



The Future of Voice Integration

White Paper

Abstract

To be able to predict the future, we need an understanding of the past and the present as well as information on data to support certain trends and likely outcomes. This paper looks at how voice technologies are likely to evolve, and is designed to enable the reader to prepare for the future and understand what is needed to develop the skills and knowledge needed to meet the likely needs of the business community.

THE PAST....

First Telegraphic Message, May 24, 1844

On May 24, 1844, Samuel F. B. Morse dispatched the first telegraphic message over an experimental line from Washington, D.C. to Baltimore. The message, taken from the Bible, Numbers 23:23 and recorded on a paper tape. The first message was “What hath God wrought?” and it was also the first use of digital encryption and compression as unless you knew that the book it was referring to was the bible... 23:23 meant absolutely nothing.

Western Union became the de-facto market leader in Telegraphs over a 25-year period up to 1870 with a process of consolidation, network expansion and mergers.

Date	Messages Handled	Date	Messages Handled
1870	9,158,000	1930	211,971,000
1880	29,216,000	1940	191,645,000
1890	55,879,000	1945	236,169,000
1900	63,168,000	1950	178,904,000
1910	75,135,000	1960	124,319,000
1920	155,884,000	1970	69,679,000

For many years, the telegraph was the de-facto standard for long distance communication due to the expansiveness of the network and reliability. Cost was also a major issue

Date	Telegraph*	Telephone**
1902	.40	5.45
1919	.60	4.65
1950	.75	1.50
1960	1.45	1.45
1970	2.25	1.05

By the 1970's, the telegraph (telex) was back to its 1900's usage numbers. The facsimile machine of the pre 1960's actually used the telegraph network but by 1963, facsimile switched over to the PSTN and finally started to erode the usefulness of telegraph. One interesting fact – you can still send a telegram today and its cost \$10 for 250 words.

From this history lesson we can take several proof points for our Nostredamus like exercise.

- 1) Quality will be sacrificed if the cost and business benefit is great enough!
- 2) Innovation is always possible if you can adapt a service using a pre existing infrastructure to a new application (ala facsimile)
- 3) Even the most deeply rooted infrastructure will change or even wither over time if a new infrastructure provides a significant enough advantage.

The First Telephone Call, March 10, 1876



"Mr. Watson--come here--I want to see you." were the first words ever spoken on the telephone. They were spoken by Alexander Graham Bell, inventor of the telephone, when he made the first call on March 10, 1876, to his assistant, Thomas Watson.

That same day, Bell wrote his father of his "great success" and speculated that "the day is coming when telegraph [phone] wires will be laid on to houses just like water and gas — and friends converse with each other without leaving home."

In 1891, Almon Brown Strowger received a patent for telephone automatic switching system. This fundamental principle is the backbone to the operation of all telephone systems no matter how sophisticated, both public and private branch exchange (PBX), which permits the caller to select a line and place call without assistance of operator. However, the first commercial telephone call for private use didn't arrive until around 1902 at the then outrageous price of \$4.65 for three minutes.

Steady increase in geographic coverage and reduction in cost was evolutionary, not revolutionary. One highlight was the first automatic PBX, which was created in the early 1900, but it wasn't until the 1980's that switching became digital – leading to the modern PABX and ultimately VoIP telephony

Another significant development was the arrival of cellular technology in the 1980. The growth of the mobile network was an order of magnitude that of the fixed line market and corresponded with advanced in electronics that made for smaller and smaller phones.

-- An Evolution of Ericsson Handhelds, from Analog to Digital			
 <p>ERICSSON</p>	 <p>ERICSSON</p>	 <p>ERICSSON</p>	 <p>ERICSSON</p>
<p>1987: Curt, a converted police radio design turned into an NMT 900 phone and later a ETACS mobile. The first Ericsson handheld. Known officially as the HotLine Pocket.</p>	<p>1989: Olivia. Introduced originally for NMT 900 networks, followed by versions for ETACS, AMPS, and eventually GSM. The first Ericsson GSM phone and consequently its first all digital mobile.</p>	<p>1991: Sandra, first version in NMT 900, then ETACS, D-AMPS/AMPS, and finally GSM in 1993.</p>	<p>1996: Jane, D-AMPS, GSM, DCS, PCS1900/GSM. A 'slim' version appeared in a D-AMPS 1900 model as well as a PDC version.</p>

By the end of 2004, the world counted a total of three billion telephone subscribers, 1.8 billion mobile subscribers and 1.2 billion fixed lines.

Bell was not psychic but simply extrapolating the past, as in the laying of water and gas pipes, to his present invention of telephony. Ultimately, his invention would surpass the telegraph and give us the most utilised means of distance communication the world has known to date.



Some key considerations to catalogue from the telephone:

- 1) Speech is still the easiest way to communicate and the infrastructure is ubiquitous.
- 2) Mobile is eclipsing fixed line in terms of sheer subscription numbers, especially within developing countries who don't have a fixed line legacy infrastructure.
- 3) Convergence: Modern telephony was built on the convergence of telegraph and radio – and will likely converge again if it offers a compelling business benefit.

Computers, Software and the Internet

Although separated by physical and conceptual differences, for the purpose of this paper we will combine the two as they are closely related. It has been disputed for a very long time as to who actually invented the first computer because the definition of what constitutes a computer is disputed. However, the 1950's saw the first manufacturers of a commercial computer system with the famous UNIVAC. 1954.

1969 work started on ARPAnet, to protect the flow of information between military installations by creating a network of geographically separated computers that could exchange information via a newly developed Network Control Protocol – the start of IP and the internet.

1970-72 was Intel's creation of the first RAM chip and true microprocessor. Between 1972-75, research staff for Xerox, at their Palo Alto Research Center developed the first implementation of Ethernet. In 1981, IBM launches the first IBM PC with the first version of Windows unveiled by Microsoft only 4 years later.

The arrival of DOS and then Windows in the 1980's kick started the era of low cost software built to a common operating systems. Applications drove the race for faster processors, bigger hard disks and more memory that still consumes hardware vendors today.

Spreadsheets, word-processing and databases were the first "killer" applications. Computer interfaces became increasingly standardised and manufactures started building add-on cards to allow software to interact with non-traditional devices. In the mid 1990's, the first software applications to directly talk to a PBX were created. By the end of the 90's, major manufacturers such as Lucent and Nortel were providing IP-enabled PBX and, by 2005, analyst IDC estimated that VoIP accounted for around 10% of all the voice traffic on the planet.

Software was the catalyst for convergence and provided the glue to combine data, processes, voice, networking mixed with human ingenuity to build a number a number of innovative voice technologies.

In terms of hardware, faster processors dominate 1985 – 2000, higher density RAM, tighter integration of integrated circuits and increased linkage of computers to the Internet. Today according to Gartner, around 200 million PC's are purchased annually across the globe. In Europe according to EuroStat, PC home ownership is around 40% while 50% of all Europeans regularly use a PC for work activities. Internet access is around 35% for Europeans and growing fast

Based on what has gone before, the internet and connected PC device – or vice-a-versa, will follow the same route as the telephone with every single person having unrestricted access to a computing device with connection through the internet to services and other people.

Let's extract some working hypothesis based on the data:

- 1) Hardware is commodity – software is the innovative and value add part of the equation
- 2) The growth of PC's with corresponding Internet access is not slowing and technical literacy is increasing to keep pace – according to Eurostat, 67% of the working population is computer literate.
- 3) Mobility and computing power is increasing – Laptop and PDA shipments beat fixed desktop computers for the first time in 2005 and the trend is growing.
- 4) All PC's will be connected to the Internet. An estimated 90% of PC's now have some form of connection to the Internet according to recent analyst data.

THE PRESENT...

For this section, we shall look at how voice, data, the Internet and computing power have shaped our present landscape, with examples from business showing how organisations are utilising technology to provide a competitive edge, reduce costs or innovate.

Our focus is on developed countries and, specifically, Europe. For the majority of Europe, business activity is focused increasingly on a service economy. Automation and globalisation has moved much of the heavy industry and manufacturing away to more economical parts of the world. Europe is increasingly, the hub of control, finance and service delivery.

The engine for this activity is Information and Communication Technology and voice is still the number one method of conducting a business related transaction. Based on the last comprehensive study conducted by the ITU in 2004, there are around 3 billion fixed and mobile telephone lines in use compared to just 775 million personal computers.

Telephone calls and related services earned the industry around 1.2 trillion in revenues so, make no mistake, even with the internet boom, the humble telephone is still the #1 method of conducting communication.

Innovative applications of voice

The social economic restraints of the labour cost in leading European countries forces two convergent practices - namely, reduction of costs and/or increase in efficiency. For a service led economy, the time taken to establish a line of communication, exchange information and action a task is constantly under pressure to be reduced, to minimise 'downtime', reduce unproductive worker time and, ultimately, increase profitability.

There are hundreds of point examples but, to focus on one in particular that is likely to have a major impact, we need to make a few predictions. Today, there are more mobile phones than fixed line. Where the fixed telephone took 120 years from invention to gain 1.2 billion subscribers, the mobile phone took just 20 years to establish 1.8 billion and the data suggest that mobiles will reign by a factor of 2:1 by 2008.

Still, costs are high, with a mobile call costing approximately 10x that of a fixed line call of similar duration. However, this is changing rapidly and, with the ultra competitiveness between carriers and bulk purchasing of airtime by users, the disparity between the cost of mobile and fixed is rapidly receding.

Although invested with a different set of economic and legacy incumbents, the US often foreshadows the most likely path for developed countries. In the US, the average wire line residential toll minutes of use (MOUs) have been dropping at a compounded rate of 15 percent since 2000, while wireless interstate MOUs per user grew at a compounded rate of nearly 40 percent during the same period. According to one FCC study, on the wireless side, the percentage of interstate residential minutes has increased from 16 percent to 26 percent of all wireless minutes. These changes in calling patterns are being reflected in ILEC (Incumbent Local Exchange Carrier) line losses - a trend likely to continue. Another interesting nugget is that six percent of households have only cell phone service and this figure is growing by a few percentage points each year.

So, based on the evidence, we are all going to be using our mobile phones and the landline will be the 'backup' consigned to the corner, a bit like the fax machine. So how are businesses grinding the cost saving and/or efficiency improvements from the mobile world?

Push-to-Talk (PTT)

Often described as a 'walkie-talkie' service using mobile phones, Push-to-Talk over Cellular (PoC) is a service that makes one-on-one and group conversations possible over a cellular network. Press the button once and everyone can hear you talk - release the button and hear others talking back to you. Phones with the PTT feature have a dedicated PTT button that is used to start a session. A session can involve from two to several participants. However, only one person can talk at a time.

The Benefits of Push to Talk

- Direct speech connection is spontaneous and convenient.
- Share information and experiences instantly, at any time.
- Get and stay in touch with a group of people - whether they're pre-set, impromptu, or open chat groups.
- Expanded range and roaming options over two-way radio.

Orange announced its PoC service (called TalkNow) at the start of this year and trials with organisations such as Pfizer, the RAC and Shell.

Private Mobile Networks

Private Mobile Network allows all outbound and incoming phone calls to be carried across a private localised GSM cell within operating site and uses a standard GSM handset. As users move into the range of the Private Mobile Network GSM coverage, the user's mobile phone automatically registers with the system and allows calls that would normally be made via the public GSM network to be made instead via the private network.

The software side is a Private mobile eXchange to interconnect the mobile phone into a traditional PBX infrastructure and provide VoIP functions, allowing networks to carry GSM traffic between mobile phones used within the campus and from mobile phones across intra site IP networks without incurring mobile operator call charges. The PMX provides both Voice and SMS coverage with full support for additional high value PBX and least cost routing functions supplied by third party vendors.

So, with PMN's starting to take off, this places another layer onto the convergence cake that so many organisations have been baking - the same network to handle fixed line voice, mobile voice, data and application access. Where robotics and automation reduced the workforce and, ultimately, cost associated with manufacturing, computerisation is doing the same to the collection and dissemination of information via voice systems.

Voice Alerts

From traffic, weather, defective items and, even, changes in the law – automated systems are, increasingly, used to disseminate information to users without the barrier of a computer terminal.

The SMS is the trigger for many of these applications which, when accessed, deliver information using text-to-speech in multiple languages.

Voice alerts highlights an innovative solution that uses existing infrastructure and voice. Unlike email or faxes, the information exchange requires no technical training and is delivered in natural speech.

Although PTT is a carrier-based technology, all these areas have a common theme: namely, reducing the time it takes to deliver or receive communication and providing a tangible business benefit by utilising the intrinsic benefits of voice:

- Voice requires no keyboard or IT skills.
- Voice can be independent of location
- Voice is independent from action which require the use of the hands
- Most importantly, voice fills a viable niche that provides a real business benefit

Leaving a Paper Trail...

If we jump back slightly and consider the humble fax machine, even though it has succumbed to the email as the document sender of choice, it still is used in one primary area, its unique ability to capture a signature and help create a binding contract. Even within the age of digital certificates and biometric authentication, a signature on a piece of paper is still the most common method of consenting to an agreement.

With the rise of voice-based systems, a corresponding need to capture voice transactions is growing rapidly. In the old world of analogue, this was a costly and cumbersome business requiring tape recorders and vaulting facilities – but with VoIP it is relatively simple and, increasingly, a core requirement of many service industry business processes, as well as compliance issues such as Sabarnes Oxley.

Identifying the Elements of Future Voice-Based Technologies

Currently, there are a number of almost modular technologies around speech that are allowing business customers to create innovative applications within the IVR space. With hardware becoming increasingly a commodity, software integration using these core skills will define the next generation of “killer apps” around voice.

- Database integration
- Business process integration
- Location based systems
- Telephony Presence
- Text to speech
- Automatic Voice Recognition
- Automatic Language Translation
- Messaging – SMS, IM, email
- IMS (IP Multimedia Subsystems)

THE FUTURE...

So we have our evidence from the past and a few reference points from the present and from this we can make a few easy predictions:

- 1) The majority of people will be connected to the Internet and voice network via a small but powerful device.
- 2) The "per minute" cost of this personal communication device will be the same as a fixed line device and potentially even cheaper (remember the Telegram)
- 3) A significant number of Workers will be task based and not location based this is especially true of service orientated economies (the rise of teleworking...)
- 4) Organisations will gain competitive advantage from how well they utilise communication infrastructure namely fixed voice, mobile, IM, email, web portals etc but will care less about the transport method in-between and more about the ease of integration between each media.
- 5) Vendors will allow services to be "converged" by the users in a 'Lego' like structure but probably based on high-level Service Provider interoperability agreements. For example, mobile voice from T-mobile, internet access and email from AOL, fixed line voice and global voicemail box from BT. Integrators will need to understand common framework such as SIP and IMS.
- 6) Systems integrators and consultants will need to be multi skilled in understanding which parts must be kept within the customer premises and which are more cost effective when outsourced or as a provided service.

So based on the past and present and our collection of anecdotal evidence, lets make some not-so-distant future application of voice:

Location Services

Many booking and registering tasks will be automated based on location awareness of mobile devices and smart software. Vendors will use the personal communication device to target individual who move onto the local voice network. For example, walking into Tesco - your phone will ring and tell you of the latest special offers in the branch and allow you to ask questions to the automated voice response systems regarding where items are and more specifics about the items your are purchasing, for example, 'Recommend me a nice bottle of not too sweet white wine under £6 please.'

Pinnacle of Convergence

So in our utopian world of the single communicator, the best method of identifying each user would be via a unique address, possible with the arrival of IPv6 providing billions of more unused addresses. Each user could have a unique IP address similar to a social security number and 'register' their current device to their global IP address to allow communication. A service could, potentially, expose to the world the user's current status - from busy (no communication), through states of only receiving textual contact (email, sms, IM), through voice only and, ultimately, voice and video. A voice activated global address book may well be a reality. *"PhoneBOT - Put me through to John Smith of Dynacorp in New York please..."* / ONE MOMENT PLEASE / JOHN SMITH IS ONLY AVAILABLE VIA INSTANT MESSAGING AT THE MOMENT - SWITCHING TO SPEECH-TO-IM MODE...

End of the Language Barrier

With the almost limitless increases of computer processor power, voice based services that offer real time audio translation simultaneously across multiple languages will appear. Imagine a conference call, where each participant hears and speaks their language of choice, with powerful systems translating on-the-fly.

One Box Fits All

With new technologies such as clustered storage (multi-tenancy) starting to impact on society, it is feasible that we will each have an independent personal 'Data Box' of several terabytes that will automatically record all our voice conversations, email, text, IM and every conceivable communication exchange for an almost indefinite period of time. With advances such as IMS, different applications could interact with the data box to allow almost total recall of any piece of useful 'digital' information ever transmitted or received from over an entire lifetime. Companies will start this trend.

Software Everywhere

Data, voice and video communication technology will follow the current trend to its logical conclusion, with progression from manual, to electro-mechanical, to digital and, finally, to purely software based. With IP the de-facto standard for communication, all PBX intelligence will move to pure software, due to the inherent flexibility it offers. Consequently, telecoms implementation will be a software exercise and, potentially, highly customised phone systems with unique security, delivery and performance characteristics will become the norm.

Smart Devices Controlled by the Network

With improvements in low power 'casual networking' such as Bluetooth and WiFi, more devices will be linked to the local network. With the inclusion of voice recognition, linked devices will respond to simple commands via voice to perform task such as turn on, off, reset, status command, accept new input or lock from use based on a biometric voice pattern. Door and lights will be the first such devices but most items could be voice activated by placing the voice intelligence within the network and not actually in the device.

Intelligent Voice and Application Roaming

Multi-network communication devices that support WiFi, GSM and fixed Ethernet will develop to automatically try and attach to the cheapest transport method to establish a voice link. Non-traditional carriers with wide geographic dispersal, such as retail outlets, will allow the customer to call for free within premises such as shops, banks and café chains. As users roam between mobile networks, tailored applications for different environments will become available. For example: in an airport, flight information and check-in application; in a hotel, guest information and room services menu; in a railway station, platform information and ticket booking applications, etc., etc.

Improved Communications Blurs Work/Life

Within certain industries, Teleworking will become the norm for a large majority of workers. With PTT technologies, high capacity and ubiquitous broadband and VPN technology – the £1000 per employee per month it costs to maintain a desk in a central city location will be an easy expense to reduce. The downside is an increasing blurring between work and non-work time and a move towards an 'on-call' working practice. Key areas such as financial services, design, marketing are likely to be initial candidates.

Google Applications

Simple applications - such as word processing, email, PowerPoint - will move to a browser-based equivalent. The advantages will be the ability to collaborate in real-time with multiple users as well as instant access from any web-enabled device. Voice-to-text will be a browser-based reality for these types of applications. The initial pioneers of this methodology will be large enterprises that need to maintain cheaper and more flexible central application islands and not support hundreds of applications across thousands of users.

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