EXPLORING THE FUTURE OF THE ELECTRONIC MEDIA EXPERIENCE

A WHITE PAPER FROM

ONE COSMOS NETWORK

March 2, 2001

by Joe Firmage
and the OCN team

Introduction

The sounds of a radio or TV nudge your senses, as your clock moves past the moment it's programmed to wake you in the morning. You grudgingly stir out of bed, head to the shower and dress, help the kids get ready for school, brew a pot of coffee with breakfast, and catch up on the news while commuting to work. By the time you are sitting at your desk, as many as nine or ten kinds of information experiences have been delivered to you, through the electronic screens and speakers embedded in your alarm clock and watch, the television in your kitchen, the dashboard in your car, the green light on your coffee maker, your cell phone or personal digital assistant, and office computer. Not to mention the screens and speakers now popping up in your kids toys, in trains, on buildings and along the sides of roads.

Ever since light bulbs and speakers were first used to communicate information, and punctuated in 1907 when the first crude images were transmitted from a primitive camera to a cathode ray tube firing electrons at a fluorescent surface to reveal patterns of images, we have been captivated by the images and sounds we experience through electronic media. In the past 50 years, modern civilization has come to depend upon screens and speakers for every facet of life – for basic communications among nations, families, friends, and associates, for every aspect of economics, and for work, entertainment, governance and education. People are increasingly aware that information experiences presented through our TVs, radios, and computing devices are central to our lives. Even as electronic media devices become ever more ubiquitous in our daily experience, though, one key aspect of media technology has received less attention than it deserves: the nature and quality of the sensory interfaces between devices and the human beings who use them.

The past two decades' advances in technologies for computer processing, storage, network accessibility and bandwidth, display, media design, rendering, animation, audio, and interaction have dramatically expanded the tools available for the improvement of "user interfaces" of electronic devices. And at the same time many people, perhaps most, have significant difficulty with the interfaces present in many kinds of interactive devices out there.

As a result of these facts, and in study of what can be seen on the horizon, we believe that a period of dramatic evolution is imminent in the nature and quality of the sensory interfaces of electronic devices.

In attempting to study this evolution as it relates to the Internet experience specifically, several questions arise: how do different uses of devices drive the requirements for the user experience? What are the strengths and weaknesses of the human interfaces of devices like television sets and computers? In the case of the much-hypothesized future of a converged computer-television device in every person's hand, how can a set of screen, speakers, keypad and various controls best be employed to serve intended purposes? What business models are there for profitably delivering information experiences to an audience – an important question in the midst of a depression in the New Economy?

And less obviously but perhaps more importantly, what are the ethical parameters framing the evolution of human-computer interfaces?

The Network Media Experience of Today

Ask people today about their "Network Media Experience" and they are as likely to talk about AOL's reliability as NBC's primetime programming – an interesting reflection of the evolution of communications unfolding around us. In the past twenty years, all sorts of lines have begun to blur, as electronic media experiences have jumped forward by leaps and bounds through several near-simultaneous innovations: the falling cost of a telephone call, the automation of television and radio broadcasting, the rising average processing speed of computing devices, their means and magnitude of information storage and networking capabilities, screen display technology, underlying operating systems, media design canvasses, object rendering engines, animation tools, audio delivery systems, and physical footprints and interaction devices. These technologies have been adopted now by both new companies and older ones, large and small, and the economic expansion of the 1990's is significantly a consequence of the impact of these innovations.

One would think that the commerce and "content" businesses that depend upon these tools to engage people in information experiences would be enjoying a golden era of prosperity. And, in a real sense, they are. The past ten years have seen the economy of the United States, and in particular Silicon Valley and its surrounding value networks, fare very well indeed. A vast library of innovation and a large number of millionaires have been established along the corridors of the information economy.

Despite the ascent of the Internet as a medium truly as epochal as the book, many companies attempting to create businesses online have failed. 2000 and 2001 will go down in history as the years of the "dot-com" crash, and consumer commerce and so-called "content" ventures have been among the earliest of casualties on the beach. There are several reasons for these failures, often having to do simply with the timing of their attempts to offer specialized experiences, products or services before a critical mass is in place of consumers, component technology, or just investors committed to provide necessary runway. As often, there are deeper lessons to be learned than are visible on the surface.

Consider the "b-to-c" commerce and content domains specifically. Businesses created to enable people to enjoy interactive experiences and purchase products and services through electronic media are not new. We've been laughing, crying, loving, cursing, conversing, playing, buying, and selling through telephones and televisions for decades. But as ordinary people have begun to venture online, problems have been experienced across many dimensions of the activity: Cost. Familiarity. Trust. Privacy. Reliability. Simplicity. Enjoyment. Quality.

Several of these objections share a common root issue.

An Enjoyable Internet Experience?

It is hard to argue that the experience today of browsing NFL.com is as engaging as watching an NFL football game on television. It is equally hard to argue that the experience of shopping on Macys.com provides a comparably rewarding sensory experience as visiting a Macy*s store. And for businesses, today's online advertising experience is no better. How many TV networks would be in business if they depended upon a 1" x 5" rectangular banner in the top center of your TV screen for conveying a sponsor's message?

In these simple facts rests a challenge common to both content and consumer enterprises doing business online: how is it possible to make the electronic media experience more familiar, simple, compelling and enjoyable? Many content ventures have attempted to explore new approaches to

the user's experience of their Web sites. American Cybercast, DEN, Pop.com, Quokka, NBCi.com, Go.com and so on. It's a Who's Who of train wrecks, at least viewed through the myopic lens of stock value. In the commerce category, other ventures have flopped or are floundering trying to sell consumers everything from pets to paper to cars online: Pets.com, Boo.com, eToys, Buy.com…

Meanwhile, by some estimates a trillion dollars has been invested by telecommunications companies, transforming cable infrastructures, sinking fiber into the soil and lofting new wireless towers and satellites, everyone getting ready for… well, certainly demand for bandwidth is rising rapidly, but not rapidly enough it seems. This is where the story of the New Economy gets a bit murky and vague, especially since the leading Internet ventures' attempts at "converged" bandwidth-consuming rich media experiences have so far failed to take off.

Why have some of these pioneering ventures collapsed? Why do others fear a large telecommunications overhang and a deflating advertising market? Why aren't the business models underlying these enterprises taking root more vigorously?

Many serious analysts identify the user's experience of the Internet as a central problem: when all the factors contributing to the experience of rich media Web sites are considered, broadband sites simply don't yet offer a sufficiently compelling total experience to motivate tens of millions of people to prefer to spend time within them. According to the Meta Group "The major problem in the consumer market, however, is the lack of compelling services to convince even affluent households to buy… high-speed Internet access… The underlying problem is that so far, the Internet has failed to compete effectively with television as an entertainment medium."

The downloaded pictures, the streaming video and audio, the games, the ads, the stories – even for users equipped with the bandwidth to make streaming tolerable – aren't yet sufficiently superior to existing forms of sensory experience to motivate a critical mass of adoption. Some analysts have gone even further to say that the Internet will be primarily a platform for text-based utility functions – good for managing your bank account and checking your stocks and for businesses to transact with each other – but that the Internet will not likely become a viable platform for popular entertainment and consumer commerce any time soon.

Is the paper-like HTML web form therefore truly to be declared the Darwinian victor in the evolution of the Internet content experience? Is today's version of Yahoo.com the limit of our imagination for an electronic canvas to call "Home"?

If the NASDAQ ticker is any indication, the market believes that there is no way to make money providing experiences through the Internet, and that the kinds of user experiences offered so far represent the limit of evolution of the medium. This is a painfully naïve view. Something far more permanent than a fad has been explored through early-stage content and commerce enterprises, and while many small entrepreneurial ventures have crashed and will yet fall, the macroeconomy has learned a great deal about its future from the companies founding the early stages of the broadband Internet Experience.

Seemingly far and distinct from these debates, another discussion capturing our attention today concerns our systems of education.

An Educational Internet Experience?

Spread across the headlines in the past election cycle has been a nearly unanimous cry: our education systems need a lot of work. Many factors contribute to the crisis facing our public schools, including equity and adequacy in funding, crumbling infrastructure, lack of effective performance measurement, availability of effective tools for teaching, balancing private and public rights, parental involvement, and the many aspects of the digital divide. One of the frequently mentioned questions discussed by leaders involved in determining the future of our education systems is this: what will information technology ultimately contribute to education? While studies on the efficacy of computers in the classroom are somewhat ambiguous, there is a strong consensus that information technology can be used in more powerful ways to advance the learning process for both children and adults. But how? And if it's possible, why hasn't it happened already?

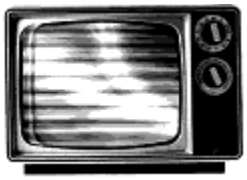
One part of the answer has to do with the intellectual and economic resources devoted to the challenge. When a computer game platform like PlayStation 2 is more elegantly designed and a B-grade Hollywood movie is better financed than the curriculum spanning entire grade levels of our education system, what can be said about our present approach to the education challenge?

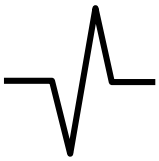
A common solution for the seemingly-disconnected challenges of making Internet commerce compelling, entertainment immersive and monetizable through advertising, and online education effective is to be found in the advancement of the sensory interface of electronic media.

Learning From History

While it takes a lot of complex infrastructure to support the networks of telephones, radios, televisions, computers, and wireless devices sustaining civilization, it is possible to understand in simple terms some of the key underlying trends that have driven and will continue to drive the evolution of the user interface of electronic media. A particularly useful diagram of the infrastructure supporting electronic media comprises three simple components: the user device, connectivity infrastructure, and the serving device or network. A look at the history of these infrastuctures – beginning with television – shows how each component has evolved over time.

1920s: Television





User Device:	Connectivity:	Serving Device:
Televisions	**One-to-Many Broadcasts**	**Electronic Cameras**

Television presented to us the first visual experience of an electronic network medium. The user device was a cathode ray tube, the connectivity infrastructure was a one-to-many broadcasting system sending its signals through the newly-understood medium of electromagnetic radiation we call “space”, and the serving device was a primitive electronic camera. The integrated result: We could enjoy a stage play in the privacy of our living rooms. We could see Walter Cronkite report on world affairs live. We could laugh at the lunacies of Lucy, revile the horrors of the Vietnam war, and stretch our imagination from the first moon landing to Star Treks of the future.

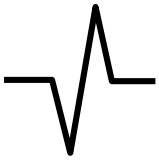
The emergence of television marked an epochal advancement in the technology available for the enhancement of human consciousness. Appearing on a screen in most homes was an electronic lens across society. Television was and is a medium as profound as its name suggests: a means for the transference of human vision.

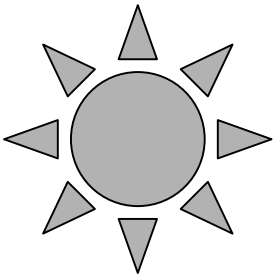
As computer scientists look back upon the evolution of electronic media, labels have been applied to categories of devices based upon their degree of self-contained logic processing capabilities. Evaluated on such a spectrum, the television box sitting in your living room today can be considered a “dumb device” – that is, it has very little computing ability; it is a screen with little or no self-contained ability to do anything useful, a device wholly dependent upon what is streamed into its receiver. Users can select a channel of information to display and adjust the volume, but that’s about it.

The same label may be applied to the other side of the equation – the “network” of the television era can be considered a “dumb server” – it’s basically a set of cameras pointed at whatever the operators choose. This is not implying anything about the operators of such cameras, rather the recording instruments themselves were not equipped with an independent decision-making capacity.

Of course, when television networks were first developed, almost no one conceived of the capabilities that might be afforded by the future of “computing.”

1960s: Terminals





User Device:
Terminals
"Dumb clients"

Connectivity:
Proprietary Networks

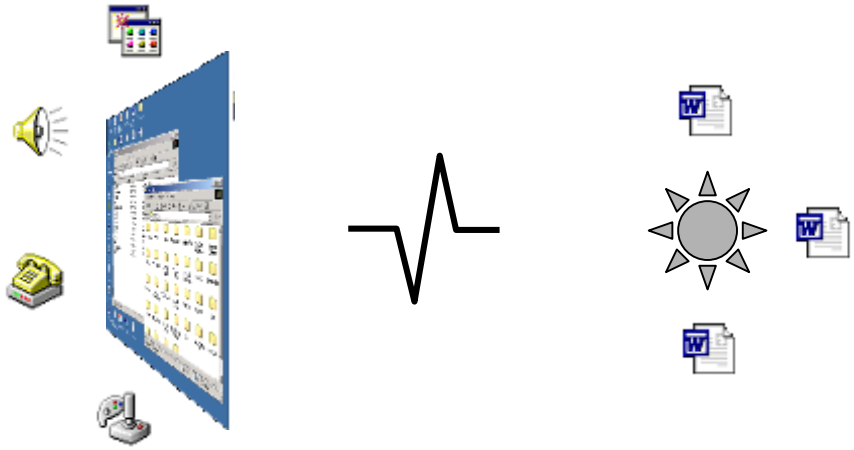
Serving Device:
Mainframes
"Smart servers"

In the 1960s, the innovations of the transistor, integrated circuit, electronic display technology, and magnetic storage systems converged to dramatically alter the landscape of modern civilization forever: networks of terminals connected to mainframes enabled computing systems to automate billions of transactional processes. Countless kinds of clerical processes could suddenly be fulfilled more economically by machines than by humans.

While the TV-derived terminal was still relatively "dumb" – having only the capability to receive and display textual symbols – the connectivity and server infrastructure began to take advantage of the integrated circuit for intelligent processing capabilities. Computers and networks could intelligently respond to user instructions entered at terminals, fulfilled by software agents we call "applications" running on mainframes. Enterprises could now scale up unhindered by the costs of clerical transaction processing by humans. Entire industries were born. Fairchild and Intel and Motorola blossomed. IBM and DEC leaped forward. While the user device was still a "dumb client", intelligent servers and networks began taking root. During this era, the US Department of Defense's Arpanet project began the process of interconnecting servers into a global network that would later come to be known as the Internet. Thus began the information age.

The business models driving this phase of the information experience were based upon the sale of client, connectivity and server hardware, software and services to individual companies. While the mainframe was joined in the 1970s by less expensive and smaller formfactor computers, the cost structures were such that only relatively large enterprises could afford to take advantage of these innovations. So the needs of individuals and organizations too small to afford mainframes, but nonetheless requiring the capabilities of computing, became urgent, and the Personal Computer was born.

1980s: Desktops



User Device:	**Connectivity:**	**Serving Device:**
Desktops "Smart GUIs"	Proprietary Protocols	File Servers "Dumb networks"

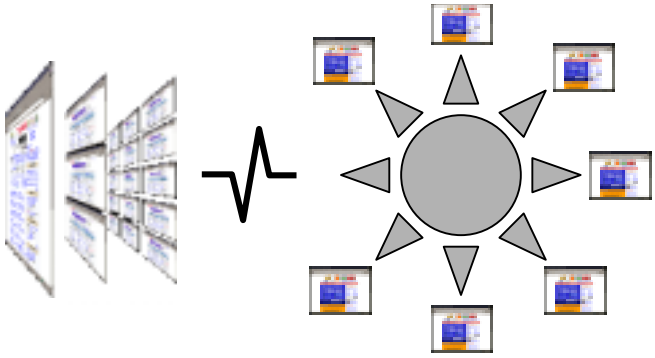
Although the era of terminals and mainframes enabled enterprises to automate vast numbers of clerical transactions, it did not give individuals or small enterprises the benefits of computing. In the 1980s, the falling price of electronic components enabled the power of computing to reach individual and the small companies. And a key software technology innovation – the graphical "desktop" user interface pioneered by Xerox PARC and popularized by Apple Computer and then Microsoft – introduced the concepts of windows, icons, and mice and enabled far less technically experienced people to use computers for tasks like word processing, spreadsheets and managing databases. The arcane symbolic interface of terminals was replaced on the PC desktop by more intuitive and friendly, increasingly visual, interfaces.

The desktop computer gave ordinary people computing tools of remarkable power. In this sense, the PC transformed the user device from a "dumb client" into a "smart graphical user interface" able not simply to display text from a mainframe, but to process applications within itself, establishing the basis for entirely new classes of computing value to users, including office productivity, desktop publishing, multimedia education, and games. Hundreds of millions of people around the world now use these capabilities every day.

But as remarkable an innovation as the desktop was, the architecture did little by itself to advance the state of the art in the use of networks. Indeed, the early networks that connected PCs together simply offered users the ability to share files and printers. The network technologies that provided the first forms of resource sharing capability among PCs, such as Novell's NetWare, were largely proprietary, and the world grappled for two decades with competing and generally incompatible systems for connecting computers together.

So while the user device of the desktop era became vastly smarter than the terminal, the network/server of the desktop PC era was effectively "dumber" than the mainframe that preceded it – leveraging little application functionality resident in the network and no standard "information dial tone" to do so.

1990s: Browsers



User Device:	**Connectivity:**	**Serving Device:**
Browsers "Dumb GUIs"	Internet Protocols	Anything "Smart Networks"

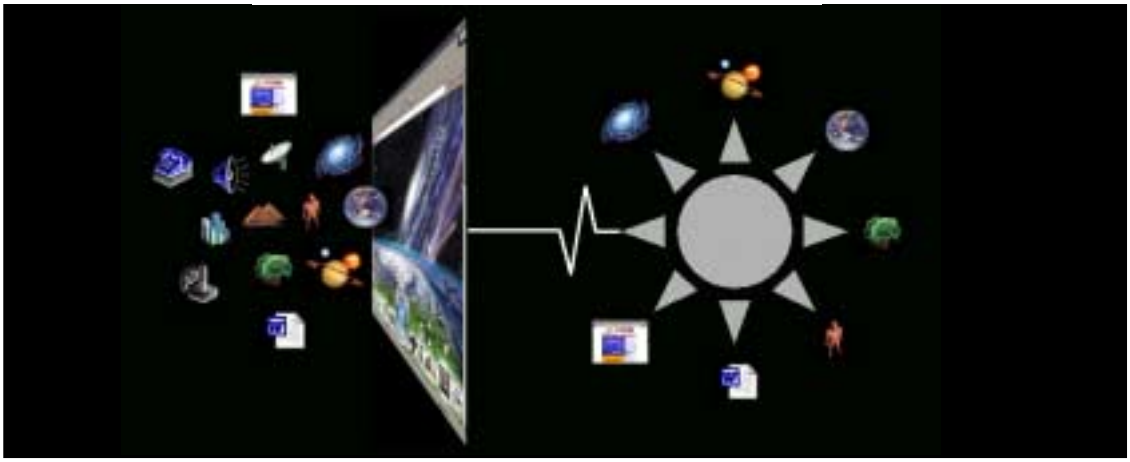
When the Internet burst in to the commercial world through the easy-to-use interface of the World Wide Web, the first information dial tone began a rapid period of public adoption, and the last 10 years have seen a remarkable evolutionary step occur in the interface between humans and electronic media. The emergence of the Web has established the first real-time n-to-n communications network for people, devices, and businesses. Through the metaphors of "pages" and "links" in electronic webs, desktop PCs have now acquired a universal window into a vast global network of information, applications and services, available through a growing set of evolving protocols establishing both generalized and specialized information dial tones (TCP/IP, HTTP, HTML, and emerging protocols like XML).

For individuals, the Web provides a means to access electronically anything previously obtained on paper. For businesses, this same capability is transforming at a staggering pace the workflows between and among businesses and their customers. Some of the most aggressive enterprise adopters of this technology have built so-called Intranets, Extranets, and electronic marketplaces slashing millions – in some cases billions – of dollars in operating costs out of their P&Ls.

As profound as today's Web truly is, there is a central problem that sets the stage for the next evolutionary advancement of electronic media. The user's experience of the Web is today limited to "flat" 2-dimensional pages, for two reasons: narrow bandwidth does not afford the ability for most people to download rich visual media in real time, and the Web sites of today are not ideally equipped to take advantage of the computer processing and visual display capabilities that non-Web, desktop-based applications can. These reasons explain why AOL, for example, requires people to download and install a visual access application that goes beyond the limits of a Web browser. It's why the most popular computer games require the installation of resources from CD-ROMs. It's why we continue to need to install applications like Microsoft Office directly on our PCs. It's indeed why we still need desktop operating systems like Microsoft Windows and Mac OS. Web sites and the browsers that access them are not yet suited to fulfill essential functions of sensory immersion and instant interactivity, because they do not take sufficient advantage of the smart processing, large storage capacity and rich media displays of PCs.

Such is the situation at the beginning of 2001. Having established this background we can now explore further the idea put forward earlier: *A common solution for the seemingly-disconnected challenges of making Internet commerce compelling, entertainment immersive and monetizable through advertising, and online education effective is to be found in the advancement of the sensory interface of electronic media.*

2000s: Consoles



User Device:	**Connectivity:**	**Serving Device:**
Consoles "Smart UIs"	Internet Protocols	Anything "Smart Networks"

One of the central challenges to the creation of rich, photorealistic, 3D user interfaces has been the deployment of broadband to a sufficient number of Internet users to justify the expense of creating rich media content. According to some estimates, half of US Internet users will still be operating at 56kbps or less by the end of 2002, and the rest of the world's population will be much further behind. The two most popular strategies for conveying rich 3D content to a consumer computing device – media download or polygon download and client-side rendering – cannot provide by themselves a compelling, immersive, photorealistic 3D "space" that instantly responds to user activity, if downloading occurs in real time on less than 5 mbps or so. The latency of response from the Internet is simply too lengthy for highly interactive content, when compared to the latency afforded by simply fetching content from local RAM or disk storage.

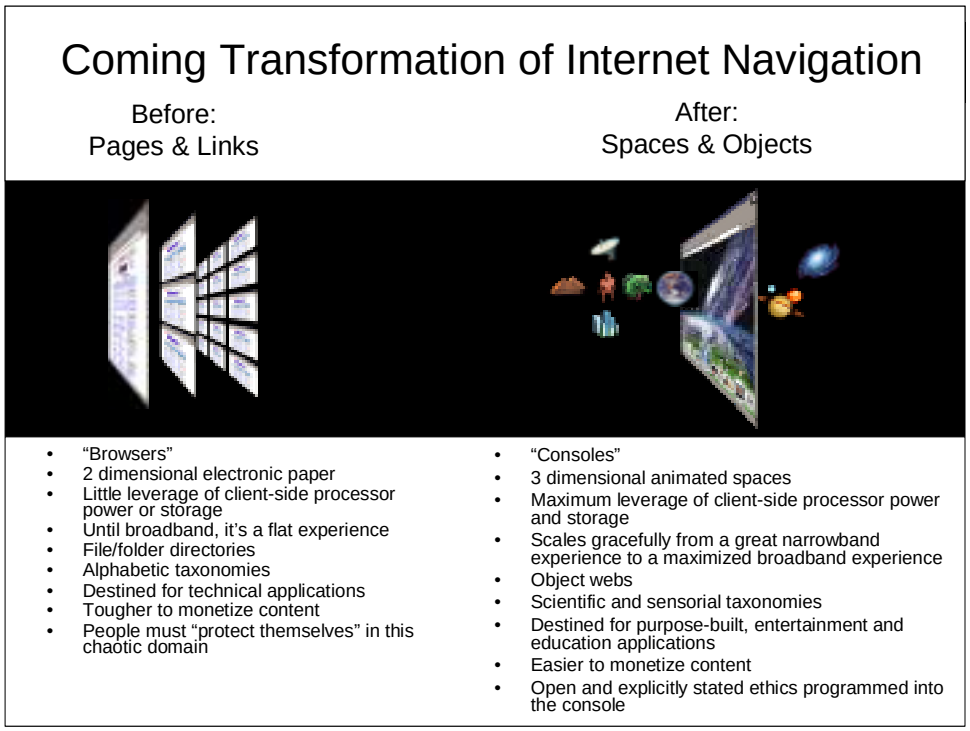
Purpose-built hardware systems and software applications that combine client-resident, local processing, storage, display, and audio resources with the remote information, applications and services available on the Internet can address this challenge. These new classes of systems may be called *Internet consoles*. Internet consoles have been informally described in many contexts, but they clearly now represent a rapidly advancing categorical trend in the evolution of electronic media deserving careful and formal study. Early examples of Internet consoles span a spectrum from dedicated applications for e-mail such as Microsoft Outlook to very generalized media interfaces such as America Online to niche tools like the popular SETI@home screen saver. Others include Yahoo's FinanceVision application, and Microsoft's WebTV and the new MSN Explorer.

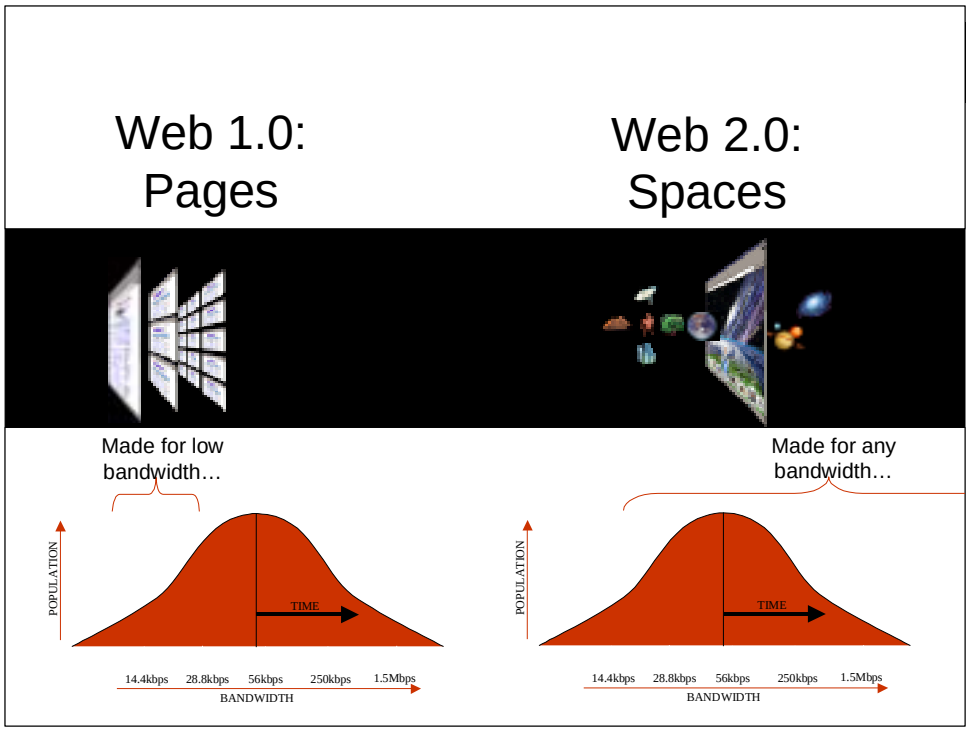
These represent merely the earliest beginning of PC-based Internet consoles, and it is important to stress that Internet consoles are now beginning to emerge in non-PC devices. Innumerable MP3 music players (and recorders!), TiVo, Sony's PlayStation 2, and AOLTV represent examples of the growing diversity of Internet consoles. By 2005, most cell phones will represent Internet consoles.

One of the benefits of the Internet console architecture is that it can offer broadband-like media experiences long before broadband can conceivably be deployed to the world's population.

Indeed, properly designed Internet consoles can provide Sony Playstation 2 levels of interactivity and immersion at Yahoo levels of snappy performance, on 28.8kbps.

The following diagrams succinctly summarize the transformation of the electronic media experience which we believe to be imminent:





Moving from 2-dimensional electronic paper as the basis for the "canvas" of the user's experience, we will see increasingly 3-dimensional interfaces. Moving beyond notions of "pages and links", we will see "spaces and objects" linked in naturally-associative webs. Moving from a browser page-based user interface that does not leverage broadband, we will see visual interfaces that intelligently scale from 28.8kbps through fiber-optic levels of broadband access, within seamless visual experiences at every level.

The applications of consoles range from wholly new kinds of networked education curriculum platforms to dazzling worldwide Internet games to special-purpose consoles for innumerable line-of-business functions. We should expect to see Internet consoles "sink into the background" of our lives, as they become seamlessly integrated with the physical objects in our homes, businesses, vehicles, and even our childrens' toys.

In summary, Internet consoles have the potential to transform the desktop PC and Internet portal landscape as significantly as the Macintosh Finder and Microsoft Windows interfaces transformed the terminal command-line interfaces from 1984 to 1994.

Let us consider one example of a new type of Internet console – OneCosmos.net – as a case study.

OneCosmos.net: A Step Towards a Holodeck

With an investment of 100 person-years of design and engineering so far, One Cosmos Network (OCN) has nearly completed development on Phase 1 of a breakthrough Internet platform that leaps beyond the aging 2D human-computer interface while simultaneously addressing the bandwidth challenge in a new way. OneCosmos.net integrates four particularly important innovations:

1. The vision behind OneCosmos.net is based upon the belief that science can provide us the ultimate desktop or home page, a truly "universal canvas." OneCosmos.net is the world's first high-quality sketch of a 3D visual dashboard that attempts to "put the Cosmos at your fingertips," replacing your desktop user interface with, literally, a cockpit-like visualization of our planet and our Universe, including representations of tough-to-structure domains such as society and technology. OneCosmos.net works within ordinary Microsoft and Netscape Web browsers, and the best sites across the Internet are placed upon and within "interactive spaces" – 3D dioramas spanning everything from spatial visualizations of business and government to the ocean's coral reefs to our solar system. Indeed, one of the science projects partially sponsored by One Cosmos Network will result in the world's first cartographically accurate map of tens of millions of stars in our Milky Way galaxy – soon explorable through OneCosmos.net from any PC with an ordinary copper phone line connection.

   Taking an Akamai-like content caching concept to its ultimately sensible limit, OneCosmos.net is installed once from CD or by download, establishing a *client-cached rich-media universe* intended ultimately to mirror the real Universe we live in, enabling the Internet user to navigate the Web from within a fully photorealistic, intuitive, 3D visual space; the 3D space is as "snappy" on 28.8kbps as if the user were downloading rich media on a 5-10 mbps broadband connection. Broadband simply makes the 3D spaces more diverse, photorealistic

and interactive. Future versions of the dashboard will become increasingly accurate and dimensionalized as OCN's architecture and third-party Internet plug-in technology advances and stabilizes. Indeed, OCN plans to sponsor worldwide contests among 3D media designers to evolve ever-more-perfect and immersive spaces that can be plugged into OneCosmos.net through a set of peer-to-peer interfaces for popular rich media tools. These peer-to-peer interfaces will enable a variety of popular rich media content development tools to be used to extend OCN's online universe. For primary contextual and featured content, these tools can be used by a network of collaborating partners across fields of science, in editorial partnership with OCN, defining something akin to an electronic Library of Alexandria accessible to ordinary people. These same peer-to-peer tools can be usable by people to homestead within a realistic online universe, wherever they wish. How about a biologist homesteading within a certain part of the DNA molecule? Or enabling millions of children to each pick a star in the Milky Way Galaxy and, within a play mode, construct their own "Sim Solar Systems," voyaging off from their home stars to interact with others'?

One of the breakthroughs afforded through an approach to navigation based upon a total and passionate commitment to science is that users of the OCN console learn science simply as they navigate the online visual universe. People learn the relationships between things simply by clicking and navigating. The value of this innovation in the context of today's challenges to education should not be underestimated, nor should we understate the importance of getting the science right, given that the console will be used as a platform for education.

2. Instead of using arbitrary alphabetized text links for navigation of Web content like most portals do today, OCN's console contains the first scientifically-focused natural map or taxonomy of content across the Internet. OneCosmos.net serves tens of thousands of links to the best of the best sites on the Web according to OCN's scientifically-derived visual representation of our real society, the real Earth and the real Universe we live within. Instead of a chaotic and disorganized online representation of reality, OCN has created the first online representation of reality that's designed to increasingly accurately mirror our world and Nature as a whole. The result over time is a new level of simple, intuitive Web navigation for ordinary people, leaping beyond the concept of "files & folders" predominating human-computer interaction today.

   In addition to a natural, scientific taxonomy, OCN has introduced into its console the ability to explore information categorized along the dimension of time. Through a user interface tool called the "Time Traveller", a user may reset the clock on the console and venture off into history or the future. Through this innovation, we can over time create interactive spaces for ancient Egypt, the Jurassic era, or even the birth of the solar system, all accessible through a scientifically-structured yet utterly simple navigation system. The Time Traveller will also perform double-duty as the archive access model for OneCosmos.net content itself – enabling future users to visit previous days and experience them as originally presented.

3. OCN has pioneered a new notion we call “interface modes” which allow the formal distinction to be made between places you can go and activities you can engage. In other words, the console formalizes the difference between nouns and verbs into the navigation paradigm. So, for example, when the mode toggle is turned to “Observe”, an interactive space, say presenting Africa, then provides the function of a newspaper – surveying the universe of news and other current information relevant to Africa. Whereas by toggling into the “Connect” mode, communities, organizations and online homesteaders who’ve chosen Africa as their electronic locale become accessible through well-designed user interface functions. In the “Play” mode, the universe of games and other entertainment pops into view. Imagine letting 100,000 kids collaborate on a simulated city on Mars, in which they can instantly toggle from the “Play” mode to the “Understand” mode, wherein links to the best educational resources online relating to Mars may be found. Another mode called “Watch” anticipates the deployment of the OCN console into interactive televisions, enabling you one day to point and touch your way through the universe of broadcast and video-on-demand channels on the horizon. The net result of the innovation is that the console can provide a genuinely converged and extremely simple navigation experience that is nonetheless entirely flexible enough to serve both the surfer seeking information and the couch potato seeking entertainment. And new modes – including verbs specific to subsets of navigational domains – can be imagined all day long.

4. OCN has designed a Microsoft and Netscape browser-compatible, client-server content request and reply taxonomy based upon scientific knowledge and described in XML documents, which will become an open source protocol at the appropriate juncture. This will allow OCN and others to develop versions of 3D navigation consoles for a variety of client devices, starting with Web browsers, and quickly evolving to include popular game console DVDs, wireless PDAs, and even Internet-ready television sets hanging on living room walls, all expressions of the protocol providing and requesting information within a scientifically-derived content request structure understood by compatible client or server applications, through XML. By opening the specification, it will be possible over time for others to supply alternative consoles and servers accessible by the user population familiar with the notion.

   The first version of the visual console is based in Macromedia Director and Shockwave, along with HTML and all of the plug-ins they support. Director is particularly strong in its “staging” capabilities, enabling framing, transition, and motion effects beyond any other PC imaging platform. Future Browser-based versions will include components more heavily based upon Pulse, Metastream, and a variety of even more advanced visualization technologies, while obvious next steps include versions of the console for Sony PlayStations, Xboxes, and Nintendo platforms.

5. OCN is connecting the console to Electron Economy’s XML-based InternetTONE, enabling users to purchase on impulse products and services while remaining within the context of an entertainment or education experience. Example: when you are navigating through the ocean realms of the OneCosmos.net universe, visiting coral reefs within the 3D visual navigation experience, all of the books or videos relevant to reefs will be able to be explored

and purchased. Within well-structured editorial and commerce policies, arbitrary vendors of products and services can plug into the OCN-InternetTONE and thereafter transact with consumers through the console, leveraging the console's integrated shopping cart and account management interfaces. As Electron Economy expands connectivity of the InternetTONE over the next several years, users of OneCosmos.net will have the ability to buy a vast diversity of products and services across the Internet through the console, with single invoices and financial transactions that consolidate items provided by multiple vendors. A well-architected implementation of this capability has not yet been seen on the Internet as of early 2001.

Building upon the commerce operations capabilities afforded by the InternetTONE, OCN's console has been designed to aggressively advance socially responsible business practices through the adoption of a "Transparent Commerce Initiative." In partnership with a network of competent non-profit organizations, this initiative aspires to provide individual and organizational consumers and investors with an innovative, customizable "software tricorder" tool to access the best information available about the social and environmental performances of companies and the impacts of their products and services. Using this tricorder-like software tool, you point to a product, service, or company anywhere on the Internet and a set of labels are revealed, telling you what growing networks of environmental and otherwise socially-conscious information services have to say about whatever is under the tricorder's lens. Though it will take many years of work among non-profits and significant development and testing, this kind of Transparent Commerce Initiative will enable consumers to easily align their on-line economic actions with their social and environmental values, and, in the aggregate, engage in collective action for social change.

Such are the kinds of things Internet consoles will do. In the case of OneCosmos.net, the result is compelling: a spectacular new kind of Internet user experience that works very well on a 28.8kbps connection, can scale gracefully to leverage broadband as broadband emerges, changes the rules and possibilities for monetizing Internet content, and advances urgent social agendas through its service to education and programmed-in capabilities for values-conscious commerce. With its pioneering visual approach to web navigation, OneCosmos.net will enable users to navigate a realistic, scientifically accurate online universe, which reflects the natural world around us in exceptional fidelity. As such, OneCosmos.net will redefine the Internet navigation experience to more closely resemble our experience of reality, and at the same time provide a breakthrough example of the solution to the problem of narrow bandwidth.

Advancing Business Models

It is instructive to examine some of the ways business models for content and services may evolve based upon the architectural capabilities of Internet consoles:

From Consumers:

1. Sale of a vast diversity of purpose-built wired and wireless devices, and disks and cartridges for multipurpose platforms such as Sony PlayStation 2, XBox, and Nintendo game systems. Unlike web sites, which rarely established sufficient value to justify subscriptions, rich media tools, games and information have always held sufficient value to justify direct consumer investment.
2. Sale/subscription of add-ons to or event-specific content within consoles. Within the context of richly interactive experiences and by better conveying real-time events, it is reasonable to expect that add-ons and event-specific content will be purchased on a subscription or pay-per-experience basis, particularly if simple user interfaces and micro-payment facilities make one-click transactions ubiquitous, painless, and available on impulse in an entertainment context, rather than simply in a catalog.
3. Sale/subscription of premium desktop services. The future desktop is likely better characterized as an Internet console, and all of the functions of today's desktops and desktop applications can be expected to morph into various kinds of Internet consoles. Microsoft's .Net and Netdocs strategies, along with Apple's OSX, can be considered to reflect this trend, although perhaps with heavier client operating systems than may actually be necessary.

From Advertisers:

1. 3D immersive experiences and rich media capabilities of the Internet consoles will enable never-before-seen kinds of advertising and sponsorship programs. Shifting from homogeneous, flat banners to diverse 3D advertising, sponsorship messages can become "bandwidth-scalable information and experiences" from the simplest animated 3D logo that "expands" into a rich message upon simply mouse rollover, all the way to television format, and ultimately beyond to interactive entertainment and extraordinary new types of commerce promotions.
2. It is likely that Internet consoles will enable advertisers to choose among impression, click, transaction, or percentage of business pricing models.

From Licensors:

1. Internet consoles can be software-only or software-hardware combinations, licensed for embedding within consumer electronics devices ranging from Internet-ready television sets to new classes of wireless devices to automobiles.
2. Internet consoles can be licensed to broadband ISPs, enabling private labeling, and simplifying the broadband experience to an AOL-level of simplicity for users by integrating user authentication and account management processes.
3. Licensors of consoles will likely engage in revenue sharing agreements that reflect joint responsibility for marketing to, reaching and serving customer audiences.

From Vendors:

1. New kinds of identity and account management tools such as those coming from major credit card companies, Microsoft's Passport, and commerce network interfaces ranging from the marketplace platforms of Ariba and CommerceOne to the commerce logistics network formed upon Electron Economy's Internet TONE, will enable Internet consoles to leverage an increasingly robust, outsourced infrastructure for commerce. The result: a single shopping cart with a single credit card transaction that can ultimately span nearly Internet-wide purchases. Internet consoles can expect affinity and/or transaction fees from vendors participating within such systems, depending upon the overall value provided to both buyers and sellers.

The Rising Importance of Ethics in Computer Interfaces and Functions

The rapidly evolving landscape of modern technology leaves us breathless, with seemingly-daily discoveries that each are world-changing in themselves. Important issues are rising to the surface of social discourse concerning the risks posed by emergent component technologies and their combinations. Will nanotechnology one day overtake the world? Will terrorists or amoral commercial interests misuse the power of genetic engineering? Will ubiquitous communications destroy cultural diversity? In what ways is the Internet an increasingly conscious nervous system of an economic-technological machine? These are among many important questions that deserve continuing examination, and the advancement of the human-computer interface is yet another dimension of technology transformation requiring such study. The resolution of such concerns likely rests primarily in evolving the metaprogramming of economics to reduce and one day eliminate systemic motivations for the intentional or accidental misuse of scientific knowledge.

Focusing on the domain of scientific advancement postulated in this white paper, we believe that step-function increases in the richness of the sensory and intellectual qualities of human-computer interfaces represent vital advances in the utility of electronic media.

Conclusion

Internet consoles are poised to advance the human-computer interface beyond the limits of prior forms of media, and can facilitate more realistic and compelling ways for telephone, radio, television, and Internet content both to converge and diversify. They represent a new category of solution for the seemingly-disconnected challenges of improving the experience of Internet commerce, making online entertainment compelling and immersive and monetizable through sponsorship, and perhaps most importantly, fundamentally transforming education.

Ethically used, Internet consoles can provide the world with wondrous new tools to address serious and urgent challenges, and open new opportunities we've barely begun to glimpse.