

Developments of computational methods and networking in medical institutions in Hungary

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Abstract

In this paper we are dealing with the applications of computers in the Hungarian medical education, research, and medical informatics. We give a review of the educational programs, of the main areas of applications, emphasizing the problems, milestones and the remarkable development of medical informatics in Hungary during the last years.

Keywords: computer based education, health care systems, networking= , medical informatics, integrated information systems.

1. Introduction

Medicine and medical education are very important in computing applications all over the world. This is also the case in Hungary. Especially, the whole spectre of applications, from health care systems to scientific modelling, can be followed at the medical universities.

The interactions and variations of technical possibilities, user's expectations, the tasks and their solutions, and the huge work of dedicated experts led to the present state, where informatics became an organic part of the everyday life of the Hungarian medical universities. There are introduced new information systems based on top-level hardware-software devices. This concerns the research, education and clinical work, too. In the paper we present the progress and the results of developments.

Above we suggested, that all the areas of medical computer applications can be found at the Hungarian medical universities. The reason is the special structure, that is not usual in some countries.

In addition to the theoretical departments, the clinical departments also belong to the universities, mainly doing the practical education. The typical structure is shown on Figure 1.

Figure 1

It's consequence is that the computer services must support not only the education and research, but also the routine health care and the financial

management. These areas are unseparable, they only mark the main directions. See Figure 2.

Figure 2

We note, that the presence of clinical and diagnostic departments has a key role in improvements, because of the demands of everyday work and of the business relations to the Health Insurance Company, which are the main motivators of the developments and immediately improves even the educational program of theoretical subjects.

Next, after some words about the history, we discuss the cases of applications in health care, economic work, graduate and postgraduate education, research and the information infrastructure.

2. The history

The history of medical informatics in Hungary is longer than 20 years, when the Computing Centers at SOTE in Budapest and at SZOTE in Szeged were founded. The other universities recognized the importance of informatics some years later. The Laboratory of Informatics at DOTE in Debrecen was established for example only in 1992.

At the beginning, because of the restricted capabilities of the hardware, the main applications were the evaluation of handly-collected data. There were also experiments to develop clinical administration systems, but their success were restricted.

The main reasons are the following:

- the potential users were not prepared for the new technic.
- the hardware could not satisfy the functional and speed expectations
- the lack of experience of the developers in developing complex systems

About ten years later the ideas were realized with success.

With the apparance of desktop computing devices and local area networks a new age started. They meant an explosion in applications. The PC-s were at once introduced in all areas. The interest of the doctors and the requirement of the management increased. In consequence, the education of computer technics was started in the middle of 80-s. Local, and later networked, in-and outpatient systems, laboratory systems etc. were developed for the clinical departments. E-mail functions helped the local communications. The researchers could start to use scientific packages.

These applications were very successful. The most important success factors are:

- close cooperations with the users,
- restructuring the working environment to the new possibilities,
- structural problem-solving, step-by-step introduction,
- responsible help of the university leaderships,
- central coordination and management,
- decreasing the prices, weakening of COCOM,
- good examples,
- Hungary-wide coordination of medical informatics,
- the introduction of cost-sensible insurance system,
- central support of the development of the infrastructure of the universities.

The success of developments generated new demands, requirements. The most important of them are the necessity of

- international network connection,
- central databank services,
- integrated clinical information system,
- use of the "live" systems in education,
- central high powered processor capacity for scientific calculations,
- central resource management.

To realize these requirements comprehensive informatical investments started at every university in Hungary. In the following sections we summarize the present state of results and applications.

3. The infrastructure

In the 90-s complete university-wide networks are developed. All the departments are networked. The university networks have connection to the world-wide Internet. The networks have optical (FDDI, Token-Ring) backbone and mostly coaxial wings (Ethernet, Token-Ring). The following parameters illustrate the sizes: of ~ 20 bridges, ~ 40 multiport repeaters, 1-2 routers, length of cableing approx. 50 km, 25 subnetworks (example of SZOTE-SZEGED).

The used network softwares are Novell-Netware, TCP/IP, DECNET. The departmental servers are mostly Novell PC-servers, serving the $\sim 500 - 1000$ PC-s in the departments (10-50 in each). For some services (Email, Internet connection, CD, etc.) central servers are installed and managed by

the computing centers. The mailers are VAX-VMS or UNIX machines. There are "Charon" mail- gateways to Novell mailing (Pegasus mail). CD servers with Novell or IP are used for scientific databank services (PC service!)

While the most application are PC-based, in some areas there are necessary high powered RISC servers and workstations as comput-servers. To reach them X-terminals and X-windows emulator softwares are installed. What concerns the education, there are networked cabinets (for example, four PC cabinets and one X-terminal cabinet at SZOTE, two PC cabinets and one X-terminal at DOTE) for education. In addition to the special servers for education, the students, who want to do research, can reach other resources. The students can work over Internet (mail, transfer, etc.). We note that the resources work continuously 24 hours a day.

Figure 3-5 show the logical structure of SZOTENET, DOTENET and SOTENET, respectively. In details see ([1], [?],[4]).

Figure 3

Figure 4

Figure 5

4. Education of Informatics and Mathematics

As we have seen above, the technical condition (resources, cabinets) make possible to realize the most modern educational programs in the frame of both the graduate and postgraduate courses and of courses for the teaching and research staff.

We summerize the main course programs. As example, Figure 6 shows the schedule.

Figure 6

Mathematics for pharmacy students.

The course is computer illustrated from 1994 at SZOTE. The Mathematica package is used for this purpose. ([2]). The main topics are: biomedical processes and functions, exponential, logarithmic functions, differential and integral calculus, differential equations, functions of several variables, applications in pharmacy.

Biostatistics for pharmacy and for Ph.D students

The practicals are computer-based. Packages SAS, SPSS and Statgraphics are used. The main topics are: elements of probability, distributions, normal distribution, data analysis, tests, regression analysis, variance analysis.

In the informatics courses the students use the "sharp" resources, programs, that they can meet in their clinical work or research.

Basics of Informatics for all graduate and Ph.D. students

The topics are: basics of personal computing (DOS, utilities, etc.), Windows, documents-editing, spread-sheet programs; Email, network services scientific databanks. Since the preliminary knowledge level of the students can be very different, there are basic and advanced groups organized.

Fundamentals of Medical Informatics

This course is not technical, the applications illustrate the learned ideas. The main topics: the main areas of medical informatics; informatics of research; information structures, information flow; clinical information systems; informatics of social health care; special areas.

In addition to the above considered ones, there are organized special courses, like

- advanced applications,
- networks in medicine,
- signal processing,
- courses on program packages,
- multimedia,
- graphic workstation applications, etc.,

Moreover, there are subjects, which are also computer based, like

- biopharmacy,
- pharmacy information systems,
- chemical modelling.

We note that the interest from the students is huge. The PC cabinets

are full between the lessons. This is the reason, that one cabinet in Szeged is established only for for the students.

5. General services, Applications for research

Nowadays, some services are so organic in the scientific work that can be considered as parts of the informatical infrastructure.

Networking For local connection for PC-s, mainly Novell Netware is used, since the main services are file and print services and mailing. Decnet and Internet are for international connection and for connection to the processing servers (VMS, UNIX servers, station). International electronic mail through Internet is available. The domains are (szote.u-szeged.hu, sote.hu, dote.hu). The international connection is quite new (3-5 years) and satisfies a very old demand from the research.

Local databanks, Information services. In addition to library informations and news, the medical CD-databanks like MedLine, Current Contents, Science Citation Index, Excerpta Medica are available from any networked stations.

Scientific Packages For the widely used packages (SAS (PC, UNIX), SPSS, BMDP, Mathematica, MAPLE, Word for Windows, etc. licences are bought and installed on the central resources.=

The computing centers coordinate and manage their usage.

The packages of special interest are ordered and installed locally in the departments, but some of them work on central servers of high speed (for example in chemistry, pharmacokinetics, etc.).

We have to mention here the systems, running on fast graphic workstations, which have been available for 1-2 years. Their graphic and multimedia capabilities haven't been recognized yet fully by the users. We feel, that this is the last moment, when the users are generally satisfied with the PC-s.

6. Patient's care

As we mentioned above, this area is the one, which forced first the modernization of computing infrastructure. In 1993 a new cost-sensible insurance system was introduced in Hungary. The budget of the hospitals was earlier more or less independent of their performance. The new system requires up to date data on patients attending on the hospitals or in our case on the clinical departments. As our universities took part in the preparation and development of the new insurance system, they realized soon the necessity of the application of computing environments.

We have to mention that our clinical departments are situated in pavilions spread about at a large area, hence networking is fundamental for a unique information system. Only on this way can overcome on the duplication of data and can be unified the departmental systems.

As results of earlier developments, at all universities and at all clinical departments, there work unified in-and outpatient departmental information

systems with common standards. Now the developments are directed to university-wide integrated clinical information systems, since the optimization of cost-income, giving management informations and supplying care histories are not possible without such a complex system.

The realizations of this goal are different. At SOTE-Budapest the integration of the networked PC-based systems is developed. In Szeged and Debrecen the PC-based system are going to be changed for a centralized information system, which works on some high-powered central servers. This model seems to be easier manageable with the present technology, although it is not properly adequate with the more or less independent management system of the clinical departments. With the development of the computing technology we have to move in the future into distributed departmental systems.

7. The organizational conditions

The tasks in doing medical informatics can be completed only under well-organized conditions. The computing centers, departments of medical informatics have basic role. They form the concepts, develop, adapt the systems, manage the university network and central resources. These departments deal with educational tasks and take part in research too.

At almost every clinical or theoretical department there are computer experts working for the local developments and system management. The departmental informatical representative coordinates the informatical work

(not technical!).

To emphasize the importance of medical informatics, the university leaderships founded the informatical committees, which "politically" help the professional work.

We believe, that these conditions, the dedicated willing and the expert are the main factors of the success of computer applications in medicine in Hungary.

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