Bulletin 2021

Department of Networked Systems and Services
Budapest University of Technology and Economics

"To build the foundation of a promising career or an industrial success you need three things: Quality, Quality and Quality!"

The **Department of Networked Systems and Services**, formerly known as the Department of Telecommunications, is focusing on the key areas of networking and networked systems: analysis and design of wired and wireless networks, new network architectures and protocols, mobile communication systems and services, multimedia networking and media distribution systems and services, cryptography and network security. Additional strengths that complement the key areas include quantum computing and communications, acoustics and studio technologies, signal processing, financial information systems.

The recent change of our name from Department of Telecommunications to **Department of Networked Systems and Services** reflects that our competences have shifted significantly during the last decades. This change has been driven by the convergence of telecommunication systems and the Internet, resulting in a global integrated network of heterogeneous devices, as well as by the widespread deployment of information technologies, and in particular the Web, resulting in innovative new network based services. While the 60 years of experience of the Department of Telecommunications in networking still provides a solid ground on which we can base our teaching, research and development activities, the new name of the department better describes what we are currently focusing on and how we are thinking of the future.

Our team of 7 professors, more than 60 staff members and 30+ PhD students can dynamically respond to the ever-increasing and leading-edge competency demands from the field of **I**nformation and **C**ommunication **T**echnologies both at the national and the international levels.

Our courses, laboratory exercises, individual student projects and diploma projects create unique opportunities for undergraduate and graduate students to obtain high level knowledge and practical skills. Furthermore, the Department's strong industrial cooperation provides excellent career opportunities for them. We always seek a balance among theoretical work, applied research and development. We are open to work with students eager to learn and to collaborate with industrial partners in different research and development projects.

If you are looking for quality and excellence in research and education, then you are welcome at the **Department of Networked Systems and Services**!

preface

Prof. Sándor Imre
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„Egy ígéretes karrier vagy egy ipari siker három tényezőn alapul: minőség, minőség, minőség!"

A BME **Hálózati Rendszerek és Szolgáltatások Tanszéke** – korábbi nevén Híradástechnikai Tanszék – a hálózatokkal és hálózati rendszerekkel kapcsolatos olyan kulcsterületekre koncentrál, mint a vezetékes és vezeték nélküli hálózatok analízise és tervezése, új hálózati architektúrák és protokollok, mobil kommunikációs rendszerek és szolgáltatások, multimédia hálózatok, médiaelosztó rendszerek és szolgáltatások, kriptográfia és hálózatbiztonság. Tanszékünk további erősségei, melyek jól kiegészítik a fenti fő tevékenységi területeinket: a kvantuminformatika és -kommunikáció, akusztika és stúdiótechnológiák, jelfeldolgozás, valamint üzleti információs rendszerek.

Tanszékünk nevének közelmúltbeli megváltoztatásával kompetenciáinknak az utóbbi évtizedekben bekövetkezett jelentős elmozdulására reflektáltunk. Ezeknek a változásoknak a fő mozgatórugói egyfelől a távközlő hálózatok és az internet konvergenciája, mely különféle eszközök globális és integrált hálózatát eredményezte, másfelől az információs technológiák széleskörű elterjedése, mely új innovatív, hálózatalapú webes szolgáltatásokhoz vezetett. Miközben tanszékünk több mint 60 éves tapasztalata a hálózatok világában olyan biztos alapot jelent, amire bátran építhetjük oktatási, kutatási és fejlesztési tevékenységünket, új nevünk jobban tükrözi a jelenleg folyó tevékenységünket és a jövőre vonatkozó terveinket.

A tanszék 7 professzora, több mint 60 munkatársa és mintegy 30 doktorandusza dinamikus és minőségi választ képes adni az ICT szektor folyamatosan erősödő kihívásaira.

Különböző képzési formáink – kötelező és választható tárgyaink, az önálló laboratóriumi gyakorlatok, a szakdolgozat és a diplomatervezés – mind hallgatóink elméleti és gyakorlati tudásának bővítését célozzák, melyek ipari kapcsolataink révén kiváló karrierépítési lehetőségekkel egészülnek ki. Gondosan ügyelünk arra, hogy az elméleti és alkalmazott kutatás és fejlesztés között egyensúlyt tartsunk, és ipari partnereinknek mindig a megfelelő megoldást nyújthassuk. Nyitottak vagyunk az olyan hallgatók felé, akik kutatási és fejlesztési projektek keretében szertetnének ipari tapasztalatra szert tenni.

Amennyiben Ön a minőség és kiválóság elkötelezett híve, bátran forduljon a **Hálózati Rendszerek és Szolgáltatások Tanszék** munkatársaihoz.

A jelen bulettinben bemutatott területek magyar nyelvű ismertetéseit lásd a honlapon:
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előszó
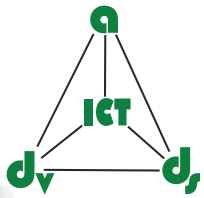
Analysis, Design and Development of ICT Systems Laboratory

The main activity of the AddICT laboratory covers the practical and theoretical aspects of ICT networks. Our profound theoretical competence in stochastic modeling, queueing theory and efficient performance evaluation algorithms is acknowledged by the Hungarian Academy of Sciences through the funding support for the MTA-BME Information Systems Research Group (led by Prof. Miklós Telek).

We are strong in the practical aspects related to development and the operation of ICT systems such as the design and analysis of telco networks and ICT systems, network virtualization and SDN, reliability studies, cloud computing, and the automatic testing solutions to enhance the reliability of networking software solutions. The research activities are carried out in collaboration with international institutes over the world and with the ICT industry. Our results (models, design and analysis methods, testing tools and techniques) have been used by national and international companies for three decades.

The researchers of the laboratory have been developing network design, performance and reliability analysis tools based on a flexible network model for more than three decades (initiated by Prof. László Jereb). The FLEXPLANET tool and its components have been used by Hungarian Telecom to plan and optimize multilayer networks, and analyze the reliability of Hungarian networks.

Apart from the ongoing research on network technology and Internet traffic modeling, the laboratory, in cooperation with Nokia Solutions and Networks, has been working on automatic software testing solutions (Prof. Tien Van Do), automatic anomaly detection methods (Prof. Gabor Horvath), and capacity dimensioning tools for future evolution (FE) traffic solutions.

Supported by our theoretical knowledge and practical experiences gained from the active research, our objective in education is to provide students with up-to-date and long lasting competences and skills in the aspects of network operation, network design, performance and reliability analysis. AddICT also hosts a Cisco training laboratory and offers hands-on lab courses, IPv6 and Cisco CCNA courses for our students and industrial partners.

laboratories

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medianets
laboratory

The mission of the Laboratory of Multimedia Networks and Services (MEDIANETS) is to combine our traditional strengths in media technologies with our new research focus, the autonomous vehicles for smart cities. Research and development activities include Cooperative Intelligent Transport Systems (V2X communications), prediction of traffic and digital profiling for smart cities (using machine learning), coordination of multiple autonomous vehicles (flocking optimization), media communications, mobile healthcare technologies and benchmarking and security analysis of IPv6 transition technologies in smart cities.

MEDIANETS has been active in significant European and national projects. In a recent EIT Digital innovation activity "Autonomous Ware-house and Last Mile Delivery" (AWARD) our team was improving the current state of operations inside a warehouse, by building a logistics platform leveraging on advanced planning and scheduling techniques based on machine learning, to coordinate a fleet of autonomous vehicles for moving goods indoors.

Founded by the National Research, Development and Innovation Office, an intelligent transportation system for cities of the future is being developed in our Lab, utilizing machine learning methods and techniques, to optimise transportation, using historical and real time traffic sensor information, preprocessing it in our stream processing platform. Our Lab is also involved in the European C-ITS flagship project C-ROADS supporting the V2X deployment activities of Hungarian Public Roads Nonprofit PLC, also working on green-field motorway/highway design projects of National Infrastructure Developing PLC, planning smart road infrastructures with advanced infocommunication techniques where ETSI ITS-G5 based V2X access networks are to be integrated.

MEDIANETS' teaching activity spans over the whole BSc-MSc-PhD structure. Along with basic courses in communication networks, it is responsible for two BSc and one MSc specializations in media technologies and media communications. Facilities for students include the Commsignia - BME HIT V2X Communication laboratory, where they can design and implement intelligent cooperative services for smart cities.

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laboratories

MCL

Mobile Communications & Quantum Technologies Lab.

Since the foundation of the laboratory in 1997, one of its main focuses has been the evaluation of wireless communications and mobile networks. The laboratory changed its name in 2012, reflecting its growing activities in the field of quantum computing and communications.

Our research community released a large number of engineers in the last two decades, while participating in numerous international and national research and development projects in wireless communications, mobile networks and quantum communications.

The members of the laboratory have over 700 scientific publications. Moreover, our colleagues have been active in providing various lectures to our industrial partners, the latest of these include topics of 5G mobile systems and quantum computing. We offer various courses for Bachelor and Master students interested in the present and future of mobile communication networks and/or quantum computing.

Some of our highlights from the past years: evaluation of the co-existence of LTE and legacy systems; analysis of capacity and throughput of LTE systems; evaluation of D2D communications' performance; evaluation of beamforming based backhauling solution to mass transportation networks; development of a passive indoor localization system; various developments on sensor networks and remote control networks, using the popular RPi platform and Arduino boards, 5G mobile networking areas in cloud RAN and edge computing. Our members are actively participating in national and international quantum related activities including building Quantum Key Distribution (QKD) experiments (fiber based and free-space experiments) and Quantum Random Number Generators. We are proud of our students who received various prizes for their work in quantum communications.

laboratories

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Laboratory of Cryptography and System Security

The Laboratory of Cryptography and System Security (CrySyS Lab) is committed to perform high quality research, teaching, and consulting activities in the fields of system and network security, applied cryptography, and economics of security and privacy. In terms of research, the laboratory's current focus is on the security of cyber-physical systems, including industrial control systems, modern vehicles, and the Internet of Things, as well as on the security issues in machine learning.

The CrySyS Lab has been active in research in security and privacy for 15+ years. It has participated in several EU and national projects (e.g., SeVeCom, UbiSec&Sens, WSAN4CIP, MELLODDY, SECREDAS, SETIT), it maintains extensive collaborations with several industrial and academic partners in Europe and in the US, and its results are well-known and appreciated by the international security research community.

The CrySyS Lab is perhaps best known for the discovery and analysis of Duqu, a targeted malware similar to Stuxnet. Other results with intensive media coverage include a proof-of-concept attack on cars by compromising diagnostic equipment and an analysis of the problem of interdependent privacy caused by third-party apps on social media sites. The CTF teams, !SpamAndHex and c0r3dump, of the lab are also well-known thanks to their outstanding results achieved at various international hacking competitions.

In terms of teaching, faculty members of the laboratory teach basic courses on IT Security in the BSc and BProf programs, and they are also responsible for running an MSc minor specialization on IT Security. The lab also runs a talent management program centered around the CrySyS Student Core, an invitation based community of practice in hacking.

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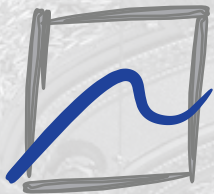
laboratories

Laboratory of Acoustics
and Studio Technologies

The **L**aboratory of **A**coustics and **S**tudio **T**echnologies is active both in the traditional fields of technical acoustics and in digital audio and video.

Electroacoustics is one of the traditional fields of the laboratory, which was extended later on towards various industrial fields such as vehicle and building acoustics, soil and building vibrations. The current activity of the lab ranges from numerical and statistical prediction of sound and vibration fields through sound recording and audio signal processing to video studio techniques and many aspects of digital media technologies.

The laboratory equipment consists of a semi-anechoic room, a small but well equipped educational recording studio, wide range of software tools for numerical and statistical acoustic simulation as well as extended hardware for video signal recording, processing and measurements. The equipment has essentially been upgraded a few years ago when 16 powerful iMac computers were installed with professional audio and video production software from Adobe and Apple.

The current staff consists of 4 staff members and 2 PhD students, giving a number of undergraduate and graduate courses for students of two faculties. The staff has a strong emphasis on fundamental research: from 2017 and on, they received 4 ÚNKP (New National Excellence Program of the Ministry of Human Capacities) and 1 Bolyai Research scholarship.

The laboratory has been involved in many international research and national development projects. LAST is currently participating in the H2020 project ANIMA (Aviation Noise Impact Management through novel Approaches), incorporating 23 partners from 11 European countries dealing with the evaluation and mitigation of aircraft noise. With the participation of the lab, the Protexsafe Eureka project dealing with the repeatable testing and development of vibration isolating gloves has been recently finished.

The Lab is also active in national R&D projects. Our members and students participate in the optimisation of driving assistance systems developed by Robert Bosch Ltd., and the vibroacoustic design of the new development center Campus 2 of Bosch in Budapest. Within an ongoing research project, the laboratory is participating in the development of acoustical sensors and signal processing algorithms for the remote detection of fixed and rotating wing unmanned aerial vehicles.

laboratories

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financial computing and signal processing

The main research and development activities of the laboratory focus on adaptive algorithms, optimization of communication protocols, statistical resource management and admission control, and time series analysis and prediction. Its expertise also includes the mathematical foundations of signal processing, statistical network reliability analysis and mobile gaming optimization.

Recent achievements include novel algorithms for identifying mean reverting portfolios, support vector machines and neural networks for efficient trading, new non-supervised channel equalization algorithms, optimal energy aware routing protocols for wireless sensor networks, adaptive server update strategies for mobile gaming, real-time network reliability analysis based on statistical sampling techniques, intelligent packet classification methods for internetworking based on computational geometry, blind equalization algorithms for radio channels corrupted by selective fading and additive Gaussian noise, novel scheduling algorithms by combinatorial optimization for telecommunication networks, hardware and software implementation of signal processing systems of QAM.

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laboratories

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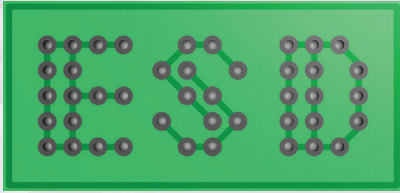
Electronic System Design Laboratory

Our laboratory has been working on the electronic system development for decades.

At ESDlab we specialize in hardware, FPGA and software development of high-speed digital and analog systems. We have created communication devices, industrial computers and peripherals, like data acquisition boards, digital signal processor and FPGA boards and many more. Most of these are available on the international market and some of them are still in operation in 24/7 service. Our research and development activities also extend to synthesizing and analyzing digitally modulated signals, designing digital modulators and demodulators, utilizing DSPs, general-purpose processors and FPGAs.

Some of the most recent development activities of the lab:

• We have developed Unmanned Aerial Vehicle (UAV) electronic systems, including the redundant autopilot with sensors, the UAV communication system from the data source to the antenna, video signal acquisition, compression and radio transmission from the UAV to the ground.

• Our team has been active in research of indoor navigation using Ultra Wide Band (UWB) technology, which is a promising solution to solve precise UAV navigation problem where Global Navigation Satellite System is not available.

• We design a wideband (30 MHz.. 6 GHz) radio wave direction finding system for drone detection application.

• We cooperate with MCL laboratory in the HunQuTech quantum key distribution project where we design the electronic control circuits.

Besides R&D, our group also takes an active part in teaching Electronics 1. (BSc), Engineering Acoustics (MSc), and Computer Architectures (BSc), Integrated Design of High-frequency Digital Circuits (BSc/MSc).

laboratories

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Radio aspects

The 5G New Radio (5G NR) is defined to work above 30 GHz as well. Far

more 5G cell sites are required, each covering a smaller area (because of higher capacity, higher frequencies and smaller latency).

In the Mobile Communications and Quantum Computing Laboratory, we are working on 5G NR, and software-defined networking (SDN) with Network Functions Virtualization (NFV) supporting the underlying physical infrastructure for the 5G networks.
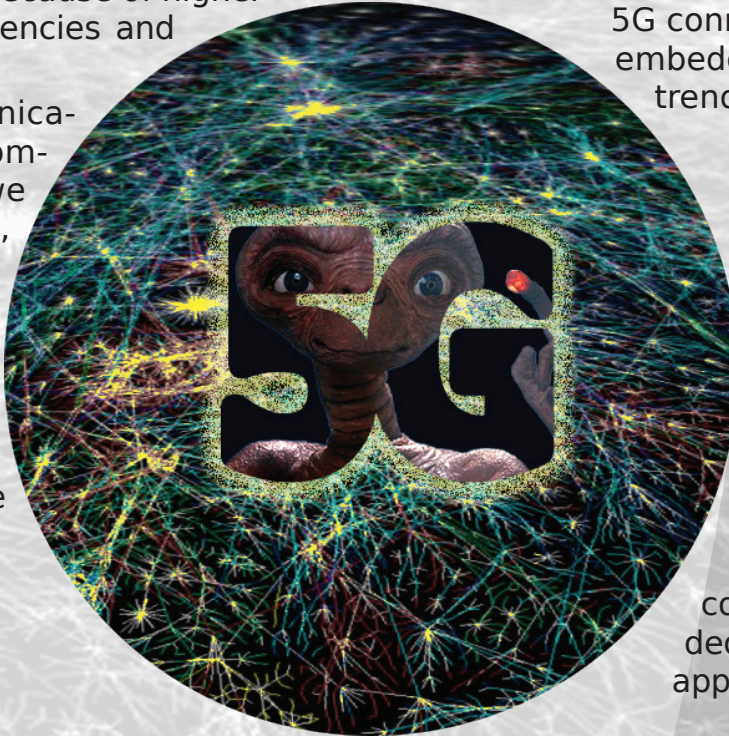
Security aspects

5G is not only about speed. 5G promises extra low latency, and access for all "smart" devices (machines, vehicles, and any smart device). 5G connects millions of small embedded devices. This new trend is called the Internet of Things (IoT).

Our department's CrySyS Lab focuses on the problems of securing embedded computing platforms used by IoT devices. This research area is important, because compromising the platform enables an attacker to take full control over the embedded devices, including all applications running on it.

Application aspects

Vehicular communication benefits from the extra low latency of 5G. In the MediaNets Laboratory we develop simulations of multiple dynamic V2X communication / service provision environments in heterogeneous 5G telco cloud systems.

Advanced 5G features like network slicing, application scaling, hybrid multiaccess V2X communications, adaptive network function placement and intelligent decision algorithms have been applied to examine how use-cases of connected and autonomous vehicles can be efficiently supported in 5G telco cloud systems.

5G

MTA-BME Information Systems Research group is one of the research groups sponsored by the Office for Research Groups Attached to Universities and Other Institutions of the Hungarian Academy of Sciences. It has been established in 2012 and since then it has conducted basic and applied research in cooperation with the members of the Department of Networked Systems and Services and the Department of Telecommunications and Media Informatics.

One of the main research directions is the stochastic modelling of network traffic and queues; development, analysis, optimization and dimensioning in the presence of various types of network traffic and services. The other main research area is the examination of communication strategies: routing algorithms are studied from a theoretical and practical perspective, including routing related problems such as efficient data structures and compression methods to be implemented in routers. In the field of quantum communication networks, reliable quantum communication over noisy quantum channels is explored.

The Department is hosting a Training Laboratory equipped with Cisco networking devices. The laboratory was established in summer 2009, and the equipments were complemented with a new set of IPv6 capable devices under the umbrella of the 6DEPLOY-2 project funded by the European Union's 7th Framework Program in summer 2011.

This laboratory serves as the place of practical exercises linked with regular university courses, such as Administrating Computer Networks, Administrating Secure Computer Networks and IPv6-based Computer Networks. Besides that, the laboratory hosts also Cisco CCNA courses in close cooperation with the Hungarian headquarters of Cisco Networking Academy.

In 2014, with the support of the local Academy, the Department initiated and launched the BME NetSkills Challenge student competition. After extending the organizing team with colleagues from the University of Pannonia in 2015, now this yearly competition is open for every Hungarian university students in the area of computer networking.

associated organizations

EIT Digital
Budapest Node

is a consortium of two local universities - namely, Eötvös Loránd University (ELTE) and Budapest University of Technology and Economics (BME) - and their leading industrial partners (consortial partners: Ericsson Hungary, Magyar Telekom, OTP, MTA-SZTAKI, E-Group, evopro); and a cooperating partner, Cisco Systems Hungary. The Department of Networked Systems and Services is strongly involved in the EIT Digital Master and PhD education programs, and in the research action lines.

HSN*Lab*
hsnlab.tmit.bme.hu

The High Speed Network Laboratory (HSNLab), as a strategic partner of the Ericsson Traffic Analysis and Network Performance Laboratory in Budapest, Hungary, focuses on high quality research and PhD education in the field of telecommunication networks. HSNLab integrates various research teams from several departments of the faculty.

HSNLab related activities of our department include the formal analysis of security protocols and security APIs, and the design of robust network topologies. Furthermore, our researchers are collaborating with Ericsson on green, i.e., energy efficient mobile networks.

Quantum Information National Laboratory

As member of a national consortium, we are working on the implementation of a national quantum communication network which can be connected to neighboring countries as well.

associated organizations

The Department of Networked Systems and Services is devoted to providing high-quality education in electrical engineering and computer science for undergraduate, graduate, and PhD students. The department actively participates in two bachelor level specializations, as well as in two major and two minor specializations at the master level.

Undergraduate program

In the undergraduate program, our department is involved in the following two specializations:

‣ Infocommunications (BSc program in Computer Engineering)
‣ Infocommunication Systems (BSc program in Electrical Engineering)

Within the Infocommunication Systems specialization, our colleagues are responsible for the Multimedia Technologies and Systems branch.

Besides the specialized and elective courses, the students also complete several laboratory exercises, and carry out individual project laboratory tasks and BSc diploma projects. Every year, over 100 students earn their BSc degree at the department.

The department also participates in the Bachelor of Profession (BProf) program, and is the coordinator of the "Networks and Security" specialization.

Graduate program

The master programs in the Department of Networked Systems and Services elaborate on the skills and enhance the knowledge of students through the following major and minor specializations:

‣ Integration of mobile networks and services (MSc major, Computer Engineering)
‣ IT security (MSc minor, Computer Engineering)
‣ Multimedia systems and services (MSc major, Electrical Engineering)
‣ Sound and studio technologies (MSc minor, Electrical Engineering)

Besides the specialized and elective courses, the students also complete several laboratory exercises, and carry out individual project laboratory tasks and MSc diploma projects. MSc level individual projects are very often related to our research activities and carried out in close cooperation with some of our industrial partners. Every year, around 30 MSc students graduate from the department.

education

Doctoral program

The doctoral training program enables students with an MSc degree to engage in independent research and research oriented postgraduate studies in the fields of wired and wireless networking, cryptography and network security, next generation communication systems, media technologies, and acoustics. Our PhD students and PhD candidates participate in the research and development projects of the department, and they also contribute to the department's teaching activities.

Discovering and working with talented students

Our department pays special attention to discovering and attracting talented students. We established special Knowledge Clubs for students in the following fields: computer security, networking and mobile systems and quantum communications. In these Knowledge Clubs, our leading researchers introduce exciting research topics to students, and in some clubs the students also perform self-study activities. In addition, we organize the CrySyS Security Challenge and the NetSkills Challenge, which are competitions where students are exposed to interesting problems.

Personal coaching

Our colleagues participate in the mentor program of our integrated MSc study program, where they advise individual students on their university studies and career opportunities.

PARIPA Program

The PARIPA is a novel complex program, unique in Hungary, founded by the Department of Networked Systems and Services. The students work on R&D topics defined by the partner companies, together with an academic and industrial adviser, targeting a strong liaison between the department and the industry. There are very strict rules for the admission, therefore only extremely motivated and well progressing students are admitted to the program. All students are members of a Soft Skill Workshop, where they receive additional skill development in creativity, communication, cooperation and strategic thinking.

Management Group

Our Management Group aims to help students develop management competencies through education (disciplines: Theory and Practice of Project Management, Startup Business Management, Self-Training Workshops) and research development (Agile Methods, DevOp, Trust Building, ePMO).

education

Vehicular networks are on the verge of becoming an essential part of our increasingly connected life. The success of the first generation large-scale V2X testbeds and the planned followers, manufacturers'/policy makers' activities aiming at applying cars with V2X communication solutions, and the maturing standards of cooperative intelligent transport systems (C-ITS) predict the inevitable and quick proliferation of vehicular networks. Three labs of our department joined to carry out research and development projects in the field of autonomous vehicles, focusing on cooperative intelligent transport systems (V2V and V2X communication), UAV design and development, urban mobility applications (mobile crowdsensing for intelligent transport) and coordination of multiple autonomous vehicles (flocking optimization). When cars are connected to each other and to the Internet, they become potential targets of cyber attacks. Therefore this team also focuses on new proof-of-concept cyber attacks against modern vehicles, analysing attack surfaces and testing security methods and testbeds for autonomous vehicles, also designing the security countermeasures against cyber attacks for autonomous vehicles and cryptographic algorithms and protocols for protecting vehicle communications.

The evolution of related technologies is still very far from finished: autonomous/automated vehicles, heterogeneous vehicular access environments, large scale deployment scenarios, application and service interoperability, security and privacy still pose serious challenges, however our team will be part of this evolution process.

Autonomous vehicles for smart cities

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We are currently witnessing a revolution in industrial manufacturing, heading towards something called Industry 4.0. Smart factories of the future will not only use robots and automation, but they will heavily rely on communications between components and massive data collection. This will allow for the optimization of manufacturing processes, customization of products, and better maintenance of equipment. Our department contributes to the fourth industrial revolution by delivering research and development results in advanced wireless communications, high performance embedded computing, and security for cyber-physical systems. As part of this activity, we built industrial control system testbeds where we study cyber attack detection and incident response approaches applicable in industrial environments.

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Activities on Industry 4.0
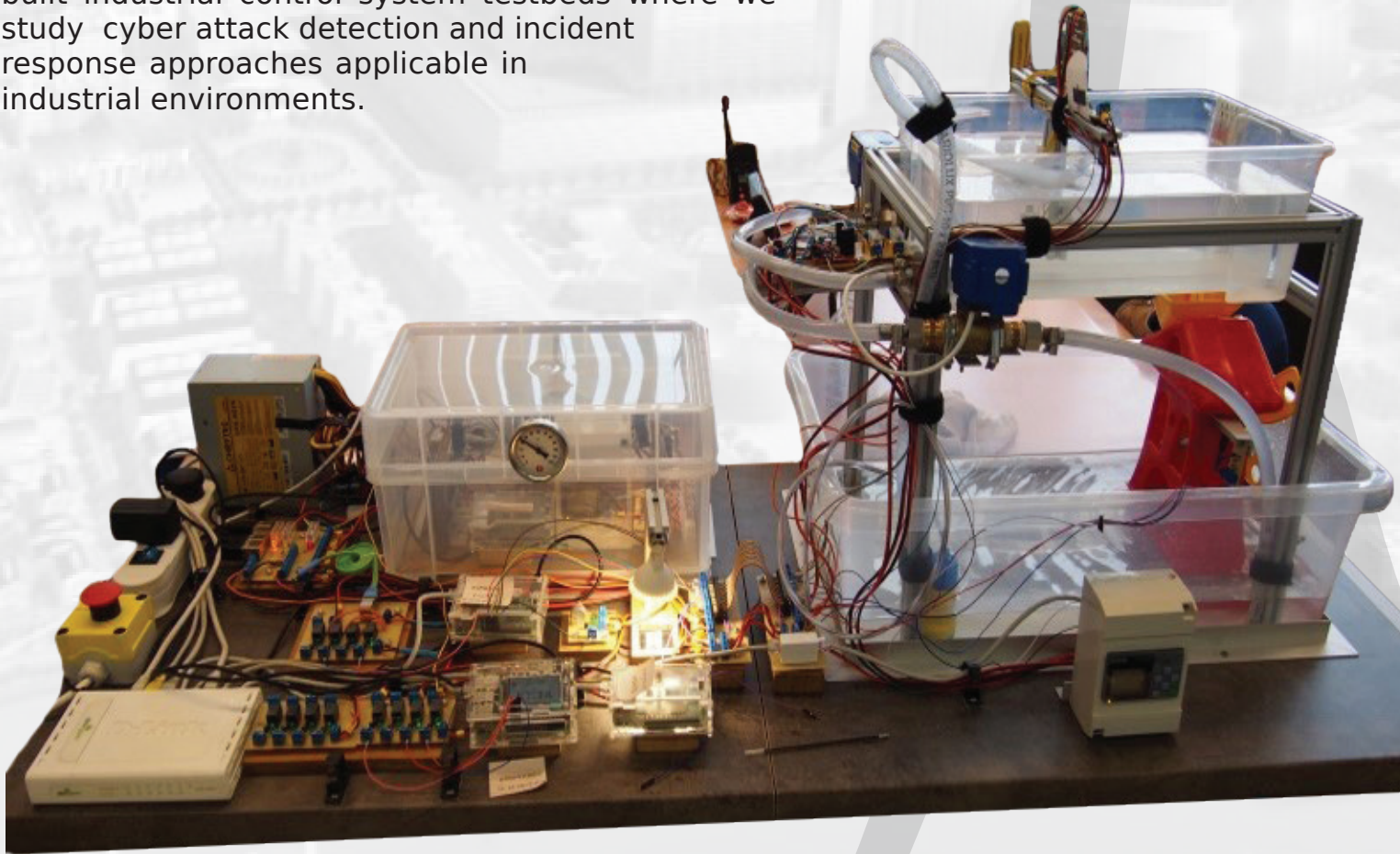
IOTAC: Security By Design IoT Development and Certificate Framework with Front-end Access Control

IOTAC aims to deliver a novel, secure and privacy-friendly IoT architecture that will facilitate the development and operation of more resilient IoT service environments. Within this EU funded H2020 project, the CrySyS Lab leads the task on designing a security baseline applicable for various IoT systems.

MELLODDY: Machine Learning Ledger Orchestration for Drug Discovery

MELLODDY aims to train machine learning models across multi-partner datasets while ensuring privacy preservation of both the data and the models by developing a platform using federated learning. This can accelerate drug discovery and increase efficiencies. Within this EU and EFPIA funded project, the CrySyS Lab works on new algorithms for privacy-preserving federated learning.

SETIT: Security Enhancing Technologies for the Internet-of-Things

The Internet has grown beyond a network of laptops, PCs, and large servers: it also connects millions of small embedded devices. This new trend is called the Internet of Things, or IoT in short. In many IoT applications, security is required, so in this project, we work on securing embedded IoT platforms by developing solutions for secure boot, secure remote firmware update, and run-time integrity monitoring.

VKE Intelligent Transportation System

Founded by the National Research, Development and Innovation Office, an intelligent transportation systems for cities of the future is developed, utilising machine learning methods and techniques, to optimise transportation, using historical and real time traffic sensor information.

Nokia Telco Cloud Simulator

An R&D cooperation between the Department of Networked Systems and Services and Nokia Bell Labs where our colleagues deal with specific tasks on simulation of multiple dynamic V2X communication / service provision environments in heterogeneous 5G telco cloud systems.

ANIMA: Aviation Noise Impact Management through novel Approaches

The aim of this project is to develop new methodologies, approaches and tools to manage and mitigate the impact of aviation noise, enhancing the capability to respond to the growing traffic demand. This project is not focused on reducing the noise, but to reduce annoyance. BME, represented by LAST, being partner in the project delivers a mobile application to test Quality of Life around Heathrow and two other European airports, and is also responsible for the development of a virtual resident tool, which aims to predict other aspects of aircraft noise annoyance than loudness.

Beamforming

This is a joint project with our industrial partner. Assessment of the mass transportation network of Budapest in terms of providing wideband backhauling connection to vehicles, using advanced beamforming solution. Advanced handover mechanisms were developed that exploit schedule and location information of vehicles.

HunQuTech: A Hungarian Quantum Technology Flagship Project

Under the framework of HunQuTech, we are responsible for quantum-based communications. Our focus is on further development of our wired-based quantum key distribution system as well as on a technology demonstration of free-space quantum communications.

NMHH

Developments of methods to estimate user perceived mobile data network performance in locations where performance measurements are not available. Assessing network level performance based on limited number and location of measurements, evaluation of the effect of advanced radio solutions and user traffic.

MEVICO: Mobile Networks Evolution for Individual Communications Experience

The project follows an end-to-end system approach on evolution of the Evolved Packet Core network of the 3GPP. The focus is on the connectivity layers of the system, for example on the part of the future LTE network which provides the efficient packet transport and mobility support for the applications and end-user services accessed over the LTE and LTE-Advanced radio systems.

AWARD: Autonomous Warehouse and Last Mile Delivery

An EIT Digital innovation activity which improves the current state of operations inside a warehouse, which is achieved by building a logistics platform leveraging on advanced planning and scheduling techniques based on machine learning, to coordinate a fleet of autonomous vehicles for moving goods indoors.

recent projects

Green projects and activities

The Department of Networked Systems and Services is dedicated to supporting and seeking environmentally friendly solutions both as research targets and during the daily routine.

In the framework of the Research University project both our education and research activities were extended towards the ecological aspects of development, design and operation of wired and wireless telecommunication networks (so-called green networks). Currently, energy consumption issues are either directly or indirectly addressed in most of our research activities. As far as the daily routine is concerned, steps are being made towards introducing processes that are environmentally friendly (e.g. use of recycled paper, selective garbage collection, focus on reduced energy and resource consumption).

Quantum Communications

The quantum mechanics-based computing is one of the most promising subfield of the Information Technology due to the quantum-based algorithms and protocols. Although quantum computers are going to be the tools of the far future, there are already physical quantum devices to solve specific problems. Our researchers at Mobile Communications and Quantum Technologies Laboratory (MCL) focuses on quantum-based communications and quantum information theory. Our research group participated in the development of the first Hungarian quantum key distribution device. Due to the nature of the quantum mechanics, an eavesdropper is automatically detected during the key distribution process, which offers revolutionary solutions in the field of cryptography.

the future in our hands

Tram 4,6

Petőfi híd

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