



# GOOSE and Smart Grid Control Signaling over 5G

Prepared by: Karl-Johan Grinnemo

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## KARLSTAD UNIVERSITY

### Purpose

Investigate through real-world experiments the feasibility of running GOOSE over 5G with real-time performance, and, in so doing, together with us and Ericsson suggest further improvements.

### Introduction

The concept of Smart Grids has recently been seen as the appropriate way to address the new challenges in the energy domain: network reliability, energy efficiency, distributed renewable energy sources and the increasing network complexity. Smart Grids are electricity networks that use digital technology to coordinate the needs and capabilities of all generators, grid operators, end users and electricity market stakeholders in such a way that it can optimize resource utilization and operation while maintaining reliability, resilience and stability.

In so-called Medium Voltage (MV) systems, i.e., systems that manage transmission voltages between 2 kV and 35 kV, the IEC 61850 standard is today one of the most common standards for the power system automation [1]. Its main scope is to guarantee the interoperability among automation devices from different vendors. To achieve this goal, the standard introduces an abstract model describing the information which can be exchanged among the various devices; introduces a set of services, i.e., the actions that can be performed based on this information; and, proposes some protocols to implement the information exchange. In particular, the standard describes the set of services required in order to facilitate the exchange of the IEC 61850 data model information between different devices in a MV system. One of these services is the Generic Object-Oriented Substation Event (GOOSE) service. The GOOSE service provides a fast and efficient way to transmit substation event information to multiple devices and encapsulates its messages in Ethernet packets.

Although Ethernet is both efficient and very lightweight, its range is rather limited. To this end, researchers have considered transmitting GOOSE over wireless media including Zigbee, WiFi, and LTE [2]. Since 5G promises even higher reliability and lower latency, Ericsson and several other telco providers envision the 5G mobile network to become the future Smart Grid transmission media. As part of this work, Ericsson is currently investigating the feasibility of sending GOOSE messages as data packets tunneled over an Ethernet Generic Routing Encapsulation (GRE) tunnel.

### Subactivities

1. On the basis of the platform for rapid prototyping GOOSE developed by Blair et al. [3], evaluate the latency of GOOSE over a 5G network serving a MV system.
  2. One foreseen challenge running GOOSE as data packets in the user plane is that it competes with all subscribers' data traffic. Ericsson suggests to solve this by introducing L4S [4], the architecture for low queueing delay currently being standardized by the IETF, and Explicit Congestion Notification (ECN) [5] in their 5G base stations. As a second step in your thesis work, you should study the effects of running GOOSE traffic over L4S and with the use of an ECN-based congestion control.
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