Обложка 1/1

Московский государственный технический университет
имени Н.Э. Баумана

Учебно-методическое пособие

О.В. Авдеева, Т.П. Смирнова

Обучение чтению литературы на английском языке по специальности «Высокопроизводительные компьютерные процессы и технологии»

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Черная краска

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2007

УДК 802.0
ББК 81.2 Англ-923
А18

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А18 Обучение чтению литературы на английском языке по специальности «Высокопроизводительные компьютерные процессы и технологии»: Учеб.-метод. пособие. – М.: Изд-во МГТУ им. Н.Э. Баумана, 2007. – 40 с.

Пособие содержит оригинальные тексты на английском языке об основных этапах развития и принципах работы суперкомпьютеров и сетей определенного типа, а также о новейших исследованиях применения суперкомпьютеров в современных технологических процессах. Кроме того, в пособие включены задания и упражнения, позволяющие овладеть терминологией и языковыми оборотами, необходимыми для понимания и перевода научно-технической литературы.

Для студентов 3-го курса факультета «Информатика и системы управления».

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ПРЕДИСЛОВИЕ

Пособие содержит основные и дополнительные тексты по специальности, задания и упражнения, позволяющие усвоить и закрепить необходимый лексический материал, отработать перевод грамматических конструкций.

В оригинальных текстах из американской технической литературы отражены новейшие тенденции высокопроизводительных компьютерных процессов и технологий. Осуществляя лексико-грамматический анализ этих текстов, студенты приобретают навыки понимания и перевода научно-технической литературы соответствующего профиля.

В конце каждого из шести разделов пособия помещены словари с основной лексикой.

Пособие предназначено для студентов факультета «Информатика и системы управления», обучающихся по специальности «Высокопроизводительные компьютерные процессы и технологии».

UNIT 1

TASK 1. *Read, translate and retell the text.*

Text 1A. The Next Generation

What is required for the next generation of computers is not simply jamming an ever-larger number of ever-smaller components onto a piece of silicon – that line of effort is costing more and yielding proportionately less speed. What's required is a complete rethinking of the way computers are built and the way they process information. From von Neumann's first computer to the world's fastest single processor, the Cray 1 supercomputer, computers have always done tasks essentially one at a time. The central processing unit, or CPU, fetches a pair of numbers from memory, adds them and replaces them in memory. Processing speed is limited not by the speed of the CPU but by the narrow pathway between the CPU and memory. Shuttling operands and results back and forth is like trying to condense all the traffic on a freeway at rush hour down to one lane. Computer scientists call the resulting traffic jam "the von Neumann bottleneck". Researchers working to build the next generation of computers are counting on parallelism (using many processors, each of which works on a piece of a larger problem) to detour around the von Neumann bottleneck and achieve revolutionary increases in speed.

Progress in developing serial computers, and the difficulty of coordinating more than one CPU, forced parallelism to the background. The first truly parallel computers emerged in the 1970s.

Two trends spurred the research forward: a need for more processing power and the revival of artificial intelligence research. By copying some of the brain's processing strategies, researchers hope to build computers capable not only of solving large scientific problems but also of reproducing human intellect.

Computer evolution having main milestones, it is often broken up into generations.

First Generation. From the first computer to the IBM 650, 1947 to 1956, computers relied on vacuum tubes as their basic switching element, and for memory, they used magnetic drums and cathode ray tubes.

These early machines were capable of processing about 10,000 instructions per second, similar to the speed of a modern personal computer, and storing 2,000 alphanumeric characters.

Second Generation. Typical machines were the IBM 7094 and the Control Data Corporation's CDC-6600. This was the era of discrete transistors and magnetic core memories, 1957 to 1963. Performance was in the neighborhood of 200,000 instructions per second with storage for 32,000 characters.

Third Generation. Stretching from 1964 to 1981, this generation marked the introduction of the computer on a chip, as well as specialized processor and memory chips for mainframe supercomputers. The IBM 360 and 370 series, the Cray 1 supercomputer, and Control Data's Cyber 205 are all third generation machines. Average performance for these machines is 5 million instructions per second with main memory capacities of at least two million characters. Peak processing speeds, often cited by the manufacturer, can be considerably higher.

Fourth Generation. The 1980s is the decade of the parallel supercomputer. Cray's X-MP, a four-processor machine, was one of the first next-generation computers, delivered in 1982. Its successor, the Cray 2, is believed to be the first machine to execute 1 billion arithmetic operations per second. Control Data has also introduced a parallel multiprocessor system, Cyberplus, that can combine and integrate the power of as many as 64 high-performance CPU's. Such a system, Control Data claims, would be capable of peak execution rates of 44 billion instructions per second, a huge leap in processing power that won´t be verified in actual tests until someone contracts to buy such a machine.

Fifth Generation. The Japanese undertook effort to develop artificial intelligence machines, begun in 1981, “The Fifth Generation Project”.

The promises of the Fifth Generation read like science fiction: machines that can process terabit of knowledge – not numbers but actual concepts, ideas, and images – per second; programs that encode encyclopedic volumes of knowledge in a particular field and thereby solve problems too complex or obscure for human specialists; computers that design and program other computers (that, in effect, have the power of reproduction); machines that learn from their mistakes and from experience; and computers that interact with humans vocally and in human language, without the need for mechanical input.

The focus of this text is to assess the present state of next-generation computer research and to outline what might realistically be expected in the next five or 10 years.

TASK 2. *Find in the text English equivalents for:*

способ обработки; полное переосмысление; ограниченная пропускная способность; ведет к уменьшению скорости; основные вехи; вакуумные лампы и электронно-лучевые трубки; так же, как и; средняя производительность; емкость основной памяти; предприняли попытку; одно задание за один прием; отодвинуть на второй план параллельное использование нескольких ЦПУ; компьютеры появились.

TASK 3. *Answer the questions.*

1. What tasks should be solved to create the next generation of computers? 2. What is a supercomputer? 3. What is known to you about von Neumann's creative work? 4. What is CPU and what for is it? 5. What was the natural sequence of steps in creating the first supercomputer? 6. Is it possible to copy processing strategies of our brain with the help of computer? 7. What is the difference between the work of our brain and computer? 8. What is known to you about the first generation of computers? 9. What should be marked in the third and the fourth generations of computers? 10. What might reasonably be expected in the nearest future in the development of computers?

TASK 4*. Read and translate the words, paying attention to the stress:*

´process *n* – ´process *v* – ´processing; ´increase *n* – in´crease *v* – in´creasing; ´program *n* – ´program *v* – ´programmer; cont´rol *n* – cont´rol *v*; eff´ect *n* – eff´ect *v*; ´access *n* – ´access *v*; ´intellect *n* – ´intell´ectual *n*; ´object *n* – ob´ject *v*; ´forecast *n* – ´forecast *v*; ´frequent *a* – fre´quent *v*; ´conduct *n* – con´duct *v*; ´progress *n* – prog´ress *v*.

TASK 5. *Translate the sentences, paying attention to modal verbs.*

1. A new website "Electronic book" of complaints appeared in the net of St. Petersburg where the townspeople could tell us about bad work of the officials. 2. We should know that the most powerful supercomputer in the world called "Earth Simulator" has been built in Japan. 3. Computer designers ought to keep in mind the fact of the influence

of electromagnetic radiation of ultra low frequency on the people sitting not in front of the computer but nearby behind it or on the right or on the left of it. 4. Designers of Intel Corp. assured that Pentium 4 was to reach the frequency of 3.8 GHz and was intended for the bus of 800 GHz. 5. Computers would be used in our everyday life being the source of information, a means of communication, a device of calculation simulation and storing data. 6. Everyone needs to have a computer always at hand. 7. Our country must invest enormous sums of money into the development of the advanced computer technology. 8. The USA had to apply supercomputer to develop the bomb Common Vehicle to be dropped from space (5000 km high).

TASK 6. *Render into Russian. Find the Gerund.*

1. Developing the most powerful computer in the world so called Big Blue, company IBM is going to use operating system Linux as a basis. 2. In the future computer will be so called "closed box" where it'll be rather difficult to change software or hardware. Interacting computer systems will be greater and they'll start deciding instead of its owner (user). 3. Big Blue producing 11 billion operations per second and being the most promising, Japanese public organization intends to buy it for scientific purposes, i.e. for conducting bio- and nanotechnological investigations. 4. We are glad of Japanese successful overcoming of boundary in creating taste with the help of supercomputer. Tasting being complex combination of the feeling of food in the mouth with chemical and sound signals, it makes the process of simulating fairly hard. 5. Japan having achieved leading positions in science and technology, it would like to apply this supercomputer with 2636 processors for selecting suitable materials for superconducting devices. 6. 5 years ago having implanted electrodes linked with the computer into the brains of paralyzed patients doctors of the Institute of Artificial Intellect taught them to move the cursor across the screen by means of the thought. Thus, being paralyzed people can communicate or even control necessary devices. 7. We are sure to say that a computer is a device that will substitute a man since the time of laughing at the jokes of its boss and shift its bugs on another computer. 8. Swedish company Electrolux is developing a new refrigerator being equipped with a tiny digital camera transmitting picture on the mobile phone.

TASK 7. *Read the text and make up a plan for rendering it.*

Text 1B. A Man Before His Time: Charles Babbage

It was more than a century before a machine capable of doing mathematics more complex than basic arithmetic was developed. Charles Babbage, in 1823, was commissioned by the British Chancellor of the Exchequer to design a machine to solve sixth-degree polynomials – $a+bN+cN^2+dN^4+eN^4+fN^5+gN^6$ – primarily for the purpose of calculating astronomical tables more accurately. Babbage had trouble constructing a working prototype and eventually abandoned the project, but it was revived by Pehr Georg Scheutz of Sweden, who built two improved Babbage-design Difference Engines with Babbage's help.

From 1833 to the end of his life in 1871, Babbage was consumed with developing a general-purpose machine, a mechanical computer with truly revolutionary speed and scope. His Analytical Engine, had it worked, would have been the world's first programmable digital computer, complete with a memory and printer. It was to have been a parallel machine as well, performing arithmetic on as many as 50 decimal digits at one time. What ultimately defeated the project was that Babbage's theory, his design, was too advanced for the technology of his day (a problem that has doomed many projects since then). It was impossible to have mechanical parts machined accurately enough for them to work together smoothly. Tiny imperfections in rods, wheels, ratchets and gears would compound as the parts were assembled into components that groaned and threatened self-destruction.

The Analytical Engine was designed as a digital, or counting, computer. Each of its inputs was accounted for by a click of the ratchet, much the same way that a clock counts seconds and compiles them into minutes and hours. Other non-electronic, digital computers were built after Babbage, but even when they functioned properly, they were slow.

Provided Ch. Babbage had created a computer in his life-time, what level of the development had our society reached nowadays?

Essential Vocabulary

average *n* – среднее
on an/the average – в среднем
character *n* – символ
claim *n* – требование, претензия
decimal *a* – десятичный

detour *n* – обход
discrete *a* – дискретный, раздельный, состоящий из разрозненных частей
doom *v* – предназначать, обрекать, предопределять
emerge *v* – появляться; всплывать; выходить
fetch *v* – выбирать, извлекать
inspiration *n* – вдохновение; влияние, воздействие
interact *v* – взаимодействовать
mainframe – основной, главный компьютер
obscure *a* – неотчетливый; неизвестный
pathway *n* – магистраль
process *v* – обрабатывать
punch *v* – перфорировать
rely *v* – полагаться на; зависеть от
retrieve *v* – восстанавливать, возвращать в прежнее состояние
revival *n* – восстановление
scope *n* – границы, пределы; область видимости
smoothly *adv* – беспрепятственно, без помех
shuttle *v* – курсировать; перемещать
spur *v* – вдохновлять, побуждать
surface *v* – покрывать
terabit *n* – терабит = 10^{12} the 12^{th} power of 10
verify *v* – проверять, контролировать
yield *v* – производить, приносить

UNIT 2

TASK 1. *Read and translate the text. Give the gist.*

Text 2A. Scalability

Given an application and a parallel computer, how much can we boost the number of processors in order to improve performance? How much can we increase the amount of data and still have the same performance? Scalability is an informal measure of how the number of processors and amount of data can be increased while keeping reasonable speedup and efficiency. Unlimited, absolute scalability is obviously unreasonable: it would be like expecting that the design principles needed to build a car could be extended to build a car that travels as fast as an airplane. Too many parameters change if the size of a system radically changes and the design has to obey different principles.

Relative scalability, that is the property of maintaining a reasonable efficiency while slightly changing the number of processors, is instead possible and indeed very useful. This scalability allows users to adapt their system to their needs without having to replace it. In general, most parallel processors are scalable in this sense unless they already use a number of processors that saturates some of the system's resources.

Changing the number of processors to execute the same problem faster causes, sooner or later, a decrease in efficiency because each processor has too little work to do compared to the overhead. If, on the other hand, the size of the problem, i.e. the amount of data, processed, also grows, the efficiency can be held constant. If, instead, the problem size grows while the number of processors remains constant, efficiency also grows unless the increase in the amount of data should saturate some system resources, e.g. the memory. This is a very important consideration because it implies that making a very efficient use of a parallel processor is possible if we are willing to apply it to a sufficiently large problem.

Scalability could be characterized by a function that indicates the relationship between number of processors and amount of data at constant efficiency. For example, if, when processors are doubled the amount of data needs to be doubled in order to keep the same efficiency, then the scalability is rather good. If, instead, data need to quadruple to keep the efficiency constant, the system is less scalable. Too large an increase in problem size in order keep efficiency constant is not a good characteristic because both the user might not need to process such a large problem and the system resources and design might not be able to deal with a very large problem.

Being able to keep efficiency constant by scaling the problem size is a very good property, unfortunately not all problems can be scaled to take advantage of a better efficiency. In some cases it might be possible to “batch” a few instances of a problem together and generate a larger problem, in other cases, e.g. weather forecasting, it is useful to solve a larger problem. In other cases, e.g. sensory problems like speech recognition, solving a larger problem does not make sense and we have to do with either a low efficiency or a low speedup, or both.

TASK 2. *Answer the following questions.*

1. Explain what scalability is? 2. How many processors can be installed in supercomputer nowadays? 3. Unlimited scalability is reasonable, isn't it? Why? 4. Why is relative scalability very useful? 5. What can cause a decrease in efficiency? 6. What should be done to hold efficiency constant? 7. What can scalability be characterized by? 8. In what fields is the application of supercomputer efficient?

TASK 3. *Complete the sentences giving definition to:*

1. Scalability is …; 2. Parallelism is …; 3. Cache memory is …; 4. Bus is …; 5. Controller is …; 6. CPU is …; 7. Open Source is …

TASK 4. *Complete the table.*

Characteristics	Size	Power	Applications	Users	Price
PC					
Supercomputer					

TASK 5. *Render into Russian. Pay attention to the meaning of the verb <u>to do</u>.*

1. Books don't simply advise what you should do, but give you efficient tools for how to do it. 2. Our desires for what we don't have keep us from enjoying what we do have. 3. Of great importance is the finding that symptoms of earth's crust shift can be noticed (sighted) from space (with the help of / by means of) satellite as soon as it does occur. 4. Computers have much to do with our brain. Nature is known to invent these so-called supercomputers ages ago. 5. Very often progress and scientific experiments have nothing to do with humanity, for instance, the launchings of the first spacecrafts with dogs without lander (landing module) board. 6. Every force does its own job no matter how many other forces are acting. 7. More education does not mean faster growth. In general it probably does. 8. It is exactly this result that will do for our purpose.

TASK 6. *Translate the text and mark the most important ideas in it.*

Text 2B. Computers That Help Designing Computers

In the sixties one could unfold a large electric diagram containing the complete description of a small computer. Today this would be completely impossible. It is not the complexity that escapes the designers but rather the sheer amount of components that go into making a computer. This is why the design of computers cannot be undertaken without the help of other (powerful) computers.

To give an example let's talk about the problem of interconnecting the basic components. State of the art CPU integrated circuits contain 200 to 300 million transistors (the switches that let the computer work) and each transistor needs to be connected with three wires. Because of technology restrictions, wires must be grouped in layers and, within each layer, wires cannot cross. The number of layers is also limited by technology to 7 or 8. Moreover, the length of the wires should be as short as possible to minimize the slow down caused by resistance and capacitance.

Now, arranging a few million transistors on the circuit surface and interconnecting them with the shortest possible wires is clearly beyond what people can efficiently do. In the past, for simpler cases, companies have used army of designers for months in order to produce a layout. Now computers are the only hope.

Even computers have a hard time with this problem: there is no nice algorithm, like Knuth's algorithm for finding the shortest path, and the computation of the best layout has to be guided by reasonable rules (heuristics) that strike a compromise between the quality of the solution and the time it takes to compute it.

Another example from this field is the simulation of integrated circuits. The final implementation phases and the construction cycle of an integrated circuit are rather expensive and take a few months. Moreover, it is hard to "probe" the single transistors inside an integrated circuits (these devices are no larger than a millionth of a meter). Therefore, new computers are simulated before they are built by mimicking in detail the behavior of all their circuits; this takes a very large computing power and a large memory.

This problem is so important that IBM, a few years ago, designed a special parallel processor (the Yorktown simulation engine) that then built exclusively for the use of its design laboratories.

Essential Vocabulary

batch *v* – собирать, объединять
boost *v* – ускорять
conceive *v* – полагать, размышлять; постигать; представлять себе

´decrease *n* – уменьшение, понижение, спад
imply *v* – подразумевать, означать
layout *n* – планировка, план, расположение, разметка
maintain *v* – поддерживать, сохранять
mimicring – имитация
minuscule *a* – (очень) маленький
nutrient *n* – питательное вещество
obey *v* – подчиняться, следовать, руководствоваться
parameter *n* – характеристика, критерий, показатель
preference *n* – предпочтение; преимущество
problem *n* – *зд.* задача
saturate *v* – насыщать, пропитывать
scalability *n* – масштабирование
sheer *a* – абсолютный, полнейший, сущий, явный
simulation engine – специальный процессор
speculate *v* – полагать, предполагать; допускать
state of the art – современное состояние, положение дел
strike a compromise – достичь компромисса
quadruple *n* – учетверенное количество, четырехкратное увеличение

UNIT 3

TASK 1. *Read and retell the text.*

Text 3A. IBM Labs Unveil Nanotech Storage "Punch Card"

IBM researchers have created a storage device that holds up to a trillion bits of information, or about 25 million textbook pages in a postage stamp-size area, as the push to find new storage technologies rolls on.

The experimental prototype, part of an ongoing nanotechnology-research project code-named Millipede, is a chip containing more than 1,000 heated spikes that can make, or read, tiny indentations in a polymer film.

Like punch cards in the computers of old, the pattern of the indentations – measuring 10 nanometres each – essentially is the digitized version of the data meant to be stored. The minute size of the indentations, though, means that Millipede chips are 20 times more densely packed with information than current hard drives. With this, cell phones could hold up to 10 GB of data.

Just as important, Millipede is likely to be relatively inexpensive to manufacture because the chips can be made through existing manufacturing techniques. A heartier 4,000-spike prototype that can be connected to handheld devices will come out a year from now with commercial products potentially arriving in a few years.

There is not a single step in fabrication to be invented if everything works well, then in the late 2005 timeframe something could be available.

Hitachi has proposed a similar polymer-punch method, but it does not involve heating the needle. Intel, meanwhile, is working on Ovonics, a type of memory made of the same material at CD-ROM disks. Start-up Matrix Semiconductor has also developed 3D record-once flash memory.

Hard drives and flash memory still work, but these new techniques promise far greater storage data, allowing consumers to store several movies on a personal video recorder, but in the space the size of a sugar cube.

This technology is a real alternative to rotating storage and systems that can be affected by heat, shock or external factors.

Heat being at the heart of Millipede, each of the spikes on a Millipede chip contains a heating resistor and sharp tip. To make an indentation, the resistor warms up the tip to 400 degrees Celsius as well as the polymer recording media, located less than a micron away. The hot tip is then plunged into the film, which creates a dent.

To read stored data, the tip is heated only to 300 degrees Celsius. This allows the tip to interpret the pattern embedded in the film without changing the pattern of the indentations. Unlike hard drives, where a needle moves to locate data, in Millipede the tips stay stationary and the film moves. The number of tips working in parallel determines the read-write speed. Millipede chips can also be re-used by reheating the film and letting it ooze to horizontal. The tip remains at 400 degrees Celsius for only a few milliseconds. The small size of the chips also means that little electricity is required to spike temperatures in this manner. External vibrations, product packaging and heat from other internal components are all issues, but not insurmountable ones.

Millipede is also part of IBM's efforts to promote nanotechnology. Today's semiconductors generally consist of transistors and components that measure 180 to 130 nanometres in length. The 100-nanometre barrier is more significant than other milestones (like the jump from 180 to 130 nanometres) because the behavior of matter begins to change at that level, according to several researchers.

The nano scale is very different and unique – the properties of matter change with size or shape. Electrons no longer behave like rocks as they do in current electronic devices. Electrons behave as waves.

Carbon nanotubes, one of the most widely discussed nanotechnology developments – and one that is often used synonymously with nanotechnology – may not hit the market for another 15 to 20 years.

By then, though, companies will release products made of silicon that fit the definition of nanotechnology. Millipede chips are an example of silicon nanotechnology. IBM's having made Millipede is a subsequent advancement to the computerdom where devices in due course appear to carry out all the wishes.

TASK 2. *Answer the following questions.*

1. What is nanotech? 2. What do advantages of Millipede consist in (lie in)? 3. What does the word combination "densely packed with information" mean? 4. What is flash memory? What advantages and disadvantages of it are known to you? 5. What are the differences between magnetic recording devices and Millipede? 6. What is the way of increasing the speed of the work of Millipede? 7. What are the differences between flash memory and Millipede. 8. Where primarily is it expected to be used? 9. There are advanced technologies of storing data to compete with Millipede, aren't there?

TASK 3. *Render into Russian. Pay attention to the use and translation of the Infinitive.*

1. We know our rector to study students' proposals thoroughly. 2. We expect our students to be involved in the experimental work. 3. Scientists of Japan hold often and long term use of mobile phones to be unhealthy for us. 4. We know the largest research centre with the area 572000 m^2 to be built in the East District of Moscow. We believe this scientific town with hotels, hostels and exhibition pavilions to be "silicon valley" for the most gifted scholars. It appears to be completely built by the year 2010. 5. Muscovite A.L. Kushnir is known to develop

a book for little ones to read itself. A device for rereading of information and reproducing sounds enables children to learn to read without parents assistance. This invention makes child be self-dependent and intent. This idea proved to be very useful and inviting.

TASK 4. *A. Construct sentences with the Infinitive, according to the pattern (Complex Subject).*

Example.

We know that metal can conduct electricity.

Metal is known to conduct electricity.

1. The whole world knows that Lobachevsky has strictly explained the principles of the theory of parallel lines. 2. We are sure that he entered the Kazan University being 14 years old. 3. Lobachevsky did not expect that he could finally be a rector of this University. 4. For 2200 years all the mankind believed that Euclid had discovered an absolute truth. 5. Lobachevsky proved that Euclids axiom on parallel lines was mistaken.

B. Construct the sentences with the Complex Object.

Example.

We know that metal can conduct electricity.

We know metal to conduct electricity.

1. We know that a supercomputer generates large amounts of heat and must be cooled. 2. We heard that specialists were speaking about cooling most supercomputers as a major HVAC (Heating, Ventilation, and Air Conditioning) problem. 3. Bernard Shaw assumed that laws had been made to be broken. 4. We know that clothes do not make the man. 5. We believed that the promising Russian microprocessor Elbrus E2K would be created to compete with world’s best Intel one. 6. We didn’t expect that Intel would buy Russian company Elbrus, having developed more advanced hardware.

TASK 5. *Construct sentences with Absolute Participial Construction.*

Example.

The idea can be pronounced true. It is tested by experience.

The idea can be pronounced true, it having been tested by experience:

1. The smallest Micro Flying Robot was created by company EPSO last year. It was controlled with the help of built-in Blue-tooth module. 2. This Flying Robot has the weight of 8.9 g. The lithium-polymer bat-

tery weights 3.7 g. 3. It has digital camera. By means of Bluetooth this Robot is able to transmit aero photos to the control centre. 4. This vehicle is equipped with unique sensors. Scientists are going to apply it for investigation distant planet investigation. 5. Specialists would like to use Micro Robot for the liquidation of the consequences of natural calamity. It is a tiny, useful device.

TASK 6. *Translate the text and discuss the problems of organic transistors.*

Text 3B. Organic Transistors

Beyond the supercold and superfast, researchers are investigating the supersmall for possible use in machines of the future. Specifically, organic molecules have shown promise as minuscule switches a thousand times smaller than the tiniest silicon switches. Instead of just 200 of the smallest silicon switches, it would be theoretically possible to line up 200,000 molecular switches across the width of a period. These tiny devices have been termed *nanocircuits* because their size is measured in nanometers (billionths of a meter).

Building circuits with pieces as small as molecules is naturally no easy task, nor is it clear that the necessary switching functions can be carried out by individual molecules. No one has ever built a functioning molecular electronic circuit, although the design for a diode made from two organic molecules was conceived and patented by IBM researchers in the mid-1970s. In the case of a molecular diode, two organic substances, abbreviated TTF and TCNQ, are separated by an insulating bridge of urethane. When the molecule is placed between two metal electrodes a few nanometers apart and a current is induced, electrons flow readily, tunneling from the TCNQ complex to the TTF complex through the insulator. But when a reverse voltage is applied, the flow of electrons is negligible. This asymmetry forms the basis for a diode, a basic element in many kinds of electronic circuitry.

Another approach to molecular circuitry combines this concept with optical computing methods to produce a *soliton switch*. An ultra-thin, polycrystalline film made of TCNQ and either copper or silver was found to exhibit switch-like behavior in experiments at the Applied Physics Laboratory at John Hopkins University. Beams of laser light directed at the film cause level of resistance to electric current flow to be reduced by a factor of 10,000. When the light is removed, the high resistivity state is restored. The researchers have speculated that the cause of the switching is not the light itself but the electric field produced by the laser.

The possible applications for molecular computers have a definite ring of science fiction. Forrest L Carter, a chemist at the Naval Research Laboratory and organizer of a workshop on molecular devices, imagines a computer the size of a sugar cube with the calculating power of a Cray 1. Such a machine might be implanted in the human brain, where it could serve as a sort of second brain, for performing complex calculations, and processing volumes of data.

Scientists at a company called EMV Associates foresee the possibility of restoring sight to the blind with molecular computers. A small television camera mounted on a pair of eyeglasses would send image data to a molecular computer connected directly to neurons in the visual cortex. Current pulses would be sent to an array of tiny electrodes. The electrodes would be coated with protein and cultured nerve cells, which would grow and form connections with the brain's natural cells.

Implanted molecular computers could go artificial intelligence machines one better by feeding complex data, directly into the brain. Current military research is focused on the development of an intelligent pilot's assistant, that keeps him informed of instrument readings and significant data from the plane's on-board electronics. The data would be displayed holographically across the pilot's field of vision or communicated verbally. But a molecular computer might be capable of sending data directly to the brain, making the pilot and his aircraft, in effect, a single machine. Similar monitoring of complex machinery, like nuclear power reactors, might be achieved with direct links between man and machine.

Others believe the initial step toward molecular electronics should involve the use of biological organisms, like bacteria, as sensors. American scientists envision using genetically engineered E. coli bacteria as a bioelectronic sensor. The behavior of E. coli is determined by its pursuit of nutrients. In seeking a supply of nutrient, the bacterium processes information about its chemical environment. Among 20 or more distinct chemical substances, the bacterium is able to pick out a single nutrient. It swims not just in the direction of more nutrient, but toward the densest concentration of nutrient. By genetically engineering the bacteria, its preference for different substances (and therefore its range as a sensor) could theoretically be altered to suit the needs of researchers.

Essential Vocabulary

affect *v* – влиять, затрагивать
fit *v* – соответствовать, устанавливать
indentation *n* – вдавливание, отпечаток
in due course – в свое время
locate *v* – обнаруживать, размещать
make through – делать что-либо при помощи чего-либо
meanwhile – между тем
node *n* – узел
punch card – перфокарта
push *n* – усилие, энергичная попытка
push out – выпускать, выступать
release *v* – выпускать
rotate *v* – вращать(ся), чередовать(ся)
rotating storage – дисковод
performance *n* – производительность
scale *n* – масштаб
scalable *a* – масштабируемый, наращиваемый
spike *n* – шип, острие
throughput *n* – пропускная способность

UNIT 4

TASK 1. *Read and translate the text with a dictionary.*

Text 4A. Local Area Networks

It is variances in topology, connectivity, protocol, dispersion, communications rates, and communications equipment that set LANs apart from WANs. LANs typically are high-speed shared media that interconnect devices in close proximity to each other (<10 km). The media is shared in the sense that multiple devices are strung by each link and there are dedicated channels between devices. The communication equipment that links the nodes together in a network is typically simpler (less costly) than for WANs. The Arpanet, for example, uses minicomputers that handle all the protocols for message transfer, whereas in many LANs the interface unit consists mainly of a few LSI/VLSI devices that implement one of the standard protocols. The media of wide area networks have typically been satellite links of leased trunk lines which are one-at-a-time media and are relatively expensive. However, in the local area networks interconnection media such as twisted pair, coaxial cable, radio signals and fiber optic cable have been the mainstays. All of them are much less expensive than their wide area network predecessors.

Protocols are another area in which LAN and WAN differ. Wide area networks typically work in what is called a "store and forward protocol". In this protocol, the message to be sent is broken up into pieces called "packets". The packets are sent into the network using a routing protocol that will provide a means to get the packet to its final destination. The message is sent one packet at a time; it flows through the network via the routes selected by routing protocols, arrives at the destination site (possible out of order), is reassembled, and then is absorbed into the destination host.

The LAN, on the other hand, uses one of three basic protocols to route the message to its destination. There are typically no intermediate steps, and the message is sent directly to receiver. The reasons for the difference in protocol arise mostly from the differences in the topologies. The WAN uses point-to-point links to build up a network and must send all data from point to point in a hopping fashion, the LAN typically exists on a shared media. Messages on the LAN are not sent NIU to NIU in a hopping fashion. Instead, messages are broadcast over the network and all NIUs see them and examine them. The one to which the message is addressed accepts it, the others ignore it.

Topologies for WANs are typically referred to as irregular because there are no set symmetrical connections. The LANs are called regular or simple since the links are simple and have symmetry. The basic types of LANs are the ring, bus, star and regular interconnects.

From the above some basic notions of what constitutes a local area network can be derived, namely:

1. Local areas networks are used mainly to connect devices over short distances (<10 km).

2. They typically are owned and used by a single organization.

3. Their topologies are simple and regular. Their interconnection hardware and software are simple in comparison to those of WANs.

4. They use high-shared media.

5. Typically they interconnect homogeneous host devices.

TASK 2. *Use the information in the text to answer the following questions.*

1. What sets LANs apart from WANs? 2. Why are LANs much less expensive against WANs? 3. Do LAN and WAN differ in protocol? 4. What links does WAN use to build up a network? 5. How are messages broadcast over LANs? 6. Are topologies for LANs referred to as regular or irregular? 7. What are the basic types of LANs?

TASK 3. *Using the text find the synonyms for the following words:*

to process, to connect, to appear, difference, to investigate, to be, to fulfill, simultaneously, to call, to send, media.

TASK 4. *Translate the following sentences explaining the functions of* ***it****.*

1. The network can be small enough to be contained within a single laboratory or building, or it can be spread out over a wide area. 2. A soft coal, however large the lumps, falls to pieces too readily in the fire and chokes it. 3. A large memory makes it easier to work with large programs, including data. 4. It is usual that the slower the rate of crystallization, the more perfect are the resulting crystals. 5. It was Clausius who in 1837 established the kinetic theory of matter according to which molecules are in constant motion. 6. It did take them more than 2 hours to carry out this experiment. 7. It was not, however, until World War 11 that the speed advantages of electronics were taken into account. 8. It is to be emphasized that these correlations are purely empirical in nature. 9. It is among the naturally occurring minerals that we find the most beautiful examples of crystals. 10. It would be possible to increase the number of telephone conversations provided a new carrier system were installed. 11. It was not until the early 1980s that people took into account extremely low ozone concentration over the South Pole.

TASK 5. *Translate the sentences paying attention to the functions of* ***by****.*

1. The product is affected little by temperature and contributes little to the net effect. 2. The temperature in this case is sure to rise by 20˚. 3. If computers are ever to gain wide acceptance for process control they must be understood by the people who have to operate them. 4. It

is by the agency of radio that we receive most of the information the satellites are collecting at the borders of space. 5. Some advantages in detector sensitivity are to be gained by working at low outlet pressures. 6. Were there no loss of energy by friction, the motion would continue indefinitely once started. 7. Different gases might cause the currents to differ by altering the surface of the metal either by combining with it, or by condensing on its surface. 8. Multiplication can be performed as a series of repeated additions, and division can be accomplished by repeated subtractions

TASK 6. *Read the text and describe major elements of an interface unit and their functions.*

Text 4B. Interface Units

Regardless of the topology, all nodes must be connected into the network via an interface unit. Generally an interface unit contains five major elements or subsystems:

■Media input ■Media output ■Interface control ■I/O buffers ■Host I/O.

The input element extracts bits from the media, converting them to internal interface unit formats and delivering them to the buffers. Additionally, this device must be designed so that it detects a particular sequence of bits and based on them, provides some further number of bits to the control element for further processing. It also strips off control words and performs error-detection checking.

The output device extracts the data from the buffers for transmissions, formats this data for transmission, and transmits them over the media. As part of its formatting function it adds header information to bind the data into a message and supplies the necessary addressing and routing, flow control, and error detection information to the data.

The controller provides the “soul” for the interface unit. Its function is to direct how all the other elements perform their tasks. It indicates to the input controller which buffer to insert incoming messages into. It indicates to the input controller whether this message is to be pulled in or ignored (not addressed to it). It helps the input device, performing error detection and correction. The controller directs the efforts of the output device, indicating to it what buffer to read the message from, what destination to send it to, how to perform the error encoding, and what type of extra bits to add for the controller on the other end to use in its function. A third job of the controller is to manage the space of the buffers. In this capacity, it determines how many buffers to allocate for input, how many for output, and which messages get associated with what buffers. Additionally, from the host input-output controllers the control unit helps to accept and decode access to read and write messages to and from buffers and to map user address to buffers to network addresses.

In its capacity for protocol control the interface unit controller must provide services for address translation and mapping, segmentation, packetization, security, routing, and fault detection as well as basic protocol functions of network control (who to put next).

Interface units come in all sizes and complexities. For instance, interface units themselves can be whole computers (microprocessor and hardware interfaces), they can be built from discrete logic (TTL, LSI, etc.) of varying complexity, or they can be VLSI implementations of protocols; however, in all cases the basic components of the design do not change – just the implementation does. In some cases, the logic associated with providing the network interface unit functions can itself represent more hardware and software then the host it is meant to support. The interface units provide the means to implement the protocols of control and to manage the flow of information over the network.

TASK 7. *Read the text and summarize it.*

Text 4C. Networking and Lans

In computer terms a network is a combination of interconnected equipment and programs used for moving information between points (nodes) in the network where it may be generated, processed, stored, or used. The interconnection may take on many forms such as dedicated links, shared links, telephone lines, microwave links, and satellite links. Networks in this sense form a loose coalition of devices that share information. This was one of the first uses of a network, although it was not the last. Users found that the network could offer more than just information sharing; they could offer other services for remote job execution and ultimately distributed computing.

The networks of the early times provided the necessary information exchange services but were limited to basically just this service. It was the information availability that stimulated more imaginative uses of this information. As this occurred and the technology of networks improved, new applications arose.

These new applications not only used information exchange but also remote job execution. It began as simply sending a batch job down the link to a less busy host, having the job completed there, and then shipping the results back to the originator.

This sufficed for awhile, but it still did not provide the real time or interactive environments that users were beginning to become accustomed to, including more advanced protocols and network operating systems to provide further services for remote job invocation and synchronization. The era of the local area network was coming. The wide area networks' biggest shortfall was in throughput or turnaround time for jobs and interprocessor communications. Because of the wide distances, delays of seconds were common place and caused much added overhead in performing otherwise simple tasks. Network designers saw the need to provide another link in the network, the local area networks.

Local area networks began to show up in the early 1970s. It was not until Ethernet was released in the mid-1970s as a product that LANs did become more widely available. Since that time, numerous LAN designs have been produced to fit an extremely wide spectrum of user requirements.

Local area networks are finding their way into all aspects of modern society. There are not too many aspects of information exchange and data processing in which a LAN cannot be found. LANs are used to connect all the personal computers in office to issue directives, schedule meetings, transmit documents, and process large volumes of data concurrently at many sites.

Essential Vocabulary

arise *v* – возникать
at a time – одновременно, за один прием
broadcast *v* – пересылать
examine *v* – изучать
dedicated link – выделенный канал связи
fault detection – обнаружение неисправностей, ошибок
flow control – управление потоком данных
handle *v* – обрабатывать
hop *v* – прыгать
host *n* – главный компьютер
invocation *n* – вызов процедуры
link *n* – канал, линия связи

link *v* – соединять, связывать
loose *a* – свободный
mainstay *n* – *зд*. основной носитель (информации)
media *n* – среда (распространения информации)
refer to as *v* – называть
remote execution – дистанционное выполнение
satellite link – спутниковый канал связи
set apart *v* – выделять
share *v* – совместно использовать
store and forward – с промежуточным хранением
string *v* – *зд*. соединять
strip off *v* – удалять
trunk line – магистральная линия
turnaround time – длительность цикла обработки
variance *n* – расхождение

UNIT 5

TASK 1. *Read and translate the text with a dictionary.*

Text 5A. Implementing a Distribured Process between Workstation and Supercomputer

As supercomputers become more powerful, scientists and engineers are running larger and larger problems. Computer graphics is accepted by most as the only viable means of understanding these large problems. Recently several workstations have been released with a dramatic increase in graphical performance when compared to their predecessors. As these new workstations will never match the CPU performance of the supercomputers, it is doubtful that their specialized graphical performance will ever be matched as well. This situation brings up a unique problem: how can an application take advantage of both the computational speed of the supercomputer and the specialized performance of the graphics workstation?

Before going on it is desirable to come up with a simple and straightforward definition of distributed processing. This is important since it seems to have become one of the latest high tech terms that members of the computer society all seem to be using, but perhaps not really understanding: *a software product, which takes advantage of more than one computer system in order to produce a result*.

Tasks that take a long time to compute are the most painful for the user, and these are the tasks that must be optimized for speed. For many cases, the communication time can be significantly greater than the computational time, thus creating an environment in which distributed processing does not seem to be practical or desirable.

Communications is known to be the fundamental component in any distributed application. While many dramatic advancements have been made, the goal of moving information from point A to point B remains unchanged. The development of extremely large networking systems encompassing many different varieties of equipment have served to complicate the task of creating distributed applications.

While there are many different communications services available, TCP/IP has been selected as providing a simple and effective system. TCP/IP is by far the most widely used communications system and the concepts it uses are applicable to other services as well.

The socket is the basic building block out of which all distributed applications are constructed using TCP. A socket provides a bidirectional stream of communications between two programs running on different machines. Data to be sent into one end of a socket appear at the other end within the remotely running program. TCP uses a client/server style of relationship between programs wishing to communicate with one another. The client program initiates communications by requesting a connection with a particular program running on a specific machine. The duty of the server program is to accept connection requests from client programs. This leads to the notion of the server process as one which provides a particular service and the client process as one requiring it. In many cases it is desirable to have the server that is able to provide this service to more than one client at a time.

Data communication over a socket style of interface is analogous to reading and writing to a file. Data, in the form of a stream of bytes, are written into one of the sockets and some time later are available for reading by the remote program. In setting up the socket connection, several different levels of communications service are available.

The use of TCP at the socket level has an impact on the structure of a distributed application. All data transfer between the different pieces of a distributed code must be done using the read/write style interface. Often times it is easier to distribute an application by looking for subroutines which could be run on a remote machine. There are several packages available to aid the developer in performing task distribution at the subroutine level, the most notable of these is RPC (remote procedure call).

MPGS is a multipurpose graphics postprocessing system developed to take advantage of both a supercomputer and a graphics workstation in the distributed environment. It runs on a graphics workstation and distributes cpu and memory intensive tasks to a Cray supercomputer.

The user begins a MPGS session by starting the workstation side of MPGS, followed by the Cray side. The Cray side of MPGS will ask for the network address of the station, and then establishes the communication connection. Next, the user requests MPGS to read the data to be post processed. The Cray side of MPGS will read the data and then download visible portions of the data to the workstation. Downloading only a portion of the data to the workstation, i.e. the visible portions of the data is a very important aspect of minimizing network traffic, and is vital to the success of MPGS.

TASK 2. *Use the information in the text to answer the questions.*

1. Why is it desirable to take advantage of both a supercomputer and a graphics workstation? 2. What is distributed processing? 3. In what cases is distributed processing practical? 4. What differs TCP/IP from other communications services? 5. What is the function of a socket? 6. What style of relationship between programs does TCP use? 7. What is MPGS? 8. How does MPGS minimize network traffic?

TASK 3. *Find in the text English equivalents for:*

ввести простое определение; создавая условия, в которых, по-видимому, распределенная обработка будет целесообразна; данные, которые должны быть отправлены; клиентская программа начинает передачу данных; серверная программа должна; предоставлять услугу более чем одному клиенту одновременно; данные в форме потока байтов; контролируемый; загрузка только части данных в рабочую станцию.

TASK 4. *Translate the following sentences explaining the use of the* ***Infinitive****.*

1. The RTK Computer Network is likely to provide a model for how to make public information electronically accessible. 2. We know the velocity of a particle to be continuously changing if this particle has a nonuniform motion. 3. The experimental data to be presented in detail will be discussed as soon as possible. 4. The logic element is known to be the basic component of all computers. 5. They often fail to understand what their users want them to do and then are unable to explain the nature of the misunderstanding to the user. 6. To summarize the findings of this tremendous work would require many pages. 7. The trend will be away from Procedure Oriented Languages toward languages that will allow the user to specify what task the system is to perform, rather than how the system will perform the task. 8. These experiments prove the ground ice of Alaska to have been formed by a process of segregation. 9. Of the numerous methods of conducting similar experiments to be found in literature, the following are among those which have been proved to be most useful. 10. The most efficient way to use tapes is to transfer information to or from them in large blocks. 11. The number of stars which is within the range of the naked eye is believed to be about 6000.

TASK 5. *Translate the sentences paying attention to the meaning of* ***to follow****.*

1. This phenomenon follows the Newton Law. 2. The temperature following the collision sharply decreased. 3. The reaction is followed by temperature rise. 4. It follows from these considerations that the problem to be solved at this stage is an entirely geometric one. 5. To be particularly considered are the following process aspects. 6. Sometimes a decision to compute is followed by a process of selecting the particular kind of computing machine best suited for the given problem. 7. By this definition the following means that it is these ions which actually transport the current. 8. A particle trace is a good example of this sequence of events, and occurs as follows. 9. In this presentation one should follow a logical rather than a historical order, though referring to the historical aspects where they are of interest.

TASK 6. *Read the text and say how to overcome the Von Neumann bottleneck.*

Text 5B. The Need for Fast Processing and Its Solutions

It seems to be unwritten law that the available processing time of any computer tends to zero as its lifetime increases. In other words, when the processing power is there, more complex problems are solved and their solution generates new scientific and technological problems, which in their turn require more computer time. This lemma is applicable to most computer environments, from CAD to Artificial Intelligence, and also forms a solid base for the development of modern supercomputing systems.

Increasing the Memory Speed

The communications path between the processor and the memory for fetching instructions and reading or writing data limits the amount of work that can be done between two memory accesses. An instruction normally involves the following phases:

IF = Instruction Fetch	Memory action
ID = Instruction Decode	Processor action
OF = Operand (s) Fetch	Memory action
EX = Execute	Processor action

Clearly, the speed of execution depends to a large extent on the memory bandwidth. A first way to enhance the processing power is to increase the memory accessibility through a wider databus. Whereas in conventional computers the databus is 16 to 32 bits wide, supercomputers use a 64 (FPS), 128 (CRAY) or even 512 wide datapath (CDC Cyber 205).

In conjunction with a wider bus, faster memory is used. Since most supercomputers obtain their maximal speed on processing large arrays of data, memory speed is of prime importance. Currently minimal access times are of the order of 50 ns. However, in many architectures a datarate of a few nanoseconds per memory fetch is required. Consequently, with today's technology and memory sizes, there is no economical way for addressing a Mega- or Gigabyte memory at the required speed.

The slow processor-memory interconnection has been commonly called the Von Neumann bottleneck, after the inventor of the Stored Program concept.

In order to circumvent the Von Neumann bottleneck, which is largely due to the technological limitations of the memory, a technique known as "interleaving" allows to create a "virtual" access time of a few nanoseconds, when the proper conditions are met. The memory is organized in *n* “banks”, where the data at location with address *i* is stored in bank *i* modulo (*n*).

TASK 7. *Read the text and summarize it.*

Text 5C. Supercomputers in Climate Research

Somewhat surprisingly, for an era in which satellites systematically scan every inch of the globe, a wide variety of environmentally important data are in short supply. New computerized monitoring techniques provide a means of quickly closing some of these data gaps. Computers connected to networks of fixed sampling devices can continuously monitor ambient concentration of pollutants, automatically delivering reports at regular intervals or when an irregularity is detected. Satellites now yield a continuous flow of information on atmospheric gas concentration, forest cover and other environmental indicators. All this information is beamed to earth and processed, and can now be viewed in combination with data from other sources.

Beyond monitoring computer systems serve a far more important function: to model industrial and biological systems. The best known of these are likely to be the global warming models. Such simulations require powerful supercomputers, because of the thousands of factors that affect climate.

Scientists are known to have theorized since 1896 that emissions of carbon dioxide from the burning of fuels could warm the global atmosphere. It was in the early 1980s, however – when computers sufficiently powerful for modeling the complex behavior of the atmosphere became available – that they were able to test their theories. Supercomputers at the climatogical centers of the USA have been programmed to stimulate the effects of increased greenhouse gas concentration on the global climate. In minutes, they perform calculations that would take an unaided scientist a lifetime or more.

This computer-based modeling of the atmosphere has produced a remarkable consensus among climatoligists about the likelihood and potential scope of global warming. If the earth’s atmosphere warms by several degrees within the span of a few decades, there will be enormous impacts on the environment and the global economy. Among the predicted impacts are a rise in sea levels that would threaten coastal populations and shifts in temperatures.

Essential Vocabulary

application *n* – прикладная программа
short supply – дефицит
come up with *v* – ввести
communication (s) *n* – информация (передаваемая в процессе общения)
databus *n* – шина данных
datarate *n* – скорость передачи данных
distribute *v* – распределять
download *v* – загружать
fetch *v* – выбирать команду или данные из памяти компьютера
socket *n* – разъем
follow *v* – *зд.* контролировать
likelihood *n* – вероятность
memory accesse – обращение к памяти компьютера
location *n* – ячейка (памяти)
performance *n* – быстродействие
postprocess *v* – выполнять заключительную обработку
processing – обработка данных
remote procedure call – дистанционный вызов процедуры
request *v* – запрашивать
run *v* – выполнять, запускать
subroutine *n* – подпрограмма
transmission control protocol (TCP) – протокол с контролем передач
transmission control protocol / internetworking protocol (TCP/IP) – набор протоколов для коммуникации в локальной сети или во взаимосвязанном наборе сетей
workstation *n* – рабочая станция

UNIT 6

TASK 1. *Read and translate the text with a dictionary.*

Text 6A. Teranet, a Lightwave Network

A recent concern in engineering communication networks has been making use of the very large transmission capacities of fiber optics. Before the introduction of fiber optics the bottleneck in most communications systems was the network links. Now, one often finds that the limiting bottleneck to throughput is the speed of nodal electronics. There has thus been an interest in new network architectures that exploit the unique properties of fiber optics.

TeraNet is a network for integrated traffic being constructed to examine network architectures with high access rates (as high as 1 Gbps) and which can support a variety of services including video and graphics. It utilizes the new ideas for network design. One is the use of a fiber optic star coupler. A star coupler is a passive fiber optic device. Each node in the network has an input fiber to send signals into the star coupler and an output fiber from the star coupler to receive signals from other nodes. A signal at carrier frequency i is transmitted into the star coupler from node i (at power P). The star coupler divides the signal equally and redistributes on each of the N output fibers (at power P/N) to all of the nodes.

Therefore, if each node (i=1, 2… N) is transmitting into the star coupler at carrier frequency i, each node receives on its output fiber all of the signals from every other node. To receive the signal of a particular node, a node will tune to the transmitting node's unique carrier frequency. It should be noted that the number of nodes that can be supported by a star coupler is limited by the $1/N$ power division in the coupler.

Coordinating the transmission and reception of messages in a star coupler based network requires some care. With present tunable laser receivers being relatively slow, TeraNet uses an elegant multi-hop approach to simplify implementation. Each node transmits into the star coupler at only two fixed carrier frequencies and receives on only two (different) fixed frequencies. These frequencies can be assigned in such a way that, at the worst, a message from node A to node B must "hop" between a number of intermediate nodes before reaching B. The beauty of this scheme is that it only requires two fixed frequency transmitters and two fixed frequency receivers per station. Naturally the hopping does increase delay. However this is traded off against the high bandwidth of the fiber optic links and the simplicity of implementation.

The Network Interface Unit (NIU) is the interface between local traffic generated and received at the node and the network itself. The NIU also serves to connect neighboring nodes through itself. There are two inputs (into optical filters) from two neighboring nodes and two outputs (through laser) to two different neighboring nodes. There is also a "User Input" for traffic originating at the node that is to be launched into the network and a "User Output" that is the entry way for network traffic destined for this particular node. The "Switch" system serves to move traffic from each of the three inputs to each of the three outputs.

TASK 2. *Use the information in the text to answer the questions.*

1. What was the bottleneck in most communications systems before the introduction of fiber optics? 2. What new ideas for network design does TeraNet utilize? 3. How does a star coupler operate? 4. What carrier frequency will a node tune to in order to receive the signal of a particular one? 5. How many nodes can be supported by a star coupler? 6. What does TeraNet use to simplify implementation? 7. Does the hopping increase delay? 8. What does the "Switch" serve to?

TASK 3. *A. Using the suffixes* ***tion, ment, ence*** *form appropriate nouns from the following verbs*:

to assign, to implement, to correspond, to utilize, to move, to synchronize, to originate, to require, to connect, to redistribute, to limit.

B. Translate them.

TASK 4. *Translate the sentences and explain the use of ing-form.*

1. Being quite different from vacuum tubes and transistors, masers operate entirely on quantum principals. 2. Steel castings are extremely difficult to machine unless unheated. 3. Of the temperatures and pressures occurring in an internal combustion engine, those that are likely to be of most interest to the designer occur immediately after combustion, that is, they are the peak values. 4. The molecules of even a good insulator being acted upon by an electric field, there is a motion of electrons due to this field. 5. The name electronics is known to be derived from the word electron, the electron itself being the basic unit of negative electricity and all electric currents consisting of electrons in motion. 6. Nothing is known about the aerial being out of order. 7 With the property of plastics being superior to that of wood, the designers are believed to be working at the problem of replacing the latter wherever possible. 8. Selecting a local area network architecture and system that will provide the optimum service to the users requires up front analysis and knowledge. 9. They succeeded in obtaining good results working with quicksilver, it being known to be a very dangerous metal. 10. The effect is highly dependent on frequency, with the lower frequencies showing less noise.

TASK 5. *Translate the sentences paying attention to the meaning of* ***one****.*

1. Unit cell may contain one, two, or, occasionally, more than two layers. 2. The history of radar is a long one, for the underlying principle has been known to science for a long time. 3. One should know that the electric cell is a device for converting chemical energy into electric one. 4. It will be seen from what follows that transmission systems used in Europe do not differ very much from ones in the United States. 5. One cannot expect a complicated problem like that of using solar energy to be solved in a year or so. 6. One finds in Europe a fairly extensive use of 12-channel carrier systems, the crosstalk being avoided by frequency separation in opposite directions. 7. After a careful study we came to the conclusion that the formula appeared more complicated than the one we had been using before. 8. One may classify systems presently manufactured into approximately 20 families.

TASK 6. *Read the text and define main approaches to monitoring the performance of networks. Describe them.*

Text 6B. Multicast-Based Inference of Network-Internal Delay Distributions

Monitoring the performance of large communications networks is essential for diagnosing the causes of performance degradation. Two broad approaches to monitoring performance currently exist: the *internal* approach, where direct measurements are made at or between network elements, e.g., of packet loss or delay, and the *external* approach, where measurements are made across a network on end-to-end paths.

The internal approach has a number of potential limitations. Due to the commercial sensitivity of performance measurements and the potential load incurred by the measurement process, it is expected that measurement access to network elements will be limited to service providers and, possibly, selected users. The internal approach assumes sufficient coverage, i.e., that measurements can be performed at all relevant elements on the paths of interest. In practice, not all elements may possess the required functionality or such functionality may be disabled at heavily utilized elements in order to reduce CPU load. On the other hand, arranging for complete coverage of larger networks raises issues of scale, both in gathering measurements data, and merging data collected from a large number of elements in order to form a composite view of end-to-end performance. Last, internal measurements usually focus on average behavior (e.g., throughput, average queue length) but not on other statistics.

This motivates the need for external approaches, where no assumption is made regarding the cooperation of network elements on the path. There has been much recent experimental work to understand the phenomenology of end-to-end performance. Several research efforts are developing measurements infrastructures with the aim of collecting and analyzing end-to-end measurements across a mesh of paths between a number of hosts. Standard diagnostic tools for IP networks, ping and trace route, report round-trip loss and delay, the latter informing incrementally along the IP path by manipulating the time-to-live (TTL) field of probe packets. More broadly, measurement approaches based on TTL expiry require the cooperation of network elements in returning Internet Control Message Protocol (ICMP) messages. Finally, the success of active measurement approaches to performance diagnosis may itself cause increased congestion if intensive probing techniques are widely adopted.

In response to some of these concerns, a multicast-based approach to active measurements has been proposed recently. The idea behind the approach is that correlation in performance seen on intersecting end-to-end paths can be used to draw inferences about the performance characteristics of the common portion (the intersection) of the path, without the cooperation of network elements on the path. Multicast traffic is particularly well suited for this since a given packet only occurs once on a given link in the (logical) multicast tree. Thus, characteristics such as loss and end-to-end delay of a given multicast packet as seen at different endpoints are highly correlated. Another advantage of using multicast traffic is scalability. Suppose packets are exchanged on a mesh of paths between a collection of N hosts stationed in a network. If the packets are unicast, then the load on the network may grow proportionally to N^2 in some parts of network, depending on the topology. For multicast traffic, the load grows proportionally only to N.

TASK 7. *Read the text and summarize it.*

Text 6C. Networking for a Sustainable Development

By itself, a computer is a valuable device. But there are limits to the amount of information and the variety of programs that can be assembled on even the largest individual machine. The usefulness of any computer increases dramatically when it is linked to other machines, since networks allow users to pool their resources. A small network–by wiring together all the computers in an office or school, for example-can make it possible to share printers, databases of contacts or clients, or a fax system. Large networks put enormous resources and reliable, inexpensive global communications at the fingertips of ordinary citizens. Those with small computers can gain access to the enormous processing power of larger machines. A climate scientist in New-York, for example, may develop programs on a small workstation in her own laboratory, and then run them on a supercomputer in California or North Carolina, with the results fed back to her machine.

The rapidly growing international web of computer systems has made it easy for many people to keep in touch with friends and colleagues on the other side of the world. E-mail is cheaper than international phone calls, faxes, or express package service, and allows its users to bypass busy signals, unpredictable postal service, and schedule conflicts created by different time zones.

Computer networks are still in their adolescence. While some systems have millions of users, they can still be difficult to use. And, like local phone systems at the dawn of the telephone age, many networks today are unable to communicate with each other, either because they are not physically connected, or because they are built to different standards.

This situation is changing rapidly, however. The Internet is a fast-growing collection of computer networks that can talk to one another. It is beginning to resemble the global phone system in its scope and common design.

The Internet originated in 1969 as a link between computer centers doing defense-related research across the United States. By the late 1980s, it had grown to become an important link for other academic researchers and reached outside academia and the borders of the United States. The Internet can be difficult to use, and the amount and variety of information available through it can be bewildering. However, many host computers now offer special programs that allow users to search thousands of systems for information on particular topics without knowledge of special commands or network addresses.

Internet users are able to discuss wild variety of topics via thousands of computer conferences. Functioning like an electronic bulletin board – participants “post” contributions, which are then available for others to read when they log in – they make possible conversation that are lively, global and immediate. When something significant happens anywhere in the world, word of it usually spreads more quickly through computer networks than through other information channels, since there are millions of users and fewer delays than are usually involved in television, radio, or telephone communication.

Essential Vocabulary

assign *v* – присваивать, приписывать
bandwidth *n* – пропускная способность
bypass *v* – обходить
carrier frequency – несущая частота
delay *n* – запаздывание, задержка
draw inference – сделать вывод
end-to-end path – сквозной маршрут
incrementally *adv* – пошагово
incur *v* – вызывать
incurred – вызванный
implementation *n* – реализация
log in *v* – входить в систему
multicast *n* – многоадресная передача
neighboring *a* – смежный
round trip loss – потери при двусторонней передаче сигнала
star coupler – звездный соединитель
station *n* – узел
support *v* – поддерживать, обеспечивать
switch *n* – переключатель
throughput *n* – пропускная способность
trade off *v* – пренебрегать
time-to-live – время существования

СПИСОК ЛИТЕРАТУРЫ И САЙТОВ

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Contents

Учебное издание

Ольга Владимировна Авдеева
Татьяна Павловна Смирнова

Обучение чтению литературы на английском языке по специальности «Высокопроизводительные компьютерные процессы и технологии»

Редактор *Н.М. Маслова*
Корректор *М.А. Василевская*
Компьютерная верстка *Е.В. Зимакова*

Подписано в печать 18.01.2007. Формат 60x84/16. Бумага офсетная.
Печ. л. 2,5. Усл. печ. л. 2,33. Уч.-изд. л. 2,25. Тираж 200 экз.
Изд № 86. Заказ

Издательство МГТУ им. Н.Э. Баумана.
105005, Москва, 2-я Бауманская, 5.