



# *Distributed Systems & Networking Virtual Laboratory*

## **Mission**

The mission of the ***Distributed Systems and Networking Virtual Laboratory (DSNET)*** is to perform outstanding research in the fields of Computer Networks, Distributed Systems, Distributed Embedded Systems, and their theoretical basis, to provide high quality university level courses, to facilitate joint research efforts between academia and industry, and to engage in multidisciplinary research efforts with other academic units and regional institutions.

The laboratory and its members have successfully participated in research efforts in different fields of electronic and computer engineering, such as: design and development of communication firmware and peripheral drivers for microcontroller systems; design and development of communication protocols for embedded systems; design and analysis of multi-tier models for realization of distributed monitoring and control systems; electronic tools for signal and data processing from medical instruments; design and analysis of wireless protocols; simulation and modelling of distributed systems' communication, mobile computing, wireless sensors networks, e-health and m-health, cloud computing technologies, M2M, and IoT.

## **Members**

Prof. Grisha V. Spasov, PhD

Assoc. Prof. Nikolay R. Kakanakov, PhD

Assoc. Prof. Galidiya Petrova, PhD

Assist. Prof. Mitko P. Shopov, PhD

Assist. Prof. Boris Y. Ribov, PhD

Stefan Stoyanov, PhD student

Dimitar Grozev, PhD student

## **Projects**

*Investigation of methods and tools for application of cloud technologies in the measurement and control in the power system*

The main objective of the project is the investigation and adaptation of cloud technologies for the design and development of industrial information systems in the power system. It is envisaged to propose methods, hardware and software based on Web services and Web applications to build a distributed system for monitoring and control of electrical power such SCADA and related electronic records for the values of the

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quantities, archiving, tools for information analysis and processing. Expected applications results will support the successful integration of the information and communications technologies in the power system of Bulgaria in accordance with European standards and directives.

Modern approaches in the design of clinical information system (CIS) for observation of pediatric surgery diseases. (PedSurgCIS)

The goal of the proposed project is analysis, design, and implementation of SOA-based clinical information system for tracking of children with surgery diseases. The development of methods and software tools, based on web services and Internet applications for building distributed CIS and related EPR, clinical archives, algorithms and modules for analysis of treatment-diagnosis data are envisioned in the project.

Web Services and Data Integration in Distributed Information Systems in Internet Environment

(Finished) This project was funded by the National Science Fund of Bulgaria. Key goal of the project is the analysis of the latest technologies in web services and their integration and adaptation in distributed automation, based on controllers with embedded TCP/IP stack and Web server. For this purpose, a model of information flow and representation in distributed automation systems will be developed, employing the standards of e-business, working on HTTP/TCP. Modules and libraries for integration of Web services in distributed embedded systems will be developed and exposed.

Analysis of attacks and methods for securing Web services in global networks

(Finished) This project is funded by the National Science Fund of Bulgaria. The main goals of the project are analysis of the current state of attacks and security mechanisms for protection of Web services, modeling and implementation of proxy services and modules based on existing standards and technologies, and realization of experimental test-bed distributed information system for monitoring the access to integrated web services.

Investigation of technologies for development of web-based systems for measurement and control of electric power systems (WebEESYS)

(Finished) Main goal of the project is analysis of energy management systems and the potential of web applications in this field. Investigation of web-enabled energy management systems and protocols for information interactions between measurement units will be made. Development of libraries and modules for web service integration in the energy management systems will be made, based on controllers with TCP/IP stack and state-of-the-art technologies.

Experimental environment for analysis of protocols and processes in multi-tiered Web-based personal health systems

(Finished) The goal of the project is to build an experimental environment for test-bed analysis of different protocols and processes in the individual tiers of one multi-tier web-based personal health system. The following scientific tasks will be considered in pursuing the given goal:

1. Building a test-bed for analysis of application and communication protocols and various parameters of Body Sensor Networks (BSN). These will require realization of a prototype of personal monitor (BSN coordinator), formation of wireless network from different medical sensors, definition of protocols and procedures in BSN.

2. Analysis of time-related parameters in one multi-tier web-based PHS and components of delay in the individual tiers, both using mathematical and simulation tools.

HOCFIT (Home Control on Fingertips)

(Finished) This project is part of the IEEE Sixth Annual Computer Society International Design Competition (CSIDC'05). The main goal of the project was to propose an open and easily extendable system for home automation.

## Selected publications

- N. Kakanakov, St. Stoyanov Н и к о л а й, "Using cloud systems and sensor networks for control and monitoring in electrical power systems," Journal "Automatics and Informatics", vol. 1, 2015 (in bulgarian).
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- N. Kakanakov, "Evaluating the Delays in Local Controller Networks," International Review on Computers and Software (IRECOS), Vol. 8, No. 1, pp. , January 2013.
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- N. Kakanakov, "Evaluating a Medical Grade Network through Network Calculus," MIPRO, 2012 Proceedings of the 35th International Convention , vol., no., pp.715-720, 21-25 May 2012.
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- M. Shopov, H. Matev, and G. Spasov, "Evaluation of Web Services Implementation for ARM-based Embedded System," In Proceedings of the International Scientific and Applied Science Conference ELECTRONICS (ET'2007), pp. 79-84, Sept. 2007, Sozopol, Bulgaria.
- M. Shopov, I. Stankov, and N. Kakanakov, "Standards and technologies for applying security in Web Services," Journal Automatics and Informatics, vol. 2, pp.8-11, 2007.
- N. Kakanakov, M. Shopov, G. Spasov, and H. Hristev, "Performance Evaluation of Switched Ethernet as Communication Media in Controller Networks," in Proc. International Conference on Computer Systems and Technologies (CompSysTech), 2007, p. IIIA.8.
- M. Shopov, H. Matev, and G. Spasov, "Evaluation of Web Services Implementation for ARM-based Embedded System," in Proc. ELECTRONICS, Sept. 2007, pp.79-84.
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- E. Peytchev, G. Spasov, V. Spasova, „Internet-based Information Flow In Mobile Systems and their Application in Traffic Monitoring Ad Hoc Networks", IEEE ELMAR 2010, 15-17 September, Zadar Croatia, pp. 265- 268, ISBN: 978-953-7044-11-4.
- M. Shopov and E. Peytchev, "Generation and Dissemination of Traffic Information in Vehicular Ad-hoc Networks," In Proceedings of the International Scientific Conference COMPUTER SCIENCE, Chalkidiki, Greece, 30th Sept. – 2nd Oct., 2005, pp.149 - 154, ISBN 954-438-526-6.