



Metering and Customer Interface Communications Enabling Infrastructure Development

Joseph Hughes Project Manager Power Delivery, Customer Communications, Industry Architecture

Electric Power Research Institute Palo Alto, California

Introduction and Objectives

- Objectives:
 - Background on the Technology
 - Present status of revenue metering enabling infrastructure development
 - Present status of customer interface communications enabling infrastructure

State of the Industry: Technical Issues and pressures

- 1. Metering and Customer Interface Communication systems are not trivial to design, specify, procure, install or maintain
- 2. Most deployed systems have significant proprietary elements
- 3. Use of standards based open systems needs to be more central to industry strategies and procurements
- Significant industry knowledge is embedded in the technical standards work that has taken place over the last ten years

Metering and Customer Interface Communications: State of the Infrastructure

- 1. Pockets of standards coherence are in place but need to be further developed in key areas
- 2. Communications and end-device security policies and technical infrastructure need to be developed and implemented consistently
- 3. Massive scaling and systems management technology is a significant challenge that needs to be developed
- 4. Several Stakeholders have roles in defining the infrastructure
- 5. Industry Needs an Open Industry-Level Architecture

Open Systems Business Drivers

Capital Cost Savings

- Competitive Procurement of intelligent equipment through Standards and Open Systems
- Multi-vendor support and avoidance of single vendor "lock-in"
- Extensible and Scalable "Industry-wide"
- Life-Cycle Cost Savings
 - More uniform Standards based systems
 - Extensible and Robust to meet Future Needs
 - More capable, easier to maintain
 - Immune to single vendor limitations
- Security and Management Policy Implementation
- Architecture Governance

What is "Enabling Infrastructure"?



CIGRE 2004: Interoperability Exhibit...

What is Distributed Computing?



Key Interoperability Concept: Use a Common Language for Communications



Key Technical Concept: Layered Communications



Architecture Enables Consistent Security Policy Administration



Vision: Customer Communications and Metering is a Key Set of Resources...





Revenue Metering Standards Development Initiatives: "The Radar Screen"



Ten Technology Categories for Integrated Utility/Customer Communications



A Standards Development Model





Key Standards Development Organizations and Consortia





- ANSI is a formal SDO
- ANSI C12 Subcommittee 17 Develops Communications Standards
- National Electrical Manufacturers Association (NEMA) is the Secretariat for meter standards
- Adopted work originally from IEEE Standards Coordinating Committee #31
- Work to date constitutes the bulk of industry knowledge on meter communications

American National Standards Institute

- ANSI C12.17 Working Groups
 - Workgroup 1:

Standard: ANSI C12.22 "Protocol Specification for Interfacing to Data Communication Networks"

- Workgroup 2
 Standard: ANSI C12.19 "Utility Industry End Device Data Tables"
- Workgroup 3
 Standard: ANSI C12.23 "Compliance Testing For Standard Protocols And Tables"

 Workgroup 4
 Standard: ANSI C12.18 "Protocol Specification For ANSI Type 2 Optical Port"

Institute of Electrical and Electronic Engineers (IEEE) <a>IEEE

- IEEE is a formal SDO
- IEEE Standards Coordinating Committee (SCC) #31 is the main group developing revenue metering standards, Automatic Meter Reading Association (AMRA) is the secretariat for SCC 31
- Developed the bulk of the Standards that are now adopted by ANSI C12 Committees
- IEEE 1459-2000 trial standard for measuring electric power quantities under varying conditions
- IEEE SCC #22 Power Quality Monitoring
- IEEE SCC#36 Communication Architecture

International Electrotechnical Commission (IEC)

- IEC is a Formal SDO
- IEC Technical Committee (TC) 57
 - Working Group 10: IEC 61850, "Power system IED communication and associated data models "
 - Working Group 14: IEC 61968, "System interfaces for distribution management"
 - Working Group 9: IEC 61334, "Distribution automation using distribution line carrier systems"
 - Working Group 17: Communications Systems for Distributed Energy Resources (DER)
 - Working Group 15: Data and communication security
- *IEC TC13*
 - WG14: IEC 62056, "Data exchange for meter reading, tariff and load control"
- IEC TC 8: Systems aspects for electrical energy supply

International Organization for Standardization (ISO)



International Organization for Standardization

- BACnet® is an International Standard under ISO (ISO 16484-5)
- ISO/IEC JTC1 Standards Committee 25: Interconnection of Information Technology Equipment : Working Group 1: Home electronic systems
- ISO 10746 Reference Model for Open Distributed Processing

In-Building Integration Standards: Commercial/Industrial

- American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) is a formal SDO
- ASHRAE SSPC 135 has developed BACnet[™] Standard for In-Building Communications
- ISO Standard TC 205
- BACnet[™] User Groups
 - BACnet[™] Interoperability Testing Consortium
 - BACnet[™] Interest Group North America (BIG-NA)
 - BACnet Interest Group Europe (BIG-EU)
 - BACnet Interest Group Australia Asia (BIG-AA)
- NEMA
 - National Electrical Manufacturers Association (NEMA) has formally endorsed BACnet as the protocol for connecting life safety and security systems to other building systems

Other Customer Communications Stakeholder Requirements Drivers

- North American Electric Reliability Council
- Department of Defense Architectural Framework
- General Services Administration
- State CIO offices
- Other

What is an Architecture?

Architecture: The Structure of Components, their relationships, and the principles and guidelines governing their design and evolution over time*.



*DoD Integrated Architecture Panel, based on IEEE Std 610.12

Key Drivers for an Industry-level Architecture

- Higher levels of integration across the enterprise between business entities and across Standards Communities
- Ability to meet heavier operating and system management demands
- Need for mature markets supplying intelligent equipment built to open industry standards
- Improved ability to manage complexity, Improved system documentation and description
- More sophisticated network, systems and intelligent equipment management
- Need for consistent implementation of security policies

Examples of Intelligrid Architecture Recommendations (Simplified)



Integration within Utility Enterprise: Field Operations and Enterprise Application Integration

R&D Needed: Integrate Across Standards=> Common Meter Data Model



Prototype "Gateway" Implementation: Integrating Major Metering, Utility Automation and Building Automation Standards



Pathways to Relationships with the Vendor Community



Intelligrid Puts a Technical Framework around Key Relationships...



Industry Level Technical Collaboration...Get Involved

- Standards Development Organizations (Formal Standards)
 - International Electrotechnical Commission
 - Institute of Electrical and Electronics Engineers
 - American National Standards Institute
- Industry User Groups (Technical Issues Resolution, Testing, Labeling)
 - UCA International Users Group
 - Open AMI
 - Common Information Model Users Group
- Collaborative Projects
 - EPRI Base and Supplemental Projects
 - IntelliGrid Consortium Projects
 - Other

EPRI Collaborative Projects: Get Involved to help Build an Open Systems Future

- Projects Planned and In Progress
 - Meter Life Testing and Obsolecence Planning
 - ANSI C12 Shared Implementation
 - Next Generation Open Systems Meter Requirements Development
 - Common Information Models for Metering and Demand Response
 - IntelliGrid Consortium
 - IntelliGrid Architecture Development
 - Customer Communications Interface Development
- Project Concepts in Development
 - Demand Response Architecture
- Contact Information: jhughes@epri.com 650 855 8586

Conclusion:

An Industry Architecture Development is a Global Imperative to Move the Future Visions Forward...



...And the work has only begun.