Lucent Technologies
Bell Labs Innovations

English Language Edition

LUX

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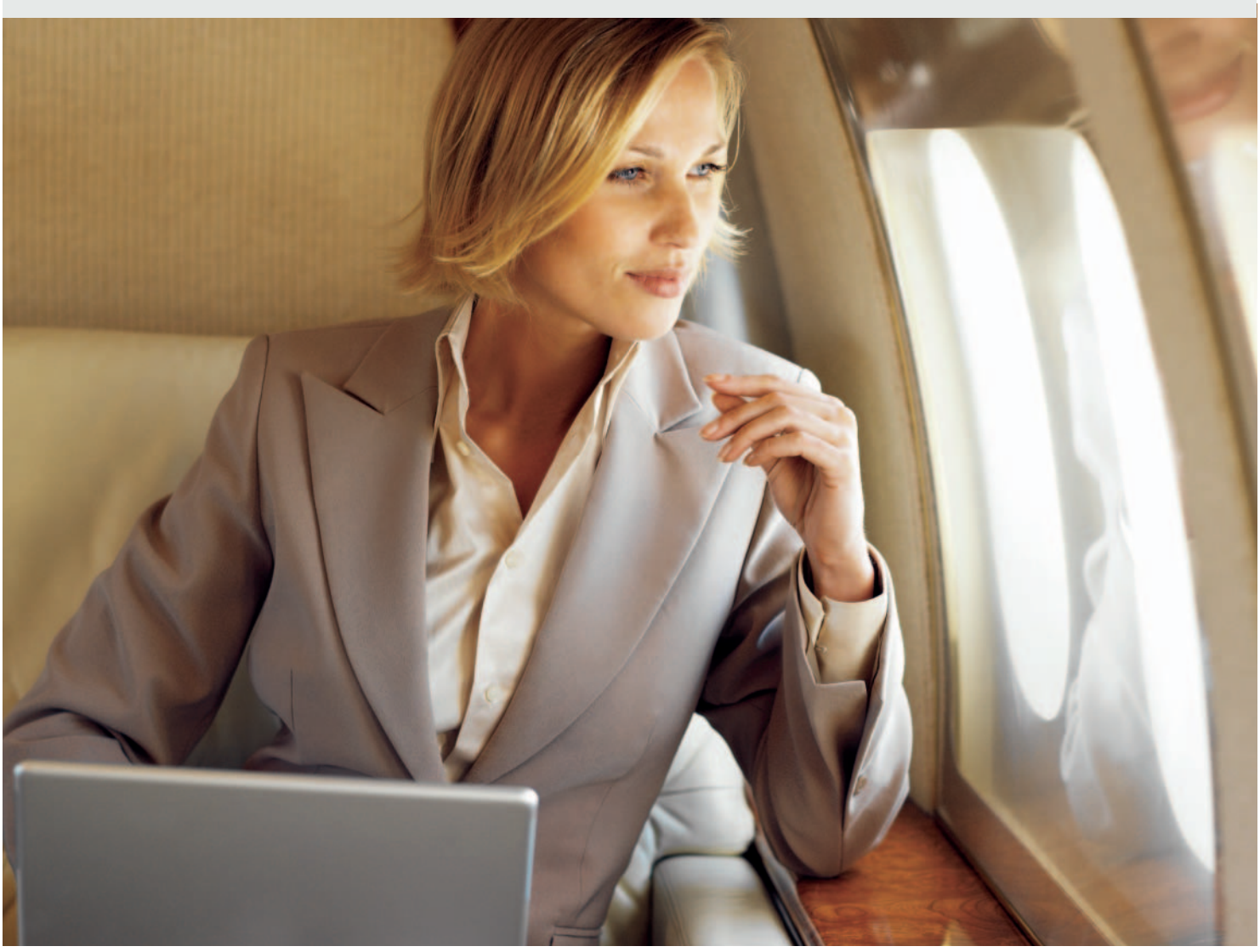
Lucent Technologies Customer Magazine

Next-Generation Access Solutions





Patricia Russo

Chairman and CEO
Lucent Technologies

Dear Customers,

Over the past several months it has become clear to me that creating new and valuable end-user, broadband services is top of mind for many of you. In the following pages of this issue of Lucent Technologies LUX magazine you will find stories on a variety of topics ranging from IP TV to a trial Telefónica is doing with Lucent on a DSL broadband access solution to how Bell Canada is extending its satellite TV services to its urban customers.

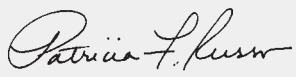
There is growing demand for such applications as home networking, IP-video and interactive gaming. Business customers want to use the latest innovations in communications to improve productivity by helping their employees stay connected no matter where they are. They want better links with their customers and their suppliers. End users want to access new applications, for both their business and professional lives.

To meet these needs you are adopting new technologies, software and services to expand and enhance your current networks and offerings. These types of investments lay the foundation for the delivery of converged communications services, what we at Lucent call "blended lifestyle" services.

Lucent is investing in several key next-generation technologies such as optical, VoIP, and mobile high-speed data to help you reach more customers and be able to offer your current customers exciting new services. And we are building partnerships with companies in a number of areas, from access to content and applications to meet your current and future needs.

I hope you enjoy this issue of LUX, and we look forward to helping you create networks that are easier to manage, more efficient and able to deliver the kinds of exciting new communications services your customers expect.

Sincerely,



Patricia Russo

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For more information, please visit www.lucent.com/access



Consumer IP Video – The New Frontier

Consumer IP Video, also referred to as Telco TV, Telco iTV, and IPTV in the industry press, is the new frontier for Telcos. It provides an opportunity for operators to leverage existing broadband access infrastructure to offer triple play service bundles to their subscribers. The timing for Consumer IP Video is right. The enabling technologies have matured and already there are over 150 Consumer IP commercial service offerings and trials around the globe.

The Business Drivers

As consumers continue to spend more and more on home entertainment and communication, their desire to economize on their communications spending sets the stage for traditional telecom service providers to offer competitive bundled voice, data, and television service. Furthermore, as these services become integrated, for example caller ID on the TV, Consumer IP Video turns the television into a universal home communications device for the end-user. This is the reason why Consumer IP Video has become an imperative for Telcos. It allows them to offer triple play service bundles to their subscribers that are similar to those offered by Cable and Satellite providers. Today, the timing is right because the regulatory and technological inhibitors have fallen like dominoes, allowing Telcos to aggressively build the infrastructure needed to support Consumer IP Video.

New DSL technologies, like ADSL2+ and VDSL/2, offer rate/reach improvements that allow significant bandwidth to be delivered to subscribers cost-effectively. In addition, new compression technologies like H.264 and VC-1 drastically reduce the bandwidth required to deliver a desirable set of TV channels to a home, making DSL pipes – the Telcos most ubiquitous broadband pipes – viable for video service.

Why IP Video Is An Imperative

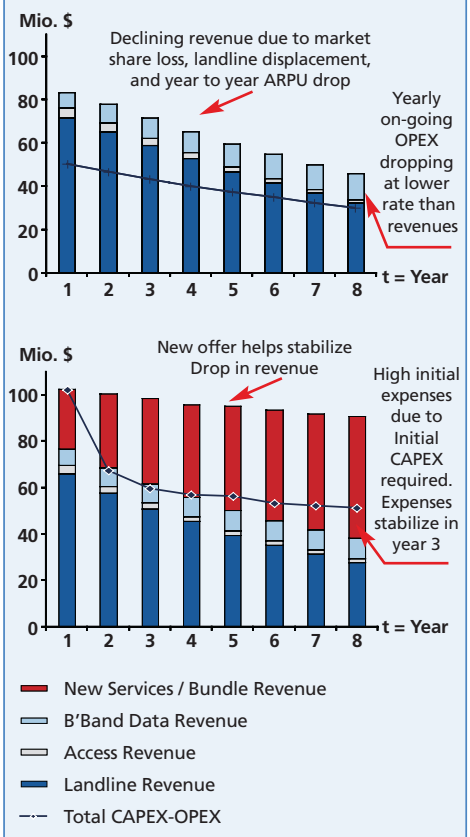
Studies by In-Stat/MDR and the Yankee Group indicate that service providers can as much as double average revenue per user by adding video services to existing Internet data and voice offerings to create a triple-play service bundle.

Moreover, Bell Labs business modeling indicates that a triple-play offer can help service providers stem revenue erosion and increase cash flow. As further evidence of the revenue generating opportunities of Consumer IP Video, primary research conducted in North America shows that 35% of existing DSL customers would most likely subscribe to a service provider's video offering.

Lucent Bell Labs experts analyzed two North America based Telco business models in order to quantitatively determine the possible impact of Consumer IP Video service on a Telco's business. The Telco in one model carried on as usual without making an investment in IP Video while the other rolled out IP Video service offerings to its subscribers at the onset of the defined study period.

Figure 1 shows the revenue results in graphical form. The results clearly indicate that the "business as usual" model, referred to as Present Mode of Operation (PMO), results in precipitous revenue and cash flow decline, based on today's access line loss trends and other factors. On the other hand, in the Future Mode of Operation (FMO) case, IP Video helped stabilize the revenues of the second Telco and improve its cash flow over the study period.

Fig. 1:



Note: Both Telcos were assumed to serve 160,800 households. The complete set of model assumptions and the Revenue assumptions can be provided on request.



Lucent's Consumer IP Video Solution

End-users want improvements in convenience, efficiency and richness in their communications services. Lucent's Consumer IP Video solution gives service providers a valuable way to meet these needs, with support for a full range of merged voice, Internet, and video features. Lucent's solution consists of the following elements:

1. Lucent Worldwide Services (LWS) Integration services
2. Video partner products
3. Lucent's broad set of network infrastructure solutions, led by our market leading Stinger® DSLAM portfolio and the AnyMedia® Access System (AMAS) portfolio
4. Lucent VitalSuite® Network & Service Management software

Convergence is transforming the telecom industry, driving growth and creating new services, opportunities, and revenue streams – as illustrated in the Bell Labs IP Video business model. It's also presenting demanding new challenges: complex, multi-vendor solutions and massive integration efforts.

In fact, integration is the key to true convergence. Success in this dynamic business environment is a matter of uniting diverse applications, systems, services, and technologies to build and efficiently manage a flexible, scalable next-generation network (NGN) – one that can carry voice, data, and video while providing security, reliability, and superior quality.

Today's television is a multi-service communications and entertainment device, supporting TV programming as well as integrated applications such as:

- **Caller ID on TV** – shows caller's phone number and name on the TV screen.
- **Web on TV** – Surf the Internet or watch TV all on one monitor.
- **Internet Walled Garden** – displays a service provider's Web portal, with information on local services, entertainment and events, customized to the subscriber's area.
- **Interactivity** – An application on the horizon that allows multiplayer gaming, instant messaging during TV program and click-to-order using the TV remote control.

LWS delivers:

- An integrated approach that extends from business modeling to maintaining the solution
- A global staff that brings unparalleled experience and expertise to every project
- Proven processes and methodologies refined on thousands of integration efforts
- Proprietary video performance and analysis tools and resources from Bell Labs, Lucent's innovation engine

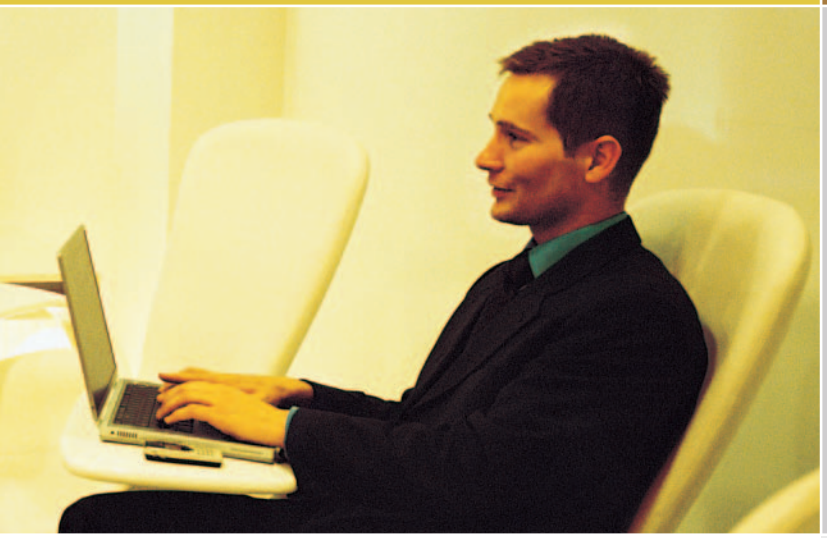
LWS supports multi-vendor IP Video solutions, but it also offers pre-integrated, "shrink wrapped" solutions based on a leading middleware ecosystem. A middleware ecosystem is a complete video solution consisting of middleware, encoder, DRM system, VoD system, and set top box. LWS teams with the leaders in the head end construction space for head end solutions.
The pre-integrated approach verifies the solution yielding faster time to market. LWS will even manage the solution until the operator is ready to take over the management responsibilities.

Suitable Vehicles For IP Video

Lucent's Stinger® portfolio is built for IP Video: its DSL price performance has been optimized, it has GigE uplinks that accommodate large video channel lineups, and it incorporates on-board Broadband Remote Access Server (BRAS) functionality for those situations where a distributed BRAS solution is more cost-effective. Its functional capabilities include IP Multicast and the sophisticated IP QoS/CoS capabilities needed for IP Video. It performs quality of service management of traffic streams related to the different triple play services over a single IP connection to the subscriber. Even within a single service like video, Stinger® can discriminate between broadcast (multicast) traffic, VoD (unicast) traffic, control traffic, and apply QoS rules accordingly. The Stinger® DSLAM portfolio eliminates the need for multiple service or device-specific ATM VCs on the access link. Service providers understand the tremendous operations benefits this entails.

Lucent is extending the IP services capabilities that make the Stinger® DSLAM portfolio a natural for IP Video to the AnyMedia® Access System portfolio. Additionally, AnyMedia® is being enhanced to provide a higher capacity backplane and GigE uplink.

For SONET/SDH aggregation and transport, our next generation multi-service SONET multiplexers, the Metropolis® DMX and the Metropolis® ADM, are the right vehicles. They possess drop and continue features developed specifically



for IP Video and have standards-based Ethernet support for metro aggregation. Additionally, they support gigabit packet ring for cost-effective transport of data and video control traffic.

For metro aggregation and transport using Ethernet, our partner products from Riverstone combine with GigE from the Stinger® DSLAM portfolio to achieve high economies of scale. Additionally, DWDM, enabled by our Metropolis® WSM platform, allows customers to leverage their embedded base of SONET transport equipment and improve fill on their scarce fiber plant.

Products from our partner Juniper, include a market leading BRAS solution for aggregating data and VoIP traffic, and core routers for MPLS based long haul transport.

Lucent's Best-in-class Solutions

Lucent's VitalSuite® Network & Service Management software enables end-to-end service assurance and IP management and helps service providers cost-effectively maintain high quality voice, video and data services. This highly scalable, multi-vendor solution proactively monitors the service delivery infrastructure to the end user, provides real-time service level network management and enables efficient IP network resource utilization. The management solution enhances the end-user experience, while increasing the delivery of converged services and increases IT operations productivity.

Lucent has partnered for IP Video solutions that are market leading. Our partners continue to integrate new subscriber features. Our end-to-end solution gives service providers the rich set of IP Video features that will allow them to grow their subscriber base and, consequently, their revenues. The Lucent IP Video solution enables an integrated TV and Internet experience – as well as providing a path for the evolution of services across wired and wireless media and subscriber devices and being in line with the IMS architecture plans.

--Paul Prah

» www.lucent.com/ipvideo

AWARD-WINNING VIDEO HISTORY

- Bell Labs Advanced Technology Video Patents: 42 in HDTV and 22 in VOD
- World's First SDTV MPEG-2 Encoder
- HDTV Grand Alliance Member
- Emmy Award in 1997 for Pioneering ATSC HDTV

Lucent Technologies and Juniper Networks Solution selected by Shenandoah Telecommunications to meet Demand for DSL Services

Lucent Technologies is deploying Juniper Networks routing platforms in Shenandoah Telecommunications' network, a Sprint PCS Affiliate, to support the growth of Shentel's DSL business and future advanced services.
The Lucent and Juniper Networks solution will enable Shentel to cost-effectively boost the capacity of its Internet Protocol (IP) network, to meet increased business and residential demand for broadband services and to deploy the foundation for advanced services such as bandwidth-on-demand to support video-on-demand and IP TV applications.

"Demand for our products and services continues to grow, and Lucent and Juniper provide us with a reliable broadband solution that will help us meet that demand," said Chris French, president of Shenandoah Telecommunications. "This IP routing solution also positions us well for the future as we introduce new revenue-generating services."

"Together Lucent and Juniper delivered a secure and assured networking solution that enables Shentel to expand their current DSL service offering, while also providing the capability to support enhanced service offerings such as IP TV in the future," said Christine Heckart, vice president of marketing at Juniper Networks. "With an IP infrastructure that provides reliable and secure support for existing services and a future-proof migration strategy for deploying new services, Shentel has built the foundation for an Infranet - combining the reliability and security of private networks with the ubiquitous connectivity of the Internet."

Lucent will provide Shentel with Juniper Networks E-series edge routing platform and the M-Series multiservice edge platform. The Juniper Networks E-series will offer Shentel scalable capacity for tens of thousands of users and aggregates IP Traffic from the broadband access network. Shentel will deploy the M10i as the core routing platform in its network, steering all traffic from its data network to the Internet.

» For more information about Lucent Technologies and Juniper Networks unified DSL Solutions for Service Providers, please visit **www.lucent.com/solutions/dsl_solutions**. For more information about DSL Services for Enterprises, please visit **www.lucent.com/solutions/dsl**.



Win the “triple play”

» Telefónica and Lucent collaborate on next-generation multimedia broadband service

Telefónica Group is one of the world's leading telecommunications companies with a customer base of nearly 100 million clients. Lucent Technologies has been working since 2001 on a project for Telefónica, to evaluate and demonstrate the feasibility of a DSL broadband access network solution. This solution, evolving from Telefónica's legacy network, should be able to support massive deployments of broadband access lines in a cost-effective manner that makes a business case positive. As part of this project, the company has engaged in a variety of activities, including technical and economic studies, business case modeling, lab tests and trials. The goal of the project was to define the business case, the services and technical requirements in order to roll-out broadband services both quickly and effectively at a national level over Telefónica's access network.

A number of working groups spent a significant amount of time defining and designing the multimedia services targeted for initial deployments, including Internet Access from TV and PC, Broadcast TV and Video on Demand. Also, a second breed of services were outlined, i.e. Audio services, on-net games, tele-surveillance, ASP services and domotics. The next analytical step was to define three application scenarios - conservative, medium and aggressive - for the time period from 2002 to 2005. Among the technical studies done by Lucent and shared with Telefónica in regular meetings, it is relevant to mention:

- Network Architecture issues and concerns around content distribution to and from head-ends and video servers
- IP Multicast external vs. internal with respect to the DSLAM
- Traffic encapsulation alternative analysis
- DSL density and service concurrency implications
- Outside DSLAM deployments vs. in-house DSLAM deployments for coverage purposes
- Operation, Administration, Maintenance and Provisioning, integration of Network Management Systems and Commercial Systems

The business case was done for the medium scenario, with extensions to a number of variants and with sensibility analysis to facilitate actions that would improve the numbers. A summary with conclusions, suggestions and recommendations was added.

Telefónica de España started the roll-out of “*Ima*genio” multimedia broadband service, initially in major cities in Spain, and continues in 2005 with extensions to other areas of the country. “*Ima*genio” is designed to deliver digital-quality broadcast multimedia services into the home over a broadband connection.

“*Ima*genio” currently offers broadcast services with a selection of the most popular audio and video channels, digital-quality video-on-demand services and high-speed Internet access to the PC and the TV. As the service expands and is rolled-out across Spain, “*Ima*genio” may be seen as the platform for its future multimedia service offering.

As part of the project, Lucent is providing its next-generation Stinger® FS+ Digital Subscriber Line (DSL) Access Concentrator, which has innovative functionalities such as built-in IP Multicasting, Gigabit Ethernet Interfaces and PPPoE termination.

Lucent has also provided OSS solutions for their IP, Optical, Voice, and triple play services to enhance the management of network traffic, Domain Name Services (DNS), IP addresses and secure user access and authentication.

“The entire Lucent team worked very closely with Telefónica to develop leading multimedia solutions and services and we are very proud to be part of this project with one of our most important global customers,” said Bernardo Villazan, president and CEO, Lucent Technologies Spain. “*Ima*genio, and the network elements and architecture that deliver it, is a sign of how the vision of innovative, multimedia “play” voice, video and data services is fast becoming a reality for service providers.”

Lucent's Stinger® DSL solutions have been designed to efficiently evolve from ATM to IP, allowing service providers to reduce operating expenses while increasing revenues when upgrading to new services. In some cases, legacy networks are used for the deployment of broadband services so Lucent has maintained ATM functionality in its next-generation IP DSLAM to allow operators to use both ATM and IP if needed.

A further step was made as part of the Telefónica Network evolution, with the decision to incorporate the Ethernet routers in the aggregation network; A solution that provides a very efficient network infrastructure over which Telefónica can deliver video and data services. In this latest phase of the deployment, Lucent is supplying and integrating Riverstone's carrier Ethernet routers with Lucent Digital Subscriber Line (DSL) access concentrators to aggregate broadband traffic onto a converged Ethernet infrastructure in Telefónica's network. By doing so, Telefónica will have a simpler, more cost-effective network that can carry multiple types of traffic and services with high reliability and Quality of Service (QoS).

A Road to Broadband

» Network as a stream of information and entertainment

According to Point Topic, an internationally recognized broadband information service, in early 2004, Poland had the highest growth rate for broadband Internet access worldwide. From December 2003 to June 2004 alone, it achieved a growth rate of 80 percent and today remains one of the fastest growing broadband markets in Eastern Europe. Although Poland's broadband penetration is still low when compared to other EU countries, it is visibly on the right track and Telekomunikacja Polska (TP), the country's incumbent service provider, no doubt plays a central role in contributing to Poland's growth in the broadband market.

Supporting over 11 million subscribers, TP is Poland's leading telecommunications service provider. It is also the leader in data transmission and Internet access. The company is a member of TP Group, which includes PTK Centertel - the operator of the IDEA mobile network, Marketplanet, an e-trade platform, as well as a few other ventures. The TP Group owns the largest telecom infrastructure in Poland and altogether provides services to more than 16.8 million customers nationwide. As part of its Internet access offering, TP offers xDSL services to its residential and business customers under the brand names "neostrada tp" and "internet DSL access tp". "Neostrada tp" is one of the most popular internet access services in Poland.



Konrad Kobylecki,
Board Member, CTO,
Telekomunikacja Polska.

"Lucent is our traditional supplier of equipment and applications, one of TP's key solutions' providers. Our relationship is a long-term one. With Lucent we moved from analog telephony to digital broadband. Since 2002 Lucent has installed DSL systems worth 100 million € in our network. At CeBIT 2005 a new framework agreement between TP and Lucent for broadband access systems was announced. We share a vision of next generation broadband services. The Lucent access platform as a basis for IP TV was thoroughly tested by our development department last year and we are aware of its capabilities for converged services."

In 2003, PC World Komputer monthly magazine named TP the "Internet Service Provider of the Year". In 2004, "neostrada tp" service was granted the "Teraz Polska" (Poland: Now) Promotional Emblem as a leading information technology & telecommunication product in the country. In addition, the "neostrada tp" DSL offer was awarded the prize "Europroduct" in the 'service' category in January 2005.

Polish Internet users are quickly getting used to the always-on, web-based lifestyle, and "neostrada tp" is the most popular internet access service in the country. Today TP offers four speeds, starting from 128 kbps up to 2048 kbps – with the cheapest option available for approximately 18 euro a month. In 2004, its number of subscribers increased from 134,000 to 631,000 and was expected to reach 700,000 during the first quarter of 2005. "We are happy to have made this growth possible," said Andrzej Dulka, Lucent Technologies sales director for Central and Eastern Europe. "We are now looking forward to working with Telekomunikacja Polska on developing VoIP multimedia service offers for TP subscribers, based on broadband internet access and the well-merited Lucent Stinger® access platform."

Stinger® access concentrators are at the foundation of TP's "neostrada tp" and "internet DSL access tp" offers for enterprise and residential customers. Enabling high-speed Internet access and providing a basis for the future introduction of "triple-play" services, the Stinger® access concentrator allows TP's subscribers to benefit from simultaneous access to Internet, voice and video (IP TV, video on demand).

Commencing at the end of last year, TP has been in the process of conducting trials aimed at introducing new multimedia services, such as TV transmission and video on demand, based on broadband ADSL. Such services fit into wider plans to offer customers a full spectrum of 'triple play' services, i.e. fixed voice transmission, data transmission and information services, including broadband internet access, high quality interactive TV and video on demand. The Lucent access platform was tested last year by TP's development department, CBR (Central Bureau for Development) as a basis for the planned introduction of new 'triple-play' services.



Converged Ethernet Transport Solutions

» Transform existing networks into service-rich platforms

Ethernet is becoming the service of choice for LAN/WAN enterprise data networking. With service providers reporting increased demand for Ethernet services each quarter, it's apparent that Ethernet will remain the mainstay for corporate LAN/WAN networks in the foreseeable future. This does, however, present service providers with technical and business challenges as they adapt their networks to meet the demand and the price/performance expectations of enterprise users.

Offer a converged network – while preserving investments

Business applications with increasing bandwidth and reliability requirements – in support of real time voice, data, and video traffic – are placing new demands on communications networks. Examples include storage extension for business continuity/disaster recovery, content distribution, video streaming, remote learning and VOIP. And certainly, residential applications are expanding beyond Internet access to triple play services including video on demand, interactive gaming and VOIP. Lucent Technologies Converged Ethernet Transport solutions, whose underpinning is carrier-grade Ethernet, address these trends. By joining with Riverstone Networks and Juniper Networks, Lucent has coupled Ethernet with existing technologies including SONET/SDH, IP, Multi Protocol Label Switching (MPLS), ATM, and Frame Relay. The solutions also combine a broad range of access capabilities to satisfy specific applications. These include Ethernet over SONET, SDH, WDM, fiber, DSL and the latest addition of Ethernet over copper technology that provides Ethernet service access to business customers without optical connections. Enabled service offerings can range from simple point-to-point E-Line connectivity such as Ethernet Private Lines to more complex, multipoint E-LAN services like Ethernet Virtual Private LANs that span enterprise-wide.

Leverage the simplicity and economics of Ethernet

Its dominance in enterprise LANs, implementation simplicity, relatively inexpensive components, and widely known familiarity makes Ethernet the compelling interface to enterprises. Next-generation multi-service access and core networks that leverage these qualities – while offering flexible service delivery and efficient traffic transport – can maintain a cost-effective competitive edge. Innovations such as Virtual LAN (VLAN) and Virtual Private LAN Service (VPLS) and MPLS enable additional reliability, availability, and scalability not inherent in Ethernet technology. Converged Ethernet Transport solutions support these capabilities in Metropolis® SONET/SDH (via Lucent's TransLAN® technology) and WDM platforms, Ethernet switches/routers, and IP/MPLS routers. There's a solution suited for each network's underlying application requirements and existing infrastructure.

Provide Quality of Service, scale, and reliability to Ethernet services

To help improve the profitability of Ethernet and enable new premium Ethernet services, carriers must deliver these services while maintaining underlying Service Level Agreements (SLAs). An end-to-end carrier-grade network is required to uphold the level of QoS, reliability and availability. Lucent's Network & Service Management OSS software offers integrated end-to-end solutions for service assurance, service quality, SLA and IP management. Our pre-integrated and tested solutions enable carrier-grade Ethernet services over a converged network. These solutions leverage multiple protection mechanisms and restoration options to increase the reliability and availability of Ethernet services and provide for differentiated SLAs.

Lucent Converged Ethernet Transport solutions help carriers make a smooth transition to offering premium Ethernet-enabled voice, data and video services. Enterprises benefit from the ability to support bandwidth-intensive, on-demand applications on a consolidated yet highly flexible and secure network.

--David Brown

» For more information, including brochures and a success story, please visit **www.lucent.com/cets**



Stefan Wieacker,
Head of Product Marketing
ClearChannel

T Systems

Ethernet Networking with Copper Technology

» Deutsche Telekom AG: Attractive entry to Ethernet-based site networking

In most countries worldwide, the connection to "the last mile" still relies on copper-based wireline networks. Now the technical requirements are in place to allow subscribers in these networks to leverage the potential of fiber-optic networks - and what is more, in full compliance with the Ethernet-over-SDH standard. This will open up substantial markets for service providers. Deutsche Telekom will be exploiting this opportunity starting mid-2005. To do this, Deutsche Telekom will be using a copper-based technology developed by Lucent, with whom it has a framework agreement, that allows customers without fiber-optic connections to use Ethernet services with a bandwidth from 4 to 10 Mbit/s.

LUX talked about this with Stefan Wieacker, head of Product Marketing ClearChannel at Deutsche Telekom.

LUX: Why is the use of Ethernet-over-copper so interesting for Deutsche Telekom?

Wieacker: Many customers will continue to depend on the copper network for a long time to come, simply because laying fiber-optic cables is expensive and must be worthwhile. However, even those subscribers that are situated away from large built-up areas – in particular organizations and companies – would in many cases love to have access to higher transmission speeds. This is what we are now able to offer. Moreover, this intermediate step also represents a more gentle transition to purely fiber-optic technology – for customers as well as for network operators.

LUX: Which services based on this technology will you be offering?

Wieacker: We will be enabling our customers to link up their locations on a plug-and-play basis. What we call "EthernetConnect" will offer scalable data transfer tailored to meet the customer's requirements between LANs at geographically dispersed locations, with a throughput of under ten megabits up to one gigabit per second. EthernetConnect will be able to provide copper-network subscribers with approximately ten megabits per second. When the customers later change to fiber-optic connections, this migration will be perfectly seamless.

LUX: Ten megabits per second – how is this transmitted over copper cables?

Wieacker: We can now equip the Lucent SDH multiplexers that we have deployed in our optical transport network with SHDSL plug-in cards. These cards form the interface between the fiber-optic infrastructure and the copper one. SHDSL achieves a throughput of approximately two megabits per second per copper wire pair. This means that a multiplexer equipped with the SHDSL card reaches the rate of ten megabits by multiplexing the signals of multiple copper wire pairs.

LUX: What, in your view as a network provider, are the key advantages of this solution?

Wieacker: There are numerous advantages. When it comes to the provisioning of Ethernet services, Deutsche Telekom now has more options than it did in the past. Furthermore, it increases the number of potential Ethernet customers considerably; and with each copper-network subscriber that opts for EthernetConnect we improve the utilization of our copper infrastructure. In addition, we should not forget that the necessary hardware does not need to be installed until a customer has signed up. This takes the guesswork out of investing. As you can see, we are expecting a host of advantages from this Lucent innovation.

LUX: Network management is a crucial factor for smooth network operation. What concept does Deutsche Telekom have for this?

Wieacker: The new Ethernet service builds on our existing SDH infrastructure, so we can readily integrate this new service into the associated proven end-to-end OSS management solution. This ensures efficient network operation.

Bell Canada reaches Consumer Mass Market with Triple-Play Services

» Lucent DSL Solutions at work at Bell Canada



The challenge: Rapidly deploy triple-play services to combat encroaching competition from cable

Headquartered in Montreal and listed on stock exchanges in Canada, the United States, and Europe, Bell Canada is Canada's largest communications company and boasts one of the broadest communication portfolios in North America. As of December 2004, Bell Canada offered local and long distance voice services, wireless and wireline data, high-speed Internet access, IP broadband services, e-business solutions, and direct-to-home satellite and Very High Density Digital Subscriber Line (VDSL) television services to more than 27 million residential and business customers across Canada.

The innovative service defense

Competitive pressures on Bell Canada intensified over the past year, as one cable company after another announced plans to add voice to their high-speed data and video service bundles in 2005. To protect its customer base, Bell Canada needed to develop its own triple-play service offering – and fast.

Bell Canada already offered satellite TV services to consumers in rural areas and bundled voice and high-speed data services over Asymmetric DSL (ADSL) to consumers in Toronto and Montreal. The solution seemed obvious: extend the existing satellite TV service into Toronto and Montreal and use it to create integrated triple-play services.

Extending triple-play services to urban customers

But there were complications. Building owners objected to the number of rooftop dishes that would be required in densely populated neighborhoods – limiting how far Bell Canada could extend its satellite TV services into Canada's urban centers. Bell Canada could leverage its satellite TV content to offer triple-play services over VDSL to customers in multi-family apartment and condominium buildings but had nothing to offer urban dwellers in single-family homes.

In addition, although Bell Canada's ADSL network could easily support its voice and high-speed data services, it could not scale to provide the minimum 5 Mbps of bandwidth per household that it needed to add IP video services. A pure fiber network would provide ample bandwidth, but replacing their existing copper access network with a fiber to the home (FTTH) solution would be prohibitively expensive. Instead, Bell Canada wanted a hybrid fiber to the node (FTTN) architecture that uses high-speed fiber lines to bring bundled voice, video, and data services closer to the consumer and leverages the existing copper access network to transport those services through the last kilometer using either VDSL or ADSL2+, a next-generation ADSL standard that provides much higher data rates to support broadband video services.

Working with Lucent to implement the solution

Bell Canada wanted one partner who could provide both the equipment and the networking expertise to address all of the hardware development, network engineering, and service design issues the FTTN deployment would pose. Lucent was the only provider who offered Bell Canada the complete picture:

- Consultation and design support to develop an FTTN network architecture capable of supporting triple-play services
- A cost-effective method for distributing power from a centralized location to the field units in the neighborhood nodes
- A compact, high-density ADSL2+ capable switch that could be mounted on Bell Canada's existing poles, Jumper Wire Interfaces (JWI)/Outside Plant Interfaces (OPI), and pedestals
- Customized installation procedures and training to speed deployment of the new Lucent Stinger® Compact Remote (CR) switches
- Quality assurance testing and integration expertise to ensure that the new equipment interoperated seamlessly with Bell Canada's existing hardware, multi-vendor networking environment, and Operational Support System (OSS) software

Bell Canada and Lucent implemented the new FTTN network in two stages. In Phase 1, the pair worked to rapidly expand the existing ADSL network into an FTTN architecture that Bell Canada could use to offer ubiquitous voice and high-speed data services throughout the Montreal and Toronto metropolitan areas. In Phase 2, the partners integrated the new technologies required to add support for IPTV services.

Phase 1: Expand the network to provide ubiquitous ADSL coverage

Although Bell Canada offered ADSL service to most of Toronto and Montreal, there were still neighborhoods where broadband voice and data services were not yet available. The partners' first job, therefore, was to design and deploy an FTTN network that would plug those gaps by bringing DSL services within 1 to 1.5 km of every customer in the Montreal and Toronto metro areas. To do this, Bell Canada required three things:

- A compact, high-density switch that could be mounted onto existing neighborhood copper cross-connect cabinets to support DSL
- A cost-effective means to power the equipment in those nodes
- A rapid installation and activation process for the new equipment



Grooming the Lucent Stinger® CR for its Bell Canada debut

Lucent worked with Bell Canada to tailor its Stinger® CR switch to meet Bell Canada's network and service requirements. Lucent and Bell Canada tested the proposed solution in Lucent's lab to verify that the Stinger® CR would interoperate with Bell Canada's preferred DSL modem. In the end, Lucent worked with Bell Canada to equip each Stinger® CR switch to serve up to 144 customers, emit zero noise, and bolt onto the existing cross-connect cabinets in multiple physical configurations without affecting the integrity of those cabinets in any way.

Phase 2: Integrate new technologies to support video services

Next, Bell Canada and Lucent evolved the FTTN implementation to support video services. The IPTV service pulls its video content from Bell Canada's existing satellite TV network and transmits it through a fiber optic core to the Lucent Stinger FS+ DSL Access Multiplexers (DSLAMs) in Bell Canada's central offices. The Stinger FS+ then transmits the video content over direct fiber connections to the smaller Stinger® CR switches at the neighborhood cross-connect cabinets for delivery to individual consumers using ADSL2+. To maintain a consistent look and feel across their entire video portfolio – regardless of the mechanism used to deliver those services into the home – Bell Canada needed a standards-based IPTV solution that integrated seamlessly with its existing satellite TV service and multi-vendor networking environment. The Lucent Stinger® CR switch offered the standards-based IP, ATM, and Ethernet support Bell Canada required.

Streamlining the installation and activation process

To meet its service targets, Bell Canada had to install 400 Stinger® CR units in just six months in Phase 1 and more than 2000 units over the course of 12 months in Phase 2. These aggressive goals made it essential for Lucent to minimize the number of truck rolls and configuration time required to install each Stinger® CR field unit. In the end, Bell Canada technicians could complete the physical installation of each new Stinger® CR switch in one day using very few tools – and without a laptop.

Lucent also worked in conjunction with CGI, Bell Canada's OSS software developer, to integrate the NavisAccess™ DSL Element Management System with Bell Canada's existing OSS. Specifically, the team worked to integrate NavisAccess™ with Nortel Networks Access Care, which Bell Canada uses for loop testing, and the Spirent MetaSolv Flowthrough Test Request Gateway, which Bell Canada uses to test its fault and provisioning management systems. Today, Bell Canada's network operations center (NOC) personnel can remotely activate new units within a few hours of the physical installation.

The bottom line

More traditional approaches to deploying triple-play services would have required Bell Canada to install a concrete base, batteries, and a bigger cabinet at each neighborhood node. By devising a new remote powering scheme and the Stinger CR switch that can be mounted onto existing cabinets, Lucent cut Bell Canada's deployment costs in half. In addition, Lucent offers Bell Canada:

- An element management system, which integrated into Bell Canada's existing multi-vendor OSS to streamline service provisioning and reduce operating costs
- The ability to leverage their existing outside plant technology for a new application
- Highly reliable DSLAMs with the highest port densities in the industry – supporting up to 72 ports per LIM card and providing 48-port low power cards for remote applications
- The ability to upgrade the cards on those DSLAMs to deploy next-generation technologies, such as VDSL2, fiber to the premises (FTTP), and passive optical networking (PON)

Bell Canada signed its first customer in June 2004 – after only nine months of working with Lucent. By December 2004, Bell Canada had 400 Stinger® CR switches delivering services to more than 160,000 homes. Bell Canada expects that it will be able to deliver triple-play services to more than 1 million customers by the end of 2005.



"We built a true partnership with Lucent, in which Lucent was just as dedicated to a successful service roll-out as we were. The two teams worked together to meet our extremely aggressive deployment targets. I am convinced that if we had not been able to take a truly transparent approach with Lucent, we would not have been successful."

Jean Huppé, Director of Access Network Technology Development for Bell Canada



Advanced Mobile Access Technologies

In Lucent's surveys of corporate mobile users, they routinely cite always-on, continuous coverage as a top need for data service to provide satisfactory performance. These surveys have indicated the following:

- The majority of mobile users are away from the office more than half of the time
- They go places that will not have predictable access to a wireless LAN
- The type of access mechanism is not important, rather the speed, security and ease of connection
- Hotspot data usage is accelerating with average BT UK hotspot user downloads 120Mb per month
- Fixed Broadband penetration drives mobile data usage
  - Korea, Japan, and the USA all have high broadband penetration and high demand for mobile data. Europe is next in line and a measure of this can be seen by the growth in, and speed of, DSL services in the UK
- Even basic data services grew rapidly
  - Color handsets and GPRS drove UK WAP impressions in the last years
  - SMS use is still increasing dramatically



"With Lucent's help, we launched Romania's first wireless broadband Internet service. Zapp clients benefit from advanced 3G services due to the EV-DO technology, which has been implemented in our network with the full support of Lucent, a traditional partner, which proved excellent EV-DO expertise. Following the EV-DO upgrade, we positioned Zapp among the best providers for wireless broadband Internet connectivity."

Victor Stan,
CTO and Vice-President
Zapp

Growing acceptance for wireless LAN systems, both in the office and in homes, has spurred a new market for public 802.11 or WiFi access points. Subscribers gain access from places such as hotels, airports, cafes, and other popular sites by either signing up for service on the spot, or subscribing to the service through their mobile service provider. However, it is yet to be seen whether these public hotspots will make a profit, or if smaller hotspot owners will accept them as a loss leader.

802.11 meets some but not all of the criteria for high-speed data access away from the office. While public hot spots may offer a convenient, high-speed service to compete with 3G in certain instances (like hotels or airports), business travellers, most field sales and service workers will fail to be satisfied by the other limitations of the service, such as coverage and mobility.

This is partly because 802.11 is not an appropriate technology for wide area deployments. The technology is designed for low power transmission, with distances less than 1000 feet from the access point. While the cost of access points themselves may be low, the associated deployment, operation, and maintenance costs of a wide area deployment for public access would be prohibitive. This is where WiMAX or 802.16, believed by Lucent to be complementary to 3G, comes into the field of play. Figure 1 looks at some of the core differences in 802.11 and 802.16 technologies.

The technical specifications of 802.16 allow it to provide high-speed data services to large areas. Coverage is roughly similar to 3G technologies with variation due to morphology (rural and urban). In rural areas coverage is about 3-5km, however up to 30km is possible with 'point-to-point' antennas and no clutter. The main challenge with 802.16 is in-building penetration, as service severely degrades as you pass through building structures (see Fig. 2).

In talking to operators across the globe we see potential to offer 802.16 services with other access mechanisms such as High Speed Downlink Packet Access (HSDPA), CDMA2000 1xEV-DO and wireline infrastructure, to deliver true converged services to users, regardless of access technology, geography or device. It is in these converged solutions, equipment, network integration and operator Business Cases that Lucent Technologies has excellent expertise.

Lucent was one of the first infrastructure vendors in the telecom industry to offer seamless handoff between disparate data networks. Our high-speed data (HSD) offer includes the components necessary to enable handoffs from 802.11 networks, to and from 3G networks (CDMA and UMTS). The same

Fig. 1:

IEEE 802.11 b/a/g versions
(for wireless in-building LAN's)

- Wireless LAN access. Operation in 20 MHz channels in 2.4 and 5GHz unlicensed bands
- Spread Spectrum (11b) and OFDM technologies (11a/g)
- Good performance indoors as a "last 30 meters" solution
- Integration offers with CDMA2000 and UMTS

IEEE 802.16 a/d/e
(for wireless Point-to-Multipoint MAN's)

- Fixed-Wireless technology for metropolitan access provision for residential and business buildings
- Covers licensed and unlicensed spectrum in the bands <11GHz and 10-66GHz
- Several channel bandwidths ("modes") from 1.25MHz to 20MHz
- Supports data and video streams
- 802.16e is attempting to add mobility at moderate vehicular speeds. Operation targeted for 2-6GHz licensed and unlicensed bands



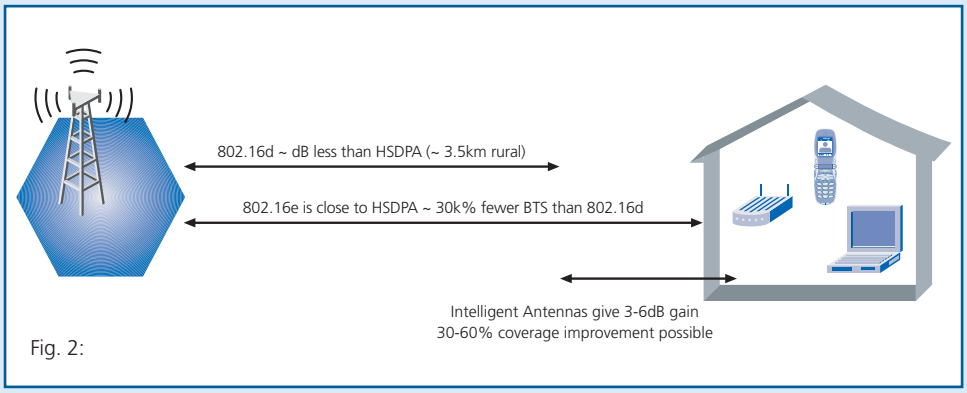


Fig. 2:

technology could be applied to enable handoffs between CDMA networks and 802.16d networks.

This would greatly assist the business community, who have been seen by Lucent as being the driving force in the uptake of 3G services. The HSD messages, put out over 3 years ago now, are still valid, if not more so with the introduction of Lucent's IMS core network architecture. The attraction for a business in accessing the intelligence in the mobile network is significant, and the Lucent Market Advantage Program extended into the Business-to-Consumer (B2C) environment. The findings and service scenarios have been taken up with interest by different sectors in the business community.

CDMA2000 1xEV-DO wireless technology, a 3G standard, currently offers speeds of up to 2.4Mbps peak rate, with average carrier throughput of 600–800kbps. This technology is designed for wide area deployments in licensed spectrum bands, from the cost effective 450-band with its large coverage areas to the more widely used 2100-band where the increased capabilities of terminals are evident. While UMTS, which is also designed for wide area deployments in licensed spectrum bands, will initially offer data rates of 384kbps, its potential speed is expected to increase significantly over the next few years with advances in technology such as HSDPA. From a cost effective standpoint, these technologies improve the ROI for an operator whilst meeting the business or end user requirements for service capabilities.

Our contribution to HSDPA and the development of 3GPP Release 5 and 6 standards is a clear demonstration of the direction that Lucent Technologies is taking to address the most important future needs of UMTS operators. The concepts underlying HSDPA and E-DCH (Enhanced Dedicated Channel) that originate from Bell Labs are attracting attention from operators worldwide. These technologies will lead to the introduction of new higher data rate services and a more efficient spectrum utilisation.

With peak throughput of 14.4Mbps per 5MHz carrier-sector and total aggregate throughput of up to 3.6Mbps, HSDPA will deliver a four-fold increase versus UMTS in capacity, while reducing round-trip time between the network and the terminal. HSDPA is a critical first step in enhancing W-CDMA network performance. However, plans are already in place to push the technology further. E-DCH, an up-link improvement solution and throughput increases through multiple-input, multiple-output (MIMO) technologies will be the next two major features of 3GPP's release 6 and 7 specifications. Operators, and the investment community, know that for the UMTS business model to work, mobile data take-up has to grow exponentially. However, the operators must ensure they can adequately support their new service portfolios with minimal capital expenditure. The commercial significance of the HSDPA/E-DCH - as well as CDMA2000 1xEV-DO - advantage should not be underestimated, as this is a technology that will lead to the cost-effective delivery of the most advanced data services and significantly improved network capacity.



Such demands mean that in the very near future, operators will need wireless networks that offer advanced quality of service capabilities and data speeds that rival those delivered by cable modem and DSL service providers. The emerging service environment will be one in which capacity can never be taken for granted, and the benefits of an advanced core network in directing traffic over multiple bearer mechanisms, where and when possible, will be reflected in the perceived quality of the operator's network by the end user. A seamless, uninterrupted personalized data stream, regardless of where they are, or what device they are using, is surely the panacea businesses and individuals want. Here at Lucent, we are well on our way to making this happen. *--Richard Jepson*

» www.lucent.com/3g

CDMA2000 is a registered trademark of the Telecommunications Industry Association (TIA-USA).

Lucent Technologies integrates WiMAX technology, based on the IEEE's 802.16 standard, through Alvarion's BreezeMAX™ product line into its Accelerate™ Next Generation Communications Solutions portfolio, which includes Lucent's industry-leading IP Multimedia Subsystem (IMS) solution.

Lucent will team with Alvarion to deliver a converged networking solution to service providers that includes the seamless interoperability of WiMAX, third-generation (3G) mobile (CDMA2000® and W-CDMA/UMTS), WiFi, and wireline networks. The partnership between Lucent Technologies and Alvarion is unique in the market due to its joint development program on Alvarion's WiMAX equipment.

Both companies are members of the WiMAX Forum™, an industry-led organization that facilitates the compatibility and certification of broadband wireless access equipment, with Alvarion holding several prominent positions on the board.

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USA
Tel. +1 908 582 8500

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Dirk Kolassa, e-mail: kolassa@lucent.com

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Lucent Technologies
Corporate Headquarters
600 Mountain Ave.
Murray Hill, NJ 07974
USA
Tel. +1 908 582 8500
www.lucent.com

Lucent Technologies
NS UK Ltd.
Nations House
103 Wigmore Street
London W1U 1QS
United Kingdom
Tel. +44 207 318 1030
www.lucent.co.uk

Lucent Technologies Belgium
Alfons Gossetlaan 54
1702 Groot-Bijgaarden
Belgium
Tel. +32 2 467 89 10
www.lucent.be

Lucent Technologies
Espana S.A.
Avenida De Bruselas 8
Alcobendas 28108
Spain
Tel. +34 91 7148400
www.lucent.es

Lucent Technologies
Network Systems GmbH
Brühler Straße 9
53119 Bonn
Germany
Tel. +49 228 2430
www.lucent.de

Lucent Technologies
France S.A.
16 Avenue Descartes
Le Plessis Robinson
Cedex 92352
France
Tel. +33 141 28 7000
www.lucent.fr

Lucent Technologies Italy
Via Tucidide 56 Torre 1
20134 Milan
Italy
Tel. +39 02 75290.1
www.lucent.it

Lucent Technologies
Nederland B.V.
Larenseweg 50
Postbus 1168
1200 BD Hilversum
The Netherlands
Tel. +31 35 687 3111
www.lucent.nl

Lucent Technologies
Poland Sp. z o.o. - Sp. jawna
Ul. Senatorska 27
Warsaw
Poland
Tel. +48 22 692 3600
www.lucent.com.pl

Lucent Technologies
Abu Dhabi, UAE
P. O. Box 44770
CERT Technology Park
Muroor Road
Abu Dhabi
Tel. +971 2 407 9400
www.lucent.com.sa

Lucent Technologies Egypt
124 Othman bin Affan Street
Heliopolis
Cairo
Tel. +20 2 648 0400
www.lucent.com.sa

Lucent Technologies
Saudi Arabia
P. O. Box 4945
Post Code 11412
Khurais Road, Naseem District
Riyadh
Tel. +966 1 239 7000
www.lucent.com.sa



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