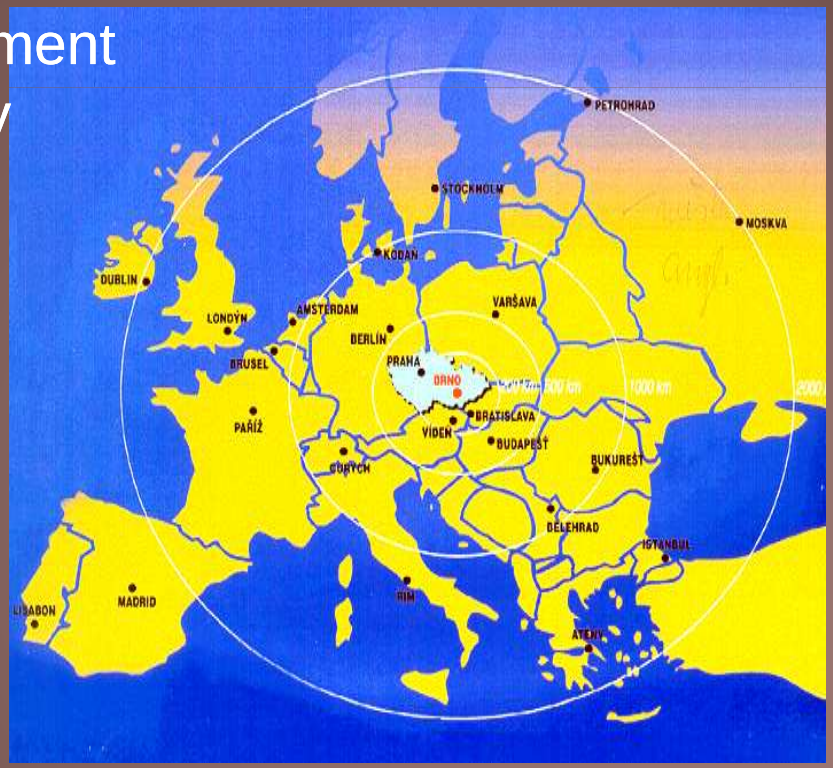
Faculty of Electrical Engineering and Communication

Brno University of Technology

Brno University of Technology

- Faculty of Civil Engineering
- Faculty of Mechanical Engineering
- Faculty of Electrical Engineering and Communication
- Faculty of Business and Management
- Faculty of Information Technology
- Faculty of Chemistry
- Faculty of Architecture
- Faculty of Fine Arts

- 23 000 students
- 2 500 academic staff
- Bc, MSc, PhD study programs
- Research, cooperation



HR and students

as of beginning 2009

- 204 professors, associate professors, assistents
- 187 other staff

- 2 840 Bachelor students
- 1 250 Master students
- 394 PhD students

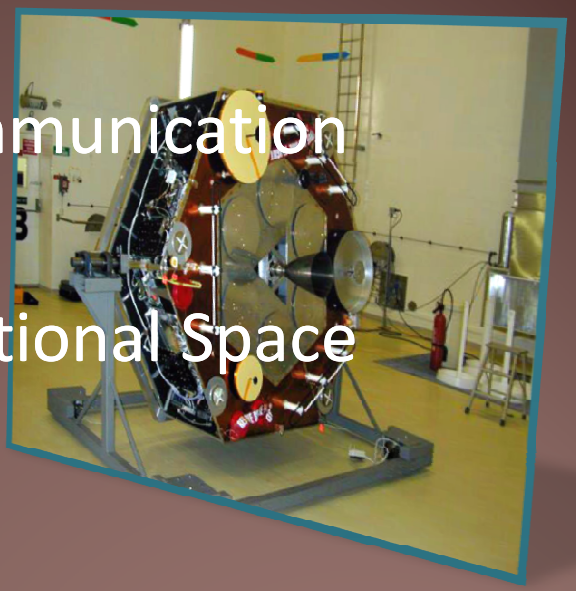
- 4 484 students total

In which branches we excel

- Automation and embedded systems
- Biomedical engineering
- Electrotechnology
- Microelectronics
- Power electrical engineering
- Radio electronics and satellite communication
- Telecommunication

International achievements in R&D

- Control station for experimental communication satellites AMSAT
- Communication modules for International Space Station



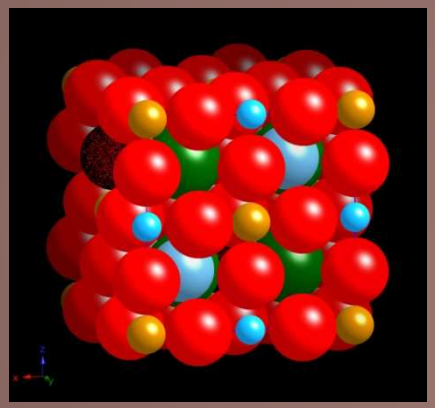
- Rescue robots Orpheus for extreme conditions

Operational programmes of EU

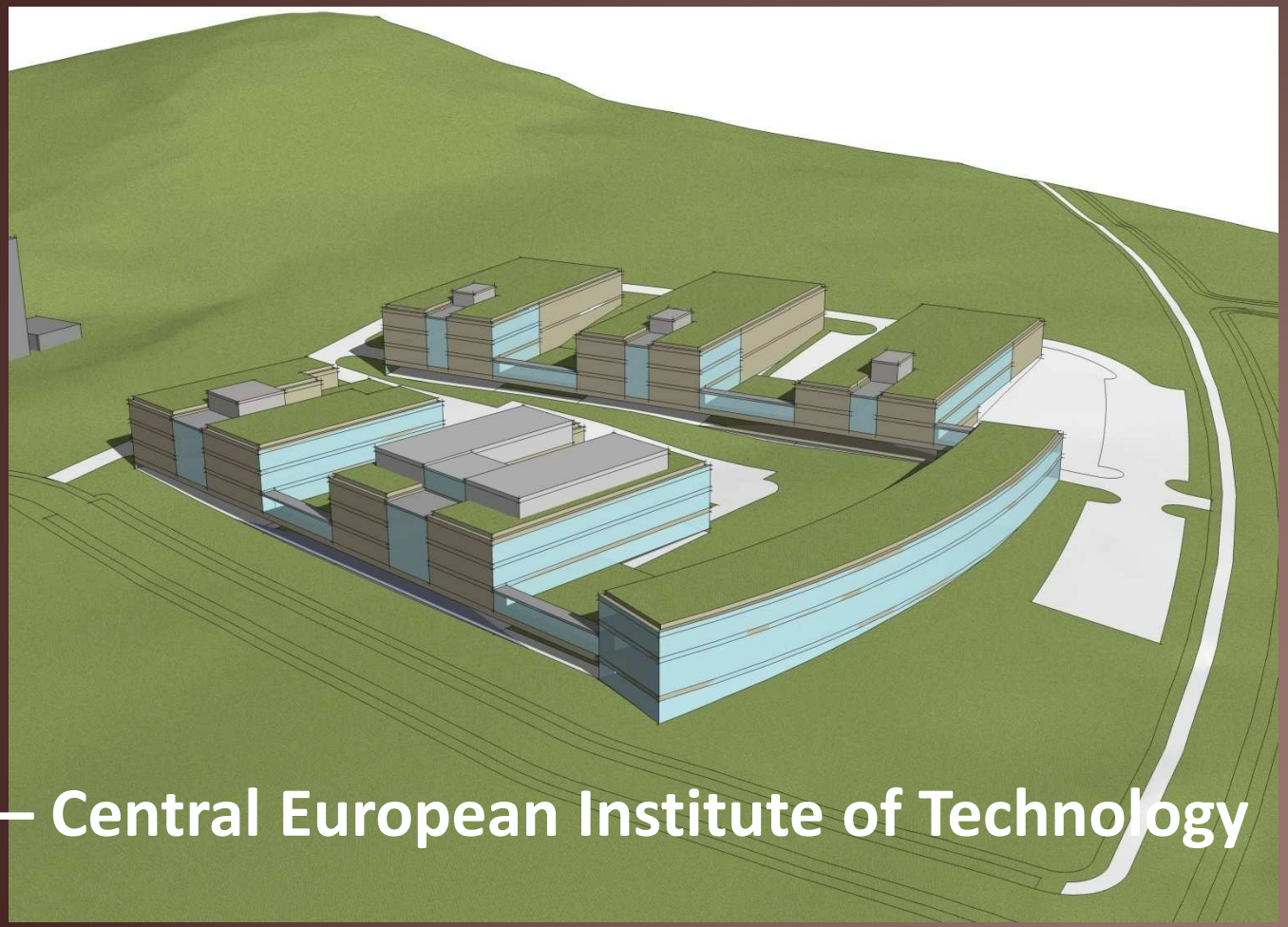
CEITEC – Central European Institute of Technology

- Bio and life sciences,
- Material sciences (ceramic, polymeric, metallic materials and composites, nanomaterials)
- Advanced technologies (nanotechnology and microtechnology, manipulation of the light beam, imaging technology, wireless communication and hypermedia services).

Estimated financial size
of investment at present
is approximately
6.5 bil. CZK (325 mil. EUR)

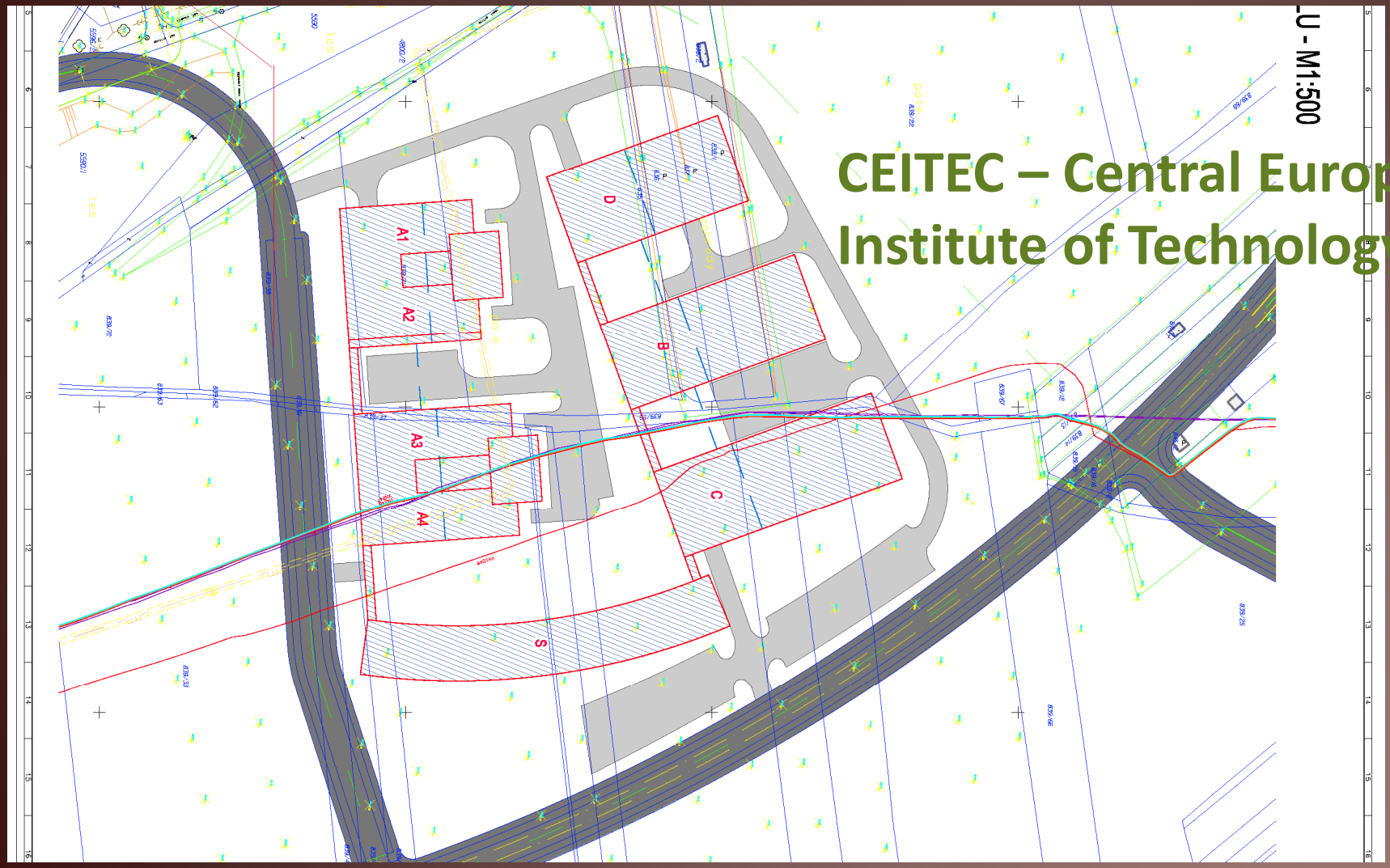


Operational programmes of EU



CEITEC – Central European Institute of Technology

Operational programmes of EU

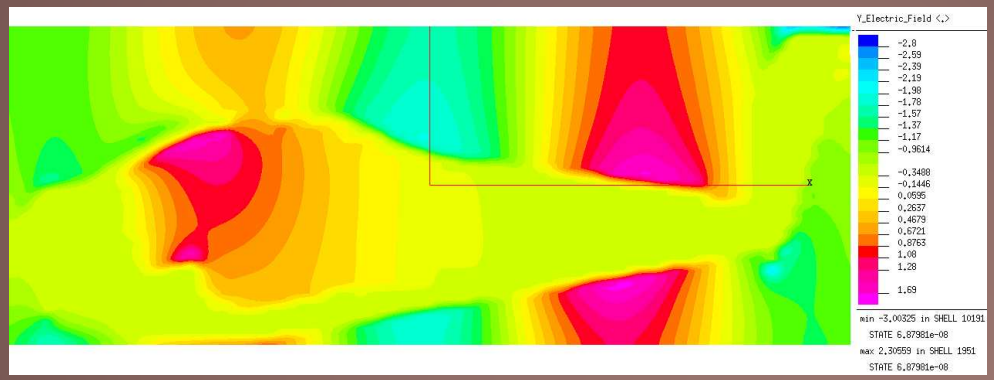


CEITEC – Central European Institute of Technology

Operational programmes of EU (OP VaVpI)

Research and Development for Innovations

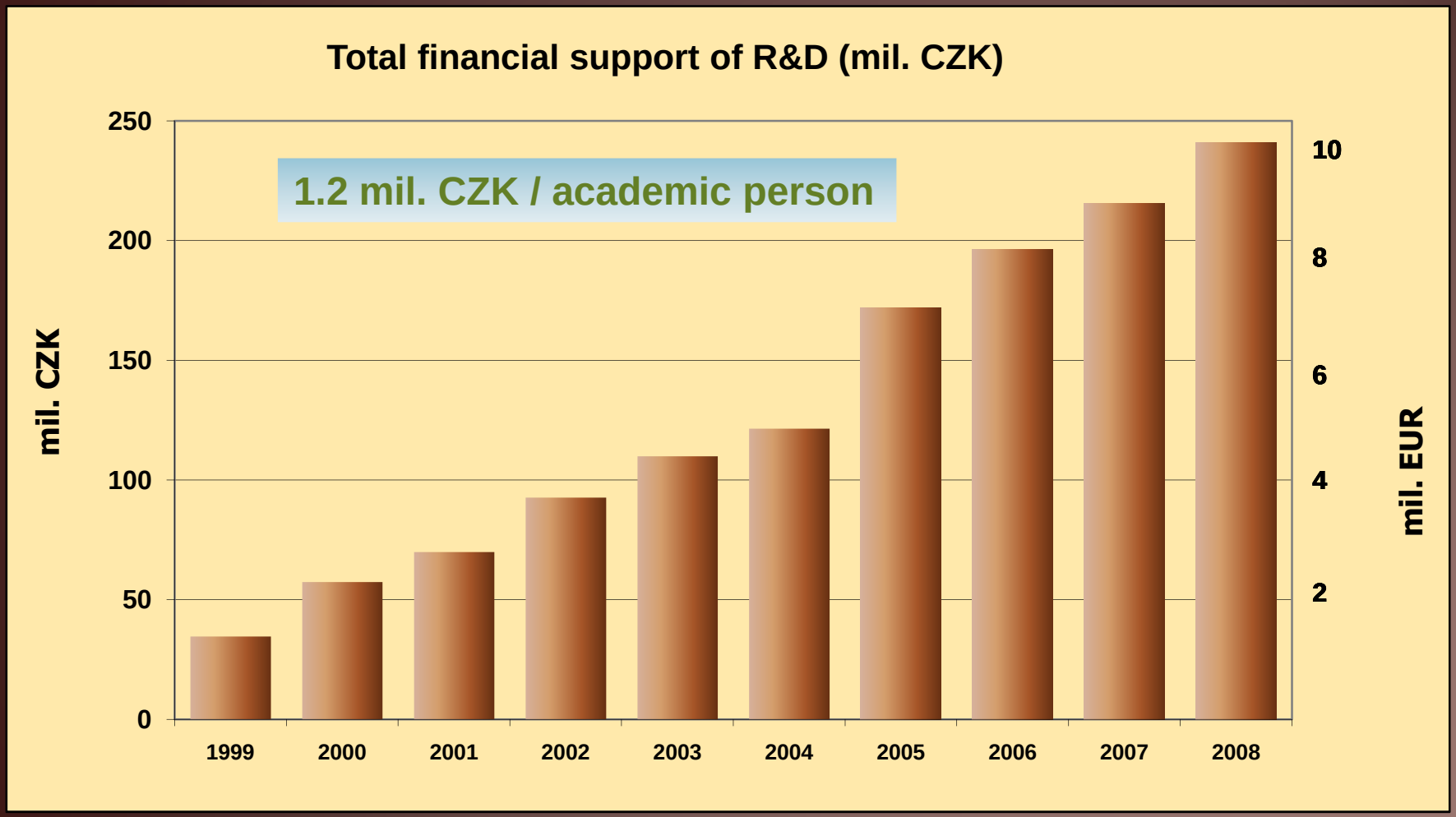
1. **Research and Technology Centre of Renewable Energy Sources** (330 mil. CZK)
2. **Centre of nano-electronics and nano-systems** (380 mil. CZK)
3. **Centre of advanced information and communication technologies** (360 **mil. CZK**)



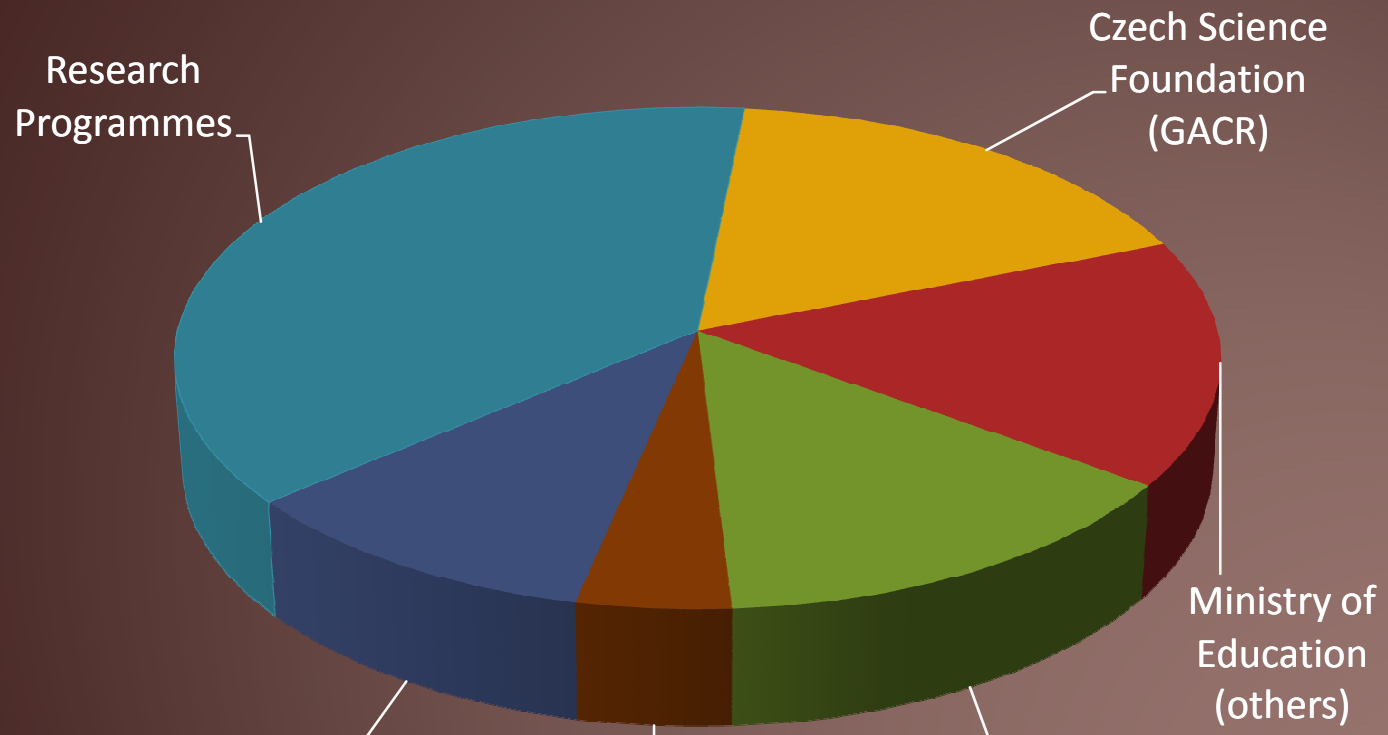
Total proposed costs
1.1 bil. CZK
(approx. 44 mil. EUR)

Proposed time schedule: 2010 to 2013

Funding of R&D at FEEC



Financial support of R&D at FEEC in 2008
(total 241 mil CZK / 9.64 mil EUR)



Excellent Teams

Wireless Communication

Prof. Zbyněk Raida

raida@feec.vutbr.cz

Brno University of Technology

Department of Radio Electronics

Research team

E
M
C

systems

- Wireless communication: optical, satellite, mobile
- Broadcasting

components

- Microwaves, antennas

basics

- Circuits, signals
- Computational electromagnetics

Research projects (selected)

IC0803: RF/Microwave communication subsystems for emerging wireless

Advanced communication systems and technologies

DAB / software defined radio

FM tuners measuring system

Laboratories (selected)

radio applications

satellite communication

free space optics

digital tv technology

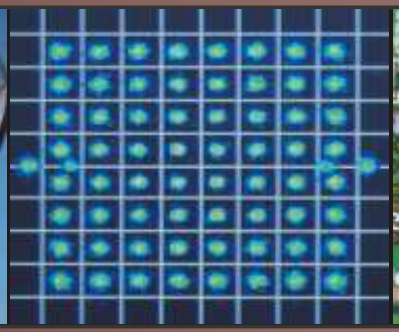
Other activities (selected)

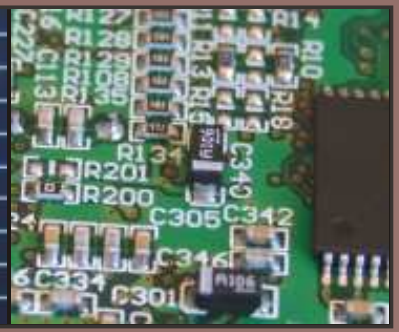
www.radioeng.cz

Radioengineering

www.radioelektronika.cz

19th International Conference
Radioelektronika 2009





IP Multimedia Communications

Dr. Dan Komosný

komosny@feec.vutbr.cz

Brno University of Technology

Department of Telecommunications

Research team

Dan Komosny, team manager

IP multicast, IPTV technology, localization of Internet nodes

Jakub Müller, junior researcher

large-scale multimedia systems, distributed IP systems

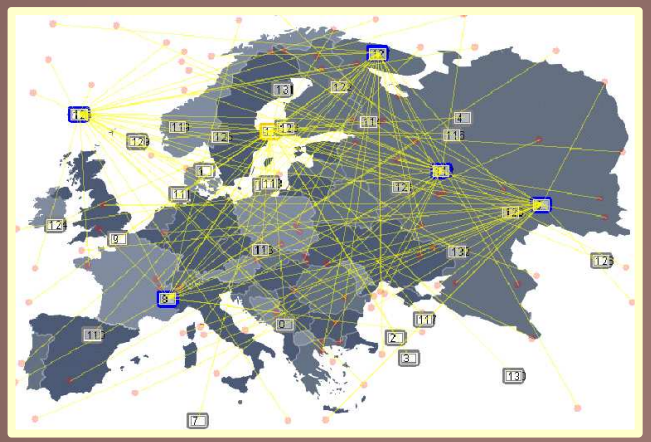
Radim Burget, junior researcher

Internet coordinate systems, genetic programming, data mining

+4 senior researchers and 4 PhD students in the team

Research projects

- Research of mechanisms for improving access to higher quality services in new generation data networks (2009-2011)
- Feedback Distribution Framework for Single Source Multicast (2007-2009)
- Optimization of methods for IP multicast networks (2005-2008)
- Sophisticated method for quality of service assurance in next generation mobile networks (2006-2008)
- Universal architecture for interactive services in terrestrial digital television (2005-2007)
- Quality of service in trunk radio networks (2003-2006)
- Communication protocols for networks with dynamic routing (2002-2005)



Laboratories

Laboratory of IPTV streaming

- IPTV broadcasting experimental network with IP/TV Program Manager, IP/TV Server, IP/TV Viewer, Cisco routers 1800, Cisco switches, WLAN networks

Laboratory of multicast communication

- IP multicast experimental network with Cisco routers and Cisco Catalyst 2960-24TT switches

Laboratory of unified communication technologies

- Experimental MOTOROLA mobile network, experimental IP Access/PMN mobile network, VoIP technology (Asterisk), H.323 (OpenH.323), Cisco (Call Manager), Siemens HiPath 3000, telephone exchange A4400, Eurogeneris, mobile terminals HSPA - N96, HTC P3700 Diamond a Sony-Ericsson Xperia X1




Other activities

International cooperation with

- University of Coimbra, Portugal, School of Computing & Information Technology, Unitec, New Zealand, ...

Members of technical program committee of international conferences

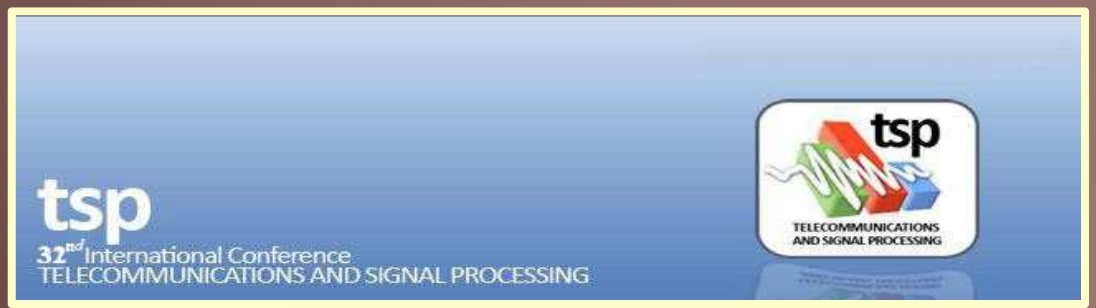
- IEEE International Conference on Scalable Computing and Communications, IEEE International Conference on High Performance Computing and Communications, ...

Members of editorial board of international journals

- International Journal On Advances in Networks and Services

Organization of Telecommunications and Signal Processing (TSP) conference

Web page
adela.utko.feec.vutbr.cz/projects/



Wireless Sensor Networks

Dr. Milan Šimek

simek@feec.vutbr.cz

Brno University of Technology

Department of Telecommunications

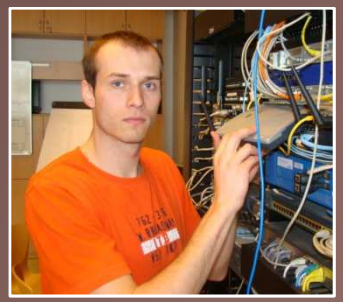
A1

Research team

Members of ***DINES (DIstributed NEtwork Systems)*** research group

Milan Šimek, team leader

Development of localization and data aggregation algorithms for WSNs, multicasting in WSNs and IP networks



Patrik Morávek

WSN network modelling and simulation

International members(PT)

Jorge sá Silva
Mobility and QoS in WSN

Ricardo Silva
Hardware programming

Pavel Holešinský
Hardware development

+ 3 another members

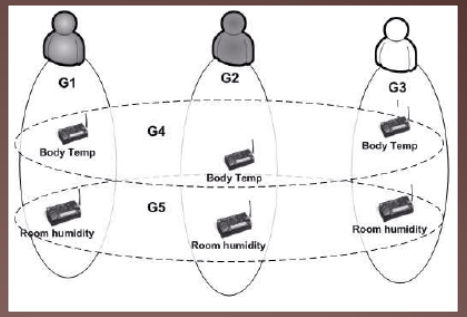
A1 WSN team is part of DINES Research group of Department of Telecommunications, FEEC. Its members are focused on the research in the field of wireless sensor network communications. Kdo co z týmu dělá naleznete u jednotlivých členů. Our team collaborate with the research team from Portugal, University of Coimbra (Silva+Silva).

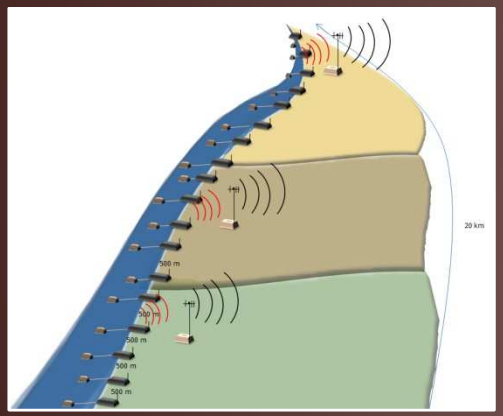
Autor; 8.4.2009

Research projects

A2

Multicasting in Wireless Sensor Networks
Investigation of multicast data distribution in WSN, Portugal project, (2006-2009)





Research and Deployment of Sensor Networks for Sustainable Managing of Natural Resources
Wireless Sensor Networks for Water Quality and Water Floods Monitoring (2009-2012), Czech project

Mechanism of High-Quality Services Discovery in New Generation Data Networks - Research of QoS mechanism for wireless networks, (2009-2011), Czech project

Snímek 25

A2 Our previous and present project are focused on the investigation of communication aspects for WSNs. We have experiences or actually work on the challenge of multicasting and also on the utilization of WSN for water quality monitoring. Detaily projektů viz slajd.

Autor; 8.4.2009

A3

Laboratories

FOR OUR RESEARCH WE USE

MicaZ motes, *(Crossbow, Inc)*. – 2,4 GHz wireless programmable modules

SUN Spots *(Sun Microsystems, Inc) JAVA Development KIT*

+ own designed hardware

in development phase☺

Snímek 26

A3 For the investigation we have deployed the experimental testbed consisting of the wireless modules from Crossbow company. This modules called MicaZ are well know in the field of WSN investigation. We use tjese sensors to verify our algorithms and to obtain experience for designing of our own hardware. We also use the modules from Sun Microsystems, SUN SPOTS. Our effort is focused on the develoment of our independent hardware modules.

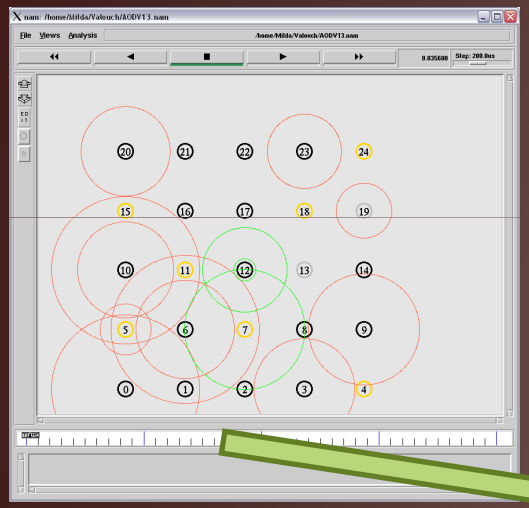
Autor; 8.4.2009

A4

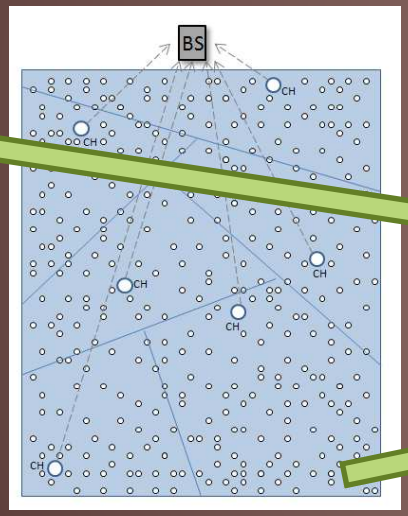
Other activities

We are focused on

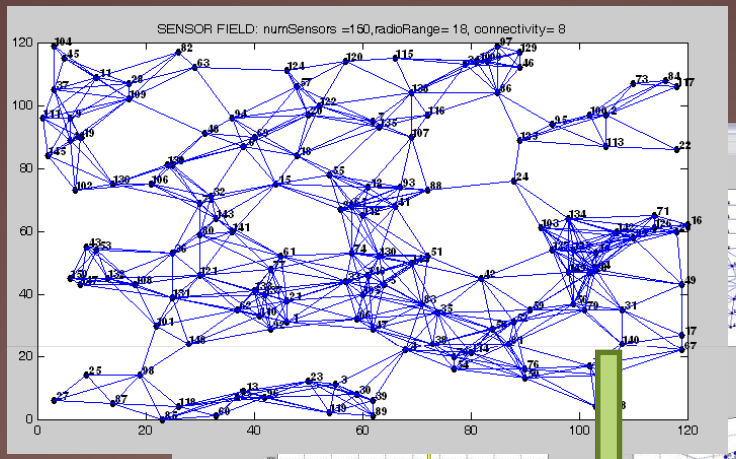
WSN multicasting

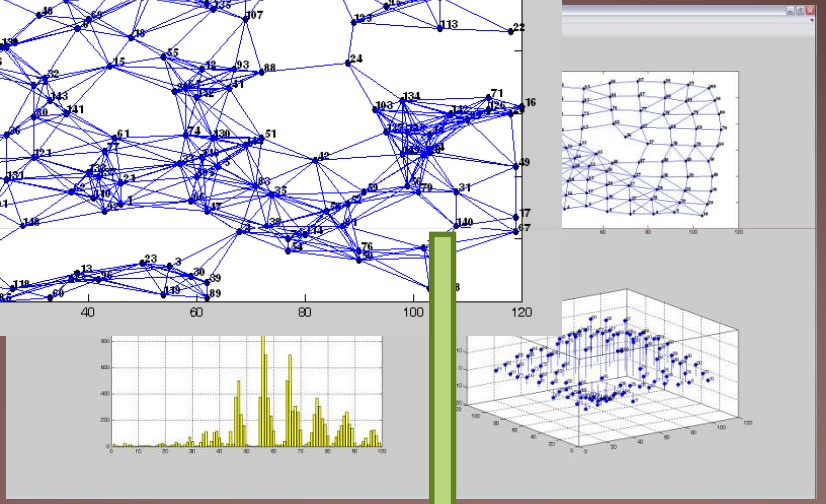


Effective data aggregation



Localization issue





for ENVIRONMENTAL SUSTAINABILITY

papers and research:
http://adela.utko.feec.vutbr.cz/projects/

A4

In our work, we are interested in the issue how to localize the individual sensors in the sensor field. How to save the energy of nodes that use only 2xAA acumulators - this energy saving we investigate upon multicast using. Also we try to propose the new effective algorithms for data agregation using the hierarchical structures. All our work and mainly results, we would like to use for deploying of modern and effective wireless sensor networks for monitoring environmental phenomenas and thus to contribute for environmental sustainability. It could be, water quality monitoring, land quality monitoring, radiation, air pollution and so on.

Děkuji. M.Šimek

Autor; 8.4.2009

Embedded Control and Meassurement Systems, Communication Systems

Assoc. Prof. Zdeněk Bradáč

bradac@feec.vutbr.cz

Brno University of Technology

Department of Control and Instrumentation

Research team

Zdeněk Bradáč, team manager

Embedded control and Data acquisitions systems, communication interfaces

Pavel Kučera, researcher

Embedded systems, RT control systems, Formal system design and verification

Marie Havlíková, researcher

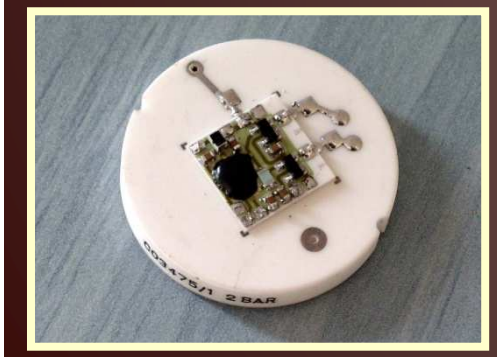
Human-in-the-loop, Control systems, EMI

+2 PhD students in the team

Research projects

- *Next generation pressure sensor (FF-P/112 – MPO CR, 2002-04)*
- *Research a new technologies and methods of differential pressure measurements (FT-TA/050 – MPO CR, 2004 – 2007)*

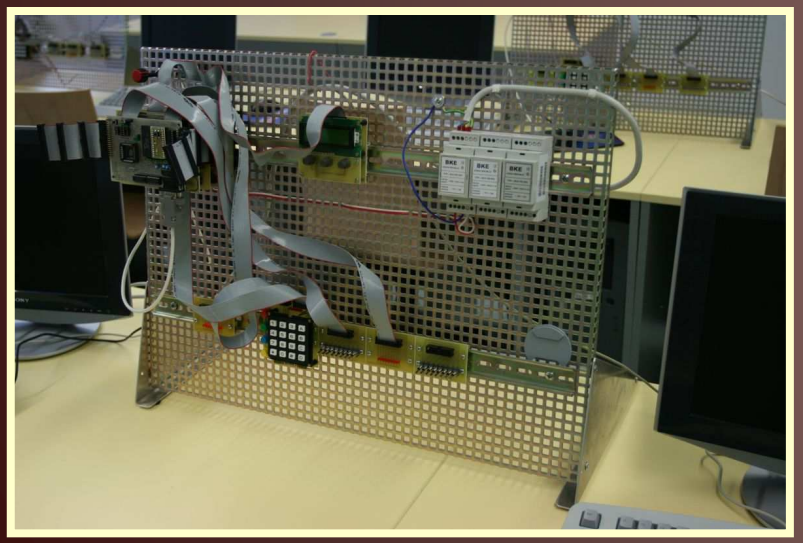
- *Research and development of economically favourable information and security system … (FT-TA2/095 – MPO CR, 2005 – 07)*
- *Implementation of state machines in RT OS (GA CR, 2009-10)*
- *ZigBee Wirelles Technology in Decentralized Control Systems (GA CR, 2005-07)*



Laboratories

Laboratory of Embedded Systems:

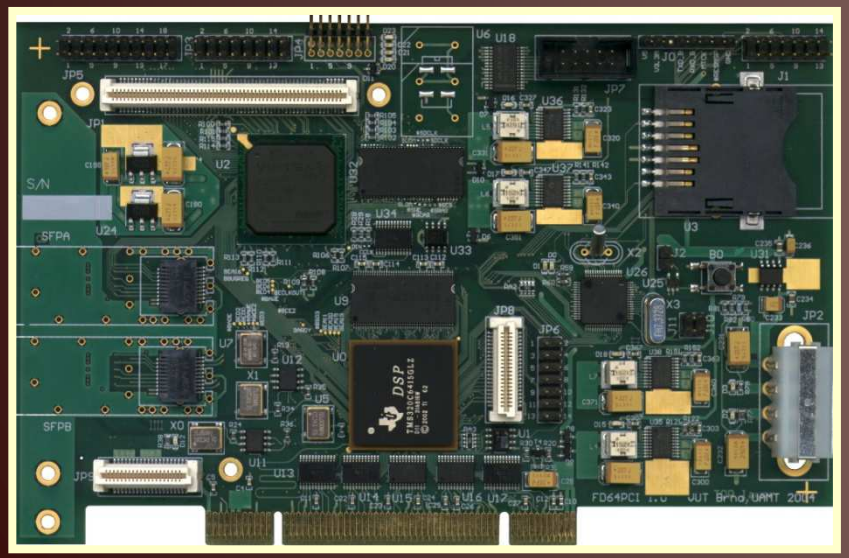
- Development environments for i51, Rabbit, ARM7, ARM9, …
- Range of debugging and diagnostic tools
- SW Tools for HW & SW development
- RT OS, State machine based design, Formal verification, …



Research interests

Relevant ICT Challenges

- *1.3 Internet of Things*
- *3.5 Engineering of Networked Monitoring and Control Systems*



Industrial Communication Networks and Industrial Ethernet, Safety and Security

Dr. Petr Fiedler

fiedlerp@feec.vutbr.cz

Brno University of Technology

Department of Control and Instrumentation

Research team

Petr Fiedler, team manager

Interoperability in communication systems, real-time communication systems, safety and security in communication

Radek Štohl, researcher

Industrial networking, smart sensors, industrial control

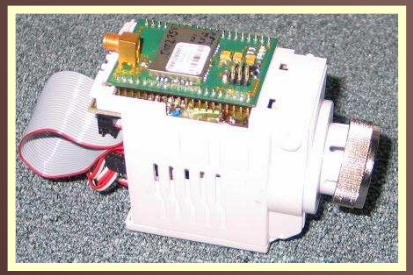
Soběslav Valach

High-speed communication interfaces, high performance embedded systems

+2 PhD students in the team

Research projects

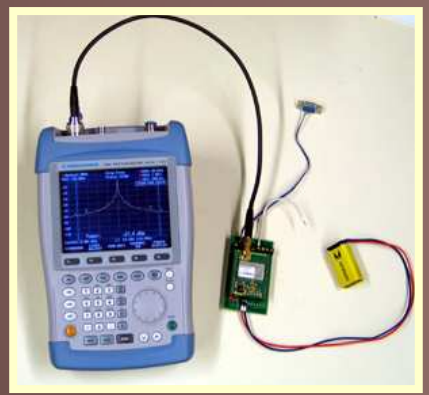
- *Virtual Automation Networks (VAN IST-FP6 Integrated Project, 2005-09)*
- *Research of new methods of pressure measurement with galvanic isolation … (FT-TA2/087 – MPO CR, 2005 – 08)*
- *Research of a new technologies and methods for differential pressure measurements ... (FT-TA/050 – MPO CR, 2004 – 2007)*
- *Research and development of economically favourable information and security system (FT-TA2/095 – MPO CR, 2005 – 07)*
- *Development of common control system (FI-IM3/040 – MPO CR, 2006- 08)*



Laboratories

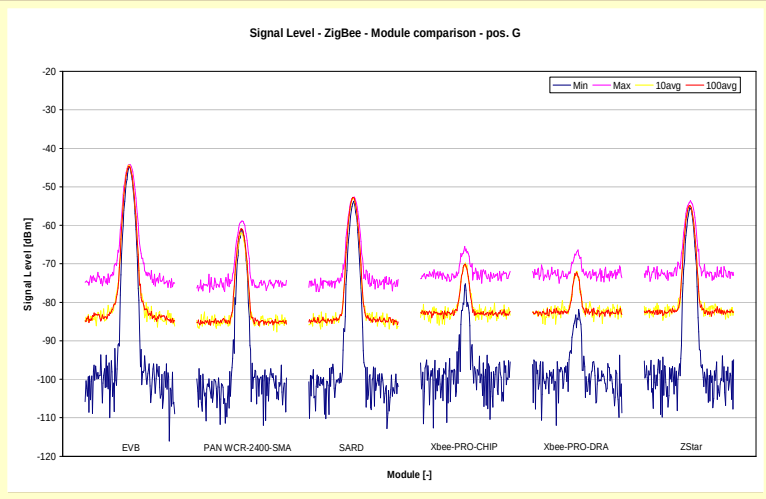
Laboratory of modern control systems

- PLCs, Industrial networks and buses
- Wireless testing equippment



Research interests & ideas

- *1.3 Internet of Things*
- *3.5 Engineering of Networked Monitoring and Control Systems*
- *6.1 ICT for Safety and Energy Efficiency in Mobility*
- *6.3 ICT for Energy Efficiency*
- *6.5 Novel ICT solutions for Smart Electricity Distribution Networks*
- *7.2 Accessible and Assistive ICT*



Networked Control Systems

Prof. František Zezulka

zezulka@feec.vutbr.cz

Brno University of Technology

Department of Control and Instrumentation

Research team

František Zezulka, team manager

Hierarchical and decentralized control systems, fieldbuses and distributed control

Ondřej Hynčica

Modelling of control systems,

Networked control systems and resource allocation

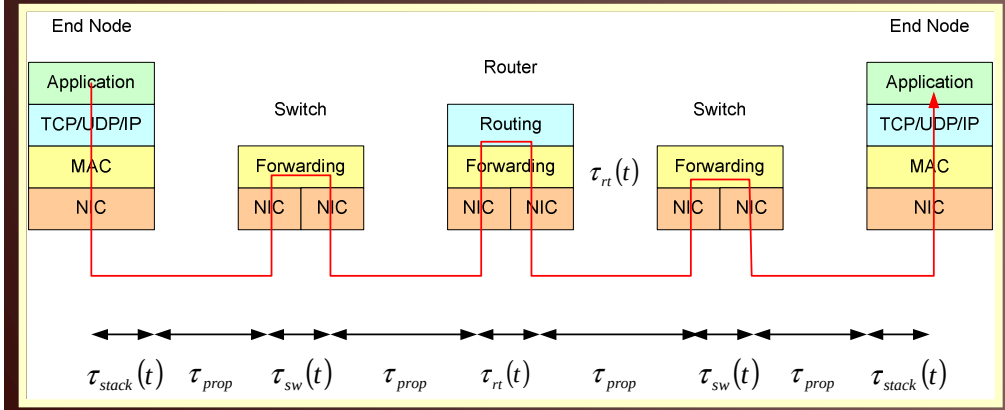
Jan Beran, researcher

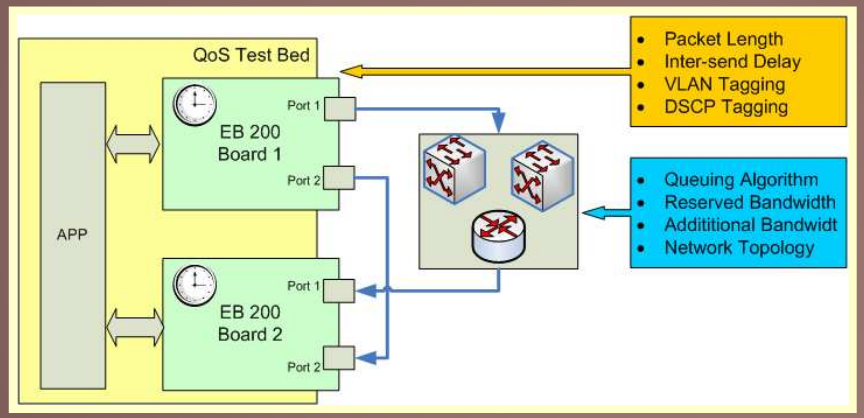
Industrial Ethernet, Network calculus, Flow modelling

+ 2 PhD students in the team

Research projects

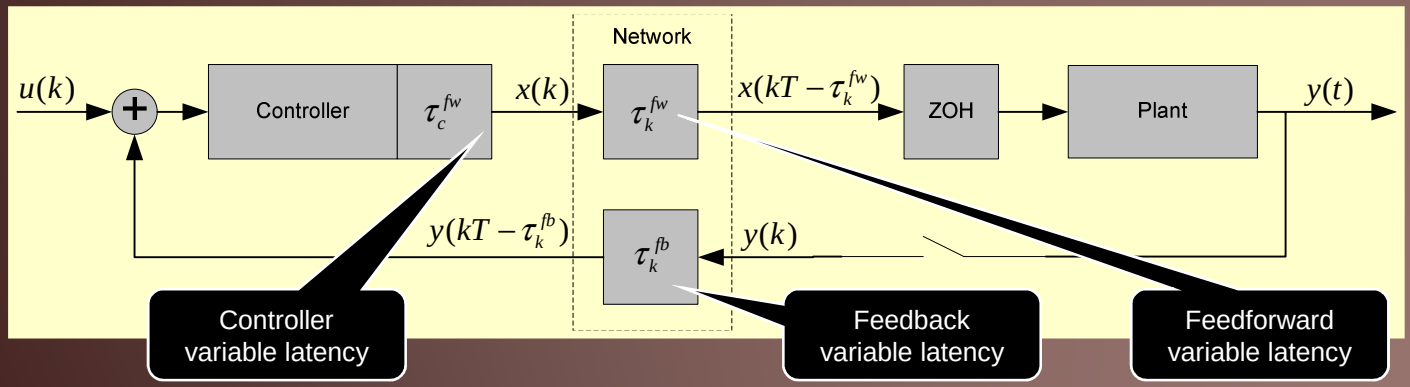
- *Virtual Automation Networks (VAN IST-FP6 Integrated Project, 2005-09)*
- *SYNERGIE - Mobile sensoric systems and networks (GA CR 2009-12)*
- *ZigBee Wirelles Technology in Decentralized Control Systems (GA CR 2005-07)*
- *Research and development of economically favourable information and security system …(MPO CR 2005 – 07)*
- SENSVISION – Internet access to the process level (MPO CR 2001-03)





Reasearch Topics

- NCS are distributed control systems networked via communication subsystems
- Trend of employment of Ethernet-based communication, which is packet-based evokes non deterministic and delayed feedback information
- Hence, the generic closed loop control is extended by another factor – non deterministic transport delay
- Furthermore, computer-based automation generates jitters in control signal transmissions



- Latencies can be handled by the classical control theory
- Variable latencies cannot be handled in a classical theory

Reasearch Goals

- Characterisation of latencies of the networked infrastructure is nevertheless not solved yet
- A method which is able to provide performance bounds of the given communication path has to be used
- Our approach is based on Network Calculus and Quality of Service
  - within NC, it is possible to characterise flows by arrival curves;or they can even be forced to conform them (applies for non-real-time flows)
  - network devices can be modelled by service curves which describe the latency a and speed of throughput (real-time flows can be prioritised using QoS methods)
  - finally, performance bounds of the given links can be inferred (latency, jitter)

Relevant ICT Topics:

- *1.3 Internet of Things*
- *3.5 Engineering of Networked Monitoring and Control Systems*

Micro- and Nanoelectronic Systems for Embedded ICT Applications

Dr. Lukáš Fujcik

fujcik@feec.vutbr.cz

Brno University of Technology

Department of Microelectronics

Research team

Lukáš Fujcik, team manager

modelling, analysis and design of digital ICs, digital synthesis on chip, CPLD and FPGA design

Radimír Vrba

algorithms for network of smart microsensors in embedded applications, sensor signal processing

Roman Prokop

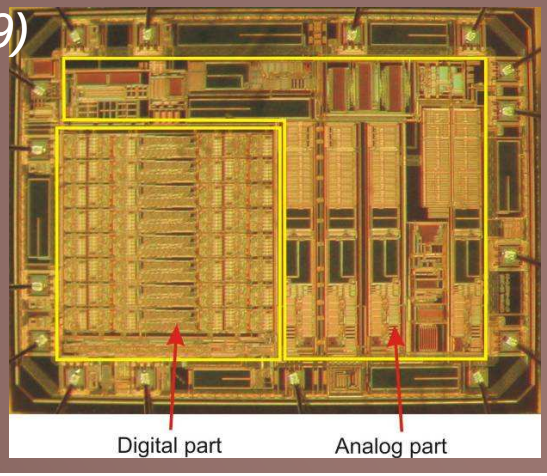
design of analog ICs, filters and circuits in current mode

+ 3 PhD students and 3 assistant professors in the team

Research projects

- FP7 ENIAC -E3CAR Nanoelectronics for an Energy Efficient Electrical Car (ENIAC EC, 2009 – 2011)
- Methods of Signal Digitizing for Advanced Sensors (GACR, 2008 – 2010)
- Research and development of digitally controlled integrated mixed-mode circuits (GACR, 2009 – 2011)
- Research of Universal and Complex Autentification and Authorization for Fixed and Mobile Computer Networks (NPVII, 2008 – 2011)

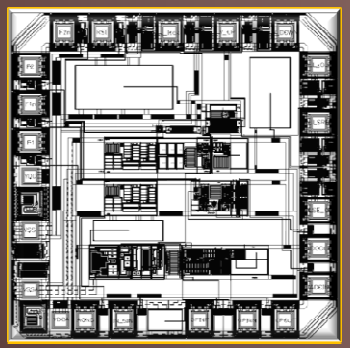
- *VAN Virtual Automation Network, FP6 EC project ref. IST-016969, real-time control over both wired and wireless links, (FP6 EC, 2005 - 2009)*
- *New principles of integrated low-voltage and low-power AD converters in sub-micron technologies (GACR, 2005 - 2007)*
- *Micro and nano sensor structures and systems (GACR, 2006 – 2008)*

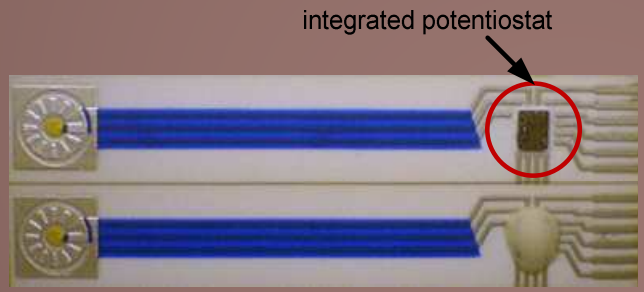


Laboratories

Laboratory of Design, Simulation and Modelling of Integrated Circuits

- Hardware
  - LAB1 – 13 DELL PC Linux workstations (*for design and education)*
  - LAB2 – 5 Autocont PC Linux power workstations (*for design and research)*
- Software
  - CADENCE - Combined IC & System Package (16 EUROPRACTICE licences)
  - MENTOR GRAPHICS Full Suite (15 EUROPRACTICE licences)
- Technology design kit
  - AMIS (CMOS07, I2T100, I3T25-50-80), *austriamicrosystems, IHP, TSMC, UMC*





Other activities

Electronic Devices and Systems IMAPS CS International Conference

- organized under IMAPS
- 16th conference will be organized in 2009
- The best papers from Conference Proceedings will be published in ElectroScope

Cooperation

- ON Semiconductor, ASICentrum, BD Sensors, Beta Control, Honeywell, TYCO, VUSTAH, IMMS Erfurt (Germany), IMEC Leuven (Belgium)
- Masaryk University Brno, CVUT Prague, University of Technology Kosice (Slovakia)

Intelligent Systems for Medical Diagnostics and Rehabilitation

Prof. Ivo Provazník

provazni@feec.vutbr.cz

Brno University of Technology

Department of Biomedical Engineering

Research team

Ivo Provazník, team manager

experimental methods for recordings of electrical activity of organs, genomic signal processing

Jiří Kozumplík, senior scientist

ECG analysis,
digital signal processing

Jana Kolářová

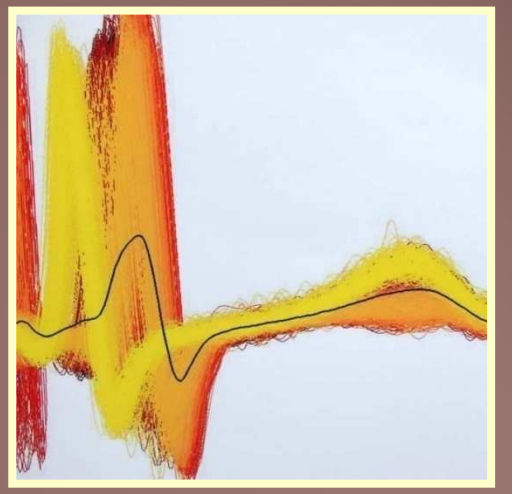
stochastic methods for analysis of electrical activity of the heart, rehabilitation technology

+7 PhD students in the team

Research projects

- Optical Methods for Registration of Heart Electrical Potentials and Calcium Concentration with Laser Stabilization (2007-2011)
- Information Technology in Biomedical Engineering (2009-2012)
- Methods of Analysis of Mechanical and Electrical Activity of the Heart in Experimental Cardiology (2007-2009)

- *High Resolution Optical Recording of Action Potentials for Analysis of T-wave Alternans (2004-2006)*
- *Modulatory Role of Sigma Signalling in Electromechanical Coupling of Isolated Cardiomyocyte and Heart (2004-2006)*
- *Optical Recording of Action Potentials and Its Use in Cardiology (2001-2003)*



Laboratories

Laboratory of Biophysics:

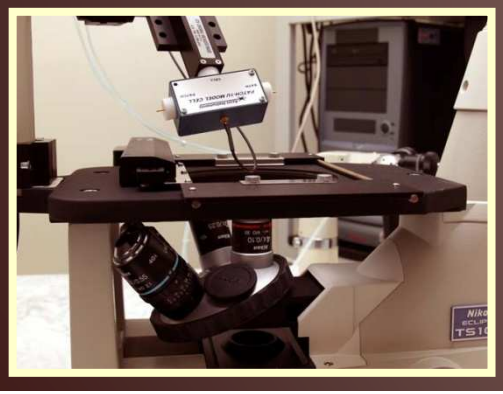
- Faraday cage, pneumatic antivibration desk, Axon Instr. patch clamp system, National Instruments data acquisition systems, fluorescent microscopy, videomicroscopy, industry boroscopes, lab instruments

Laboratory of Genomics:

- DNA sequencer, PCR, gel electrophoresis, DNA microarray scanner

Laboratory of Clinical Instruments:

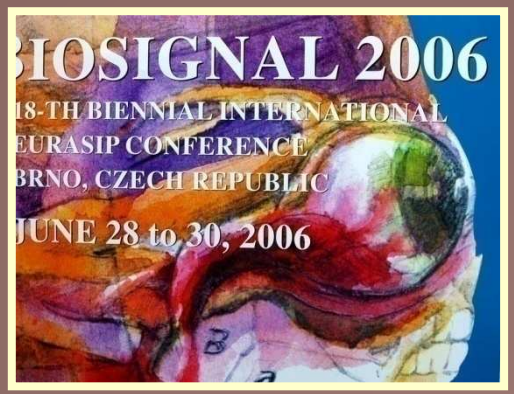
- EEG, video-EEG, photostimulation, visual evoked potentials, biofeedback, EMG, verticalizator



Other activities

Biennial international conference BIOSIGNAL

- traditional scientific conference on biomedical engineering and medical infomatics
- organized under EURASIP and IEEE EMBS
- 20th conference will be organized in 2010



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http://www.feec.vutbr.cz/dokumenty/vyrzpravy/