

GUIDELINES FOR THE INFORMATIZATION STRATEGY OF THE FACULTY OF AGRICULTURE AT THE UNIVERSITY OF ZAGREB BY 2005

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SUMMARY

The process of the systematic informatization of the Faculty of Agriculture by 2005 represents an attempt of the Faculty of Agriculture, an institution with rich tradition and good prospects, to meet new and emerging challenges in the area of computer technology. Aim of the paper is to suggest structural changes in the domain of development and application of information and telecommunication technology along with knowledge based on it, which this institution will be introducing in the near future in areas of education, scientific research and management. Having in mind this context, these strategic guidelines will be our response to emerging needs for informatization of the Faculty of Agriculture. This paper offers a strategy, which is aiming at the improvement and standardization of the existing network and information infrastructure of the Faculty of Agriculture.

Keywords: Informatization, information technology development and implementation, strategy for information systems development, higher education and information technology

1. INTRODUCTION

Systematic informatization of the Faculty of Agriculture by 2005 is a response to emerging challenges in the area of computer technology this high education institution of rich tradition is going to face in the near future.

Aim of the paper "Guidelines for the informatization strategy of the Faculty of Agriculture at the University of Zagreb by 2005" is to suggest structural changes in the domain of information and communication technology along with knowledge based on that technology, which this institution will introduce in near future in areas of education, scientific research and management. Having in

mind this context, these strategic guidelines will add new dynamics to the response to emerging needs for informatization of the Faculty of Agriculture. These guidelines will be a starting point for future annual informatization plans, which will be implemented in accordance with the financial potentials of the appropriate ministries.

The strategy suggested in this paper is aiming at the advancement and standardization of the existing computer network and information infrastructure. By complying with standards this institution will follow European and world trends present higher education institutions of similar kind. By combining different scientific methods and based on an estimation, we decided upon use of a combined research approach in order to determine the facts about the current state of information resources. This approach will employ methods of analysis and synthesis and taking into account the time sequence, we will quantify the information resources and their validity. These values will serve as a basis for the determination of the strategic direction in the process of informatization.

The following part of the paper will offer an overview of the current state of information resources in the domain of local area network, and domain of the organization of the information resources at the Faculty.

2. GOALS OF THE STRATEGIC GUIDELINES OF THE FACULTY OF AGRICULTURE

From the current point of view, it is certain that the process of informatization in form of application of information and communication technology and knowledge based in it will strongly mark the development of the Faculty of Agriculture by 2005. All current and prospective students at the Faculty will be finding themselves in an active contact with information and communication technology in the near future. Furthermore, we all must be aware of the fact that while working in higher education institutions of rich tradition we have to prepare the existing educational system for the transformation into a system for lifelong learning. This idea suggests itself as a prerequisite of the modern Croatian society based on agriculture.

In order to carry out the informatization plan in form of application of the information and communication technology and knowledge based on it, it is necessary to do the following:

- Make available all necessary information and communication technology as well as software tools and applications, and provide support for its use
- Provide opportunity for all Faculty staff and students to freely and without any charge access the Internet at the Faculty, and make plans for dial-up access from home
- Provide access to all relevant scientific databases and information services for all Faculty staff and students

- Set up Faculty information system that will connect all organizational and administrative activities at the Faculty, and connect the Faculty to the relevant University environment and enable tele-working
- Make possible for all students to continue acquiring knowledge and skills in the domain of informatics as a discipline which systematically follows the development, application and use of information and communication technology in agriculture
- Encourage realization of the practical work by use of information and communication technology installed in the computer classroom at the Institute for mathematics and informatics at the Faculty of Agriculture in accordance with requirements of other agricultural teaching disciplines and the Faculty staff
- Establish "Information technology support service" which will provide support for maintenance of the existing "Faculty information system" and its further development as well as to provide support to the Faculty staff in work and teaching
- Provide opportunity for all Faculty staff and students to purchase personal information and communication equipment at discount prices, with the help of Information technology support service
- Establish and maintain databases and information services containing Croatian scientific information and make them available in the Croatian and English language
- Give active support to scientific projects dealing with informatization of the Croatian agriculture, as well as the use of information and communication technology in projects of agricultural attribution

3. THE RESEARCH IN THE DOMAIN OF THE GUIDELINES FOR THE INFORMATIZATION OF THE FACULTY OF AGRICULTURE

There is no doubt that the Faculty of Agriculture will be deeply involved in the process of informatization by 2005. The informatization process will involve education, research and management areas and this will clearly designate the position of the Faculty in the area of the Croatian and world science.

Having this context in mind, the strategic guidelines seem to be a next logical step in achieving the aims set in the introduction of this paper. However, the guidelines need to be supplemented by an explanation about the reason for choosing year 2005 as a primary goal. Because of the fast and unpredictable technological development it is unwise if not almost impossible to predict developments beyond 2005.

Using these determinants as a guidance, and taking into account previous informatization development processes at the Faculty published in the "Current state of the information resources at the Faculty of Agriculture by 2002", we will introduce the strategic guidelines of the process of informatization at the Faculty

by presenting the strategic guidelines of informatization of the computer resources, the strategic guidelines of informatization of the local area network and the strategic guidelines of informatization of the Faculty information technology support service.

3.1. Current state of the information resources at the Faculty of Agriculture by 2002

The acquisition of the information technology equipment for the Faculty has been done systematically since the beginning of the 1990s. It covered all organization segments of the Faculty in two ways. The Faculty and the Faculty institutes purchased on portion of information technology equipment. The other portion was distributed directly by the Ministry of science and technology of the Republic of Croatia and the Ministry of Agriculture of the Republic of Croatia for teaching and research purposes. Since the beginning of the 1990s, the Faculty has reached a certain level of development in the domain of information system development. At the present moment, there is a need for a survey of the current state of the information technology on the Faculty level and on the level of the Faculty institutes in order to create a new management plan for managing the existing equipment and for the purchase of new equipment. Such a plan would facilitate the Faculty to keep its current position in the process of education of future agricultural experts in Croatia.

In consistence with the aim set in introduction, we analysed the current state of the information technology resources. Data from the Faculty accountancy were used as basis for the analysis. The analysis of the systematic informatization of the Faculty and its information technology will cover two periods. First, the period until 1997, and second, the period from 1998 to 2002. These periods were decided upon on the basis of the equipment lifespan; equipment existing before 1997 was already written off, or is ready to be written off while the equipment installed in period between 1998 and 2002 is mainly still in use.

Based on the presented facts, the analysis of the state of the information technology equipment at the Faculty of Agriculture will be presented in cumulative manner according to equipment categories within the chosen timeframe.

3.1. Outline of the current state of the information technology equipment at the Faculty level

During the last 12 years of the process of the informatization of the Faculty of Agriculture, the following equipment was at disposal: 323 personal computers, 181 printer, 61 additionally purchased monitors, 23 CD-ROMs, 16 scanners and 7 fax modems (Table 1.). The current state is as follows: 222 personal computers, 115 printers, 44 additional monitors, 19 CD-ROMs, 12 scanners and 1 modem.

Table 1. 1990-2002 equipment inventory overview

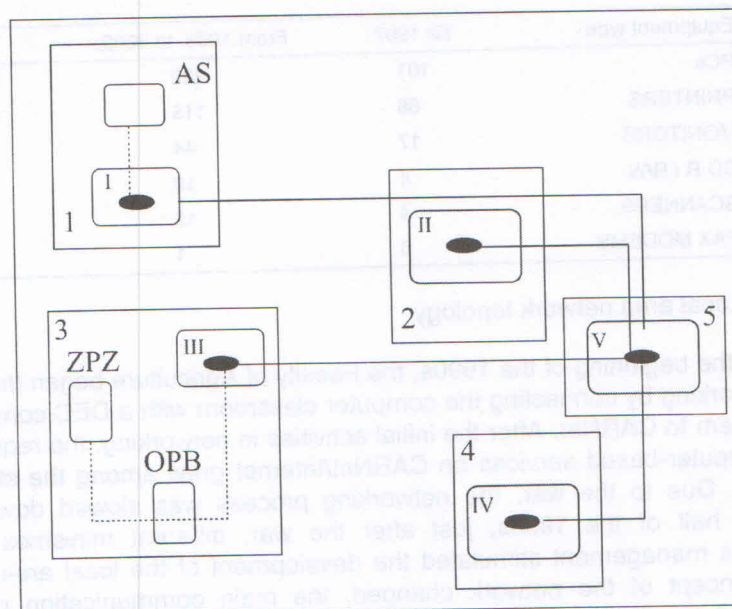
No.	Equipment type	Till 1997.	From 1998. to 2002.	Total
1.	PCs	101	222	323
2.	PRINTERS	66	115	181
3.	MONITORS	17	44	61
4.	CD R i R/W	4	19	23
5.	SCANNERS	4	12	16
6.	FAX MODEMS	6	1	7

3.1.2. Local area network topology

At the beginning of the 1990s, the Faculty of Agriculture began the process of networking by connecting the computer classroom with a DEC computer in it by modem to CARNet. After the initial activities in networking, the requirements for computer-based services on CARNet/Internet grew among the staff of the Faculty. Due to the war, the networking process was slowed down. In the second half of the 1990s, just after the war, different ministries and the Faculty's management stimulated the development of the local area network. The concept of the network changed, the main communication point was relocated to pavilion V. All other pavilions were mostly networked with the available financial resources. The procedure of networking was outsourced to the contracted private firms, which didn't provide necessary LAN documentation due to insufficient funding.

Local area network (Figure 1.) is connected by 2 megabits fiber optic link (2 fibers) to CARNet. A CISCO router is placed towards the local area network accompanied by a 12 port switch with the single output for the Faculty of Agriculture and the Faculty of Forestry. The complete local area network of the Faculty of Forestry is based on 1 port switch connected to the fiber optic link. The local area network connects five pavilions and there is a modem connection to locations outside the local area network. The connection between pavilions is based on 10 hubs (only 5 comply with standards) and 15 switches (only 7 comply with standards). There are about 200 UTP 100 megabit network sockets available, and this number is hardly sufficient. The main difference between a hub and a switch is that the switch has the tenfold capacity of the hub. However, the technicians didn't use the programmable switches, so there is no backbone routing option available. The capacity of the communication resources in the local area network is 10/100 megabits but the capacity was reduced due to the use of hubs. The Internet domain of the Faculty of Agriculture is agr.hr and the IP address block begins with 161.53.95.xxx. The existing IP address pool is nearly exhausted, and more addresses will be asked from CARNet.

Figure 1. Faculty of Agriculture local area network



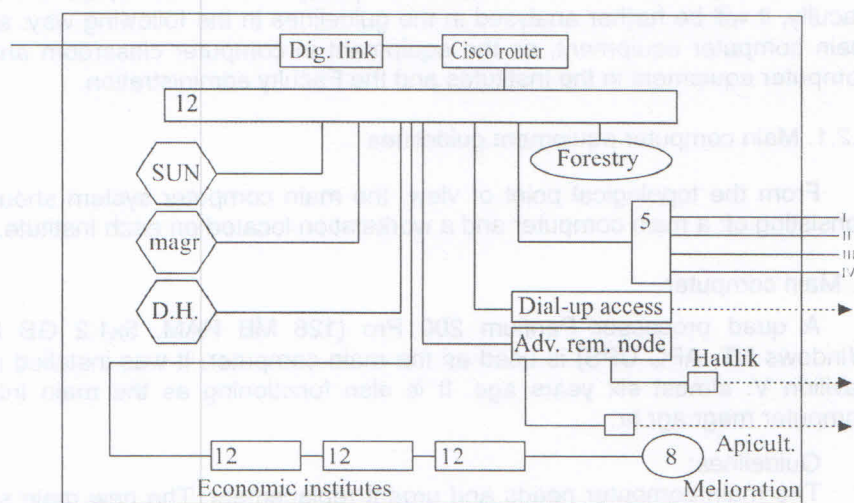
3.1.2.1. An example of the outline of the LAN of the pavilion V. (main connection point)

The concept of the local area network in the pavilion V. (Figure 2.) is based on star topology and it has two dependent communication levels. One level covers the communication towards CARNet and this is a 2 megabits link. The second level is responsible for 10/100 megabits communication link between decentralized pavilions. The outer communication environment (CARNet) is connected to the local area network by a 12 ports CISCO router with only one output port from the Faculty of Agriculture and the Faculty of Forestry. The whole local area network at the Faculty of Forestry is based on 1 port switch connected by fiber optic link to pavilion IV. There is a SUN Ultra server (Solaris 5.7) with 13,3GB HDD and 64MB RAM. This local area network utilizes only 25 IP addresses and there are plans for the increase of that number to 150 IP addresses. Pavilion IV. Has two 24 port switches and the new Faculty building will also be connected to it. The network cabling in the building relies on 1000 megabits UTP.

The CISCO router is connected to the main server at the Faculty (magr.agr.hr). This is a quad processor Pentium 200 Pro with 128 MB RAM, 5 x 1-2 GB HDD, it works under Windows NT 4.0 SP6 and is relying on APC smart UPS 1000; and there are HP Procurve switch, and D.H. resource. There is also supports for dial-up users (US Robotics Net server) with one switch and

12 dial-up access points for end users. Furthermore, there are 2 Bay Networks advanced remote nodes, which make possible connection with the Haulik castle and Department for Apiculture, and additional 1 modem connection to the Central Faculty library and another modem connection to the main server. Three 12 port switches are connected in cascades to the CISCO router, while 8 port hub (Institute for Melioration) is connected to one of the switches and is used exclusively by the economic group of the Institute. Additionally, a 5 port switch is connected as a one port switch to the 12 port switch. This computer equipment was installed 5 or 6 years ago and represents main Faculty server, which now needs a replacement.

Figure 2. Pavilion V. local area network topology



3.1.3. Current state of the Faculty information technology support services organization

The current human resources organization at the Faculty of Agriculture supports only one job for a system engineer from CARNet financed by the Ministry of science and technology. His working position is located at the Faculty. CARNet also recommended appointing a person from the Faculty as a coordinator, which in return will be financially compensated for his job.

The main way in which information technology support service has been functioning in the last 5 years was a communication between the system engineer and the CARNet coordinator in all matters regarding potential needs for information resources, which then needed to be approved by the Faculty management. Much anticipated Committee for computer systems was found in

academic year 2001/2002. The new human resources regulations at the Faculty of Agriculture at the University of Zagreb will provide grounds for two work places: Head of computer networking and Networking operator.

3.2. Strategic guidelines for informatization of the computer resources

The key factor contributing to the quality of informatization of the Faculty of Agriculture are the existing computer resources. The development of the guidelines is a complex and scientifically precise task. Having in mind this context, main data in Table 1. and chapter 3.1.1 show the total number of pieces of equipment in the last 12 years presented in two time periods until 1997. and from 1998 to 2002 (still in function).

With respect to the achieved level of quality of technical equipment at the Faculty, it will be further analysed in the guidelines in the following way: as the main computer equipment, as the equipment in computer classroom and the computer equipment in the Institutes and the Faculty administration.

3.2.1. Main computer equipment guidelines

From the topological point of view, the main computer system should be consisting of: a main computer and a workstation located on each Institute.

A. Main computer

A quad processor Pentium 200 Pro (128 MB RAM, 5x1,2 GB HDD, Windows NT, APC UPS) is used as the main computer. It was installed in the pavilion V. almost six years ago. It is also functioning as the main Internet computer magr.agr.hr.

Guidelines:

The main computer needs and urgent replacement. The new main server should be dual Pentium 4 computer with 1 GB RAM, 3 x 40 GB HDD and 2 x 80 GB HDD SCSI RAID, a DAT backup system, a CD/DVD RW, a FDD, a keyboard, a mouse, a monitor and a network card. This computer should be used as the main server for the Faculty staff. Its location should be also carefully planned to be adequate and optimal for the future information technology expansions.

Another server is provided by CARNet: Compaq, PC Pentium III, Model ProLiant ML330e 933 MHz, 25 K, M1 EURO, 15" monitor, with Linux OS and should become the main server for students and be a potential backup server in case of failure of the main Faculty server.

Each Institute should have one PC workstation to facilitate the communication between the Institutes and the Faculty. Recommendations for this equipment should be provided by the Information technology support service, and this would help maintaining inauguration of technological standards at the Faculty.

B. Computer equipment in the Faculty computer classroom

The Faculty computer classroom is located in the Institute for informatics and mathematics (pavilion IV.) and it has been serving students for the past 12 years in doing their practical computer related assignments in agriculture. These activities include following subjects: informatics, information systems in agriculture and information and communication systems. The same classroom is also used for other practical computer work in agriculture. The computer classroom needs new equipment and electronic content that can be applied in the process of teaching.

Guidelines:

New computer equipment should be purchased and installed as well as new multimedia technology necessary for the presentations of education material to students.

C. Computer equipment in the Institutes and the Faculty administration

The existing computer equipment located in different Institutes and Administration offices at the Faculty is now at the lower limit of its performance acceptability. The equipment acquisition procedure should be also revised in order to comply with information technology standards and to meet the economic criteria related to the acquisition of new computer equipment. The Faculty will encourage the acquisition of specialised computer equipment essential for scientific research and education. The administrative services such as the Faculty accounting and the student administration should change their status in organizational scheme from an autonomous one to an internal one by 2005. New technologies enabling wired and wireless communication will help carrying out changes and will help teaching staff, students and other Faculty staff to improve their working results. The central agricultural library should be additionally equipped with necessary hardware and software. All enumerated organizational segments should be considered as an integrated whole of the future information system of the Faculty.

Guidelines:

As dynamics in technology development increases, especially in computer technology development, there is a need for the exact time frame divided in quarters during the whole year and a new plan for selection of quality equipment suppliers. In this way newly purchased equipment would comply with computer standards and would be cheaper as well as carrying out of equipment acquired through processes of solicitation for tenders.

3.3. Strategic guidelines of informatization of the local area network infrastructure

It is important to point out that quality of information system presumes carefully planned network infrastructure, which is a prerequisite for smooth operation of the information system of the Faculty. The analysis based on the conducted research shows that the local area network of the Faculty of Agriculture was built up according to financial and organization capacities of the Faculty and with the support of the different Ministries which responded to the information technology requirements of the Faculty.

Unfortunately, during the building up process of the local area network, the contractor didn't provide proper documentation. Furthermore, the Faculty didn't make an investment project regarding the local area network. The installed communication resources of the local area network of the Faculty (hubs and switches) are already obsolete, and the existing IP address range (.agr.hr) needs expansion. The current communication link to CARNet is now 2 megabits, and seems to be insufficient because its capacity is assigned both to the Faculty of Agriculture and the Faculty of Forestry. Therefore, it is necessary to rethink the current network configuration where the Faculty of Forestry should expand their communication link to 2 megabits.

The new pavilion VI. and dislocated Faculty facilities will be also connected to the existing local area network by use of a fiber optic link.

Guidelines

The Faculty of Forestry and the Faculty of Agriculture need to submit a request to the Ministry of science and technology for the expansion of the current link to CARNet from 2 megabits to 4 megabits is needed. It is crucial for documentation of the existing local area network to be prepared by a contracted specialized firm in order to gather information about the accurate capacity of the installed communication resources. This information will also provide an overview of the network bottlenecks, which will, again, help in removing them and finding out the accurate local area network capacity of all the pavilions.

Hubs need to be replaced with programmable switches because one switch has a tenfold capacity of one hub. The existing non-programmable switches should be replaced with programmable ones, and make network structure more intelligent.

The present capacity of UTP based link is 100 megabits and is still within acceptable boundaries, however, replacement of the existing components with faster ones is also recommended. The high bandwidth equipment should be also provided in the process of connecting the remote Faculty locations and pavilion VI.

The existing IP address range (agr.hr) has reached its limits. All users need fixed IP addresses. This initiative requires support from the Ministry of

science and technology and CARNet, which should allocate additional IP addresses to the Faculty.

3.4. Strategic guidelines of informatization of information technology support service

Even the best computer equipment and well-designed local area network cannot provide expected results if there is no quality information technology support service with IT experts in it. Since the Faculty of Agriculture doesn't have Information technology support service, it is important that such a service should be found. The task of the service would be supervision of the information technology resources of the Faculty, giving recommendations regarding standards, taking care of the development of the information system of the Faculty and becoming the central point for the distribution of the legally obtained software.

The human resources structure of the information technology support service should be as follows: a head of computer networking, a system engineer and a networking operator. The head of the computer networking would be responsible to the dean and vice-dean of the Faculty, and system engineer and networking operator would be responsible to the head of networking. Additionally, the system engineer would be responsible to the CARNet coordinator too, and the coordinator would be a member of the Committee for computer systems of the Faculty. The dean and the Faculty council will nominate the head of the Committee, and he/she would be steering the Committee. The accomplishment of this initiative would result in optimal management and compliance with standards of the information technology resources at the Faculty.

The information technology support service should be formed under the initiative of the Faculty management and should include the following work positions: a head of the computer networking, a system engineer and a network operator. The main incentive for this initiative is the need for the optimal management and supervision of the installed information technology equipment and its improvement if needs for that should arise.

The information technology support service should have the competence for licensed software and inform all end users about its availability. Its task would also be recommending standards in the domain of system and application software and giving encouragement for its use.

Information technology support service should give support to end users in gaining knowledge about the existing and new information technology solutions

In cooperation with the Institute for informatics and mathematics, Information technology support service should organize courses for the Faculty staff.

4. INSTEAD OF CONCLUSION

The implementation of the strategic guidelines for the informatization of the Faculty of Agriculture is not going to be an easy task. It will be a complex task requiring some structural changes that will satisfy the needs of the Faculty for the support of information technology in education and research. On account of these thoughts, it is important to identify the effects of the informatization as well as obstacles and strategic steps of the informatization together with the short-term effects of the informatization.

4.1. Expected effects of the informatization

The application of the defined guidelines will provide opportunities for:

- Scientific discoveries to become available to all the Faculty staff and students
- Croatian scientific discoveries to become available to the Croatian and world scientific community
- Education of students to be adapted to their needs and abilities and all relevant resources to be at their disposal
- Loss of time on administrative jobs of the Faculty teaching staff and students to be decreased to minimum
- Work at the Faculty to be transparent and results available to the all people interested in them
- The Faculty to become a development component of the advancements in society and development of information society based on agriculture

4.2. Obstacles for the informatization process

It is expected that some obstacles will be encountered in the application of the strategic guidelines at the Faculty of Agriculture. We should be aware of their existence and try to overcome them:

- Insufficient application of the information technology solutions by teaching staff and students in the process of education and transfer of knowledge
- There are certain shortcomings in the national strategy "Information and communication technology – Croatia in the 21st century" regarding the informatization of the agricultural higher education institutions, and there is no general strategy for the informatization of science and higher education
- Possible lack of funding for the informatization of the Faculty can slow down the process and changes its implementation dynamics
- Insufficient motivation of students can significantly influence their participation in forthcoming changes

4.3. Strategic steps in the informatization process

Indeed, the strategic steps should provide prerequisites for the application of the guidelines in the following way:

- Lobbying in order to gain higher level of consciousness about the importance and role of the process of informatization of the Faculty in future
- Education of students about use of information technology, and education of the Faculty teaching staff and administration for use of information and communication technology
- Creation of a favourable climate for the process of informatization

4.4. Short-term effects of informatization

Some short-term effects can be achieved by application of the guidelines:

- Annual education of the Faculty teaching staff for the use of relevant information tools and equipment
- Making available information about curriculum, exams, exam schedules and their results as well as information about the teaching staff on the Internet
- Establishment of the information technology support service at the Faculty level for the improvement of the informational function of the Faculty
- Education of students for the use of information resources in agriculture
- Development of the annual plan for the informatization of the Faculty based on accurate needs of the Faculty for the information technology
- Creation of a favourable climate for the further development of informatization at the Faculty of Agriculture.

STRATEGIJSKE SMJERNICE INFORMATIZACIJE AGRONOMSKOG FAKULTETA SVEUČILIŠTA U ZAGREBU DO 2005. GODINE

Sažetak

Sustavna informatizacija Agronomskog fakulteta u razdoblju do 2005. godine odgovor je na sve narastajuće informatičke izazove pred kojima se nalazi ili će se naći ova visokoškolska institucija, kao institucija bogate tradicije, respektabilne sadašnjosti i izgledne budućnosti. Ciljevi rada usmjereni su na strukturalne promjene iz domene informacijsko-komunikacijskih tehnologija i na njima temeljnih znanja, pred kojima će se naći ova institucija kako u sferi obrazovanja i znanstveno-istraživačkog rada, tako i u sferi poslovanja.

Gledano u tom kontekstu, ove strategijske smjernice daju dinamiku našeg odgovora na sve narastajuće potrebe za informatizacijom fakulteta. U radu je predložena strategija, koja je usmjerena na unaprijeđenje i standardizaciju postojeće kompjutorsko-mrežne informacijske infrastrukture fakulteta.

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