Digital Futures

“the Unified Network”

“the only permanent thing is change”

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"the only thing permanent is change"

In the last ten years we have witnessed huge advancements in technology across networks and devices and the services offered on top of them. However, the next ten years are showing signs of change that will be an order of magnitude greater then even the previous decade. There will be huge seismic shifts across many industries, great repercussions in many more, and the heralding in of a new dawn in technology.

Digitisation has made it possible to store various types of information such as sound, image and data in the same simple digital format. This allows for storage of different information on the same mediums (such as CDs DVDs and Hard Disks) and transmission on the same networks (Digital Satellite, Cable, and the Internet). Even though many of our networks are digital they aren't interoperable. They were never built with interoperability in mind and most were built for carrying only one kind of information. Our telephone networks were built for carrying telephone calls and our satellite TV networks for carrying TV streams. However, there is one network built for carrying any kind of data - the Internet.

The Internet offers a platform for carrying any kind of digital data to anywhere with an Internet connection. Its reach is growing, broadband is rapidly gaining ground and wireless internet services such as 3G are improving all the time. As bandwidth increases and technology improves, the types of services that can be offered over the Internet are expanding. As quality of these services increases and public acceptance of the IP (Internet Protocol) alternatives grows, the relevance of existing fixed purpose networks will become compromised. Even today we are witnessing the first signs of the networks converging and the consequences this is having across various industries.

From humble beginnings a few years ago with dubious reach and service quality, making voice calls over the Internet (Voice over IP or 'VoIP') has become a serious contender for voice communications that can't be ignored. So much so that in Costa Rica the state-owned telecommunications monopoly has suggested legislation that would effectively criminalise VoIP. It claims VoIP is a value-added service, and as such, should be regulated. However, in the US, attempts by several states to 'port-block' VoIP calls (effectively blocking the service from working) has been met by a ruling from the FCC (Federal Communications Commission) that prohibits the activity. Some in the telecommunications industry have already accepted defeat and are in retreat, the Dutch telecommunications company KPN has stated it will lose 1,750 employees every year for the next ten years. KPN Chief executive Ad Scheepbouwer commented "Starting in 2005, we intend to have a big push in broadband and VoIP. This will have consequences for short-term profitability, but will position us strongly for today's market and deliver greater benefits in the future." In the United Kingdom BT are taking a pro-active stance and in June 2004 announced their intentions to create an entirely new IP based network, '21CN', to replace their current network. In February 2005 BT's wholesale chief executive, Paul Reynolds stated, "None of us can stop the march of technological progress. The future became inevitable the day we learned how to fully digitise our industry. Digitised voice, data and video can now be combined, changed, merged and manipulated on a single digital platform." This view is hardly surprising. In the past couple of years easy to use voice over IP (VoIP) services such as those offered by Skype and Vonage have come along in leaps and bounds causing the popularity of VoIP to soar. In June, BT launched 'BT Fusion' in collaboration with Vodafone. BT Fusion merges your mobile and fixed-line phone services into one product. By making use of a new handset from Motorola which is capable of seamlessly switching between the mobile phone network (provided by Vodafone) and onto a home/business wireless broadband network which utilises VoIP, BT has made some of the first steps towards protecting its future. With fixed line revenues being eroded away by both the mobile telecommunications and VoIP industries, the once mighty telecommunications industry is being left with little choice but to embrace the digital revolution whole-heartedly.

The mobile telecommunications industry is also well aware of the growing importance of the Internet and has been trying to take advantage of it since the introduction of WAP. Excited by the possibilities that high-bandwidth data brings to the mobile phone, the mobile networks have invested heavily in 3G networks. To re-coup their investments operators have focused on building their brands as both networks and content providers, creating 'walled garden mobile portals' such as Vodafone's Live! and T-Mobile's T-Zone's services and taking more control in branding and distribution of the handsets. Through these portals operators can sell on-demand content and charge for information and leisure services such as football highlights and mapping. To encourage traffic, the mobile operators often make these portals free to surf and provide basic services such as news headlines for free. Access to the

wider internet is completely prohibited by some operators or greatly inhibited through cost by others. However, the speed at which technology is advancing may not have been anticipated by the mobile operators at the time they developed their business models for 3G. Technologies are emerging which have the potential to threaten the operators' current privileged position of controlling not only the networks, but the devices and services which run on top of them. The operators are now beginning to feel the pressure. In June 2005 T-Mobile international announced it would be using Google as its point of entry for its European mobile internet service replacing its current walled-garden approach. A T-Mobile board member stated "With the Google homepage we want [to] tell our customers from the first moment that they are carrying with them the Internet they know from home".

WAP may have failed to inspire the consumer, but the draw of wireless Internet access most certainly hasn't. According to Parks Associates WiFi now accounts for 52% of North American home networks, the popularity of laptops and having the freedom to use a computer wherever in the house you choose, responsible for driving demand. In the business market, commercial WiFi networks operated by companies such as T-Mobile and BT are gaining popularity. Access to high-speed Internet services at train stations, airports, and coffee shops enabling the 'mobile office'. The potential of WiFi networks is seeing devices other then laptops take advantage of this now abundant wireless IP connectivity. Both Sony and Nintendo's latest entrants in to the mobile computer entertainment market, the PSP and Gameboy DS, come with WiFi connectivity as standard. Motorola, the world's third largest mobile handset manufacturer, announced at 3GSM in February 2005 its intention to build integrated cell and WiFi handsets that would utilise VoIP software licensed from Skype.

Following up on the success of WiFi, the computing industry is now looking at ways to take wireless technology even further – literally. The desire for wireless high-bandwidth Internet connectivity and the false economies of providing technologies such as DSL and Cable to rural areas has driven the development of technologies able to fill this gap. One such technology is 'Worldwide Interoperability for Microwave Access' or WiMAX. Although still in the early stages of development WiMAX promises to eventually fulfil these requirements. As a standards based technology (IEEE 802.16) WiMAX will force down costs by stimulating competition and volume as well as guaranteeing interoperability. Many countries, to stimulate uptake of broadband, are auctioning the frequencies that the technology operates on cheaply. This, and the falling price of dark fibre used to build a network infrastructure, makes WiMAX an increasingly attractive business opportunity for those in the telecommunications industry. In fact, an estimate by In-Stat puts the cost of building a National WiMAX network covering 90% of the population in the US, including equipment, tower, sites, labour and set-up costs, at just $3bn. It is expected that by 2006 this technology will be refined to such a size that it will be capable of fitting inside a laptop or PDA, able to perform cell handovers, and transfer data at speeds of up to 40Mbps, 80 times faster then the average UK broadband connection! A report by Datacomm research and Rysavy research believes wireless broadband technologies (such as WiMAX) will soon end up replacing 3G cellular data technologies. The report states the findings of a panel of experts who say that wireless broadband based on Orthogonal Frequency Division Multiplexing (OFDM) technology, such as WiMAX, is better suited for high-speed wireless access. Sprint, an American mobile operator, has already stated it will trial and probably deploy WiMAX in addition to the 3G network it is already deploying.

In broadcasting we have seen the advent of Internet Protocol Television or IPTV. Companies such as HomeChoice in the UK are already offering this service which is capable of showing on-demand streaming television with pause, rewind, and fast-forward capabilities as well as providing access to a huge back catalogue of content. Its capabilities outstrip those of even the latest digital satellite and cable solutions. Although the IPTV services were of dubious quality when first introduced, in much the same way VoIP has improved, increasing bandwidth and advancements in compression algorithms now see IPTV solutions contending with traditional networks in terms of their broadcast quality. This is highlighted by the many IPTV services planned with support for High Definition content. Telecommunications companies in the US, such as Verizon, already concerned with the encroachment of their revenue streams by VoIP and mobile telecommunications are now looking at IPTV as a prime candidate for future revenue. Microsoft has even created its own IPTV platform which it is now licensing to service providers. This is leaving many of the traditional pay TV service providers in an uncomfortable position. This was high-lighted by Sky's announcement in June 2005 that it would begin to make various portions of its portfolio available through an 'on-demand' service delivered via the internet and onto a PC. Could this be the first sign of Sky transitioning from its satellite network on to the internet?

It appears the fixed telecommunications, mobile telecommunications, and broadcasting networks are either moving, or soon will be moving, to IP based technologies. Consolidation of all our various networks into one single network, the Internet, is happening right before our eyes. Even if services such as IPTV will initially be operated by network providers in order to guarantee service levels, bandwidth and network quality will inevitably increase allowing even services such as these to run un-aided across the Internet. The Internet's flexibility allows for the support of many disparate devices and services, and this will create demand for companies which can offer the most comprehensive access. KDDI in Japan is already touting an all-round service which includes both mobile access and fibre to the home. Vodafone announced at CeBIT their intentions to offer broadband to the home through their own 3G network, moving into a space traditionally held by the fixed line telcos. France Telecom, owners of both ISP Wanadoo and mobile phone operator Orange, is also showing it is aware of changes taking place in the industry. On the 29th of June 2005 France Telecom announced they will be re-branding their Wanadoo ISP to the same Orange brand as their mobile phone outfit. France Telecom states the reason for this change as wanting to "pursue its transformation as an integrated operator" and to provide a "whole new world of services in the areas of communication, infotainment and everyday life".

An infrastructure is being constructed which will provide high speed Internet access from anywhere and with any device. Ultimately, convergence will bring us the Unified Network.

Of course, a network is worthless without the devices that can utilise the information it carries. Until now the PC has dominated the Internet, but soon it will have to share its position with a plethora of other devices designed to take advantage of a unified network.

Consumer electronics devices already rely heavily on digital technologies, and this trend will continue. We are starting to see the development of digital platforms allowing consumer electronics companies to use the same components and software across a variety of different devices. Sony has recently finished work on the Cell processor which will form the centrepiece of its successor to the PlayStation 2. Developed jointly with IBM and Toshiba the processor is equipped with immense power and scalability. However, it's not just the next generation PlayStation that will play host to the new chip. A platform such as the Cell empowers consumer electronics companies to standardise on one central component capable of performing various digital tasks demanded of modern day consumer electronics equipment. The use of such high powered equipment actually makes sound economic sense as it allows the same components and technologies to be used across multiple devices. This kind of architecture will reduce development cycle durations and costs, as well as driving the creation of a diverse range of interoperable devices.

Smart-phones, based on platforms such as the Symbian OS and Microsoft's Window's Mobile Edition, are increasing in popularity. The Zelos Group predicts that by 2008, sales of full-featured handsets, mobile phones that incorporate full-featured operating systems, will grow to about 290 million, or about 43% of global handset sales. At this rate of growth Zelos group predicts that shipments of full-feature handsets will overtake shipments of personal computers in 2006. Based upon the Psion code base, the Symbian mobile operating system has found its way into 15 different manufacturers' handsets already. Handsets that are based on a platform such as Symbian or Window's Mobile Edition allow developers to write native applications that will run on a host of different devices instead of having to re-write each from the ground up. This, you may think, is not much different to a platform such as Java. However, writing applications natively for a platform such as Symbian allows application developers to access features right at the heart of the phone such as the user's contact list or even invoking a call. This kind of scope, power and flexibility will spark a whole new range of innovative mobile applications.

The immense power of tomorrow's devices will enable them to perform additional tasks on top of their core functionality. Device manufacturers will use this extra horsepower to support application development platforms that in addition to being tried and tested platforms provide them access to a large and experienced pool of developers eager to extend the abilities of their product. This has already happened on the mobile phone where Java is now commonplace. We are also seeing targeted platforms, such as Flash Lite on the Interface layer, making an increasing impact. Manufacturers like Samsung are already taking advantage of the rapid interface development and experienced developer pool a platform such as Flash brings. Some recently released phones from Samsung have user

interfaces built entirely with Flash Lite, with other manufacturers showing signs of following suite. Soon it will be unthinkable to create a device which *doesn't* support certain standard APIs as doing so would inhibit the pool of resources the manufacturer has available to them.

The convergence of our networks and devices is inevitable due to the speed and quality benefits that the utilisation of standardised technologies brings. The use of standards and championing of interoperability that has laid the foundation for the success of the internet so-far will have to be embraced by both the consumer electronics companies and service providers (many whose networks will become partially obsolete) in order to succeed in the future. This will result in the coming together of all our digital needs. The network, the devices and finally the services, make up the three layers of an incredibly flexible common digital platform.

It's easy to surmise the kinds of opportunities that this convergence ultimately brings, but the truth is convergence is a transition that will occur in stages. There will still be a range of disparate networks for a while to come as the Internet grows in range and dominance. Small seismic shifts in the network layer will trigger shifts in the services layer, triggering yet more changes in the devices layer, and so the cycle continues. We've already witnessed this with the arrival of broadband, the resultant success of VoIP, followed by the consequential creation of VoIP handsets. Each small change in one layer has implications for another, bringing us further along towards ultimate convergence. So as we procrastinate about the possibilities that convergence brings us, we know that some of these things will be possible today, and some of these things will be possible later down the line. Whilst we do not necessarily know exactly *when* they will be possible we know that they *will* be possible, and possible soon. Convergence offers us a clear view of what's to come but patience will be necessary to see our visions through.

Huge opportunities abound for those who already have experience accrued in the Internet and its associated standardised technologies. Some of the patterns that will emerge in the future can be put into practice now with technologies available today.

For example, by creating a system for a retailer which incorporates RFID (Radio Frequency Identification) tags in merchandise labels, customers can be afforded some of the benefits that shopping online provides within a retail environment. In a sportswear store, a display trainer could have an RFID tag attached to the laces. A shopper interested in the shoe could take it to a terminal, wave it against an RFID sensor and be displayed an array of related information concerning the item. This could include price, special offers, detailed material information, related products, different styles, stock levels, etc. It could even allow the customer to request a pair be brought out by an assistant for them to try on.

Only a small number of new skills would be required to make such a solution become a reality. Firstly, on the technical side of things the ability to put together a hardware solution suitable for carrying out such a task. This would include the sourcing of the RFID reader/s and tags (which are already exceptionally economical). Then, the software engineering of a middleware solution, which would give an interface technology (such as flash), the ability to send and receive information from external IO devices (Such as an RFID reader). Secondly, on the creative level, the creation of a user experience that encompasses the interface and the physical retail environment. It is important to make both as seamless as possible, with the physical environment designed to make interacting with a digital interface as easy and natural as possible. Avoidance of clichéd "hi-tech" connotations and making an effort for the technology to blend in with the environment allows the functionality of such a system to speak for itself.

But how does this kind of system relate to the future, and specifically the unified network? The components and skills required to produce such a system can be evolved, ready for the kind of system that will become more commonplace as we go through the various transitions on the way to reaching a common digital platform. The user experience design will begin to encompass and consider not only the GUI of a system, but the input devices, product design, and even the surrounding environment. User experience design will correlate much more closely to product design then it does to graphic design and will further emphasise the importance for form to follow function. The use of cognitive psychology and research of the various kinds of input and output methods will all have an influence on the final solution delivered. Technical abilities should be honed to produce software capable of taking advantage of emerging technologies such as RFID and even UWB (Ultra Wide Band) the successor to Bluetooth. By building very light-weight middleware solutions and sandwiching them between

proficient interface and backend programming skills many already have good knowledge in, it will be possible to build powerful, flexible systems rapidly and profitably.

As expertise in these areas grows it will be possible to take advantage of the opportunities emerging from the introduction of new technologies. It is important not to forget the importance of the PC in these emerging technologies. Its unique breadth of input capabilities, output capabilities, and power, provide an extremely strong interface, and one which will still be used to make many of the more complex digital interactions.

However, the functionality of the web and browser are currently stretched to the limit. The PC will too experience change as we move to the future. Some of the tasks we currently perform within a web browser are simply a consequence of making use of the technologies which were available to produce a solution at the time. The Web is a medium, like TV, Radio, or Cinema. It excels at the function it was developed for – browsing information. The web is simply an interactive library, based on pages of knowledge, enhanced here and there with the benefits that digital interaction can bring. It is not the Internet. The use of forward and back buttons is perfect for the exploration of information. However, it begins to break down when the task deviates from this function, but as there are currently few other options, this is the route many have taken to produce their internet based solutions. The future will see many of the tasks that you currently perform in a web browser moving to custom internet applications when the appropriate frameworks are developed.

Online banking, e-commerce applications, social networking services, are all better suited to work as applications. That's not to say they shouldn't be accessible from a web browser, but it does mean they shouldn't be *exclusively* accessible from a web browser. It seems only a matter of time before people will be able to use these online applications in the same way they use any other application installed on their machines. What is required is for the operating system (OS) manufacturers to implement a framework that facilitates this possibility whilst preventing the compromise of security and retaining complete control for the user.

For example, instead of visiting your bank online and being presented with the usual web-based interface, you would be presented with an option to 'launch banking application'. Clicking on this link would handover control from the browser to an online application manager built into the OS. This manager would provide a 'sand-box' for applications to run in preventing access to potentially sensitive information on a user's machine without their permission (much like java) and would require interaction from the user to launch, instead of an abuse prone auto-launching functionality. What would make the online application manager so different from the web would be its relationship with the rest of the operating system. Once an online application has been launched, it would appear in your list of recently used applications with the option to keep it there permanently. To the user it would appear transparently as just another application on their computer. As management and administration of the online applications would be handled by an online application manager in the operating system, ease of removal and assurance of security could be ensured. The user experience is dramatically improved as they interact with an interface designed specifically for the task they are performing.

The PC also provides the perfect platform for administrating other devices and services which may not have the breadth of input and output options that a PC has. The iPod and iTunes partnership shows a great example of complimentary services. A user may wish to have access to a service at all times, but this does not necessarily mean they need access to the administration and management of a service at all times. The design of a product should consider where there are opportunities to separate functionality amongst devices to improve usability. A unified network provides an incredible platform for introducing this functionality.

On mobile phones we are seeing the growing popularity of platforms such as Symbian. By creating middleware Symbian applications in C++ which launch flash interfaces it is possible to rapidly develop applications on a phone that operate with much the same philosophy as discussed above in regards to web applications. Phone services do not have to be accessed through WAP browsers. For example, an online telephone directory service could provide users with the opportunity to install a free branded application on to their mobile phone. They would receive the application by setting up an account online. The user registers for their application on the PC, they set-up common postcodes (Home, work, partner's, friend's etc) and common services (Takeaways, cabs, flowers) they expect to use whilst on the move, as well as providing their phone number for delivery of the application to their handset.

Then, when the application is downloaded and installed it has its interface pre-populated with the services and addresses you have specified that you are likely to use. Not only that, but the user doesn't have to go through the hassle of getting to the service through layers of WAP menus. The service is displayed clearly, with an icon, right in the phone's main menu (Or a sub-folder they choose to file it under). The user can go online to customise and administrate this service at any time. This more direct access to services should be the way in which people access their mobile services.

Knowledge of how to create effective user experiences and the ability to engineer middleware to take advantage of more low-level components opens up the opportunity to develop for the much more varied range of devices that will be appearing in the future. Good quality screens, high bandwidth network connections, and powerful hardware will generate some great opportunities across a range of different devices. In ten years time it won't be a shock to see a washing machine with a processor as powerful as your home PC, and a touch-screen control panel with higher definition then most TV screens of today!

It will also be possible to produce systems that would have previously required bespoke dedicated networks with huge initial outlay for far less. Eventually, when wireless broadband becomes a reality, it will for example be possible to create a highly economical public transport information system. By equipping a bus with GPS and wireless internet technology, a system can be produced which facilitates detailed information about service information and bus arrival times. Users can download an application which resides on their mobile, previously configured with their specified bus routes and stops, and will allow them to see what time their next bus is due from their chosen location. This saves unnecessary waiting and makes the option of travelling via public transport more appealing. Add to this the deployment of shelter information on in shelter terminals. High quality screens with screen estate for quality advertising and the use of wireless internet connections for accessing up to the second information, you have a high quality, easy to deploy, revenue generating information system.

The automobile industry has the potential to benefit enormously from convergence. In car entertainment systems could potentially become as advanced as their home counterparts and the opportunity for in car information systems is tremendous. By utilising constantly improving mobile bandwidth as well as short-range but faster connectivity through wi-fi, there is scope for some really compelling in-car services. In car media centres can provide a range of entertainment which can be accessed in a variety of ways. Obviously you could use the home Wi-Fi connection to download content such as films and music from a home media server before you make a trip, but what about the possibility of accessing streaming media via the wireless internet connection (such as 3G or Wi-MAX) on the road? Or even using the Wi-Fi connection at a petrol or service station to buy or rent new content when you make a stop? As well as this are the information services that a car can offer. On top of the navigation systems and maps which are becoming common place, the GPS system of a car can be used to offer location-based search facilities including finding the nearest petrol station, ATM or restaurant quickly and simply. Local services could also be facilitated via the Wi-Fi connection, paying for petrol at service stations or tolls on motorways.

I think the list of possibilities that make use of this emerging network and the technologies that sit on top of it is truly inexhaustible. The challenge lies in creating products which can take advantage of these possibilities whilst remaining simple and easy to use. As well as the networks changing, both those companies who produce devices and those who provide services will need to adapt to remain competitive. By both highlighting where and how companies can take advantage of emerging technologies, as well as appreciating the role the user experience plays in making a product successful, it is possible to take a key role in shaping the digital future.