Mobile VoIP: IP Convergence Goes Mobile

The telecommunications industry is in the midst of the megatrend of IP (Internet Protocol) convergence, with the shift from circuit-based networks and system to IP packet-based networks being driven by the new rich service innovation opportunities and cost savings they offer. Every level of the value chain is evolving: fixed operators are looking to take advantage of reduced infrastructure and maintenance expenditure; mobile operators hope to accelerate fixed-mobile substitution by offering services previously available only from fixed lines; and enterprise and end users are eager to see the benefits of reduced call tariffs and the advanced services IP systems offer.

The most visible aspect of IP convergence is through Voice over IP (VoIP), a way to carry voice calls over an IP network by digitizing and packetizing them as data streams. Operators already use VoIP through IP trunking and the use of softswitches to reduce backhaul and transmission charges. In this scenario, traffic between telephony switches is routed over an IP network, in a manner transparent to end users. IP trunking is often used to reduce the cost of transmitting international calls or backhaul from a cellular base station.

But thanks to the growing popularity of consumer services, VoIP over broadband Internet connections is becoming more and more common. Call quality as good as, if not better than that of, traditional phones and advanced features add to the attraction of call charges that are significantly lower than those of traditional circuit-based fixed operators. While a small percentage of total worldwide telephone subscribers currently use VoIP services, the number is growing quickly as incumbent operators roll out their own IP-based systems to compete with those from new entrants.

The IP revolution is going on simultaneously with another telecom trend: voice goes mobile. Mobile subscriber penetration exceeds 100% in many mature markets, while in many emerging economies, mobile users far exceed the number of fixed subscribers. And even as the high-speed data capabilities of mobile networks increase, voice is still expected to be the most significant mobile application. Cellular voice service will remain circuit-switched for some time to come, but combining VoIP and mobile networks can make a perfect match; delivering clear benefits to enterprise users, consumers and operators.

A combined mobile VoIP offering could drive mobile voice penetration and usage while reducing costs, and make it possible for operators to introduce new voice-based services and other innovative, rich multimedia services. By introducing fixed VoIP to cellular telephony and mobile VoiP to fixed telephony, operators could have the possibility to create a unified voice and multimedia service experience.

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Mobilizing the enterprise

Enterprise solutions will likely provide the first commercially relevant mobile VoIP business. IP-based corporate PBX systems are already common, and mobile-only systems hold significantly less market share. Mobile-only scenarios are often unfeasible due to lack of indoor coverage, reliability and perceived high cost compared to fixed solutions. But a combination of the two allows enterprises to leverage the cost savings of VoIP, the convenience of a single device and the ability for rich services that are impossible to deliver over a standard telephone line, while supplanting in-building mobile coverage with WLAN infrastructure.

VoIP allows enterprises to route internal calls over the company's data network, rather than paying to transmit them over the PSTN. This is particularly useful in large enterprises with far-flung operations, particularly in multiple countries. This benefit is already apparent in fixed IP PBX systems, but combining such an existing system with VoWLAN and cellular multiradio smartphones running the proper software allows access from the mobile network to the same PBX functions as from a desk phone, such as directories, conference calls, voicemail, and so on.

When the user roams off the corporate WLAN network, the terminal connects to the wide-area mobile network as usual. Enterprise users can also take advantage of other WLAN networks to bypass mobile toll charges. All this comes from a single multiradio terminal that can access VoWLAN networks as well as the standard mobile network, allowing the use of the best and most cost-effective network at a given time, and delivering unified communications to a single device through a single number – and all with a consistent user experience. While calls will be routed differently depending on if the WLAN or cellular network is being used, the user's mobile device gives them access to the same services with a consistent user experience.

The cost savings and control such as system offer could offset the initial infrastructure investment, particularly if an enterprise already has a WLAN network in place. But VoIP also adds value by making possible the introduction of rich new services as it blends voice and data. Users on a conference call could share documents or other electronic media in real time; videoconferencing could be done from a standard mobile device, without the use of special equipment; push-to-talk could be made available at any time, rather than just when the user is on the mobile device. Many of these features are already available in PC-based messaging systems – mobile VoIP frees them from a computer and puts them in a mobile.

VoIP can also deliver enhancements to standard PBX features through the use of presence information. Users can set rules to handle calls or messages: perhaps as simple as a "do not disturb", or more complex, such as "if the time is past 5 p.m., and my boss is calling, forward immediately to voicemail", or even having the system respond to certain people by sending back information, documents or data (ie, "if Tom calls, send strategy_plan.doc" to him).

Driving consumer value through Mobile VoIP

Mobile VoIP also has a lot to offer consumers, by combining the compelling aspects of current VoIP offerings with a single multiradio mobile device.

By utilizing a home WLAN access point, consumers can save on call costs, and Unlicensed Mobile Access technology bridges the gap between standard mobile networks and fixed VoIP services by allowing operators to route calls over the fixed network. Users can roam and handover calls across the mobile and WLAN networks, and have access to the services they've come to expect from their existing mobile subscription through a consistent user experience, regardless of the network being used.

An added benefit of such a UMA-based system is that it enhances coverage in a user's home or office. In some markets, in-building cellular coverage is quite a problem: one US operator reported that 60% of some two million customers cited poor home coverage as a reason for changing mobile providers. It's a significant problem; combining mobile service with VoWLAN is an enabler for more complete coverage.

In the same way that enterprise mobile VoIP allows for the introduction of new

Use scenario: David puts the PBX in his pocket

David is a project manager in a large company. He has a multiradio cellular/WLAN mobile device that he uses throughout an average day. Thanks to the network infrastructure and to software running on his smartphone, his device acts as an extension of his company's PBX, even when he's not at his desk or even in the building.

When David is in the office, his mobile device connects to the internal WLAN network, and his calls are routed over the internal data network. He keeps in regular touch with the company's Beijing office, and since inter-office calls are routed over the internal network, rather than the PSTN, his company saves money on call charges. He can also access all kinds of advanced features, including low-cost internal conference calls, videoconferencing, and document sharing. The system's presence features let him control how people can communicate with him: when he goes into a meeting, for instance, he sets his status to "meeting," and according to rules he's defined, all his calls are routed to voicemail and he can't be reached via instant messaging.

When David leaves the office, his device roams onto his provider's mobile network seamlessly, keeping him connected to his services with a single device. His employer is pleased because the terminal is set to use WLAN connections and make VoIP calls whenever possible, which cuts down on David's mobile phone bill, while David is happy because he doesn't have to juggle a PBX extension and a separate mobile line, and all his communications are centered on his mobile device.

services, consumers can also benefit, particularly from SIP-based VoIP. Again, PC-based VoIP systems combine voice service with additional data features like instant messaging or file transfer. But mobile VoIP solutions untie all these services – along with attractive voice tariffs – from a user's computer and put it into their mobile device.

Operators will in the future be able to make a combined offering, replacing separate subscriptions from several providers covering different networks and services. Users can get access to all of them from a single device, with a consistent user experience regardless of their location, rather than having to use multiple PC applications or other devices and services. All of the technology works in the background, invisible to the user: for them, everything "just works".

Mobile VoIP leads the way for operator IP convergence

VoIP is expected to offer mobile operators a significant business opportunity by allowing them to harness three powerful characteristics: they can cut infrastructure costs and service charges to better compete with fixed operators, they can expand their coverage by supporting access from WLAN access points, and they can offer richer communications services to their users.

Mobile VoIP helps operators accelerate the voice goes mobile trend: users that utilize fixed networks or Internet VoIP services for cost savings will now be able to save on mobile call rates by using WLAN, with the benefit of not being tied to an external device like a computer. Mobile operators could also be able to emphasize that they offer true ubiquity and mobility: whereas VoWLAN-only mobile devices only function within range of a compatible WLAN access point, a multiradio cellular/WLAN terminal can fall back on the wide-area coverage of mobile networks.

Mobile VoIP also allows mobile operators to penetrate further into the enterprise. An estimated 88% of all calls in Western Europe are made from either the home or office, and just 20% of those are made on mobile networks. With VoIP, operators will be able to sell mobile subscriptions integrated with WLAN IP-PBX systems that better answer the needs of enterprise users while letting mobile operators take away in-office traffic – and its associated revenues – from their fixed competitors.

For operators with both mobile and fixed networks, the opportunity is clear: they can offer enterprise users and consumers a single subscription through a single device that maintains the benefits of mobile telephony and fixed VoIP or fixed IP PBX, as well as offer new services the converged network makes possible.

But even for fixed operators, the potential of mobile VoIP can be harnessed through a mobile virtual network operator (MVNO) arrangement. This lets them combine the pricing of a fixed network with the services of a mobile network, and offer new services VoIP enables. This lets fixed operators leverage their existing strengths, particularly broadband connections to the home and voice and data services to the enterprise, while taking advantage of the cost savings and new services VoIP offers and adding in the coverage of mobile service through MVNO service. This allows fixed operators to combat the declining voice and long-distance calling businesses by stemming the tide of enterprise users moving to competitive local exchange carriers (CLECs), consumers switching to Internet VOIP services, and those dropping fixed lines in favor of mobile.

VoIP is also a key enabler of the triple- or quadruple-play scenario, where a single operator offers users the convenience of voice, data, video, and mobile service in one package. But in addition to different types of connectivity and VoIP telephony, the IP Multimedia Subsystem (IMS) is a key enabler, allowing operators to offer all kinds of new differentiated services, like rich calling applications, such as file-sharing during a call, or voice-based applications such as Push-to-talk over Cellular (PoC).

Use scenario: Mobile VoIP keeps Nancy in touch

Nancy is a recent college graduate whose work as a consultant means she has a busy travel schedule. She uses a multiradio mobile device and a mobile VoIP service subscription to stay in touch with her friends and family whether she's at home or on the road. She used to subscribe to an Internet VoIP service to save money on calls to her family and college friends that are now spread around the globe, but since her mobile operator utilizes Unlicensed Mobile Access technology, she's now able to enjoy cheaper calls by using her mobile phone and connecting to her home WLAN network or public hotspots.

Her mobile device also enables a number of rich services that let her communicate with her friends via video and text as well as voice. When she was on vacation in Paris recently, she was able to show the pictures she'd taken with her mobile device to a friend while she was talking to her over a VoIP call, and later sent a "wish you were here" video message to her parents. Since all her communications are unified in a single device, Nancy's friends and family can always reach her, either by voice, text, instant message, video call or any other method, while Nancy can use presence to broadcast her availability to her contacts (such as "busy" or "traveling"), as well as manage the incoming communication depending on the context of what she's doing.

Now, she can keep her long-distance bills lower by using VoIP, but since it's in her mobile device, she doesn't have to be sitting in front of her PC to use it. And whereas some of the PC-based services Nancy previously were difficult to set up, and she had separate providers for her telecom services, she gets all this functionality in a bundled offering from a single operator, and all technology takes care of itself, working invisibly to her through an easy-to-use interface.

Key technologies

The availability of affordable high-speed broadband connections is a basic requirement for enabling the growth of VoIP, so as high-speed DSL and cable modem connections penetrate the market further, it's unsurprising that the number of VoIP users is growing as well. The proliferation of multiradio smartphones with WLAN functionality will make VoIP an interesting proposition for enterprises, consumers, and operators as well.

Proprietary solutions have fragmented the current VoIP technology market, resulting in incompatibility among services and confusion among users. However, there are several open technologies emerging to support the interoperability of mobile VoIP, such as IETF and IMS SIP-based VoIP and UMA. Developing solutions based on open standards like SIP and UMA will help to deliver the interoperability needed among services and vendors to enable a mass market for mobile VoIP. Users have an expectation that they can reach anyone from their device, and making users reachable regardless of their network or mobile device adds value for everyone.

Two important open standards to consider are the Session Initiation Protocol (SIP) and the IP Multimedia Subsystem (IMS), which allow access to the same voice and multimedia services independent of the access network, allowing first and foremost for mobility, but also for interoperability across networks and multiple clients. A SIP client on a terminal device issues a find and connect request, then the IMS finds the right terminals and establishes an IP, packet connection between them, which can then be used to exchange any type of communication media: voice, video, content, and so on.

SIP and IMS are access network-independent, meaning they work over any IP connection, like the PSTN and DSL in the fixed domain, and various types of mobile networks. The technologies provide a common and standardized environment for the deployment of applications that deliver services like VoIP, push-to-talk, messaging, and content sharing, as well as for rich applications combining these services.

They can lower the cost and speed the development of new services because they use a common IP platform, and let operators deploy applications across networks and on multiple types of terminals. In the case of SIP, its underlying elements are similar to HTTP, the protocol used to convey information on the World Wide Web, so it holds the promise of making the innovation of new telephony and communications applications move as quickly as that of Web applications.

Another key technology – and another common standard – for mobile VoIP is Unlicensed Mobile Access, or UMA, which provides access to GSM and GPRS services over unlicensed spectrum technologies like WLAN or Bluetooth. Subscribers of operators that deploy UMA technology can roam from the operator's mobile network onto broadband networks with a multiradio mobile device, and have access to the same services available when they're on the mobile network, providing a consistent user experience. With UMA, operators can expand their in-building coverage using WLAN or Bluetooth access points, and converge fixed and mobile networks by shifting calls from the mobile device to the fixed broadband network when the user is within range.

Nokia: Driving converged voice services

Nokia views IP convergence and VoIP as a strong industry trend that will impact the communications market in the mid to long term. This development is expected to create new opportunities for innovative and fast-moving companies, and Nokia will actively embrace the IP convergence and VoIP trend to enable value for its existing and new customers and itself.

Nokia already has a strong track record in IP-enabled mobile devices and networks and in combining IP with mobility, while its deep competency in voice also provides it with the expertise to lead the mobile VoIP market. For example, it has already taken an early leadership role in delivering mobile SIP-based applications by providing more carriers with push-to-talk over cellular solutions than any other vendor.

PoC and other rich, converged applications Nokia has delivered, such as video sharing, are enabled by the use of its commercially available IMS network solution. IMS is a standardized service machinery that allows for communication across multiple types of networks and this interoperability is crucial to the creation of a mass market for mobile VoIP and other converged services. Nokia is driving interoperable and open standards-based SIP VoIP technologies through work with such bodies as 3GPP and IETF, and also by working with leading enterprise vendors to develop SIP standard-based products and to extend mobile interoperability to the enterprise IP PBX market. The company is also participating in the development of the UMA specification and is developing device and infrastructure solutions based on this technology.

Going forward, Nokia will provide market-leading mobile VoIP solutions by leveraging its ability to offer end-to-end solutions and create a range of products for operators, enterprises, and consumers. The company has unique strengths in creating compelling, user-friendly mobile devices based on well-integrated multiradio technology and powerful smartphone software, like the Symbian OS-based Series 60 Platform. These strengths are enhanced by its deep understanding of mobile users, which is needed to create the easy-to-use, convenient and attractive user experience necessary for VoIP to succeed in the mobile industry.

Glossary

3GPP	3rd Generation Partnership Project
CLEC	Competitive Local Exchange Carrier
DSL	Digital Subscriber Line
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HTTP	Hypertext Transfer Protocol
IETF	Internet Engineering Task Force
IMS	IP Multimedia Subsystem
IP	Internet Protocol
MVNO	Mobile virtual network operator
PBX	Private Branch Exchange
PoC	Push-to-talk over Cellular
PSTN	Public Switched Telephone Network
SIP	Session Initiation Protocol
UMA	Unlicensed Mobile Access
VoIP	Voice over Internet Protocol
VoWLAN	Voice over Wireless Local Area Network
WLAN	Wireless Local Area Network

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