Innovating Innovation

Innovating innovation is about channeling the talents of some of the smartest people in the world to be the foundation that enables an organization to be fast and best in the markets in which it competes.
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Innovating Innovation
Foreword by Peter Bernstein, Senior Editor, TMCnet

A culture committed to meeting challenges and driving change – the key ingredients

The culture of “Innovating Innovation” has two key components.

A critical mass of diverse scientists and engineers
It goes without saying that you have to assemble the right people in the proper environment, with the best tools and proper guidance and allow them to not just work alone but to enrich their work through the free-flowing of ideas and collaboration with each other. However, they also need to be aggressively challenged, open to input from others and dedicated to accommodating change on the path to creating and executing optimal solutions.

History has shown that just gathering the best and brightest is not enough. Compelling results and true breakthroughs come from taking the generation of big ideas and working through those ideas from multiple angles. This requires doing so in a systematic and disciplined manner, making sure the right and best resources are in the right hands at the right time. It is a bit of a misnomer to think that innovation is solely about inspiration and perspiration. It is also is about the right mix of collegiality, direction/leadership and execution.

Infusion and adoption of an entrepreneurial persona
The history of scientific discovery, and at a macro level creating and driving paradigm shifts, starts with insatiable curiosity:
- Better understanding of the things you know that you know
- Exploring the boundaries of the things you know you do not know
- Absorbing the impact of the things you did not know you did not know when exposed to them

This curiosity and the discovery of new facts are then coupled with the ability to employ them to imagine how to create something totally new (sometimes previously implausible) or to radically improve something that currently exists. Those are the raw ingredients of innovation.

The trick is to infuse a passion for turning knowledge into products and services, and embedding that passion into the communal DNA, i.e., create an entrepreneurial persona. This persona is what enables research assets to be rapidly driven into the business and delivered into the market.

In short, “Innovating Innovations” is not just about people. It is about channeling the talents of some of the smartest people in the world to be the foundation that enables Alcatel-Lucent to be fast and best in the markets in which it competes.
Innovating Innovation

Bell Labs: The Alcatel-Lucent Innovation Engine
By Peter Bernstein, Senior Editor, TMCnet

Let’s start with the basics.
The term innovation comes from the Latin innovatus, the noun form of innovare “to renew or change.” It refers to the creation of better and/or more effective products, processes, technologies or ideas that impact markets, governments and society as a whole. Today it also connotes an unleashing of ingenuity that results in substantive not incremental positive change — a single word that packs a powerful punch.

In a business context, innovation also represents both current value (in the form of libraries of intellectual property), and the ability to generate incalculable future value. And, if innovation were viewed as a generic brand category, its leading sub-brand would be Alcatel-Lucent’s Bell Labs. It is internationally recognized as one of the world’s preeminent industrial and applied research facilities, almost without peer in terms of its impact on modern society.

Consider the following. Alcatel-Lucent Bell Labs has been for 80 years, and remains, the leading source of new communications and information technologies globally:

- It has generated more than 33,000 patents since 1925
- Bell Labs and its researchers count among awards: seven Nobel prizes, nine U.S. Medals of Science, seven U.S. Medals of Technology, two Draper prizes, eight Marconi Awards, an Emmy, a GRAMMY, and an Academy Award
- It has played a pivotal role in inventing or perfecting (to mention a few things): the transistors, digital networking and signal processing, lasers, fiber optics and fiber-based communications systems, communications satellites, cellular telephony, WiFi, C++, and Unix

In short, it has invented, reimagined and enriched much of the modern communications and information technology we take for granted. It remains fully engaged and funded today to envisage and create the future.

As the headline on the Bell Labs landing page states:

Innovation at Alcatel-Lucent is where vision and technology meet our customers’ needs.

Alcatel-Lucent CEO Ben Verwaayen in various forums has highlighted the importance of innovation to the company. He has done so in the context of the care and feeding of this vital international resource. He cites three things as important:

1. Keep your eye on the customer to ensure that your product is relevant
2. Move with speed so the competition doesn’t beat you to market
3. Have a business model that enables you to achieve your business goals

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Bell Labs: The Alcatel-Lucent Innovation Engine

Bell Labs is in the business of innovation that drives results, doing well by doing good. The objective is to dream the impossible, push the envelope of the implausible and translate it into the practical and doable – turn curiosity into learning, learning into knowledge and knowledge into solutions.

The Labs is pushing the envelope at research centers around the world in the following areas:

- Convergence, software and computer science
- Enabling physical technologies
- Government research – Bell Labs is engineering, deploying, monitoring and maintaining complex communications networks for the government worldwide.
- Mathematical and algorithmic sciences
- Networking and network management – Bell Labs is researching the underlying technologies for next-generation global information infrastructure, focusing in areas such as protocols, routers, control, signaling, software and hardware, for both wireless and wireline networks, network management, and networking platforms.
- Network planning, performance and economic analysis
- Optical transport networks – Bell Labs is continually innovating for optical transport networks in areas such as creating experimental test beds and demonstrating the viability of flexible, low cost, high-capacity optical networks for the future.
- Security solutions
- Wireless and broadband access networks

Important work is also being done in behavioral science, heuristics and ergonomics.

There is almost unanimous agreement that we are at a pivotal point in terms of the acceleration of innovation that will flow from fulfillment of the convergence of continuous, ubiquitous networking with pervasive computing.
lightRadio™ Network: A New Wireless Experience
By Rasika Abeysinghe, PhD, Alcatel-Lucent

The rising demand for mobile broadband services is straining legacy wireless networks. Operators face increasing pressure to deliver the rich quality of experience (QoE) their customers and partners expect. To meet these expectations and remain competitive, they need cost-effective and sustainable network architectures that can deliver increased connectivity and capacity on demand.

QoE: The new currency in the mobile value chain
As the focus of mobile wireless communications shifts from voice to data, users attach greater importance to QoE. Today’s users expect fast wireless networks, comprehensive coverage and uninterrupted connectivity. There’s no room for delays, dropped connections or peak-time congestion in their vision of mobile broadband.

Users clearly value QoE, but application and content providers (ACPs) depend on it. Whether ACPs offer TV streams, interactive apps or video conferencing services, QoE plays a central role in their success. They have a vested interest in ensuring that users enjoy the best possible experience. For this, ACPs rely on mobile operators and their networks.

To move up the mobile value chain and attract partnerships with ACPs, operators have to deliver on QoE. Operators can control QoE, for example, by managing bit rates or by making it easy for users to switch between 2G/3G/LTE networks and Wi-Fi hotspots. But they need to control it more efficiently to prove their value as partners and providers and position themselves as the ideal channel for delivering value-added applications and content.

The QoE and capacity challenge
Legacy macro networks were built to support voice services, a task they perform extremely well. But the demand for mobile broadband data services adds new and more complex challenges to wireless networks. Operators who retrofit voice networks for data face a host of new challenges.

For example, operators don’t always have spectrum for mobile broadband services. This makes it tough to meet demand for data. Increasing indoor wireless use also presents problems. Outdoor macro towers can’t always deliver sufficient data rates, coverage and capacity to users in homes and offices.

Today, operators are constantly trying to squeeze more capacity out of legacy networks. One common strategy is cell splitting — adding cells, towers and sites. This can be complex and expensive, and zoning rules can even make it impossible in some areas. Operators that don’t evolve their networks — or don’t evolve fast enough — may be left behind by customers and competitors who embrace next-generation equipment.
lightRadio™ Network: A New Wireless Experience

Building wireless networks for an unpredictable future
Mobile operators want wireless networks that can help them tackle the challenges of today and tomorrow. These challenges include:

- Adding capacity where users want and need it
- Ensuring that customer QoE is met
- Building a cost-effective foundation for addressing future demand
- Delivering eco-sustainable solutions

Smartphone penetration and mobile data traffic are increasing rapidly.¹ According to Vision Mobile, in the 3rd quarter of 2011 smartphone shipments penetration surpassed 29% globally.¹ People still use their phones mostly for voice – on a time basis. However, they consume more data with apps including video streaming, music, web browsing and social networking from their homes, offices and in the community. They connect to hotspots in high-traffic areas like stadiums, public squares and hotels. Operators have to provide more capacity in more locations to ensure that QoE follows users wherever they go.

While no one can say for certain what capacity needs will be in 5 years, we do have reasonably good models for the next 6 months to a year. However, if a new type of device like the Apple iPhone® or iPad® arrives on the market it could cause a major disruption. What we know right now is that new wireless devices – smartphones, tablets, gaming consoles, in-car devices – will fuel demand by supporting smarter applications and richer content. Wireless networks will need to be flexible enough to handle whatever demand the future brings. And they’ll need to do it while keeping costs low.

It’s not all about delivering more capacity and richer experiences. Operators need to consider the environment, too. The next generation of wireless network architectures must have a smaller carbon footprint. This means consuming less power. It also means deploying elements that use less space and blend in with what’s around them. No one wants to see more towers and more bulky equipment.

The lightRadio™ Network advantage
Alcatel-Lucent has introduced the lightRadio Network to empower operators to deliver on their present and future challenges. It seamlessly increases capacity and extends it to more places, helping operators satisfy users and generate new revenue. It reduces power consumption and footprint, enabling operators to promote sustainability and bottom-line growth. And it provides an effective foundation for supporting future demand, helping operators manage capacity and cost.

For users, it all comes down to QoE. With the lightRadio Network, users get higher throughputs to support the rich experiences they crave. In contrast to traditional wireless networks, this support is continuous: Whether indoors, outdoors or on the move, users switch seamlessly to the best possible network. There’s no need to pause a video or interrupt an application to select a hotspot or enter a password.

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lightRadio™ Network: A New Wireless Experience

A closer look

The lightRadio Network is inherently heterogeneous bringing together a broad range of technologies and different types of access nodes. At the same time, the architecture is homogenous: Its components share the same platforms, control and management. These components can include:

- Small cells, which extend coverage indoors and in hotspots. Small cells perform efficiently in residences and businesses. They work best when deployed close to users, for example, on lampposts or walls in train stations or shopping centers. In a given network, operators can deliver up to 10 times more throughput by deploying a 1:10 ratio of macro to small cells.³
- lightRadio wideband active antenna arrays (WB-AAA), popularly known as cubes, that use advanced interference management algorithms to create overlapping zones of high signal strength. Known as vertical sectorization, this increases capacity and coverage for a given area. These comparatively low-power elements make more efficient use of spectrum. When deployed in a macro environment, they can improve capacity by up to 70%. This improved capacity can help operators attract users and generate more revenue.⁴
- Wi-Fi hotspots that allow operators to offer additional options for access to high bandwidth data users. This has the dual benefit of keeping the end user satisfied and allowing the operator to take some traffic off costly cellular spectrum. The lightRadio architecture uses a common core network to support Wi-Fi and cellular access. Users can seamlessly switch between the two without having to enter a new password.

All of these components support sharing and virtualization, which help operators deliver more flexible capacity and control. For example, operators can connect lightRadio cubes to external baseband units (BBUs) to serve hotspots that require massive capacity, such as sports arenas. Or, operators can scale and share control capacity to cost effectively improve performance at specific places and times. This can help overcome traffic spikes that arise as new devices connect to the data network.

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lightRadio™ Network: A New Wireless Experience

Making the move
Operators face no significant barriers to making the move to the lightRadio Network. While each operator has a unique starting point based on its own business needs and operating environment, they have a number of things in common. They need modular, flexible wireless networks that can address data demand and keep costs in check.

This new network architecture helps operators kick-start transformation with the wireless infrastructure, spectrum and multivendor networks they have now. An effective transformation includes:

- Targeting capacity problems in hotspots and indoors
- Migrating to LTE for efficient spectrum usage
- Adding a WB-AAA architecture for more capacity per site
- Virtualizing capacity and control for more flexibility

Operators can control costs by scaling capacity in manageable increments. These strategies and savings can extend to many parts of the network, including wireless backhaul links, small sites and legacy equipment.

By alleviating concerns about capacity, scalability and cost, the lightRadio network architecture offers operators the chance to rethink the challenges of the present and future. It can help them swap a defensive stance — coping with demand — for a positive approach focused on turning mobile broadband demand into new revenue.

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2 iPhone® and iPad® are trademarks of Apple Inc.
3 Based on Alcatel-Lucent study, 2011
4 Ibid
Alcatel-Lucent lightRadio Extends Broadband Access via Cellular and Wi-Fi Integration

By Peter Bernstein, Senior Editor, TMCnet

Ever wonder why, despite the fact that your smartphone can access cellular and Wi-Fi networks, actually getting on a Wi-Fi network is so much harder? The good news is lightRadio™ Wi-Fi from Alcatel-Lucent has given all of us connection-hungry nomads the promise of relief.

Addressing user pain points

We all know the problem. When arriving at a new, distant location, what we really would like is to get on the “best” network automatically. This is “best” according to our own — or in the new world of Bring Your Own Device (BYOD), our company’s — policies and rules. That stated, there needs to be no pricing surprises and no access hassles, just quality broadband access everywhere we roam.

Until 4G LTE becomes widely available including in-building, Wi-Fi, because of its speed, would be our choice today, especially for data and video intensive sessions. In fact, secure Wi-Fi, if reasonably priced and with a seamless connection, would be the likely first preference. This includes voice sessions, particularly when we are out of the country. Today, however, confusion can arise when faced with complex Wi-Fi network login procedures and the many and varied ways to pay for using them. There are often concerns about the level of security offered by an unfamiliar network too.

Yes! We have all been frustrated when landing at an airport where the inaccurately named “public” Wi-Fi is a subscription based service for which we are not subscribers and have little time or inclination to become subscribers except in dire emergencies. We have also questioned the security of our personal data when connected to a true public hotspot no matter where we are.

The big news is twofold. First, lightRadio Wi-Fi, when integrated into mobile networks and small cell base stations, allows smartphones, tablets and other devices to switch automatically from a cellular network to Wi-Fi and back again. This is a major convenience.

For industry aficionados familiar with Unlicensed Mobile Access (UMA), the widely unadopted technical standard from the 3GPP organization, this should sound familiar. UMA enables access to cellular GSM and GPRS networks over Wi-Fi. It allows service provider subscribers roaming and seamless handover between cellular and public or private Wi-Fi networks in a secure manner leveraging device SIM cards. However, it has not been widely advertised. After all, no cellular carrier looking to have people abandon their landline phone wants customers to think their network is not ubiquitous or can’t provide a great experience for voice. And there is no CDMA version.

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Alcatel-Lucent lightRadio Extends Broadband Access via Cellular and Wi-Fi Integration

The capabilities of lightRadio Wi-Fi, that allow for automatic login so users do not have to enter complex passwords or search for a secure wireless network are important conveniences.

TMCnet spoke with Gary Leonard, Director of Product Marketing, Wireless Division of Alcatel-Lucent, who said the goal simply stated is, “creation of a seamless wireless broadband user experience that not only delights end users but keeps service providers as central parts of evolving ecosystems.” He added that for the service provider, lightRadio Wi-Fi allows them the important benefit of “offloading data to relieve network conjunction and reduce costs but not offloading the customers.” In fact, it is this dual ability to provide a better customer experience while enabling SPs to manage traffic growth and costs without losing customers that is likely to drive the business case for acceleration of 4G LTE deployments as well as drive cable and other fixed operators to collaborate with cellular companies.

As stated, the aim is not just seamless access but flawless delivery of a consistent and secure quality user experience. The secure aspect of the solution should not be under-emphasized for two reasons:

- End users need peace of mind in accessing mission critical and/or sensitive personal information – something that increases exponentially as the BYOD trend accelerates and smartphones and tablets demand and receive remote access to enterprise and various cloud networks.
- Service providers need a linchpin for keeping customers on their billable services no matter their connection at any given point in time and security fits the bill.

This all makes sense in the context of the lightRadio architecture. It is designed to transform today’s macro cellular networks into massively distributed ones using small metro cells that add cellular capacity and coverage in dense traffic areas along with femto cells (“personal base stations”) for doing the same in homes or offices. Seamless Wi-Fi integration is a critical component of an evolutionary strategy for the architecture which gives SPs planning and pricing flexibility as they move forward in a world that currently is starved for licensed spectrum.

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Alcatel-Lucent lightRadio Extends Broadband Access via Cellular and Wi-Fi Integration

Show me the solution and the money!
Here is how Alcatel-Lucent describes the solution in terms of service providers integrating lightRadio Wi-Fi into their access portfolios in conjunction with deployment of Alcatel-Lucent’s lightRadio multi-standard femto cells and metro cells with the integrated Wi-Fi as an option:

- Alcatel-Lucent has added secure Wi-Fi gateway functionality to further enhance its market-leading 7750 Service Router. This enables service providers to offer large-scale Wi-Fi services in conjunction with fixed and mobile broadband services from a single platform, reducing cost and complexity.
- Alcatel-Lucent has added the Automatic Network Discovery and Selection (ANDSF) function to its policy manager, the 5780 Dynamic Services Controller. This allows the automatic selection of the “best” network connection based on criteria such as service type, subscription type and network congestion levels, helping to improve the overall customer experience.
- Alcatel-Lucent is also offering full services and end-to-end project management expertise to help service providers deploy lightRadio Wi-Fi quickly and easily to meet their business goals and the needs of their customers. It also is working with a number of Wi-Fi access point (AP) vendors through the lightRadio™ AP/RG ecosystem program to take interoperability off the table as a concern.

Disruption in the force?
This is a non-trivial announcement. We literally stand on the cusp of a major disruption not just in the traditional way phone calls are made but also the way they are billed, with major implications for all involved. The world is barely in the 4G era, which will open up the spigots for VoIP calling, although a SIP client on a smartphone right now gives a reasonable VoIP experience even over public Wi-Fi on 3G. While not perfect, who among us has not used Skype when attached to a Wi-Fi network overseas to avoid roaming charges?

The good news for cellular operators who are aggressively expanding their 4G LTE footprints is that lightRadio Wi-Fi gives them an opportunity, while at the same time presenting a challenge. Call me crazy, but a service bundle that includes “best” network access with guaranteed security is a better way to engage customers and reduce churn than ignoring market realities. This, in fact, is a foundational element of the Alcatel-Lucent High Leverage Network™ approach and its assistance to mobile operators moving to a wireless packet core as part of creating an end-to-end all IP capability to meet the needs of next-generation network customers.
Innovating Innovation

Alcatel-Lucent lightRadio Extends Broadband Access via Cellular and Wi-Fi Integration

Secured service, instead of the difficulties of falling back on “best effort” Internet capabilities via public and unsecure hotspots, may be fine for some because “free service” is an attraction, but it is certainly not going to be satisfactory for those using their smartphones for business communications or who have an expectation of a quality experience for data as well as voice.

In the name of full disclosure, I admit to having a 4G LTE phone and hence might be accused of bias on the subject. Nevertheless, the prospect of being able to use that phone anywhere in the world, according to my networking preferences as to what is “best,” and to know the access is secure and I have one person to blame if there is an issue, is more than attractive. It is enticing. IT managers looking for solutions to BYOD security concerns, and a reduction in “user experience” complaints, as well as costs, take note.
Innovating Innovation

Building a Core Router for the Next Decade

By Ken Kutzler, VP of Hardware Engineering, IP Division, Alcatel-Lucent

The need for more in the core

As service providers bolster their networks with 100 Gigabit Ethernet links to stay ahead of rapidly growing bandwidth requirements, existing core routers struggle to cost effectively scale capacity. They are challenged to deliver high volumes of 100G links while keeping power and space consumption down, not to mention incremental capabilities that will be required as services and the applications that drive them evolve. We saw these challenges as an important opportunity to reshape the core router market.

Core routers of the past decade had a simple and singular mission – deliver scalable bandwidth in support of Internet traffic growth. Today this simple picture has become far more nuanced as the scope and nature of applications and the distribution of content are driving an evolution in metro networks and cloud infrastructure (Figures 1 and 2). Some implementations within core networks may solely focus on IP core routing and Internet peering, while others will benefit from the reduced complexity of Multiprotocol Label Switching (MPLS). Still others will look to interconnect data centers or incorporate Virtual Private Network (VPN) infrastructure services to best serve the range of applications delivered by their services. The flexibility to address the broader set of core network requirements is increasingly valuable, in addition to higher capacity and efficiency.

Pushing beyond traditional trade-offs

Developing dedicated platforms with single-purpose designs and limited feature sets has been suggested as one way to support the requirements of the core network in a scalable and cost-efficient way. You remove functionality to reduce costs, but in doing so you lose flexibility, and may force service providers to maintain multiple platforms to meet their full scope of needs.

Figure 1. Traditional view of the network

Figure 2. Changing dynamics of content consumption and distribution place new demands on core networks
Building a Core Router for the Next Decade

The historical alternative has been to add chassis to existing deployments, but this escalates space and power costs. Traditional industry thinking views scalability and span of capability as desirable attributes that require trade-offs. This is a classic product design challenge that has grown more intense as core router capacity tries to keep pace with Internet traffic growth that has been doubling every 18 months.

We believed we could push the boundaries in each of these areas simultaneously: to scale density and maximize efficiency without sacrificing the versatility to support the range of present and future core network needs. We had to rethink some critical aspects of the router, but rather than start from scratch, we chose to base our design on our field-proven techniques and technologies:

Our 400G FP3 Network Processing Unit (NPU) silicon allowed us to massively scale bandwidth, not only at 10G, 40G and 100G, but also with a clear path to 400GE.

Our Service Router Operating System (SR OS) provides robust and proven feature and protocol capabilities, having been operationalized in service provider IP networks for a decade. The flexibility to add features on a solid base, and to deliver them through software licenses as needed to ensure superior economics is an inherent advantage of the 7950 XRS family.

![Figure 3. The 7950 XRS efficiently scales capacity without compromising versatility](image)

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Building a Core Router for the Next Decade

Our multi-faceted design mandate
To enter a new market, and be successful, you need to have both a disruptive change and a product that can significantly leapfrog the status quo. The transition to 100G is a disruptive change, but to scale on bandwidth alone is not enough. We also had to scale features – a capability that incumbent core routers struggle to achieve. We needed to:

- Deliver massive scale, but with the versatility to evolve and address different sets of core networking requirements.
- Ensure our platform could scale capacity and features while maintaining greater efficiency.

Designing for scalability and versatility
The 7950 XRS is the industry’s first network processor-based core router platform. To deliver the combination of capacity and capabilities that are needed, we focused on silicon design and achieving 400G forwarding in our third-generation FP3 chipset. In addition to best-in-class port scaling at 100G, it paves the way for support for 400G clear-channel Ethernet on the existing chipset. The FP3 scales the span of feature capabilities as well. Resembling the FP and FP2 before it, the FP3 is a fully programmable network processor. Unlike off-the-shelf approaches that hardcode “engines” with predetermined tasks, no feature or function is hardcoded in the FP3. This allows us to add and change features through software as customers’ needs and requirements evolve.

The SR OS operating system represents years of accumulated features, design experience and field testing. Rather than port the SR OS to the 7950 XRS platform, the software team pulled the 7950 XRS into the SR OS and scaled it for bandwidth capacity, features and routing table size. This approach allows the 7950 XRS to run the same SR OS binary as our line of IP/MPLS products. It wasn’t easy, but we can truly say we use a single operating system across all of our products.

To build a router that can last for at least a decade, we realized the importance of delivering a very flexible platform that lets service providers make changes in place and avoid forklift upgrades. Most routers let you upgrade the forwarding card, central control processor or central switch fabric. We designed the 7950 XRS chassis to include 21 field-upgradeable units that can be removed and upgraded without rebooting the system. It supports the standard upgrades described above, as well as upgrades to the:

- Central processor
- Distributed control processors on each forwarding complex
- Distributed forwarding complex fabric taps
- Large unit link power modules

An individual power lug can even be replaced if one is damaged during installation.
Building a Core Router for the Next Decade

Designing for efficiency

Power efficiency is a growing concern as core router scale and density are constantly driven to new heights. There are strict limits to the amount of power that can be dissipated in a rack and that can be fed to a central office. If the 7950 XRS was going to provide five times the capacity of existing routers, we didn’t want it to require five times the power. This concern was particularly important because we wanted to scale features along with capacity.

Saving power is only one aspect of efficiency. Space and cost efficiencies are also important. The 7950 XRS had to offer a relatively small form factor to make it cost effective for customers that want maximum bandwidth with the right mix of features for their service delivery needs. Efficiency could not be an afterthought. It had to be incorporated in the system’s development at all levels.

We designed every component of the data plane for optimal forwarding capacity. Scale allowed us to condense more capabilities in a smaller footprint. In addition, a higher capacity of components meant that fewer components were needed and less power consumed.

We developed dynamic control functions to minimize power draw on the individual chips, sections of chips and on complete line cards based on utilization at any given point in time. At the chassis level, we employed subsystems that can power down a complete forwarding line card when placed in a redundancy or offline mode. Using advanced cooling techniques, the system keeps critical chips at temperatures where they provide optimal performance with minimal power leakage.

To make the best use of available resources, we also made sure that our hardware had the perfect geometry to support Ethernet interface speeds. Simply put, a forwarding plane that is dimensioned on an odd baseline, such as 140G or 240G, is not best suited to efficiently handle the required Ethernet speeds. It leaves a significant amount of available line card capacity unused. With the FP3, we designed 200G and 400G line cards with a perfect geometry for 10G, 40G and 100G speeds and the ability to support 400G as the technology emerges.

Support for 400G is crucial for the future, but it also helps to reduce the number of components for accelerating broad deployments of 100GE right now. If you design a 400G card with 4 100G interfaces and use a 400G forwarding plane, those 4 interfaces are tied to the same forwarding plane. All packets go through the same FP3 chip, the same memory surrounding the chip and the same fabric.

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Building a Core Router for the Next Decade

Conversely, a line card design using 100G chips will need 4 chips instead of 1. It will also need 4 times the memory because each memory complex has to address the full forwarding plane of the entire network. That’s a lot of redundant memory. More redundant memory leads to higher power draw and more elements that can fail. Our 400G silicon makes the 7950 XRS a less complex product, with higher quality and lower power consumption, as well as favorable economics.

Evolution instead of revolution

When introducing a new product, it always sounds great to say: “We’ve developed 12 revolutionary new ways of doing things.” However, you may also have at least 12 new bugs that you don’t know about yet because your new methods haven’t been fully tested in the field.

Core routers need to be extremely reliable and our goal was to launch a new platform that lives up to these expectations. Reuse and evolution can accelerate development and ensure higher reliability.

The FP3 chipset and SR OS are building blocks that have been widely used in our routing and switching portfolio for about a decade. Our extensive experience at the IP network edge has paid off too because the core now requires a degree of flexibility that was already provided within the scope of capabilities of the IP service edge.

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<td>2 m</td>
<td>4 m</td>
</tr>
</tbody>
</table>

MAC FIB = Media Access Control Forwarding Information Base

Table 1. Building on three consecutive generations of silicon innovation

By combining these assets, we are able to bring a complete set of features into the 7950 XRS platform in a very short time, while maintaining high quality. Because the OS running on the 7950 XRS is the same as the Alcatel-Lucent 7750 Service Router, we are able to test just one binary that delivered the accumulated benefits of ten years of testing and fault elimination.

Similarly, the FP3 is the first and only 400G network processor chipset in the marketplace. It represents the third generation of NPU silicon innovation from our team. Because we built the FP3 in-house with close cooperation from our service provider customers, we were able to tune the processor to their unique needs. As a result, the FP3 capabilities have been thoroughly tested in many different ways on many different platforms.

With the 7950 XRS, we now add another platform to our routing portfolio, this one designed to optimize the core, both Internet backbones and metro cores. This new platform and the experience the team gained in developing it will serve as the
Energize the IP Edge: Creating Unique Value with Alcatel-Lucent's 7750 Service Router

By Beecher Tuttle, TMCnet Contributor

Traditional residential broadband service no longer whets the appetite of the average subscriber. Today's users demand broadband without boundaries, capable of delivering high-bandwidth services like IPTV or Over the Top Video on Demand – from anyplace, at any time, on any device.

While this evolution can create several challenges for service providers (SPs), it also provides a myriad of revenue-generating opportunities for operators with the right technology in place. The traditional centralized BRAS architectures employed by the majority of today's SPs are incapable of meeting the evolving needs of residential broadband service subscribers.

Clearly, a new approach is needed. Fortunately, newly-introduced Ethernet-based Broadband Network Gateway (BNG) routers – providing speeds of 100G+, IPv6 migration and new service enablement – are now available. In addition to delivering high network speeds, BNG IP edge routers enable convergence, allowing SPs to deliver blended, personalized offerings from a common delivery platform in the IP edge. Alcatel-Lucent is delivering the promise of this technology with its 7750 Service Router (SR).

Purpose-built 7750 SR

With its decades of experience in the telecom space, Alcatel-Lucent built the 7750 Service Router with performance and scale in mind. Industry-leading features include, but are not limited to:

- A robust subscriber management implementation to enable video and other new service capabilities
- Automated provisioning of logical access interfaces to minimize operational costs and reduce time to market
- Support for time- and volume-based accounting with RADIUS- or diameter-based credit control
- Flexible IP address management
- Multivendor support for RADIUS authentication
- Flexible use of network infrastructure
- Highest levels of BNG redundancy to ensure the highest quality of service

A key differentiating feature of the Alcatel-Lucent service router is the recently-introduced third-generation network processor, the FP3, which has the bandwidth, feature processing scale and packet throughput to energize the IP edge and support service convergence service blending.

Yet another component of the 7750 SR is the Multi-Service Integrated Service Adapter, enabling the distributed service intelligence and embedded high-touch processing necessary to differentiate services, optimize network operations and enable long-term scale, according to Alcatel-Lucent.

continued...
Energize the IP Edge: Creating Unique Value with Alcatel-Lucent's 7750 Service Router

Built with the transition from IPv4 to IPv6 in mind, the Alcatel-Lucent service router also provides the flexibility to generate revenue now while setting the stage for future growth.

Monetization

Placing rigid caps on bandwidth utilization is, at best, a temporary solution for broadband demand. Leveraging the 7750 SR, SPs can instead create personalized plans that enable subscribers to choose how they utilize their bandwidth allotment.

“Personalized plans are enabled by the unique ability of the application assurance (AA) software on the MS-ISA module to fulfill each subscriber’s application- and session-level needs. With AA, service providers can see into their network down to the application level and limit, boost and reprioritize that traffic on a per-subscriber, per-session or per-application basis,” says Alcatel-Lucent.

This way, subscribers can fulfill their desires for bandwidth-hungry content like streaming video and social media if they so choose. Service providers, meanwhile, can monetize the flows while offering differentiated services.

In addition, SPs can leverage the 7750 SR to drive revenue-sharing partnerships with content providers, advertising providers, application providers and retailers that market OTT services. Alcatel-Lucent’s BNG can identify, zero-rate or apply special treatment to traffic flows and offer a better quality of service for end users, thus providing unique value for OTT vendors.

Yet another differentiator is the WLAN capability of an Alcatel-Lucent 7750 SR, which can aggregate a service provider’s Wi-Fi hotspots, providing subscribers with a low-cost alternative to 3G service when outside their home network.

“Residential subscribers within range of their service provider’s Wi-Fi hotspots can transparently connect to their service provider as if they were at home — simply, securely, with access to all their services and content and with a familiar QoE. Transparent Wi-Fi access allows residential broadband providers to offer subscribers freedom in the truest sense,” says Alcatel-Lucent.

Other defining capabilities provided by the 7750 SR include enhanced IPTV service, industry-leading subscriber management, distributed service intelligence and a universal broadband network gateway — each helping to provide the freedom to reap the benefits of convergence.

Today’s service providers find themselves at a crossroads. SPs are providing the broadband necessary to deliver revenue-generating services, but are seeing none of the financial windfall with current technologies in place. The 7750 SR provides SPs with the tools to benefit subscribers and partners while also solidifying their own place in the value chain.
Extend the Range, Performance and Capacity of 100G Optical Networks

By Beecher Tuttle, TMCnet Contributor

The introduction of popular, high-bandwidth applications is a bit of a Catch-22 for communication service providers. On the one hand, bandwidth-hungry apps give carriers opportunities to support new revenue-generating services that can differentiate them from the competition. Unfortunately, these services require a level of speed that most networks are unable to provide, leaving many service providers on the outside looking in.

To help carriers overcome this hurdle, Alcatel-Lucent has created 100G single-carrier coherent technology that can turn a standard optical transport network from a cost center to an easy-to-manage revenue enabler. The technology includes the 100G eXtended Reach (XR) card, a highly flexible and scalable solution that can grow at the same pace as a service provider’s needs.

The Alcatel-Lucent 100G XR card extends the range, performance and capacity of 100G optical networks like no technology before it. With the highest current transmission reach in the industry, the 100G coherent technology can extend a carrier’s customer base while also enabling it to offer its current subscribers additional revenue-generating services.

The new Alcatel-Lucent technology can meet the distance and capacity requirements for most any wireless, wireline, cable and Internet provider, not to mention national research and educational networks. The premium card’s wide reach is due to its compatibility with 10G, 40G and 100G mixed signals that are transported across any type of fiber line, whether they are new or legacy infrastructures. The solution can also provide up to a 30 percent increase in reach, meaning carriers can transmit up to 2,000 kilometers and beyond.

In essence, the Alcatel-Lucent technology can help turn any old, underperforming fiber network into an optimized next-generation network capable of meeting consumer demands, lowering operating costs and unearthing new revenue generation possibilities.

The Alcatel-Lucent 100G coherent transmission solution is supported by the 1830 Photonic Service Switch platform, which provides the extensibility and reliability of an electrical-based transport network. The end result is a scalable, automated and fast time-to-service solution that can significantly reduce a service provider’s cost per bit and their total cost of ownership. The platform also provides industry-leading energy efficiency and relies on fewer components, further enhancing its cost-effective nature.

100G technology, researched by Alcatel-Lucent for more than five years now, is an integral component of the Alcatel-Lucent High Leverage Network architecture (HLN), which has proven to support new revenue-generating services while also managing record network usage.

Examples of how the Alcatel-Lucent 100G technology has been used can be seen in both test cases and the real world by companies like P&T Luxembourg and T-Systems.
Illuminating the Path to 400G with Alcatel-Lucent's 400G Photonic Service Engine

By Beecher Tuttle, TMCnet Contributor

Ensuring high-quality, always-on connectivity is a desire for any service provider that hopes to find success in current and future markets. The demand for bandwidth-intensive services has forced operators to ratchet up transport speeds from 10G to 40G and soon to 100 gigabits per second.

With ever-evolving network needs in mind, Alcatel-Lucent has launched the 400G Photonic Service Engine (PSE), the first commercially available, electro-optics chip capable of accelerating network speeds to an astounding yet soon to be necessary 400 gigs per second.

Based on Bell Labs innovations and developed for the Alcatel-Lucent 1830 Photonic Service Switch (PSS) platform, the 400G PSE is extremely flexible and can be adapted in a number of ways. Perhaps the most beneficial aspect of the solution is that it can support 400G transport while also maintaining backward compatibility with current 100G systems, ensuring investment protection for service providers that are slowly migrating to 400G.

As Alcatel-Lucent likes to say, 400G PSE is ushering in the age of 100G while illuminating the path to 400G.

When configured for 100G transport, PSE can increase network capacity by 33 percent, extend network reach by more than 50 percent and reduce power consumption by a third – all without the need for footprint expansion or for costly electrical regeneration.

Moreover, PSE allows service providers to realize the full wavelength capacity of fiber, resulting in a spectral efficiency increase of as much as 33 percent. Simply put, PSE delivers the highest possible performance per wavelength at 100G, enabling significant increases in network performance, scale and flexibility.

When service providers are ready to migrate to 400G, PSE offers a direct path that provides even greater benefits. The solution can increase traffic capacity by nearly threefold while reducing power consumption per gigabit by 33 percent.

In addition, PSE is equipped with digital-to-analog and analog-to-digital converters and powerful DSP-based forward-error correction functionality. The solution also minimizes space and power requirements and can be tuned to optimize performance per route.

"Given the cost of evolving the network, providers cannot afford to overhaul their infrastructures wholesale every half-dozen years to keep pace with traffic growth," says Alcatel-Lucent. "Solutions have to be scalable, and they have to be backwards-compatible as well."
Illuminating the Path to 400G with Alcatel-Lucent's 400G Photonic Service Engine

The 400G PSE does exactly that. The solution enables service providers to leverage their existing infrastructure and migrate to higher transport speeds as needed. As previously mentioned, this evolutionary path is delivered via Alcatel-Lucent's 1830 Photonic Service Switch, a multi-reach photonic platform that already leads the industry in 100G deployments and was purpose-built for high-speed transport.

The coherent optical transport switch, already on its fourth release, sports cross-layer capabilities, a common network management system and new PSS-36 and PSS-64 scalable multi-terabit OTN switching options.

The benefits of the 1830 PSS are substantial. While reducing operating expenses, the 1830 PSS provides a scalable and sustainable way to create enormous capacity. The service switch also enables the transparent transport of multiple operators' traffic while eliminating the need for end-to-end control and quality assurance.

1830 PSS provides the following additional benefits:

- Provides payback in 12 months
- Reduces operational expenditures (OPEX) by 78% through simplified operations
- Reduces capital expenditures (CAPEX) by 17% through high-density technology
- Generates revenue from new on-demand services and more dynamic protections

The need for speed is a constant in communications. Indeed, the history of innovation in communications infrastructure has been driven from its inception by the fact that bigger and faster will always find a market. 400G is an impressive achievement. It is sure to enable the coming era of even more immersive communications and applications. It also happens, thanks to Alcatel-Lucent, to include a smooth glide path from today to tomorrow.
Open APIs and the Cloud — Providing the Clout You Need
By Erin Harrison, Executive Editor, Cloud Computing, TMCnet

Much is being written about the promise of cloud computing, but when it comes down to it, how much clout does cloud actually have? While still in the early stages of adoption, cloud-based services offer powerful benefits. However, more questions continue to arise about the actual capabilities of cloud solutions.

While there is a high level of interest in cloud-based services, many businesses and service providers alike are asking questions about the details of cloud services, including how they can manage and control the cloud, assure performance and regulatory parameters and integrate cloud services into their current IT environment.

In an effort to better understand the concerns developing around cloud services, Alcatel-Lucent recently conducted a study of perceptions and attitudes toward the cloud among 3,886 IT decision makers in seven countries. According to this study, concerns about performance, data security and ease of use are top-of-mind for the decision makers.

An Alcatel-Lucent white paper, “Alcatel-Lucent Cloud Clout with open APIs,” explains the value of well designed cloud APIs, both for the data center and the cloud network. It also summarizes the critical issues cloud users and cloud providers need to consider as they look to take advantage of the cloud. The carrier cloud addresses these concerns, and open application programming interfaces (APIs) play a key role in meeting the requirements of cloud users.

“For cloud users to take full advantage of APIs, they must be open; that is, they need to be well documented and the documentation needs to be easily available,” according to the white paper. “In addition, the API syntax and semantics must remain stable for a reasonable amount of time.”

As Alcatel-Lucent points out, most cloud providers already offer some form of APIs. They emphasize that, “The Network Makes the Cloud.”

Let’s take a look at the types of APIs that apply to cloud offerings. Typically, three levels of cloud services are offered, which are:

- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS)
- Software as a Service (SaaS)
Open APIs and the Cloud — Providing the Clout You Need

A cloud-based approach separates the application from the resources it needs to execute. Applying this principle to wide area networks creates new challenges. With a High Leverage Network, many service providers own a rich set of network capabilities that can be monetized in differentiated cloud offerings, Alcatel-Lucent maintains.

What is often misunderstood in what is currently the infancy of the cloud movement is the perception that business-critical resources are no longer under the control of the application developer and user.

However, a carrier cloud offering that supports open APIs and API management systems gives cloud users control at the right level, meaning that there is no need to know the exact physical server blade and rack position where an application is being run.

Alcatel-Lucent’s CloudBand™ solution, which is intended to serve as the foundation for a new class of carrier cloud services, allows service providers to bring the benefits of the cloud to their own networks and business operations, and put them in an ideal position to offer a new range of high-performance cloud services to enterprises and consumers.

According to Alcatel-Lucent, cloud users should make sure that:

- The cloud parameters that affect the performance and security of an application are readily available through both APIs and APIs
- APIs are available for computing and storage resources as well as for the cloud network
- APIs are open; that is, they are well documented and stable
- APIs from different subsystems are normalized and access to APIs is securely managed

In conclusion, both API management and cloud orchestration systems are needed to build a clear API strategy. As Alcatel-Lucent states, an API strategy delivers the “cloud clout” needed to meet efficiency and security requirements and to reduce total cost of ownership.
Downloads

Documents

- Rethinking the IP Core
- Alcatel-Lucent lightRadio™ Wi-Fi® Solution
- Evolution of the Broadband Network Gateway
- Cloud Clout with Open APIs
- The 400G Photonic Service Engine

Podcasts

- MIT's Top 50 Most Innovative Companies
- What Can Telecom Innovation Do For Us?
- The Future of Technology
- Boao Forum Perspectives: Cloud, Mobility & Social Media
- Seeing 20/20 with Optical Networking Research

Videos

- Bell Labs Open Days 2012
- Discover the 7950 XRS portfolio
- 4 Principles to Building a Versatile Core Router
- ACG HotSeat with Basil Alwan
- Alcatel-Lucent Global Cloud Initiative
- TM Forum - Cloud Energizing the Edge
- 400G coherent optics
- Breakthrough silicon innovation from Alcatel-Lucent
- Alcatel-Lucent’s latest move in optical 100G

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