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NETWORKS

White Paper |

Voice over Wireless IP

A New Generation of Voice Services

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Executive Summary

The telecommunications marketplace is rapidly evolving. One of the major drivers in this evolution is the convergence of voice and data communications. This is evidenced by the extensive deployment of broadband networks and the uptake in Voice over IP (VoIP) technology.

However, an even more exciting development in the market is the emergence of Voice over Wireless IP. Voice over Wireless IP focuses on the delivery of voice services over unlicensed wireless networks such as Wi-Fi® and Bluetooth®. By leveraging these communication channels, operators can deliver wireless voice services at a much lower cost than using traditional cellular networks.

Using a single device equipped with a Bluetooth and/or Wi-Fi radio, such as a mobile phone, PDA or laptop, users can make and receive calls either in the home, at the office or in public hotspot locations. As operators can terminate these calls to any network, be it fixed-line or broadband, users benefit from reduced call costs without compromising on mobility and flexibility.

As competition within the telecommunications industry further intensifies, the focus for operators is to introduce value-added services that attract new customers, reduce churn and increase revenues. In addition to fixed-line and mobile operators, there are a growing number of service providers, from broadband ISPs to hotspot operators, vying for customer attention.

Voice over Wireless IP is one of the most exciting new developments emerging within the telephony market. It is set to revolutionise the delivery of mobile voice services and provide exciting new opportunities for operators and service providers alike.

The Changing Face of the Telecommunications Market

Having experienced significant upheaval in recent years, the telecommunications market is again undergoing major change. As significant as the impact of digitalisation and market liberalisation, the traditional 100 year old fixed-line business model is being radically challenged by the adoption of Internet technology and the proliferation of mobile communications.

Voice Data Convergence

Today, Internet technologies which were primarily deployed for the delivery of data services are now being used to route voice. Voice over IP offers telecommunication network operators a cost effective means of using their existing data networks for the delivery of voice traffic.

The convergence of Internet technologies and circuit-switched telecommunications infrastructure is a step change which fundamentally alters the way voice and data services are delivered. In addition, the time and distance-based charging model which has long underpinned the pricing of telecommunications services is facing disruption by Internet-style flat-rate pricing. Not alone is VoIP more cost effective, it also enables the delivery of a host of new value-added services to customers by a broader spectrum of service providers, creating opportunities and challenges alike.

In the past, packet-switched voice has been implemented primarily within the core telecoms infrastructure. However, it is beginning to move from a behind-the-scenes network to being a billable service. Enterprise users have also been key adopters of the technology, leveraging their existing investment in data networks to deliver internal voice services more cost-effectively.

According to leading analysts, VoIP has the potential to create a paradigm shift, increasingly moving power to the end user and to new service providers. However, there is an even more exciting revolution taking place within the VoIP marketplace, creating new ways in which traditional telecom operators can exploit their existing voice infrastructure.

Fixed Mobile Convergence

The adoption and growth in cellular communications has been a dramatic feature of the telecommunications industry over the past fifteen years. With more than 1.5 billion people using mobile phones wordlwide, fixed-to-mobile substitution has become one of the biggest issues facing fixed-line operators. Users want the freedom to make and receive calls anytime, anywhere and are prepared to pay higher prices for this mobility.

While there is increasing pressure from mobile operators, fixed-line call charges are still much cheaper than their mobile equivalents. In addition, fixed-line networks continue to provide a more cost-effective means of delivering Internet access.

With a background of VoIP adoption and mobile service growth, fixed-line networks need solutions that allow them to continue to compete. Enter the new era of unlicensed mobile access – Voice over Wireless IP – which unleashes a new world of mobile voice communications.

Voice over Wireless IP - A New Generation of Voice Services

Voice over Wireless IP combines the power of VoIP with the demand for mobility to create a whole new voice ecosystem. Exploiting unlicensed mobile access channels, including Wi-Fi and Bluetooth, it allows fixed-line operators to leverage their existing IP infrastructure to offer mobile voice services.

Unlicensed Wireless Technologies

The ability to offer Voice over Wireless IP services currently centres on two unlicensed wireless technologies: Wi-Fi and Bluetooth.

Wi-Fi

Wi-Fi, also known as WLAN or 802.11, is a wireless radio technology with a range of 50 – 100m that enables users to connect to the Internet and other devices without the use of cables. The Wi-Fi market has experienced phenomenal growth in the last three years and is becoming standard in both the office and home environments.

While the corporate market has been the most prolific adopter of the technology, Wi-Fi has spawned new applications of the technology for both public hotspots and home networking. Gartner Dataquest predicts there will be over 150,000 public hotspots in operation worldwide by 2005. Typical examples of these hotspot locations include hotels, airport lounges, convention centres, cafes and university campuses.

Bluetooth

Bluetooth technology is a low cost, short-range wireless specification for connecting mobile devices to each other. Typically Bluetooth radios operate at approximately 10m range, with some extending up to 100m.

As of June 2004, over 150millon units with Bluetooth have been shipped globally. With shipments of more than two million per week, the technology is rapidly moving into the mainstream consumer market.

Mobile Voice Services using Wireless IP

While there has been massive proliferation of both public and private wireless access points (hotspots) in recent years, the principal focus has been on enabling access to data applications. However, with the developments in Voice over Wireless IP, Wi-Fi and Bluetooth networks can be transformed into viable channels for high quality voice communications.

By using a mobile device - a mobile phone, PDA or laptop - which is equipped with a Bluetooth or Wi-Fi radio, users can connect to access points and make calls over IP networks. These access points can be located at home, in the office or in a public hotspot location.

Operators and service providers receive these calls into their access network, using VoIP, and can then terminate the calls either entirely over IP or by routing them through their circuit-switched voice network. This cost advantage, combined with the ability to offer users a single device for both wired and mobile communications, provides a very compelling proposition.

Harnessing Wi-Fi and Bluetooth represents a very exciting development within the telephony market and creates a significant opportunity for existing voice operators, broadband service providers and hotspot operators alike.

Opportunities for Operators and Service Providers

Exploiting unlicensed wireless networks to deliver mobile voice services is a highly innovative, value-added service for fixed-line operators or wireless service providers. In today's highly competitive marketplace it enhances their ability to reduce churn among their existing customer base and to acquire new subscribers.

There is a persistent and substantial difference in cost between cellular and fixed-line services. With voice over wireless IP, the ability to terminate calls through the lowest cost route provides operators with a broad range of pricing options in the provision of wireless IP voice services. As a result, it offers benefits to both fixed-line operators seeking to gain a mobile offering and to alternative service providers looking to add new services and increase market share. It could even be used by mobile operators looking to further promote fixed-to-mobile substitution.

Enterprises that have invested in Wi-Fi technology can generate an even bigger return on investment by integrating voice over Wi-Fi. It is a natural next step for the wireless office and it delivers even greater flexibility and mobility to employees while actually reducing costs. While indoor cellular use has increased, the cost of calls is still a factor inhibiting absolute dominance over fixed-line. With Voice over Wireless IP, the cost issue is dramatically removed and users could opt to use a single device for all communications.

From the user's perspective, Voice over Wireless IP is a killer application that is simple to use and requires little by way of outlay other than upgrading to the next generation of mobile devices. It offers enhanced flexibility and mobility whereby a single device can be used at home, in the office or out in public hotspots to make and receive calls at a lower cost than through traditional cellular networks. It means that subscribers can effectively manage their own telecommunications spend by having a choice over the type of mobile voice service they use.

Business Case

The financial business case for Voice over Wireless IP services is strong both from a carrier and subscriber perspective.

Carrier Benefits

There are significant financial benefits available to the operator from the introduction of voice over wireless IP services, incorporating both increased call revenues and, in certain cases, reduced interconnection costs.

The scope for increased call revenues is outlined in Table 1.0 below. For illustration purposes, it assumes an average of one additional voice minute per user per day as a result of the introduction of a voice over wireless IP service. The revenue per minute figure used is the standard peak rate for an Irish fixed-line operator.

Call Revenues

Users	Minutes per day	Revenue per min	Revenue per day	Revenue per year
1,000	1.00	0.0407	41	14,856
10,000	1.00	0.0407	407	148,555
100,000	1.00	0.0407	4,070	1,485,550
1,000,000	1.00	0.0407	40,700	14,855,500

Table 1.0

The scope for reduced interconnection costs is outlined in Table 1.2. Despite reducing the average call volume from one to one quarter of a minute per day, significant savings could also be made.

Interconnect Costs

Users	Minutes per day	Saving per min	Saving per day	Saving per year
1,000	0.25	0.1080	27	9,855
10,000	0.25	0.1080	270	98,550
100,000	0.25	0.1080	2,700	985,500
1,000,000	0.25	0.1080	27,000	9,855,000

Table 1.2

Subscriber Benefits

Subscribers benefit by having their calls routed over the most appropriate network, thus reducing mobile call costs. Rather than routing all calls through the traditional cellular network, calls to landlines and other networks can be routed through a Bluetooth or Wi-Fi connection at fixed line prices.

Table 1.3 opposite highlights the savings available to subscribers, which are substantial across all call types*.

Subscriber Call Cost Savings

Destination	Cellular	Fixed	Saving
Local Fixed-line Peak	35.00c	4.93c	85.9%
Local Fixed-line Off-peak	15.00c	1.26c	91.6%
National Fixed-line	35.00c	6.75c	80.7%
National Mobile (off network)	40.00c	23.70c	40.7%
International Fixed-line	69.13c	15.35c	77.8%
International Mobile	69.13c	34.57c	50%

Table 1.3

**The figures used in the above table are based on the published 2004 rates of two Irish operators. The international figures assume calls being made to the United Kingdom.*

Benefits of Voice over Wireless IP

The adoption of Voice over Wireless IP delivers tremendous benefits for both service providers and subscribers. It is a compelling value-added service for voice operators and other service providers, providing them with an exciting means of attracting new customers. Crucially, it delivers real value for money to users who want the flexibility of mobile voice services at fixed-line rates.

Increase revenues

Leveraging unlicensed wireless networks, service providers can increase revenue streams by providing new voice services to customers. Importantly fixed-line operators that have no cellular division can now offer mobility as part of their service bundle.

Reduce call costs

Businesses and individual users can benefit from a significant reduction in their overall voice communication costs. The savings available are particularly marked for international and roaming calls.

Reduce interconnect fees

The closed nature of cellular networks allows mobile operators to charge a considerable premium for terminating calls to their subscribers. Wireless IP connections offer an alternative route for terminating calls to mobile devices, delivering savings that can be shared with the subscribers involved.

Increase customer satisfaction

Service providers can benefit from higher usage levels as subscribers use a single device to make and receive calls whether at home, in the office or in a public hotspot.

Increase productivity

At work, users can roam freely and make and receive calls while connected to the wireless network. Employees can use their phones or PDAs to communicate freely without being concerned about costly cellular phone bills. This is particularly attractive to enterprises that are challenged with increasing employee productivity without driving up their cost base.

Industry Challenges

While the business case for Voice over Wireless IP is compelling, there are a number of challenges to be overcome during the adoption period that will enable the technology to move into the mainstream market. In particular, the adoption rate of Voice over Wireless IP services will be strongly influenced by the availability of programmable dual-mode handsets that incorporate Wi-Fi and Bluetooth radios.

While the connected smartphone market is expanding today, a number of technical and market challenges remain.

- Firstly, the power consumption profile of Wi-Fi and certain Bluetooth radios limits talk-time.
- Secondly, the potential for interference in the air interface places strong demands on the design of wireless networks and on any real-time applications that use them.
- Thirdly, there is a mismatch between the Bluetooth radios being installed in mobile devices and the Wi-Fi radios being installed at hotspots locations.

The technical barriers to adoption will be short-lived. These challenges are being addressed at multiple levels from the hardware layer to the application layer by chip manufactures and system developers with considerable success.

From a market perspective, there is some reluctance among traditional cellular operators and their suppliers to facilitate the routing of calls away from their core network. However, this is only a temporary barrier to adoption because:

- As fixed-line incumbent operators introduce new service offerings that incorporate Voice over Wireless IP to establish a footing within the mobile market and to retain their existing customer base, the re-routing of calls will inevitably occur.
- The fundamental costs involved in providing Voice over Wireless IP services is far below that of providing voice services over traditional cellular networks. As a result, the cost to the subscriber will be bid down significantly when Voice over Wireless IP services can be provided.

Cicero and Voice over Wireless IP Solutions

Cicero Networks is at the forefront of the wireless Internet revolution, taking VoIP a step further by enabling it to be used by the new generation of mobile phones, PDAs and laptops to cost effectively make wireless voice calls without comprising service or flexibility.

These devices, which are equipped with Bluetooth and/or Wi-Fi radios, allow the establishment of high-bandwidth connections to public or private IP networks. By using these capabilities Cicero enables exciting new applications.

Using a single handset, Cicero users can:

- make voice calls over the broadband connection in their home
- connect wirelessly to the office phone system
- connect to the company telephone network from a public hotspot
- connect to the office phone network when visiting other company locations
- make low-cost calls from public hotspots in cafes, airport lounges, etc

Key Features

Cicero is designed specifically for operators and its key features centre on ease of use and platform independence. This solution works over both Wi-Fi and Bluetooth networks and has been developed to support a broad range of devices and access points.

Cicero design has been driven by a number of key operator requirements:

- **High Quality of Service (QoS)**
  Cicero enables service providers to deliver high quality voice services over broadband and wireless connections.

- **Highly scalable, carrier grade solution**
  Cicero is designed to offer near-linear scalability through its unique distributable server and gateway architecture.

- **Supports open, standards-based infrastructure**
  Cicero uses industry standard mobile phones and wireless-enabled PDAs requiring no proprietary infrastructure investment. It is also designed to operate through standard access points and over standard IP networks.

- **Unique Wi-Fi and Bluetooth radio interfaces**
  Cicero is designed specifically for both Wi-Fi and Bluetooth networks, thus maximising the potential subscriber population.

- **Easy to provision and use**
  Cicero Phone is very simple to install and is easily downloadable over the air, via the web or, at point of first use through the access point itself.

How it Works

Cicero is a simple to use, easy to deploy solution for subscribers. For operators and service providers it is a highly scalable, robust telecommunications service. The following providers a summary demonstration of how it works.

1. The user downloads the Cicero client to their mobile phone or PDA. As simple as installing a new ringtone, it can be delivered over-the-air, downloaded from a website or transferred over the access point itself.
2. When the user enters an access point location, the Cicero client automatically registers with the Cicero server. The user is then authenticated and authorised for a range of services.
3. The user places a call using Cicero. The highly intuitive user interface supports both direct number entry and selection from the contact list on their mobile phone or PDA.
4. When it receives the call request, the Cicero server uses the details of both the caller and the person being called to select an appropriate Cicero gateway for call completion.
5. The Cicero server maintains a complete record of the call, including time and duration, for delivery to the service provider's charging and billing systems.

Cicero maintains detailed presence information on its subscribers, enabling the service provider to terminate calls through Cicero. In addition to increasing user mobility, this call termination capability allows the service provider to reduce their mobile interconnection costs.

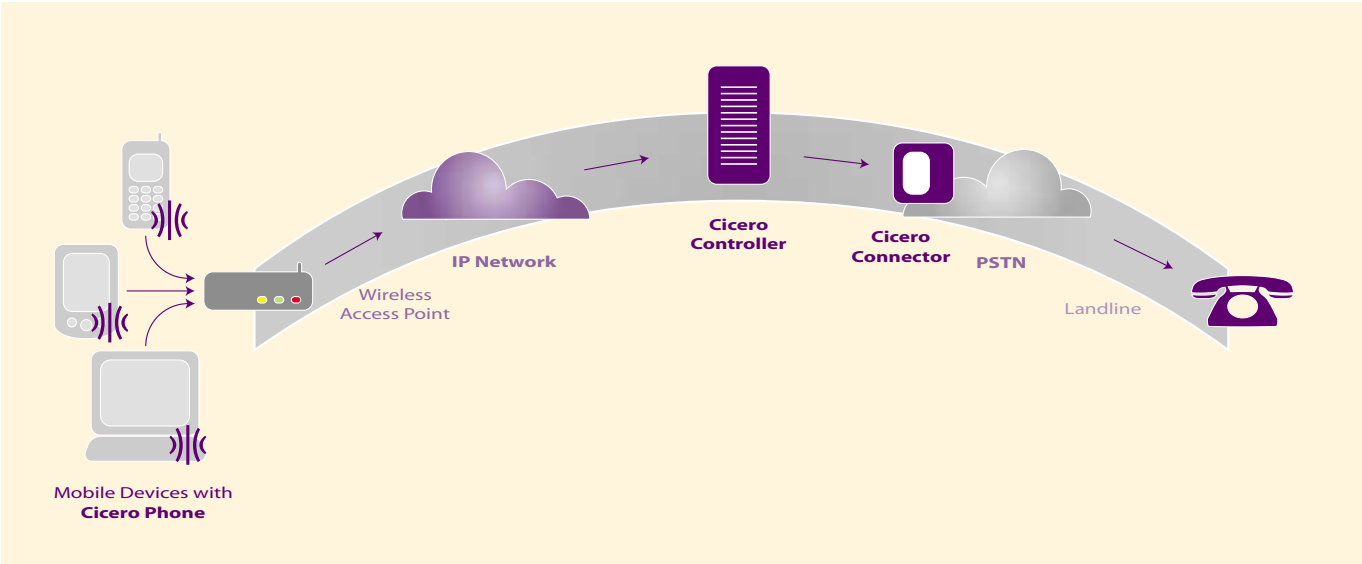

Diagram 1

Deployment Scenarios

Fixed Line Operator

Faced with increasing pressure from both fixed-mobile substitution and the introduction of VoIP over broadband services, a fixed line operator can leverage the value of unlicensed mobile access to deliver new wireless voice services to both its home users and corporate customers.

Home Users

At home, a Cicero user can simply place and receive calls through a wireless access point, over the DSL network and connecting to either another Cicero user or to a fixed or mobile number.

This same user can then also make and receive calls, when he or she is at a public access point - airport lounge, hotel, café – anywhere in the world, allowing them to communicate as if calling from their own home.

Implementing a Voice over Wireless IP solution such as Cicero means that communication costs can be dramatically reduced and subscribers can use the same mobile device for calls whether they are at home or in public hotspot locations.

Corporate Users

Leveraging their existing Wi-Fi network, corporates can implement Voice over Wireless IP to achieve significant cost savings in mobile telecommunications costs.

It means that:

- Employees in the office can use their mobile device as their primary communication device, using it like a cordless fixed line telephone to make and receive calls over the office telephone network.
- All voice calls between company offices, can be made over the wide area network. Even where offices are in the same region, the cost savings can be considerable.
- Teleworkers and field personnel can now access the office phone system from external locations through wireless internet using their PCs, mobile phones or PDAs.

In addition, employees can use their mobile device to make and receive voice calls while moving between office locations.

Mobile Operator

Mobile operators can further enhance their wireless service offerings by providing subscribers with a more competitively priced wireless voice service for use indoors, i.e. in the office or at home.

By delivering voice services over Wi-Fi and Bluetooth channels rather than just cellular networks, it further extends the mobile voice bundle operators can provide to customers. It also provides operators with a lower cost delivery channel meaning that their users can roam freely making and receiving calls both indoors and outdoors using their existing mobile phone or PDA.

Having a single communications device, capable of routing calls over the most appropriate network will continue to drive the market for mobile voice services and to reduce dependencies on fixed-line service. It also increases customer satisfaction and reduces churn.

Broadband Service Provider

Cicero offers a highly compelling solution for alternative service providers such as hotspot operators and broadband service providers to enter the lucrative mobile voice market.

Broadband service providers, for instance, who are already providing VoIP services, can further leverage their network investment by offering Voice over Wireless IP. Clearly, by adding another component to their service bundle, it moves broadband providers further along the telecommunications food chain.

Conclusion

Delivering Voice over Wireless IP is a revolutionary step in the convergence of mobile and fixed-line communications. For service providers, it provides an additional bundle of voice service offerings that increase revenues and reduce churn. It opens a new and exciting business model for traditional operators, giving them a mobile voice service which can be offered at a lower cost than traditional cellular voice communications. For subscribers, having a single device for wireless voice and data services, both indoors and outdoors at a much reduced rate, is a highly compelling proposition.

About Cicero Networks

Cicero Networks is at the forefront of the wireless internet evolution developing solutions for the delivery of voice over wireless IP. Unique in its development of platform-independent solutions, Cicero Networks offers operator and service providers a means of delivering high-quality voice services over Wi-Fi and Bluetooth networks.

For more information visit
www.ciceronetworks.com