SEEEI – Electricity 2017

Fast & Secure Switching via LTE Mobile Networks

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MV/LV networks becoming Smart Grids: Changes / Implications

- ✓ Proliferating DER injection
  - Customer's premises as "**Hot Spots**"
  - Stability of the MV/LV grid becoming jeopardised
- ✓ Real-time/fast communications with network end-points getting pre-requisite
- ✓ Interconnected market participants
- ✓ Life-time security for the assets
- ✓ Transparency of physical losses
- ✓ Move from DSM towards DMS in LV networks
- ✓ Communicating meters with real-time interval metering
- ✓ Increasing energy storage ability

VPPs, Direct Marketing

- ✓ A „**Virtual Power Plant“** is a cluster of distributed energy managed as a whole:
  - Pooling of producers
  - Aggregation of consumers
- ✓ As a complex system scheme VPP embraces;
  - Real-time communication
  - Monitoring and control
  - Trading & optimised demand/supply balancing
  - Portfolio-Management, provision of reserve energy
  - Energy exchange

Four Reasons for Fast Communications

1. Dynamic Demand/Supply Response
2. Prioritised switching during critical grid situations in real-time
3. Increased overload due ubiquitous high security functionality throughout the distributed system
4. Communication network monitoring and quality of service provision in real-time

Risk Consideration, Security Impact:
High Level Approach for Secure Products

Risk = Threat x Vulnerability x Consequences

Common Criteria CC EAL 4+ Compliant
Inherent Security:

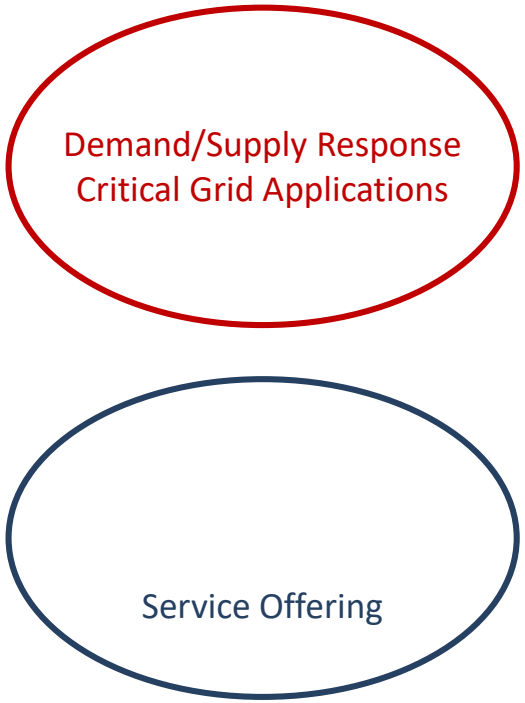
- Integrated Security Module
- PKI based Double-end Authentication
- All TLS protection
- Life-Cycle Security

DMS Enhancement

- ✓ Distribution Management Systems generally provide observability and controllability of medium voltage distribution grids
- ✓ The growing amounts of distributed generation in low and medium voltage grids require an efficient and secure operation, particularly in time critical situations in order to maintain the stability of the energy system
- ✓ Widely distributed controllable equipment like generators, storage and responsive loads today are thus to be managed in real-time via fast and secure communication channels, preferably through a dedicated network
- ✓ Existing DMS can be extended to include new functionalities that build on real-time data acquisition and on control schemes by ensuring coordinated functionality at the distribution grid end points

Grid Control Schemes Blurring with Service Offering

- ✓ Demand/Supply Response Applications:
  - Load management (e.g. Heating)
  - Equipment/ renewables management
  - Tariff-/event driven load & renewables management
  - Public lighting
  - Car charging at end customer‘s premises
- ✓ Critical Grid Applications:
  - Distribution Automation
  - Time critical control in LV distribution networks
  - Time critical control in MV distribution networks
- ✓ Services to End Customers:
  - Monitoring services via the secure platform
  - Secure access of independent service providers
  - Remote maintenance of equipment/devices



CC*) certified secure Gateway SGH-S 1

CC compatible secure Grid Unit GCU-S 2

- ✓ Deployment in MV/LV distribution networks
- ✓ Installation in sec sub-stations and end at customer‘s equipment

1

2

*) CC: Common Criteria

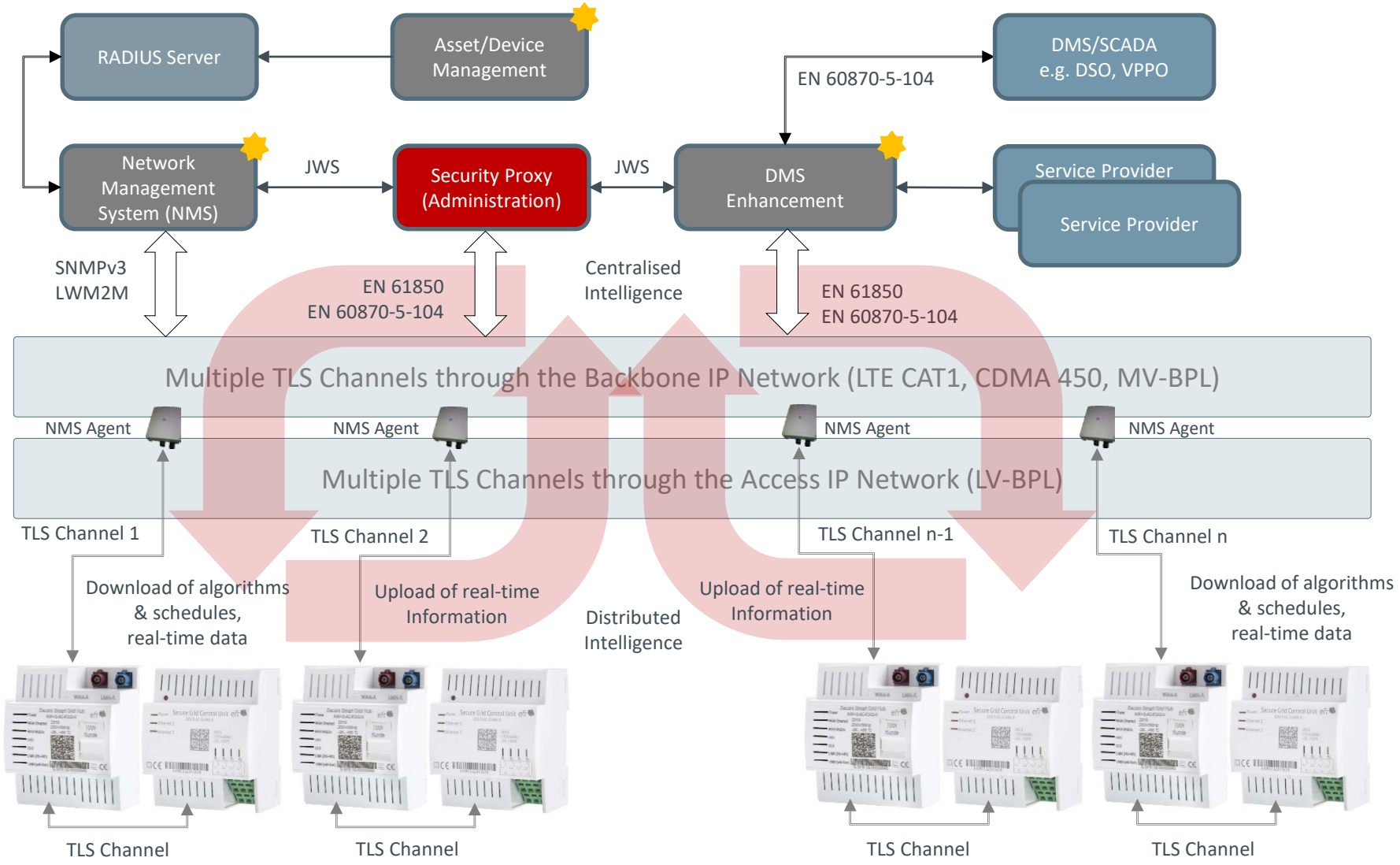
Secure Gateway/Grid Control Platform: Communication Channels

- ✓ Ethernet interfaces:
  - ETH1 for secure LAN
  - ETH2 for secure WAN
  - Integrated Ethernet Switch
- ✓ Mobile Carrier Options:
  - LTE CAT1, 800/1800/2600 MHz with 2G Back-up
  - CDMA 450 MHz (EV DO)
- ✓ Integrated Broadband Mains Option:
  - Frequency band between 2 to 10 MHz
  - Dynamic Network Management
- ✓ RS 485 bus interface for meter & sensor communication

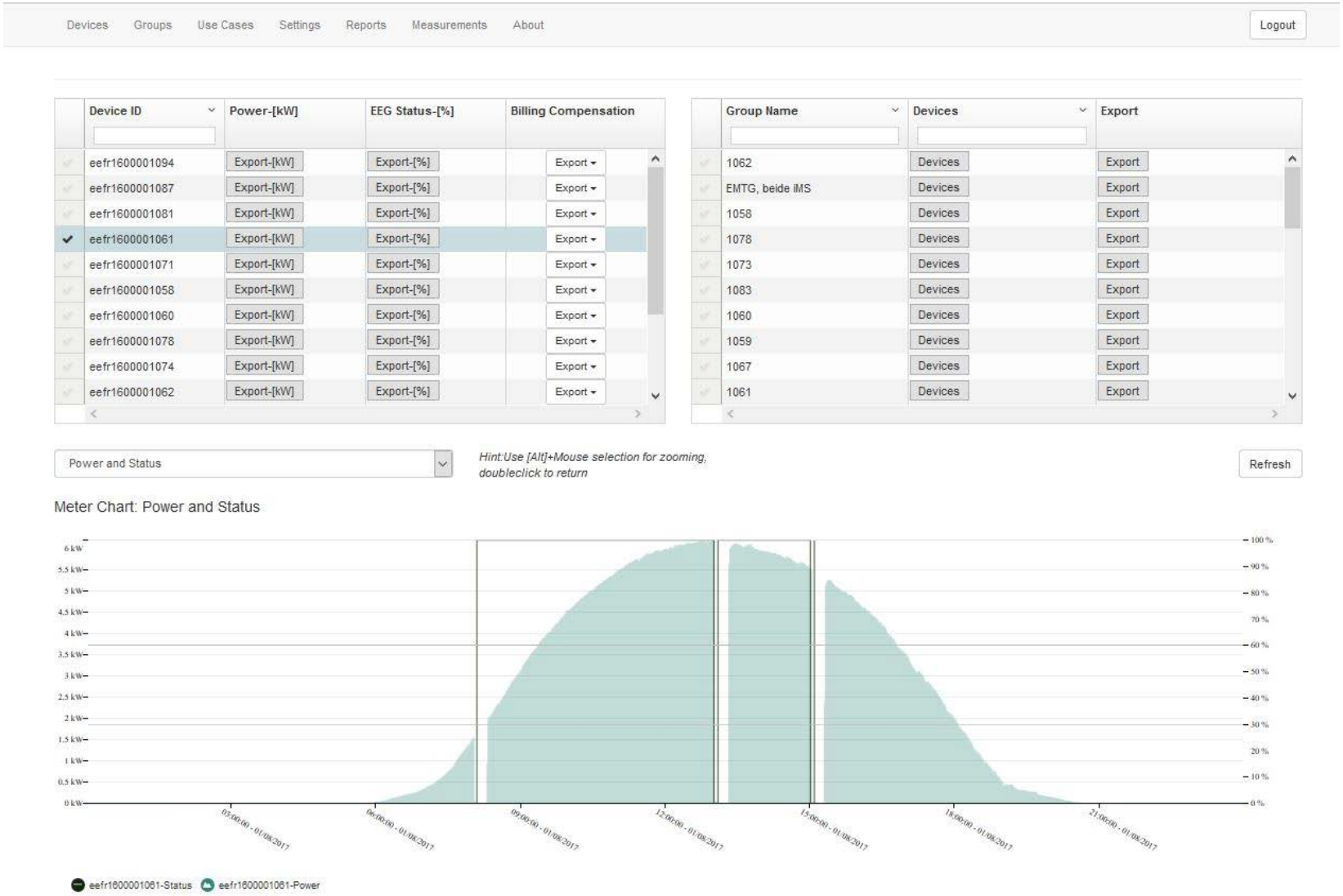
High Performance LTE Communication

- ✓ Separate IPv6 addresses, APNs and TLS channels for payload and network management
- ✓ IPv6 address assignment:
  - Stateless Auto Address Configuration SLAAC
  - Script controlled assignment of the fixed interface ID
  - Automated address notification by keep-alive messaging
- ✓ Parallel SAE bearers for payload best effort, prioritised payload and management
- ✓ QoS support: LTE QCI and ARP (Allocation and Retention Priority)
- ✓ LWM2M (OMA) and SNMPv3 protocol for Device Management, performance monitoring, congestion control
- ✓ IEC 61850 Protocol with Scheduling extension for grid control
- ✓ Extremely low latency and very high message throughput
- ✓ High availability

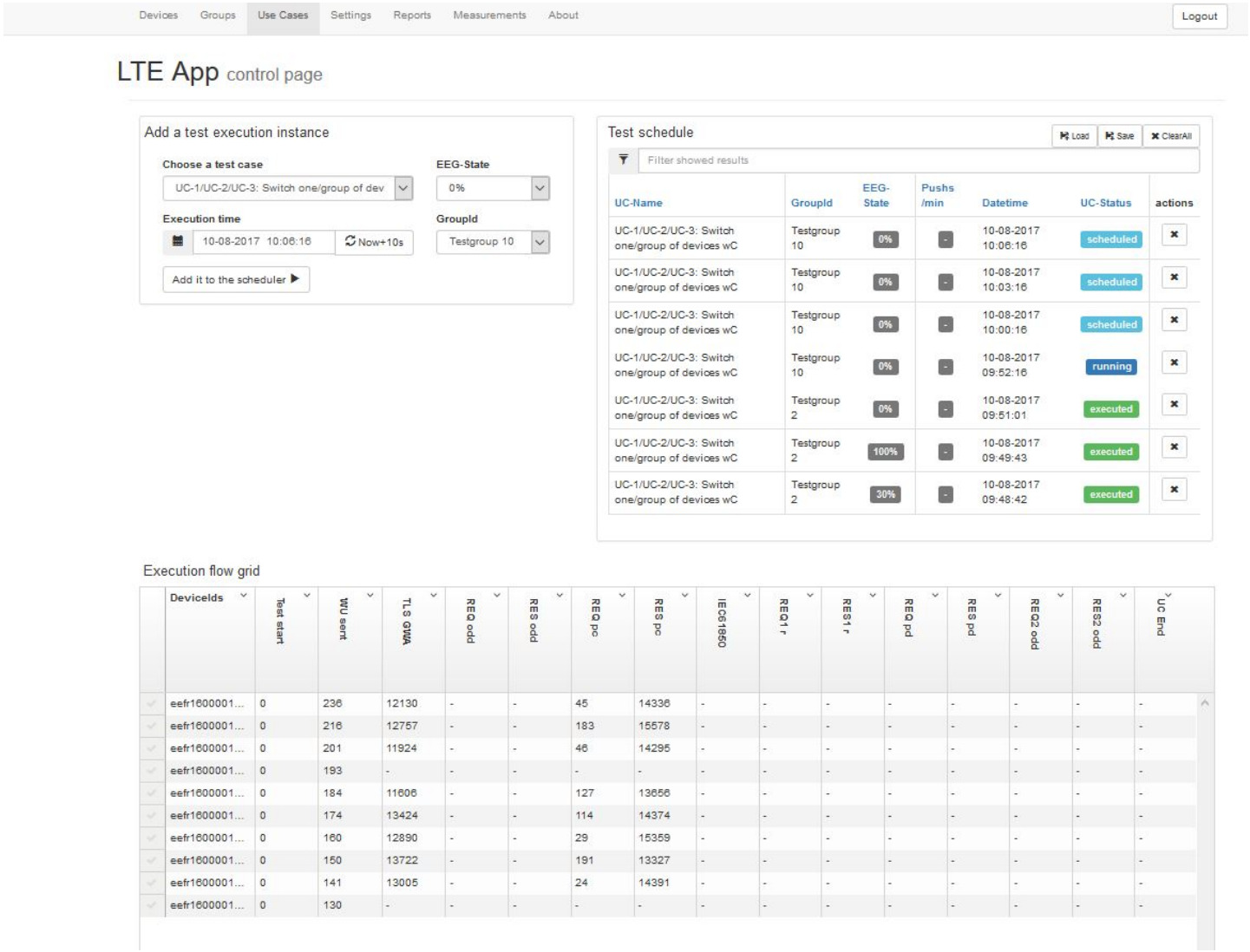
Fast & Secure Smart Grid Management



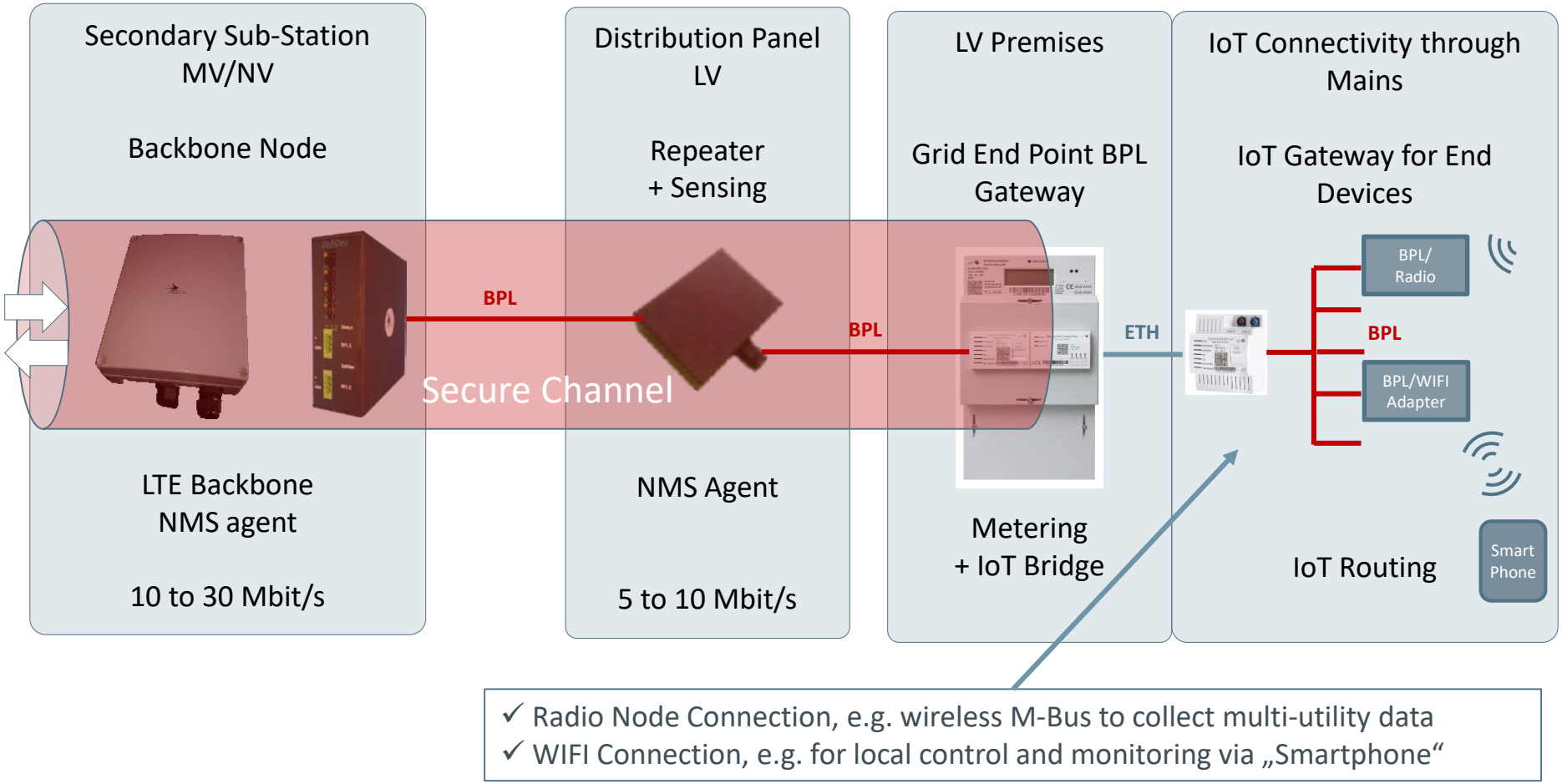
Controlled Group of PV-Injections



Switching Schedule



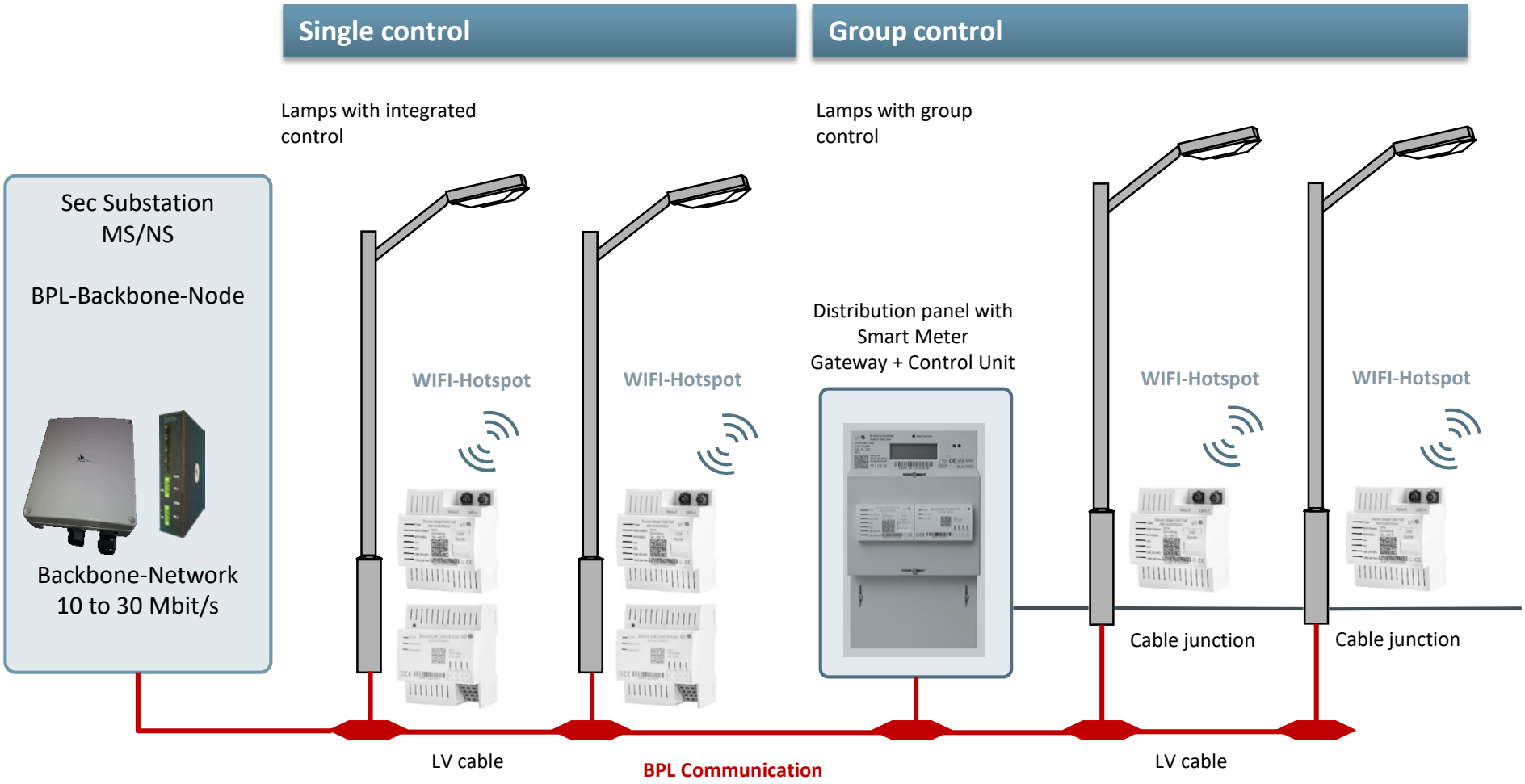
BPL Product Hierarchy, Comprehensive Connectivity, IoT Routing



BPL Management in Online Regime

- ✓ IPv6 in every BPL Device with stateless auto-configuration, router advertisement and certificates for DNS SEC
- ✓ Radius authentication in the backbone node for BPL repeaters and end devices
- ✓ SNMPv3 using (D)TLS in every BPL device with certificates
- ✓ SSH tunnelling and SCP in the backbone node for managing repeaters and end devices with certificates
- ✓ „Tagged Traffic“ within the BPL network and „Untagged Traffic“ in the end device
- ✓ „Network Management System“ NMS for the dynamical control of the BPL network

Public Lighting Control combined with WIFI-Hotspot Provision



Thank you very much for your attention!

Your contact to EFR…

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