A VIEW FROM THE OUTSIDE: INFOSPHERE

Immediately after the invention of computers, we started teaching them. Initially, we taught computers to perform computations. Then, we started to improve their skills by developing various service programs. First, so-called linkage editors appeared, which could assemble large programs from small ones and organize libraries of such half-finished programs. Later, compilers were written that taught computers to understand various programming languages. The next stage was the development of operating systems, which almost hid computers from users and could control the operation of computer devices thus making them work in parallel. Operating systems also made it possible to run several programs on the same computer simultaneously and serve several users. Software for local area networks enabled employees of the same organization exchange information from their desks.

A new stage began when regional, national, and later global computer communications were laid. Programs located at the nodes of the global computer network turned all the computers connected to the network to its clients. Each of them got a unique address, and they obtained the possibility to quickly exchange information. At this moment, it became evident that the global computer brain will be distributed rather than centralized.

A complex of programs under the common name “Internet” that covered the global computer network has played the major role in uniting the software developers in the world and in the considerable extension of the ranks of computer users. The Internet relieved us of the necessity to know where the desired information is stored; it ensured the reliable delivery of this information, and created conditions for the development of a variety of information servers. New sections of population got quick access to reference, encyclopedic and other kinds of information, to universal, specialized, worldwide, and regional libraries, and other storages of information. Programmers and other people acquired the possibility to develop joint projects without leaving their cities and countries.

Now, we have on the Internet programs that represent agents of the real world such as industrial enter-
prizes, organizations, banks, stock exchanges, government bodies, and mass media. These programs (sites) not only disseminate information about the agents they represent but sometimes act on their behalf—hold tenders, make contracts, manage accounts, etc.

Presently, a new layer of programs which was given the name “grid” is built over the Internet. The Internet socialized information, and the grid is going to socialize computer resources. We will cease to bother where our programs are executed. The corresponding programs (they are called services in the grid) will find appropriate available resources, arrange with their owners the conditions of use, deliver there our programs and files containing the initial data, and then deliver us the results. All the necessary measures for the reliable identification of the customer and executor will be taken, the confidentiality of the transferred data will be ensured, and so on. Our interests in this process will be represented by special certified program agents. The interests of the resource owners will naturally be represented by program agents as well. It remains to note that the resources in the grid are not only computers but also communication channels, databases, and various external devices, that is, everything that can obtain, generate, process, store, and transfer information. Software is also included in this list. It is easy to assume that the resources of the real world will be also considered as grid resources.

Certainly, this is not the final stage. The next software superstructure apparently will take from us the care of knowing which programs perform our tasks. It will be sufficient to formulate it in certain terms, and intelligent services in the superstructure will find an appropriate program or a group of programs, organize their interaction, and pass them to grid services for execution.

At some time, we will see that the language in which we communicate with programs has the basic features inherent in natural languages such as free vocabulary, a conventional set of basic concepts and relationships between them, the capability to explain new concepts in terms of already available ones, incomplete and approximate expressions and the possibility to refine them in the course of a dialog, and so on. From this moment on, we can tell that we deal with the worldwide artificial mind, which certainly will continue to develop, but now using its own effort in addition to human efforts (partially, we already observe this phenomenon now). This will mean that programs learned to read our books and watch our films (at least, scientific ones) and that they know how to interpret readings of their sensors. Therefore, we will be able to conclude that the programs formed a model of the world corresponding to our model and continue to develop and improve it on the basis of their experience, that is, reflexively. This will mean that a new “infosphere” has formed within the noosphere introduced by Vernadsky (or along with it).

From the outside, the noosphere looks as the unified worldwide mind; from the inside, it is the community of thinking units (homo sapiens). These thinking units are connected by a dense network of communications, know how to unite themselves for cooperative actions into various types of groups; they learned and continue to learn rules of coexistence on the planet, that is, in the common habitat with a limited amount of resources. They learned how to write down and save their knowledge in libraries and other knowledge stores, how to systemize the knowledge using various classifiers, and how to make it a public property. Let us discuss the internal structure of the infosphere. We will see that the infosphere will be a community of programs organized on the basis of the same principles as the human society. Even at the present time, when working on a computer, we deal not with an isolated program but with an organized set of programs and data involved in a dialog.

Therefore, the internal meaning of the process of “informatization” and computerization of society, which is a major trend in the modern growth of technology, is that we are together building the worldwide community of programs.

PROGRAMS AND COMPUTERS

Before starting to discuss the community of programs in more detail, I must explain why I mention only programs rather than computers, communication hardware, or external devices. It is conventional to assume that the grid consists of computation nodes, high-speed global communication channels, and the software is a secondary thing. Is it correct to discuss software without mentioning computers? Yes, I think it is. A program is a kind of general knowledge, while a computer is only an instrument used to interpret this knowledge. The program is independent of the computer in the sense that if the former knows, for example, how to multiply matrices, it will be able to multiply them on any computer (possibly, upon the proper translation). On the other hand, any computer does only what a program instructs it to do. Under the control of a program designed to multiply matrices, a computer will multiply them; and under the control of a program designed to add matrices, it will add them. If any particular computer breaks, the program remains untouched. Much the same as when a piano breaks, the Moonlight Sonata remains untouched.

Computers all over the world and channels connecting them are a habitat for programs. Somewhere in this habitat, they are developed by programmers, debugged, tested, and optimized. Programs are stored in various places. Sometimes, multiple copies are stored in different places. In response to our requests, some programs move other programs to distant parts of the network or