

AMI: Communication Needs and Integration Options

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PSERC

Advanced Metering Infrastructure

- A popular tool to modernize the electric grid
- Facilitates two-way communication between smart meter and control center
- Captures and transmits energy-use on a hourly or sub-hourly basis
 - As opposed to the current meters that provide daily energy usage and monthly bill
- Expected to facilitate consumer participation in the Smart Grid

Smart Grid

Power network which has the ability to self heal from a disturbance, **enables active participation** by consumers in demand response, operating resiliently against physical and cyber attacks, accommodates all generation and storage options, provides power quality for the 21st century needs and optimizes assets and operating efficiency

- U.S Department of Energy

Benefits

Utilities

- Peak shaving, load control, power quality measurements, improved outage management systems (OMS)

Consumers

- Energy use awareness and possible efficiency savings, automated billing (even daily or weekly), potential bundling of water, gas, and electric billing

Society

- Financial and environmental benefits from:
 - Improved system efficiency and reliability
 - Improve integration of EVs and DERs



Source: Energy Retail Association, UK, 2010

Some EU countries and U.S lead in AMI Deployments

Communication Backhaul Technology Options

- PLC
 - Pros: Reuse power lines, upgrades needed mainly at only one location, the substations
 - Cons: Low data rates
- Wireless
 - Pros: Greater data rates, flexible
 - Cons: Needs careful planning to avoid interference issues, larger investments needed

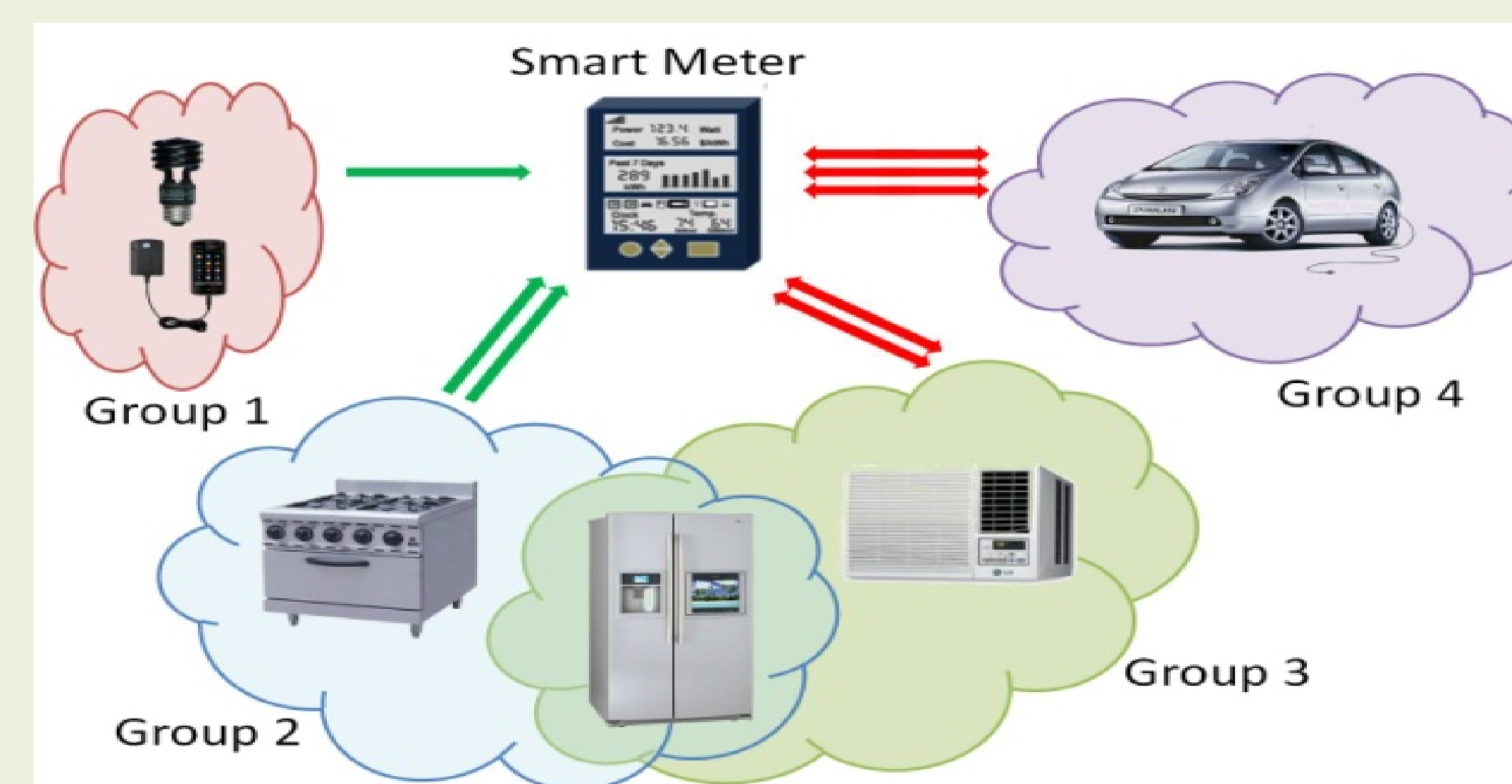
Wireless has greater future potential to meet future backhaul needs

Table 1: Comparison of backhaul wireless communication technologies

Attribute	WiMAX	Wi-Fi	ZigBee	GSM/UMTS
Cost	High	Medium	Medium	High
Range	500-900 m, 4 km (rural)	100-200 m	70-100 m	1-2 mi
Max. Data Rate	70 Mbps	54 Mbps	250 kbps	20-800 kbps
Frequency Band	2-11, 10-66 GHz	2.4, 5 GHz	2.4, 5 GHz	700 MHz, 2.1 GHz
Band License	Free and Licensed	Free	Free	Licensed
Robustness	Medium	High	High	Low

Little consensus on best technology and architecture

Home Area Network Model and Technology Options



HAN Appliance Classification for AMI Application: Communication requirements vary based on criticality for consumers and size of load

Table 2: Comparison of HAN Communication Technologies

Technology	Data-Rate (Mbps)	Range (meters)	Security	Cost
Ethernet	10,000-100,000	100	High	High
PLC	1-10	10-100	High	Medium
Bluetooth	0.7-2.1	100	Medium	Low
Wi-Fi	11-54	32-90	Low	Medium
Zigbee	0.02-0.2	10-75	Low	Low

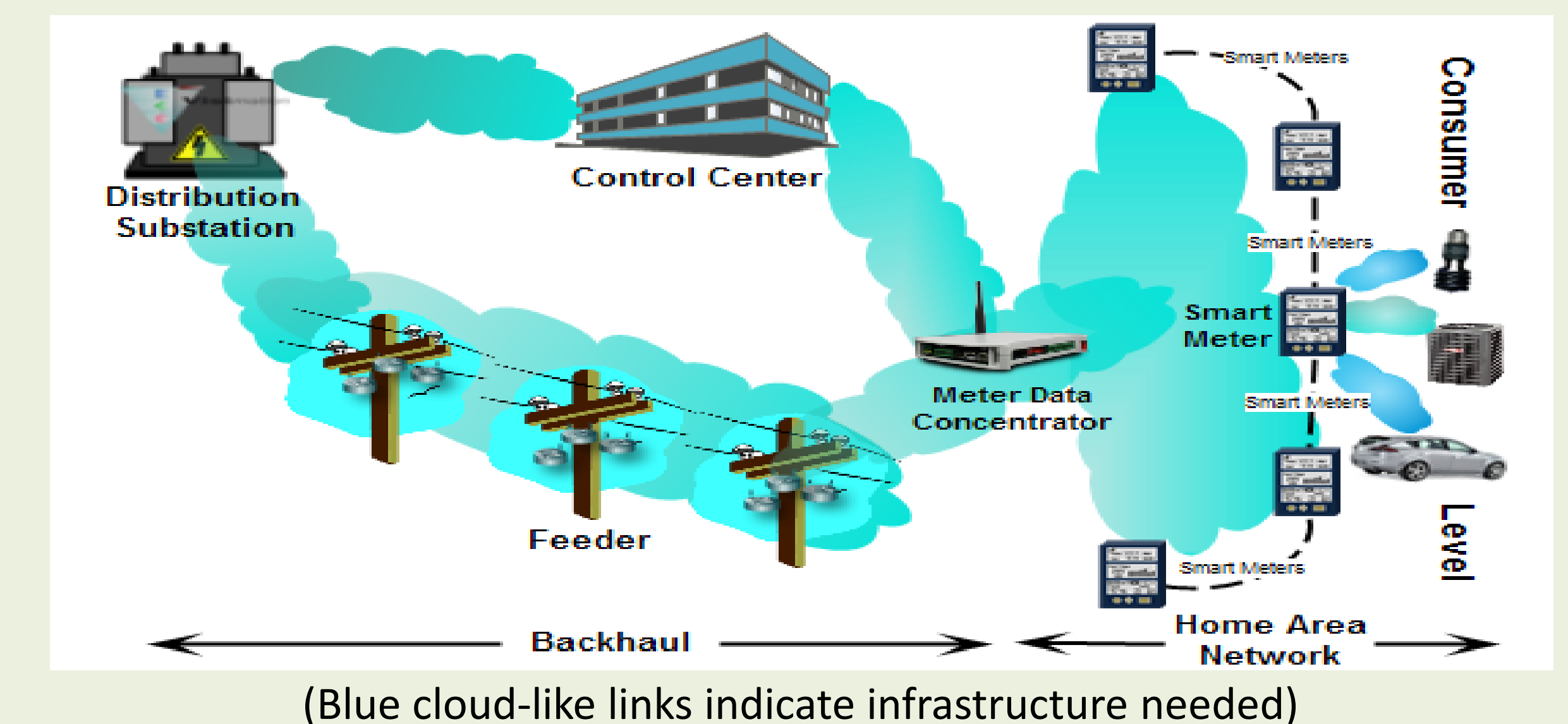
ZigBee emerging as consensus

Security and privacy a greater threat in HANs with consumer involved

Security Threats to AMI



Communication Infrastructure Needed for AMI



Future Needs

- Design integrated communications architecture to meet emerging application needs
- Scalable data collection and management
- Information security and consumer privacy

- Encourage investments that meet long-term goals
- Guidelines on utility actions and consumer protections for security and privacy threats

Research Needs

Policy Needs

Standards

- Communication and control model for HANs
- Security
- Interoperability testing with Internet standards