

5G Network Slicing for Smart Distribution Grids

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Motivation

- The protection and control operations of smart distribution grids are mission critical.
- These operations impose strict performance requirements and necessitate ultra-reliable low-latency communication (URLLC) services.
- 5G network slicing is a promising candidate for smart distribution grid communications.
- Network slicing is able to create several virtual end-to-end (E2E) networks by reserving virtual resources upon one physical network.

Research Questions

- What are the constraints and requirements for the communication networks in distribution grid protection and control?
- How can 5G network slicing support End-to-end (E2E) URLLC services?

Approach

- 5G Radio Access Technology (RAT): resource block allocation with mixed numerology to ensure resource isolation (analytic model)
- 5G Radio Access Network (RAN): resource management of virtualized resources in the RAN with RAT integration to ensure isolation (analytic or simulation model)
- 5G core network: resource management to ensure E2E guarantees of the URLLC services (analytic or simulation model)

Findings

- The different message types for grid protection and control are classified into categories which are mapped into 5G use cases
- RAN slices are designed such that they meet the communication requirements needed as above.
- The performance and dependability measures of the RAN slices are evaluated using a multi-dimensional loss system.

Significant results

Mendis, Handunneththi V. Kalpanie; Heegaard, Poul Einar; Krlevska, Katina. (2019) 5G Network Slicing as an Enabler for Smart Distribution Grid Operations. CIRED Conference Proceedings.

