\Orchestrating a brighter world **NEC**

## 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

Many of the technologies we develop 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 in the areas of SDN, NFV, LTE Advanced and 5G, Mobile Edge Computing and IoT/M2M. NLE is driving progress in various Standard Development Organizations (SDOs) by contributing to new technologies and aligning different groups. NLE also holds numerous official positions in key standardization bodies and takes pride in leading rather than following evolving standards.

**We are hiring:**
staff and interns
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Information and Communication
Technologies for a better tomorrow

# NEC Laboratories Europe



# Our R&D agenda

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 "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 four major technology areas that are linked with standards activities, as shown below:

| Data Science | Security |
|---|---|
| IoT and AI Platforms | 5G Networks |

# NEC Laboratories Europe
## Our four major technology areas.

## Data Science

With our leading artificial intelligence technologies, we develop new business and government applications, including personalized advertising, retail optimizations, financial predictions, health monitoring and public safety infrastructure planning.

Our predictive analytics and real-time optimization technologies help bus operators, transport authorities, road operators and automotive companies make transportation systems more efficient.

By combining logic and deep learning, our research has enhanced the fundamental capabilities of artificial intelligence systems. We have overcome the restrictions of deep learning to low-dimensional data structures. Enhanced by innovative representation learning methods, we apply deep learning to systems of high complexity with improved prediction accuracy, high scalability, and a performance suited for low-latency applications.

We enable machine learning to adapt to environmental changes by developing new learning algorithms that can detect environmental changes and adapt their behavior without frequent retraining.

## System Platforms for IoT and AI

The Internet of Things (IoT) brings a huge variety of innovation opportunities by connecting physical and virtual objects with the cloud. Our IoT platform has become a part of the European Future Internet platform FIWARE. It enables commercial applications to monitor and control smart cities. Our unique FogFlow technology provides scalability, efficient resource usage, and high data quality for edge-cloud systems. It offers convenient programming models for utilizing advanced IoT platform capabilities, such as AI engines at the edge for distributed analysis of IoT data streams.

As artificial intelligence becomes more commonly used in all aspects of human life, there is a growing need for easy-to-use and highly scalable AI platforms. Our research addresses these needs by building highly performant and scalable implementations of neural networks that efficiently use available resources and achieve top performance on hardware accelerators.

## Security

Lack of trust and reliability is often a major barrier for the adoption of innovative, but highly distributed and cloud-based applications.

Our security technologies ensure a chain of trust from small sensors all the way up to the cloud. We achieve IoT security with trusted device execution environments in edge devices and with scalable access control and policy checking at the edge and in the cloud.

With our leading blockchain technology, we provide trusted distributed storage and transactions with high scalability, low energy consumption and unique privacy. We address a wide range of applications, including financial systems and supply-chain-management.

## 5G Networks

The transition to fifth generation (5G) technologies opens mobile networks to a wide variety of applications and specializations beyond the traditional telecom domain.

We build on our strength in developing mobile technology and virtualization to create networks that are highly flexible and support new use cases for vertical service scenarios in smart cities, automotive communication and industry 4.0. We achieve this by converging 5G technologies with the Internet of things and by using artificial intelligence to continuously adapt and optimize the network.