Collaborative Energy and the Future Smart Grid
ISA Expo 2009-10-07

Setting the Standard for Automation™

Collaborative Energy and the Future Smart Grid

William Cox
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William Cox

- William Cox has a deep and practical understanding of software architecture and technologies such as XML, Web services, Service-oriented architectures, eBusiness, Networking and system software, and has been applying those skills to improved interoperation between smart power grids and smart buildings, industrial facilities, homes, and more.
- He has been working to define standards for Energy Interoperation, including Demand Response and Distributed Energy Resources, and Market Information such as prices and energy characteristics, and is a member of the NIST Domain Expert Working Groups for Industry to Grid, Building to Grid, and more.
- He earned a PhD and MS in Computer Sciences from the University of Wisconsin—Madison.

COX SOFTWARE ARCHITECTS

Outline

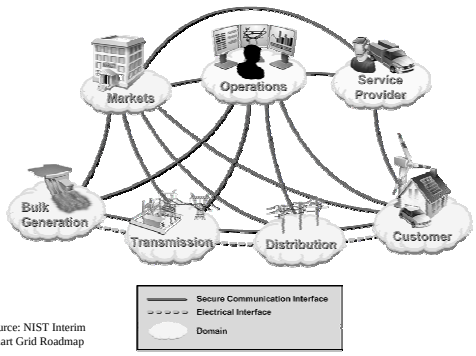
- Smart Grid Conceptual Model
- Key Architectural Elements
- Energy Production and Consumption
- Actionable Information
- Collaborative Energy
- Microgrids
- The Future is (sort of) Now
- Conclusions
- References and Contact Information

Terminology Affects Thought

Utility, Customer
Utility, Ratepayer ⇨ ***Producer, Consumer***
CoGeneration, Utility

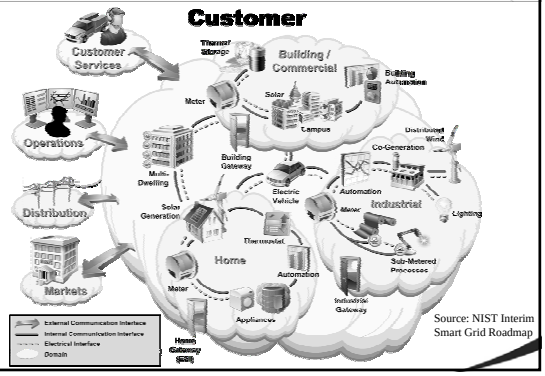
Load Side
Demand Reduction
Demand Response ⇨ ***Collaborative Energy***
Distributed Energy Resources

The Smart Grid Conceptual Model



Source: NIST Interim Smart Grid Roadmap

The Customer Domain



Source: NIST Interim Smart Grid Roadmap

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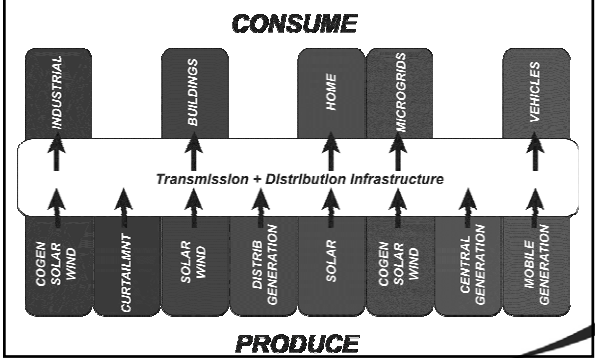
Key architectural elements

- Gateway (also called Energy Services Interface [ESI])
- Line of demarcation
  - Physical
  - Ownership
  - Control
- Inter-domain interoperation is important
  - Light, flexible integration interfaces
- Industrial and large commercial have moved from Direct Load Control approaches toward **Collaborative Energy**
- Some Direct Load Control (**Managed Energy**) in residential and small commercial

Energy Production + Consumption



Actionable Information

- For collaboration must ***make timely decisions***
- Price
  - The ***result*** of a tariff computation, not the computation
  - The ***currency***
  - Need tariff simplification/computation—a long way to go
- Product Definition
  - The ***qualities*** of energy sold, e.g. source, carbon characteristics
  - The ***quantity*** and the ***units***
- Usage Information
  - Interval, other metrology—already available in industrial settings
  - Price applied to usage

Collaborative Energy

- Collaborative Energy
  - Collaboration between consumer and producer
  - Adjust usage and generation to fit circumstances
  - Scales well
- Managed Energy
  - Control of consumption and distributed generation
    - Usually by utilities
  - Utility or grid management reaches into the facility
  - Commonly residential or where no facility Energy Management System or Facility Control Systems
  - Harder to scale
- Blends

Collaborative Energy Standards

- Primarily in OASIS, leading eBusiness, Web services, XML Standards Developing Organization
- OASIS Energy Interoperation Technical Committee
  - Started with Open Automated Demand Response, Lawrence Berkeley National Labs
  - Interoperation protocol
  - Signal semantics
  - More input needed from industrial operators
  - Started Summer 2009
- OASIS Energy Market Information Exchange TC
  - Actionable price information
  - Characteristics, quantity, price, currency, schedule
  - Starting October 15, 2009

Market [Software] Architecture

Market Design and Description

What Is Communicated - Price, Characteristics

How It's Communicated - Messages, Protocols

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Market [Software] Architecture

Market Design and Description	
What Is Communicated - Price, Characteristics	EMIX
How It's Communicated - Messages, Protocols	Energy Interoperation

Microgrids and the Future

- Microgrids are being implemented now
  - District Power, campus, …
- Energy trading and collaboration within a microgrid
- Goal—use consistent standards for collaborative energy
  - *Inside* a microgrid
  - *To and from* a microgrid
  - Where there are no microgrids
- Avoid the net metering arguments
  - Blended inside-the-grid prices with lower spreads?
  - Industrial co-generation has obvious benefits
- Much microgrid interaction will be DC, not AC
  - Avoid inverter losses, phase issues
  - Add DC-to-DC conversion issues

In Some Ways the Future is Now

- For Some Industrial and larger Commercial Customers
  - Dynamic Prices
  - Price responsiveness
  - Distributed Energy Resources [DER/co-generation]
  - Large scale process and building control
- But…
  - Inconsistent communication means custom implementations
    - 3000 ways to describe retail price, 27 different wholesale markets
  - Tariff and contractual limits on co-generation and collaboration
  - Microgrids being deployed but not in broad use
  - Collaboration is limited

Conclusions

- Collaborative Energy will enable
  - More effective and efficient use of resources
  - More price competition
  - New market differentiation by source characteristics
  - Better use of industrial co-generation
  - Better grid stability with intermittent inputs
- Microgrids will develop into a place for innovation
- Better collaboration will lead to lower costs
- Better collaboration will save you money

References

- Energy Market Information Exchange TC
  - http://www.oasis-open.org/committees/emix/
- Energy Interoperation TC
  - http://www.oasis-open.org/committees/energyinterop/
- NIST Smart Grid Interim Roadmap
- NIST Framework and Roadmap Release 1.0
- NIST Smart Grid Home Page
  - http://nist.gov/smartgrid/
- Microgrids
  - http://www.galvinpower.org/ The Galvin Initiative

Contact Information

Newsletter Signup, Papers, Presentations
Energy Interoperation Technical Committee
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Energy-related and other papers and presentations are at http://www.CoxSoftwareArchitects.com/

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