5G – Requirements from M2M / Smart Grid

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Content

- Machine-to-Machine
- Smart Grid
  - Scenarios
  - Requirements
- Research @LKN

Machine-to-Machine Communication

Data-only subscriptions

no voice service required

Enhanced coverage

indoor and basement installations

Release 13

Wide range of performance requirements
from utility meters to automotive

Low cost devices

<10$ per modem

Release 12

Release 13

Larger amount of devices

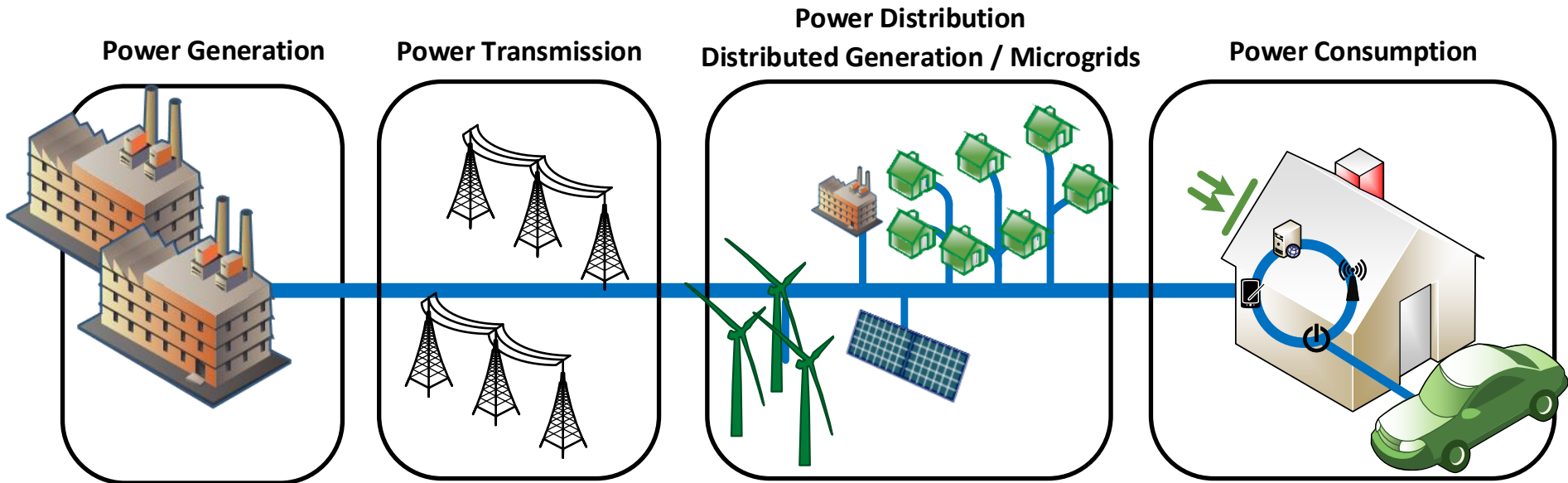orders of magnitude higher than conventional devices

Release 13
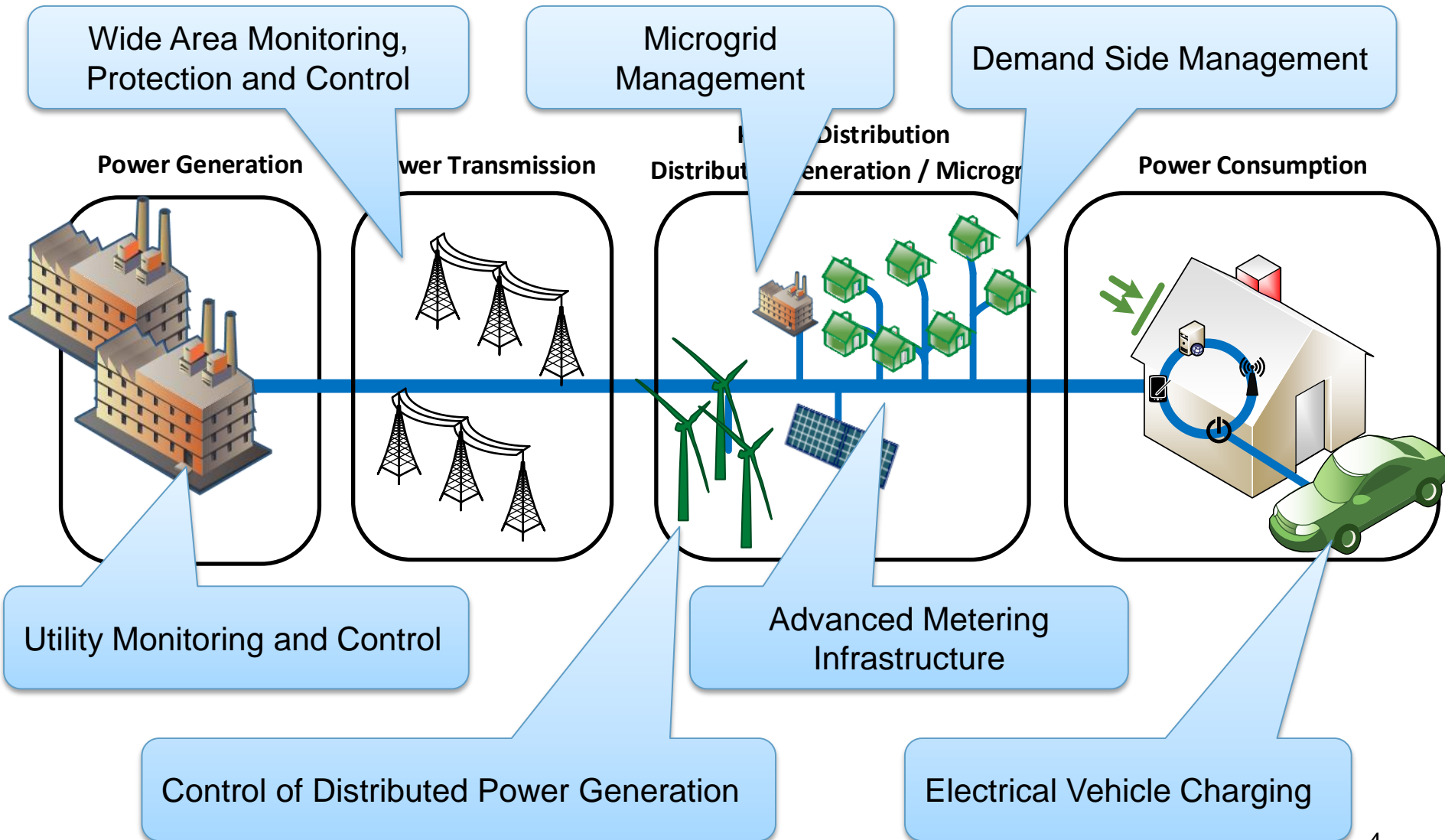
Longer battery life

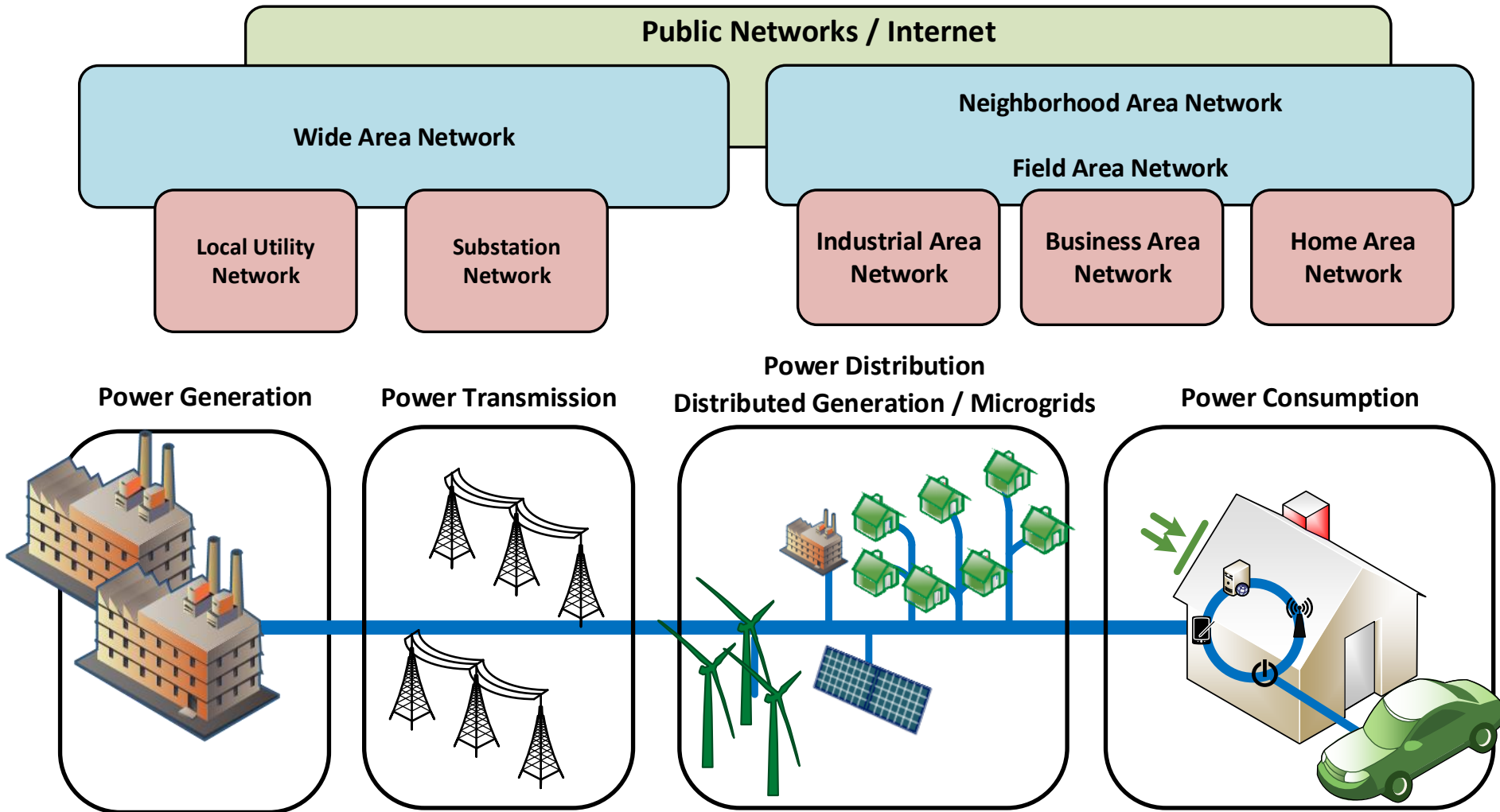up to 10 years

Release 12

Release 13

Smart Grid: Scenarios

Power Generation   Power Transmission   **Power Distribution** / Distributed Generation / Microgrids   Power Consumption

Smart Grid: Scenarios

Wide Area Monitoring, Protection and Control

Microgrid Management

Demand Side Management

Power Generation

Power Transmission

Power Distribution
Distributed Generation / Microgrid

Power Consumption

Utility Monitoring and Control

Control of Distributed Power Generation

Advanced Metering Infrastructure

Electrical Vehicle Charging

Smart Grid: Scenarios

Smart Grid: Requirements

	E2E Latency	Reliability	Datarate	Installation
Wide Area Monitoring, Protection and Control	5-20ms	99.999%	100 Mbps	Indoor & Outdoor
Microgrid Management	50ms	99.99%	2 Mbps	Indoor & Outdoor
Control of Distributed Power Generation	50-500ms	99.99%	50-200 kbps per site	Indoor & Outdoor
Advanced Metering Infrastructure	1s	99%	10 kbps per site	Indoor / Basements
Demand Side Management	1min	99%	100 kbps per site	Indoor / Basement
Electrical Vehicle Charging	500ms	99.5%	9.6-56 kbps per site	Indoor & Outdoor

[2] Siemens Whitepaper, Smart Communications for Smart Grid
[3] Cheng et al, Feasibility Study of Applying LTE to Smart Grid, IEEE SmartGridComm 2011
[4] Patel et al, Assessing Communications Technology Options for Smart Grid Applications, IEEE SmartGridComm 2011

Smart Grid: Requirements

	E2E Latency	Reliability	Datarate	Installation
Wide Area Monitoring, Protection and Control	5-20ms	99.999%	100 Mbps	Indoor & Outdoor
Microgrid Management	50ms	99.99%	2 Mbps	Indoor & Outdoor
Control of Distributed Power Generation	50-500ms	99.99%	50-200 kbps per site	Indoor & Outdoor
Advanced Metering Infrastructure	1s	99%	10 kbps per site	Indoor Basements
Demand Side Management	1min	99%	100 kbps per site	Indoor Basements
Electrical Vehicle Charging	500ms	99.5%	9.6-56 kbps per site	Indoor & Outdoor

Power Consumption

# of devices

Low mobility

[2] Siemens Whitepaper, Smart Communications for Smart Grid
[3] Cheng et al, Feasibility Study of Applying LTE to Smart Grid, IEEE SmartGridComm 2011
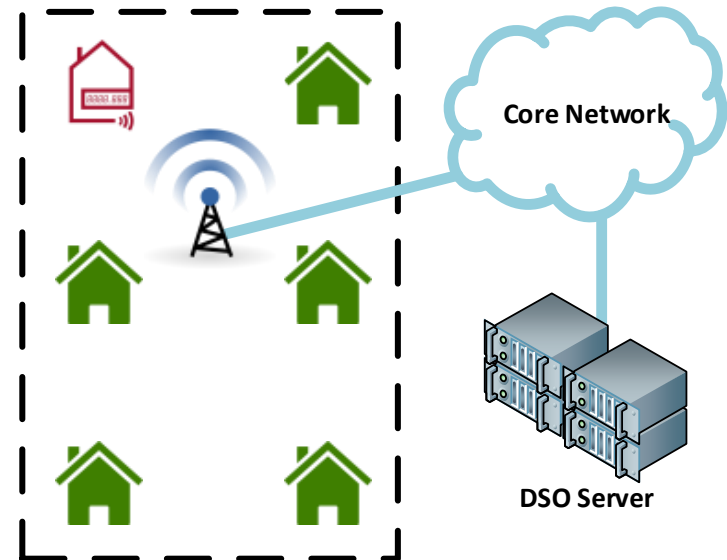[4] Patel et al, Assessing Communications Technology Options for Smart Grid Applications, IEEE SmartGridComm 2011

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Applicability to SmartGrid: LTE and Beyond

- Distribution Grid / Radio Access Network

- How scalable is LTE:
    - Amount of devices to be accommodated in one cell without violating the requirements
    - C-plane

- LTE performance evaluation:
    - Latency
    - Reliability
    - U-plane

- Coexistence of H2H and M2M traffic:
    - with/without differentiation
    - QoS degradation in a loaded cell

- Data aggregation using 802.15.4g standard (Smart Utility Networks)
    - Coverage extension
    - Radio resource saving

Neighborhood Area Network Scenario

Core Network

DSO Server

Control of Distributed Power Generation

Advanced Metering Infrastructure

Demand Side Management

Electrical Vehicle Charging

Questions?

References

[1] White Paper on Optimizing LTE for the IoT, Nokia, 2014

[2] Siemens Whitepaper, Smart Communications for Smart Grid

[3] Cheng et al, Feasibility Study of Applying LTE to Smart Grid, IEEE SmartGridComm 2011

[4] Patel et al, Assessing Communications Technology Options for Smart Grid Applications, IEEE SmartGridComm 2011