

THE INTELLIGENT INTERNET

A Return of the Dot.Com Boom?

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An abundance of information technology (IT) exists today that can vastly improve human life – yet it is seriously underutilized. Broadband, e-commerce, wireless, instant messaging and other time-saving and relationship-building tools can greatly enhance people’s everyday experience. Despite the benefits of these powerful advances, however, the IT industry is languishing because it lacks a compelling vision of how technology can serve the public’s needs more conveniently.

We serve on the AMD Global Consumer Advisory Board, a respected group of technology experts and consumer advocates from around the world that has been studying this Technology Gap. Early adopters may love broadband and the hottest new devices, but average Americans are reluctant to upgrade their old PC hooked up to a 56 K modem because it works just fine at word processing, email, and other simple applications most people use. That’s why computer sales have leveled off at 60 percent of American homes in recent years and show little sign of turning up. Forty-one percent of the population does not see the need for a PC, 90 percent say computers are too complex and time-consuming, and 60 percent say they are uninterested in broadband. ¹

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¹ Halal, “The Technology Gap,” *On the Horizon* (2002)

Fortunately, our studies suggest that modern nations may overcome this Gap in this decade by adopting “intelligent” technologies offering greater benefits more conveniently. In fact, the evidence assembled in this article indicates that the IT industry may resume a more sustainable version of the heady growth of the ‘90s.

Yes, we realize It seems foolhardy to claim that IT will soon thrive again when economies around the globe wallow in recession. After all, it was the unrealistic hype of endless growth we heard during the dot.com boom that caused today’s economic pain, and it may have contributed to the Technology Gap by causing consumers to distrust the promises of technology.

However, our forecasts and technology scans suggest that commercial use of an “intelligent” Internet is likely to mature and rejuvenate the economy during this decade. The TechCast project at George Washington University forecasts that major aspects of Internet use should reach 30 percent “take-off” adoption levels during the period 2004-2010, while trends in computer intelligence are driving the rise of a “conversational” human-machine interface. We think the result is likely to be an “Intelligent Internet” that forms the next generation of IT. Rather than hunching over a keyboard, this new IT paradigm should allow us to converse with life-sized images while shopping, working, learning, and conducting most social transactions, offering the same comfort and convenience that made telephone and television indispensable – “TeleLiving.”

Economic Maturing of the Internet

The TechCast system is a data-based driven website in which panels of experts provide online estimates to carefully researched questions. The estimates are pooled

automatically to produce the best possible forecast of when each technology is likely to take-off, the associated confidence level, and size of the potential market - in real time.²

Results are presented in the table below for 20 types of E-Commerce. The expert panel convened for this study includes 38 authorities from a variety of backgrounds: CEO's of Internet firms, technology officers, scientists and engineers, technology consultants, academics, and futurists. Not all experts respond to every question, so the typical number of respondents averages 22. Delphi forecasts of this type are generally considered sound if they use a dozen or more experts, which makes these results fairly reliable. We've found that the variance among forecasts over time averages +/- three years. Hardly perfect, but it gets us "into the right ballpark."

Table 1

E-Commerce Forecasts

(Number of Expert Responses Averages 22)

E-Commerce Services	Likely Year	Confidence Level (0-100%)	Market Size (1 min - 7 max)
Broadband High-speed channels (DSL, cable, Ethernet, and satellite) are used at 30% of homes	2004	65	3
B2B 30% of commercial transactions are conducted online	2006	64	5
Online Finance 30% of banking, investments, and other financial services are performed online.	2007	60	3
Internet Taxation Internet sales are taxed by major nations.	2007	53	2
Entertainment on Demand 30% of music, movies, games, and other entertainment is sold online.	2007	59	2
E-Training Distance learning (Internet, video, email) is the main method used in 30% of training programs.	2008	61	2
Knowledge On Demand Focused educational programs are used online to serve 30% of specific needs.	2008	53	1

² See Halal, "85 Emerging Technologies," *The Futurist* (Nov-Dec '97) and "The GWU Forecast of Emerging Technologies," *Technology Forecasting* (Sept '98).

Wireless Webphones, palmtops, etc are used by 30% of the population for Internet, video, etc.	2009	66	4
Privacy & Security A majority of the public feels safe about the privacy and security of their information.	2009	53	1
E-Tailing 30% of goods and services are sold online	2010	58	4
Public Services 30% of government services (auto registration, licenses, fees, etc.) are conducted online.	2010	57	3
Online Publishing 30% of newspapers, magazines, journals, and books are sold online.	2010	47	2
Medical Research 30% of clinical research is conducted using computerized systems.	2010	48	1
Telesurgery Surgical procedures are performed at remote locations.	2012	44	2
Online Voting ATM-type machines or PCs on the Internet are used in 30% of elections.	2012	39	1
Virtual University Distance learning (Internet, video, email) is the main method used in 30% of courses.	2014	41	3
E-Health Online systems are used 30% of the time to prescribe drugs, order lab tests, monitor patients, etc.	2015	45	4
Global Grid Half of the world population has access to PCs, Internet, etc.	2017	41	3
Virtual Reality Systems are used by 30% of the public to experience exotic environments (Mars), entertainment (games, virtual sex), education, testing designs, etc.	2016	36	2
Equal Access Most (90%) of underprivileged people have Internet access.	2017	44	1

Notes: “Likely Year” is the most likely year that each E-Commerce service will reach it’s stated adoption level (usually 32 %) in industrialized nations. “Confidence Level” is the confidence that experts place in their forecast of “Likely Year.” “Market Size” is a measure of the relative size of the economic market resulting from each E-Commerce service, on a scale from 1 (minimum) to 7 (maximum). For details, see the website: www.TechCast.org

These results portray a striking scenario in which the dominant forms of e-commerce – Broadband, Business-to-Business (B2B), Online Finance, Entertainment-on-Demand, Wireless, E-Training, Knowledge-On-Demand, Electronic Public Services, Online Publishing, E-Tailing – grow from their present 5-20% adoption levels to 30% in industrialized nations between 2004-2010 (2007 +/- 3years). We consider the 30% penetration level significant because this roughly marks the “take-off point” when technologies move from their “early adopter” phase to enter the mainstream and

permeate economic and social life. Andrew Grove, former CEO of Intel, recently affirmed this view: “Everything we ever said about the Internet is happening now.”³

Many think the Internet is mainstream now, but that’s only true for non-paying use, such as surfing for free information. As of 2003, commercial operations involving monetary exchange were limited to about 23% for Broadband, 10% for E-Tailing, 12% for B2B, 10% for Distance Learning, and 5% for Music.⁴ And these are the most popular Internet applications. Others hardly register in adoption levels at all.

Our other results suggest that less prominent and more difficult applications – Online Voting, E-Health, the Virtual University, Virtual Reality, and the Global Grid – are likely to follow later. These forms of E-Commerce lag because they involve more exotic and costly technology, difficult institutional changes, and new forms of consumer behavior. Making the Virtual University a reality, for instance, requires professors to switch from traditional lectures to communication technologies that are poorly developed, college administrators must justify the economic feasibility of more expensive technologies, and students have to feel comfortable and trusting in a virtual setting. E-Health demands a similar transformation among physicians, hospitals, and patients; protecting the privacy of patient data is a particular challenge.

The remaining developments in our forecast – Taxation, Privacy & Security, Computerized Research, Telesurgery, and Equal Access – should appear at varying times throughout the next two decades. These applications differ because do not serve major new social needs but involve modifications of existing systems.

³ Grove is quoted in “The E-Biz Surprise,” BusinessWeek (May 5, 2003)

⁴ Adoption levels are calculated as a percent of the total group in the U.S. that could possibly use each technology. In the case of broadband, the adoption level is the percent of households. For E-Tailing, it is the percent of retail sales. And so on.

Rise of the Intelligent Interface

Interwoven through these advances in e-commerce are powerful trends leading to a new generation of intelligent systems we forecast to emerge during the same time period.⁵ We call it “TeleLiving” – a conversational human-machine interface that allows a more comfortable and convenient way to shop, work, educate, entertain, and conduct most other social relationships.⁶ The box below outlines advances in speech recognition, artificial intelligence, powerful chips, virtual environments, flat wall monitors, and the semantic web that are likely to produce this intelligent interface:

Box 1

TECHNOLOGICAL ADVANCES UNDERWAY

Good Speech recognition should be common by 2010

- ◆ IBM has a “Super Speech Recognition Program” to greatly improve accuracy, and Microsoft’s program is expected to reduce the error rate of speech recognition to match humans in a decade.
- ◆ MIT is planning to demonstrate their Project Oxygen, which features a voice-machine interface.
- ◆ Speech recognition call centers are replacing the maddening touch-tone call centers, and some analysts think most will make the conversion in a year or two. For instance, Amtrak’s “Julie” can now provide train schedules, make reservations, and accept payment; customer satisfaction is up and Amtrak recovered its investment in one year.
- ◆ Search engines, like Google and Yahoo, operate voice recognition systems that help users find what they seek and send the results wherever instructed.
- ◆ General Motors OnStar driver assistance system replies primarily on voice commands, with live staff for back up; the number of subscribers has grown from 200,000 to 2 million and is increasing 1-2 million per year. The Lexus DVD Navigation System responds to over 100 commands, and guides the driver with voice and visual directions.
- ◆ Even more pervasive yet simpler, Sprint offers voice dialing on most cellphones and networks.

Smart computers should learn and adapt in a decade

- ◆ The Defense Advanced Research Projects Agency s developing a hypersmart computer that can maintain itself, assess its performance, make adaptive changes, and respond to different situations.

⁵ See www.TechCast.org

⁶ Halal, “TeleLiving,” *The Futurist* (Jan-Feb 2003)

- ◆ IBM's "autonomic computing" program will allow servers and networks to solve problems and reconfigure themselves to accomplish a goal, just as organisms rely on an autonomic nervous system to regulate heartbeat and body temperature.
- ◆ PC applications provided by Norton System Works can eliminate virus infections, optimize PC performance, fix registry mistakes, and perform other tasks without user intervention.
- ◆ AI is being used to intelligently guide the human actions of figures in computer games, such as Sims, Metal Gear Solid, Unreal Tournament, and Halo.
- ◆ Pattern matching and text parsing are used to improve searches by Google and AltaVista.
- ◆ BCC Corporation estimates total AI sales to grow from \$1B in '93, to \$12B in '02, to \$21 B in '07.

A new generation of computer power is here

- ◆ The 32 bit generation was introduced over a decade ago with the AMD AM386, Intel 386, and Motorola MC68020 processors, enabling widespread use of graphical interfaces, such as Windows.
- ◆ Intel is now introducing a 64 bit chip. AMD and IBM produce 64 bit chips that are fully compatible with 32 bit chips, offering the additional benefit of easing the transition from 32 bit to 64 bit computing.
- ◆ At double the data width and nearly 10 times the memory, 64 bit chips mark a new generation of computer power that features true cinematic displays rivaling the most sophisticated science fiction movies, continuous and more accurate speech recognition, and the immense improvements in database performance required by the Intelligent Internet.

Virtual Robots/Environments will populate the web by 2010.

- ◆ Virtual robots, or avatars, are becoming common, such as. Ananova, a female robot who presents weather reports. In Japan, a virtual rock star has become a national idol.
- ◆ "There" is a multimedia website featuring 3D computer-generated environments populated with Avatars that interact with users and other avatars.
- ◆ The UCLA Cultural Virtual Reality Lab virtually recreates ancient Rome, including 3D images of temples and monuments that users can walk around. The lab head called it "A kind of time machine."
- ◆ The CEO of Native Minds, a virtual robot maker, said "The Internet will be filled with robots by 2010."

Flat wall monitors should become common in a few years.

- ◆ Sales of Liquid Crystal Display (LCD) monitors now surpass Cathode Ray Tube (CRT) sales, introducing an era of flat monitors that use one third the power of CRTs. "Ultimately, the flat panel is less expensive," said a Dell manager.
- ◆ Leading TV makers are all bringing out 60 inch wall-mounted digital TV monitors.
- ◆ The Waldorf Astoria Hotel in New York City has been using a 4X7 foot video conferencing system for years. "It feels like you are all sitting in the same meeting," said one user.

- ◆ Albeit expensive now, as the switch from CRTs to LCDs gathers momentum, costs and prices should fall dramatically, making \$1000 wall monitors the size of a movie screen fairly common. A fully functional 3 x 5 foot wall monitor should sell for less than \$500.

The “Semantic Web” is in progress

- ◆ Tim Berners-Lee, founder of the world-wide web, is designing the “semantic web,” which will make the Internet a far more intelligent system. The semantic web is estimated to come online in 2005.

These are formidable undertakings, to be sure, and some may not succeed as planned. But such remarkable developments promise to transform the human-computer interface. As the above trends show, powerful new scientific capabilities are being applied now for simple uses, and if current trends hold, a modest version of the talking computer made famous by Hal in the movie *Space Odyssey* should be available about 2010 –3/+5 years, or sometime between 2007 and 2015. Rather than hunching over a keyboard or using a mouse, the PC will disappear into a corner while we talk to life-sized virtual persons on large wall monitors.

A few years ago Bill Gates claimed “The future lies with computers that talk, see, listen, and learn,” while more recently Robert McClure, a computer analysts at IDC, stated “What the GUI was in the ‘90s, the natural user interface will be in this decade.” This conclusion is further supported by other IT industry leaders. Sony President Kunitake Ando expects the PC of the year 2005 to be a more personalized, intelligent system, acting as a “teacher, agent, and guide.” And Ian Pearson, a senior analyst at British Telecom, sees a resumption of the dot-com boom driven by new technologies:⁷

While this recession is happening, technology is improving so that by the years 2005 and 2006, there will be really good ideas waiting to be developed. We are seeing the growth of interface technology, better displays, much better storage, faster processing, and better AI.

⁷ These quotes are from “Sony’s Ando,” *ZDNet.com* (Dec 5 ‘03), and “New Technology Boom Forecast” *Scottsman.com* (Jan 29 ‘03)

A Vision for the Next IT Generation

The enormous gap between today's depressed IT industry and the vibrant trends noted above signifies that we are poised at the cusp of another major IT transition, much as the '80s brought the PC and the '90's brought the Internet

The economic recession left in the wake of dot-com bust may linger a while, but all technological revolutions go through a similar boom and bust cycle. The introduction of railroads, telephones, and radios invited wild speculation similar to the dot-com bubble, yet, a few years after the inevitable crash, renewed economic growth and more prudent business practices caused these fledgling industries to boom again.

A similar resumption of growth is likely for the Internet. Economically sound e-practices are common now and should continue to improve. And as the economic recession runs its course, venture capital is also appearing to support new startups. The nagging problem of Digital Rights Management is also likely to be resolved soon, which could unleash a market for music, videos, publications, and other IP. Meanwhile, the first "wired generation" of college students is entering work, expecting the unlimited bandwidth and sophisticated Internet features they have grown accustomed to. We see no serious obstacles to the first wave of relatively straightforward E-Commerce services noted in our forecast, therefore, which is likely to reach the 30 percent adoption level somewhere during this "take-off period" running roughly from 2004 to 2010.

This time, however, we think the intelligent interface holds the key to putting today's underutilized IT to work . Consider this brief scenario outlining how an Intelligent Internet might move to the mainstream of modern societies:

- Simple versions of intelligent systems are likely to appear more frequently as web entrepreneurs explore this new market now being opened by scientific advances.
- Other trends are encouraging intelligent IT, such as the U.S. Military's support of intelligent systems as part of its transformation to "Network-Centric Warfare."
- The main impetus could be competition to provide customers with attractive benefits. The life-life, conversational multimedia we call TeleLiving should prove extremely appealing and help to relieve exploding complexity.

We suspect such forces will fuel demand for the Intelligent Internet to blossom sometime around 2010, as our trends suggest. BusinessWeek's special issue, "The E-Biz Surprise," noted: "The Web is the same age color TV was when it turned profitable."

The impact on everyday life could be profound. Almost any social transaction – teleworking with colleagues, buying and selling online, education and training, consulting with your physician, entertaining – could soon be conducted in a conversational mode, speaking with life-sized images as comfortably as we now use telephone and television. The result is likely to absorb simpler information appliances into a larger venue as video-cameras and web-based video, instant messaging, voice messages, TV, fax, virtual robots, and all other manner of information are displayed vividly on wall-sized screens – an historic movement from TelePhone, to TeleVision, to TeleLiving. It will seem like virtual people are right there in the same room with you. .

We are fully aware of the cynicism that persists over the unrealized promises of AI, and we also know the Intelligent Internet will present it's own problems. If you think today's dumb computers are frustrating, wait until you find yourself shouting at a virtual robot that repeatedly fails to grasp what you badly want it to do. We also realize that this

forecast may seem extravagant in contrast to the dismal mood of the IT industry today. However, the main cause of this stagnation is that the industry has lost its vision.

Yes, the dot.com boom was unrealistic to a large extent, but at least it was driven by a powerful image that inspired huge gains in many areas. If the industry hopes to see a revival, it will have to define an attractive but feasible image of how it can conveniently improve public life in the promising but difficult years ahead. We think the evidence suggests that the future lies in developing intelligent systems, and we also think the industry could resume its good fortunes rather quickly if it were to seize upon such a vision with clarity and determination.