

Unflagging technology activist Gordon Bell previews a future in which plugging in to a worldwide network is as easy as getting a dial tone

JOHN HARRING

THE VIEW FROM HERE

By Gordon Bell

Bell is creator of the Digital Equipment Corp. VAX and founder of the Computer Museum in Boston. This week he is also Computerworld's publisher, a position he won as highest bidder at last year's Computer Bowl fund-raiser.

Times Square. Midnight. 1999. A thunderous roar fills the air as the crowd celebrates the new millennium. Few in that New York crowd may be aware, however, that a lot more than just their calendars will change. In the year 2000, a momentous leap forward in computing will begin as pieces of a ubiquitous environment of scalable networks and platforms start to appear.

How sweeping a computer evolution the year 2000 ushers in will depend on the speed of technological advancement, our own willingness to adopt standards and the vagaries of vendors.

There will be plenty to ooh and aah about when we greet the new millennium: increased reliance on standard platforms, operating systems and Asynchronous Transfer Mode (ATM) networks; new "mainframes" made of stacks of linked PCs running Microsoft Corp. Windows NT and SQL-based databases all connected to a high bandwidth switch; some consolidation of the flavors of Unix; and, perhaps most important, a worldwide dial tone of sorts that will encompass telephone, videophone, videofax and computers and that will let anyone communicate with anyone else anywhere in the world.

It all boils down to what I call SNAP — or scalable networks and platforms — a term coined by me and Jim Gray, a professor at the University of California at Berkeley.

From a systems architect standpoint, scalable networks and platforms will enable users to have only one system — a worldwide network — that will equate to a second-generation Internet, or Internet II. In this internetwork, systems will offer peak speeds of more than 1 billion instructions per second.

For Internet II to happen, users must get wide-scale, fully symmetric 25M bit/sec. communications (at least) at the price of Integrated Services Digital Network (ISDN). T1 lines may be the answer, if the telecommunications providers make T1 available on an interim basis for the same price as ISDN. For about \$100 billion, telecommunications companies can build Internet II so it goes to every phone jack worldwide.

Full realization of scalable networks and platforms can happen within 10 years — if the telecommunications companies cooperate. (The communications industry, while having the most technology, always seems to end up underperforming my already low expectations.) Specifically, the following technology pieces need to converge:

DRIVER: PC powerhouses Time frame: 2000

When the year 2000 arrives, 32M bytes on a single chip will be the norm.

Processors will likely be running at 400 MHz to 1 GHz. Two-and-a-half-inch magnetic disks will be less than 5 cents per megabyte and hold 20G bytes of information — about 10 hours of video or 20,000 books.

The sheer power of the microprocessor and increased magnetic capacity will enable the PC to emerge as the most incredibly flexible product component civilization has ever had. PCs may be harnessed as ultrapowerful worldwide nodes on the desktop, wrist-watch-size personal digital assistants, voice-activated computers or television/computer combinations in the home. Each machine would order and install its own software and be maintained remotely.

Will credit-card-size computers link to public I/O devices and carry a user's personal databases? Sure, that's possible; at the very least, credit cards will contain memory and a processor to identify the card's owner and protect its contents. They may even carry personal medical data (but that assumes medical record keeping is going to creep out of the Dark Ages).

DRIVER: **Communications become one** Time frame: 2005

To achieve scalable networks and platforms, all types of networks and nodes must become one — mobile nets, distributed and point-to-point LANs, private and public wide-area networks, proprietary terminals, cluster interconnects and protocols and phone networks, including telephony switching mechanisms. A single switch standard will enable geographic scaling and fault-tolerant structures.

Fiber-optic technology has brought greater bandwidth to the wide area than to the local area, and in the next four to 10 years, there could be a convergence of LAN and WAN with ATM into a single standard. The new ATM will eliminate network delay, enabling a world-scalable computer. With a single standard and a single network for local areas, campuses and wide areas, the high cost of networking could be reduced to the cost of POTS (a.k.a. Plain Old Telephone Service).

Phone communications will evolve toward a single, pervasive digital dial tone for high-speed networks. These will offer bandwidth scalable to several hundred megabits per second for handling video over phone lines and virtual reality.

DRIVER: NT platforms Time frame: Before 2000

My operating system of choice for the nodes on this worldwide network is
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Windows NT. Why NT you ask? Because it works on all the major hardware platforms — those from Intel Corp. and Mips Technologies, Inc. as well as Digital Equipment Corp.'s Alpha, Apple/IBM/Motorola's PowerPC and Hewlett-Packard Co.'s PA-RISC. NT is compatible with today's 100 million Windows systems and has a massive and growing trained user base. NT makes server platforms commodities and standardizes them.

The impediment here is systems vendors that are stonewalling because they don't want to be compared based on servers — or what is basically a commodity.

NT's capabilities, including built-in SQL, provide nearly all the benefits of a single hardware architecture. Files can be carried on disk from platform to platform thanks to a single disk structure.

Unix must converge to permit applications to be distributed arbitrarily among client and server from any vendor. Once Windows NT begins to take market share from Unix, Unix consolidation will begin.

To help ensure openness, user companies might consider the Bell Rule of Two, which is, "Don't buy software unless it runs on two platforms, and then maintain applications on both platforms."

Again, the PC is the only platform that allows for one platform to run several operating systems for Windows applications. While supporting applications on more than one platform may cost a bit more initially, it will save money over the system's life and will help push standards.

DRIVER: Scalable computers

Time frame: 2000
(if you're an optimist)

Scalable computers can grow virtually without bounds and bottlenecks. Proces-

or large multiprocessors.

Scalable computers will enable every computer to be part of a cluster; in that way, companies can put together large computers by adding together many small ones. Ideally, the scalable computer should scale up to several thousand processor nodes. These computers connect to a high-bandwidth switch.

Multiple microprocessor NT servers operating as scalable clusters can provide the power of a mainframe without the high cost. We're already seeing some of that today through Microsoft's Tiger scalable server demonstration, which is essentially a roomful of PCs connected to an ATM switch.

In a scalable network and protocol environment, nodes act and are managed as distributed workstations and are also managed as a shared-memory multiprocessor.

Individual low-cost, high-powered PCs, such as Compaq Computer Corp.'s ProLiant, combined with Windows NT, SQL-based databases and a single communications network will form the heart of the scalable computer. You can say good-bye to mainframes, proprietary minicomputers, servers and workstations.

The wait times associated with networked computers will not be an issue thanks to scalable switches that allow network bandwidth to be automatically increased or decreased to support the internode traffic. Lower latency, less overhead, increased reliability and constant cost are also keys to making this work.

Two standard switch candidates that can be used to build clusters are Tandem Computers, Inc.'s TNet, which is due this summer, and a souped-up Myrinet from Myricom Corp., which would encompass Tandem's fault tolerance. There would no longer be the need for proprietary switches from different vendors.

DRIVER: True client/server

Time frame: 2000

In this vision of scalable networks and platforms, the role of clients and servers also changes. Today, you essentially have a client-centric version of computing brought about by workstations and PCs or a server-centric version, which is really just a more difficult to manage version of mainframe computing with a graphical front end.

With scalable networks and platforms, you can expect multiple transactions among a number of computers, all of which do their own thing.

You get a glimpse of what will be possible by looking at the workings of the Internet: A client views something on a server and then either goes off on a parallel search of other databases or makes a transaction, such as paying for an item. In such an environment, you get computers that communicate with others and computers that act as agents and carry out compound tasks.

While only pieces of SNAP will materialize by 2000, think about this vision when you're uncorking that bottle of Asti Spumanti at Broadway and 7th Avenue. ■

COMPUTING ENVIRONMENT CIRCA 2000

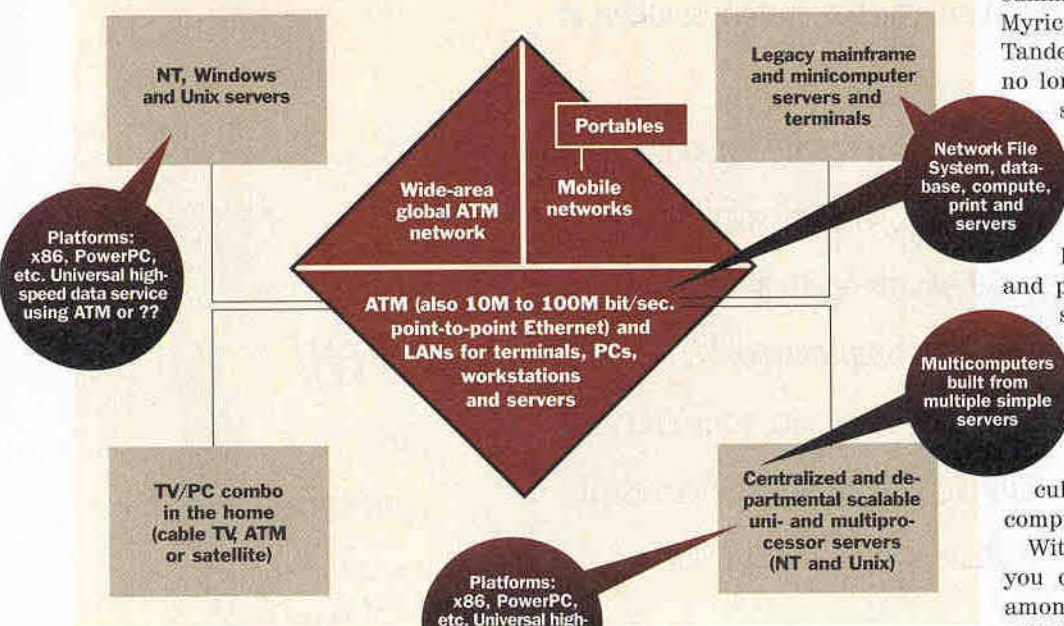


• By 2000, 2 1/2-in. magnetic disks will cost less than 5 cents per megabyte and hold 20G bytes of information — about 10 hours of video or 20,000 books.

• With a single standard and a single network for local areas, wide areas and campuses, the high cost of networking will be reduced to the cost of POTS (a.k.a. the Plain Old Telephone Service).

• Bell predicts Windows NT will outsell Unix in 1995.

• The Bell Rule of Two: Don't buy software unless it runs on two platforms, and then maintain applications on both platforms.



That's zero-cost portability. Unix, by comparison, is portable, but someone has to recompile applications and translate them into formats for different machines. That's costly portability. As a result, I predict Windows NT will outsell Unix this year.

NT's built-in relational database and the various network server protocols equate to lower costs and reduced installation and maintenance charges.

True, client/server technology won't happen until ubiquitous and reliable networking occurs. The various dialects of

servers connected to a single memory pool act as independent computer nodes and are interconnected through a switch to communicate with one another.

Applications involving large amounts of data distributed through the enterprise can grow without bounds because multiple computers can act as one.

A scalable environment of networks and platforms lets users increase performance by scaling rather than having specialized boxes. Enterprise-level servers will be simple uniprocessor and multiprocessor Intel Pentium 7-based PCs

WILD CARDS

Every vision has a blur factor.

With scalable networks and platforms, the following are several potential problem spots:

• **Telecommunications companies.** The single biggest impediment to this vision of the new-world computing environment is the telecommunications industry. These folks are more worried about acquiring other businesses they perceive as a threat, such as cable TV or mobile communications businesses, than concentrating on improving the computer as an information provider or receiver.

Telephone companies are interested in cable TV because of the power and money implicit in it. They can control and bill for information delivered to couch potatoes. Essentially, telecommunications companies are following the old mainframe model of information delivery in which a large mainframe running SNA feeds data to the people sitting at 3270 terminals — a centralized model all the way.

Those of us who have had a taste of the Internet and can see its potential ought to insist that telecom companies provide fully symmetric high-bandwidth communications to the home. This is especially important for people expected to work at home, performing the same kind of work in their house that they do at the office.

• **Computer vendor community.** Platform vendors don't want to hear talk of standard platforms and operating systems. It goes against everything they learned in Business 101. By locking users into proprietary solutions, they harness a stable base of customers and maintain their margins.

The nature of scalable networks and platforms, though, is that all of the nodes need to be standardized; they need to interoperate and support a common applications environment. The standards in this environment would force vendors to change their business — or get out of business.

To survive, the vendors should be concentrating on differentiators that do not lock in buyers. They can attract customers by looking at unique items such as earthquake readiness or systems that respond well to the changing size requirements of an organization.

— Gordon Bell