

THE EVOLUTION OF TELECOM BUSINESS, ECONOMY, AND POLICIES



Ivo Maljević



Ahmed Alsohaily



Dean Brenner



Wen Tong

The telecommunications industry, while inherently dynamic in nature, is at the advent of a paradigm shift from strictly providing connectivity services (a so-called “dumb pipe”) to becoming the foundation of a digital future extending to virtually every facet of the economy and society. Indeed, initial economic measures clearly indicate this shift with mobile technologies and services generating 3.9 Trillion USD of economic value in 2018, corresponding to 4.6 percent of the global GDP [1]. The transformation the telecom industry is undergoing will blur the lines between connectivity, information technology, computing and a wide range of verticals. The Evolution of Telecom Business, Economy and Policies is the subject of this Feature Topic, which provides a closer look at network transformation, radio equipment certification, service monetization and even the far-reaching outlook for 6G.

In the context of expected network transformation, the first article explores a promising potential future evolution path of Network Functions Virtualization (NFV) technologies that leverages Unikernel Network Functions (UNF). While “traditional” NFV can achieve OpEx and agility requirements of network operators, security, isolation and minimization limitations of such technologies are better addressed via UNFs. A comprehensive overview of the differences between NFV and UNF is supported by experimental results and possible avenues for future research.

Technological developments continuously drive regulatory modernization, and the second article discusses the European “Radio Equipment Directive” (RED), a harmonized standard for radio equipment certification, in addition to providing a short overview of market access in other regions and exploring possible implications of RED articles.

Evolution of business models continuously pursues improving the profitability of telecom and connectivity services. The third article (Towards Flexible Wireless Data Services) explains various mechanisms for service monetization and examines different data mechanisms under a fixed data cap. By focusing on the time dimension, it provides a comprehensive discussion on some of the key questions around the most time-flexible data mechanisms, beneficiaries of time-flexible data and the interrelationships and viability between different types of flexibility.

The fourth and last article specifies the top 10 trends in the cellular industry and provides an outlook for 6G research and development. While 5G has tremendous potential for growth and is yet to show limitations that would necessitate the introduction of “6G”, it is important that research continue without necessarily requiring new ideas to be developed in the context of a specific 5G system or configuration to maintain the pace of technological innovation in this field. In that spirit, the most promising potential directions to set the stage for future 6G systems are laid out, some of which are likely to involve significant challenges, such as increasing the operating frequencies beyond

100 GHz or substantially increasing the system bandwidth beyond current 5G capabilities. Other issues, while essentially based on current trends, form a strong basis for future research when put together.

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REFERENCES

- [1] GSMA, “The Mobile Economy 2019,” report, <https://www.gsma.com/r/mobileeconomy/>; accessed on Oct. 27, 2019.

BIOGRAPHIES

IVO MALJEVIĆ is a senior member of TELUS’ technology strategy team, where he focuses on defining a long-term vision for radio access network (RAN) evolution, radio performance characterization and modeling, radio spectrum strategy and technology standardization. His current experience includes 10 years of work with TELUS. Additionally, Ivo is an adjunct professor at the University of Toronto. Prior to TELUS, he was with Soma Networks, and before that, he worked at Motorola Canada. He received the B.S. degree from the University of Podgorica in 1991, the M.S. degree from the University of Belgrade in 1995, and the Ph.D. degree from the University of Toronto, Canada, in 2004, all in electrical engineering.

AHMED ALSOHAILEY is the Chief Technology Adviser of the Communications and Information Technology Commission of Saudi Arabia. In addition to contributing to the realization and regulation of 5G in Saudi Arabia, he has contributed to the development and standardization of cellular 5G and IoT technologies at the 3GPP, NGMN, IEEE and ITU, and holds multiple 5G related patents. Prior to joining CITC, Ahmed was a senior member of the 5G Spectrum and Wireless Networks team at TELUS Corporation while serving as an Adjunct Professor and Assistant Director of the Wireless Lab at the University of Toronto. Ahmed holds a Ph.D. in electrical and computer engineering from the University of Toronto.

DEAN BRENNER is Senior Vice President, Spectrum Strategy & Technology Policy for Qualcomm Incorporated. He directs Qualcomm’s global spectrum strategy and its other global technology policy initiatives. He represents Qualcomm before spectrum regulators around the world. For the past 16 years, he has led Qualcomm’s successful efforts to win regulatory approval for many new wireless technologies. Mr. Brenner received his A.B. degree, magna cum laude with distinction in public policy studies, from Duke University in 1982. He won a prize for the best paper on communications policy, and he was a recipient for four years of a CBS Scholarship. He received his J.D., cum laude, from Georgetown University in 1985.

WEN TONG is the CTO of Huawei Wireless and a Huawei Fellow. He is the head of the Communications Technologies Labs at Huawei and Huawei’s 5G chief scientist, leading Huawei’s 5G research and standardization. Prior to joining Huawei in 2009, he was the Nortel Fellow and head of the Network Technology Labs at Nortel. He joined Bell Northern Research in 1995 in Canada. He is an IEEE Fellow. He was the recipient of the IEEE Communications Society Industry Innovation Award and the Distinguished Industry Leader Award. He has pioneered fundamental technologies from 1G to 5G wireless with 430 granted U.S. patents. He is a Fellow of the Canadian Academy of Engineering, and also serves on the Board of Directors of the WiFi Alliance.