Text 1. WHAT IS COMPUTER SCIENCE?

WHAT IS A COMPUTER SCIENTIST?

The information is modified from material in the US Bureau of Labor Statistics/Occupational Outlook Handbook

The title computer scientist can be applied to a wide range computer professionals who generally design computers and the software that runs them, develop information technologies, and develop and adapt principles for applying computers to new uses. Computer scientists are distinguished from other computer professionals by the higher level of theoretical expertise and innovation they apply to complex problems and the creation or application of new technology.

Computer scientists must be able to think logically and have good communication skills. They often deal with a number of tasks simultaneously; the ability to concentrate and pay close attention to detail is important. Although many computer specialists sometimes work independently, they often work in teams on large projects. They must be able to communicate effectively with computer personnel, such as programmers and managers, as well as with users or other staff who may have no technical computer background.

Computer scientists employed in industry may eventually advance into managerial or project leadership positions. Those employed in academic institutions can become heads of research departments or published authorities in their field. Computer professionals with several years of experience and considerable expertise in a particular subject area or application may find lucrative opportunities as independent consultants or choose to start their own computer consulting firms.

Technological advances come so rapidly in the computer field that continuous study is necessary to keep skills up to date. Continuing education is usually offered by employers, hardware and software vendors, colleges and universities, or private training institutions. Additional training may come from professional development seminars offered by professional computing societies.

Computing Science is one of the most rapidly developing scientific disciplines. Computing Science is a relatively young scientific discipline with the first modern computer being constructed only about forty-five years ago.

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Computing Science encompasses the study of computing systems with their components, communication networks, formal languages, analysis of algorithms, automata, artificial intelligence and a wide range of applications. The requirement for human-computer communication has given rise to the study of both natural and artificial languages for this purpose, as well as image processing and graphics. The study of intelligence is concerned with the challenging problem of programming computers to play games, prove theorems, converse with people, and generally do things that require human intelligence. Problems in organizing the large amounts of data for storage and fast retrieval has given impetus to data base designs and products. Communication networks dealing with data transmission, voice, images and video are also hot topics.

Computers are rapidly becoming part of our daily routine. They are encountered everywhere: in banks, in shops, at office desks, local restaurants and pubs. Computer literacy is becoming a must in today's highly technical world. They take pictures of other planets, they control traffic in the cities, they connect your phone calls, they check your tax returns, they control power stations whether nuclear, hydro, or coal based, they do computations for engineers. Computers assist the architect in designing your house. A cosmetician may use a computer to suggest makeup or a hairstyle for you. Many children can not imagine life without video games that are run by computers. The creation of the World Wide Web has increased communication from around the world through the use of a computer and has brought advertising to a whole new level. Every day life would be hard to imagine without the invention of this fascinating machine.

Many people can say that their job is in "computers", though very few of them have graduated from a Computing Science department at a university. An accountant can run a computerized, off-the-shelf accounting system in a company without being a computer specialist. Many young people become computer hackers without any university education. Why then would you study Computing Science at a university?

A university education in Computing Science is more than just the study of existing techniques for using computers. It is the study of the nature and techniques of problem solving. In Computing Science, we are particularly interested in those problems that are solvable by computation. Understanding computation requires a knowledge of not only hardware, software, many branches of mathematics and logic but also of many topicsnot usually associated with computers such as psychology, philosophy, linguistics and management skills.

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Jobs in computer sciences are expected to be the fastest growing through the year 2006. Employment of computing professionals is expected to increase much faster than average as technology becomes more sophisticated and organizations continue to adopt and integrate these technologies, making for plentiful job openings. Growth will be driven by very rapid growth in computer and data processing services. In addition, thousands of job openings will result annually from the need to replace workers who move into managerial positions or other occupations or who leave the labor force.

College graduates with a bachelor's degree in computer science, computer engineering, information science, or information systems should also enjoy very favorable prospects, particularly if they have supplemented their formal education with some level of practical experience. College graduates with non-computer science majors who have had courses in computer programming, systems analysis, and other data processing areas, as well as training or experience in an applied field, should be able to find jobs as system analysts. Those who are familiar with client/server environments, CASE tools and object oriented programming, Internet, Intranet, and multimedia technology will have an even greater advantage, as will individuals with significant networking, database, and systems experience.

Employers will continue to seek computer professionals who can combine strong programming and traditional systems analysis skills with good interpersonal and business skills.

Text 2. DUKE COMPUTER SCIENTISTS EXCEED "GIGABIT" DATA PROCESSING SPEEDS WITH INTERNET SOFTWARE DURHAM, N.C.

International Online Conference on Computer Science. More details can be found at the Duke department of computer science web site at www.cs.duke.edu/ari/trapeze .

Duke University computer science researchers have developed a system for Internet communications at speeds higher than one billion bits - 1 gigabit - per second in a local area network (LAN) of personal computers.

This system essentially doubles the current speed at which data can be transferred over the fastest LANs with TCP/IP, the communications standard used for the Internet and the World Wide Web. It is 20,000 times faster than communication through a telephone modem.

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The system uses a special high-speed Myrinet LAN operating at Duke's computer science department. Duke's Myrinet system was supplied by Myricom Inc. of Arcadia, Calif., as part of an experimental project, funded by the National Science Foundation, to develop new techniques for high-speed communications.

This Myrinet network is itself rated at more than 1 gigabit. But system bottlenecks limit the rate at which data can move between the network and the computers connected to it, said Jeff Chase, Duke assistant computer science professor.

Using the fastest LANs now on the market, "you'll get about a half a gigabit per second through TCP," Chase said in an interview. However, by using the latest newly released Myrinet network cards together with their own modifications, the Duke team achieved speeds of 1.147 billion bits a second by mid-May, added Andrew Gallatin, a senior systems programmer within Duke's computer science department who works with Chase.

Other members of the Duke group include computer science graduate student Kenneth Yocum and Alvin Lebeck, also an assistant computer science professor.

"It's the first demonstration on public record of TCP/IP running faster than a gigabit per second, end-to-end, one host (network workstation) to another," Chase said. "What we have done is provide the software support that's needed to allow others to achieve similar speeds on other networks that will arrive in the future."

LANs are groups of computers that are wired together to allow them to exchange messages and data. They range in speed and complexity from commonplace office networks to the array of high-end Digital Alpha workstations currently connected by Myrinet in a glassed-in "fishbowl lab" in Chase's department.

Those machines and associated equipment are part of a larger Duke computer science testbed cluster funded by grants from the National Science Foundation, Myricom and Intel Corp.

While the Myricom LAN is experimental and operates within a small space, the techniques developed there could eventually help computer users obtain more efficient access to larger scale networks, including a future version of the Internet, Chase said.

It might also mean that standard TCP/IP type software could be used for such cutting edge applications as wiring together individual desktop computers into a massively parallel supercomputer.

"What we've done is narrow the gap between standard TCP/IP communications that everybody loves and knows how to use and have the

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software to use and these more cutting edge technologies that are harder to use and difficult for people to program," he said.

TCP/IP communications software operates in software layers called a "protocol stack" inside individual LAN computers. That protocol software works in coordination with other software in sending and receiving data across the network connecting each computer.

"The sending and receiving software must be in synch to make sure that they are carrying as many bits as they can carry," Chase added. "That software has to run very efficiently or else the computers won't be able to keep up."

What the Duke team did is "streamline" software operations on both the sending and receiving sides of the central protocol stacks through a variety of modifications.

One change, called "zero-copy data movement," circumvents the time-consuming step of reading data from one area of computer network memory and writing it into another, which taxes a computer's central processing unit (CPU).

"One might think we could fix this problem by using faster CPUs," Chase added. "As it turns out, memory speeds are not growing as fast as CPU speed. As CPU speed increases relative to memory speed, your fast CPU spends a larger share of its processing power waiting for the slow memory to respond to these copy operations."

A related feature, called "scatter/gather input/output," allows data in various locations of computer memory to be rounded up and sent together as large messages. A third, called "checksum offloading," enables computers to use special hardware on their network cards to speed up error checking.

Another innovation, for which the Duke group has filed for a patent, is "adaptive message pipelining," which schedules the movement of data between the network and an individual computer's memory to deliver high performance.

Some of these changes involved modifying software codes. Others involved changing "firmware," codes in network cards that programmers ordinarily cannot alter. By special agreement, Myricom provided the Duke researchers the tools to alter the firmware.

Major components of the network system that the Duke team did not alter are the protocol stacks themselves, obtained from a standard Unix operating system public domain TCP/IP source called FreeBSD.

"A lot of very smart people at a lot of places over a period of decades have done a lot of work trying to write the software that allows TCP

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communications at very high speeds," Chase said. "In some sense, what we have done really is show that they got it right."

Text 3. WORD SCANS INDICATE NEW WAYS OF SEARCHING THE WEB

International Online Conference on Computer Science

In the years after the American Revolution, U.S. presidents were talking about the British a lot, and then about militias, France and Spain. In the mid-19th century, words like "emancipation," "slaves" and "rebellion" popped up in their speeches. In the early 20th century, presidents started using a lot of business-expansion words, soon to be replaced by "depression."

A couple of decades later they spoke of atoms and communism. By the 1990s, buzzwords prevailed.

Jon Kleinberg, a professor of computer science at Cornell University, Ithaca, N.Y., has developed a method for a computer to find the topics that dominate a discussion at a particular time by scanning large collections of documents for sudden, rapid bursts of words. Among other tests of the method, he scanned presidential State of the Union addresses from 1790 to the present and created a list of words that easily reflects historical trends. The technique, he suggests, could have many "data mining" applications, including searching the Web or studying trends in society as reflected in Web pages.

Kleinberg will emphasize the Web applications of his searching technique in a talk, "Web Structure and the Design of Search Algorithms," at the annual meeting of the American Association for the Advancement of Science (AAAS) in Denver on Feb. 18. He is taking part in a symposium on "Modeling the Internet and the World Wide Web".

Kleinberg says he got the idea of searching over time while trying to deal with his own flood of incoming e-mail. He reasoned that when an important topic comes up for discussion, keywords related to the topic will show a sudden increase in frequency. A search for these words that suddenly appear more often might, he theorized, provide ways to categorize messages.

He devised a search algorithm that looks for "burstiness," measuring not just the number of times words appear, but the rate of increase in those numbers over time. Programs based on his algorithm can scan text that varies with time and flag the most "bursty" words. "The method is motivated by probability models used to analyze the behavior of

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communication networks, where burstiness occurs in the traffic due to congestion and hot spots," he explains.

In his own e-mail -- largely from other computer scientists -- he quickly found keywords relating to hot topics. In mail from students he found bursts in the word "prelim" shortly before each midterm exam. Later, he tried the same technique on the texts of State of the Union addresses, all of which are available on the Web, from Washington in 1790 through George W. Bush in 2002. From these speeches he produced a long list of words (see attached table) that summarizes American politics from early revolutionary fervor up to the age of the modern speechwriter.

While we already know about these trends in American history, Kleinberg points out, a computer doesn't, and it has found these ideas just by scanning raw text. So such a technique should work just as well on historical records in obscure situations where we have no idea what the important terms or keywords are. It might even be used to screen e-mail "chatter" by terrorists. Sociologists, Kleinberg adds, may find it interesting to look for trends in personal Web logs popularly known as "blogs."

For searching the Web, Kleinberg suggests, such a technique could help zero in on what a searcher wants by recognizing the time context of such material as news stories. For instance, he says, a person searching for the word "sniper" today is likely to be looking for information about the recent attacks around the nation's capital -- but the same search nearly four decades ago might have come from someone interested in the Kennedy assassination.

In his AAAS talk Kleinberg also explores other Web-searching techniques. A few years ago, he suggested that a way to find the most useful Web sites on a particular subject would be to look at the way they are linked to one another. Sites that are "linked to" by many others are probably "authorities." Sites that link to many others are likely to be "hubs." The most authoritative sites on a topic would be the ones that are linked to most often by the most active hubs, he reasoned. A variation on this idea is used by Google, and a more formal version is being used in a new search engine called Teoma.

http://www.teoma.com .

Kleinberg and others have found that despite its anarchy, there is a great deal of "self-organization" on the Web. In a variation on the "six degrees of separation" idea, Kleinberg says, almost every site on the Web can be reached from almost any other through a series of steps. The structure seems to be a bit like the Milky Way galaxy, with a very dense "core" of heavily interconnected sites surrounded by less dense regions. Nodes

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outside the core are divided into three categories: "upstream" nodes that link to the core but cannot be reached from it; "downstream" nodes that can be reached from the core but don't link back to it; and isolated "tendrils" that are not linked directly to the core at all.

Within this structure there are many "communities" of sites representing common interests that are extensively linked to one another. So, Kleinberg suggests, searches might be done by following along the link paths from one site to another, as well as just scanning an index of everything.

"Deeper analysis, exposing the structure of communities embedded in the Web, raises the prospect of bringing together individuals with common interests and lowering barriers to communication," Kleinberg concludes.

Text 4. SAPPHIRE/SLAMMER WORM SHATTERS PREVIOUS SPEED RECORDS FOR SPREADING THROUGH THE INTERNET

International Online Conference on Computer Science

A team of network security experts in California has determined that the computer worm that attacked and hobbled the global Internet 11 days ago was the fastest computer worm ever recorded. In a technical paper released today, the experts report that the speed and nature of the Sapphire worm (also called Slammer) represent significant and worrisome milestones in the evolution of computer worms.

Computer scientists at the University of California, San Diego and its San Diego Supercomputer Center (SDSC), Eureka-based Silicon Defense, the University of California, Berkeley, and the nonprofit International Computer Science Institute in Berkeley, found that the Sapphire worm doubled its numbers every 8.5 seconds during the explosive first minute of its attack. Within 10 minutes of debuting at 5:30 a.m. (UTC) Jan. 25 (9:30 p.m. PST, Jan. 24) the worm was observed to have infected more than 75,000 vulnerable hosts. Thousands of other hosts may also have been infected worldwide. The infected hosts spewed billions of copies of the worm into cyberspace, significantly slowing Internet traffic, and interfering with many business services that rely on the Internet.

"The Sapphire/Slammer worm represents a major new threat in computer worm technology, demonstrating that lightning-fast computer worms are not just a theoretical threat, but a reality," said Stuart Staniford, president and founder of Silicon Defense. "Although this particular computer worm did not carry a malicious payload, it did a lot of harm by spreading so aggressively and blocking networks."

The Sapphire worm's software instructions, at 376 bytes, are about the length of the text in this paragraph, or only one-tenth the size of the Code

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Red worm, which spread through the Internet in July 2001. Sapphire's tiny size enabled it to reproduce rapidly and also fit into a type of network "packet" that was sent one-way to potential victims, an aggressive approach designed to infect all vulnerable machines rapidly and saturate the Internet's bandwidth, the experts said. In comparison, the Code Red worm spread much more slowly not only because it took longer to replicate, but also because infected machines sent a different type of message to potential victims that required them to wait for responses before subsequently attacking other vulnerable machines.

The Code Red worm ended up infecting 359,000 hosts, in contrast to the approximately 75,000 machines that Sapphire hit. However, Code Red took about 12 hours to do most of its dirty work, a snail's pace compared with the speedy Sapphire.

The Code Red worm sent six copies of itself from each infected machine every second, in effect "scanning" the Internet randomly for vulnerable machines. In contrast, the speed with which the diminutive Sapphire worm copied itself and scanned the Internet for additional vulnerable hosts was limited only by the capacity of individual network connections.

"For example, the Sapphire worm infecting a computer with a one-megabit-per-second connection is capable of sending out 300 copies of itself each second," said Staniford. A single computer with a 100-megabit-per-second connection, found at many universities and large corporations, would allow the worm to scan 30,000 machines per second.

"The novel feature of this worm, compared to all the other worms we've studied, is its incredible speed: it flooded the Internet with copies of itself so aggressively that it basically clogged the available bandwidth and interfered with its own growth," said David Moore, an Internet researcher at SDSC's Cooperative Association for Internet Data Analysis (CAIDA) and a Ph.D. candidate at UCSD under the direction of Stefan Savage, an assistant professor in the Department of Computer Science and Engineering. "Although our colleagues at Silicon Defense and UC Berkeley had predicted the possibility of such high-speed worms on theoretical grounds, Sapphire is the first such incredibly fast worm to be released by computer hackers into the wild," said Moore.

Sapphire exploited a known vulnerability in Microsoft SQL servers used for database management, and MSDE 2000, a mini version of SQL for desktop use. Although Microsoft had made a patch available, many machines did not have the patch installed when Sapphire struck. Fortunately, even the successfully attacked machines were only temporarily out of service.

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"Sapphire's greatest harm was caused by collateral damage--a denial of legitimate service by taking database servers out of operation and overloading networks," said Colleen Shannon, a CAIDA researcher. "At Sapphire's peak, it was scanning 55 million hosts per second, causing a computer version of freeway gridlock when all the available lanes are bumper-to-bumper." Many operators of infected computers shut down their machines, disconnected them from the Internet, installed the Microsoft patch, and turned them back on with few, if any, ill effects.

The team in California investigating the attack relied on data gathered by an array of Internet "telescopes" strategically placed at network junctions around the globe. These devices sampled billions of information-containing "packets" analogous to the way telescopes gather photons.

With the Internet telescopes, the team found that nearly 43 percent of the machines that became infected are located in the United States, almost 12 percent are in South Korea, and more than 6 percent are in China.

Text 5. DESIGNING A ROBOT THAT CAN SENSE HUMAN EMOTION

International Online Conference on Computer Science

Forget the robot child in the movie "AI." Vanderbilt researchers Nilanjan Sarkar and Craig Smith have a less romantic but more practical idea in mind.

"We are not trying to give a robot emotions. We are trying to make robots that are sensitive to our emotions," says Smith, associate professor of psychology and human development.

Their vision, which is to create a kind of robot Friday, a personal assistant who can accurately sense the moods of its human bosses and respond appropriately, is described in the article, "Online Stress Detection using Psychophysiological Signals for Implicit Human-Robot Cooperation." The article, which appears in the Dec. issue of the journal Robotica, also reports the initial steps that they have taken to make their vision a reality.

"Psychological research shows that a lot of our communications, human to human, are implicit," says Sarkar, an assistant professor in mechanical engineering. "The better we know the other person the better we get at understanding the psychological state of that person. So the prime motivation of our research is to determine whether a robot can sense the psychological state of a human person. Sooner or later, robots will be everywhere. As they become increasingly common, they will need to interact with humans in a more natural fashion." When Sarkar first

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approached him about collaborating on the project, Smith admits that he was very skeptical. "I expected to listen and then explain to him why his ideas would never work." But the engineer surprised him on two counts: the amount he knew about the psychophysiology of emotions and his realization that any system for detecting emotions cannot be universal, but must be based on individual patterns.

The project has two basic parts, and both are ambitious. One is to develop a system that can accurately detect a person's psychological state by analyzing the output of a variety of physiological sensors. The other is to process this information in real time (as it happens) and convert it into a form that a computer or robot can process.

"Psychologists have been trying to identify universal patterns of physiological response since the turn of the century without success. All this effort has shown is that there are no such universal patterns," says Smith. "The hard fact is that different individuals express the same emotion rather differently. But I think that we have established the feasibility of the individual-specific approach that we are taking and there is a good chance that we can succeed," says Smith.

The Vanderbilt researchers are using an approach similar to that adopted by voice and handwriting recognition systems. They are gathering baseline information about each person and analyzing it to identify the responses associated with different mental states. One advantage that the researchers have is the recent advances in sensor technology. "Extremely small, 'wearable' sensors have been developed that are quite comfortable and are fast enough for real-time applications," says Sarkar.

Their first experiments concentrated on detecting high and low anxiety levels using a heart rate monitor. "There are sophisticated medical diagnostic techniques that can detect stress in a patient," they acknowledge in their Robotica paper, but add, "All those techniques are slow, expensive and, more importantly, not suitable for a person who is moving and working."

In this case the researchers used playing video games to put subjects under pressure and induce stress. By varying the level of difficulty of the games, they were able to vary the level of stress involved. They obtained electrocardiogram data from several video-gaming playing subjects over a six-month period.

Sarkar and his research team used advanced signal processing techniques, including wavelet analysis and fuzzy logic, to analyze the heart-

rate data. They looked specifically at variations in the interval between heartbeats, a common measure of heart rate variability. They identified two

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frequency bands that vary predictably with changes in stress levels. These bands are associated with the parasympathetic and sympathetic divisions of the autonomic nervous system. The parasympathetic system reduces heart rate and tends to control heart rate under most normal conditions. The sympathetic system responds to fear and excitement and tends to increase heart rate during emergency situations.

"In all the experiments we conducted, we found that, when a subject became stressed, the level of sympathetic activity increased and level of parasympathetic activity decreased," Sarkar says.

He and his research team have since supplemented their measures of heart rate with measures of skin conductance (affected by variations hand sweating) and facial muscle activity (brow furrowing and jaw clenching). They were able to combine this information to produce a series of rules that allow a robot to respond to information about a person's emotional state. They have used these to program a small mobile robot. The robot is initially given a task of exploring the room. So it begins moving randomly about on the floor. Then physiological data of a person experiencing high anxiety levels is sent to a processor that detects the anxiety level and instructs the mobile robot to move to a specific location and say, "I sense that you are anxious. Is there anything I can do to help?"

Text 6. UNIVERSITY OF DELAWARE RESEARCHERS DEVELOP REVOLUTIONARY COMPUTER INTERFACE TECHNOLOGY; FINGERWORKS SYSTEM USES HAND MOTIONS

International Online Conference on Computer Science. For more on FingerWorks, see the web site at http://www.fingerworks.com.

University of Delaware researchers have developed a revolutionary computer interface technology that promises to put the bite on the traditional mouse and mechanical keyboard.

"This is not just a little step in improving the mouse, this is the first step in a new way of communicating with the computer through gestures and the movements of your hands. This is, after all, one of the ways humans interact." John Elias, UD professor of electrical and computer engineering, said.

Elias and Wayne Westerman, UD visiting assistant professor of electrical and computer engineering, have been working on the new interface for about five years and are now marketing their iGesture product through a company called FingerWorks.

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The project started as a doctoral thesis by Westerman, who was then a UD graduate student working with Elias.

The FingerWorks name fits because the technology uses a touch pad and a range of finger motions to communicate commands and keys to the computer. To open a file, you rotate your hand as if opening a jar; to zoom or de-zoom, you expand or contract your hand.

Elias said the communication power of their system is "thousands of times greater" than that of a mouse, which uses just a single moving point as the main input. Using this new technology, two human hands provide 10 points of contact, with a wide range of motion for each, thus providing thousands of different patterns, each of which can mean something different to the computer.

While much about the computer has changed over the last three decades-greater power, faster speeds, more memory-what has not changed is the user interface.

"For what it was invented for, the mouse does a good job," Elias said. "People accept the mouse and the mechanical keyboard because that's the way it is. But there are limitations in terms of information flow. There is so much power in the computer, and so much power in the human, but the present situation results in a communications bottleneck between the two."

Elias and Westerman have a better idea. "I believe we are on the verge of changing the way people interact with computers," Elias said. "Imagine trying to communicate with another human being using just a mouse and a keyboard. It works, but it is slow and tedious."

Elias said he could envision in the next 10 years "a very complex gestural language between man and machine."

The system is a multi-touch, zero force technology, Elias said, meaning the gestures and movements use all the fingers in a light and subtle manner.

Because of that, the system has a second major advantage over the mouse and mechanical keyboard because it can greatly reduce stress injuries such as tendonitis and carpal tunnel syndrome attributed to traditional computer work.

The company markets both stand-alone touch pads and touch pads built into nonmechanical keyboards. In the keyboards, the keys overlap the touch pad so the operator does not have to move his hands when switching between typing and using the mouse. Rather, everything can be done in a smoother flow of hand motions.

Elias explained the touch pad acts like a video camera, recording the objects touching its surface. An embedded microprocessor then applies an

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algorithmic process to convert those touches into commands understood by the computer.

"To observers watching somebody use multi-touch, it looks a little like magic," Elias said, illustrating his point on a computer in Evans Hall. "People see lots of things happening on the computer screen but very little hand motion is observed."

He said the system has been designed so the gestures used make sense for the operation being performed. For instance, you cut text with a pinch and paste it with a flick.

Eventually, he said, the computer password could be a gesture known only to the user.

Elias said people often think that speech recognition systems will become the ultimate user interface. "Voice commands are good for many things but terrible for other things," Elias said, adding he believes there are inherent problems with a speech-only interface.

"If you want to test this claim, you can do so with a perfect speech recognition system-another human being," Elias said. "Put somebody in front of your computer and try to do your work by issuing voice commands to him. You'll quickly find that many common tasks are difficult to do using speech, even though your 'computer interface' understands you perfectly."

Using hand and finger motion to input commands is, for many tasks, much more effective than trying to explain what you want to do in words, he said.

The system is being used at several work stations in Evans Hall and the reaction is largely favorable. It is something of a challenge for some workers, Elias said, because it is like learning a new language.

Susan Foster, UD vice president of information technologies, said she is impressed with the interface and plans to adopt it for use at several computer sites around campus.

"The device is the result of new thinking about the 'bandwidth' that constrains the physical interaction between operator and computer," Foster said. "It capitalizes on human gestures, which are easy to understand and execute. Once learned, like other motor skills, they are readily retained. The assistive qualities of the device also make it quite useful for those with limitations on upper extremity use."

The plug-and-play device, which requires no special software, should be of particular interest to programmers, graphic designers and editors, Foster said, and she is recommending they consider making use of a new technology that was "born and bred at UD and under continuing development here."

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Tet 7. NEWER DESIGN OF CLOSE-UP COMPUTER MONITORS INCREASES EASE OF USE COLUMBUS, OHIO

Eyeglasses with built-in computer monitors could soon be a reasonable alternative to reading text from a traditional computer screen, according to new research from Ohio State University.

Participants in a recent study rated the comfort and performance of these so-called near-eye displays as comparable to that of traditional computer monitors. Near-eye displays are like eyeglasses with a monitor built into the lenses.

"The problems with near-eye devices range from motion sickness to the device's weight to poor image resolution," said James Sheedy, a study co-author and an associate professor of optometry at Ohio State University.

"But the design of such devices is improving, and the subjects in our study found the function and usefulness of the near-eye display similar to that of a regular computer screen."

The research appears in a recent issue of the journal Optometry and Vision Science. Sheedy, who is also the director of the computer vision clinic at Ohio State, conducted the study with Neil Bergstrom, the vice president of business development at Iridigm Display Corporation in San Francisco.

At the time of the study, Bergstrom was the chief technology officer of InViso Corporation, a now-defunct startup company specializing in microdisplays. InViso provided support for the study, and Sheedy served as a consultant to InViso during the study. InViso was acquired by the company Three-Five Systems, Inc. in spring 2002.

The researchers asked 22 subjects to participate in a reading experiment and a separate movement experiment.

The subjects used a total of five different displays to complete the tasks in the reading experiment: a hand-held monocular vision display with an attached cover for the non-viewing eye; a binocular vision display with a holder that wrapped around the subject's head; hard copy with printed text; a flat panel computer screen; and a screen on a hand-held computer.

The participants were asked to perform four trials each of three different reading tasks: the first had subjects reading four separate paragraphs of about 325 words in length and answering three to four multiple choice questions at the end of each passage. The second task involved counting the occurrences of an assigned letter in a paragraph of nonsense words. In the final reading experiment, subjects were instructed to find three out of four occurrences of an assigned three-letter word on a spreadsheet filled with various three-letter words.

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The researchers measured how long it took each subject to complete each reading task using the respective visual display. After using each type of display, the subjects were asked if they had experienced any of the following symptoms, and to what degree: headache, eyestrain, sore or irritated eyes, blurry vision, dizziness, nausea, disorientation, neck ache or backache.

Results showed that the performance of the monocular vision display was comparable to the performance of the flat panel screen and hard copy text.

"To our surprise, the reading tasks were completed faster with the monocular display than with the binocular display," said Sheedy. "This may have had to do with how each display fit the user, or the design of the respective device."

However, the subjects did complain about eyestrain more with the monocular display than with any of the other displays.

Performance speeds with the binocular display were about 5 to 7 percent slower than for the other displays, the researchers found. Sheedy suspects that this slower speed may have something to do with how the image is aligned along the line of sight in each lens.

The image displayed by a near-eye device may appear to be much farther - up to 6 feet away - from the viewer than an image on a typical computer monitor. The seemingly greater distance makes for easier viewing, Sheedy said. But the image size in a near-eye display is about the size of an average computer screen.

"Traditional displays are constrained by their physical size and are usually about 20 to 30 inches from the eyes," he said.

The second experiment assessed the risk for motion-related symptoms while wearing the binocular head display.

Seated subjects were asked to rotate their heads several times to the left and right, and again up and down. They performed the same task while standing. They were also asked to rotate their head while sitting and while standing.

"Motion-related symptoms were a large problem in previous studies," Sheedy said. "Participants didn't have much problem with motion sickness

in this study, probably due in part to the nature of the tasks they were asked to perform.

"Most of the previous studies on near-eye displays used video movement or virtual reality tasks that created movement on the virtual display. These kinds of tasks are more likely to cause queasiness."

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Nor were the participants in the current study fully immersed in the image. That is, neither the monocular nor binocular displays blocked the user's peripheral vision, so he could focus on the image in front of him and still see his surroundings.

"Being able to see the real environment while wearing a display gives the user a visual reference that can help lessen confusion when the eye sees the image move," Sheedy said. "For most of the common uses, the user wouldn't want to be fully immersed in the virtual environment."

Although several prototypes exist, near-eye displays have yet to become common. It's only a matter of time before they do, Sheedy said. He doesn't see such devices becoming a commodity in the office, but he does predict that they'll find a place in business and industry.

Text 8. NEW WAVE SUPERCOMPUTERS CATCH BIG WAVES

ALBUQUERQUE, NM, June 5, 2002

The new wave in computing - super-fast machines churning out three-dimensional models viewable in high-tech, immersive theaters - may teach us more about the big waves that sometimes threaten people who live near the seashore.

Although earthquakes cause most of these giant waves, called tsunamis, researchers at the National Nuclear Security Administration's Los Alamos National Laboratory recently completed the largest and most accurate simulation of tsunamis caused by asteroids. They presented the first data from that model today to the American Astronomical Society meeting in Albuquerque.

The scientists aren't working on a sequel to the Hollywood blockbusters Deep Impact or Armageddon. They reason that since a large percentage of the world's population lives on islands, bays or coastlines, a better model could help predict how tsunamis behave, aiding emergency responders.

Most tsunamis often result when earthquakes send huge landslides tumbling into bays or oceans. Recent studies of a 30-foot-high tsunami that killed more than 2,100 people on Papua New Guinea in July 1998 showed the cause was an underwater landslide more than 2,000 miles away. A landslide in Lituya Bay, Alaska, in July 1958 inundated the shore of Gilbert

Inlet nearly a third of a mile above the high tide line, and its monster wave is the largest ever documented.

Computer scientists Galen Gisler and Bob Weaver from the Los Alamos' Thermonuclear Applications Group, and Michael Gittings of Science Applications International Corp., created simulations of six different

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asteroid scenarios, varying the size and composition of a space visitor hitting a three-mile-deep patch of ocean at a speed of 45,000 miles an hour. The Big Kahuna in their model was an iron asteroid one kilometer in diameter; they also looked at half-sized, or 500-meter, and quarter-sized variants, and at asteroids made of stone, roughly 40 percent less dense than iron.

"We found that the one-kilometer iron asteroid struck with an impact equal to about 1.5 trillion tons of TNT, and produced a jet of water more than 12 miles high," Gisler said. The team's effort builds on the pioneering research of Los Alamos' Chuck Mader and Dave Crawford of Sandia National Laboratories. More accurate models of tsunami behavior are now possible, thanks to recent improvements in high-performance computers and the codes that run on them funded by the NNSA's Advanced Simulation and Computing program.

"Although this is important science and has potential value in predicting and planning emergency response, it's an great way to test and improve the code," Gisler said. "We can do the problem better now by simulating an entire tsunami event from beginning to end and bringing more computing power to bear on some of the key variables."

The code, called SAGE for SAIC's Adaptive Grid Eulerian, was developed by Los Alamos and SAIC. A majority of large simulations come in one of two flavors: Lagrange, in which a grid or mesh of mathematical points matches with and follows molecules or other physical variables through space; or Eulerian, in which the mesh is fixed in space, thereby permitting researchers to follow fluids as they move from point to point.

SAGE's power lies in its flexibility. Scientists can continuously refine the mesh and increase the level of detail the code provides about specific physical elements in the mesh. The new Los Alamos simulation uses realistic equations to represent the atmosphere, seawater and ocean crust.

To follow a tsunami from the point of splashdown to a city like Honolulu or Long Beach, Gisler and his colleagues needed to model in great detail the interactions between air and water and between water and the surface of an asteroid. Then they followed how the shock waves moved through the ocean and the seabed below and how water waves propagated through the water.

"We looked in some detail at a couple of the key variables, especially the heights of tsunamis as a function of their distance from the point of impact; we modeled the heights of individual waves and studied how densely spaced they would be at various distances," Gisler explained.

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When the enormous simulation was done - more than a million hours of individual processor time, or three weeks on Los Alamos' Blue Mountain supercomputer and the ASCI White machine at Lawrence Livermore National Laboratory - the team found they had some good news and some bad news for coastal dwellers.

"The waves are nearly double the height predicted in the earlier simulation, that's the bad news, but they take about 25 percent longer to get to you, which could help more people get to higher ground if they had some warning," Gisler said.

The model predicts that wave velocities for the largest asteroid will be roughly 380 miles an hour, while the older model calculated their speed at close to 500 miles an hour. However, the initial tsunami waves are more than half a mile high, abating to about two-thirds of that height 40 miles in all directions from the point of impact.

The earlier model of asteroid-caused tsunamis actually was a patchwork of three different computer codes, Gisler said. The first code simulated the big splash and formation of the cavity, the second depicted how the water collapsed to create the tsunami and a final code followed the tsunami wave through the ocean.

"With the SAGE code, we were able to avoid a series of potential mistakes that happen when the model doesn't understand the conditions that you're passing on from each separate code," Gisler said.

In addition to learning more about how wave height and density vary with distance from the asteroid impact, the Los Alamos team also improved the way the computer model represents the strength of materials, which can be applied to other codes with industrial, defense and scientific applications.

As the asteroid strikes the water, its overall density decreases rapidly. One challenge for the team was to model accurately how acoustic waves propagate through the asteroid as it vaporizes. Initially, that problem appeared insurmountable because both the earlier codes and SAGE showed the acoustic waves -moving at physically impossible speeds through the highly mixed materials. By adjusting how the cells in the mesh represent those rapidly changing materials, the team was able to model the acoustic waves accurately.

Text 9. SMALLER SLOWER, SUPERCOMPUTERS SOMEDAY MAY WIN THE RACE

LOS ALAMOS, NM, May 29, 2002.

The supercomputers of the future will never crash and will cost far less to run than today's machines. At least that's the vision of a scientist at the

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National Nuclear Security Administration's Los Alamos National Laboratory.

"Everyone's fixed on the mantra of performance at all costs," said Wu Feng of Los Alamos' Advanced Computing Laboratory. "What we've done is redefine the price-to-performance ratio to look at efficiency, reliability and availability, in other words, total cost of ownership."

Feng and colleagues Michael Warren and Eric Weigle developed the first of this new breed of high-performing, low-cost computers, which they named "Green Destiny." The machine has been operating with unprecedented stability and performance efficiency for more than eight months in a dusty warehouse where temperatures routinely reach 85-degrees Fahrenheit.

Feng, Warren and Weigle argue that the costs of computing should include electrical power, infrastructure, air conditioning, floor space, time lost to system failures and salaries for the people needed to keep finicky machines operating. Supercomputers of the future may very well be similar to Green Destiny, they say: small, extremely stable and miserly in their power use.

Green Destiny represents a new "flavor" of supercomputer, Feng said. The machine packs 240 Transmeta processors that operate at 667 MegaHertz, mounted onto a half-inch-slim compact motherboard, or blade. A total of 24 blades then mount into a RLX Technologies System 324 chassis, and then ten chassis, with network switches, are mounted in a standard computer rack.

Currently computing at a peak rate of 160-billion operations per second, Green Destiny uses less than ten percent of the electricity and twenty-five percent of the space to give performance comparable to the previous generation of so-called cluster computers. More important is reliability, Feng said.

"As the push for performance goes up, so does the power consumption. And system failure is directly proportional to power consumption," he pointed out. "If your machine isn't available all the time, then you can't do any computing.

In fact, unpublished empirical data from computer vendors indicate that as processor temperatures increase by 10-degrees Celsius, failure rates double. Typical computing-intensive businesses depend on hundreds or even thousands of identical servers to handle multiple requests for information simultaneously. When the servers go down, hourly losses can range up to $6.5 million for a large brokerage firm.

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Green Destiny, whose processors operate roughly one-tenth as hot as market-leading chips, has been running continuously since September without air filtration or special cooling. In fact, it kept humming even with the fans removed. "It's absolutely rock solid," Feng said. "It's so reliable we only keep one spare blade around, and we have never needed it."

In a recent paper, available at http://public.lanl.gov/feng/Bladed-Beowulf.pdf online, Feng predicts, based on Moore's law, that the drive for increased performance will result in "the microprocessor of 2010 having over one billion transistors and dissipating over one kilowatt of thermal energy; this is considerably more energy per square centimeter than even a nuclear reactor."

Beowulf clusters, developed at NASA in the early 1990s, group commodity processors with commercial switches and have attracted much attention because they're able to handle many computations simultaneously. A larger version of the Green Destiny Bladed Beowulf cluster would require far less space than a traditional Beowulf cluster. Putting 2,000 of the bladed machines together could yield an enormous savings in space, and in costs, with floor space in Silicon Valley renting for more than $150 a square foot.

Feng argued that with all these factors taken into account, the true price-to-performance rating for Green Destiny would be at least twice as good as other supercomputers.

Internet pioneer Gordon Bell, software guru Linus Torvalds and other guests visited Los Alamos Laboratory recently to learn more about Green Destiny and the Supercomputing in Small Spaces project, whose web site is at http://sss.lanl.gov online.

Stephen Lee, acting deputy leader of Los Alamos' Computer and Computational Sciences Division, said Green Destiny represents a promising research advance, but emphasized the national need for large platforms that are uniquely able to move huge amounts of data in and out of memory rapidly, such as Los Alamos' Q machine, developed for NNSA's Advanced Simulation and Computing program, or ASCI.

"This could be the next important step in scalable supercomputing, but the challenge of maintaining the nation's nuclear stockpile in the face of aging weapons, eroding expertise and nearly a decade without nuclear testing demand three-dimensional, full physics computing on tera-scale computers today, while designers and engineers with weapon test experience are still available to validate the ASCI simulations." Lee said.

The best use for machines like Green Destiny might be in the inexpensive development of scientific codes for a wide range of

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applications, Feng and Lee said. Once the code has been developed and stabilized, it could move to an ASCI-style supercomputer.

Feng's team at Los Alamos originally bought the machine from RLX Technologies to host large volumes of data. After several delays in compiling the data, they decided to make a cluster instead and tested it with some high-performance applications, such as Warren's simulation of the beginnings of the universe and his three-dimensional model of supernovae. Among planned future jobs for Green Destiny are global climate modeling, large-scale molecular dynamics, computational fluid dynamics and bioinformatics.

"At first, we did not think that there was anything particularly novel about this," Feng said. "We showed it to fellow researchers at a supercomputing conference last November, and we saw more than 7,000 hits on our web site the following week. This project has taken on a life of its own."

The Transmeta Crusoe processor provides about 75 percent of the performance of similarly clocked chips from a major manufacturer used in other Beowulf clusters. So Green Destiny might be compared to the tortoise, eventual winner of the fabled race with the speedy hare.

Text 10. IBM'S TEST-TUBE QUANTUM COMPUTER MAKES HISTORY; FIRST DEMONSTRATION OF SHOR'S HISTORIC FACTORING ALGORITHM

SAN JOSE, California

Scientists at IBM's Almaden Research Center have performed the world's most complicated quantum-computer calculation to date. They caused a billion billion custom-designed molecules in a test tube to become a seven-qubit quantum computer that solved a simple version of the mathematical problem at the heart of many of today's data-security cryptographic systems.

"This result reinforces the growing realization that quantum computers may someday be able to solve problems that are so complex that even the most powerful supercomputers working for millions of years can't calculate the answers," said Nabil Amer, manager and strategist of IBM Research's physics of information group.

In today's issue of the scientific journal Nature, a team of IBM scientists and Stanford University graduate students report the first demonstration of "Shor's Algorithm" -- a method developed in 1994 by AT&T scientist Peter Shor for using the futuristic quantum computer to find a number's factors -- numbers that are multiplied together to give the original number. Today, factoring a large number is so difficult for conventional computers -- yet so simple to verify -- that it is used by many cryptographic methods to protect data.

A quantum computer gets its power by taking advantage of certain quantum properties of atoms or nuclei that allow them to work together as quantum bits, or "qubits," which serve simultaneously as the computer's processor and memory . By directing the interactions between qubits while keeping them isolated from the external environment, scientists enable a quantum computer to perform certain calculations, such as factoring, exponentially faster than conventional computers. When factoring large numbers using a conventional computer, each added digit roughly doubles the time to find the factors. In contrast, the quantum factoring time increases by only a constant increment with each additional digit.

The simplest meaningful instance of Shor's Algorithm is finding the factors of the number 15, which requires a seven-qubit quantum computer. IBM chemists designed and made a new molecule that has seven nuclear spins -- the nuclei of five fluorine and two carbon atoms -- which can interact with each other as qubits, be programmed by radio frequency pulses and be detected by nuclear magnetic resonance (NMR) instruments similar to those commonly used in hospitals and chemistry labs.

The IBM scientists controlled a vial of a billion billion (10**18) of these molecules so they executed Shor's algorithm and correctly identified 3 and 5 as the factors of 15. "Although the answer may appear to be trivial, the unprecedented control required over the seven spins during the calculation made this the most complex quantum computation performed to date," Amer said.

"Now we have the challenge of turning quantum computation into an engineering reality," said Isaac Chuang, leader of the research team and now an associate professor at MIT. "If we could perform this calculation at much larger scales -- say the thousands of qubits required to factor very large numbers -- fundamental changes would be needed in cryptography implementations."

While the potential for quantum computing is huge and recent progress is encouraging, commercial quantum computers are still many years away. NMR-based quantum computers are laboratory experiments. The first quantum computing applications would likely to be co-processors for specific functions, such as solving difficult mathematical problems, modeling quantum systems and performing unstructured searches. Word processing or simple problem-solving tasks are more easily handled by today's computers.

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IBM's demonstration of Shor's algorithm also shows the value of quantum computing experiments using NMR, an approach pioneered independently in the mid-1990s by Chuang and Neil Gershenfeld of MIT and by David Cory and colleagues, also at MIT. "Our NMR experiments stimulated us to develop fundamental tools that can be used in many future types of quantum computers," said Chuang. "Most important of these was a way to simulate and predict the signal degradation caused by 'decoherence' -- unintended quantum fluctuations. This tool enabled us to minimize decoherence errors in our 7-qubit experiment."

While NMR will continue to provide a testbed for developing quantum computing tools and techniques, it will be very difficult to develop and synthesize molecules with many more than seven qubits. As a result, new experiments at IBM and elsewhere are aimed at developing new quantum computing systems that can more easily "scale" to the large numbers of qubits needed for practical applications. Strong candidates today include electron spins confined in semiconductor nanostructures (often called quantum dots), nuclear spins associated with single-atom impurities in a semiconductor, and electronic or magnetic flux through supercoductors. Atomic and optical implementations continue to be evaluated.

When quantum computers were first proposed in the 1970s and 1980s (by theorists such as the late Richard Feynmann of California Institute of Technology, Pasadena, Calif.; Paul Benioff of Argonne National Laboratory in Illinois; David Deutsch of Oxford U. in England., and Charles Bennett of IBM's T.J. Watson Research Center, Yorktown Heights, N.Y.), many scientists doubted that they could ever be made practical. But in 1994, Peter Shor of AT&T Research described a specific quantum algorithm for factoring large numbers exponentially faster than conventional computers fast enough to defeat the security of many public-key cryptosystems. The potential of Shor's algorithm stimulated many scientists to work toward realizing the quantum computers' potential. Significant progress has been made in recent years by numerous research groups around the world.

Text 11. THE STATUS OF APPLICATIONS SOFTWARE: LATE

BYTE's software reviews editor offers his views on the widening gap between hardware and software, Dennis Allen

If you've ever set out to accomplish a particular task on your PC only to find there was no software that could do it, you've experienced software lag. It's a frustrating feeling—knowing that your computer is capable of doing what you need but is prevented from doing so by the lack of the right software. You've been cheated. The computer that once promised so much

now has so little to offer.

The root of the problem, is forked. Neither IBM nor Microsoft has provided a 32-bit DOS-compatible operating system, and developers are still learning how to cope with many megabytes of data. As a result, the current crop of applications software often relies on brute force to get things done.

Not everything, however, is bad in the software world. In fact, there is evidence that applications software is headed for a common user interface, and that WYSIWYG may become a way of life. And programs may even be getting smarter.

Although you don't need a crystal ball to predict that new changes in software are coming, exactly what the changes will be is less clear. But you can identify some of the forces driving the changes. The one thing that is certain is that users know what they want.

The Operating-System Bottleneck

Of course, not all the fault for the software lag belongs to applications developers. They're missing an operating system designed specifically for 80386-based hardware. Although OS/2 happens to work on 80386 systems, it was not designed for them. It's a 16-bit operating system for 80286 machines.

On the other hand, developers have yet to conquer OS/2. Even the grandest application of them all—Lotus 1-2-3 release 3.0, which took years to produce - was designed for DOS 3.x. You'd be hard-pressed to walk into any computer store and find five OS/2 applications sitting on the shelf. A lot of software companies talk about OS/2 applications, but few have actually produced any.

The reasons offered are many, but it all boils down to a matter of investment. While OS/2's complexities, such as multitasking and data sharing, ultimately offer more headroom for sophisticated programs, its learning curve for developers is more like a brick wall.

Even the software giants such as Lotus, Ashton-Tate, and Microsoft, with their abundant resources, have ex-perienced setbacks. Just consider the long waits for 1-2-3 release 3.0, dBASE IV, and a full-featured Windows word processor. And those are just DOS-based applications. The point is that, even for these companies with their millions of R&D dollars, the number of labor hours needed to develop sophisticated applications is gargantuah.

Managing Megabytes

To complicate matters further, increased storage capacities have offered new op-portunities and challenges for applications developers. While more storage would seem obviously better, not every-one is certain how best to use the hundreds of megabytes that optical drives provide.

For now, publishers are using CD-ROMs to provide static reference materials. Notable examples are Grolier's Electronic Encyclopedia and Microsoft's Programmer's Library. But what most users really need is for their applications to manage dynamic archiving.

Currently, when your hard disk becomes nearly full, you have to remove your older files. Maybe you archive them on floppy disks. If you do, chances are that you don't bother referring to those files again because it's too much trouble:You would have to fumble through all your archive disks, trying one and then, another, to find a certain bit of information. You might even find it easier and faster to search through printed reports in a file cabinet.

That's one of the ironies of today's applications software. Although most of the modern world is convinced that you can do record keeping and manage things better on personal computers, you still have to resort to a file cabinet and Pendaflex folders to see your old records.

A better arrangement would be applications software that really takes advantage of read/write or WORM (write once, read many times) optical disks. Such software would, on a regular basis, archive your old records and files on optical disks. More important, the application program would manage those archives. It would continually update its indexes so that, say, five years from now, on a moment's notice, you could call up the spreadsheet for October 1989's production costs. If you needed to change optical disks, the program would fell you which one to insert.

Also, your application should be able to use that archived information. It should be able to correlate it with more recent information to generate comparative reports and to project the next year's performance.

Unfortunately, that kind of software does not exist today, even though the hardware to handle such tasks exists. The fact is, software for dealing with large amounts of on-line data is just emerging. Consider Lotus Magellan and Traveling Software's ViewLink, for example. They are the first major attempts to help you actively manage several megabytes of disparate information. Either will let you peer into data files on your hard disk and view the data in its native format. Both will also search your hard disk for the file or files containing specific information.

But while Magellan and ViewLink work fine as utilities for managing what's currently on your hard disk, they're really no help at managing archives on floppy disks. Both would also fall short in handling a gigabyte

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or more of data on optical disks. Even worse, both of these programs create a whole new set of problems. Magellan takes up valuable hard disk space with its index, and it needs to update the index frequently, sometimes taking several minutes to do that. And because ViewLink doesn't use an index, its searches can take a long time if you're working with a large disk with lots of

data. Equally as bad, there are no Magellan or ViewLink equivalents for Windows or Presentation Manager (PM).

Text 12. WHAT IS A COMPUTER VIRUS?

It is an executable code able to reproduce itself. Viruses are an area of pure programming, and, unlike other computer programs, cany intellectual functions on protection from being found and destroyed. They have to fight for survival in complex conditions of conflicting computer systems.

That's why they evolve as if they were alive.

Yes, viruses seem to be the only alive organisms in the computer environment, and yet another their main goal is survival. That is why they may have complex crypting/ decrypting engines, which is indeed a sort of a standard for computer viruses nowadays, in order to carry out processes of duplicating, adaptation and disguise

It is necessary to differentiate between reproducing programs and Trojan horses. Reproducing programs will not necessarily harm your system because they are aimed at producing as many copies (or somewhat-copies) of their own as possible by means of so-called agent programs or without their help. In the later case they are referred to as "worms".

Meanwhile Trojan horses are programs aimed at causing harm or damage to PC's. Certainly it's a usual practice, when they are part of "tech-organism", bat they have completely different functions.

That is an important point. Destructive actions are not an integral part of the virus by default. However virus-writers allow presence of destructive mechanisms as an active protection from finding and destroying their creatures, as well as a response to the attitude of society to viruses and their authors.

As you see, there are different types of viruses, and they have already been separated into classes and categories. For instance: dangerous, harmless, and very dangerous. No destruction means a harmless one, tricks with system halts means a dangerous one, and finally with a devastating destruction means a very dangerous virus.

But viruses are famous not only for their destructive actions, but also for their special effects, which are almost impossible to classify. Some

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virus-writers suggest the following: funny, very funny and sad or melancholy (keeps silence and infects). But one should remember that special effects must occur only after a certain number of contaminations. Users should also be given a chance to restrict execution

of destructive actions, such as deleting files, formatting hard disks. Thereby virus can be considered to be a useful program, keeping a check on system changes and preventing any surprises such as of deletion of files or wiping out hard disks.

It sounds quite heretical to say such words about viruses, which are usually considered to be a disaster. The less person understands in programming and virology, the greater influence will have on him possibility of being infected with a virus. Thus, let's consider creators of viruses as the best source.

Who writes computer viruses?

They are lone wolves or programmers groups.

In spite of the fact that a lot of people think, that to write a computer virus is a hardship, it is no exactly so. Using special programs called "Virus creators" even beginners in computer world can build their own viruses, which will be a strain of a certain major virus. This is precisely the case with notorious virus "Anna Cumikova",

which is actually a worm. The aim of creation of viruses in such way is pretty obvious: the author wants to become well known all over the world and to show his powers.

Somehow, the results of the attempt can be very sad (see a bit of history), only real professionals can go famous and stay uncaught. A good example is Dark Avenger. Yes, and it's yet another custom of participants of "the scene" - to take terrifying monikers (nicknames).

To write sotttething really new and remarkable programmer should have some extra knowledge and skills, for example:

1) good strategic thinking and intuition - releasing a virus and its descendants live their own independent life in nearly unpredictable conditions. Therefore the author must anticipate a lot of things;

2) splendid knowledge Of language of the Assembler and the operating system he writes for - the more there are mistakes in the virus the quicker its will be caught;

3) attention to details and a skill to solve the most varied tactical questions - one won't write a compact, satisfactory working program without this abilities;

4) a high professional discipline in order to join preceding points together.

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A computer virus group is an informal non-profit organisation, uniting programmers-authors of viruses regardless of their qualifications. Everyone can become a member of the club, if he creates viruses, studies them for the reason of creation and spreading.

The aims they pursue together may After from that of a single virus writer, although they usually also try to become as famous as possible. But in the same time they may render help to beginning programmers in the field of viruses and spread commented sources of viruses and virus algorithm descriptions.

One can't say that all of the group members write viruses in Assembler. Actually, you don't have to know any computer language or write any program code to become a member or a friend of the group. But programming in Assembler is preferred, Pascal, C++ and other high level languages are considered to be humiliating. It does make sense since programs compiled in Assembler are much smaller (0.5-5 kb) and therefore more robust. On the other hand

Assembler is quite difficult to understand especially for beginners. One should think in the way computer does: all commands are send directly to the central processing unit of PC.

There are computer virus groups all over the world, few being more successful than others. It may be pretty hard to get in contact with them since they are quite typical representatives of computer underground world as well as (free)wares groups. Sometimes, however, creating viruses can become a respectable occupation, bringing

constant income. After all, no one but the author of the virus can bring valuable information on the way it should be treated and cured.

Text 13. CONTROL AT A DISTANCE

By Kris Fuller, National Instruments

In a very real sense, the Internet has changed the way we think about information and exchange of resources. Now engineers are using the Internet and software applications to remotely monitor and perform distributed execution of test and control applications. Such an approach reduces the time and cost involved in tests by sharing optoelectronics instrumentation and by distributing tasks to optimal locations.

A typical automated test and control system uses a computer to control positioning equipment and instrumentation. We'll use the term "remote control" to refer to the technique of enabling an outside computer to connect

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to an experiment and control that experiment from a distance. Such an approach benefits engineers who need to monitor applications running in harsh environments that offer them limited access, or for tests whose long durations are impractical for continuous human monitoring.

In addition, remote control offers engineers the ability to change test parameters at certain intervals without traveling to the site or even running from their office into another area of the building. This convenience allows a test operator to view results and make test modifications from home on the weekend, for example. The user simply logs on to the network from home, connects to the application, and makes those changes just as though he or she were on site.

Control via Internet

To effectively control applications via the Internet, companies are developing software programs that champion remote execution. For instance, Lab VIEW (National Instruments; Austin, TX) allows users to configure many software applications for remote control through a common Web browser simply by pointing the browser to a Web page associated with the application. Without any additional programming, the remote user can access fully the user interface that appears in the browser. The acquisition still occurs on the host computer, but the remote user has complete control of the process and can view acquired data in real time. Other users also can point their browser to the same URL to view the test.

Windows XP makes it easier to control applications via the Internet. With this Microsoft OS, users now get Remote Desktop and Remote Assistance, which offer tools for debugging deployed systems. After a system is deployed in the field, it is often cost-prohibitive for the support staff to visit every site. With Remote Desktop, a support operator can log in to a remote

Windows XP machine and work as if he or she were sitting at the desk where that machine is located. With Remote Assistance, the onsite operator can remain in control of the desktop but the support operator can view the desktop on his or her remote machine. At any time, the onsite operator can give up control of the desktop to the support operator and still monitor which troubleshooting techniques are in use. Industry-standard software development tools take advantage of these new features.

At times, it may be desirable to use the Web browser to initiate a measurement or automation application but not actually control the experiment."; In this case, the remote operator can log in, set certain parameters, and run the application over a common gateway interface (CGI). With CGI, the user communicates with a server-side program or script run by an HTTP server in response to an HTTP request from a Web

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browser. This program normally builds HTML dynamically by accessing other data sources such as a database. As part of the HTTP request, the browser can send to the server the parameters to use in running the application.

Distributed Execution

In classical remote control, one person or machine at a time is charged with controlling the experiment. In distributed execution, however, a user can truly take advantage of the benefits of networking, extending control to an entire remote system connected on the same network. In this way, individual machines focus on specific functions, and each system is optimized to perform its chosen task. Because data can be shared among the distributed components and each component accomplishes a unique task, this network functions as a complete system. For instance, it is possible to dedicate certain machines for acquisition and control while relegating analysis and presentation to other systems. Technology makes it possible to remotely monitor, control, and even run diagnostics while the system itself is dedicated to running acquisition and control, introducing the ability to multitask.

Certain test and control applications require an embedded, reliable solution. For these applications, the user can download the software to a headless, embedded controller to connect and control remotely. The controller can be a single unit or a series of form factors (such as the FieldPoint module that is able to perform monitoring and control tasks in harsh environments). In either case, software runs on a real-time operating system, but it can be accessed from a host computer using an Ethernet connection.

For example, consider a structural test system measuring the vibration and harmonics of a bridge design. It is possible to set up one node with a camera to monitor the testing of the bridge, then set up another node to measure parameters such as temperature, humidity, and wind direction and speed. Finally, one can set up a node to measure the load, strain, and displacement on certain areas of the bridge. The system can send all the data back to a main computer that correlates the data, analyzes it, and displays the results of the test on a Web page.

Each of these nodes would need to be running autonomously, acquiring data and sending it onto other computers to correlate the data and create reports. With the right software and hardware, each measurement node becomes an embedded, reliable, and durable solution. The user could easily

control any of the measurement nodes to modify parameters of the test. In some systems, the origin of the test and the code is completed using a

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Windows operating system and then downloaded to the measurement node. This enables the user to make major modifications to the test and download them to the embedded target without visiting the site.

Next, one of the live data-sharing techniques could be used to transfer the data to another cluster of computers that would correlate and analyze the data. Finally, an Internet server could allow project members to share the Web reports and analysis in geographically separated locations.

Text 14. DATA SHARING

A key to accomplishing remote control and distributed execution is the data-sharing ability inherent to the Web. With new software programs, live data sharing can be as easy as simply right-clicking the item and placing a checkmark in a checkbox, which saves time for users and allows them to take advantage of the Web economies of scale such as efficient data transfer from one computer to another and the ability to access data in real time. Applications must also afford users real-time access to acquired data to control or monitor a process or perform a test across a network.

Sharing data leads to convenience—users can be remote while control applications are running, and contact methods can extend to mobile phones or pagers. For example, certain software programs allow users to send e-mail alerts. Electronic notifications can be created that allow operators to receive alerts from the production area via mobile phones or pagers when certain process values exceed established limits; at that point, the operator can log on to control the application. Such updates generated automatically during the testing process free up operator time to be spent on more productive tasks. As an example, this technique would be useful for a small company running burn-in tests, which can take six to 10 hours. With the type of system described above, the engineer could go back to his or her desk and receive an alert if test results don't fall within set test parameters.

With distributed execution tasks, the network enables users to access various measurement nodes. It is possible to develop software that uses each computer to complete a portion of the application; a test could have several acquisition nodes, each sharing data with the main computer or cluster of computers that perform the analysis, generate reports, and send them to the Web.

XML and other Strategies

For data sharing, extensible markup language (XML, which enables definition, transmission, validation, and interpretation of data between applications and organizations), is quickly becoming a standard way to

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transfer data in a text-readable fashion that can easily be displayed on the Web. Because of the universal XML standard, one can generate a Web report featuring a defined data set and easily import it into other applications. Because the data is readily accessible, applications can download any XML document, parse the data, and perform custom analyses. Some software applications now include built-in functions for creating or reading XML documents.

Manufacturers have realized the enormous cost benefits of using common off-the-shelf, Internet-related hardware and software components to communicate process data. The same technology used for Internet applications can also be used to connect the enterprise. On the plant floor, data acquisition and automation systems serve as information-access points to the larger corporate IT systems. Data can be transported using existing, widely accepted protocols to guarantee not only interconnectivity but also interoperability. The workforce is already trained to fetch and use data supplied through a browser.

NI's DataSocket provides another method of sharing data directly with other parts of an organization. DataSocket implementation requires no extra development time—it streams the data in a graph or other user interface item over the network. Because DataSocket also is implemented as an ActiveX control, a Java Bean, and a component of Measurement Studio for C/C++ and Visual Basic development, users can incorporate the technology in many other applications. Project members who want to subscribe to the DataSocket Server item that contains the data use a URL to begin receiving data and any updates sent. With DataSocket, engineers can generate Web pages to display quality information from a manufacturing floor, changing properties of materials during an ongoing test, or even updates of the weather.

The Drawbacks

Although remotely controlling applications and distributing control via the Web has countless benefits related to operator convenience, as well as company time and cost savings, operators should also be cognizant of possible drawbacks. High amounts of traffic on the network could lead to slow updates or data transfer. The method of communication (Ethernet) is not a deterministic bus and offers no guarantee that data or execution will occur in a reliable amount of time.

Security is often a concern of Internet-related activities. If the remote system is on the same network as hundreds or millions of other users, the potential exists for possible system interference. Test and control applications should be implemented so that the network is protected by

existing IT security systems. Best practices call for users to work with IT professionals to determine the best way to implement Web-based control applications without interfering with the particular IT system security.

In addition, many people could be trying to access the same application simultaneously. This requires companies to choose applications capable of handling multiple users accessing at the same time. If multiple access to an application is not possible, the users ultimately accomplish no more than they would through a single transaction.

The benefits of Web-based control far outweigh the disadvantages. Although certain hindrances may occur as a result of doing business on a network shared by millions, die advantages of convenience, cost, and time prompt software developers to investigate new ways to deal with the potential problems. For example, to avoid user confusion, software constraints can limit access so that only one client can control the application at a time, but that control can pass easily among the various clients at run-time. In addition, the host computer can take control of the application away from any of the remote clients at any time. The technique can also minimize cost by allowing service personnel to control and test remotely, for example.

The Internet is changing the way we control our applications by providing new ways to take measurements and distribute results. Many different options exist for remotely controlling applications and distributing execution. The best software programs allow users to take advantage of the power of the Web without having to become experts in any of its technologies, helping them incorporate the Internet into many different aspects of their application. This allows companies to integrate their applications easily into the existing corporate networking infrastructure so they can increase the productivity of those performing control.

Text 15. PAST AS PROLOGUE

WHERE ARE WE HEADING?

Sometimes it is difficult to see the forest for the trees. Let us, therefore, briefly review where we have been in order to have a clearer idea of where we are going.

Toward Integration and Ease of Use

In the last twelve chapters, we have examined software, hardware, and systems separately. Let us now reexamine them and see how they are evolving and how they fit together into an information processing system.

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Software All the advances in computers would be of limited value without software to instruct the computers on the operations to be performed. Historically, businesses developed their own software, mainly to run large computers and transaction processing information systems. Recently, however, the trend has been toward purchasing integrated packages, both for microcomputers and for main-frames. As we have seen, integrated software packages combine word processing, spreadsheets, data base management, graphics and communications programs. Such packages are capable of creating a data base of information, maintaining it, and retrieving information from it.

For both users and programmers, structured programming concepts have greatly improved the efficiency of the programming process. Also, applications languages are being developed that are very high level and much more user-friendly, which will benefit nontechnical users. The evolution in software is toward integrated software packages and higher-level user-friendly languages. The key words are integration and ease of use.

Probably most dramatic, however, is the increasing use of research in artificial intelligence. We may expect to see expert systems not only in specific applications, as in knowledge-based systems, but also in large-scale applications in the three levels of information systems: TPIS, MIS, and DSS.

Hardware Technology is the driving force of the information revolution, and this technology is centered on improvements in hardware. Here are some of the recent developments:

- **Input devices**: These are now designed to eliminate data entry steps by allowing direct data entry from source documents, thereby reducing human errors and

removing the need for batch data entry. A particularly fascinating development is the refinement of voice input.

- **Output devices**: These are becoming more varied, more reliable and faster. High-quality output devices are readily affordable for low-cost computer systems. Graphics terminals and laser printers have greatly extended the capability of presenting output, enabling sophisticated desktop publishing, graphics presentations and the like.

- **CPUs**: Integrated circuits are less expensive, faster, and more reliable. The famous Intel "386" chip has opened the door to microcomputers with CPUs that exceed the power that only mainframes had a few years ago. The

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processors of tomorrow promise to be even more powerful, particularly with new developments in parallel processing.

- **Secondary storage devices**: Optical disks and other devices allow more information to be stored and retrieved than would have been thought possible a few years ago, which means that large data bases can now be created and maintained relatively easily.

- **Data communications**: The communication links that allow the integration and common sharing of various information resources are constantly improving. Micros and mainframes now work constantly together, and many offices have multiuser systems for micros.

- **Microcomputers**: One of the most dramatic hardware advances, the microcomputer, when combined with communication links, can give users a wide variety of powers, from solving individual problems locally to calling up information from large centralized data bases. The microcomputer is a tool that enhances personal productivity, whereas the mainframe or minicomputer is a corporate tool.

As with software, the evolution in hardware has been toward integration of equipment, use of communications systems, and the development of ever more user-friendly capabilities.

Especially important is the capability to integrate microcomputers into an organization's total computer information system through data communications links.

Systems. As we have seen, within large organizations, computer applications can be categorized into three areas: transaction processing information systems (TPISs); management information systems (MISs); and decision support systems (DSSs).

TPISs focus on record keeping and clerical operations. MISs focus on management reports. DSSs focus on supporting decision-making and planning activities. Although each system is separate and performs a distinct function within the organization, all require and use a common data base of corporate information.

The revolution in information systems is in the development of DSSs and the use of common data bases inside and outside the organization. The result is, once again, toward integrating information and making it user-friendly. The key to this integration has been the recent development of powerful yet easy to use data base management systems that allow TPIS, MIS, and DSS systems to efficiently share common data. In particular, the OS/2 operating system permits windowing, multiuser use, and multiprocessing, and allows better integration between system software. As

mentioned, we will probably also see further integration of expert systems and AI into TPIS, MIS, and DSS.

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Text 16. PRIVACY, SECURITY AND ETHICS: CEEPING INFORMATION SAFE

Privacy is primarily a personal concern; it is the assurance to individuals that personal information will be used properly and protected against improper access. Security is primarily a business concern; it is a system of safeguards designed to protect a computer system and data from deliberate or accidental damage or access by unauthorized persons.

Concern has been growing about possible invasion of privacy by computer misuse. Computer technology may include methods of information use that outstrip the current ethical and legal standards for their use. Even so, there are some privacy laws: (1) The Fair Credit Reporting Act, passed in 1970, gives individuals the right to gain access to records kept about them by credit bureaus—and to challenge the records that may be inaccurate. (2) The Freedom of Information Act, also passed in 1970, gives ordinary people the right to have access to data about them gathered by federal agencies. This sometimes requires a lawsuit, may be time-consuming, and may result in heavily censored photocopies. (3) The Federal Privacy Act, passed in 1974, prohibits secret personal files, stipulates that individuals must be allowed to know the content and use of files about them, and extends the restrictions beyond government agencies to include private contractors dealing with the government. Government organizations may not launch "fishing expeditions" to collect data about individuals; they must justify the effort.

Three problems that might compromise computer security are: (1) Computer crime—use of computers to steal money, goods, information, or computer time. (2) Piracy—stealing or unauthorized copying of programs or software. [3) Industrial espionage—stealing of computer industry trade secrets.

Computer crime includes various activities; among them are the following: (1) Theft of computer time ranges from the trivial—people using their employers' computers for games or personal use—to the serious, such as people using their employers computers to operate their own businesses. (2) Manipulation of computer programs or data ranges from changing grades in college computer files to altering important instructions in a business system for personal gain. Two tricks of data manipulation are the Trojan Horse, which is adding instructions to someone else's program so it works normally but also does additional illegal things, and data diddling in which data is modified before it goes into a computer file. (3) Theft of data includes using microcomputers to break into large data banks and data

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bases. It also includes embezzlement; one trick, called the salami method, is to take from many acounts only a few cents ("slices") that will not be missed but that will add up to quite a large sum.

Piracy is illegal copying of software. It includes the copying of commercially developed software by private individuals, who give or sell copies to their friends. Many manufacturers build in software protection codes to prevent duplication, but these codes can be cracked. Piracy also describes the activity of programmers who steal programs they write for their employers. Programs legally belong to the employers of the programmers who develop them.

The U.S. Supreme Court has ruled that software can be patented. The Copyright Act of 1976 states that flowcharts, source code, and object code are copyrightable.

Shareware is software such as word processors, spreadsheets, and the like, that people may purchchase for a very small fee (for example, $5). If they like it, they can send the author more money for it, which entitles the buyers to updates and other information.

Industrial espionage is the misappropriation of company trade secrets, either by theft or by more subtle means. Legitimate ways for a business to gather intelligence include getting reports from its sales force as well as from published sources about the competition. However, photographing a competitor's factory layout or breaking into another company's data bases is espionage.

Copying of software is unfortunately widespread, but it is unethical because software writers are cheated out of the rewards they deserve for their work. Moreover, software manufacturers are forced to charge higher prices for the products they do sell.

Passes and passwords are two security measures to prevent unauthorized computer access. A pass, such as a badge or a card, perhaps with magnetized coding, may be required of authorized employers by computer room security guards. The new field of biometrics—the measurement and use of individual characteristics such as fingerprints as unique identifiers—may provide new forms of identification systems. Every computer system also should require special passwords—secret words or numbers that must be keyed into the system before it will operate. Passwords should not be obvious, should be at least six characters long, and should be changed randomly and frequently.

Technical controls can improve security against unauthorized system entry: (1) Security dial-back devices, which call back the caller, assuming the correct password has been submitted, and connect him or her to the

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computer, may eliminate the problems of access by former employees and by hackers. Hackers used to mean "computer enthusiasts" but now seems to apply to people who invade other people's files and data bases. (2) Encryption devices scramble or encode data sent over telecommunications lines so it can be decoded only by an authorized person. The Data Encryption Standard (DES), endorsed by the American National Standards Institute, is one such code. (3) Some software has built-in access restrictions to limit users to certain parts of a program. (4) Software may have a user profile— information about regular users, such as job, budget number and access privileges, which can be checked if there is a problem. (5) Such software can also provide an audit trail—a means by which audi-1 tors can see who has had access to what parts of the data.

Text 17. THE BBE PROCESS

Introduction

Virsonix™ is a California-based company that specializes in developing software audio applications for professional and consumer use. In conjunction with BBE Sound Inc., Virsonix is proud to introduce the Sonic Maximizer Plugin. For years professional musicians and studio engineers have known that the Sonic Maximizer is the best way to get that professional sound and extra sparkle that is so difficult to capture. Now you can access BBE processing technology within the digital domain. Virsonix has been able to recreate a software version of the Sonic Maximizer that is identical to the physical unit in terms of utility and processing. Our advanced sonic processing technology and proprietary algorithms have allowed us to create a plugin that boasts the following features:

- Realistic interface and intuitive navigation

- Real-time play meters

- Low CPU consumption

- Supports mono and stereo operation

- Supports 22kHz, 44.1 kHz, 48 kHz, and 96kHz sample rates

- Supports 16 and 24 bit processing

Loudspeakers have difficulty working with the electronic signals supplied by an amplifier. These difficulties cause such major phase and amplitude distortion that the sound reproduced by speaker differs significantly from the sound produced by the original source. In the past,

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these problems proved unsolvable and were thus relegated to a position of secondary importance in audio system design. However, phase and amplitude integrity is essential to accurate sound reproduction.

Research shows that the information which the listener translates into the recognizable characteristics of a live performance are intimately tied into complex time and amplitude relationships between the fundamental and harmonic components of a given musical note or sound. These relationships define a sound's "sound". When these complex relationships pass through a speaker, the proper order is lost. The higher frequencies are delayed. A lower frequency may reach the listener's ear first or perhaps simultaneously with that of a higher frequency. In some cases, the fundamental components may be so time-shifted that they reach the listener's ear ahead of some or all of the harmonic components. This change in the phase and amplitude relationship on the harmonic and fundamental frequencies is technically called "envelope distortion." The listener perceives this loss of sound integrity in the reproduced sound as "muddy" and "smeared." In the extreme, it can become difficult to tell the difference between musical instruments, for example, an oboe and a clarinet.

BBE Sound, Inc. conducted extensive studies of numerous speaker systems over a ten year period. With this knowledge, it became possible to identify the characteristics of an ideal speaker and to distill the corrections necessary to return the fundamental and harmonic frequency structures to their correct order. While there are differences among various speaker designs in the magnitude of their correction, the overall pattern of correction needed is remarkably consistent. The BBE Process is so unique that 42 patents have been awarded by the U.S. Patent Office.

The BBE Sonic Maximizer will deliver surprisingly good results on guitar, bass and keyboard tracks. Electric guitars have added "bite", "chunk" and improved definition. As Guitar Player magazine said, "BBE is the most cost effective improvement you can add to your rig." Acoustic guitars processed with the Sonic Maximizer have a breathtakingly natural sparkle and presence. Bassists will delight in the BBE Sonic Maximizer's ability to bring much more punch to the bottom end without muddying up the midrange. The Sonic Maximizer is also great for keyboards, with everything from the latest samples to a vintage Rhodes benefiting equally from the patented BBE process. For more information about the BBE process, please visit BBE on line at...

Plug-in Usage and Info

The BBE Sonic Maximizer plug-in is designed to be used as an "insert" type effect and should be configured into the effects chain in series with the

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signal path the same way a graphic equalizer or limiter would be connected. In other words, the entire signal should pass through the plug-in. Setting up the BBE Sonic Maximizer as an echo send or "AUX" device like a digital reverb is not recommended, as the processed effect is not fully realized when summed with the original source audio.

The plug-in can be used as an effect on individual tracks or applied overall during mixdown. The BBE process dramatically improves the clarity and intelligibility of vocals and musical instruments in a track insert situation. As a global effect, the BBE Process will add more depth, detail and punch over the entire mix. When using in conjunction with an equalizer, the Sonic Maximizer should be added after the equalizer in the signal chain. In the event that the equalizer is being used for drastic tone alteration, then insert the Sonic Maximizer before the equalizer in the signal chain. Placement either before or after an equalizer should have no negative effect on its processing ability, however most users find they prefer more modest use of their equalizers once the BBE Sonic Maximizer has been added to their sound systems.

Several presets have been provided to get you started using the Sonic Maximizer, however, there is no "right" way to it. Simply adjust the settings to determine what sounds right to you. We believe that you can never have enough Sonic Maximizing! Please consult the documentation of you host application for information about saving your own presets.

The Sonic Maximizer does not generate new harmonic material, as many other type audio enhancers do. Rather, it corrects the phase shift and distortion that happens naturally when the sound is reproduced by the speakers. Because the BBE process is unique, you can use the plug-in with other sonic enhancer products you may have.

Even though the plugin was calibrated with several different Sonic Maximizer units, there may be a discrepancy between the levels of an actual BBE unit and the levels of the plug-in. Such variations are normal because of the slight differences that exist in the potentiometers and analog nature of the Sonic Maximizer.

The plug-in LEDs will provide an accurate visual representation of what is happening with the processed signal in most software applications. However, with some applications, or when preview mode is used, the LED levels may not correspond because the applications route audio signals through the plug-in before sending the actual result out to the sound card. The meters on the Sonic Maximizer react to the signal that is currently being processed, not the signal that is coming out of the sound card. This works fine in real-time processing situations, because the sound is sent out

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the sound card immediately after processing. However, when an application buffers up large amounts of audio, and there is latency before it sends the results out the sound card (e.g. for an offline preview), the meters will react out of synch from what is heard. This is not a defect in the design of the Sonic Maximizer plug-in, but rather how host applications handle the processing of the data.

Text 18. BIRTH OF THE MICROPROCESSOR

Since 1960 the complexity of the integrated circuits, i.e. the number of electronic elements on one chip, continued to double every year. Today we haven't yet seen any significant deviation. from this exponential law. Nor are there any signs that the process is slowing down. The technology is still far from the fundamental limits imposed by the laws of physics: further miniaturization is less likely to be limited by the laws of physics than by the laws of economics.

The culmination of all these advancements was the micropro-cessor, which has become virtually synonymous with microelec-tronics, but should not be confused with it. The microprocessor emerged in consequence of the progress of the microcalculators.

As we know, the electronic calculator in all but the latest versions uses hardwired logic. The arithmetic functions, or the operating program instructions, are embedded in the chips while the application program is in the user's head — his instructions yield the desired calculations.

M. E. Hoff, a young Intel Company engineer, envisaged a different way of employing the new electronic capabilities of the calculator. In 1969 he found himself in charge of a project that Intel took on for Busicom, a Japanese calculator company.

Busicom wanted Intel to produce calculator'chips of Japanese design. The logic circuits were spread around eleven chips and the com-plexity of the design would have taxed Intel capabilities — it was then a small company. Hoff saw a way to improve on the Japanese design by making a bold technological leap. The fact is Intel had pioneered in the development of semiconductor memory chips to be used in large computers. In the intricate innards of a memory chip, Hoff knew, it was possible to store a program to run a mi-nuscule computing circuit.

In his preliminary design, Hoff condensed the layout onto three chips. He put the computer's "brain", its central processing unit, on a single chip of silicon. That was possible because the semiconductor industry had

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developed a means of inscribing very complex circuits on tiny surfaces. A master drawing, usually 500 times as large as the actual chip, is reduced photographically to microminiature size. The photo images are then transferred to the chip by the-technique similar to photoengraving.

Hoff's Central Processing Unit (CPU) on a chip became known as the microprocessor. The CPU comprised a logic unit, an arithmetic unit and a control unit. To the microprocessor Hoff a-ttactied two memory chips, one to move data in and out of the CPU and one to provide the program to drive the CPU. Hoff now hadf in hand a rudimentary general-purpose computer' (microcomputer) that could not only run a complex calculator, but also control, for example, an elevator or a set of traffic lights, or a wasliing-mnchine, or a multifunction digital watch, and perform a great many other tasks, depending on its program only.

So the microprocessor is an integrated circuit which hai the properties and fulfils the role of a complete central processing unit of a computer. This means that the circuit does not just react in a fixed, pre-programmed way to an input signal to produce an output signal. The main feature of the microprocessor is that its response and its logic can be altered. In other words, the micro-processor can be programmed in different ways rather than react in one pre-programmed way only.

For logic and systems designers the appearance of the micro-processor brought with it a dramatic change in Iln' way they employed electronics. They could now replace all those rigid hard-wired logic systems with microcomputers because they could store program sequences in the labyrinthine circuits of I he memory chips instead of using individual logic chips and discrete compo-nents to implement the program. Engineers could thus substitute program code words for hardware parts.

It took about three years before the first devices reached the market but in the meantime about a hundred different microprocessors had become available. As with all microelectronic products, the capabilities of microprocessors advanced rapidly and the sophistication of circuits increased day by day.

After other Intel engineers who took over the detailed design work got through with it, Hoff's invention contained 2250 micro-miniaturized transistors on a chip slightly less th;m one-sixth of an inch long and one-eighth of an inch wide, and each of those microscopic transistors was roughly equal to an ENIAC vacuum tube. Intel labelled the microprocessor chip 4004 and the whole microcomputer MCS-4 (microcomputer system-4). Despite its small size, the 4004 just about matched ENIAC computational

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power. It also matched the capability of an IBM machine of the early 1960s whose central processing unit (CPU) took up the space of an office desk.

Text 19. PERIPHERAL EQUIPMENT

The microcomputer has to communicate with the outside world, so that programs and data can be entered into its memory and processed information can be displayed or transmitted in some form to the microcomputer user.

There are various types of peripheral equipment that may be attached to microcomputers including keyboards and paper tape readers for input, and visual display units (VDUs) and printers for output. Information may be output from the microcomputer on to magnetic tape or disk for storage and re-entered when required.

Different sensors and actuators may be linked (interfaced) to the microcomputer for controlling instruments and machines; their use is discussed in later chapters.

Keyboards

A keyboard consists of a number of switches which are activated by pressure or simply by touching them. The keys are arranged as a matrix, so that the depression of any key can be detected by scanning the rows and columns of the matrix. Hardware may be used to sense which key has been pressed or this may be carried out by a software routine.

The layout of the keyboard may be similar to that of the con-ventional typewriter or may be designed for particular users. For example, if a large amount of the data to be entered is generally numeric, then a numeric key pad containing keys for decimal 0 through 9, full stop, and some special characters, is an essential feature.

Teletypewriters

Teletypewriters may be used for a number of different purposes in computer systems. For example, they may be used as terminals to transmit and receive information over telephone lines or as input/output devices directly connected to a computer.

Teletypewriters transmit and receive information in serial form, that is, each character is converted to a bit-code, and then sent as a stream of serial data bits with start

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and stop control bits for each character. The characters have to be decoded when they reach the computer end.

Teletypewriters and other terminals using telephone lines require modems(modulators - demodulators) at each end, to convert the data to a form suitable for voice transmission and vice versa.

As well as having a keyboard, teletypewriters are fitted with a printing device, so that a hard copy of the information sent and received is available. Characters are printed one at a time by moving the block containing the characters across the paper from left to right. The selected character is pressed against a typewriter ribbon to give a solid shape. Speeds vary from about 10—30 characters/second.

Teletypewriters may have paper tape stations for producing output on to punched paper tape.

Visual display units

These units have a cathode-ray tube (CRT) for displaying information and often a keyboard which may be attached or is detachable. The VDU may be part of a self-contained micro-computer, with all the necessary circuitry contained in the case holding the CRT.

The output from the keyboard is decoded into a form suitable for the computer being used. This function is usually carried out within the VDU which may also have its own buffer, so that. information keyed in is not transmitted immediately giving the operator a chance to correct it.

Other more sophisticated features may be available on more expensive VDUs such as graphics facilities and screen-editing. With the latter facility, changes may be made to information displayed on the screen by moving a special character (cursor) to the position on the screen which requires alteration. Often these facilities will be under the control of programs stored in ROMs on the VDU board. Additionally, a light pen may be used as an input device by pointing it to the required position on the screen.

Magnetic recording devices

There are basically two types of devices, serial access, e. g. magnetic tape, and random access, e. g. magnetic disk.

Information is recorded magnetically on both these media, which generally consist of a substrate made from a plastics material coated with magnetic oxide. A 1 bit is represented by a portion of magnetized material (magnetic spot) and a 0 bit by the absence of a magnetic spot. Patterns of Is and Os are used to represent character codes.

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Ordinary portable cassette recorders and standard audio cassettes can be used with some microcomputers. Standard cassette interfaces are used to allow binary information in the microcomputer memory to be transmitted as a serial bit stream for recording on tape. The 1 and 0 bits are generated as two different tones.

Magnetic disks have data recorded on them in a series of circular tracks. Each track is divided into sectors and is uniquely identified. Data is transferred in sectors or groups of these. Read/write heads are moved to the appropriate track for recording or accessing data under hardware/software control, so that random access of data can be achieved. Indexes may be used to enable the required data to be located or data may be retrieved randomly by using relative addressing, in which data is recorded in known positions. Data may also be recorded serially as on magnetic tape.

Two types of disk are commonly used, floppy (flexible) disks and hard disks. Floppy disks are available in two sizes, standard 8 inches and mini 5 inches. Hard or soft sectoring may be em-ployed.

Hard disk drives, available for use with microcomputers, are usually based on Winchester technology. The units consist of a hard disk totally enclosed and sealed in a chamber. This ensures that extraneous particles of dust or dirt cannot get into the very small gap between the fast spinning disk and the floating read/ write head, as this would cause a head-crash which would ruin the head and disk resulting in the loss of all the information held on the disk. The disks are the same size (8 inches diameter) as standard floppy disks, but can hold much more data and have greater reliability.

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Text 20. HARDWARE COMPONENTS: DISPLAYS, KEYBOARDS, PROCESSORS, AND STORAGE

INFORMATION PROCESSING WORKSTATIONS

Today equipment that once handled only word processing applications is capable of using the different types of software. The equipment on which word processing was done was called a word processor. Word processing can presently be done on equipment dedicated solely to this application, or it can be done on a general-purpose piece of equipment that uses a variety of different types of software such as spreadsheet applications software, data base software, and graphics software. A term more appropriate for this type of equipment is an information processor.

Information processor is a general term that is applied to the various computers in use today. Some of the terms commonly used to refer to information processors are word processors, office information systems, and personal computers.

Certain parts make up an information processor. The components of a personal computer have been chosen to illustrate these parts because they are representative of the parts of nearly any computer system in use today. Whatever the machine, it will have a keyboard, video display, central processing unit, storage unit, and possibly a printer.

A keyboard is the most common means of entering information and instructions into a computer (inputting); a visual display and a printer are standard means of getting information from the computer back out to the user (outputting). All computers also need the equivalent of a disk drive,
a device used in running additional software and storing information.

When grouped together, these components may be called a workstation.

Nondisplay systems (Blind Terminals)

Nondisplay systems are workstations that print output (hard copy) using the same piece of equipment for inputting and outputting. For this reason, they are referred to as combination input/output terminals or 1/0 terminals. These input/output terminals do not provide the opportunity to view the entire page of material as corrections or revisions are being made. They are, therefore, called blind terminals. Only the portion of the text that is changed appears on the printed page (unless the entire text is played out on paper). Very few of the workstations in use in industry today are blind terminals.

Visual Display Terminals

An important component of a workstation is a visual display terminal (VDT). A visual display terminal is a television-like screen, often called a monitor. Although visual displays are presently found on the majority of workstations, the first word processors were nondisplay systems.

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Workstations with a visual display terminal show the document being key-boarded (inputted) or retrieved from storage. Using a VDT makes it possible to produce a document without the use of paper. Corrections and changes made at the keyboard can be seen on the screen. When all the corrections and revisions have been made, the document is recorded on storage media and can be played back at a later time.

Advantages:

1. You see the document during its creation.

2. You can proofread, correct, and revise the document before it is printed.

3. The process is done on a screen so that no paper is used.

4. You can clearly see the correction when revising rather than striking over the change/error and waiting for a printout to see the revised copy.

5. You can keyboard the next page while the printer types the previous page.

6. Printout and key-hoarding can occur simuitaneously.

7. A proofreader can use a different VDT as a second monitor, revise if necessary, and begin the printout while the original text is still being keyboarded.

Disadvantages:

1. Display systems are more expensive than nondisplay systems because the initial "typing" shows up on a screen and not on paper. Most systems include a separate printer to create the final document.

2. Eyestrain is a factor. Considerable research has been done on these systems to determine the effect of working with VDTs.

Features of a video display screen are:

1. Number of lines presented on the screen are from 1 to 66 at a time.

2. Wraparound capability (visual width expanse).

3. The scroll-up feature of the screen allows the operator to bring lines into view from the top or bottom of the screen.

4. Visual components are CRT, EL, gas plasma, or liquid crystal.

5. Visual characteristics are: **a**. Color (green on black; white on green; black on white; amber on black). **b**. Nonglare screens.

Four major technologies, each with its own characteristic resolution (clarity), size, and weight are used in visual display terminals. Resolution is the number of identifiable elements on a display, often expressed in lines per inch. The identifiable items or pixels (picture elements) are the smallest elements that are visible on a display screen. The greater the number of pixels, the higher the resolution. Many graphics applications require high-resolution displays.