Panel: Smart Grids

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Drivers for Smart Grid

- Reduce energy consumption
  - Customer awareness of individual consumption: online meter reading ⟹ smart meter
  - Peak load clipping ⟹ demand side management
- Reduce energy losses
  - .. in distribution networks ⟹ local production
  - Optimize transport network utilization
- Manage non-stationary power generation
  - Wind, photovoltaic, water

BB-PLC

Features

- Gross data rate: 500 Mbit/s @ 500 m, (IEEE P1901, G.hn, Homeplug, OPERA,..)
- Low latency: 20... 100 ms
- **Shared medium**, dynamic bw. allocation
- IPv6 enabled
- Problems:
  - Power line is a „bad“ transmission medium
  - Electro-magnetic compatibility (EMC)

Features

- Robust, longer span: 1000 m w/o repeater
- IPv6 enabled?, header compression needed. (6LOWPAN)
- Standard CENELEC bands (9-148 kHz), (or up to 500 kHz)
- PHY data rate: approx. 100 (300) kbit/s
- Industry solutions: PRIME, G3, Yitran, iAd
- Standardisation: IEEE P1901.2 / G.hnem, nearly finished

Reliability

Smart Grid Communications Network:
Very high availability required

- ‚Black start' must be supported
- Redundancy concepts:
  - Alternate paths
  - Alternate comms technology (wired, wireless)
  - Redundant power supplies

Security, Privacy

- Security & privacy mechanisms to avoid
  - unauthorized readout (of smart meters)
  - attacks: illegal control commands
- require
  - end-to-end crypto-algorithms
- producing
  - overhead ⟹ higher datarate

Research Questions

- Power Grid Control
  - Control loop stability - for very many partners
  - Control loop hierarchy
- Smart Grid Communications
  - Efficient & stable medium access
  - Resource allocation
  - IP over bandwidth restricted networks
  - Protocol stack (IP + SCADA, ?)
- Security