ICT Development Strategy at UWB 2016-2020

Version of 8 January 2016, state: processing comments from CIV. The corresponding typographic proofing is missing.

Analysis of the Current State and Position of UWB

Evaluation of the Previous Period

The description of the state of ICT is based on the UWB analytical model of ICT used in the ICT strategy 2010-2014 [1]. The overall situation described with regard to [1]: the situation corresponds to *Scenario 5.2.1 "Full Fulfilment of the Long-Term Plan Objectives"*, i.e. UWB has developed rapidly in recent years: new centres, new buildings, new requirements have been created; at the same time, the number of students has decreased, which resulted in a changing structure of needs. A number of expected trends were confirmed, in particular, in the area of ICT penetration into all University activities, change in user behaviour (availability of equipment, mobility), and needs arising from project management and new activities. Our strength is that, thanks to the strategic plans embodied in [1] and the RIPO project, *there is conceptual and coordinated development*. The weakness is an *increasing gap* between legitimate needs of the University (development version) and the stagnating or even declining ICT budget. This discrepancy is significantly but not fully compensated for by the increase in work efficiency and providing services.

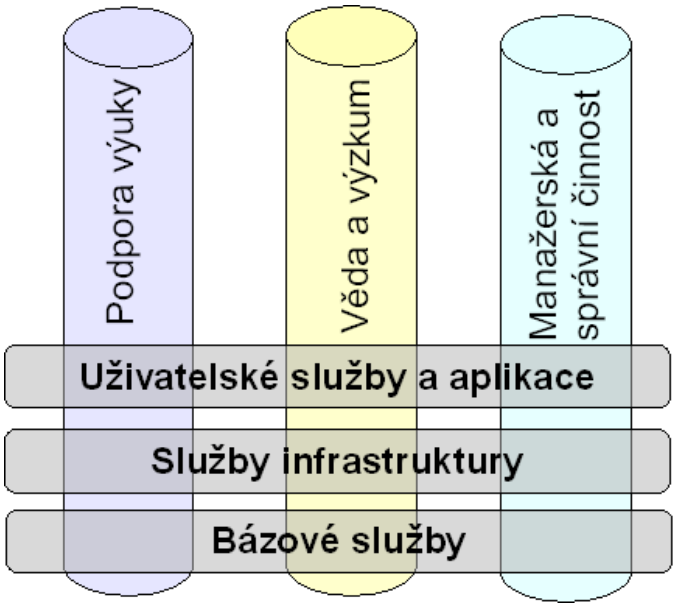

Figure 1: Analytical model of ICT infrastructure

Long-term problems in the area of *base services*, especially in the physical infrastructure (energy centre, data centre equipment, cooling, data protection against fire destruction and unauthorized access) have been sorted out in a fundamental way. We managed to increase the capacity and reliability of selected *infrastructure services*, especially connectivity and data and file services. While the growth of needs in this area is very high (60% increase in PC network ports, wireless base stations increase by nearly 100%, data increase by 40% per year), we are able to fully meet needs while ensuring adequate availability and quality of service. We are successfully fulfilling long-term goals in specific areas (telephony, user support, unified identification system linked to the payment system and regional cooperation with the Pilsen Card, IS endpoints and their modernization, and strategic cooperation with the national CESNET e-infrastructure).

In the area of vertical pillars, *support for teaching* remains our strength. The IS/STAG study support continues to be the flagship of the University, but other components in this area are also being successfully developed. A task for the future is further development of Courseware and support for modern forms of education in general. The last period was in line with assumptions marked by fundamental changes and an increase in needs in the area of *research and development* support. A working group for RDI IS was established for coordination, which is significant progress. We managed to deploy new needed and desired applications. In some areas, we are still looking for appropriate tools

to meet newly arisen needs. We have some reserves in *supporting administrative and management processes* and project reporting, and in integrating data and applications. While we have been able to address specific needs and problems, we have failed to make a leap between "common applications" and the desired state of a "coordinated conceptually developed and integrated system".

Dimension and Key Parameters of Infrastructure

Users and Their Activity

Since 2010, the number of students has fallen by more than a quarter, yet the number of active service users is increasing. This is due to the fact that, as expected, the penetration of ICT into the life of all students and employees of UWB has accelerated and its role in research and development activities has strengthened.

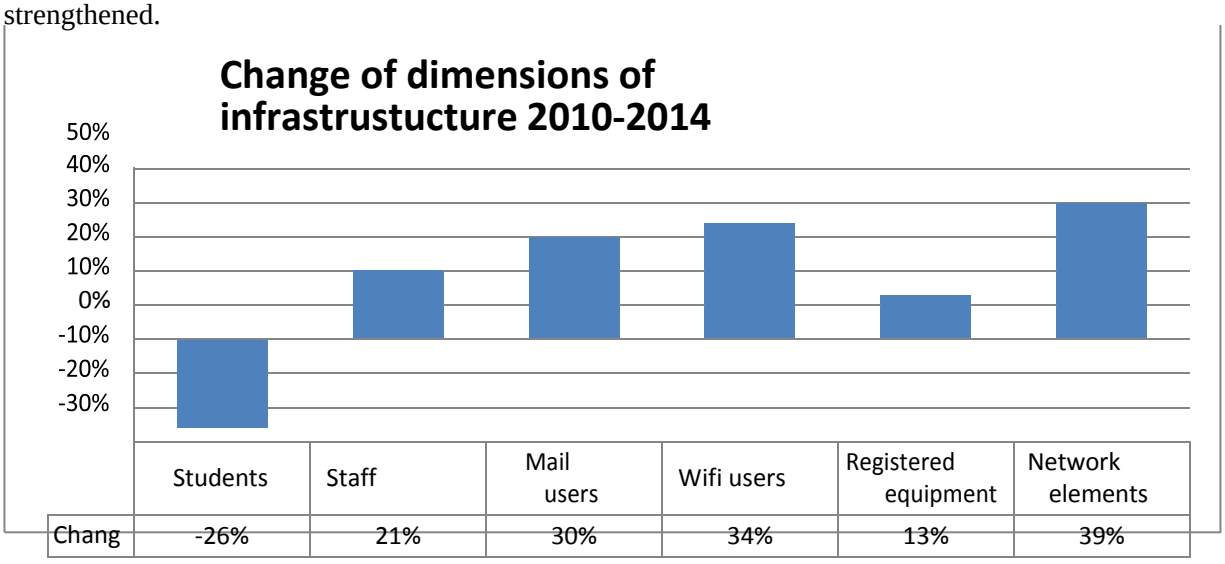

Figure 2: Although the number of students is decreasing, the number of active service users is increasing.

In the reporting period, there was a significant increase in the number of unregistered devices, which are mobile devices connected only via the wireless network. 40% of the facilities owned by UWB (including classrooms and laboratories) are mobile. In addition, the number of private mobile devices is increasing, especially among students (significantly more than one per person). Correspondingly, the number of places in public computer classrooms has fallen (from 221 to 124) and the number of user support requests and requests for mobile devices has increased. In portal access, Android and iOS mobile devices represent a quarter of the hits.

In relation to the above, the intensity of interaction between users and services has increased. Services (email, social networks, data storage, communication tools) are used more frequently and some interactions (pre-enrollment, use of Courseware) are more intensive. The affinity for web applications is also confirmed. For email that provides the same functionality in email and webmail applications, 73% of users use the web applications.

In terms of user support and communication with users, it is necessary for us to adapt to the fact that communication is becoming abbreviated and it is difficult to attract and inform users. We had to invest our efforts in communication via Facebook; we were able to design and implement a tool for effective presentation of information - the Civenka project - and we are using comics for specific messages. User support works according to a standard three-level model with the inclusion of the HELPS service (student involvement) in the second layer of support. Figure 3 shows that the hierarchical request solution model works. The figure shows only the requests received by HelpDesk and processed in the RT system (2,500 per year); in addition, 13,000 people visit HelpDesk annually in person and certain groups of requests are taken upward automatically (device registration and communication of local administrators).

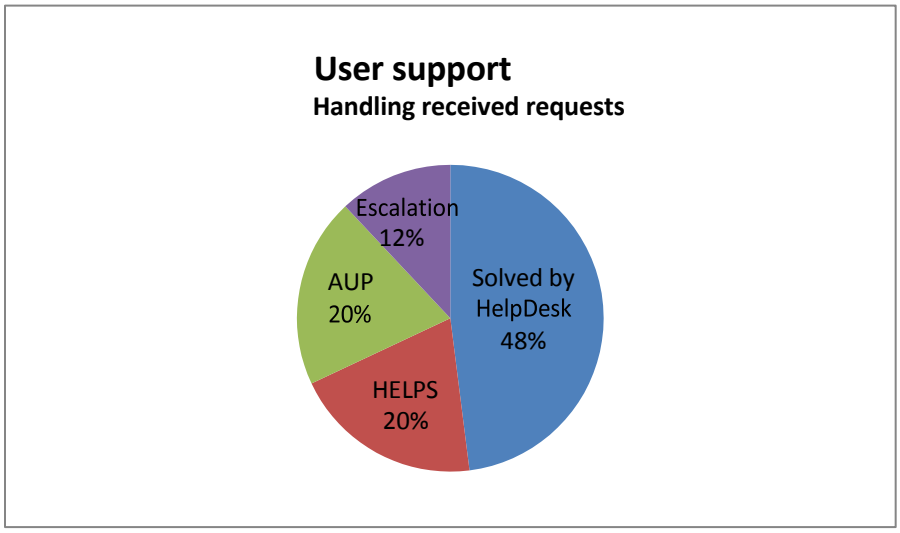

Figure 3: Procedure for processing received requests to operator@service.zcu.cz (2,500 in total); HELPS and AUP also represent on-site interventions; in total 20,000 requests annually pass through the RT system.

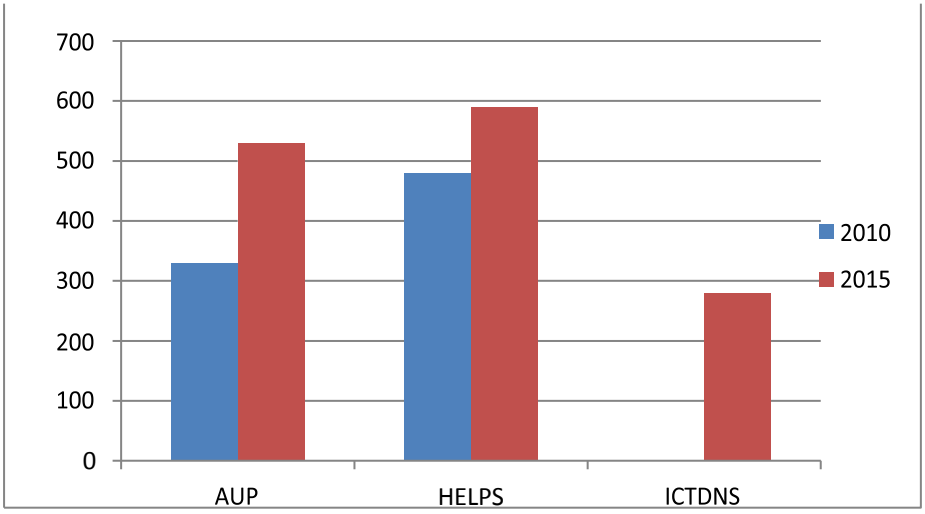

Figure 4: Absolute number of tasks is growing; AUP (internal user support) and HELPS (student service) are addressing the second level of support and on-site intervention; ICTDNS are checking purchases within DNS.

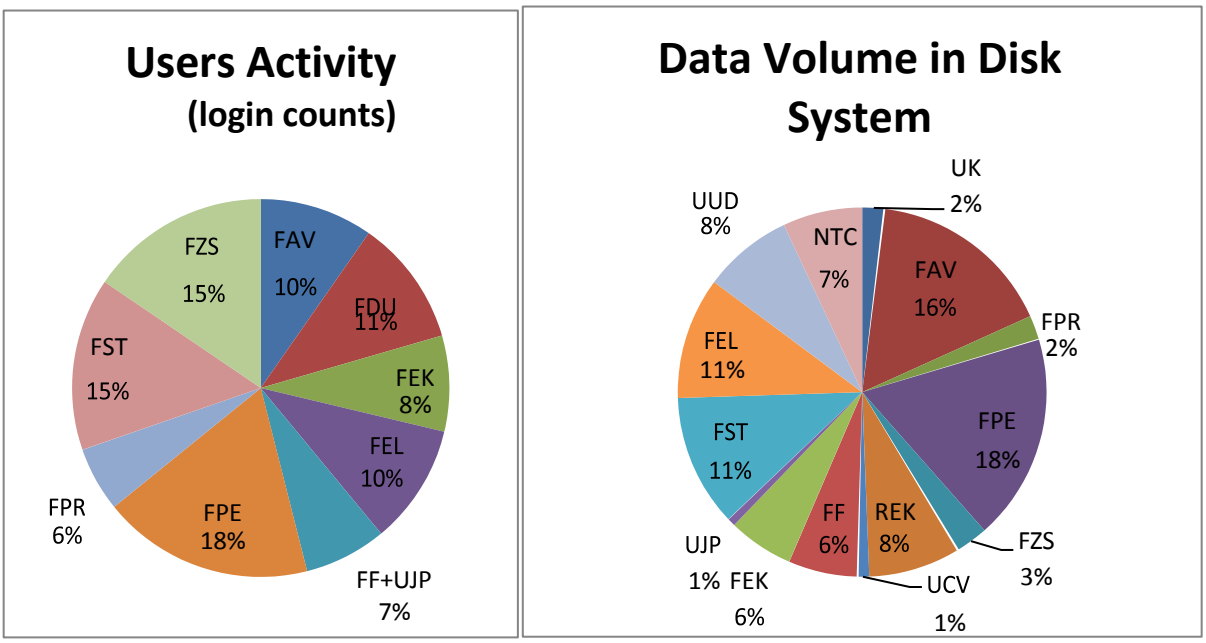

Figure 5: The daily use of computing and ICT services goes across all fields.

ICT Dynamics

We can identify three determining factors:

- **Success of RDI projects, establishment of science centres, and, more generally, strengthening the role of science and innovation.** The trend of data-centric science is only partially reflected. Devices produce data, scientists work with data, demands regarding data storage, backup, and processing are growing, but this has been, so far, a relatively evolutionary change. There has not been a revolutionary change (the need for completely new approaches, science based on the possibility of innovative processing of archival data files, etc.); more generally, the big-data trend has not yet significantly affected us. Development in this direction is ahead of us; there already are, however, "islands" with research based on the processing of large data files. On the other hand, the current situation in this area (a substantial increase in the capacity, performance and reliability of the central data storage) would not have been possible without the RIPO project, which represented a significant "injection" of money and effort. Sustainable growth in administration and reporting is also a sign of changes related to the success of RDI projects.
- **New buildings with new standards, changes of existing buildings (modernization, relocation).** As part of the construction of new buildings and relocations, the working environment is being modernized in line with the set standards. This is reflected in better access to the computer network (number of ports, bandwidth, coverage and capacity of the wireless network), expansion of the JIS system and modernization of telephones. As can be seen in Figure 6, 2014 was a unique year in the history of modernization of PC stations, adding the innovation of IS workplaces (from their own resources) with RDI projects (especially NTIS) and RIPO (the library).

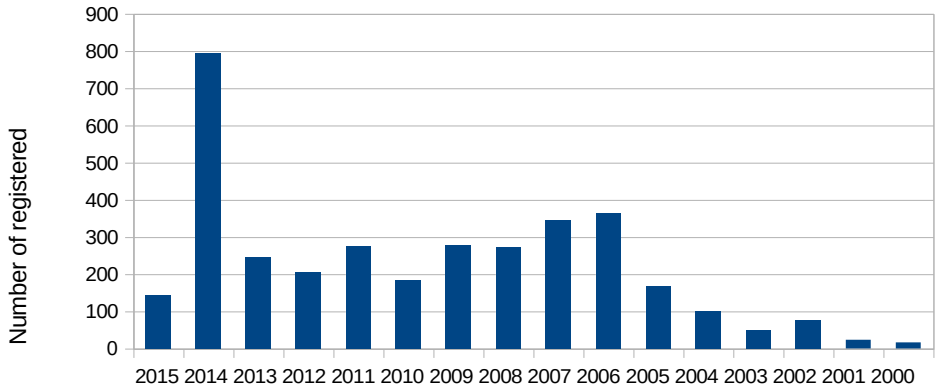

Figure 6: Age structure of PC stations; 2014 represents 25.9 million CZK.

- **Emphasis on quality and effectiveness of teaching.** The core of the support of teaching is the IS/STAG system; students access the portal more and more, and the portfolio of activities supported by it is expanding. New modules are being added and the functionality of existing modules is continuously growing. In practice, this means that the work of both study officers, timetable creators, teachers and other user roles is more and more performed within IS/STAG and less in other systems or in MS Excel or in paper form. The Courseware e-learning support system is being used intensively, although funding has not been found for its modernization and operation. Part of the issue of support for teaching and students in general is the demand for modernization of the ICT infrastructure, which is only partially fulfilled within the available human and financial resources. These demands are both upgrades (e.g. Wifi on the rails) and new functionalities and features (mobility, workflow for guests, etc.).

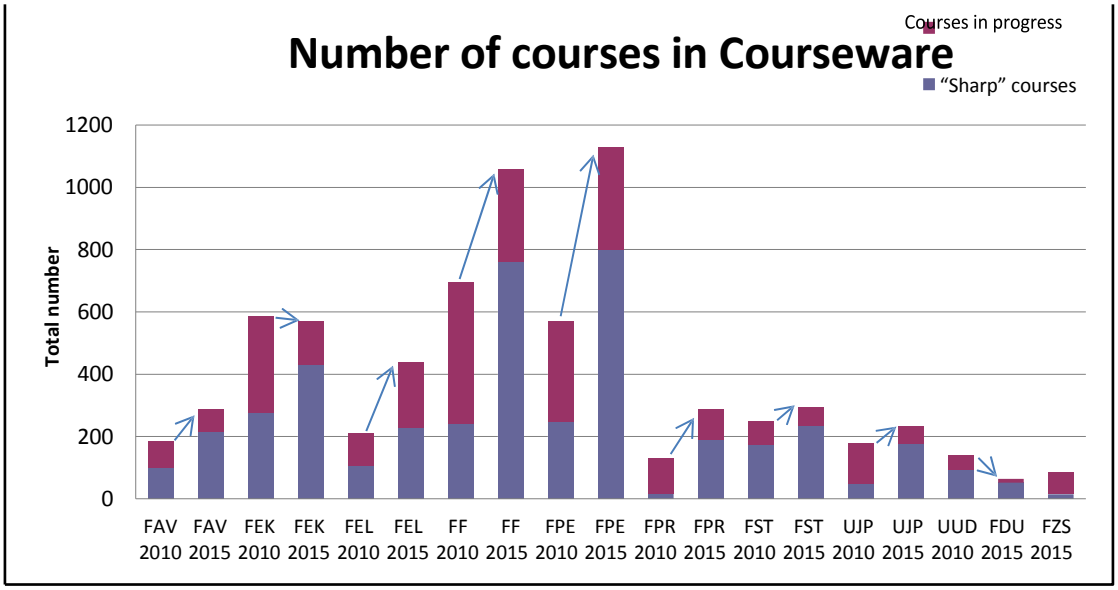

Figure 7: Trend in course numbers in Courseware: a total of 3,103 courses fully connected (2.4-fold increase since 2010) and 1,344 courses in progress.

New big installatio	Wifi access elements
Rails B1 and B2	144
NTIS & CTPVV	99
CVSMD	70

RICE	19
other	51
Total	383

Figure: Number of the Wifi wireless network access elements 2010-2015

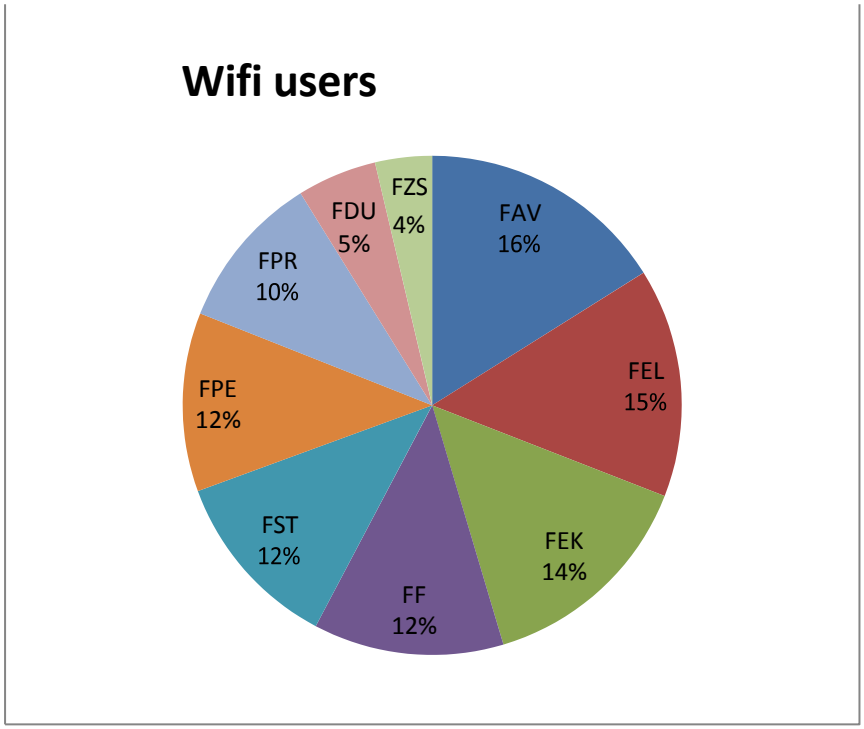

Figure 8: Wireless network users.

ICT Structure of Activities and Degree of Centralization

The structure of ICT activities and the degree of its centralization have not changed significantly; some specific activities are strengthening (large research teams and some centres have their own ICT components in the planned project activities), some activities are weakening (support for classrooms for independent work, reducing the capacity of specialized teaching laboratories), in line with expected trends. The vast majority of workplaces have their own local administrators; the distribution of responsibilities and remits is balanced and creates an effective link between the whole University and individual workplaces. This arrangement is in line with the CIV planning and corresponds to the nature of the environment and its specific needs. At the same time, local innovators work at many workplaces and these represent an irreplaceable source of innovation. The role of CIV in this case is providing access to data (web-services, access to applications and databases for this purpose) and central resources (virtual servers, data spaces), and using successful innovations as input for modernization of central services and applications. Besides the irreplaceability of local administrators and innovators, there is agreement on the necessity for some central or coordinated roles (network, wireless technology, optical infrastructure, AAI, security).

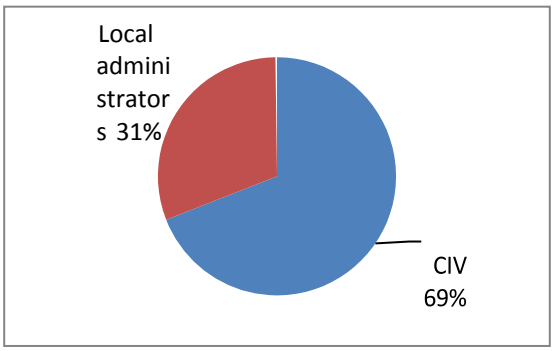

Figure 9: Distribution of user support between CIV and Faculties

State and structure of CIV assets

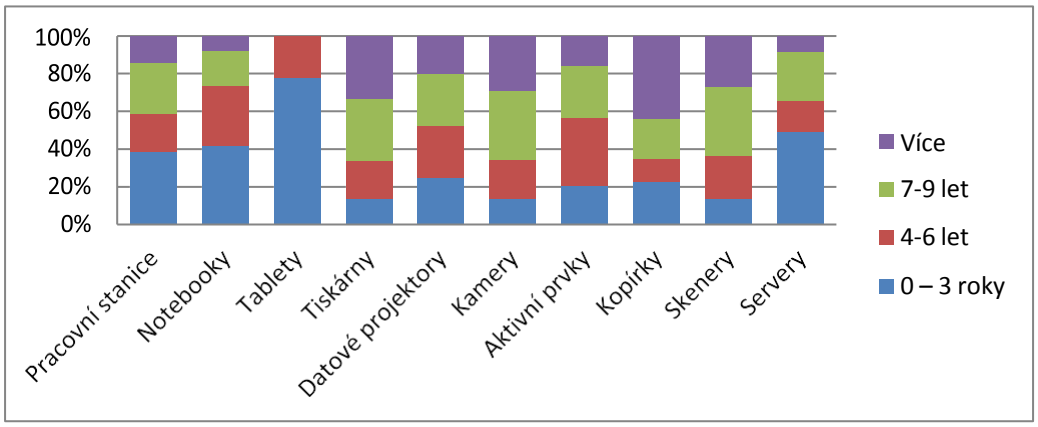

Figure 10: Age of registered ICT assets at UWB.

The structure of assets in terms of year of acquisition does not indicate significant obsolescence in average numbers, but there is a large dispersion between workplaces; a number of specific important activities are performed on obsolete HW. In addition to reliability, maintenance costs and increasing the risk of security incidents, this can have an impact on the ICT energy balance at UWB. The move to mobile devices is evident but not overwhelming (among devices under 4 years of age, fixed PCs represent over one half).

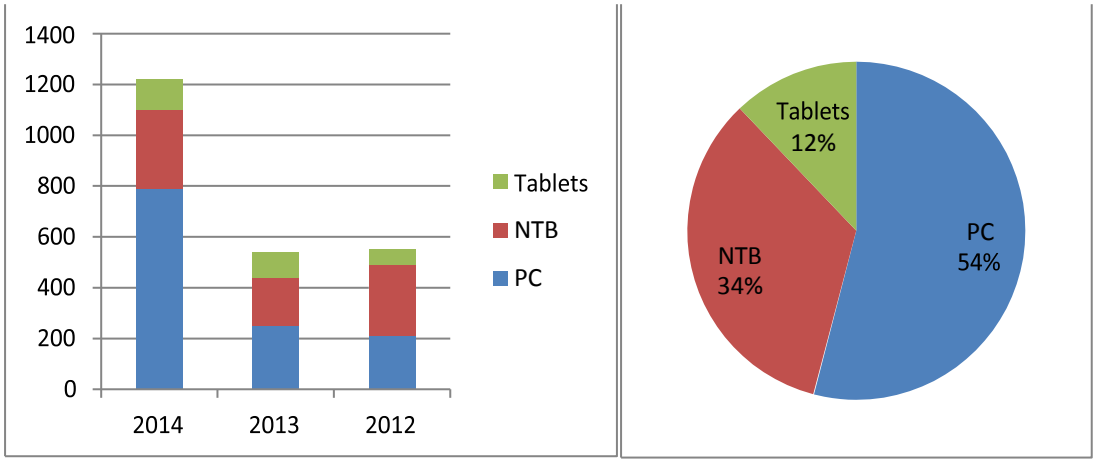

Figure 11: Purchases (pieces) by device type and structure (over 3 years in total).

In connection with the termination of purchases of computers and printers through framework contracts and the transition to DNS, the new equipment is very variable in terms of technology and manufacturers. Of course, this has resulted in increased operating support entitlements, and may soon be reflected in a more complex repair process.

Internal and External Conditions

Wide Range of Services and Needs

The spectrum of services supported is broad and is constantly expanding. This, together with the wide range of users (students, scientists, administration, project managers and research teams), leads to the aforementioned opening of scissors between CIV capacity (human resources, finance, speed of technology deployment) and legitimate user needs. We can respond to change, find appropriate innovations to meet new demands, and play an educational role, but compromises often need to be sought. In this situation, the choice of priorities is a matter of non-trivial communication, an area in which there are reserves. Very often, part of the compromise found is an increase in the internal debt of the CIV, which mainly takes the form of a reduction in the quality of services, limited readiness to respond to exceptional operating conditions and external circumstances, and a form of attenuation of planning work. The whole area of service life cycle management can be considered a weakness.

University Environment

The University environment has a number of characteristics. It is open to the world and yet a popular target for attacks; students and scientists need to experiment and have freedom (independent selection and management of devices, software, and methods of accessing devices or data). At the same time, there is a need for coordination, for various reasons. Another feature is the high turnover of users – students, which results from the mission of the University. The strategy of investing in approaches and instruments that allows respect for the above-mentioned characteristics, not in measures to tie up and repress them, has proven to be successful.

CIV has three roles – not only operation and innovation, but also education. Education means, in particular, educating users to make them responsible and fully fledged cyberspace participants with the right habits and prerequisites for adequate professional growth in the knowledge economy. Linking these three roles effectively while emphasizing the specificities of the University world described above is a key strategic objective of CIV.

An important function of CIV is cooperation with partners. These include municipalities, CESNET, regional secondary schools, technological companies and partner universities. The cooperation is long-term and based on both the fulfilment of the educational role of the University (where the aim is, in particular, attracting quality applicants and lifelong education of graduates) and the area of service provision (where the main goal is the efficiency of operation and corresponding modernization of the computing environment and related processes).

Security

In general, safety can be referred to as the main and connecting trend for the next period. It combines internal and external needs; requirements are coming from all three pillars of ICT infrastructure (operational, management and research). At the same time, security, in the broad sense, has a naturally connecting role. A coherent approach and ongoing coordination significantly strengthen the position of both the organization and individuals against threats.

The main characteristic of security incidents addressed in the last three years is their clustering at a time when they show peaks returning several times a year. Peaks are stronger than the values between them by an order of up to two. The characteristics of the incidents are quite different, the common denominator being that they pose a threat to the University's reputation and operational security. We are also expecting

a shift towards direct economic profit attempts (such as data attacks with ransom elements). Some attacks, during the reporting period, were probably linked to the security situation in the world; Universities as free public institutions with a wide range of activities and opinions naturally attract attention.

Security is a very complex and expensive matter. In addition to technical measures, it is necessary to invest in human resources and appropriate rules, which requires clear support from executives and a relatively intensive and long-term activity with no visible results at first glance. Similarly, any deficiency and underdevelopment are not easy to identify and measure. Moreover, it is not possible to fully manage all risks, yet priorities need to be sought in terms of possible impacts. In the period under review, a number of things were moved forward significantly (technical support thanks to the RIPO project, staff training thanks to management support); on the other hand, however, a number of new needs emerged (new computer network functions for non-compliant terminal elements, such as printers, AV technology, cameras, etc.), barriers and the JIS boom. We are facing a review of contracts with suppliers, investing in deepening crisis planning and conducting regular tests to deal with serious situations. On the horizon, there is the whole issue of IoT (Internet of Things - sensors, automation, operating systems management), embedded systems and a strong link to physical security (attackable devices capable of causing injury or damage). Applied research places higher demands on data leakage protection as well as knowledge of how to process it.

Nové budovy	Snímače JIS
NTIS & CTPVV	411
FDU	73
RICE	70
ostatní	61
Celkem	613

Obrázek 12 JIS snímače 2010 - 2015

Figure 12: JIS sensors 2010 – 2015.

Development and Operation Funding

In [1], several economic analyses and proposals for planning development towards operational savings (especially energy and paper/toners) were carried out. Unfortunately, we do not have the appropriate tool to evaluate the reporting period from this perspective. We believe that there has been a significant improvement in terms of energy (both the new energy centre and the data centre itself are more energy efficient, the computer core for the information system workstations has been replaced), with energy savings estimated at several hundreds of thousands of CZK a year. We probably have reserves in the area of paper consumption (paperless office, modernization of printing equipment).

Basic renewal investments remain the same over the period under review (11 million CZK per year). The modernization of the central ICT infrastructure was significantly accelerated by the RIPO project, thanks to which over 50 million CZK "extra" was invested. The plan for the coming years is to strive for a similar "injection", which is necessary to maintain the increased quality and capacity of the infrastructure as well as the necessary development. RIPO was significantly focused on long-term investments, especially its own data centre and energy centre (at least 10 years service life) and disk system (4-6 years service life). Investments in cloud infrastructure (disk system, servers, network elements) are what we need for the next period).

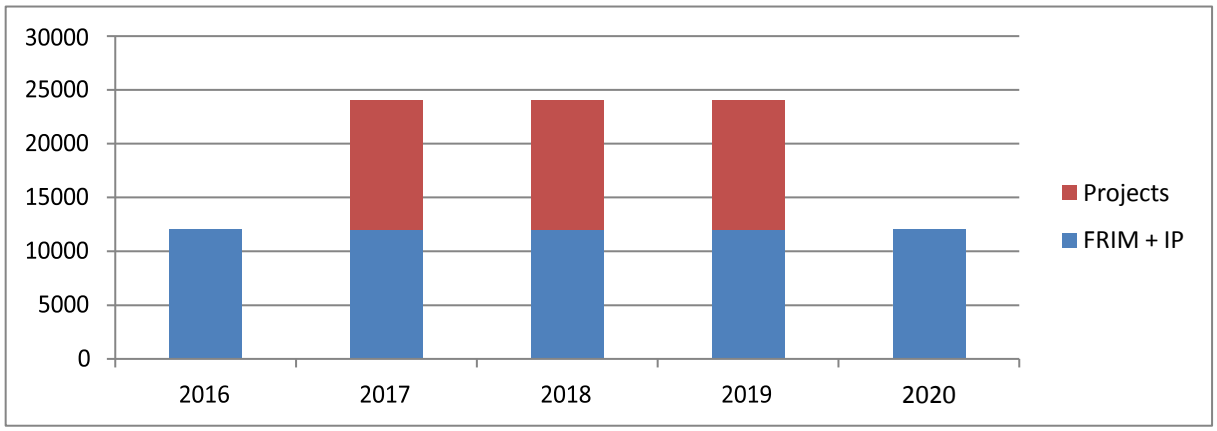

Figure 13: Optimal interconnection of basic resources with project resources.

Strategic Development Plan

All components of the infrastructure must be continuously modernized, developed and expanded in line with technological developments and capacity and quality needs. We are using the principles of cloud computing for the design and implementation of modernization. Virtualization and the cloud approach are being used as a tool to increase operational efficiency, service flexibility and inter-operability. All layers of infrastructure are properly interconnected to function as a higher quality whole. The aim is, of course, to actively use the benefits of this infrastructure in order to achieve operational efficiency and meet the needs of both users and the University. The role of ICT is to be a step ahead of user needs and actively fill the gap between conservatively driven activities and activities based on experimental and advanced solutions. We need to help research teams differentiate the moment it pays to abandon the "run-off rails" and take the risks associated with ICT background innovation.

For the sake of brevity, the infrastructure architecture is described only by the following figure; the following priority directions are a key tool for describing the strategy. Beyond this document, the main technological units have their own development plans, which are the basis for financial and technical planning. These plans are primarily the responsibility of the Heads of the relevant departments, in accordance with the CIV Organizational Rules and Regulations.

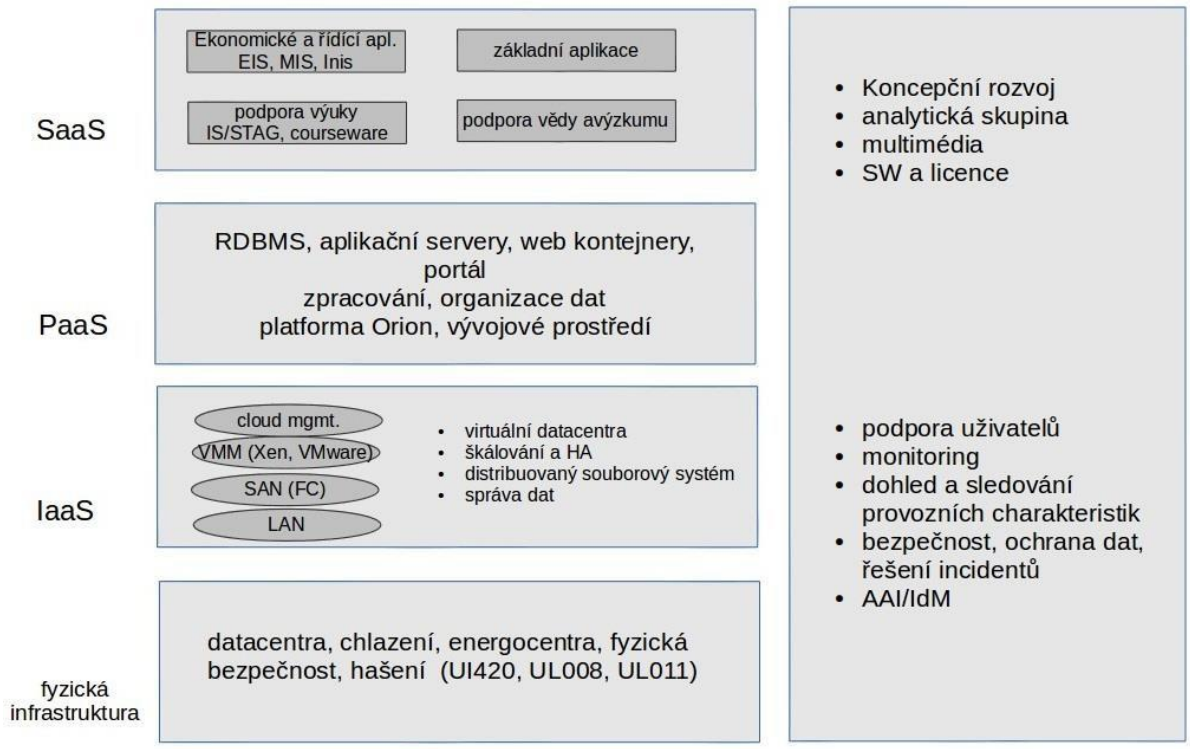

Figure 2: ICT architecture of UWB infrastructure.

Strategic Development Plans

a) Strategic Direction – Cloud Infrastructure

- Infrastructure based on a flexible system that transforms physical resources (computing and storage capacities, communication and other elements) into diverse virtual infrastructures (a set of resources) according to current needs. The benefits of this infrastructure are actively used for achieving operational efficiency, service flexibility and interoperability, and meeting users' and the University's needs. All layers of infrastructure are properly interconnected so as to function as a higher quality whole. Specific new services can be virtual datacentres, platforms and virtual laboratories.
- Data centres and their supporting technologies (energy centre, guarding and access system, fire fighting, cooling) are continuously modernized in accordance with the needs of higher layers of infrastructure. Specifically, all data centres need to be brought to the appropriate technological standards (reconstruction of the remaining smaller data centres).
- Infrastructure is a tool for achieving appropriate quality of service (availability, response, capacity). These parameters are systematically monitored and evaluated as an integral part of the operational characteristics of the infrastructure. It also serves as a feedback for planning the development or modernization of physical resources.
- Focus on strategic cooperation within the Czech Republic in the area of infrastructures for science, research and education, especially through the CESNET association. The key idea is to link local resources to higher units to achieve higher quality – resource management (peaks in needs, addressing temporary outages), standardization, linking specialized human resources, and geographical distribution to reduce risks. This strategic direction develops the basic ideas of grid and utility computing and relies on long-term cooperation within CESNET.

- In the area of network infrastructure design and infrastructure in general, flexibility and efficiency of service provision can be considered a priority, even at the cost of increasing centralization and the resulting restriction of the autonomy of individual locations.
- Infrastructure is divided into the following main components, which have their own development plans:
    - Data centre infrastructure
    - Data and file storage
    - Relational database services
    - Connectivity and basic network services
    - Infrastructure of hardware and software (servers and basic SW)
    - Virtualization and cloud management

b) Strategic Direction – Security

- A comprehensive and systematic understanding of cyber security issues and the growth of its importance for the University and its students. We are expecting ICT security to move to the common level of occupational safety and become a higher education component. In 2020, every UWB graduate must have the theoretical and practical knowledge necessary for safe life in cyberspace. The security awareness of the academic community must be seen as an essential part of the package of measures.
- The emergence of new services to enable end users to access appropriate tools and methods for securing data and information assets in general.
- Continuous assessment of individual elements of the system (infrastructure, human resources, processes) and targeted management of the whole. The aim, in our environment, is not a low number of incidents *per se*, but, above all, adequate coping with dangerous situations and preventing incidents with a significant impact on the University's key activities and assets.
- Developing technical and organizational elements for pro-active protection of infrastructure, applications, data and users towards early warning tools and compliance monitoring. Development of tools enhancing the effectiveness of activities in this area (SIEM – security information and event management, central antivirus, antispam, new generation firewall, IDS/IPS systems, etc.). It is essential to generally see security as an investment for the future and to prepare for the "next wars", i.e. to actively and purposefully work with security elements as an essential part of every layer of infrastructure. Requiring compliance with defined security features and functionalities for each new application and new infrastructure element. Creating space for regular security testing and validation of applicable policies and procedures.
- In the context of the Cybersecurity Act and the National Cybersecurity Strategy, applying a systematic approach to assessing assets and risks, while maintaining all environmental specifics in order to minimize the impact of all measures on restricting or hampering the academic space.
- Strengthening elements of national cooperation, both in the area of coping with major incidents and threats, and in the area of "normal" development. This strategic direction is intertwined with all parts of the ICT infrastructure; the prerequisite for its proper mastery is the adequate professional level of staff, which can be gained mainly through participation in relevant projects and activities at the national and the international levels.
- Identity Management (IdM) is an important “cementing” element of ICT infrastructure interconnecting individual infrastructure components (central and local components operated by UWB Parts) and, at the same time, a basic prerequisite for involvement in national and international infrastructures (eduroam, eduID.cz, e-infrastructure CESNET, EGI, eduGAIN). IdM must be open, allowing the integration of external or loosely bound user identities (public identities such as social networks or MojeId.cz) into services and workflows.
- IdM provides an information and process base for security measures, specifically categorizing users into security profiles by role, job position, qualification, or automatic evaluation of risky electronic identity behaviour.
- This strategic direction also includes the corresponding development of the JIS identification system, access system and tools for electronic identity of users and services. We expect the

development of multi-factor authentication and technical measures to reduce the risks of using passwords as the primary method of identity verification.

c) Strategic Direction – User Support and New User Needs

- Services provided must vary according to the needs of users. Implementing systematic service lifecycle planning based on matching user and the University needs with available technologies and expected trends. Designing and implementing formalized measures for change management and acceptance testing of external and internal products.
- Investing in functional and healthy communication between all parties in the process of operating and developing ICT services. Developing modern forms of information exchange aimed at users' mutual communication and quick feedback regarding the content and quality of available documentation.
- CIV is a partner for key research teams and helps them to find new ways, through ICT, to achieve their goals – excellent results in their field of expertise. This includes, in addition to mobile services, particularly exceptional services, either in terms of capacity or experimental nature (e.g. in the area of a computer network on one side of a high capacity line and, on the other side, services with low and stable latency or other qualitative indicators). The standard portfolio also includes support for the work of teams with an inhomogeneous structure of members (employee, student, guest, external partner) and easy establishment and change of the working team, including the possibility of using external identities.
- We are expecting a significant increase in the links between the University environment and the research application sphere, the need to provide services to commercial research organizations and teams consisting of staff from several institutions.
- In order for the University dormitories to continue to function as a competitive advantage and beneficial tool for students, their ICT infrastructure needs to be modernized, particularly towards wireless networks.
- Continuing the conceptual development of the Wifi network and increasing coverage and capacity based on user needs. Responding appropriately to the trend of expanding wireless technologies, perceiving the frequency spectrum as a vital asset that must be protected and managed.
- Quality and affordable end user support as an integral part of central ICT services. The local administrator and ICT contact for each University Part as a fundamental aspect of a balanced configuration of central and distributed services and applications. Cooperation with students (the so-called HELPS service) as an important tool for the effectiveness of CIV and, at the same time, providing enough internships for students. Maintaining the availability of the HelpDesk in a wide range of operating hours, and strengthening optimal distribution of remits among individual layers of user support.
- Continuing to transform public computer classrooms to make them provide support for students' own (mobile) devices, including appropriate premises and appropriate SW tools. Optimizing the functioning of specialized laboratories, and strengthening the role of virtual laboratories and experimental platforms.
- Building on the established CIV role in education and working with new opportunities. The priority remains the area of LifeLong Learning and the emphasis on regional interconnection (companies, secondary schools, cooperation with PIT – gaining competitive advantage and enhancing the attractiveness of UWB). The main theme for this period will be security, which naturally interconnects with other topics (computer networks, clouds). A secondary objective is synergy with internal staff training and curricula in study fields in the area of security awareness and some OSH equivalent for the area of ICT (Cyber Security Fundamentals).
- Supporting the development of Faculties in the area of multidisciplinary teams with the participation of CIV staff (seeking technological possibilities, guaranteeing uniform architecture and operational efficiency). Supporting the role of "local innovators", allowing them access to data and other resources, and regularly evaluating prototyping solutions that have been developed and "professionalizing" them.

- We are expecting the growing importance of commercial software as an asset to be managed appropriately (shifting costs from HW to SW).

d) Strategic Direction – Support for Teaching

- Development of IS/STAG to achieve required functionality. The key topic will be, in particular, evaluation of quality and, in general, the use of the database of study information in the area of managerial decision-making. The database will be connectable with the data of other IS of the University, especially with financial and personal data. Other development topics are: the extension of study support and presentation of study materials, and information support for new forms of accreditation. The legalization of the so-called Institutional Accreditation can be expected. Support of assignments of end-of-study theses and semester theses from the application sphere. Further development in the area of mobility support and the graduate management system.
- Development of IS/STAG as a robust information system: increasing the security and availability of data and applications, also with regard to remote provision of services to some partner Universities, strengthening the audit system in order to detect attacks, monitoring policy settings, signing documents and improving support for multilingual deployment.
- Extending the connection of the study system with the Moodle system for admission tests. In general, support for e-learning.
- Support for the involvement of selected social networking functions in education. Utilization of positive elements of social networks in common services and applications of UWB IS while maintaining the necessary level of protection of information and users.
- Increased role of audio-video techniques so as to support learning, enabling online learning, supporting the study of foreign students, supporting the preparation of multimedia learning aids and teaching support.

e) Strategic Direction – R&D Support

- Tools for building virtual infrastructures linking teams and collaborating institutions. Providing a substrate on which research teams or their internal ICT professionals can build customized services or prototype new solutions.
- Support for "scientific operation", i.e. transmission, storage and processing of data, support for research based on electronic workflow and "in-silico" experiments. Support for the Big Data concept, data management tools, including long-term storage and data "maintenance" (data curation). Tools necessary for reporting and administration of research and project activities (laboratory and instrument log, job reporting) and presentation of results (open access).
- The main objective in this area is ICT support for research teams, projects and individuals in achieving success in their field of expertise. An important tool for this is the mediation of cooperation and services provided within the framework of national and international cooperation of research infrastructures.

f) **Strategic Direction – Management and Administration Support**

- Continued development and in some cases reconstruction of major information systems and sub-systems (EIS, MIS, support for management and decision-making). Supporting the introduction of new processes and electronization of existing processes (e.g. evaluation of services, public procurement contracts, reporting and management of the use of RDI resources). Modernization of solutions for unified handling of documents and their interconnection into relevant sub-systems (DMS).

- Unified communication platform. Streamlining information transfer and daily communication. Enhanced support for the University's presentation and external relations (website, Portal and other "showcases" are linked by tools for creating, approving and distributing their content).
- Upgrading of the backbone network of end stations (Orion IS), modern measures for flexibility of end stations (virtualization), operational efficiency (energy consumption) and optimization of printing services.
- Support for new generation administration of buildings and property, enhanced management of real estate and technology infrastructure, modernization of ICT infrastructure for buildings, the "smart building" concept.
- Support of operational decision-making at all levels of management, and simplified access of ordinary employees and lower management segments to relevant information in central systems (financial, operational, personnel information).
- Modern solution for unified work with documents (DMS) and its connection to relevant sub-systems.
- Unified communication platform and tools for efficient transmission of information in daily communication both within the University and with external entities.

Major Methods for Achieving Strategic Goals

- Central infrastructure meeting the needs of modern science and education (emphasis on data, reporting, experiment management, virtual laboratories, efficient communication).
- Reducing administrative burdens by optimizing processes and further expanding the use of ICT. Operational efficiency of services (energy consumption, optimization of printing services).
- Support for presentations of the University and external relations (website, Portal and other "showcases" linked by tools for creating, approving, and distributing their content).
- Responding accordingly to new trends and needs of users (employees, students, guests).
- Strengthening the lifecycle management of applications and infrastructure elements; designing and implementing formalized change management and product acceptance testing measures.
- Unified and centrally managed set of information systems; centralized management of key end stations. Increasing internal flexibility and efficiency of central ICT; new services – virtual datacentres, platforms, virtual laboratories and development environments.
- Systematic monitoring and evaluation of service quality parameters that serve as feedback for planning development and operations control.
- Development and emergence of new services in the area of tools and methods for securing data and information assets in general. Continuous assessment of individual elements of the system (infrastructure, human resources, processes) and conceptual management of the whole.
- Developing proactive infrastructure, data and user protection, early warning tools and effective compliance monitoring. Requiring compliance with defined security features for each new application or infrastructure element.
- Strengthening the elements of cooperation and coordination for managing major security incidents and threats. Establishing Action Plans and an Emergency Coordination Team.
- Services reflecting the links between the University environment and research application sphere and the need to provide these services to commercial research organizations and teams from several organizations.
- Continuing the conceptual development of the WiFi network; perceiving the frequency spectrum as an essential asset that needs to be protected and managed.
- Connecting existing relatively isolated communication tools (email, disk and document storage, wiki, videoconferencing, streaming, telephony) into an integrated whole. Using the elements of social networks while maintaining the necessary level of information protection.

- Building on the established CIV role in education, and working with new opportunities. The area of Lifelong Learning and the emphasis on regional interconnection remain a priority.
- Supporting multidisciplinary development teams involving CIV staff (seeking technological options, guaranteeing unified architecture and operational efficiency). Using local innovators, allowing them access to data and other resources, regularly evaluating prototyping solutions and ensuring their operational implementation.
- The study information system as a source of improving the quality of teaching and curricula.
- Extending the interconnection of the study system with e-learning systems (Moodle), and using the e-learning tool also for admission procedures.
- Enhancing support for online learning, audiovisual teaching aids, and supporting the study of foreign students.
- Creating a management information system for the current records, which will support strategic decision-making at the level of Faculties and the University.
- Support for research centres in the area of contract research and additional activities. Planning, modeling and creating variants. Interlinking data from databases.
- When selecting technologies and solutions that provide services, pursuing a strategy of an optimal mix of technologies, licensing conditions and operational support. Preferring open solutions and standards and trying to avoid strict licensing models and support conditions based on the number of users or otherwise restricting general availability across UWB.

Indicators

- UWB operates an infrastructure based on the principles of cloud computing.
- All infrastructure components are continually upgraded and strengthened in line with technological developments and capacity and quality needs.
- Managing critical situations and preventing incidents with significant impact. The indicator is the achievement of 80% of incidents managed without serious impact on the operation of the University.
- Central IdM automates the management of access permissions, and ensures and implements ongoing evaluation of compliance with approved policies.
- Courseware 2.0 is introduced and works, extended by elements of social communication.
- Financial resources for central ICT are handled transparently. CIV is consistently used for obtaining part of development funds in the form of projects and cooperation. Operating parameters and service conditions are disclosed.
- New data warehouse contains study data for managerial decision-making.
- Interconnected system for effective planning, management and reporting of research results.
- Basic administrative and control processes (paperless administration) are in electronic form.

References

[1] ICT development strategy at UWB, medium-term outlook for 2010-2014, http://download.zcu.cz/secure/doc/web_civ/Strategie_IT_V2.pdf

List of abbreviations and acronyms

- ICT – Information and Communication Technologies
- IaaS – Infrastructure as a Service
- PaaS – Platform as a Service
- SaaS – Software as a Service
- VMM - Virtual Machine Monitor, technical implementation of virtualization

- HA – High Availability – system feature for high availability
- IdM – Identity Management (electronic identity lifecycle management system)
- BYOD – Bring Your Own Device (the issue of the use of private devices for work)
- PIT – Platform of Information Technologies http://www.pit-plzen.cz/
- RIPO – RDI OP project implemented in the period 2012-2014
- DMS – Document Management System – system for managing documents
- EIS – Economic Information System (at UWB mainly Magion)
- MIS – Management Information System (at UWB mainly INIS and Portal applications),
- VaVpI – Operational Programme Research and Development for Innovation
- EGI – European infrastructure for demanding computing and data processing
- eduGAIN – European Academic Identity Federation