Smart Grid Communications, Security, and Privacy

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Communications vs Networks

• Communications: Direct Point-to-Point, no hopping, relates more to physical layer, media
• Networks: Software involvement (routing) for routing over hops, flow control, congestion..
• There are challenges in both domains for T & D
Communications

- Wireless communications apply more to the distribution system typically
- Physical and MAC layer protocols for link layer technologies (wireless, PLC,..)
- Interference assessment and mitigation (white space Cognitive Radio Networks) of deployed wireless technologies
- Resource management and cross-layer optimization
Data Stream – An Abstract View

- Data Generators
- Communications Network
- Data Processing/Storage

Control
Networks

- Networking challenges apply to both Transmission and Distribution
- Capacity and network planning, resource and service discovery
  - Network bandwidth needs, lease vs build
- Multi-hop communication and mesh networking, Scalable network and system architecture
  - (e.g., FAN, HAN, NAN and BAN)
- Communication protocols optimized for (real-time) information collection and control applications
- Data models and communication-aware data management solutions for various data generators (PMUs, Smart Meters, other IEDs)
- Coexistence, convergence and interoperability mechanisms
Cyber-Security and Privacy

- Applies to both Transmission and Distribution
- Secure and resilient cyber-physical and communication architectures
- Security risk assessment, measurement and management
- Tamper-resistant device technologies
- Cryptography, key management, authorization and access control
- False data injection, detection and mitigation
- Privacy preservation and inference
- Cyber and Cross-Domain (power to cyber) security event detection, analysis and response
- DoS/DDoS resiliency
- Cloud security
- SCADA and legacy system security
- Security design and verification tools
Some Emerging Paradigms

- Software-Defined Networks
- Internet of Things
- UAVs/Drones