix of broadcast and unicast services, while combining them with interactive capabilities, will not only improve the performance of their customer retention initiatives, but also drive higher mobile service revenues.

In any case, a dedicated broadcast network is mandatory as a kind of overlay to existing cellular networks. To deploy and integrate such mobile broadcast services over existing network infrastructures, a few key questions must be addressed, including:

- What spectrum is required?
- Which standard must be supported?
- How can target coverage be achieved effectively?
- Which existing assets can be leveraged?
- What is the best way to combine services?

**Leveraging Existing Infrastructure Assets**

It is important to optimize the use of existing network investments and resources, and combine them with new technical capabilities and spectrum options to deliver a complete end-to-end solution.

Depending on a service provider’s current asset base (network and spectrum – Figure 1) and service objectives, service providers should look for ways to take advantage of:

- High-power mobile broadcast satellites, which provide direct terminal reception across rural areas nationwide
- Medium- to high-power transmitters for urban/suburban outdoor reception
- Low-power transmitters for cellular-like quality of service in urban indoor areas

![Figure 1: Alcatel-Lucent: selecting the standard adapted to your spectrum options](image-url)
Alcatel-Lucent believes that full flexibility between terrestrial and satellite transmission will be critical to the distribution of mobile TV service with the required channels and the expected coverage. That is why it will be important to identify strategies for enabling end-user terminals (i.e. mobile devices) to receive broadcast TV signals from either terrestrial repeaters or directly from satellites, while leveraging third generation (3G) broadband connections to support unicast TV.

One of the most important decisions service providers can make is to integrate their IP infrastructure developments with their broadband wireless platforms. Done properly, the mobile TV service delivery platforms should be able to adapt and aggregate TV programs and rich multimedia services onto IP service streams and let the infrastructure automatically select the transmission format – broadcast, unicast (second generation, 3G, etc.) and even Internet Protocol TV – that is appropriate for the application.

**Embrace Relevant Mobile TV Standards Early**

Alcatel-Lucent believes that solutions should be based on open standards, such as that defined by the Digital Video Broadcasting (DVB)-Forum. The company initiated the development of a further evolution of DVB-Handheld (DVB-H), with three main goals:

- Achieve better spectrum efficiency to save costs
- Make it suitable for wider frequencies to benefit from spectrum availability
- Enable satellite/terrestrial hybrid networks to optimize coverage

The result is that infrastructures based on the DVB family of mobile TV standards will be able to use a wider spectrum, integrating everything from ultra high frequency signals up to 3 GHz transmission, and save on deployment costs. This approach will allow service providers to choose the best combination of DVB-H and Digital Video Broadcasting – Satellite services to Handhelds (DVB-SH) technologies, satellite and terrestrial transmitters, low and high frequencies – whether in a dense urban/industrialized environment or in a rural/emerging economy (Figure 2).

The standards are already quite mature, robust and integrated. It is now possible to leverage DVB-SH-based infrastructures to enhance the range of DVB standards for the delivery of mobile digital television. As DVB-H, the DVB-SH standards support the delivery of IP-based media content and data to mobile phones, Portable Multimedia Players (PMPs) and in-car devices. They will also enable three key improvements to facilitate and optimize mobile broadcast implementation:

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**Figure 2:** Alcatel-Lucent unlimited mobile TV solution with DVB-H/DVB-SH
Facilitate the ability to work with multiple channel configurations at up to 3 GHz, allowing a much greater choice in terms of spectrum options.

- Improve spectral efficiency and reduce costs, since DVB-SH offers twice the number of channels from the same capital expenditures investment.
- Extend mobile broadcast reach by using DVB-SH to roll out hybrid satellite/terrestrial operations across a region. The terrestrial components ensure efficient coverage (including indoor) in urban and dense areas; satellite transmission provides coverage in rural and outdoor areas where a terrestrial network would be too expensive to deploy.

Beyond these transmission-related improvements, DVB-SH fully complies with and benefits from the existing upper-layer services (electronic programming guide, content delivery protocols, service purchase and protection) defined for DVB-H.

Mobile Interactive TV Successes

Alcatel-Lucent can help service providers jump-start their mobile TV businesses by helping them develop a complete understanding of their market and end-user expectations. The company has established an ecosystem of industrial and research partners to optimize the delivery of unlimited mobile TV. Furthermore, support has been secured from renowned international scientific institutions in the field of hybrid satellite and terrestrial reception; complex wave form optimization; and the optimal delivery of video and audio services over cellular networks.

Interactive mobile TV deployments are under way with over 80 mobile operators around the world, including Orange with its World Video portal; Telefónica in Spain and Mexico; T-Mobile in Germany, the UK and Austria; MTN South Africa; and Optimus and SIC TV in Portugal.

Detailed technical trials of mobile broadcast networks based on DVB-SH are also being carried out for many mobile operators.

- Vodafone SFR is running a trial in Pau in the south of France.
- H3G Italy and RAI recently started a DVB-SH trial in Turin. This is an interesting development, since H3G Italy has already deployed a significant DVB-H network, but is now testing DVB-SH as a potential evolution.
- ICO US has launched its Mobile Interactive Multimedia Service offer based on DVB-SH. It plans to cover the whole of North America, using satellites to complement with terrestrial repeaters.

Conclusion

In response to all the current activity and attention surrounding mobile TV, Alcatel-Lucent has launched a complete mobile TV solution designed to optimize the delivery of broadcast digital multimedia services to mobile end users. Called Unlimited Mobile TV, the solution creates an opportunity to help service providers optimize the exciting emerging market for mobile TV broadcasting.

The solution team has already demonstrated the world’s first unified mobile TV experience across 3G and broadcast networks, which enables a compelling end-user experience, combining unicast and broadcast channels connected to the same service platform on the same handset.

Media solutions include mobile interactive TV applications, which allow extensive interactivity and personalization, complement traditional live TV with made-for-mobile content, and create the opportunity to deliver targeted, advertising-supported content to end users.

Alcatel-Lucent is currently working with service providers to design, develop, deploy and operate effective mobile TV services that are optimized to leverage existing infrastructure investments and to serve discrete demand segments.

The company believes that it is important for service providers to move beyond point-to-point mobile TV offers and to provide mass-market access to mainstream TV channels on mobile devices. To do this, service providers must deploy dedicated mobile broadcast networks that complement existing cellular networks. The design of these networks may be expensive; however, Alcatel-Lucent can help minimize the expense and risk of mobile TV deployments by designing mass-market solutions that address the expectations of consumers, television broadcasters and mobile operators.

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Alcatel-Lucent teams up with many service providers to make mobile TV a reality

Alcatel-Lucent has undertaken a series of joint initiatives with service providers to ensure the availability of mobile TV capacity in time to harvest projected consumer demand. Unlimited Mobile TV with DVB-SH has attracted mobile service providers, as well as broadcast network operators and satellite operators.

- Already in 2005 CNES (Centre National d'Etudes Spatiales), Orange France and Alcatel-Lucent joined forces to test the new mobile broadcasting concept with hybrid satellite and terrestrial transmission system using S-band. This system is central to Alcatel’s “Unlimited Mobile TV” solution. The technical trial was performed in Toulouse.
- In October 2006 SES and Eutelsat announced their plans to operate the W2A satellite provided by Thales Alenia Space. Scheduled for launch in 2009, the W2A satellite will support the delivery of mobile broadcast services across Europe. Alcatel-Lucent's Unlimited Mobile TV solution is designed to integrate transmissions from satellite signals and terrestrial repeaters. The initiative is an early example of the synergies offered by hybrid terrestrial/satellite telecommunication networks and applications.
- In February 2007, Alcatel-Lucent and Telefónica announced a pilot project for mobile interactive multimedia (MIM) services in Spain. The pilot project encompassed a comprehensive offer of cutting-edge interactive TV, radio and music services for mobile handsets.
- In the same month, Spain's Abertis Telecom and Alcatel-Lucent set up a joint working group to explore the development of the mobile TV market, and to evaluate the technical specifications of Alcatel-Lucent's Unlimited Mobile TV system in the Spanish market.

- In June 2007 Vodafone SFR announced that it is performing a technical test of broadcast mobile TV using the DVB-SH standard in the S-Band (2.2GHz). This pilot took place from June 2007 on in the South-West part of France. It is using SFR's operational 3G mobile infrastructure.
- In July 2007, Alcatel Lucent teamed up with ICO Global Communications in the United States to provide end-to-end network integration services as well as equipment, engineering and implementation services for ICO's alpha trial of Mobile Interactive Media (MIM) services. The offer will be provided over ICO's integrated satellite and terrestrial network using the new DVB-SH mobile broadcast standard.
- In December 2007, H3G Italy and Radio Audizioni Italiane (RAI) started a DVB-SH trial in Turin. H3G Italy has already deployed a significant DVB-H network, and is now testing DVB-SH as a potential evolution. The downward compatibility between DVB-SH and DVB-H will guarantee a seamless end-user experience.
Growing Sophistication of Mobile Users

There’s no question that mobile subscribers are becoming increasingly sophisticated. A look at the myriad available mobile devices, coupled with the growing list of features demanded by consumers and businesses alike, all point to the need for richer, more personalized services. Subscribers are looking for services which increase productivity, allow more leisure time and deliver performance comparable in quality to what they receive from wireline services, but with the convenience that mobility brings – anytime and anywhere.

So what effect does this have on the network? In short, the network will require a well-integrated service infrastructure that tightly couples subscriber management with network resource allocation. In an IP Multimedia Subsystem (IMS) environment, IMS-enabled network transport elements can support dynamic resource allocation to supply the appropriate level of network resources and Quality of Service (QoS) required. This service-oriented infrastructure supports the end-to-end QoS, high-availability, scalability and security required by the new mobile broadband services.

Subscriber Management

A key element in facilitating network agility and strategically positioning a service operation to have the flexibility to shift business paradigms is to maintain simplification and control of subscriber data.

Many service providers today authenticate and authorize services by managing subscriber data through traditional methods (Figure 1). Mobile operators may use Home Location Registers (HLRs). Broadband and Internet service providers may use Authentication, Authorization and Accounting (AAA) servers, while IMS networks encapsulate subscriber data in a Home Subscriber Server (HSS).
To offer services that are access/connectivity agnostic and available everywhere, service providers must ensure services are available to the same subscriber across multiple networks and domains. But using multiple data stores to support individual services across networks and domains creates independent databases. These databases are often independently managed, administered and uniquely provisioned. As a result, subscriber profile data records are often duplicated, fragmented or out-of-date and out-of-synch. In fact, it is estimated that up to 50 percent of existing access network records have some level of inaccuracy with as many as 50 percent of access network faults related to inaccurate data.  

Alcatel-Lucent, along with Bell Labs, developed the Alcatel-Lucent Subscriber Data Management (SDM) solution. This allows service providers to deploy a single, virtual repository of subscriber data on an off-the-shelf IT/Telco grade platform that is configurable for high availability, high reliability and geographical redundancy (Figure 2).

It also eliminates the risk of duplicate data and gives service providers the opportunity to reduce the operational costs of managing subscriber profile information. As a result, service providers can simplify the management and administration of subscriber profile data across multiple networks. Simplification comes from being able to provide a common subscriber profile combined with the needed HLR, HSS and AAA services. In addition, with its unique architecture, the Alcatel-Lucent SDM solution is able to support multiple fixed, broadband and wireless networks simultaneously, including:

- Code Division Multiple Access/Evolution Data Optimized (CDMA/EV-DO) and Global System for Mobile communications/General Packet Radio Service/Universal Mobile Telecommunications System (GSM/GPRS/UMTS)

References:

1. 'Dirty Data' secrets - exposed, Total Telecom, J.Mellis, 2006
In the short term, SDM reduces labor and network costs with network/data source rationalization. In the medium term, SDM improves profitability by reducing time-to-market for new services. Finally, in the long term, SDM provides a flexible “future proof” environment to adapt to the needs of the market, thereby increasing customer satisfaction.

Additionally, the solution delivers:
- A unified database that provides uniform data management for multiple applications across the network
- Data federation that offers a universal view of multiple data sources
- Flexible and efficient provisioning
- Scalability, density and capacity
- End-user single sign-on with identity management
- Reduced operating expenses through centralized management and reporting
- Revenue generation with the easy introduction of new services

**Transport Evolution**

The continuing rise in subscribers, currently three billion worldwide and expected to reach five billion in three to five years, and the availability of new technologies including High-speed Packet Access (HsxPA), EV-DO, WiMAX, and IMS, have the potential to bring huge amounts of data into the mobile transport network.

Meanwhile, operators are experiencing declines in Average Revenue Per User (ARPU) from commoditized voice services. They are tasked with lowering recurring costs in the mobile transport network and introducing new, personalized mobile broadband services to differentiate their offerings.

Current radio access network transport mechanisms based on legacy T1/E1 access mechanisms do not scale cost-effectively, limiting mobile broadband deployment and services. Therefore, mobile operators must transform to more scalable and cost-effective packet-based transport media such as Ethernet and IP. This can save operators money and allow them to expand more aggressively to support new services delivered via broadband radio interfaces such as HsxPA and EV-DO.

However, migrating to a packet-based network does introduce challenges. To effectively and reliably meet new service demand, the network must provide:
- A scalable and efficient solution (both in terms of capital and operational expense) leveraging the lowered price points of carrier Ethernet
- The ability to adapt a range of legacy access protocols to a normalized Internet Protocol/Multi Protocol Label Switching (IP/MPLS) infrastructure
- The solution must retain the determinism, control and availability of current solutions
- Quality of service capabilities must be supported to both address aggregated flow capabilities and also be adaptable for more “per-subscriber” granular capabilities as the range of services supported in the mobile infrastructure broadens
- End-to-end synchronization solutions must be provided as appropriate to maintain call quality and traffic throughput.

Operators who fail to transition to cost-effective packet-based services will see exponential traffic growth without a corresponding increase in revenue. To address this gap, the mobile transport network must transform to support an order of magnitude more bandwidth at a fraction of the cost per Mb/s operators pay today. The best way to do this is to transform networks by consolidating on a unified IP infrastructure, which offers efficiencies with:
- Fewer network elements to purchase, manage and maintain
- Faster time-to-market for new services
- Streamlined operations
- Voice/data channels compression/aggregation and Ethernet economics
- Statistical gain across all traffic types sharing a common packet network

The best way to transform to all-IP is to utilize an all-inclusive solution that can be customized to the operator’s needs while leveraging existing infrastructure to improve return on investment. This approach is supported by the Alcatel-Lucent Mobile Evolution Transport Architecture (META).
“META is one of the industry’s most comprehensive end-to-end frameworks for mobile transport evolution to all-IP,” Patrick Donegan, senior analyst at Heavy Reading, writes. META builds upon Alcatel-Lucent’s leadership in the IP transformation of fixed networks, based on its successfully deployed Triple Play service delivery infrastructure.

Leveraging the service-aware capabilities of MPLS and the economies of Ethernet, META provides the scalability, high availability, QoS and Operation Administration and Maintenance (OAM) capabilities that service providers require (see Figure 3). With end-to-end, seamless “Service Aware Management” across the fixed and mobile domains, META enables service providers to dramatically simplify network operation and reduce costs. This unique capability allows service providers to manage across base stations and transport infrastructure in a single view – dramatically simplifying the operations, end to and OAM and QoS across these disparate transport networks. META also supports long term evolutionary scenarios toward a “flattened” network architecture with the controller functions moving to the cell sites. In parallel with this, increasing use of end-to-end IP/MPLS networking will drive service scaling across the converged network.

**IMS Application Management**

IMS provides a framework for operators to deliver high value-added services in a homogeneous way to their subscribers. Enabling a unified user session/service interaction, the IMS framework provides a highly improved and simplified end-user experience, while efficiently managing transport resources to provide a high QoS level for each service. It does this by leveraging:

- A centralized database that contains subscription-based user profiles
- An open architecture that allows a wide range of composite multimedia services (including legacy services as well as new innovative services)
- A way for improving the end-user experience by utilizing a single subscription, a single bill and a single customer support
- A dynamic session-based interaction between the service level and the transport level in order to ensure an adequate QoS for each media component

IMS is now a worldwide telecommunication framework accepted by both operators and manufacturers in main standards organizations concerned with mobile and fixed services (3GPP, 3GPP2, Telecoms and Internet Converged and Services for Advanced Networks

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*Figure 3: Mobile Evolution Transport Architecture (META)*
[TISPAN]). In the first release of IMS, an initial set of popular services including Presence, Instant Messaging and Push Over Cellular were commonly proposed.

These services are classically identified as “non real-time” services and don’t need stringent QoS from the underlying IP transport network to offer an acceptable user experience. Now in the maturation phase, more and more multimedia real-times services (Voice over Internet Protocol [VoIP] gaming, videoconference, Video on Demand, etc.) are emerging in the portfolios of the manufacturers.

QoS Challenges of Real-Time Multimedia

But providing multimedia real-time service in an IP network is a challenge in terms of QoS. People will not accept these new services if the quality, as perceived by the end users, is not good enough. Voice or video quality does not have to be sacrificed because of parallel web browsing or chat sessions. A massive use of VoIP, gaming or Video on Demand (VoD) means that more and more stringent real-time constraints will have to be supported in the network.

The Network Transformation to an all-IP network enables some QoS control throughout the network. A major strength of IMS is its incorporation of the mechanisms required for the session layer to control and enforce QoS in the underlying IP transport layer, as shown in Figure 4.

In Step 1 of the figure, a service request is sent from the terminal to an IMS application. This service request is based on the Internet Engineering Task Force Session Initiation Protocol and contains information on the different media components and their associated QoS that will be used in the session for the service.

Step 2 allows the IMS session core to send the QoS related information to the IP transport layer (in fact to the IP Access Gateway node that handles the IP bearer from itself) to the terminal. By using the QoS information received in Step 2, the IP Access Gateway ensures the QoS control on the data path (verifying that the user has established the adequate IP bearer resource on the user/IP gateway segment). That is the purpose of Step 3. The access networks are evolving to improve the efficiency of this model and to enhance the user experience: In future Long-term Evolution/System Architecture Evolution (LTE/SAE) and 3G UMTS/2.5G GPRS networks, the network will establish the bearer, in order to ensure the correct bearer with its adequate level of QoS.

When this bearer establishment phase is performed for all the media components of the invoked service, the terminal can send user traffic (VoIP, video, gaming...) by using the correct bearer. The terminal is assured that the transport resources are efficiently used and the end-user experience is improved since the network controls the correct level of QoS.
Conclusion
Traffic levels (driven particularly by data applications) continue to rise and stress the network. Operators, experiencing declines in ARPU from commoditized voice services, are tasked with lowering recurring costs in the mobile transport network and introducing new, personalized mobile broadband services to differentiate their offerings. In order to succeed, they need to leverage the cost efficiency of a scaleable Ethernet architecture without relinquishing the resiliency, determinism and operational control they have established, which assist them in attracting and retaining their subscriber bases.

To meet the increasing end-user demand for mobile broadband services, while at the same time mitigating against competitive pressures and streamlining network operations to reduce costs, mobile service providers must act now to take a more holistic approach to network transformation.

The transformation to all-IP must be an all-inclusive solution that can be customized to the operator's needs while leveraging existing infrastructure. A service-oriented infrastructure, enabled by an IMS, service-aware transport infrastructure and subscriber management, will provide the end-to-end QoS, high availability, scalability and security required to meet subscriber demand for new mobile broadband services.

Using this approach, META enables operators to transform their networks from Time-division Multiplexing (TDM) to all-IP, yielding significant operating expenditure reductions, improving average revenue per user and delivering a bigger return on investment. Through the creation of a multi-service IP infrastructure, fixed-mobile convergence is simplified, providing a platform in which anytime, anywhere communications are supported cost-efficiently to provide competitive advantage.

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The main focus of the traditional telecommunications industry over the past century or so has revolved around enabling interpersonal interactions. This includes point-to-point interactions (which happens when one person picks up a phone and calls another) as well as point-to-multi-point communications (such as when broadcasters transmit a signal that is received by millions of people).

While this paradigm remains important to the future of the communications industry, another set of opportunities is emerging that requires an entirely different way of thinking about communications. Computer and communications equipment are becoming so sophisticated that machines themselves (and by themselves) are driving demand for communications services. It seems difficult to believe, but already today, a growing number of communications sessions are initiated by machines to interact with:

- One or more machines
- One or more humans
- Both humans and machines simultaneously

Some of the applications that we are talking about are straightforward enough.

- They include technologies like Follow Me or Find Me services in which a call to one number triggers the network or device to make another call to where the intended recipient may be reached.

- Other applications are a little more exotic and complex – such as a centralized security system that detects a break-in at a remote facility many miles away, triggering voice calls and e-mail notifications to police and office managers, while instructing surveillance equipment to begin recording developments. In this scenario, an event occurs, triggering machines to contact other machines as well as people over the telecommunications network.

In both scenarios, events are causing machines to make calls without human intervention. Machines are not only generating traffic over the network, but also they are creating demand for value-added services. We live today in a world in which we are not only surrounded by devices – phones, PDAs, computers, servers, etc. – but are interacting with devices that can initiate communications with people and other devices. As a result, we are not just connected, but immersed in a communications environment.
Kathleen wakes up to the alarm; blinds are drawn up and the coffee pot is turned on automatically.

7:00 AM

Kathleen leaves for work and notices on her way out that the lawn is too dry; uses cell phone to change settings to increase watering time.

9:00 AM

Kathleen thinks she may have forgotten to turn on the slow cooker; checks over the Web and makes sure it is indeed on.

10:00 AM

Kathleen receives call from her son Bob's school saying school will close ahead of usual time, at 1 PM.

12:00 PM

Kathleen adjusts thermostat from work over the Web so that home is comfortable when Bob arrives.

12:30 PM

Kathleen calls Bob and asks him to go home and stay at home.

1:00 PM

Bob calls Kathleen from door front and Kathleen opens the door for Bob; deactivates alarm.

1:10 PM

Bob wants to watch a movie and calls Kathleen; Kathleen orders a movie from work over the Web for Bob to watch.

2:00 PM

Kathleen gets a warning that her pet dog is not in the house anymore; Kathleen calls Bob and confirms they are both out together.

3:00 PM

Example of Anything-to-Anything Immersive Communications Service

There are applications of M2M communications in a variety of domains, such as home automation and control, e-health, enterprise asset tracking and in enriching the entertainment experience. Consumers now have the ability to remotely monitor and control home devices and appliances conveniently, either from inside or outside the home via their cell phones or personal digital assistants (PDAs) and through personal computers or laptops with Internet access. The impact of these developments can perhaps be best illustrated by following a day in the life of Kathleen, a hypothetical working mother (Figure 1).

The underlying requirement for these services is M2M communications.

Numerous technological advances will also enable the rapidly aging populations of industrialized nations to stay at home safely, rather than be cared for in an institutionalized environment. Technology-enabled services range from virtual aides and assistants who can perform daily activities – like balancing checkbooks and helping with personal business correspondence – to medical-monitoring devices that can not only track key vital statistics, but also take action (such as administer an insulin shot) when conditions so warrant. The systems can detect anomalies in everyday activities of the elderly and inform family members or healthcare providers.

A growing number of enterprises are automating asset-tracking activities to streamline business processes and increase productivity. Consider a hospital environment where many high-value assets – such as wheelchairs, stretcher beds and IV pumps – are routinely misplaced. Technologies like RFID, which interact with base stations throughout the facility can take the guess work out of finding these assets and make it possible to provide more patients with better access to the resources they need while under the care of the facility. Asset location information can be integrated with dispatch applications to make it easier...
for doctors and nurses to find and use the equipment closest to where the service needs to be provided.

Alcatel-Lucent is currently engaged with the University of Pittsburgh Medical Center (UPMC) to develop intelligent software for asset tracking that incorporates data fusion from different localization technologies, sophisticated data mining and interfaces to a variety of hospital applications.

NFC technology in popular devices – such as mobile phones – is opening up a whole series of new applications. Consider these prototype applications developed by Alcatel-Lucent Bell Labs. Imagine Kathleen strolling in the city and noticing a Pop Band poster at the bus stop. Being a great Pop Band fan, she touches the poster with her NFC-enabled mobile phone to collect all the available information (concert dates, ticket prices, etc.).

Returning home, she touches the family TV set with her mobile phone, signaling to the communications network that she is home. Immediately, the TV’s user guide displays all the information Kathleen collected during the day: Kathleen clicks on the Pop Band icon and re-experiences all the related information. She can now select the appropriate concert date and buy tickets for two (Figure 2).

Later in the evening, Kathleen calls her best friend to give her the good news about the Pop Band concert. During the call, the real-time content inspection service detects that the conversation is about the pop star and immediately pushes related and relevant content from the Internet to Kathleen. This information will provide her sufficient context in order to spend more time with her friend. Even when the conversation deviates to her latest visit to the Louvre Museum, the service pushes all relevant information on the museum.

The Future $40 Billion M2M Market
Strategy Analytics estimates the worldwide M2M communications market will reach $40 Billion USD by 2011, with more than 500 million machines connected to each other generating communications traffic. The growth is expected to accelerate as the underlying technology infrastructure evolves from a fragmented, niche environment to a mature market that has mature standards.

For example, sensor communication in the home environment used to be a privilege of the rich. But with wireless standards such as Zigbee and Z-wave, numerous vendors of home automation products have emerged, resulting in more affordable solutions. Similarly, standards have been developed for asset-tracking RFID tags.


Telecommunications operators, mobile communications operators and cable service providers have an opportunity to grow their revenue by enabling new applications and M2M communications services. Saturation in voice-penetration and relatively stagnant or declining average revenue per user are driving operators to accelerate broadband data networks deployment and provide data communication-related application and services.

The always-on data networks being deployed can be leveraged to connect anything to anything at anytime from anywhere. Beyond providing transport of information, operators can augment service platform infrastructure with new service enablers that exploit machine-enabled information. Management infrastructure also can be augmented with remote management of networked devices such as sensor networks in the home-automation network. These added enablers will result in new, intuitive communication schemes that enrich the consumer’s experience, and that will increase the service provider’s average revenue per user and reduce customer churn.

With the introduction of these new applications, new stakeholders come into play in the communications value chain. For example, the introduction of intelligent electricity metering in the home introduces the electricity supplier into the value chain. The cross-media application introduces content provider and advertising agencies into the value chain. In fact, the multitude of stakeholders justifies the more appropriate term of “value network,” instead of value chain, to show the complex nature of interactions between these stakeholders.

The value network for telemetry applications is illustrated in Figure 3. In this new ecosystem, relationships between the various stakeholders need to be established in order to define, among other things, the roles of the partners, the interfaces between the parties, the business logic and the revenue streams.

Technology and Network Impact

The remote provisioning and management of the M2M network is an important technological enabler if service providers are to roll out these applications as part of their home services offering. Consumers cannot be burdened with the task of maintaining the home network, yet they must have some flexibility to add other devices/sensors to the network at their will. Consumers also have come to expect good quality for the services offered by their service providers. For issues with the home broadband service, the consumer is used to immediately calling the service provider to fix the problem remotely, for which remote monitoring capabilities have been built into the set of tools operators use to manage their services. When a home-sensor network service is offered, a similar set of tools that enables them to remotely manage the network will be required. In e-health applications, the need for high reliability and security will drive additional requirements, further enhancing the value that can be added by service providers. Additional features specific to sensor networking and its requirements need to be added to the existing set of management features. New data object models and name-value pairs for sensor network management will have to be defined.
Intelligent middleware makes application creation intuitive. Application servers should not be burdened with low-level complexities of the sensor network communication such as addressing, interference management, link data rates and routing. A layer of processing that abstracts the sensor network operation and presents a simple interface to the application to utilize the network is highly desirable.

Consider the home environment, for example. An application requirement may be to turn off all lights in the house. With intelligent middleware, a single command from the application server will trigger the middleware to send messages to each of the light switch sensors in the house. Using this approach, the addresses, types or locations of light switches are hidden from the application. Intelligent middleware also can be designed to perform sophisticated data correlation to determine the context and forward data to appropriate application servers. This enables sensor-sharing and results in cost-savings.

**Immersive Business Models**

Anytime, anywhere machine-to-machine communications will result in the entry of new players into the traditional value network. Telecommunication operators will need to take on new roles and relationships if they want to bank on additional revenue streams for these applications.

The first challenge is to define the innovative business model. Innovation, which has been largely driven from a technology perspective in the past, will need to be complemented with substantial efforts by all stakeholders into business model innovation.

For example, billing system technology should take into account the need for complex revenue-sharing models and possibly collect usage information on finer spatial and time scales. There likely will be a shift away from subscription-based models toward targeted advertisement-based models where services are paid for by a combination of end-user fees and advertising sponsorships. Another feature to expect is that business models will become region-specific because of varied user perceptions and regulatory differences.

The second challenge is the go-to-market strategy, which requires a carefully orchestrated introduction of these new roles to the target audience. In general, two basic approaches are possible. The first is a vertically integrated strategy (Apple’s iTunes approach). Market and consumer pressures will force this initially closed approach to open up to other players. An alternative approach is to build a consortium comprised of stakeholders who have sufficient clout together to negotiate and position the innovative business model into the market.

Business model evolution has already started with the introduction of IPTV applications in the telecommunication operator space where operators are engaged in a new relationship with content providers. Further efforts need to be undertaken in different spaces to build the relationships and develop business models that optimize investments in immersive M2M technologies.

**Conclusion**

Intelligent devices combined with machine-to-machine communications offer the potential to enrich end-user experiences. Alcatel-Lucent has developed and continues to develop technology enablers for such applications and services. But bringing such services to fruition requires a concerted effort by the industry as a whole. Communications service providers, being end-to-end solution providers for traditional services, are well-positioned to bring together the different players and have the opportunity to capitalize on the “first mover advantage.” The keys to success will be a focus on the value created for the end users, new business models and an ecosystem where all participants can be successful. Taking these steps now will enable a competitive advantage in this important market.

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Mapping the Wireless Technology Migration Path: The Evolution to 4G Systems

By J.-P. Rissen

Wireless service providers around the world are at a business and technological tipping point. Having made investments in legacy technologies that were designed primarily to support voice traffic they now need to cope with new standards, protocols and business imperatives. In so doing, existing business models and technology platforms will be rendered moot. Consider this:

- While the International Telecommunication Union (ITU)-R M.2072 expects voice traffic to account for the lion’s share of volume through 2015, a shift is already underway for revenue to be driven by rich multimedia entertainment services like video messaging or all forms of mobile commerce.

- This shift will place a premium on technologies that maximize bandwidth and throughput while maximizing spectral efficiency,

- Fourth Generation (4G) wireless architectures are rapidly maturing to address these requirements while leveraging the capabilities of Third Generation (3G) technologies, taking advantage of the features associated with an all-IP network system.

As a result of these trends, service providers are scrambling to assess, purchase and deploy new wireless service delivery technologies that will address emerging demand, while maximizing the revenue generated from traditional sources. Those organizations that most effectively manage the transition from Second Generation (2G), 3G and ultimately 4G infrastructures will be best positioned to grow through the rest of the decade and into the next. To that end, this article puts these overlapping wireless standards (2G, 3G and 4G) into a context that will explain the evolution of the wireless technology infrastructure and provide a basis for optimizing a company’s investment in next generation systems and business models.
Public wireless communications have evolved considerably since the emergence of 2G digital wireless cellular technologies in the early ’90s. In their earliest incarnation, Groupe Spécial Mobile (GSM) and its North American counterpart Code division multiple access cdmaOne™, primarily were designed for voice services (although they did support some limited data capabilities such as Short Message Service [SMS] and low-speed circuit-switched data).

By the late ’90s, 3G cellular systems emerged, driven by the need for a universal and interoperable technology with greater user performances. While 3G technologies offered an improvement on both fronts, incompatibility between different systems remained. From 2003 to 2006, early 3G technologies like Universal Mobile Telecommunications System (UMTS) and cdma2000® offered two key improvements over 2G:

- Simultaneous use of circuit services (like voice and video calls) and packet services (like web browsing or instant messaging)
- Higher speeds (up to 384 kb/s for data in UMTS Release 99 and a peak value of 2.4 Mb/s for the initial release of cdma2000® Evolution Data Optimized (EV-DO)

Later, these early 3G systems were enhanced with the introduction of faster uplink and downlink packet access channels such as High-Speed Packet Access (HSPA) for UMTS and EV-DO Revision A for cdma2000®. These technologies, which began to be deployed in the 2005-06 timeframe, improved both the user experience and spectral efficiency for both uplink and downlink transmission. Fast and adaptive radio interface packet transmission schemes and advanced re-transmission techniques such as Hybrid Automatic Repeat Request (HARQ) made these benefits possible.

The All-IP Migration

Examining fixed network evolution over time always has been a good way to predict the major changes in the wireless system. This is particularly true when considering the ever-increasing transmission speeds (from modem-based dial-up connections to high-speed Asymmetric Digital Subscriber Line [ADSL] and service offerings from circuit-switched to Internet Protocol [IP] packet-based architectures).

Clearly, wireless technologies had to be prepared for the migration toward all-IP service platforms. That is why work on developing an IP Multimedia Subsystems (IMS) standard was initiated in 2002, during the same timeframe as High Speed Packet Access (HSPA) radio access evolution. IMS provides an interoperable IP-based framework for supporting multimedia services on a single network topology.

Similarly, Evolved Packet System (EPS), also known as a combination of Long-Term Evolution (LTE) and System Architecture Evolution (SAE) is being defined as a major UMTS evolution, proposing an all-IP integrated architecture for both the Access Network and Core Network. A similar evolution is now under development for CDMA markets with the introduction of Ultra Mobile Broadband (UMB), also known as Evolution Data Optimized (EV-DO) Revision C. During this same time period, a third major mobile access technology, Worldwide Interoperability for Microwave Access (WiMAX), was introduced, initially using the Institute of Electrical and Electronics Engineers (IEEE) 802.16e standard. WiMAX, LTE and UMB are all based on Orthogonal Frequency Division Multiplex (OFDM) radio access technologies and all have adopted an IP-based network architecture.

Toward 4G Systems

Now the industry is looking ahead to 4G systems that aim to expand the capabilities of 3G systems to meet increased demand in terms of user bit rate and capacity (which translates into spectral efficiency).

Like the 3G/International Mobile Telecommunications (IMT)-2000 evolution (Figure 1), the framework for 4G systems will be ruled by the Radiocommunication group of the ITU-R under the name of IMT-Advanced. IMT-Advanced roadmap aims to finalize the requirements for candidate 4G radio access technologies by the end of January 2008 and make available the radio interface specification for the new systems by mid-2010. Completion of these steps would allow full commercial availability in 2015.

Analyzing 4G from the Technical Perspective

As of Nov. 1, 2007, the technical requirements of 4G had not yet been finalized, but industry insiders anticipate that 4G Radio Access Technologies will be able to deliver 1 GB/s over a 100 MHz channel, which corresponds to a peak spectral efficiency of 10 bit/s/Hz. The average 4G spectral efficiency will be around 5 bit/s/Hz, which represents approximately three times the performance of EPS networks.
From an architectural perspective, 4G is in line with the latest 3G EPS and UMB evolutions, as seen as an all-IP system. So it’s likely that the latest 3G evolutions (like EPS and UMB) and 4G will have more in common than were seen between early 3G systems and EPS.

4G systems will support built-in “always-on” support, as the traditional “dial-in” model doesn’t comply with the new set of services like “Presence,” “Instant Messaging” and all other real-time information or interactive services. This is a key enabler of “anytime/anywhere” user experience currently supported by technologies like Wi-Fi. In addition, 4G also promises to improve resource efficiency and enhance the user experience.

Systems based on 4G will support the full range of features that public 3G cellular systems already provide including:

- Optimized link adaptation and power control to allow increased user rates and efficient radio resource usage
- Configurable time or frequency duplex modes to better accommodate asymmetric services
- Seamless service provision in case of intra- and inter-system mobility
- Security protection for user data, control signalling and subscriber information.

In the future, special care has to be given to the radio frame structure definition, which is needed to enable different systems to coexist and to minimize handover time interruption when moving between disparate systems.

**What Will be the 4G Standard?**

As in IMT-2000, 4G/IMT-Advanced will not be subject to a single Radio Access Technology, but rather a family of technologies. Late in 2006, IEEE launched 802.16m, which is a candidate for IMT-Advanced services. Specifically, 802.16m will be the 4G version of the Wireless Ethernet standard and will be backward-compatible with existing 802.16e and WiMax, the IEEE standard for broadband mobile operation in licensed frequency bands.

In early 1999, the Third Generation Partnership Project (3GPP) and 3GPP2 groups were created to specify a candidate standard for 3G/IMT-2000. The mandates of these two consortia will be extended to encompass future 4G standard specifications.

In mid-2007, the 3GPP2 consortium began work on the definition of a candidate for the IMT-Advanced family, which eventually should replace the current UMB standard. The 3GPP consortium also started an IMT-Advanced activity at the end of 2007 and most likely will submit an evolved version of EPS/LTE as its 4G candidate.

**How these Developments will Affect Migration to all-IP Networks**

This is a major challenge for operators engaged in a comprehensive migration to an all-IP network. This change deeply impacts the Core Network and service...
Beyond the complexity of network migration, it’s also critical to ensure a smooth transition of the subscriber base from the existing circuit-based architecture toward the new all-IP networks. There are three key points to consider:

• **The need to maintain the Quality of Experience**, not only in terms of voice or video quality but also in terms of call set-up time and network response time. Existing circuit-based systems have been optimized since the early ’90s and subscribers will not tolerate a noticeable degradation of such performance indicators.

• **The need to maintain service continuity when moving between systems**. cdma2000® EV-DO already provides a solution to ensure voice call seamless continuity between circuit-based and packet-based systems. A similar solution recently has been standardized to ensure seamless service continuity in UMTS systems between Circuit Switched and IMS domains.

• **The need to maintain network capacity** – or make sure that full wireless Voice over Internet Protocol (VoIP) does not translate into radio resource inefficiency. Circuit voice over the radio interface was initially designed in a much optimized way, based on efficient channel protection (known as UEP for Unequal Error Protection) and later extended using Adaptive MultiRate (AMR) speech codecs. In the IP domain, thanks to Robust Header Compression (RoHC) scheme, adaptive channel coding and the gains in terms of statistical multiplexing provided by the use of high-speed shared radio channels, VoIP is able to reach the same, if not better, level of performance over the radio interface.

In some operational networks, the first step in all-IP migration is performed at the transport level, long before the migration at the service level. This is made possible in GSM and UMTS networks thanks to the 3GPP-Release 4, which opens the possibility to dissociate the communication call control (which still relies on classical circuit-switched protocols) from the transport level. Similarly the UMTS Terrestrial Radio Access Network-Internet Protocol (UTRAN-IP) evolution allows supporting any of the circuit or packet-based services over an IP-based access network.

**What about 4G Technology Disruptions?**

There are a number of technology enablers that add value to 4G network corresponding to Alcatel-Lucent research areas and domains of expertise:

- **Collaborative MIMO**
  Inter-cell interference is very often a limiting factor to cellular wireless system capacity. The Collaborative Multi Input Multi Output (Co-MIMO) technique relies on non-coherent signal combining, which dramatically reduces inter-cell interference. As opposed to conventional MIMO (where a terminal is served by one unique Base Station), a terminal in Co-MIMO conditions is served by multiple base stations.

- **Network MIMO**
  Network-MIMO is a coherent interference coordination which allows suppressing inter-cell interference by coordinating transmission and reception of users’ signals at many base stations. This method relies on coherent transmit- and receive-beamforming across different base stations.

  It mandates high-bandwidth, low-latency backhaul network and highly synchronized bases to be able to share channel knowledge information among coordinated base stations.

  Network MIMO performance is higher than Conventional MIMO and Collaborative MIMO, at the expense of higher performance backhaul and increased complexity. Figure 2 describes the gain of Network MIMO against conventional MIMO techniques.
Multi-User MIMO
This technique aims to improve the overall system throughput by simultaneously serving multiple users during a frame on multiple spatial channels. These channels are formed using knowledge of the users' channels at the base station transmitter and by applying a different set of coherent weights across the antennas for each user's data stream. This technique is known as beamforming or precoding. It is performed in such a way to minimize interference between beams.

Software Defined Radio
Software Defined Radio (SDR) is a technology which enables multi-standard/multiband base stations. In an SDR product, a significant amount of the processing is performed by software libraries over a hardware platform which can serve as a common basis to many kinds of wireless standards. The obvious benefit of SDR is in the reduction of the number of dedicated developments for different standards and frequency bands, as such evolutions can be supported by software upgrade and at much lower cost.

Self-Organized Radio Networks
Mobile network deployment and operation are still cost-intensive, especially at installation, network optimization and day-to-day network operation and failure handling. All these operations require manual interaction and a high level of technical expertise.
Future systems have to provide innovative means for reduction of operational cost and ease overall system operation. Basically, this can be achieved through the three following axis:

- Self-configuration of the newly added site
- Self-optimization for radio parameters and neighboring list configuration
- Self-adaptation to network load variation (e.g., a sports event or unpredictable condition)

**Wireless Relay and Mesh Networking**

The emerging wireless relay and mesh networking aims to provide improved capacity and network reliability. Relaying helps extend coverage in areas suffering from excessive path loss while mesh networking architectures based on interconnected wireless base stations help provide data path redundancy. Those two techniques can facilitate the deployment of 4G network in a cost-effective way.

**Femto and Small Cell Coverage**

Femto and small cell solutions – like the Alcatel-Lucent Base Station Router (BSR) – offer connectivity and access to legacy Core Network domains over a 3G radio and fixed Internet line (ADSL/Ethernet) to subscribers equipped with legacy 3G terminals. This architecture is a key element to providing increased end-user experience; knowing that 70 percent of calls are made indoors, but only two percent of buildings have purpose-built indoor coverage.

Besides, such a solution will extend cellular network capacity and provide wireless service providers with new revenue opportunities.

The Evolution of Global Wireless Traffic

The evolution of the volume and characteristics of global wireless traffic is driven by four factors:

- **Mass evolution** – the growing use of electronic devices such as cameras, personal digital assistants, etc. is increasing the number of people who download, exchange or share data;
- **Virtual evolution** – more and more user-related content is digitized;
- **Socialization** – people are becoming more comfortable with one-to many or many-to-many (peer-to-peer) forms of communications;
- **Personalization** – the development of a user-centric vision induces various new types of multimedia services with new end-user behaviors.

It’s hard to predict to what extent these drivers will influence wireless traffic. Still, by using world population forecasts, as well as service penetration and usage models, it is possible to make estimates (Figure 3). The ITU-R M.2072 report projects that traffic growth will be linear from 2007 to 2020, with voice traffic still dominant through 2015. But, the development of rich multimedia entertainment services like video messaging or all forms of mobile commerce will shift that trend toward more multimedia communications.

The next figure (Figure 4) shows the total wireless cellular spectrum demand, resulting from the traffic forecast described above. This estimation takes into account the evolution in spectral

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**Figure 4: Spectrum requirements estimation**

- **Red line**: Spectrum currently identified for cellular use in Europe
- **Green triangle**: FMS “Smooth Development”
- **Pink square**: FMS “Constant Change”
- **Blue diamond**: Magic Mobile Future
- **Orange circle**: FMS “Economic Stagnation”

Source: Report No. 40 from UMTS Forum
efficiency brought by 3G, evolved 3G and future 4G/IMT-Advanced technologies, as well as the fact that different generations of technology will co-exist on operated networks.

**Conclusion**

Improved spectral efficiency is a key aspect of future wireless technologies. Even more than the constant technological race toward increased bit rate, spectral efficiency will be essential to the wireless ecosystem if it is to cope with the future new forms of communication, behaviors and business models that are emerging for the next decade.

From that perspective, the evolution from 3G toward 4G/IMT-Advanced should be pursued in a sensible and phased manner, while providing enough backward compatibility to secure and maximize investments in existing operator assets.

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Eco-Sustainability Initiatives Yield Business Benefits for Service Providers

By A. Kowalik, D. Fisher

Public advocacy toward ecologically-friendly technologies, business practices and personal life styles is compelling many in the telecommunications industry to examine their own environmental footprint, eco-friendly services and overall business strategies. Advances in new technologies and the emergence of new business practices create an opportunity to expand services within emerging and developed economies, while mitigating disruption to the environment and reducing the amount of energy consumed by service providers, businesses and consumers. In other words, “eco-sustainability” can, in fact, deliver profitability.

As you consider where to go “green”, consider the following key drivers behind this trend:

▷ More Efficient Infrastructure Technologies. A new generation of infrastructure-grade technologies – including wireless base stations, central office switches, information storage facilities and data processing centers – are much more efficient. They can handle a higher volume of traffic while occupying a smaller physical footprint. In the process, they consume significantly less energy. Alcatel Lucent’s new GSM BTS Transmitting Module Twin TRX, for instance, reduces power consumption by more than 30%, while reducing the number of cell sites needed to serve an area by up to 50%.

▷ Converging and Consolidating Infrastructures. Service providers are moving away from networks dedicated to voice- or data-only traffic. New IP-based networks can handle multimedia transmissions over a single, more efficient infrastructure. This reduces the infrastructure footprint required to serve growing populations with a greater array of services. By moving all traffic to a broadband IP platform, service providers reduce the environmental impact of enabling technology while expanding top- and bottom-line growth. A recent report from the American Consumer Institute projects that the world will save roughly 1 billion tons of carbon in the next ten years as people perform more tasks over a broadband Internet infrastructure.

▷ Alternative Energy Strategies. Many service providers are taking a hard look at non-traditional sources of power. Advances in solar cell technologies, for instance, make it feasible to power microwave and cellular towers without tapping into the traditional power grid. Similarly, central office switch facilities are looking at renewable energy sources, including windmill technology, to supplement power. Fresh air cooling technology, for instance, used in Alcatel-Lucent CDMA Base stations reduces energy consumption and noise while increasing reliability. And Alcatel-Lucent’s base stations incorporate a solar panel system including photovoltaic modules, control cabinet and battery bank.

▷ Global Expansion of Wireless Infrastructure. Because fewer trenches need to be dug, or overhead wires slung, wireless infrastructure technology is less disruptive to urban, rural and undeveloped landscapes than wired technologies. The trend toward radio network access sharing (RAN sharing), fixed mobile convergence (FMC) and the ability of the wireless infrastructure (including satellite technology) to deliver multi-media broadband services allows telecom operators to roll out new services and add more customers without a commensurate impact on the local landscape. For example, in 2007
Vodafone and Orange agreed to share their 3G RANs in the UK, reducing the number of communications towers while increasing the ability to serve new customers with new services (such as mobile TV offerings).

**More Efficient End-User Technologies.** Consumer devices themselves are becoming more robust, efficient and innovative. New phones, PDAs and other network-enabled consumer technologies use less energy, and in some cases, are powered by solar cells. As an example, Japan’s DoCoMo has rolled out a solar-powered cell phone.

**Eco-friendly Services Appeal.** The use of teleconferencing, telecommuting solutions, managed and hosted services, and web-enabled real time customer service, have captured the attention of a growing number of buyers. For example, consumer research from the Envisioneering Group shows that between 7 and 11% of Americans consider themselves to be “green.” And a growing number of purchases are flowing to organizations that have reputations of being environmentally friendly.

Each of these trends stands alone to contribute to a greener and more profitable telecom industry. But, because these capabilities are consciously applied, managed and integrated by service providers and enterprises, the opportunity to produce increased returns at lower cost with a more positive impact to the environment can result in significant efficiencies as well as brand-management gains. We invite you to engage with us to learn more about how Eco-Sustainability initiatives can contribute real business benefits.

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The Dynamics of India

From Western countries to Southeast Asia, the diversity of telecom markets presents extraordinary challenges to companies striving to address a range of needs, from the basic communication needs of people in emerging areas to advanced services in the world's wealthiest economies.

India, in particular, is a rapidly transforming market rich in opportunities and developments within telecom services and technologies. Alcatel-Lucent plays a major role there as an important partner of major Indian service providers BSNL, MTNL, Reliance, Bharti and TATA, and through its local expertise in R&D, customer support, services and operations.

For this edition of Enriching Communications, our Editor-in-Chief, Alcatel-Lucent's CMO John Giere, sat down with Frederic Rose, President of our Europe, Asia & Africa region to explore Rose's unique perspective on the impact communications can have on countries that are in various stages of economic development.
John Giere: First of all, Frederic, thanks for taking the time to talk with us today. The market in India is quite diverse. What do you see as the major communications market trends?

Frederic Rose: Well, thank you John, it is my pleasure. In answer to your question, the Indian market has been experiencing a telecom revolution, driven by socio-economic and political changes after the neo-liberalization. Global players entered, competition grew fierce and end users became increasingly demanding. The last year has seen a month-on-month increase of more than six million telecom subscribers. The mobile subscriber base grows at a rate of more than 80%. The metropolitan cities such as Chennai and Delhi witnessed almost saturated tele-density rates.

The tremendous rise in purchase-power of individuals and urban families coupled with developments in segments such as hospitality, transportation, health and defense have created huge opportunities to build telecom infrastructure. Demand for broadband technologies like gigabit passive optical network (GPON) and the demands of enterprises are driving a rising demand for IP transformation and innovative telecom services.

Coverage and tele-penetration are also key trends of the Indian telecom market. This makes broadband, especially wireless broadband, a key differentiator in the government’s growth plans for the country. Although Global System for Mobile communications (GSM) and code division multiple access (CDMA) have a long way to go in terms of providing connectivity to underserved areas, a focus on e-education, e-health and e-Government currently demands broadband access and connectivity.

Adding to market competitiveness, India boasts minimum call charges and the cheapest handsets. Service providers compete on very low average revenue per user with furious cost competitiveness.

JG: Who would you say are the major Indian service providers today?

FR: If we talk about the major Indian service providers in wireline and wireless today, we can start with the two public giants – BSNL and MTNL. Together they have about 27% of the market. Coming down to the private operators, Bharti enjoys a 20% market share. Reliance and Vodafone-Essar with around 15% each. Almost all the operators are turning focus on next generation technologies such as third generation (3G)/Evolution-Data Optimized, Worldwide Interoperability for Microwave Access (WiMAX), IPTV, Mobile TV, GPON, DSL, Fiber to the x (FTTX), IP Multimedia Subsystem (IMS) or Next Generation Network (NGN). In addition to these players, the mobile GSM market is opening up for some new licensees and together they are expected to add over 100 million mobile subs per annum for the next three years.

JG: With India being a key growth market, how competitively are we positioned in the country?

FR: Alcatel-Lucent has established itself as a key player in the Indian market. We are being looked upon as leaders in many areas. In the fastest growing wireless space, particularly in CDMA, we enjoy more than an 80% market share. We also supply 75% of submarine telecommunications equipment, 60% of transmission equipment and over 50% of the fixed lines business. We have recently entered the GSM space, and already have close to a 15% share. We are also a significant player in the industry & public sector and the enterprise communications area.

JG: Innovation and R&D play a major role in the Indian development. How do you see it influencing Indian telecom market trends? How does Alcatel-Lucent contribute to it?

FR: A prime strength in India has been the evolution of research, technology and innovation activities. Developments in technology and intellectual property being generated in the country add to the fuel that the region needs to grow further and faster. India’s skilled and competent manpower has rendered the country a key contributor to our innovation capability. Alcatel-Lucent has been one of the first global telecom multi-national companies to start R&D in India. We have therefore been a firm supporter of the growing market needs in the region.

Alcatel-Lucent R&D centers in India play a pivotal role in enabling worldwide product development, including testing and maintenance of future solutions and services targeting wireless, wireline and enterprise business segments.
Two particularly rich examples of this are Bell Labs and the C-DOT Alcatel Research Center. Bell Labs Research India was launched in October 2004 and is located in Bangalore, India’s silicon city. It has already started contributing to Alcatel-Lucent’s solution development like the Laptop Guardian, which is making big differences in enterprise security needs. The C-DOT Alcatel Research Center – a joint venture between Alcatel-Lucent and the government of India’s Center for Development of Telematics – is a center for the development of WiMAX Rev-e technology. It focuses on broadband wireless access for rural, urban and suburban regions with many applications. The center has also been involved in many trials in the region, successfully demonstrating applications such as video streaming, high-speed file downloads, Voice over Internet Protocol and web browsing.

JG: What’s your view of Alcatel-Lucent’s future in India?
FR: Bright! Alcatel-Lucent is driving the most dynamic segments, with growth in new technology areas like WiMAX, GPON and IN services. We have partnered with major service providers. We have also developed powerful positions in the non-carrier space — in particular with the government through our public partnerships. All of these factors fuel a great deal of potential. However, with great glory comes great responsibility. We will continue to concentrate our efforts in service offerings and raise delivery and quality industry standards to enhance customer satisfaction.
Dear Customers,

From boomer-generation office workers to multi-tasking Millennials, from Apple’s iTunes™ to Google’s YouTube™ to mobile TV, and all the possibilities in between – our world and the applications we use at work, at home and at play are on the move. Today the mobility industry is a dynamic and growing market. We see growth from first-time users, such as in India where more than six million people a month sign up for mobile service, to the sophisticated multimedia sessions happening in Korea where savvy consumers are enjoying multi-user mobile gaming and video calling. As SK Telecom’s Dr. Jay Ihm noted in his article, the introduction of these types of services marks an important transition for his company as it moves from a voice-based business model to one contingent on monetizing data services. We are only beginning to capitalize on the versatility and potential of these ever-advancing technologies and business models.

Consumers and enterprises are using mobile services differently from the way they did just a few years ago, and the underlying technology is evolving rapidly, which inevitably means change is coming to how we all operate in this new mobile market. To be successful, all along the value chain we will need to transform ourselves to embrace new business models that can capitalize on these market dynamics and adopt operational processes that improve both top line and bottom line results.

This edition of Enriching Communications frames and explores this mobile transformation from a 360-degree view, looking at it from the perspective of users, market strategies, technologies and business models. We hope it offers you insights into our industry that will be helpful to your company.

Alcatel-Lucent is proud of our technological leadership, market understanding, world-class global employee skill base as well as the robust eco-system that we create and maintain to support our customers to be the winners in this mobile transformation. You, our customers, are at the center of our eco-system, and we are grateful for you, who inspire, drive and guide us in our mutual goal to make the exciting future communication possibilities a reality for the 6.4 billion people of the world.

We enjoy bringing you Enriching Communications and appreciate the numerous comments, ideas and thought-provoking feedback we receive from many of our 80,000 readers. Thank you, and please keep them coming.

So till we meet again Anywhere, Anytime…enjoy!

Sincerely,

John Giere
CMO, Alcatel-Lucent
You want to transform your business.

She just wants to transform her score.

Communication is Everywhere and Anytime.

SK Telecom Adopts HSPA to Strengthen Mobile Data Strategy

Realizing the Converged Broadband Service Provider

Mobile TV Projected to Take Off… Are Service Providers Ready?