what path the data take, they can see where information exchange is being suppressed and attempt to circumvent those areas.”

SIGNIFICANT ADVANTAGES

However, the new system is not without its drawbacks: the administrative effort required to manage the individual sub-networks and cryptographic keys is greater than for the existing system. Yet Perrig is convinced that the advantages are so compelling that customers would accept it: “A smartphone is more complex to use than old-style feature phones, yet we would never want to give them up any more.”

Perrig has now chalked up his first successes with his project. “It’s going well,” he notes with satisfaction. “We have two important partners, Swisscom and Switch, already on board. Two Swiss banks, the Federal Office of Information Technology and several companies are also currently testing our system.” Abroad, too, Perrig has turned colleagues into partners: SCION routers based on this new architecture are now set up around the world. Together with David Basin and Peter Müller, both professors in the Department of Computer Science, Perrig founded the company Anapaya Systems, through which he intends to commercialise the SCION network architecture.

“We plan to build highly secure routers ‘made in Switzerland’,” says Perrig enthusiastically.

Nevertheless, it’s going to take a bit more persuasion: “To recognise the advantages of our system, one must first understand the new architecture. With SCION, we are creating an internet that works somewhat differently than the current system. Fortunately, conventional networks will require only small changes to unlock the advantages of the new architecture.” //

THE NETWORK SECURITIY GROUP:
www.netsec.ethz.ch

ADRIAN PERRIG is a Professor of Network Security and Head of the Institute of Information Security. His research encompasses the development of new technologies for secure and reliable data exchange in networks.

SCION
Efficient and secure routing with SCION: Senders and receivers define for themselves the paths used to transmit data.

1 AUTONOMOUS SYSTEMS are operated by both institutions and companies. Within every autonomous system, the respective operator controls how data is exchanged between computers.

3 ISD CORE : Each isolation domain (ISD) is managed by selected autonomous systems, which form the core of the domain. They also control the paths along which data is exchanged with the other domains.

2 An ISOLATION DOMAIN (ISD) is an independent regional network of different autonomous systems. Within each domain, the autonomous systems agree on a common technical and legal framework.

Learning starts with people

Fast, intelligent data systems are Ce Zhang’s speciality. To make sure they function smoothly, the data scientist combines basic research with service and dialogue.

TEXT Florian Meyer

CE ZHANG of China has been teaching and conducting research in the Department of Computer Science since autumn 2016, focusing on data systems, databases, data processing and machine learning. Born in 1987, he is one of the youngest professors at ETH.

Ce Zhang loves to talk with researchers from other disciplines. For the computer science professor, discussions with colleagues are a constant source of inspiration and motivation. Zhang, a native of China, is a computer scientist by training with a focus on interdisciplinary, data-driven research. He specialises in data systems that enable machine learning and artificial intelligence – in other words, applications that automatically comb through data to find information researchers could not otherwise obtain on their own. “The goal of my research is really quite simple,” explains Zhang. “I support other researchers so that they can apply the latest developments of modern-day data analysis and expand their knowledge.”

For example, Zhang’s team is working on an adaptive machine application for biologists at ETH Zurich. The goal of the application is that it will read scientific journals in order to automatically glean the key information from the articles, since today it is impossible for anyone to read every biology publication themselves. Working with a team of astrophysicists headed by ETH Professor Kevin Schawinski, Zhang’s group also recently developed a machine learning system that automatically processes telescope images to make it much easier for the astrophysicists to detect faraway galaxies.

Zhang is collaborating on similar projects with the private sector: his team is developing another adaptive application, this time for a communications company, that automatically filters information from PDF documents.

A FLAIR FOR USER PSYCHOLOGY

This type of interdisciplinary collaboration, which also involves the user in the development process, is typical of Zhang’s work – and for data science in general. It also explains why, in talks with researchers, he places such value on teasing out the genuine need and building a data system around it. Data systems function better when they are designed with the user’s needs and certain human characteristics in mind.

“When a data-driven application helps scientists free up more time for actual research by relieving them of routine tasks, that’s when it feels my work has been truly worthwhile,” says Zhang. His knack for understanding user psychology goes back to his early days in this field: before beginning advanced computer science studies at the University of Wisconsin-Madison and Stanford University in the United States, Zhang graduated from Peking University with a Bachelor’s degree in machine intelligence. The programme, which was new at the time, linked computer science to the neurosciences and experimental psychology.

More specifically, Zhang focuses primarily on the next generation of data systems. “We want to make the data systems as fast as possible,” he explains. That’s because powerful and efficient systems provide the foundation for rapid data processing and for adaptive applications.

Collaboration with users outside computer science helps Zhang’s team further simplify their systems for machine learning. Today, says Zhang, scientists still spend a lot of time writing hundreds of lines of code, since they must specify – that is, individually execute – every task that the system is expected to perform with machine learning. In future, computers are to handle this, and learn on their own how they are to find the desired information in the data. //

FURTHER INFORMATION:
www.inf.ethz.ch/personal/ce.zhang/