Aim higher...

Create Value over IP



The Lucent Technologies IP multimedia solution gives networks a competitive edge in providing the rich, seamless services that draw – and keep – subscribers

Voice over IP is back on the business pages, with ILECs and independent providers announcing plans to offer the service in some of the largest metropolitan markets. Even in cases where the VoIP offering risks cannibalizing switched phone revenues, it's thought that there are incremental gains to be made from packetized voice, particularly among business customers. And in an atmosphere of falling voice-minutes and market saturation, providers can't afford to overlook any opportunity to lock in subscribers.

But adding VoIP to a service portfolio will not be enough to defend a service provider's customer

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base or average revenue per user (ARPU). As a standalone offering, IP voice service will become quickly commoditized, just as long distance service has become; and as customers churn to the cheapest provider, VoIP's value as a competitive differentiator will be neutralized.

Far better to add value to voice over IP by making it part of a larger convergence of media and access modes, allowing service providers to roll out the kind of customized, convenient advanced services that segments of their markets are asking for today. These truly sticky services are the surest and ultimately the most cost-effective way for service providers of all sizes to cut churn, maintain ARPU, and steal market share from their competitors.

IP Convergence has been planned, plotted and prematurely celebrated for years. But several criteria have come together to make the time right for the "Value over IP" strategy of offering highly personalized services to all points of the telecom compass. For one, consumers are now accustomed to broadband and to the enriched experience of communications enhanced with sound, pictures or video. Key IETF protocols such as SIP, Parlay and RTP have coalesced into building blocks for a robust multimedia network. Also, the installed communications base now has embedded a critical mass of intelligence both in the networks and in the endpoints: the smart phones, NIC-equipped laptops and Internet PDAs. Finally, regulators have begun taking down some of the barriers that hindered convergence, for example permitting ILECs to merge their local and long-haul networks and offer long distance voice.

These factors have given rise to a renewed interest in putting disparate parts of the communications puzzle together: wireline and wireless services; switched and IP networks; voice and other media; and access modes of all types. Service providers who can generate the right combinations of these services for their markets, bundle them properly, and deploy them ahead of the competition stand the best chance of earning customer loyalty and revenue growth in the converged future.

The IMS Architecture: Centralized to the Core

The problem is that neither the traditional switched network nor its current IP version are designed to roll out highly integrated, deeply customized services quickly or cost-effectively. Providers who want to take advantage of the opportunity by adding value to IP voice need to look for a new kind of service-enabled architecture. Lucent Technologies has exactly the new design they're seeking in its IP Multimedia Subsystem (IMS).

IMS is based on IP core networking standards that have been developed by the 3G Partnership Project (3GPP) and 3GPP2, industry bodies that are responsible for the establishment of standards for 3G networks.

The Lucent implementation of IMS architecture is founded on four principles:

- An open-standards interface allowing plug-and-play integration of any number of applications.
- A common session control element through which all application servers can signal. This allows full convergence of services over a number of access modes – blending instant messaging with unified communications and VoIP, for example.
- A centralized subscriber database that locates all customer profile data in one spot. This concept, similar to the home location registries (HLRs) of the wireless world, makes both service rollout and ongoing administration manageable and scalable.
- A set of completely access-agnostic interfaces down into the access network, so that these converged services can be adapted to any device the end-user chooses and delivered with consistency.

"IMS embodies these key attributes and thus supports a level of convergence that no one has been able to do to date," says Tom Anderson, director for IMS in Lucent's chief technology office. "We're excited about IMS' ability to really deliver the convergence that people have only talked about until now."

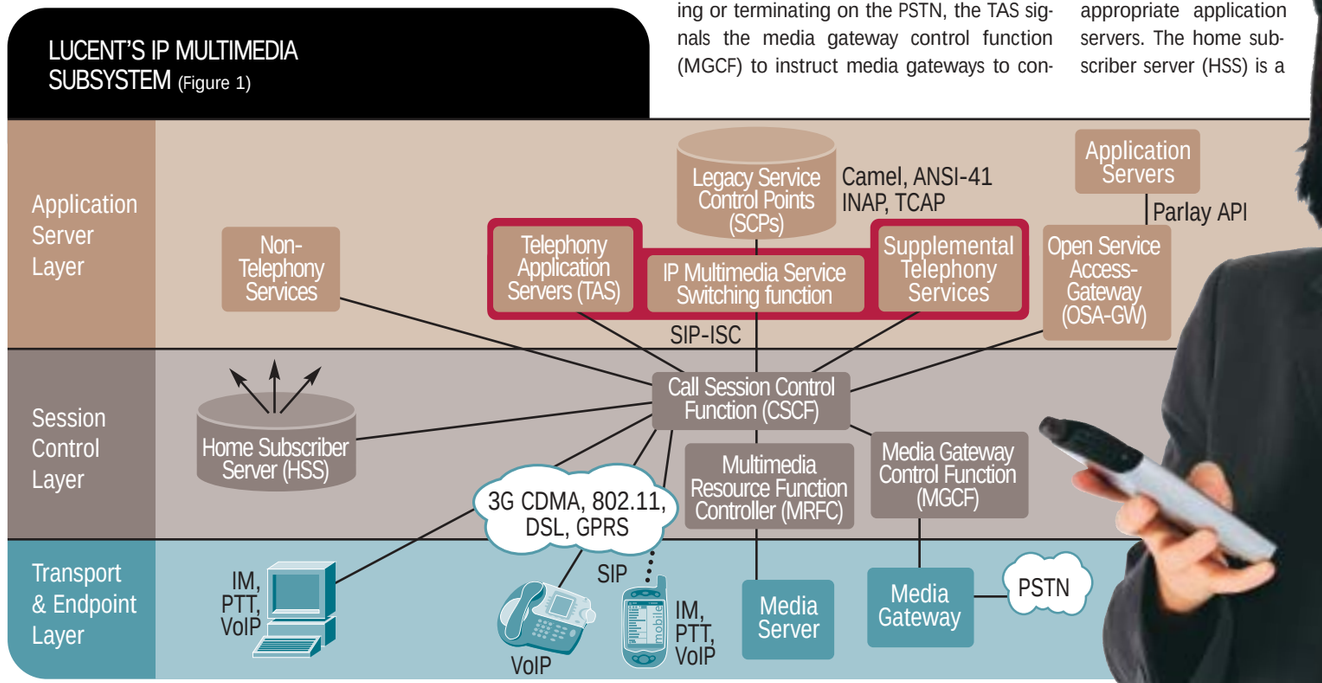
Lucent's IMS implementation breaks down into three main component layers (Fig 1.). At the top is the application level, supporting a wide variety of telephony and non-telephony network application servers. Consumers can access these directly through a Web portal to enable and disable whatever services they choose. The telephony application server (TAS) contains the service logic that provides the basic call processing services and invokes the media servers to provide the appropriate progress tones and announcements. For calls originating or terminating on the PSTN, the TAS signals the media gateway control function (MGCF) to instruct media gateways to convert the TDM voice stream to IP and direct it to the proper IP phone address. Multiple TASs can provide features to specific endpoints: for example, one might provide IP Centrex features (private dialing plans, shared directory features, automatic call distribution) while another could support PBXs and provide advanced VPN services.

Still in the application layer, the IP multimedia service switching function provides functions to IP phones supported by IMS such as calling name services, 1-800 numbers, local number portability and one-number dialing. Operators can add supplemental application servers that can provide additional call-based services, such as click to dial or to conference, voice mail, and prepaid billing and call blocking.

Other SIP-based servers at this level can provide non-telephony services such as IM, push-to-talk, and presence-enabled services. The ability to integrate these services into the IMS architecture allows providers to blend voice and non-voice services into attractive and marketable bundles across multiple access modes: for example, a converged click-to-contact buddy list that displays the end-user's presence and availability, or a pre-paid account for both telephony and video on demand. An open services access gateway lets providers permit enterprise customers to add their own customized communications services using a Parlay API.

Below the Lucent IMS application layer is the call session control function (CSCF), which registers the network's endpoints and routes SIP signaling messages to the appropriate application servers. The home subscriber server (HSS) is a

LUCENT'S IP MULTIMEDIA SUBSYSTEM (Figure 1)





Partnering with best-of-breed IP developers

Convergence is as good for vendors as it is for providers, and Lucent has partnered with some of the best-in-class OEMs and software developers to assemble VoIP and multimedia solutions that are telco-grade robust but flexible and easy to sell and manage.

For example, Lucent Technologies has integrated the popular BroadSoft® BroadWorks® communications platform with the Lucent Accelerate™ VoIP portfolio, allowing service providers to offer enterprise users a full menu of IP Centrex, Hosted PBX and voice VPN services that deliver value over IP.

"We wanted to partner with Lucent as a world-class provider of infrastructure solutions," says Scott Wharton, BroadSoft marketing vice president. "Then we focus on making existing applications work better than they do already, and adding value to new apps by integrating them into single solutions."



BroadWorks' hosted PBX capability allows providers to extend network-based IP PBX services to every corner of an enterprise. Enterprises can now spread the same feature sets to branch offices that the home office enjoys without the expense of training IT personnel. And providers get to sell service suites rather than just connectivity, enabling more successful market penetration than with traditional Centrex.

BROADSOFT®

– Scott Wharton, BroadSoft marketing vice president

The BroadWorks platform also adds value by integrating voice, video and data in its collaboration and messaging features, and offers the same applications over both wireline and wireless access. "Carriers can brand by offering the same features to end-users over both modes–a tremendous competitive advantage," says Wharton. Provider Choice One Communications is currently trialing a Lucent Accelerate™ VoIP Solution that includes the BroadWorks Platform and the Lucent Softswitch.

"BroadSoft adds a world-class feature server capability to Lucent's existing deep assets," says Lee Brandes, vice president of Lucent's convergence solutions group. "Carriers receive a complete turnkey solution from Lucent, solving all their problems from engineering and installation to after-sale market support. BroadSoft is one of a select list of third-party developers chosen to provide the right applications to run over optimized Lucent VoIP infrastructure."

global resource used by both this layer and by application layer components to determine which of its services are applicable. It maintains the unique service profile for each end user, including IP address, roaming information, buddy lists, calling service subscriptions, and voice mail options.

Finally, the transport and endpoint layer sets up sessions through SIP signaling and provides bearer services such as packetizing analog voice. This layer provides media gateways for converting VoIP bearer streams to TDM. A pool of media servers supports functions such as conferencing, announcements, speech recognition, and collecting digits across a range of applications including voice mail, advanced 800 numbers, and interactive VXML.

Lucent's IMS is the next step in the evolution of the network. Anderson points out that the TDM infrastructure was designed around call processing software optimized for a 64-kilobit communications paradigm, which permitted VoIP but not advanced multimedia services. Softswitches separated call processing from the switches and gateways and distributed that function around the data network; but they did not re-architect call processing or session control to enable new services. As a result, operators began to view them as simply a means to manage the PSTN interface and began adding feature servers, most of which still communicated directly to gateways and endpoints, resulting in an even more vertical infrastructure with little interworking.

"Lucent's IMS blows these old architectures apart," Anderson says. "Now providers can implement an architecture that's designed to support new and exciting converged services from the start, not as an add-in capability such as AIN (advanced intelligent networking) was. This is AIN on steroids. Instead of having one feature server talking to everything, Lucent's IMS supports a variety of application servers. IMS employs a common CSCF to interwork all of these applications, with a common database for customer specific data that the application servers and CSCF can access".

Softswitches can still play a part in the Lucent IMS design as interfaces to the PSTN. In fact, IMS has been architected purposely to make the most of a provider's legacy TDM infrastructure. For example, a SIP-based packet interface on the trunk side of a TDM switch will allow the lines on that switch to be controlled on a per-line basis as if they were SIP access devices. This would allow easy migration of individual lines onto the new infrastructure -- for example, to service an enterprise requiring multimedia conferencing or messaging -- while letting others remain on the TDM network.

Apart from the services it enables, Lucent's IMS architecture itself offers providers multiple opportunities for competitive differentiation and new revenue streams. With IMS, providers can more easily wholesale services to ASPs. Small wireline providers seeking to add national wireless access to their product offerings can interwork more cleanly and tightly with potential wireless partners using IMS. Calls from a visited network come into a proxy CSCF and are routed to the CSCF in the home network, so the end-user experiences service transparency even when roaming. And customers' wireline phones can "roam" onto the wireless network to access the same service sets at home that they get when mobile. ●

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A New Spin on the New Convergence



– Patricia Russo, chairman and CEO of Lucent Technologies

Convergence has been long on vision but short on market delivery. Until now, that is, because times are changing -- and fast.

Today that vision has collided with market realities, perhaps not the way we expected, but convergence is now beginning to deliver real benefits to the market. We're in the early phase of this new era, but we can already see what's evolving – the creation of a richer, more spontaneous and easier to manage communications experience for the end user.

Enterprises and consumers are continually seeking offerings to enhance and more easily manage their communications "experience." Network technologies, and expertise in rapidly deploying them, are creating the capability to deliver exactly the kind of experiences users want. Service providers are bringing to the market innovative new bundled and blended voice, video and data services to meet these insatiable demands.

Communications used to be about bringing people to the network. Now it's about bringing the network to people 24 hours a day. They want access at home, work and even when they are "off line." They are demanding access to communications services from a wide range of locations over an ever-increasing variety of devices – telephones, PCs, mobile phones and PDAs. People who used to make business and personal calls primarily from the office or home now make them from cars, grocery stores, shopping centers and other public places. One device now may have multiple utility. For example, cell phones are now used for e-mail and other Internet applications, including playing games.

But even that is not enough. People want these experiences to be richer and more integrated. They want to be able to take pictures and email them to family and friends as an instant postcard. They want to download songs and videos, then play them. They want to update their business contacts from their car or a park bench. They want a single way to sign on, a common set of contacts for every service and "access aware" information delivery. They want their unique service profile to find them, not just the particular device they use, wherever they are, day or night, in business life or on personal time.

And there are also things they don't want, such as spam and hackers. Privacy is becoming an increasingly important issue for end users, and Bell Labs scientists are responding. For example, Bell Labs researchers have developed a prototype "personal privacy shield" for managing mobile phone location information that lets users of devices such as cell phones precisely control how their communications is shared and with whom.

Finally, they do not want more complexity in their lives, especially when it comes to their communications experience. Even with the proliferation of all these new access devices, services and even networks they ride over, users want the communications to be simple, manageable, and non-intrusive in their lives. So, technology has to be facilitating not debilitating.

Just as end users are redefining the kind of communications experience they want, Lucent is redefining convergence as the way to help service providers deliver it. For Lucent, the vision of convergence starts with reducing the complexity. We are working hard to de-layer every aspect -- from design to supply to installation, management and service delivery. Our vision centers on products, services and software integrated across three layers of the network – the transport layer for end user access, the services control layer to manage the network, and an applications layer to rapidly deploy new services.

Continued on page 12

Building Bundles of IP Value



Lucent's IMS lets providers target exactly the right users with sticky bundles of the converged services they want now

So much for the IMS plumbing. Now, on to the payoff. What are the benefits of deploying an infrastructure that can link any application server to any end device anywhere, and deliver highly personalized features?

For end-users, it's the ability to communicate anywhere, in any form they choose; and that capability suits their needs today. Everything in the current communications environment – from camera phones and Wi-Fi hotspots to music downloads and online gaming -- has demonstrated to users the value of a rich, interactive communications experience, and they are ready to pay for features that will port those attributes to their everyday phone usage. Communication is rapidly evolving into a "lifestyle service" that makes daily business easier, more efficient and more enjoyable, and Lucent's IMS solution is a large stride along that evolutionary path.

That's good news for providers with the infrastructure to support such enhanced services. Because they are not easily replicable, these higher services lift an operator out of the low-margin table stakes game of selling 2.5G voice, where pricing is a race to the bottom and churn is an ever-expanding percentage. In this environment, services that allow a more complex com-

munication experience and reflect users' preferences by morphing content to suit context (home, car, office) and access (POTS phone, desktop, PDA, mobile phone) will exert a stronger retention on existing subscribers. ARPU will rise as providers move away from the fixed-cost business model of functions such as voice messaging to a usage-based rate for more fully featured multimedia services. In the best cases, such services will offer opportunities to poach market share from competitors – a considerable advantage in a market saturated with wireless and cable TV, where all players are now competing for the same consumer spend.

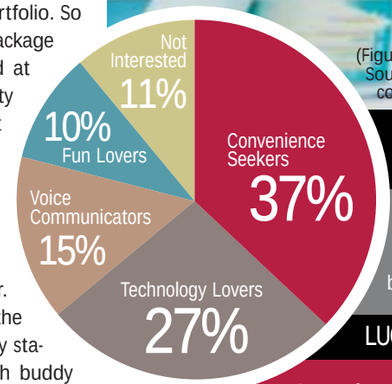
Proprietary market research conducted by Lucent finds that residential and enterprise subscribers are willing to pay now for the added value of the integrated services available with the IMS solution (Fig. 2.) Typically, these are services that add convenience, efficiency and ease to users' communications packages. Consumers want these services to be always on, and always available. And if their current provider doesn't offer them, respondents indicate a willingness to switch to a provider who does.

Providers will do best offering enhanced IP services after carefully micro-segmenting their markets. "Service providers must create the right bundles and target the correct market segments: large and small enterprises, teen markets, soccer moms, and others," says Jeff Cortley, Lucent director of mobility strategy and business development. "They must bring these services to market in the appropriate targeted fashion and create communities of interest around the services. In the professional segments, they can do this by starting with the more complex bundles including IP Centrex, portal applications, etc. On the consumer side, they can start with the simpler services and drive up the curve. For example, you can take a gaming application and add presence. Now the consumer can find other people who are connected to the network and want to play an interactive game. With IMS, we can take a service for which the market is already conditioned–gaming–and blend it with another service, presence, to add value."

According to market research conducted by Lucent, residential consumers are most interested in the services that increase convenience, security, time efficiency and control. Users want the ability to determine when they communicate and with whom, how they get alerted to specific events, when they can and cannot be reached, and in what mode. They also, of course, want to be entertained; entertainment content of all types will be an important value-add to any service portfolio. So one potential bundle is a family package that lets teens download music, and at the same time gives parents the ability to track those teens when they go out after dark.

Other value-added services include a portable concierge that will allow an end-user to locate a restaurant, book a table, find other friends in the area and send an invitation to dinner. An active phone book service offers the user presence, location and availability status on contacts, synchronization with buddy lists for IM, SMS and multimedia messaging, and a click-to-dial/message/conference function.





(Figure 2)
Source: Market research conducted by Lucent Technologies

MASS MARKET SEGMENTATION FOR ENHANCED FEATURES

Market research conducted by Lucent has found that substantial segments of the U.S. market express a willingness to sign up and pay for properly targeted bundles of features available over IMS.

LUCENT IP MULTIMEDIA SUBSYSTEM

Convenience Seekers:	• Simplify daily life and improve time management • 57 million US subscribers
Technology Lovers:	• Allow Internet use anytime anywhere • 42 million US subscribers
Voice Communicators:	• Improve voice-centric communications and keep in touch • 23 million US subscribers
Fun Lovers:	• Fun and entertainment are what life is all about • 16 million US subscribers

POTENTIAL MARKET SEGMENTATION BY SERVICE

Converged IP functions such as those listed below come with a hefty first-mover advantage: the provider who introduces them to a market will win (and hold) the customers most ready to buy.

Convenience Seekers:	• finding places • portable travel agent • home security • activity agent
Technology Lovers:	• finding places • video clip messaging • news, sports & leisure clips on demand • video clip alerts • home security
Voice Communicators:	• finding places • voice control • personal organizer
Fun Lovers:	• finding places • personal organizer • video clip messaging • news, sports & leisure clips on demand • gaming • portable travel agent

Delivering Value over IP:
High-Value Apps Make Service Provider's Business Case

PHONOM

VoIP start-up Phonom began selling VoIP calling in the Mid-Atlantic corridor in January 2004. And while it's the price of IP voice service that draws customers' attention, Phonom realizes that keeping their business means offering call features that deliver value over IP.

"IP voice can become a race to the bottom all too quickly," says Clint McDonald, Phonom IP telephony product manager. "That's just not how we want to compete. You have to look to the services to differentiate yourself. You don't want people changing providers as easily as they change the shell cases on their mobile phones."

For that reason, Phonom opted to build its services on a Lucent Accelerate™ VoIP platform integrated with the DSL network operated by Cavalier Telephone. Customers can choose to get both high-speed Internet and VoIP from Phonom, or they can bring their own DSL. If they buy from Phonom, the added measure of control allows the carrier to package dial-tone service with sticky features aimed at either residential or enterprise customers.

For businesses, that means offering IP Centrex as well as simple loop replacement, and selling bundles aimed specifically at "road warriors" and teleworkers. Highly mobile professionals can get a USB mobile handset with adapter that will allow them to dial in to their Centrex portal from any location and access the same feature set they get on their desktop phone. And remote workers whose employers buy Phonom Centrex service can buy voice service over their own local provider's broadband network for a special low price point–again, accessing the same valuable feature set available at the home office.

On the residential side, subscribers get a full suite of useful call management features: find me/ follow me services, click to dial, unified messaging, call logs and onscreen pop-ups for missed or waiting calls, and integration with the most popular address and calendar software, all available over any device they choose–standard POTS phone, mobile handset, desktop or laptop PC, or PDA.

Subscribers inevitably come to Phonom VoIP because of the potential savings, but they'll stay for the value, once these service features demonstrate how they can enhance the convenience and improve the productivity of IP calling. That will be important in the near future as not only other CLECs but also service providers and large cable providers prepare to offer IP calling in Phonom's market.

McDonald says, bring it on. "We're selling the product at a better price point, with more services and more features, at the same quality as traditional voice services," he says. "And we have a rich feature set that will lead customers to look beyond what they're saving to what they can now do over IP."

> "Integration of all different kinds of media goes a long way toward making collaboration easier within the enterprise."
>
> – **J.J. Lhospital,** vice president and general manager, Lucent messaging solutions

On the enterprise side, productivity improvement and increased mobility are the market drivers. "Everyone in business wants to communicate more efficiently, to collapse the number of profiles and personas of individuals being messaged," says J.J. Lhospital, vice president and general manager of Lucent messaging solutions. "The integration of all different kinds of media goes a long way toward making collaboration much easier within the enterprise." He offers the example of a "persistent collaboration" session in which two colleagues start conferring in IM, then opt to enrich the dialogue by moving to video IM. More people enter the discussion, so to reduce the static, the group moves via call control to real-time conferencing. Throughout those changes, all the e-mails, IMs and data generated during the discussion is available to the entire community of interest, who can review and refer to them as needed during the conference.

That's a powerful, flexible collaboration application that makes use of all the media options and all the intelligence built into the network. And while the persistence feature may appeal first to enterprises and most certainly will be useful to call center applications, it will eventually gain traction among families and other communities of interest, including clubs and church groups.

"We see IMS changing the whole business-to-consumer paradigm, as enterprises re-engineer their businesses around the technology," says Cortley. An entertainment company might use these services to market to consumers by sending vacationers planning a trip to one of its theme parks a PDA or cell phone preloaded with the theme park's URL, park restaurant information and a personalized itinerary. When users show up at the theme park, their location is tracked; they have pre-paid access to attractions and receive push alerts telling them that lines are short at a particular ride. When they end their stay, the devices are turned in and recycled to the next user.



"Customer relationship management will change as IMS technology becomes broadly adopted," Cortley says. "We see companies strategizing to create competitive advantage around its capabilities."

Apart from the pull of customer demand, advanced multimedia services over the IMS platform open up new opportunities for provider revenue streams from transactions and other ancillary functions. For example, a business traveler can register with either her service provider or online ticket broker to receive alerts when teams are playing near her location. The provider detects that she's in New York and sends her an SMS (with video clip) that Kansas City is playing that night in New York. She clicks to reserve a seat, but wants to speak with a representative and is instantly connected. While she's on the phone with a representative, she views an interactive seating chart to help her choose her seat.

"The service provider supplied value in terms of knowing where you are and your preference information, sent the alert and facilitated the transaction," Cortley says. "So they are now in a position to negotiate a referral fee on the basis of the value their network has provided." Other possibilities for incremental revenue range from microbilling for content, to tiered bandwidth and service levels, and premium anti-spamming and privacy control such as network-based firewalls.

Those incremental revenues are important, but they take a back seat to the power of Lucent's IMS architecture to draw and retain customers with a consistent set of highly enriched services made available wherever and however they want them. By leveraging intelligence in both the network and its device endpoints, IMS is able to serve end-users with communications that are at once highly customized and easy to use.

"The traditional paradigm is that the user has to come to the network," says Cortley. "With IMS, we say that we're bringing the network to the user, providing seamless mobility across all devices and delivering services that fit their preferences. That will allow service providers to increase retention, build ARPU by adding value, and take market share from competitors who lag at deploying these capabilities." ●

Bell Labs Maps the Future of Multimedia IP

Lucent Technologies' Bell Labs' contributions to future-forward communications are legend, earning it 30,000 patents to date, including one for VoIP QoS that was designated one of MIT Technology Review's "Killer Patents of 2003". But in addition to helping design SIP and other next-gen building blocks, Bell Labs is developing many of the enhanced applications those protocols enable.

"Running voice, data and video on a common infrastructure opens the opportunity to take services now available in the voice world and enrich them with multimedia," says Dr. Sudhir "Sid" Ahuja, Bell Labs' vice president for converged networks and services research. These include "push to show", allowing instant connection over any video-enabled device; automatic call reconnection; and a personal info digest that can push alerts relevant to the user's context (virus warnings when online, community meetings when at home.)

Carriers will have to accommodate these services from deep within their networks. For example, subscribers will occasionally want to block their locations. This should be done not as an add-on but from a centralized customer profile database, as Bell Lab's new Privacy–Conscious Personalization framework does.



– **Dr. Sudhir Ahuja,** vice president, Bell Labs converged networks and services research

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Customer profiles will also enable highly personalized Find Me/ Follow Me services, enabling customers to designate who can get through to them and over what devices and to set those policies on the fly via a Web interface.

Looking ahead, users will someday prove their identity over VoIP networks that use speech authentication: software that can guarantee that you are who you say by matching your spoken words to voice patterns in your profile. "That mechanism will allow us to do in the voice world transactions that can now be done over a secure Web connection, further converging the two," Ahuja says.

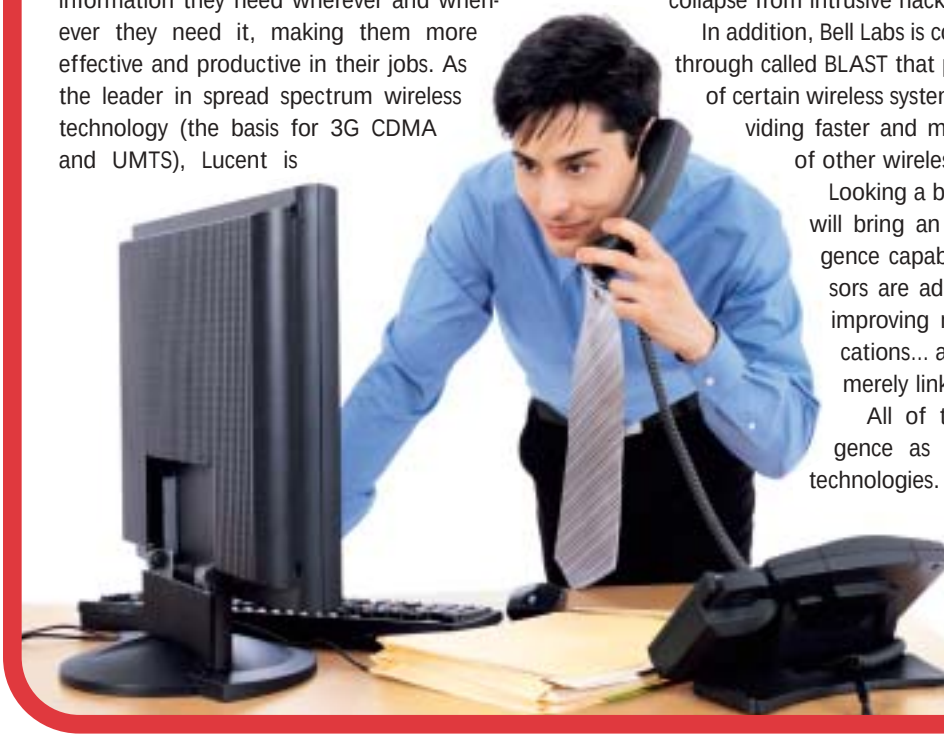
In all its initiatives at the protocol, infrastructure and application levels, Bell Labs' innovations help Lucent to expand the frontiers of what's possible in communications networks. "By working together with Lucent's business units, we enable them to make innovations happen in an aggressive way," Ahuja says. "We lead with research, and they make sure the products that reach the market are robust, well-differentiated and ultimately successful for providers."

Continued from page 5

One of the key building blocks in this vision is an open, access-agnostic network architecture, which includes a vital element, the Lucent Softswitch. Working in the services control layer, the Softswitch manages the network by separating call control from signaling using the SIP protocol. With that foundation, service providers will be able to deliver mobile voice and high-speed data, voice over IP, legacy voice services and even video service.

Similarly, people want the same high-speed access to information at home that they enjoy in the office, and they are willing to pay to receive it, as the growth of DSL and cable modems suggests.

The technologies and open systems architecture supporting the new convergence are already having an impact in the marketplace. For example, the rollout of next-generation mobile networks is creating the ability to deliver mobile high-speed data, enabling employees to get the information they need wherever and whenever they need it, making them more effective and productive in their jobs. As the leader in spread spectrum wireless technology (the basis for 3G CDMA and UMTS), Lucent is conducting next generation trials of high-speed data networks. In one of those trials, a UMTS pilot project, the service provider reported that UMTS can generate a significant boost in productivity – an increase of up to 13 percent per employee, or more than five working hours per employee each week.



Other next generation high speed wireless trials are underway in market segments such as insurance, finance, energy, professional services and manufacturing, where timeliness of information is crucial in generating revenues and containing costs.

The good news is that we have started building a convergent world of services and we're already looking to further refine it.

For example, Lucent's Bell Labs researchers continue to make progress in developing technologies in key areas such as security systems to ensure these networks don't collapse from intrusive hackers or unwanted spamming.

In addition, Bell Labs is continuing to refine a key breakthrough called BLAST that promises to boost the capacity of certain wireless systems by 10 to 20 times while providing faster and more cost-effective deployment of other wireless systems.

Looking a bit further out, nanotechnology will bring an entirely new class of convergence capabilities as tiny devices and sensors are added to networks and devices, improving machine-to-machine communications... and promising to go far beyond merely linking computers.

All of these trends redefine convergence as more than a confluence of technologies. In the end it's all about creating seamless communications experiences for the individual at home, at work or on the go. The new convergence is about each of us as individual users. ●

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