Celtic-Plus
Smart Connected World

Project Achievements

SENDATE Secure DCI

SENDATE-Secure DCI

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SENDATE Secure DCI

SENDATE Secure-DCI focused on the development of an architecture for next-generation distributed data centers with open SDN/NFV control and orchestration allowing flexible and secure provisioning of compute, storage and networking resources to tenants and applications at scale.

Main focus

Large Data Centers (DCs) are forming the most important control centers for communication and cloud-based services on the Internet. Within DCs, business as well as private data is stored, processed, and forwarded.

Although current DCs have a huge computing power, massive storage capacities, and an enormous performance based on centrally stored data, they are located far away from the customer, use the network only for transport, and are mostly owned by non-European companies. This leads to low flexibility, long delays to customers, and security concerns.

New application scenarios in our digital society such as Industrial Internet, mobile connected objects, Internet of Things, health applications, and especially 5G lead to a huge number of end devices and an enormous increase of traffic volume. The high demands on security, location awareness, service guarantees, flexibility, and latency require a convergence of telecommunication networks and IT as well as distributed data centers, which are placed close to the customers. The forthcoming integration of many smaller distributed data centers into a flexible, powerful ensemble represents an ideal network infrastructure to solve today's problems with latency, the data traffic volume and data sovereignty.

The project supports Industry-4.0 applications with extremely fast and flexible connection. For high security and confidentiality independent of any higher layer protocol, data transmission is encrypted on the physical layer. In combination with quantum safe encryption a higher level of security is introduced and allows for innovative applications in sensitive areas such as telemedicine.

Secure interconnection of distributed data centers (Source: ShutterStock / ADVA)

Approach

Within the SENDATE Secure-DCI project, the architecture for next-generation distributed data centers has been developed allowing a flexible and secure provisioning of compute, storage and networking resources to tenants and applications at scale. Innovative approaches such as Network Functions Virtualization (NFV) in combination with Software Defined Networking (SDN) are the basis for a secure, flexible, low-latency, and locality-aware distributed data center approach to support the upcoming application scenarios.

Targets of the project were:

- Development of a novel, packet-optical distributed data center fabric architecture facilitating a 10-fold higher fabric capacity, 50% better network efficiency and 30% lower energy consumption than today's implementations.
- Integration and extension of open-source based control and orchestration software for distributed compute, storage and networking resources, allowing an application driven resource optimization with sub-second response times
- Development of a new multi-layer data center switch as elementary fabric building block providing a hardware-based layer 0 to layer 4 forwarding plane and embedded storage and compute capabilities to host software-based virtual network functions
- Development of new transmission schemes and optical interface technologies supporting WDM based intra-data center connectivity, metro-scale inter-data center interconnects, and long-haul inter-data center connectivity at 400 Gb/s+ channel speeds allowing up to a 10-fold increase in fiber capacity while lowering power and maintaining reach.
- Development of an integral security concept ensuring that user and application data is only accessible in clear text within verifiably trusted areas and encrypted, preferably by post-quantum secure encryption methods, anywhere else.

Achieved results

SENDATE Secure-DCI developed and evaluated an innovative architecture for extremely fast and flexible connection and networking of distributed data centers to support Industry-4.0 applications such as tele-medicine. Encrypting transmission data on the physical layer ensures confidentiality of all data, independent of any higher layer protocol. In combination with quantum safe encryption a higher level of security is introduced and allows for innovative applications in sensitive areas such as tele-medicine.

Together with the SENDATE FICUS project, SENDATE Secure-DCI conducted a cooperative multi-partner field trial with SDN-based reach planning and service provisioning in a disaggregated optical multi-domain network (Autenrieth et al., ONDM 2019), which is a main element of the distributed data center network.

A key success factor and at the same time a key outcome of the project was the founding and operation of the Open SDN & NFV Lab (OSNL), Berlin. This lab allowed the development and evaluation of research concepts and solutions for distributed data centers, and it was used successfully in proof-of-concept demos for scientific conferences, standardization and key stakeholders.

Impact

SENDATE Secure-DCI achieved its objectives with excellent scientific and pre-commercial results based on good collaboration of the project partners, which resulted in 73 publications and presentations, 6 journal papers, 4 demonstrators, 2 standardization contributions and 5 standard implementations or workability trials, 2 invention reports and 3 press releases.

The outcome of the project is expected to have long term impact, as the ongoing usage of the OSNL as well as commercial offers of improved products and solutions already indicate.

About Celtic-Plus

Celtic-Plus is an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications & services focusing on a new „Smart Connected World" paradigm. Celtic-Plus is a EUREKA ICT cluster and belongs to the intergovernmental EUREKA network. Celtic-Plus is open to any type of company covering the Celtic-Plus research areas, large industry as well as small companies or universities and research organisations. Even companies outside the EUREKA countries may get some possibilities to join a Celtic-Plus project under certain conditions.

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