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TOWARDS SPACE-BASED EDGE COMPUTING AND CONNECTIVITY AS GLOBAL INDUSTRIAL BACKBONE – A LAB SETUP FOR INDUSTRY APPLICATIONS

Abstract

Availability and access to global ubiquitous communication and computation is a key enabler for modern infrastructure and future industrial businesses. Ubiquitous connectivity and computation is critical for modern of infrastructure for our daily life, including sustainable supply chains, industrial infrastructure and the global operation of industrial assets. This requires robust, resilient operation of the essential support of the core or critical infrastructure for e.g., smart cities, mobility, railways, energy grids, pipelines. This infrastructure also needs to be operational in crisis situations and need to support rapid and resilient crisis response. While satellite communication has been used as customized solutions in industrial use cases for decades, it recently has started to become commodity and more and more competitive to terrestrial networks – especially in rural areas. This trend is clearly visible in the target technologies and architectures of future 6G and even recently in new 5G scenarios and services from upcoming new-space companies.

With the convergence of space, IT, and OT technology technologies and the development of standardized space systems, an additional globally accessible space-based edge-cloud infrastructure is of high value in order to address these challenges and business demands. Such a space-based solution tackles with one solution both challenges of accessibility of ICT infrastructure for everyone, for critical infrastructure, and the global industrial business use case demands.

This work provides the results of an initial transfer of designs and technologies for industrial edge-computing systems to space based industrial edge-computing systems. Space-based edge-network topologies are presented, and the required mechanisms and network functions are analyzed. We also describe a testbed that allows for easy integration testing and system emulation of space-based industrial edge systems for typical industrial use cases. An initial reference test setup is used for a first case-study of an industrial application. It is based on virtualization, network emulation forming an industrial edge cloud with emulated behavior of Sat-com networks. This will be used as baseline setup to drive the refinement and realization of the vision of a space-based, industrial compute and connectivity backbone infrastructure for industrial use cases and future space scenarios.