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Information and Communication  
Technologies for a better tomorrow

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### Collaborative Research in European R&D Programs

EU projects are venues for different players from industry and academia in Europe to conduct collaborative research activities addressing the European Digital Agenda. NLE continues to contribute to many EU projects and has built a solid reputation in this area. Despite fierce competition, NLE has submitted a significant number of successful proposals and has provided many successful innovative contributions in collaboration with its EU project partners.

### Standardization

Network and communication service technologies have expanded tremendously in variety and scope. Technologies (such as SDN, NFV, LTE Advanced and 5G, Car-to-X Communication, Hybrid Access for Home Gateways, Mobile Edge Computing, and IoT/M2M) require standardization of architectures, data models, protocols and interfaces at increasing pace and in multiple combinations. NLE actively promotes the industry consensus needed for rapid deployment and for interworking. NLE is driving progress in various Standard Development Organizations (SDOs) by contributing to new technologies and aligning different groups where possible. NLE also holds numerous official positions in key standardization bodies and takes pride in leading rather than following evolving standards.

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NEC Laboratories Europe, NEC Europe Ltd.

## Information and Communication Technologies for a better tomorrow



NLE's R&D agenda  
supports the NEC  
Group Vision 2017.

NEC Laboratories Europe (NLE) is based in Heidelberg, City of Science and Culture in southwest Germany. NLE's R&D agenda supports the NEC Group Vision 2017 "to be a leading global company leveraging the power of innovation to realize an information society friendly to humans and the earth".

This flyer presents an overview of NLE's main research activities and participation in collaborative efforts within the research community. NLE has an internationally diverse staff that includes currently over 100 staff members.

### Research Topics

NLE's R&D focus is primarily represented by seven major technology areas that are linked with standards activities, as shown below:

Network Platform	Social Solutions
Network Softwarization	Security
5G Networks	Smart Sensing
Network Data Analytics	Smart Transportation
	Smart Energy





# NEC Laboratories Europe (NLE)

## Our seven major technology areas.

### Network Platform

#### Network Softwarization

Softwarization is a key element of the new generation of Information and Communication Technology (ICT) platforms, using Software-Defined Networking (SDN), Network Function Virtualization (NFV) and Cloud technologies. However, virtualization causes significant impact on performance and scalability. Our work on the SuperFluid cloud platform targets at providing the full benefit of virtualization with minimal performance impact and extreme scalability.

#### 5G Networks

NLE contributes to the development of fifth generation (5G) mobile networks that will not just increase network performance but also accelerate network flexibility and convergence. NLE's focus areas include the virtualization of the 5G infrastructure and the orchestration of network functions and computational resources. With these technologies, we will enable 5G networks to support new service scenarios (e.g. IoT, vehicular, tactile) in a cost-efficient manner.

#### Network Data Analytics

Our research applies data analytics to streaming data in the network. We have developed a high performance distributed stream processing platform for collecting and analyzing large amounts of data in real-time. Combined with novel prediction algorithms, we open up new business and government applications in various areas including personalized advertising, health monitoring, and public infrastructure planning.



### Social Solutions

#### Security

Making the cloud trustworthy is a key challenge for business and society. The cloud should become a practical option for all sizes of enterprises and use sectors (e.g., government and private use sectors). NLE creates technologies for secure, reliable and auditable cloud storage and computation on encrypted data in the cloud. A second line of research focuses on securing IoT solutions against device tampering. This is important to guarantee the integrity of surveillance systems using video cameras or sensors deployed in open public spaces. Finally, the emerging SDN-based networks are subject to new vulnerabilities. We address the security of SDN control planes as well as novel security-services enabled by SDN.

#### Smart Sensing

The Internet-of-Things (IoT) enables new services by connecting physical and virtual objects with the cloud. NLE's IoT platform has become part of the European Future Internet platform FIWARE. It is used in commercial settings to monitor and control Smart Cities. Our platform was developed for scalability, efficient resource usage and high data quality. New analytic algorithms embedded into the platform are used to gain actionable insights, for example to detect city emergencies and crowds of moving persons. Typical use cases are public safety and digital signage for retail.

#### Smart Transportation

Building on its leadership in vehicular communications, NLE has extended its Intelligent Transportation Systems (ITS) activities to transport analytics and control technologies. We apply data analytics / machine learning techniques to better detect and predict inefficiencies, demand and anomalies in public transportation and road traffic. Furthermore, we develop infrastructure and vehicle-based optimization, such as routing and scheduling for fleets, as well as autonomous vehicle speed and trajectory control.

#### Smart Energy

With dramatic changes in the energy landscape and the increasing use of renewable energy, new schemes to manage and optimize energy generation, storage and usage are needed. We focus on algorithms to predict energy supply and consumption, to increase energy savings by using smart sensing and real-time control, and to improve energy and operation efficiency. Our research focuses on solutions for large facilities and urban grid management. Special attention is placed on systems that interact across multiple energy domains, such as electricity and heat networks.