5G Network Slicing: Part 1 – Concepts, Principles, and Architectures


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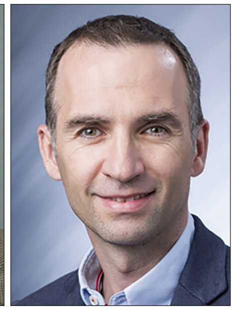
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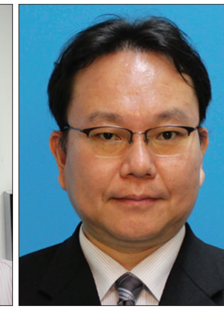
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Network slicing has evolved from a simple fixed network overlay concept to a fundamental feature of the emerging multi-provider fifth generation (5G) systems, enabling new business opportunities by facilitating flexible and agile support for multi-service and multi-tenancy. Network slicing can drastically transform the monolithic "one network fits all" architecture by abstracting, isolating, and separating logical network behaviors from the underlying physical network resources, opening the network to third parties and providing the means of integrating vertical market segments. Network operators can exploit network slicing not only for reducing capital and operational expenditures, but for enabling network programmability and innovation, in order to enrich the offered services from providing simple communication pipelines to a wider range of business solutions.

Network slicing in 5G systems defines logical, self-contained networks that consist of a mixture of shared and dedicated resource instances, such as radio spectrum or network equipment, and virtual network functions. Virtualization allows the decoupling of network functions from proprietary hardware appliances in order to create distinct building blocks that can be flexibly chained to create value-added communication services.

The notion of resources in 5G network slicing includes network, compute, and storage capacity resources, virtualized network functions, and radio resources. Service designers can select the optimal control/user plane split, as well as compose and allocate virtualized network functions at particular locations inside the core or radio access network depending on the service requirements. 5G network slicing enables a particular communication service exploiting the principles of software defined networks (SDN) and network functions virtualization (NFV) to fulfill the business and regulatory requirements. The achieved networking and service flexibility enables a radical change, beyond network sharing, enabling tailored services to third parties and vertical market players.

This Feature Topic includes five outstanding articles that focus on 5G network slicing — elaborating the network slicing concept, principles, and architectures from different perspectives considering distinct network parts, for instance, the radio access, mobile core network, backhaul, and fixed IP, as well as the support of different tenants and services. In addition, these articles provide insight on the architecture aspects, pointing out enhancements of the current mobile networks and on key enabling technologies, highlighting operational features for efficient management and orchestration in order to achieve the desired flexibility, service isolation, and performance customization.

The first article, "Network Slicing to Enable Scalability and Flexibility in 5G Mobile Networks," by P. Rost, C. Mannweiler, D. Michalopoulos, C. Sartori, V. Sciancalepore, N. Sastry, O. Holland, S. Tayade, B. Han, D. Bega, D. Aziz, and H. Bakker, presents the concept of network slicing in 5G networks focusing on the architectural aspects associated with the coexistence of dedicated and shared slices, bringing light to the revenue potential. In addition, it analyzes the different options for providing a flexible radio access network considering the impact on the 5G mobile network design.

The second article, "Slicing for 5G with SDN/NFV: Concepts, Architectures and Challenges," by J. Ordonez-Lucena, P. Ameigeiras, D. Lopez, J. J. Ramos-Munoz, L. Lorca, and J. Folgueira elaborates the concept of 5G network slicing, analyzing the Open Networking Foundation (ONF) SDN and European Telecommunications Standards Institute (ETSI) NFV technologies in an effort to introduce a combined solution for realizing network slicing.

The following article, "PERMIT: Network Slicing for Personalized 5G Mobile Telecommunications," by T. Taleb, M. Corici, A. Nakao, and H. Flinck, brings light to the 5G network architecture in terms of elasticity and scalability requirements with respect to network slicing for providing deep customization at different granularity levels, while ensuring the desired service delivery on the top of a common infrastructure.

The next article, "Network Slicing in 5G: Survey and Challenges," by X. Foukas, G. Patounas, A. Elmokashfi, and M. Marina, analyzes the concept of network slicing with respect to multi-service support and provides a comprehensive overview of different network slicing proposals, presenting a framework that can evaluate their maturity and identify potential open research challenges.

The last article, "5G-ICN: Delivering ICN Services over 5G using Network Slicing," by R. Ravindran, A. Chakraborti, S. O. Amin, A. Azgin, and G. Wang, elaborates the notion of application-centric network slicing over a programmable compute, storage, and transport infrastructure considering information-centric networking (ICN). The article emphasizes the flexibility offered by NFV/SDN over which 5G-ICN can be realized and introduces the concept of mobility as a service.

We hope that these five articles provide an overview to the readers with a representative taste of the 5G network slicing concepts, principles, and architectures.

BIOGRAPHIES

KONSTANTINOS SAMDANIS (konstantinos.samdanis@huawei.com) is a principal researcher at Huawei for 5G carrier networks. He is involved in research for 5G SDN/NFV architectures and network slice OS, being also active at BBF in wireless-wired converged networks and the 5GPPP Architecture WG. Previously he worked for NEC Europe, Germany, as a senior researcher and a broadband standardization specialist, involved in numerous EU projects and 3GPP. He received his Ph.D. and M.Sc. degrees from Kings College London.

STEVEN A. WRIGHT, M.B.A., Ph.D., J.D. (s.wright@ieee.org), has been involved in the communications industry in research, development, program management, product management, university faculty, and board roles, resulting in 50+ patents and a number of diverse publications. He has presented his research at international conferences in Europe, Asia, Australia, and the United States, and founded the IEEE NFV SDN conference.

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