

Institute of Computer Science

Annual Activity Report 2001

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1. INFORMATION INFRASTRUCTURE AT MU

The information infrastructure at Masaryk University is made up of sub-systems processing specialized fields of data from either the entire University or from local sources. The university-wide sub-systems that support university functioning in key operations (*programmes of study, science & research, finance & accounting, and personnel & payroll*) are linked to an integrated system called *IRIS MU* (IRIS is the Czech acronym for *Integrated Management and Information System*). Other sub-systems are linked to that integrated core via imports and exports of data (for example the library system and its loans module, the administrative system of the University Computer Centre, and the system of accommodation in the halls of residence), or are operated independently (the university cafeteria system).

IRIS MU Databases

The IRIS MU core comprises three independent university-wide databases operated on different servers and under different database machines:

1. the database for *economic, personnel, and payroll data* (*EkoPmDB*) maintained by the ICS MU; its development started in 1979, and it contains primary economic, accounting, personnel and payroll data of MU; some types of information (mainly on the active degree status, are systematically obtained from the *StuDB*;
2. the database for *public Internet presentation of MU* (*WebDB*) maintained by the ICS MU; its development started in 1997; it contains all information for the presentation of the University, and large volumes of data are therefore systematically taken over from the other two databases – mainly information on employment contracts, agreements, and high academic offices from the *EkoPmDB*, and information on degree studies and publications from the *StuDB*; it is the primary storage facility for data on research at MU, and addresses of people and offices;
3. the database of *degree studies and publications* (*StuDB*) maintained by FoI MU (in the MU Annual Report presented by the Centre of Information Technologies of the FoI as an independent Information Centre); under development since late 1998, and contains primary data on the student register, the register of MU publishing activities and user passwords to the MU intranets. Some types of information, especially those on effective employment contracts and external teachers' contracts, are regularly downloaded from the *EkoPmDB*.

The three databases contain areas the data of which are mutually overlapping: either they have a single reference database, and the data are mirrored, on or off-line, by other databases (a typical example would be information on active studies or workloads), or they have data that have more than one reference database (a typical example would be basic personal information: personal identification, names, academic degrees and addresses). The *EkoPmDB* and *WebDB* databases are fully integrated in their overlapping sections (partly on-line, whereby all changes are made in the reference *EkoPmDB*, and subsequently taken over by *WebDB*). The integration of the *EkoPmDB* and *StuDB* databases (on the principle of mutual on-line change monitoring exchange and implementation) was carried out in 2001 in the area of basic personal information (identification, names and degrees), in 2002 the system will be expanded to include other types of data.

User access to IRIS MU Data

Users access IRIS MU data via specialized non-web, web-intranet and web-Internet application systems over individual databases.

The *specialized non-web* application layer, accessible to a limited group of authorized persons (from the Economic, Personnel, Payroll, and Student Departments), is placed over the EkoPmDB database. It comprises the Magion Vsetín financial system integrated with a personnel-payroll system developed by the ISC MU. Users receive EkoPmDB data mainly in text terminal mode, or under a graphic client in the case of new applications. Applications for the administration of fixed assets of the university were developed for the launching of the system in the early 2002.

There is strong support for the *web-intranet* systems at MU as an access gateway to data for all people to whom the data relate: a protected and differentiated user access requiring only a typically furnished user station (i.e., authenticated access via a standard WWW interface, for which the client needs only a web browser supporting the https protocol) is being implemented at all three central IRIS MU databases – the user interface to the WebDB is the intranet subsystem <https://wwwdata.muni.cz/auth> (developed at the ICS MU since 1998; for details see below); the StuDB subsystem uses the <https://is.muni.cz/auth> interface (developed by the IS MU since 1998; for details, see the separate IS MU section), and access primarily to EkoPmDB is via the user interface <https://inet.muni.cz> (*Inet MU*, developed at the ICS MU since 2000; for details, see below). All three subsystems are generally intended for all individuals registered in the personnel database of MU, i.e., the current and former employees, students and associates of MU, and using one common database of user passwords (maintained at StuDB).

Because a significant amount of information stored in the IRIS MU databases can be published externally, the IRIS MU must naturally include the *web Internet layer*. The general MU presentation is at <http://www.muni.cz>, and it is over the WebDB, and its wap version for cellular phones at wap.muni.cz (see below). The public layer of information, mainly on MU study programmes, is also built over the StuDB at <http://is.muni.cz> (for more information, see the IS MU report).

Inet MU Intranet Subsystem – <https://inet.muni.cz>

Inet MU, whose development, in terms of a university information infrastructure, was the ISC MU's main focus in 2001 (most of the applications existing in the late 2001 were implemented this year), is mainly built over the EkoDB, and it provides access to selected data sets and applications:

- *Personnel-payroll* (personal data, contact information, information on employment status and agreements, data related to employment, hours at work, payroll information and monthly/annual payroll summaries, etc.; either as statements for individuals or summaries for heads of units; correcting option for personal data, hours at work, etc., is slated for completion in 2002);
- *Finance* (downloads of economic overviews for project managers are already available; information on scholarships, fixed assets, travel expense accounts, etc. are timetabled to be added in 2002);
- *University computer centres* (personal records, current information on use rates, statistics on use rates and other general statistical data);
- *Document data* (a proxy for access to selected categories of internal university documents and to licensed information sources has been developed);
- *Administration* (statistics on accessing servers, statistics on utilization of the server and individual applications, user IP – security, and documentation for the server).

Inet MU has been built to provide access to data from separate independent databases (besides the primary EkoPmDB, it also uses WebDB for contact data and StuDB for the verification of user authentication and checks of data consistency with EkoPmDB). It is built over the J2EE technology for server and distributed applications that allow the development of applications that can be operated at any application server implementing the J2EE standard, and the definition of a common interface be-

tween the client and the data server (XML/XSLT) for the unification of data transmissions between the application and the presentation levels of the system architecture.

A special attention has been paid to the Inet security – both at the technology and system levels (secure physical location, firewall, communication exclusively via protected https protocol) and at the application level: in 2001, the User IPs were installed that make it possible to selectively restrict access to applications with different levels of sensitive for only certain IP-addresses or groups of addresses of client stations.

Masaryk University Internet presentation – <http://www.muni.cz>

The Internet presentation of Masaryk University at www.muni.cz has been under development at the ICS MU since 1996. It provides (generally in two languages, i.e. Czech and English) profile and detailed information on all units of MU (academic management and profile, structure and profile of programmes and departments, employees and students, research projects and plans, publications, calendars of important events, job openings, legal norms, etc.) on the principle of uniform information content, uniform presentation format and automatic transfer of information from IRIS MU databases. The presentation has been built on the ASP technology over the WebDB database, whose primary content is enhanced and updated by authorized administrators from all MU units via the intranet sub-system <https://wwwdata.muni.cz/auth>, and large blocks of data mirrored from the EkoPmDB and StuDB databases are, without any intervention, updated daily in batches. The intranet at <https://wwwdata.muni.cz/auth> holds mainly contact data of staff and departments, calendars of important events, data on associate and full professorship proceedings, academic structures and, most since 2001, the research projects data administration. In 2001, the presentation was awarded the 1st prize in the national competition for the best Czech university websites.

Since 2000, the MU Internet presentation has also been accessible to the users of mobile telephones supporting WAP technology at the address wap.muni.cz. This server utilizes the same data as www.muni.cz, that is WebDB, and on its web pages it provides basic information including contacts (telephone, fax, addresses...) for every department, employee, and student of MU, and information about the current utilization of the university computer centre. Also, the results of entrance exams were made available at wap.muni.cz (as well as www.muni.cz) in 2001.

2. ACCESSIBILITY OF MU INFORMATION SOURCES

Access to information sources is provided at MU by the Library and Information Centre, which is part of the ISC MU.

The emphasis was on expanding options for access to professional electronic information sources for science, research and instruction at MU. Grants awarded to the Institute have made it possible to offer access to new big sources such as the digital Idealibrary (full texts of electronic versions of scientific journals from Academic Press), the ScienceDirect service (electronic versions of journals from the Elsevier Science publishing house, the Journal Citation Report database (impact factors of scientific journals), and many others. Today, users at Masaryk University have access to about 20 very big world commercial information mega-sources representing more than ten thousand scientific journals in full text electronic version from every possible discipline, hundreds of very large bibliographic and factual databases, and a large number of other specialized sources. The ISC has installed a proxy-server allowing access to authorized users from any location of the global network.

Another important activity of the Library-Information Centre was the start of preparation work on the selection of a new library system for the university that will allow the introduction of new types of services and the integration of various information sources into a uniform environment.

3. PARTICIPATION IN NATIONAL AND INTERNATIONAL HIGH-SPEED NETWORKS PROJECTS

The MU Institute of Computer Science operates the point of presence, i.e. the main access point of CESNET2, the high-speed network for research and development, with a direct link to Prague at the rate of 2.5 Gb/s. The CESNET2 network is linked to the GEANT European network with connection speed of 1.2 Gb/s and also has a transatlantic connection at the rate of 155Mb/s. The ICS staff also took an active part in research into high-speed networks, and applying its results on the national level in close cooperation with the CESNET association and its research goals. Masaryk University is thus also involved in building the all-European network GEANT, and several other related research activities. Through the CESNET association, ICS workers have been a part of the DataGrid project of the 5th Framework Programme for the European Union since 1 Jan. 2001, participating thus in the creation of a computer and data infrastructure for processing the results of experiments in the area of high-energy physics.

In 2001, the ICS also participated in preparing another EU project in large distributed computer systems called GridLab. The project was officially launched on 1 January 2002. Its main coordinator is the Poznan Network and Supercomputer Centre (Poland) and other partners in the project are important academic institutions such as the Max Planck Institute in Potsdam, the Konrad Zuse Centre in Berlin, universities in Amsterdam and Lecce, the Compaq and Sun companies, and several institutions in the USA (ANL, ISI and the University of Wisconsin). The project has a twofold objective. On the one hand, to create an application toolkit that will facilitate the development of applications capable of making use of a broadly distributed computer environment, the so-called Grid. The toolkit, based on the cactus programming system, will not only support the distribution of calculations between nodes of the Grid, but it will also support the mobility and migration of the code between individual computation sources, and adaptation to the possibilities of both the nodes and the connecting network. The project also aims at creating a permanent distributed environment, with nodes that will be powerful calculation systems in Europe and the USA. Responsibility for the setting up, operation, maintenance and development of this environment has been given to the Institute of Computer Science at Masaryk University.

4. COMPUTER TECHNOLOGY AT MU

Supercomputer Centre

The ICS operates the Supercomputer Centre (SCB) equipped with a 40-processor SGI Origin 2000 computer, and a 21-processor SGI Power Challenge computer. The two computers are interlinked via the HiPPI.

The Origin 2000 computer is the most powerful computer with shared memory installed in the academic community in the Czech Republic, and is equipped with the most efficient graphics system, the RealityInfinity2. The SCB has also at its disposal disk area in excess of 1.3 TB, and offers these systems to the general academic community in the CR. SCB personnel act as coordinators in the Meta-Centrum national project. Under the project, MU has a tape library of 12 TB on-line, and a PC cluster equipped at present with 64 Pentium III 700 MHz and 1000 MHz processors, and a total of 32 GB memory. The individual processors in the cluster are linked by the high-speed network Myrinet (1.3 Gb/s permeability and 7.5 μ s delay) or by the Gigabyte Ethernet. SCB computers have direct connection to a high-speed 1 Gb/s backbone link that meets even the most demanding data transmission requirements.

MU Computer Centre

The computer centre is open 24 hours a day 7 days a week. It has over a hundred personal computers with Pentium III 533 MHz processors, 128 MB of main memory, hard disk, floppy disk drives, CD-

ROM drives and 17" monitors. The computers run the MS Windows 2000 operating system. The clients can use a number of applications, which are being gradually enhanced and complemented to cover the basic needs of the majority of the clients in accordance with the Centre's mission. The Centre is well connected to the Internet and MU information resources.

In 2001, the MU Computer Centre was equipped with air conditioning, making it possible to maintain a comfortable environment during non-stop operations even during the summer. The number of installed applications increased significantly.

The MU backbone computer network

The ISC operates the biggest access point of the high-speed academic network CESNET2 outside Prague, and its connection to the metropolitan Brno Academic Computer Network (BAPS). High reliability of the backbone network was successfully maintained throughout the year, and the network was extended in accordance with the needs of the university, e.g., high-speed connections to two more student halls of residence were installed.

At the same time, the Centre worked intensively on the selection of suitable elements and the design of an optimum structure for the next generation backbone network at MU, which will be based on the gigabyte Ethernet technology. Plans for modifications in the backbone network cabling and access points at faculties were made and partly also implemented. The modifications will give the new backbone network more power and better reliability parameters.

In 2001, significant modifications of the central node at Botanická were made. A new centre for the fibre optic cable network was built there, with a total of 12 optic fibre distributors providing connection for a total of 15 racks. The original ATM technology was also moved there and reconnected. At the same time, preparations were made for the installation of the gigabyte technology, planned for the beginning of 2002.

The present metropolitan backbone network comprises a total of 82 nodes, and is 78 kilometres long. In view of the constantly increasing demands on information transmission routes, 48-bundle fibre optics cables are gradually installed. In 2001, it became possible to lay underground cables alongside fibre optics routes of other operators. Consequently, it was possible to extend the municipal network, and surface routes were replaced with underground ones. The surface routes, which originally was the only type installed, now only make less than 40 per cent of the system. In 2001, a total of 25 km of cable were installed underground.

Important MU servers administered by the ICS

- SGI Origin 2000 – supercomputer
- SGI InfiniteReality2 Onyx2 – graphic superprocessor
- SGI Power Challenge XL – supercomputer
- Sun Enterprise 450 – financial/personnel server of the MU Information System
- Sun Enterprise 450 – server for the distributed file system (AFS) and the high-capacity backup system
- Sun Fire 280R – server for the MU network services (WWW, FTP, ...), and the library-information system (including upcoming new generation library system)
- Dell Power Edge 4100/200 – CD ROM server
- Dell Power Edge 2300 – server for remote access to applications running under Windows
- Sun UltraSparc 1 – main e-mail server at MU
- Sun Enterprise 250 – CPS administration server

- Dell Power Edge – CPS data server
- Dell Power Edge – CPS network server

The university has over 2600 computers in service connected to the university computer network.

5. RESEARCH PLAN OF THE MU-ICS

A total of 15 ICS researchers participated in the third year of the research project "Digital Library". Its goal is to combine the traditionally strong ICS disciplines - computer networks, building of information systems, system infrastructure, automation of libraries, www, and multimedia – for a uniform umbrella system for digital libraries that will give a broad spectrum of specialists the opportunity to extensively participate in coordinated research. The project has four aims: (a) the transformation of traditional libraries, the infrastructure of digital libraries; (b) processing information stored in heterogeneous distributed sources and providing access to it; (c) security protocols and mechanisms for accessing and transmitting sensitive information over public information networks; and (d) technology for the acquisition, processing, archiving, and transmitting digitalized images in medical applications. Research findings have been published in 32 papers, and presented at 15 major national and international conferences.