Jožef Stefan Institute
Department of Communication Systems

Core Research

- research, development and design of next generation networks
- parallel and distributed computing and computer simulations
- digital signal processing
- tools for testing, modelling and simulation of communication systems
- provision of security services in communication networks

Staff & Publications (2000 - 2006)

- 22 researchers (12 PhDs, 7 PhD students)
- 87 journal papers, 134 conference contributions, 29 contributions in scientific and professional books

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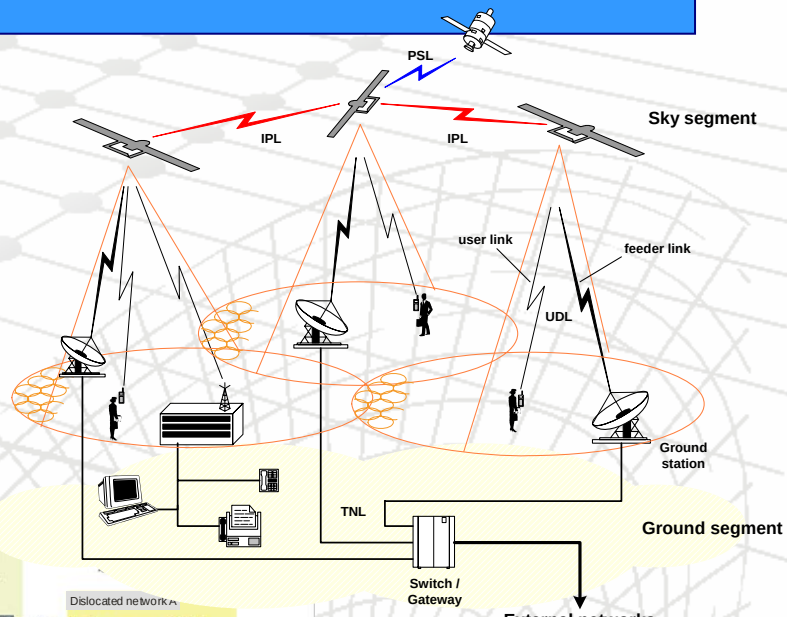
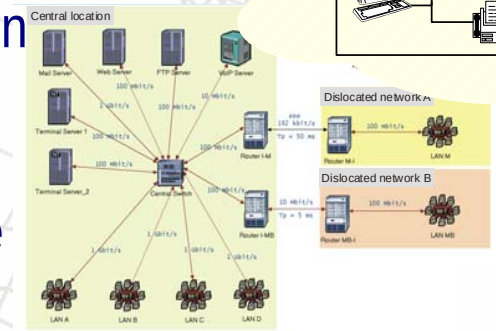
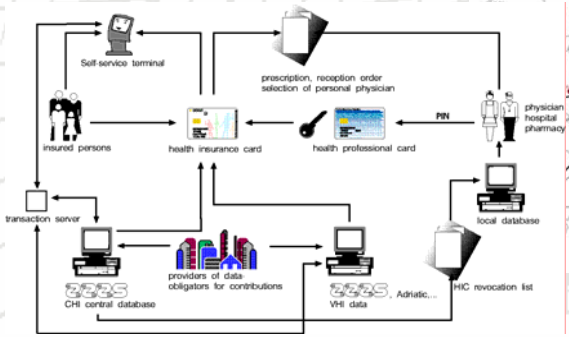
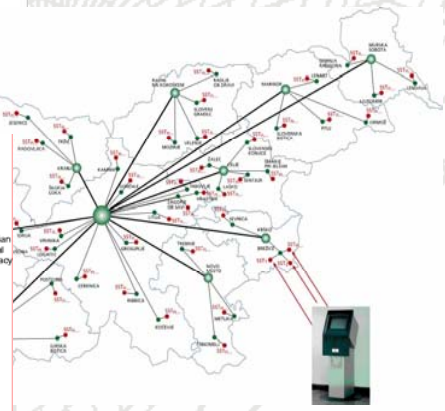
Digital telecommunication systems

- Development and performance evaluation of telecommunication systems, networks and services
- Fixed and mobile wireless access based on terrestrial, satellite and aerial platform systems
- Adaptive coding and modulation in wireless communication systems
- Development and performance evaluation of communication protocols, adaptive routing procedures and traffic engineering
- Security and interoperability in communication networks



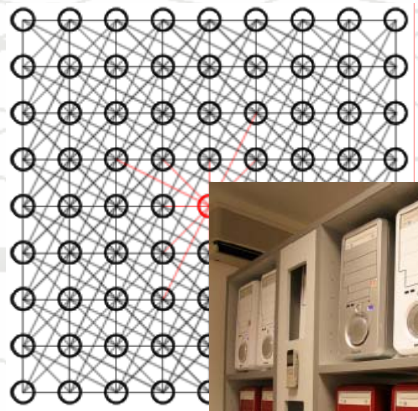


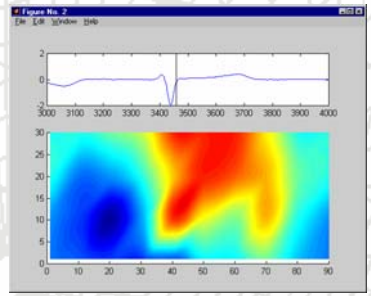
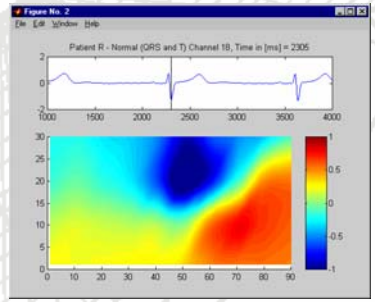
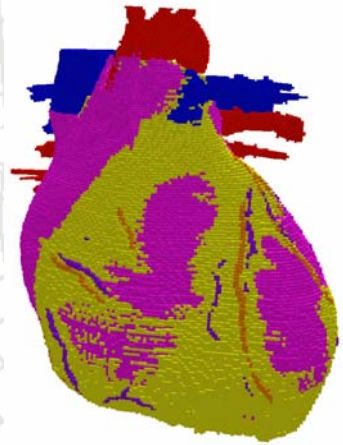
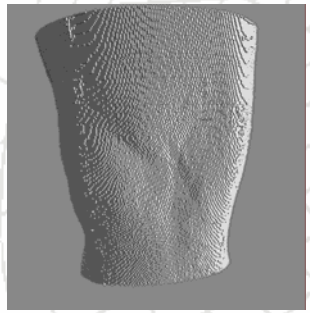




Parallel computing

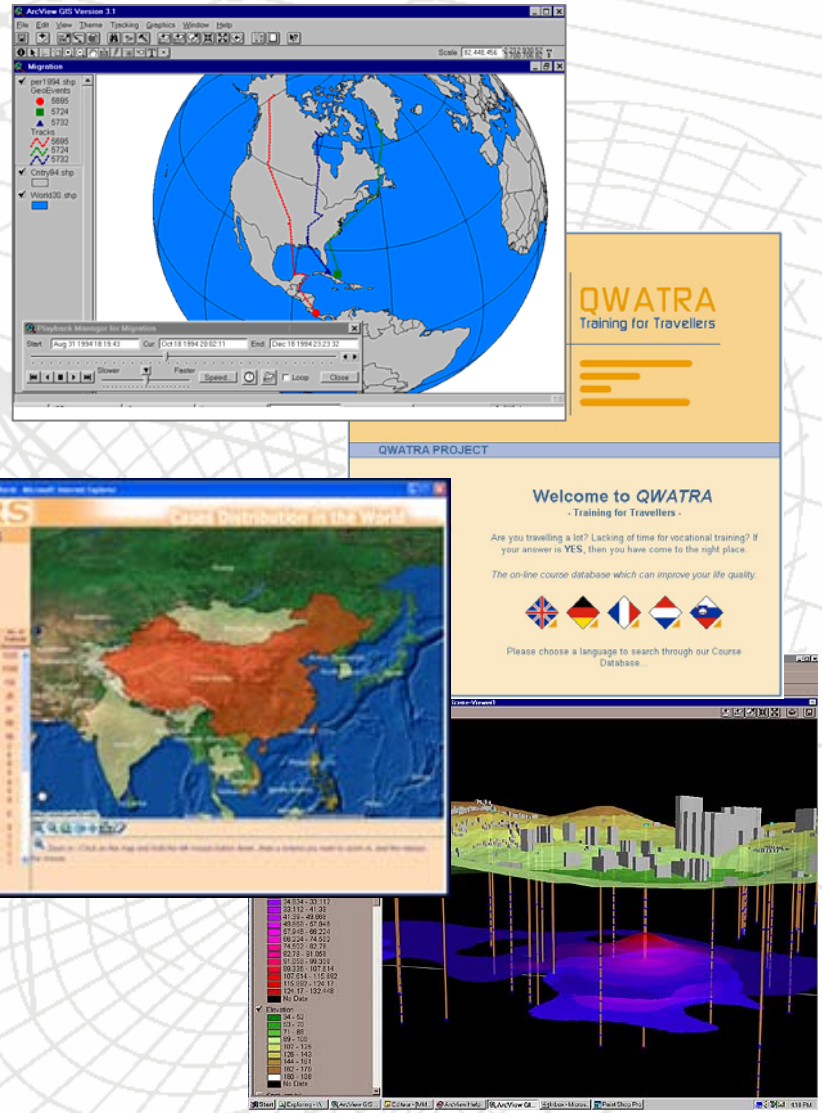
- Development of parallel and distributed algorithms and architectures for computer simulations
- Grid technologies
- Modelling and simulation in the field of medicine and chemistry (molecular dynamics, human heart, human knee, biological tissues, ...)
- Measurement, analysis and post-processing of bioelectrical signals



Computer networks and distributed systems

- Development of distributed environments for Computer-Supported Cooperative Work and Tele-teaching
- Implementation of user and administration interfaces for the access to e-learning system
- Formal specification techniques and methods for distributed systems development
- Security and reliability of information systems



Participation in international RTD projects

INCO-Copernicus

ATNMIS-TMS - Advanced Integrated Satellite/Terrestrial Mobile Systems

CRII - Affordable Dial-Up PPP/SLIP LAN-to-Internet Connection

NETLINK-CEE - Transfer of EU Experience in Helthcards into CEE Countries

Past COST Actions

227, 229, 231, 252, 253, 259, 263, 272, 273, 279

Socrates/Minerva

GISAS - Geographic Information System - Application for Schools

5th FP - IST

SUITED - Multi-segment System for Broadband Ubiquitous Access to Internet Services and Demonstrator (Vis. Sci.)

HeliNet - Network of stratospheric platforms for traffic monitoring, environmental surveillance and broadband services (R&D)

LEONARDO DA VINCI

APPOLO - TransEuropean Pilot for Paramedical-Technical Training in Medical Informatics via an Open Distance Learning System

QWATRA - Training for Travellers

Participation in international RTD projects

6th FP - IST

CAPANINA - Communications from Aerial Platform Networks delivering Broadband Communications for All (STREP)

SatNEx - Satellite Communications Network of Excellence (NoE)

Idealist7fp - Support for participants in ICT Priority by network for IST under the transition to the 7th Framework Programme (SSA)

COST Actions

COST 2100 - Pervasive Mobile & Ambient Wireless Communications

COST 297 - High Altitude Platforms for Communications and Other Services

COST 290 - Traffic and QoS Management in Wireless Multimedia Networks

Participation in international RTD projects

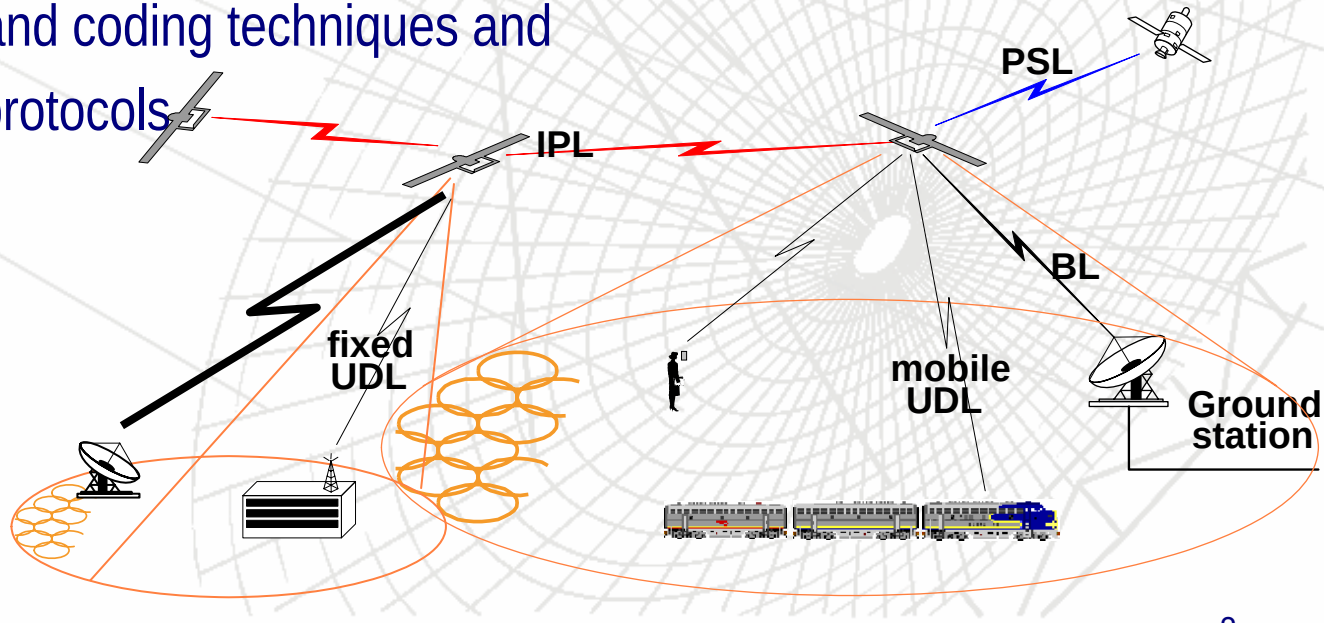
7th FP - REGPOT

AgroSense - Wireless Sensor Networks and Remote Sensing - Foundation of a modern agricultural infrastructure in the region (CSA)

ProSense - Promote, Mobilize, Reinforce and Integrate Wireless Sensor Networking Research and Researchers: Towards Pervasive Networking of WBC and the EU (CSA)

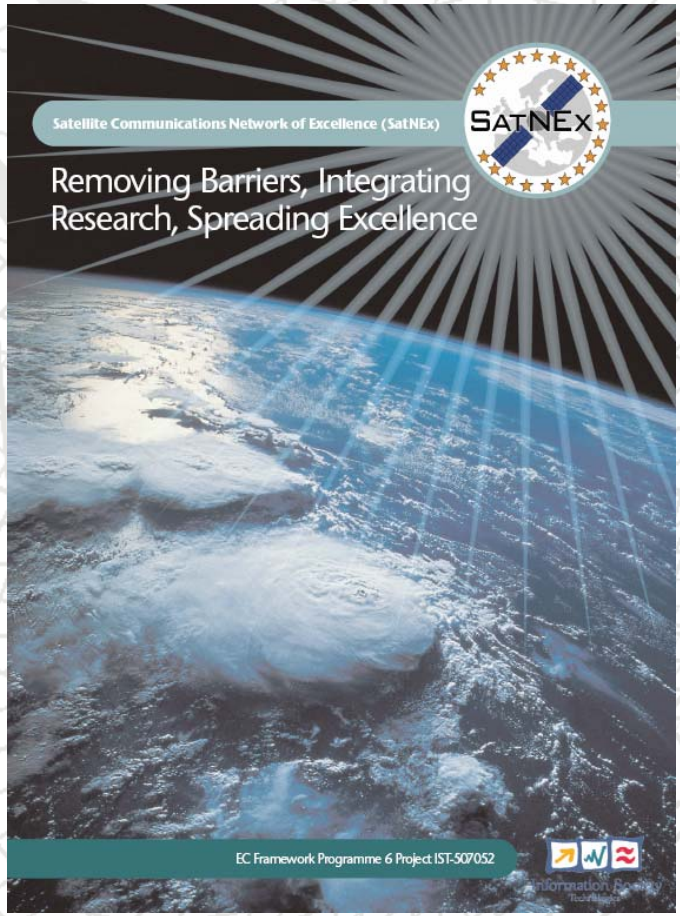
Selected international projects (i)

- 6th Framework Programme IST STREP project CAPANINA - Communications from Aerial Platform Networks delivering Broadband Communications for All
- JSI particularly involved in:
  - selection and adaptation of communication standards
  - investigation of diversity aspects,
  - modulation and coding techniques and
  - networking protocols



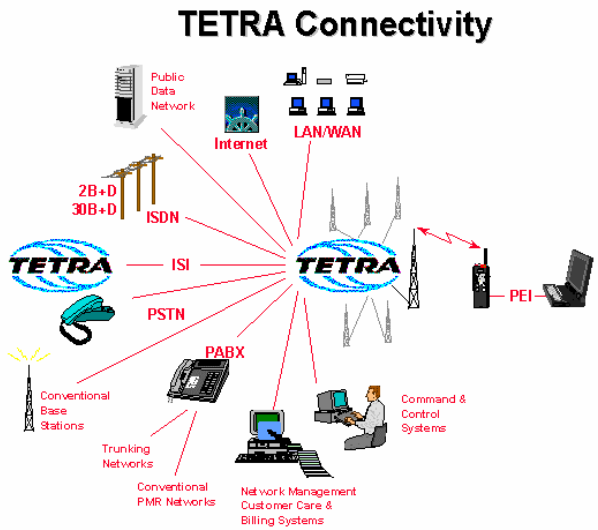
Selected international projects (ii)

- 6th Framework Programme IST Network of Excellence SatNEx - Satellite Communications Network of Excellence
- JSI contributes in the areas of:
  - modulation schemes and coding techniques
  - adaptive routing and traffic engineering
  - traffic modelling
  - high-altitude platform communications
  - internetworking



Selected national projects

- TETRA pilot system deployment & development of applications (MoD)
  - Set-up of TETRA pilot system for civil protection and disaster relief
  - Data and video transmission in TETRA
  - GPS-based location determination of TETRA terminals / users
  - Interworking with paging system
  - WAP access to applications and data bases
  - Radio network planning tool for the investigation of the TETRA signal coverage

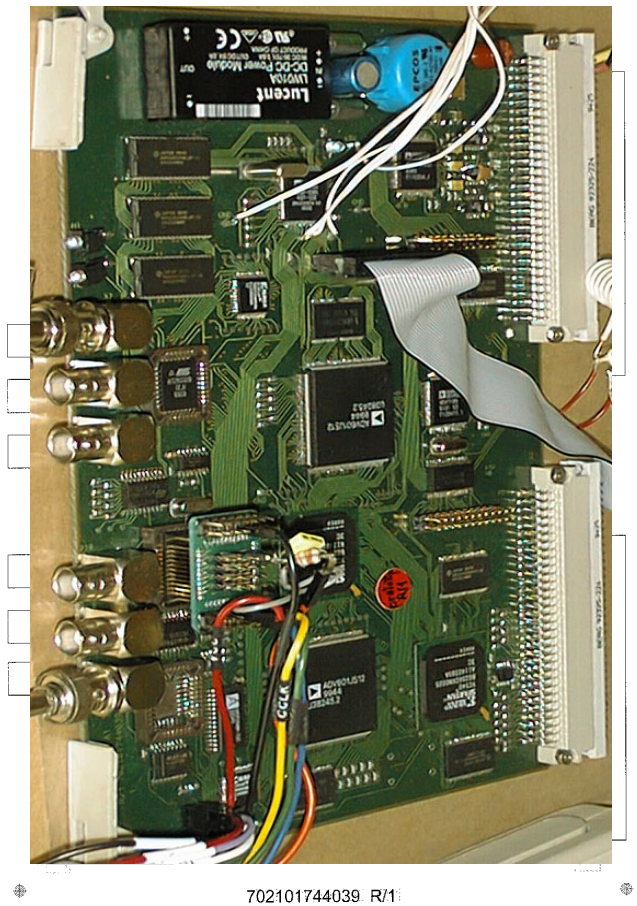


Industrial cooperation with Iskra Transmission

Iskra
Iskra Transmission

- Development of single-board wavelet video compression/ decompression unit

- DRS



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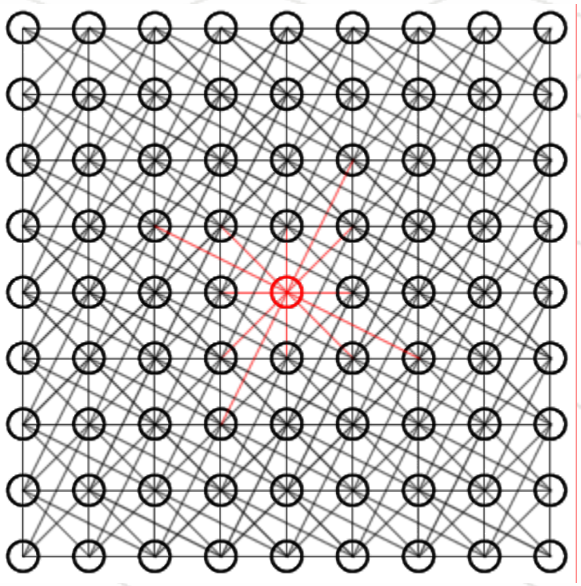
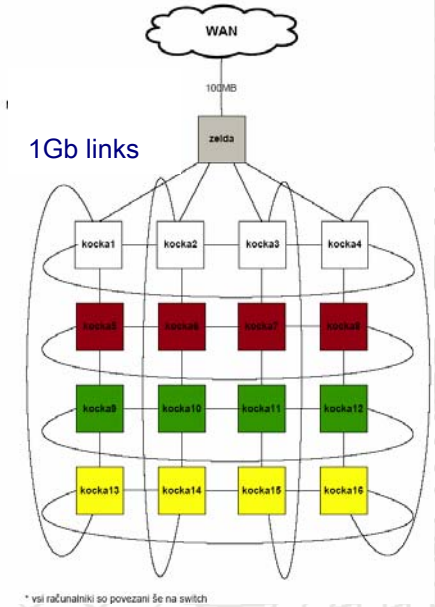
Regular interconnection topologies

- Theoretical investigation of regular interconnection topologies with application to numerical analysis using for instance 2-D toroidal 4-mesh



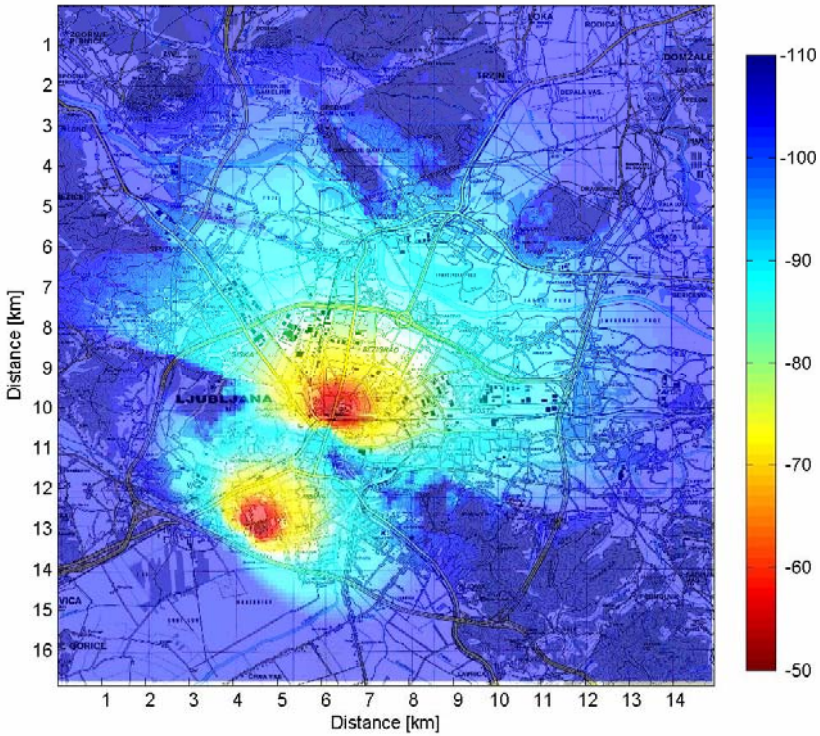
Parallel computer

- 16 AMD OPTERON 244 (1.8GHz) (dual processor)
- connected in a 2-D toroidal 4-mesh by Gb Ethernet
- MPI library, C, C++, Linux Fedora2

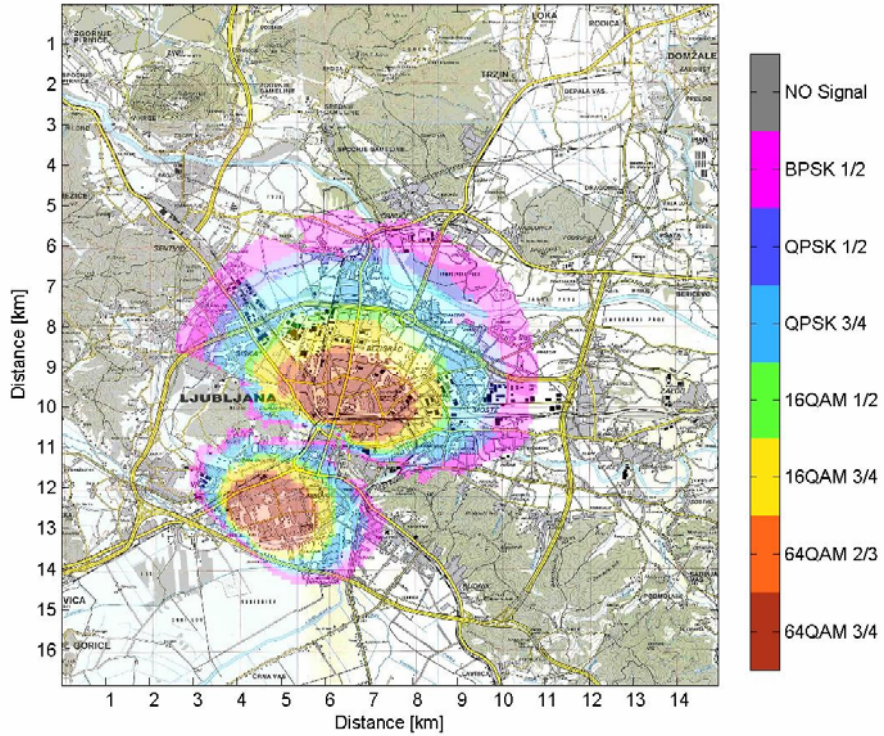


Industrial cooperation with Telsima Wireless

- Currently working on the development of BWA system based on WiMAX specifications
  - Radio network planning tool for the WiMAX signal coverage
  - System integration



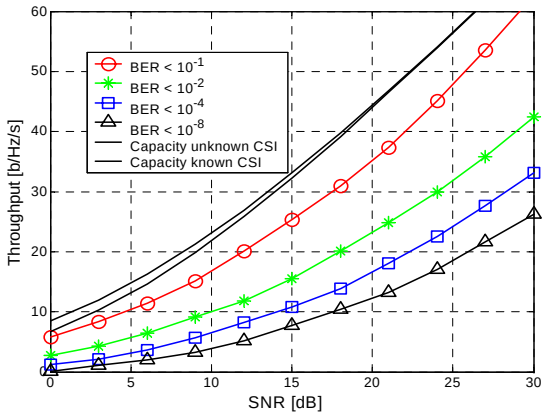
WiMAX signal level at 3.5 GHz in dBm

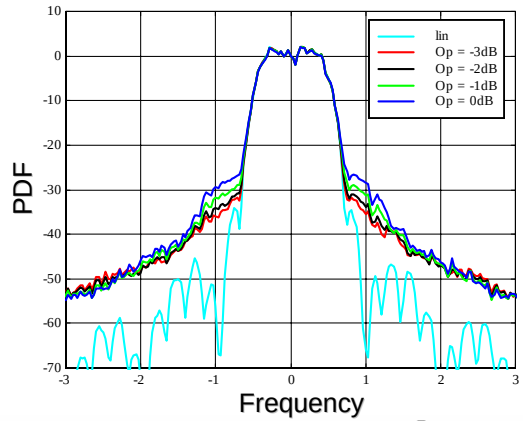


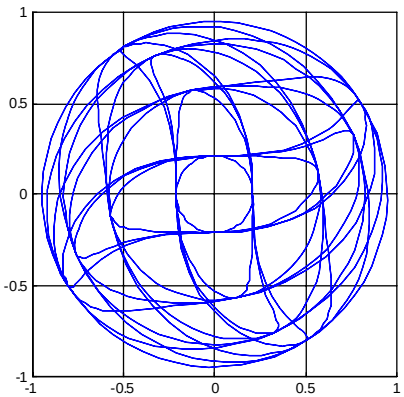
Required WiMAX modulation/coding schemes for coverage

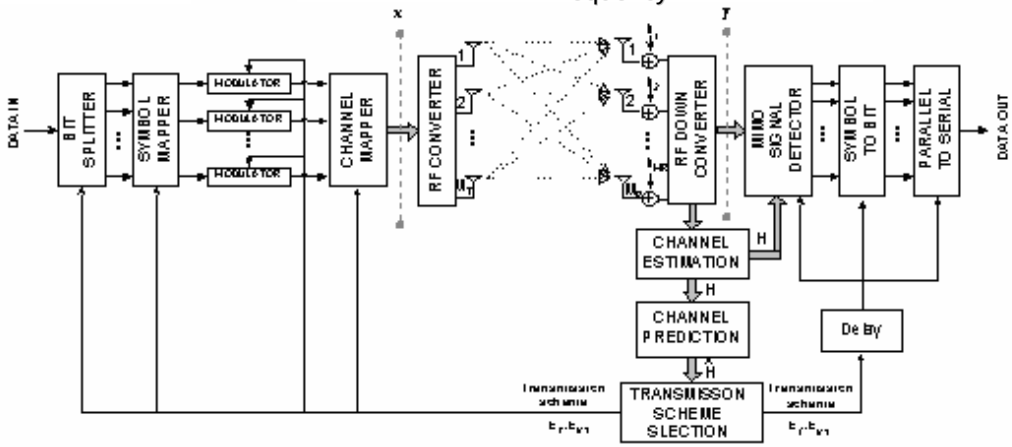
Modelling and simulations in ICT (i)

- Performance evaluation of adaptive coding and modulation in different wireless communication systems



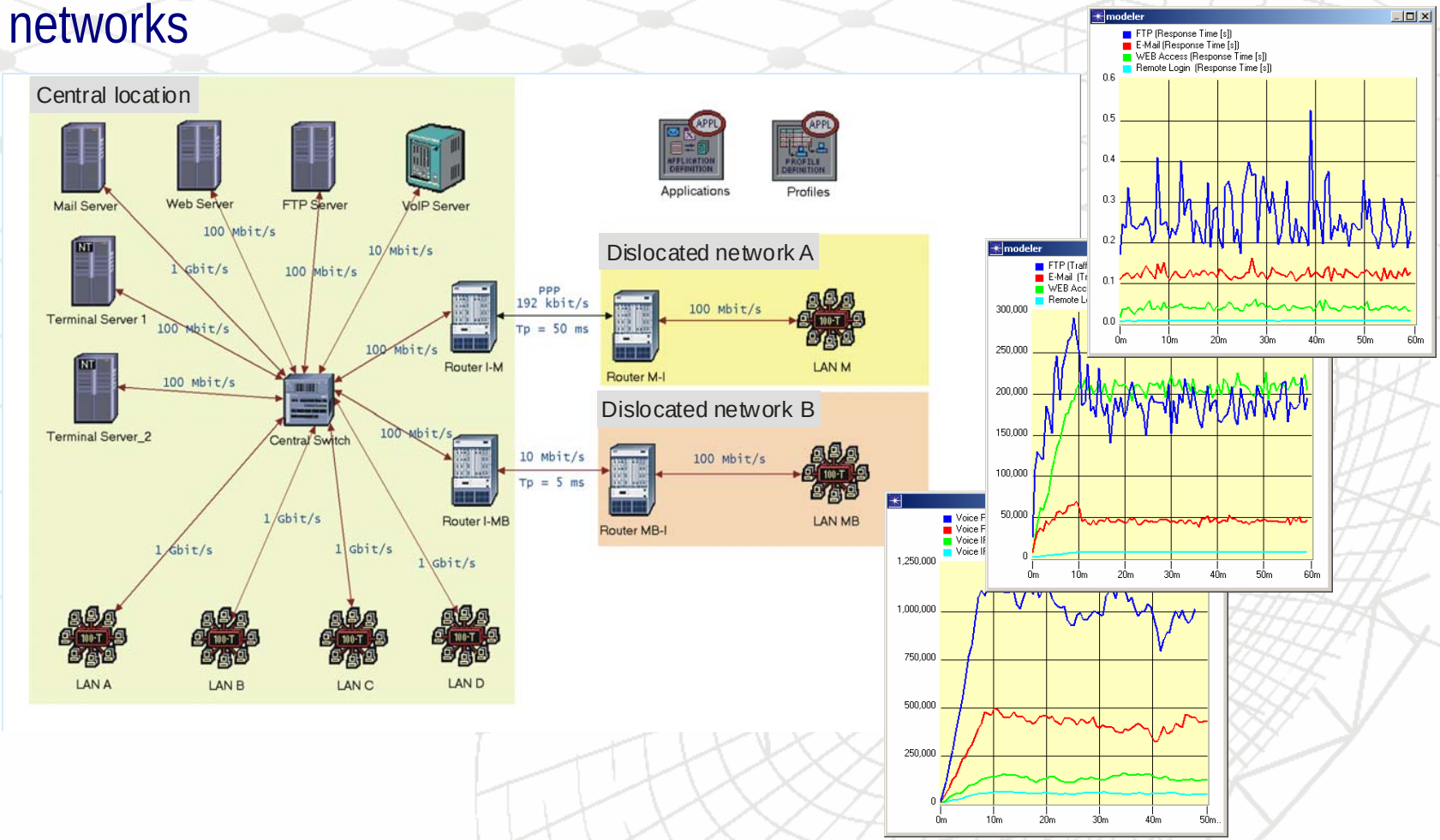






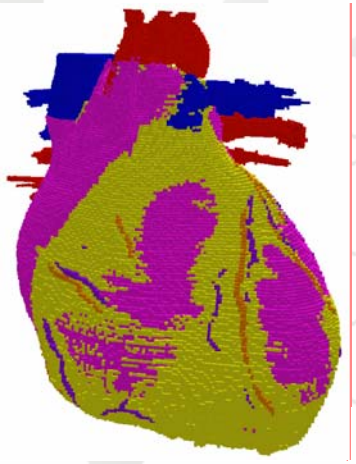
Modelling and simulations in ICT (ii)

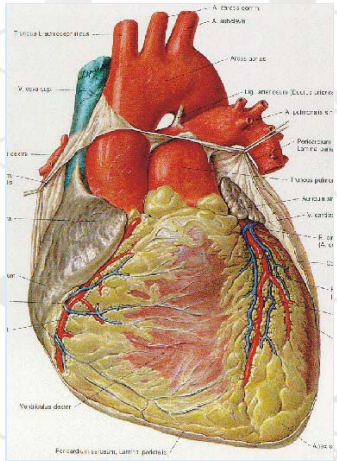
- Performance evaluation and traffic analysis of telecommunication networks



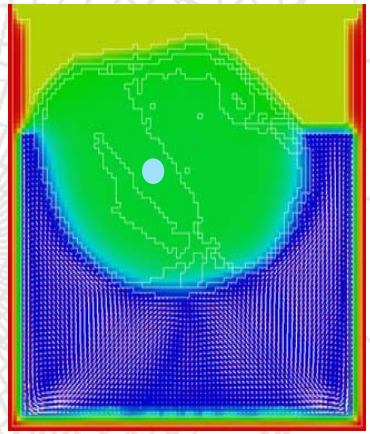
Modelling and simulations in medicine

- 3D model of human heart for simulations of heart cooling during open-heart surgery to prevent tissue decay (similar model developed for knee)

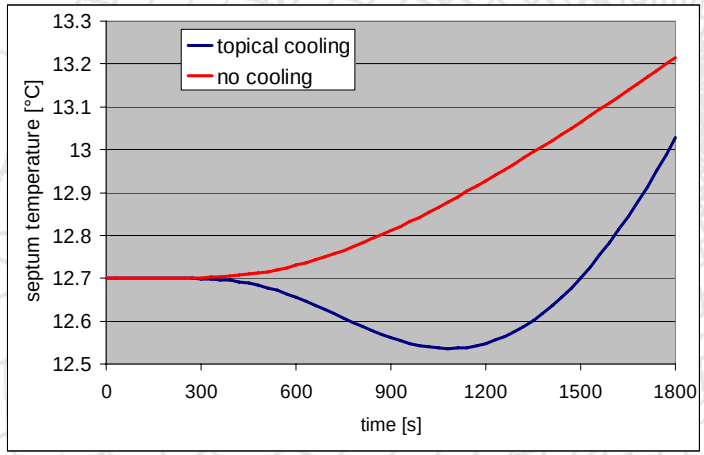




- Example: Simulation results
  - ⇨ Heart initially cooled to 12.7°C.
    1) topical cooling with cold liquid to prevent warming up
    2) no cooling

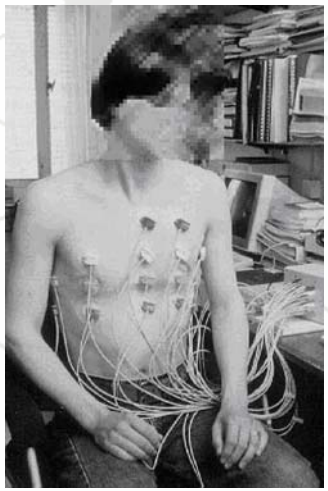


- Graph shows septum temperature (white dot)
  - cooling is necessary
  - cooling liquid warms up and should be replaced after ca 1500s

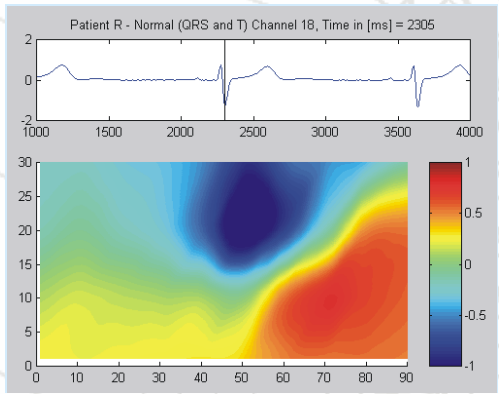


Biomedical measuring devices

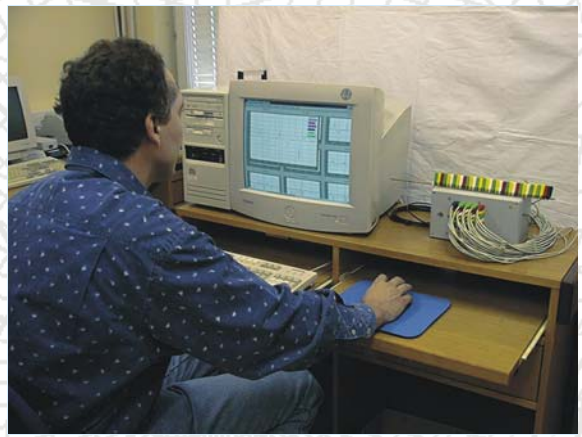
- Implementation of measuring devices and methodologies for the acquisition of biomedical signals with special attention devoted to the measuring and post processing of electric potentials induced by heart muscle on the human body surface (multichannel high-resolution electrocardiography, MECG)



Placement of the electrodes on the body surface



Body surface potential map at an instant of cardiac cycle - during the depolarization of ventricles



Post processing of ECG signals

Networking Infrastructure

- Academic and Research Network of Slovenia (ARNES) as the main provider of networking infrastructure
- ARNES has origins in the Department of Communication Systems
- builds, maintains and manages infrastructure which links universities, institutes, research laboratories, museums, schools, databases and digital libraries
- international connections with educational and research networks in other countries through the several-dozen gigabit GÉANT2 network
- allows cooperation in working groups and projects of the major educational and research institutions all over Europe
- 20 Gbit/s link (GRID, telemedicine, research of fundamental particles)

Cooperation perspectives?

- within close cooperation with the Department of low and intermediate energy physics

- digital signal processing
- data-acquisition architectures
- parallelization of computationally intensive tasks
- performance evaluation of communication protocols