



The Role of Communication Protocols in the Smart Grid

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President

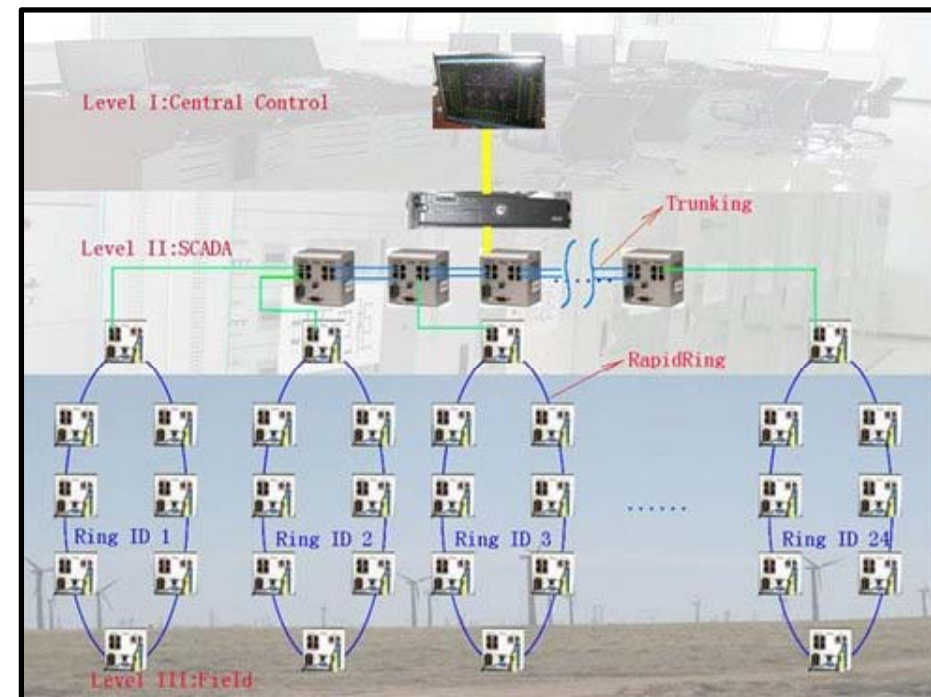
Contemporary Controls

1000 Wind Turbines in Inner Mongolia Communicate Using Fiber Optic Ethernet



Multiple Fiber Rings Provide Cable Redundancy for Higher Reliability

- 24 Ethernet 100 Mbps single-mode fiber optic rings
- Head-end switches use trunking for higher throughput
- Managed switches use SNMP protocol



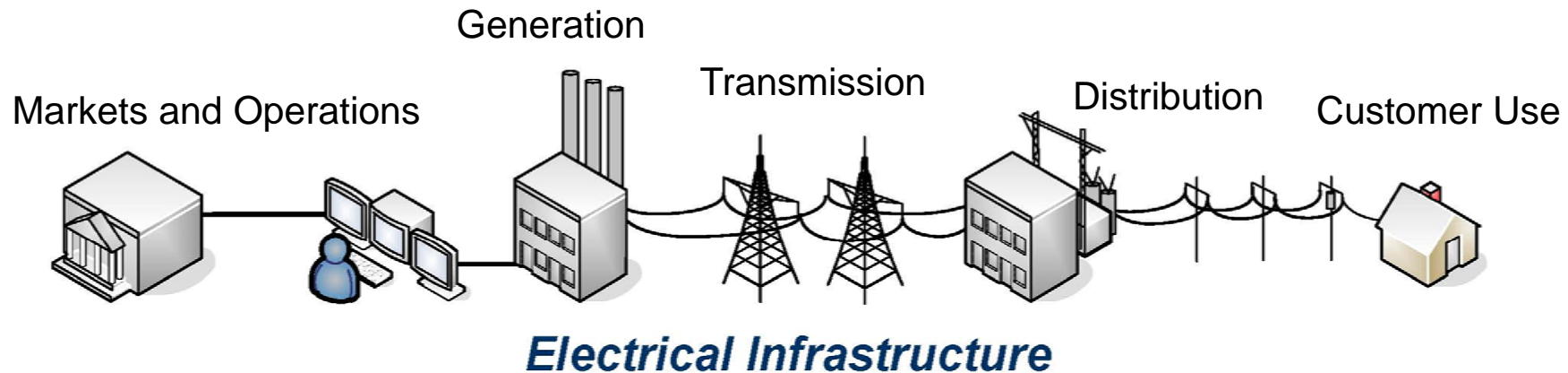
Viable Communication Protocols Exist from the Building Automation Industry

- SNMP protocol is only one of a suite of IP protocols available for use with the Smart Grid
- In addition, the building automation industry has developed several proven protocols that are available
- Use what you can – develop what you need



Since commercial buildings consume 40% and residential buildings 32% of all electricity, we need to go after buildings and make them “smart.”

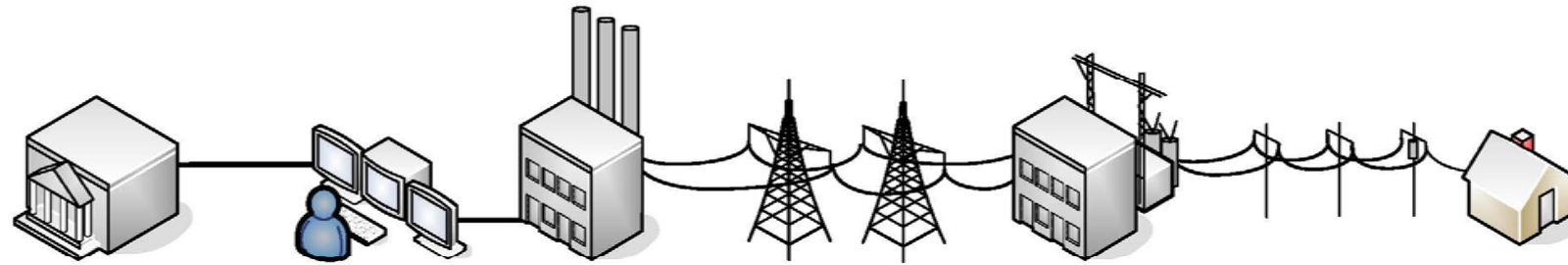
Today's Electric Grid



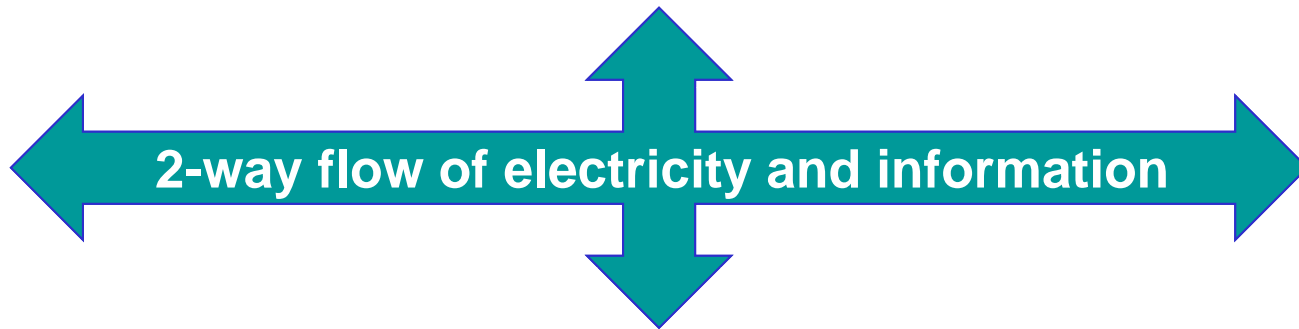
One-way flow of electricity

- Centralized, bulk generation, mainly coal and natural gas in U.S.
- Responsible for 40% of human-caused CO₂ production
- Controllable generation and predictable loads
- Limited automation and situational awareness
- Lack of customer-side data to manage and reduce energy use

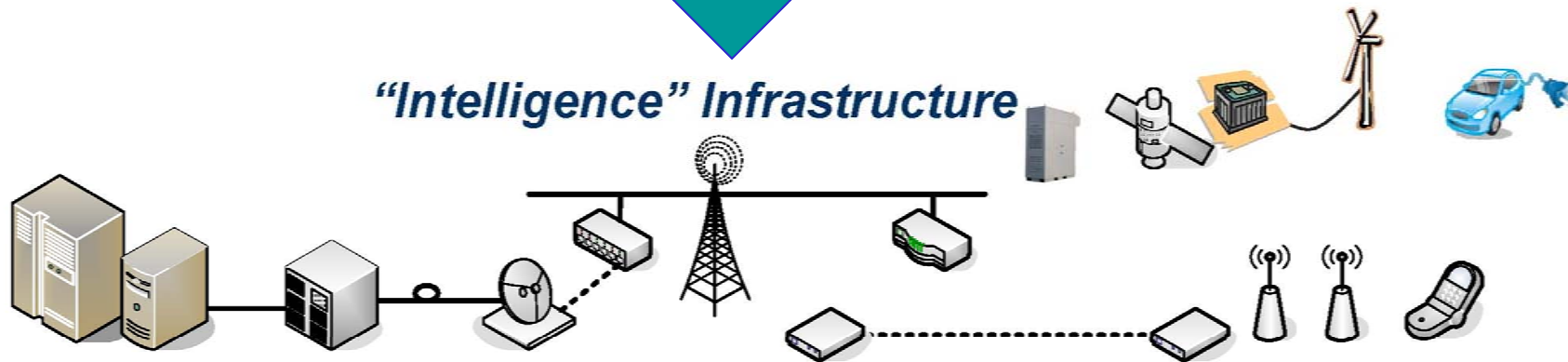
Tomorrow's "Smarter Grid"



Electrical Infrastructure



"Intelligence" Infrastructure





- Public-private partnership with 700 member organizations
- Coordinates standards developed by Standards Development Organizations (SDOs) such as IEEE and ANSI
- Develops Priority Action Plans (PAPs) in order to focus efforts



- Develops standards for customer-owned energy management systems
- Provides information to policymakers and stakeholders on energy management systems and smart grid
- Developed Use Cases/Standards for:
 - Customer Energy Management Systems
 - Electric Vehicle Service Equipment (PEV Chargers)



PURPOSE: The purpose of this standard is to define an abstract, object-oriented information model to enable appliances and control systems in homes, buildings, and industrial facilities to manage electrical loads and generation sources in response to communication with a “smart” electrical grid and to communicate information about those electrical loads to utility and other electrical service providers.

This standard will be used by standards development organizations to develop or enhance protocol specific implementations of the model, e.g., BACnet.



Participants in the Process

- Commercial/Institutional/Industrial Producers
- Appliance, Residential Automation, and Consumer Electronics Producers
- Consumers — Residential, Commercial, and Industrial
- Utility
- General

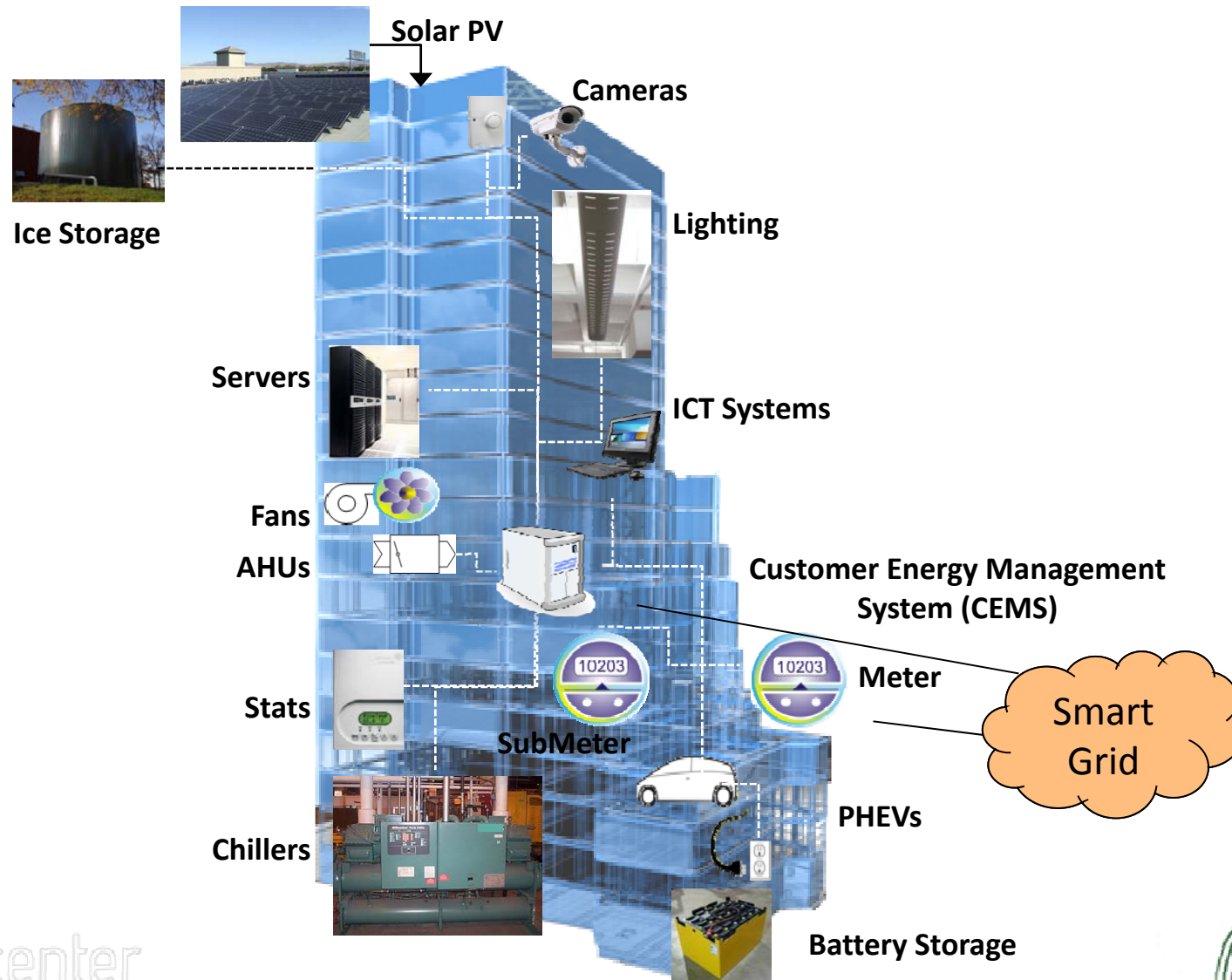


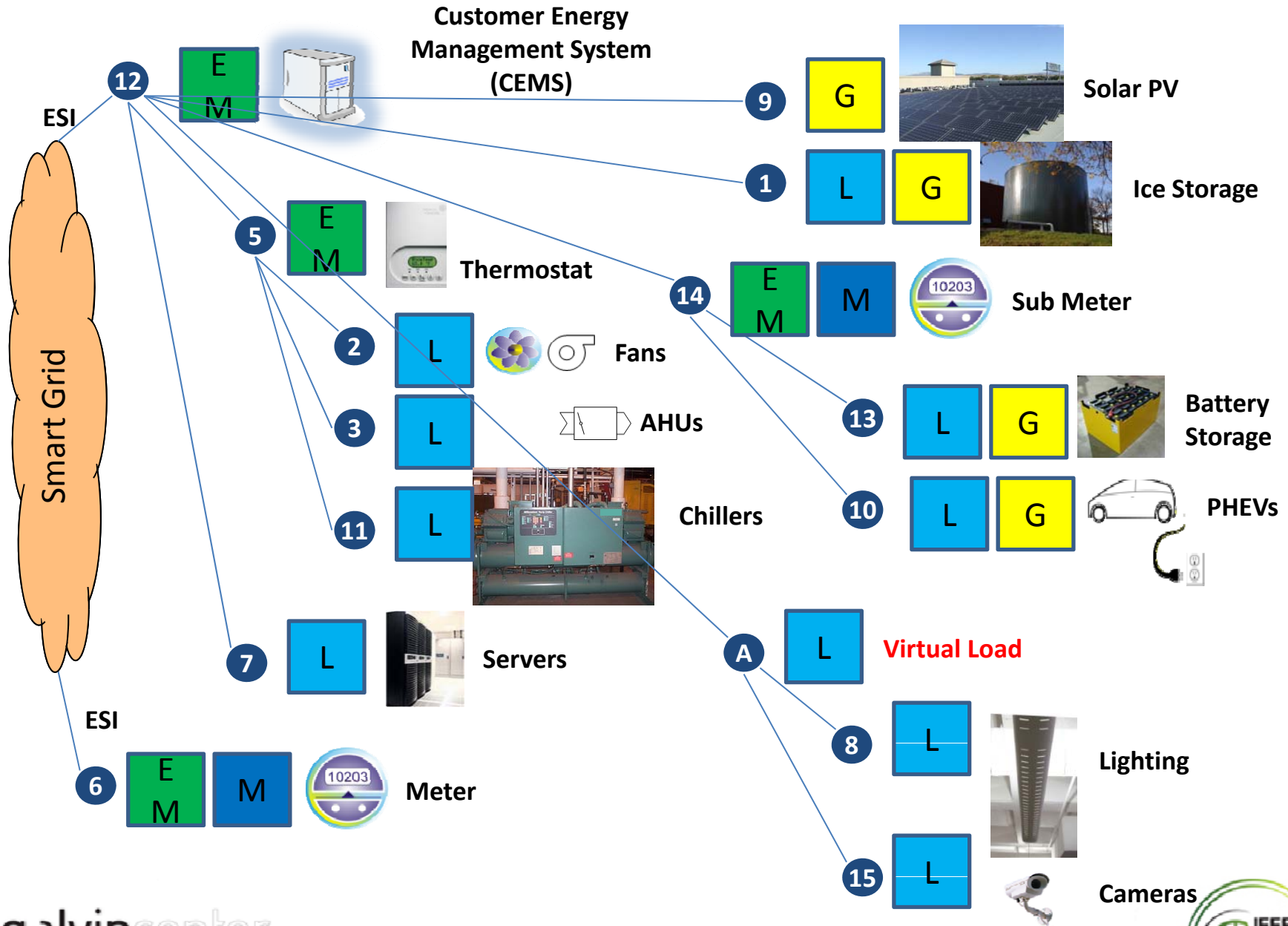
BSR/ASHRAE/NEMA Standard 201P

Advisory Public Review Draft

Facility Smart Grid Information Model

A Physical Example of SPC 201P Energy Objects





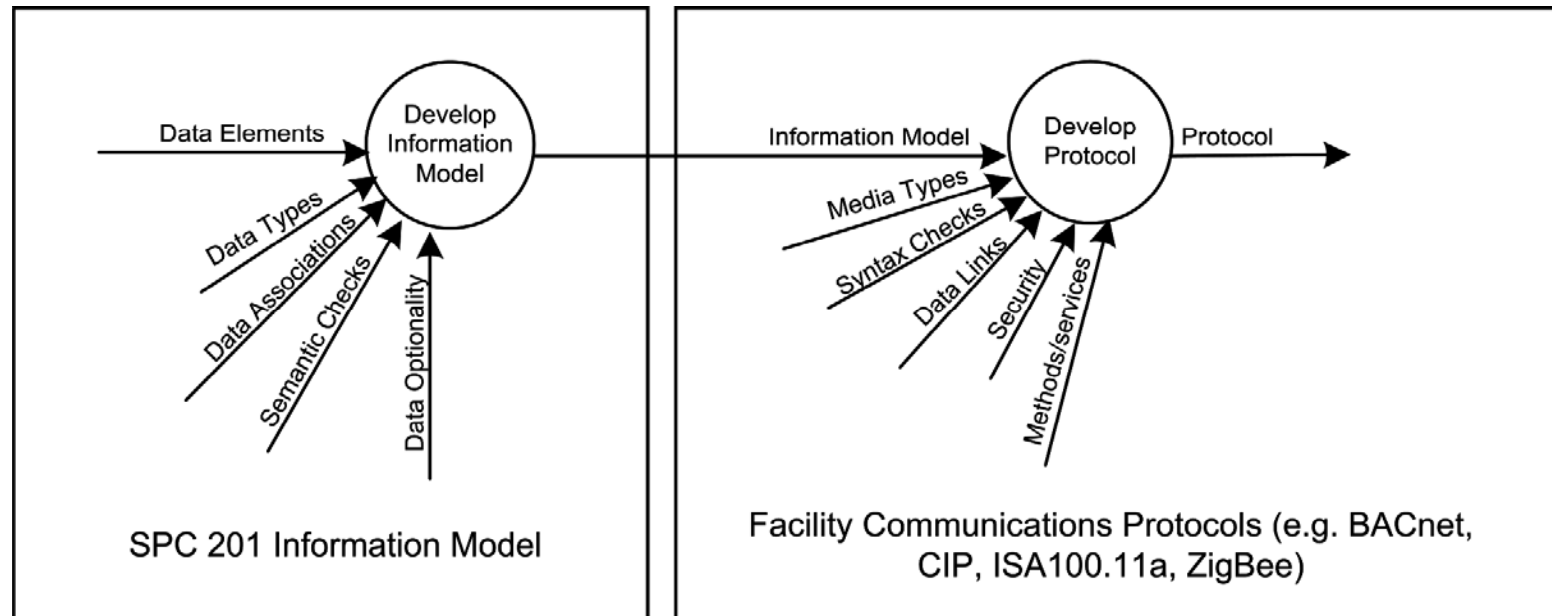
ASHRAE

NEMA

FSGIM

Facility Smart Grid Information Model

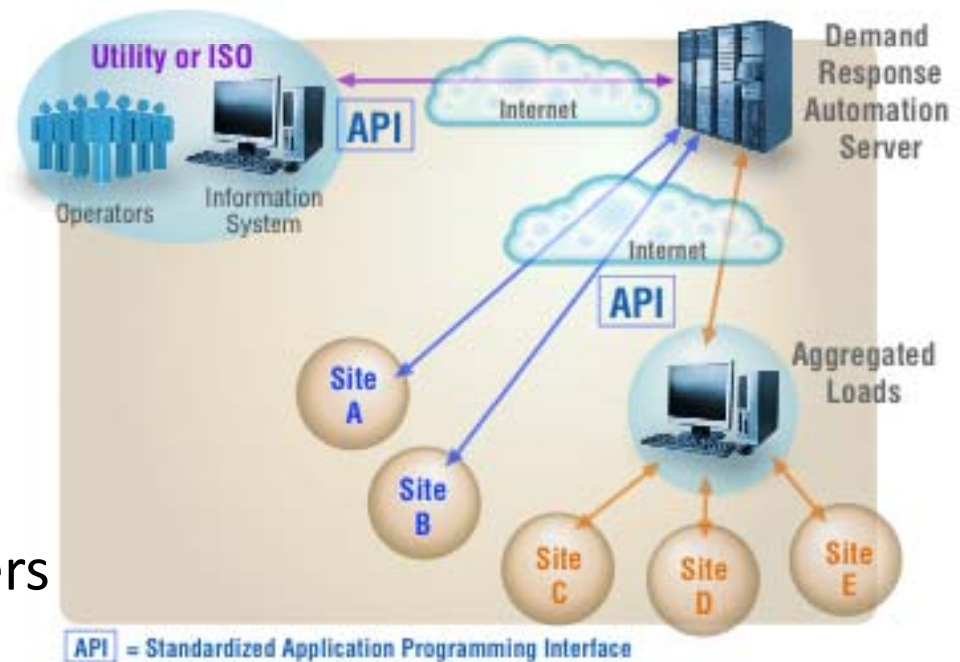
SPC 201P



The SPC 201 model is to be independent of facility protocols. The hope of the committee is that all facility protocols will adapt to this common information model when developing an Energy Supplier Interface.

OpenADR as a Communications Protocol in an Energy Supplier Interface

- Open Automated Demand Response (OpenADR) provides a non-proprietary, open standardized DR interface that allows electricity providers to communicate DR signals directly to existing customers using a common language and existing communications such as the Internet.

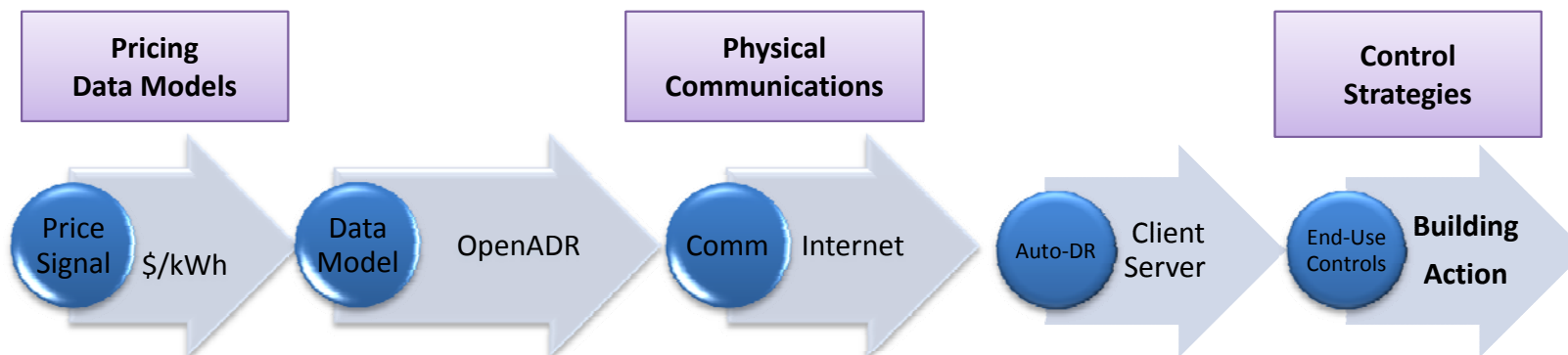


Source: LBNL



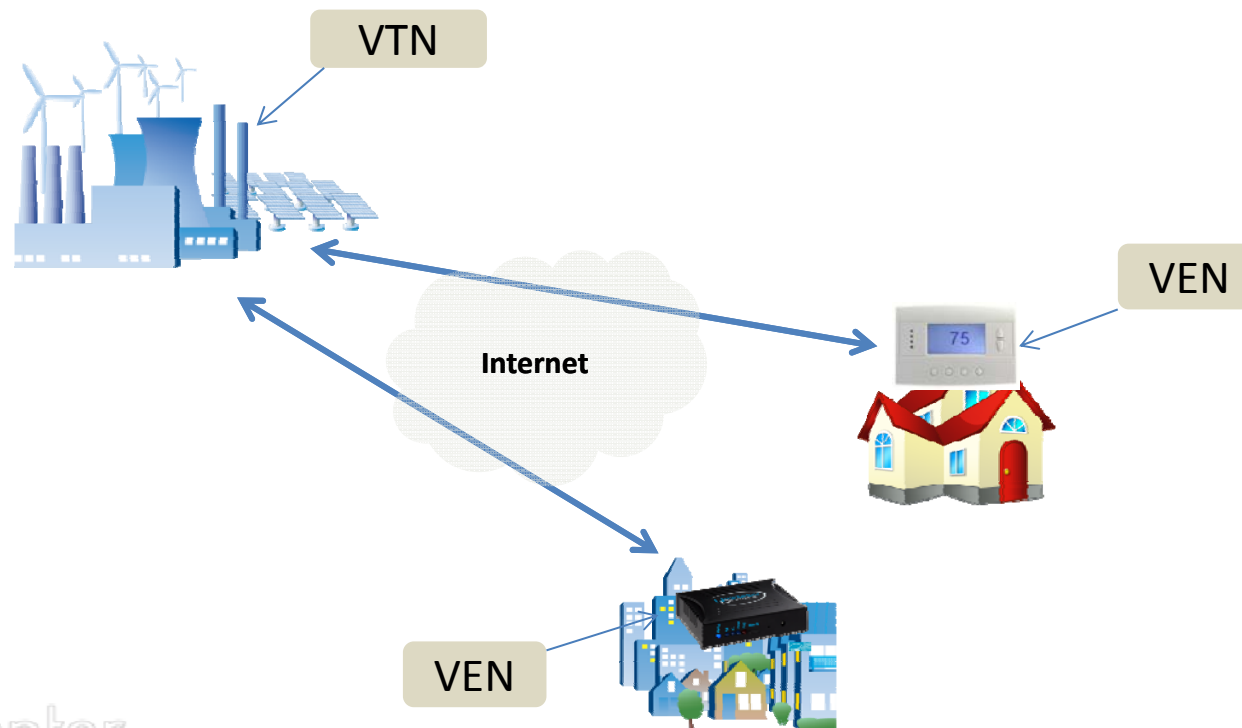
OpenADR 2.0

- OpenADR 2.0 is based upon work done by OASIS in response to Priority Action Plans (PAPs) 3, 4 and 9
- Addresses price models, schedule representation and standard DR Signals
- Adds feedback and other price related features



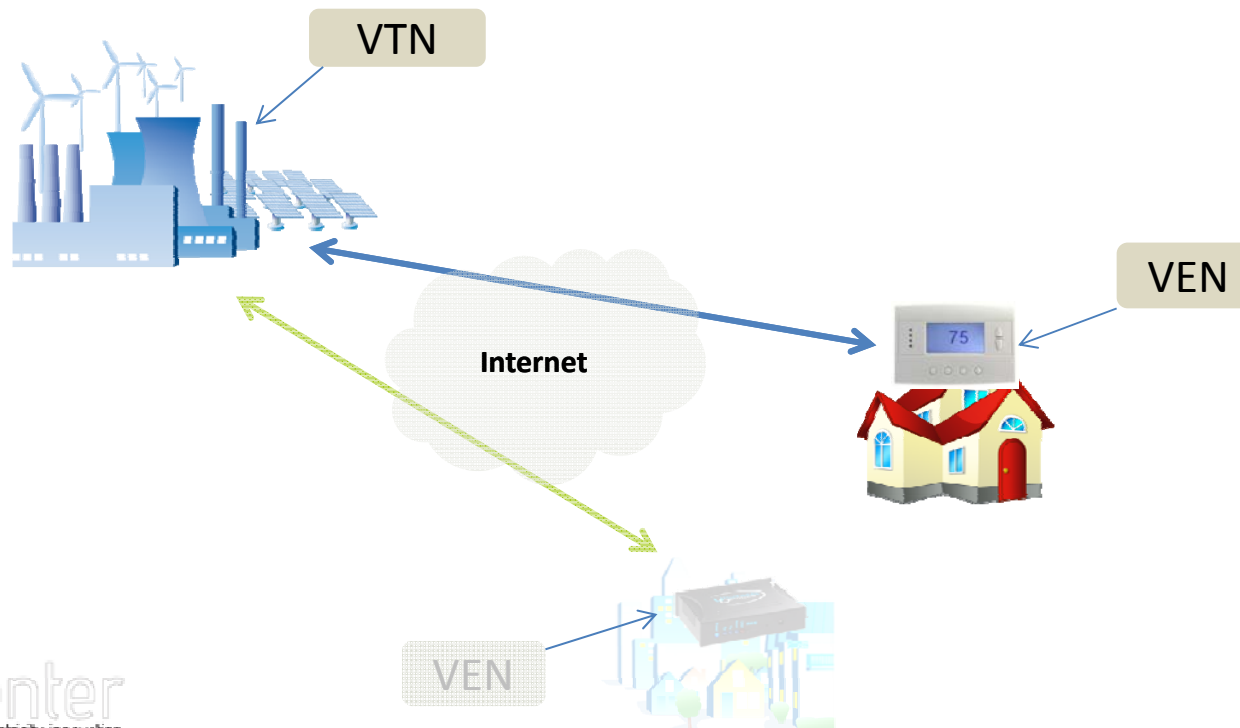
Implementation Configurations

- Direct Connect
 - A Virtual Top Node (VTN) is a server
 - A Virtual End Node (VEN) is a client



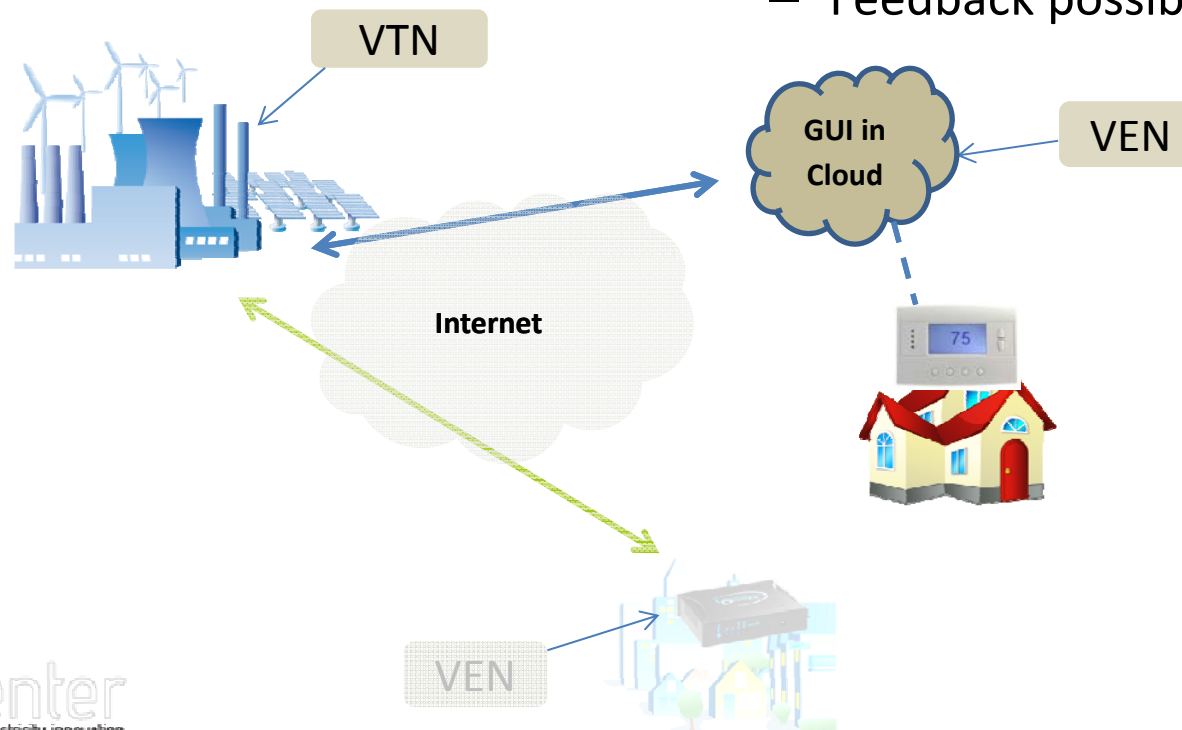
Implementation Configurations

- Direct Connect
 - OpenADR 2.0a enabled thermostat
 - Retail or Operator provided
 - Need to be configured on device level
 - Internet connection required
 - Resource constraint, no feedback



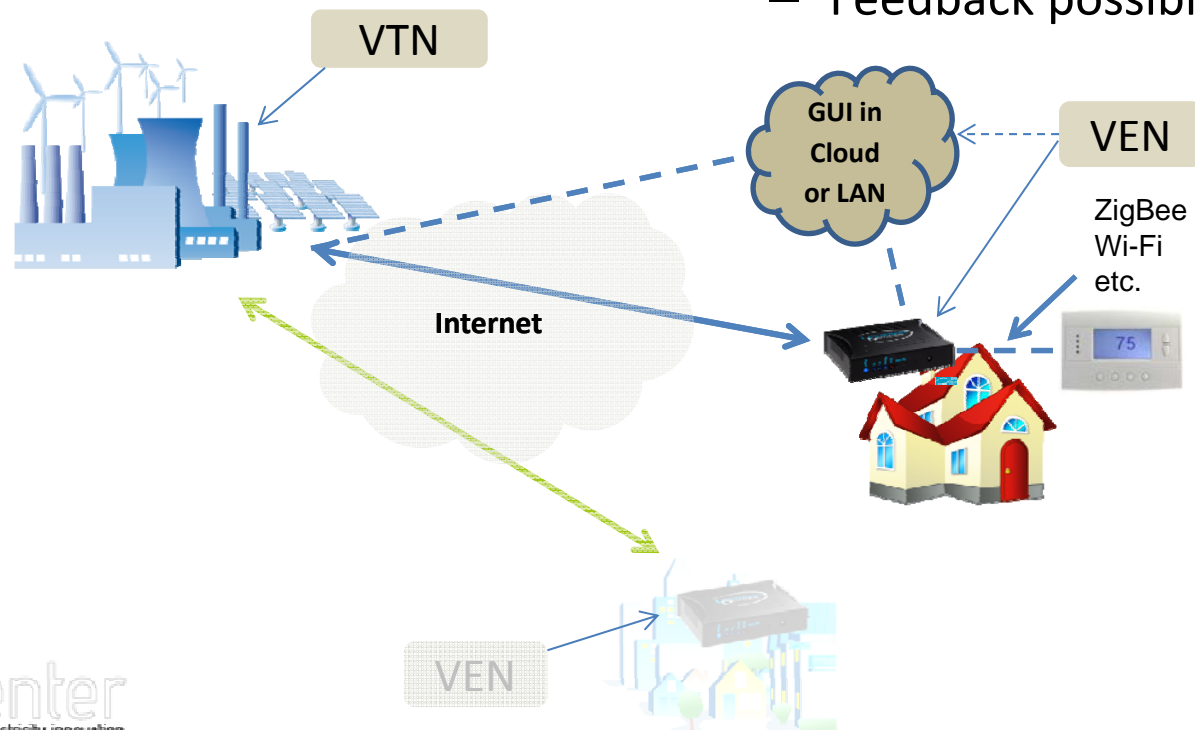
Implementation Configurations

- Direct Connect– Cloud Interface (RI)
 - OpenADR 2.0a or b enabled
 - Retail or Operator provided
 - Easy config in cloud interface
 - Connection from cloud to device up to vendor
 - No resource constraints
 - Feedback possible



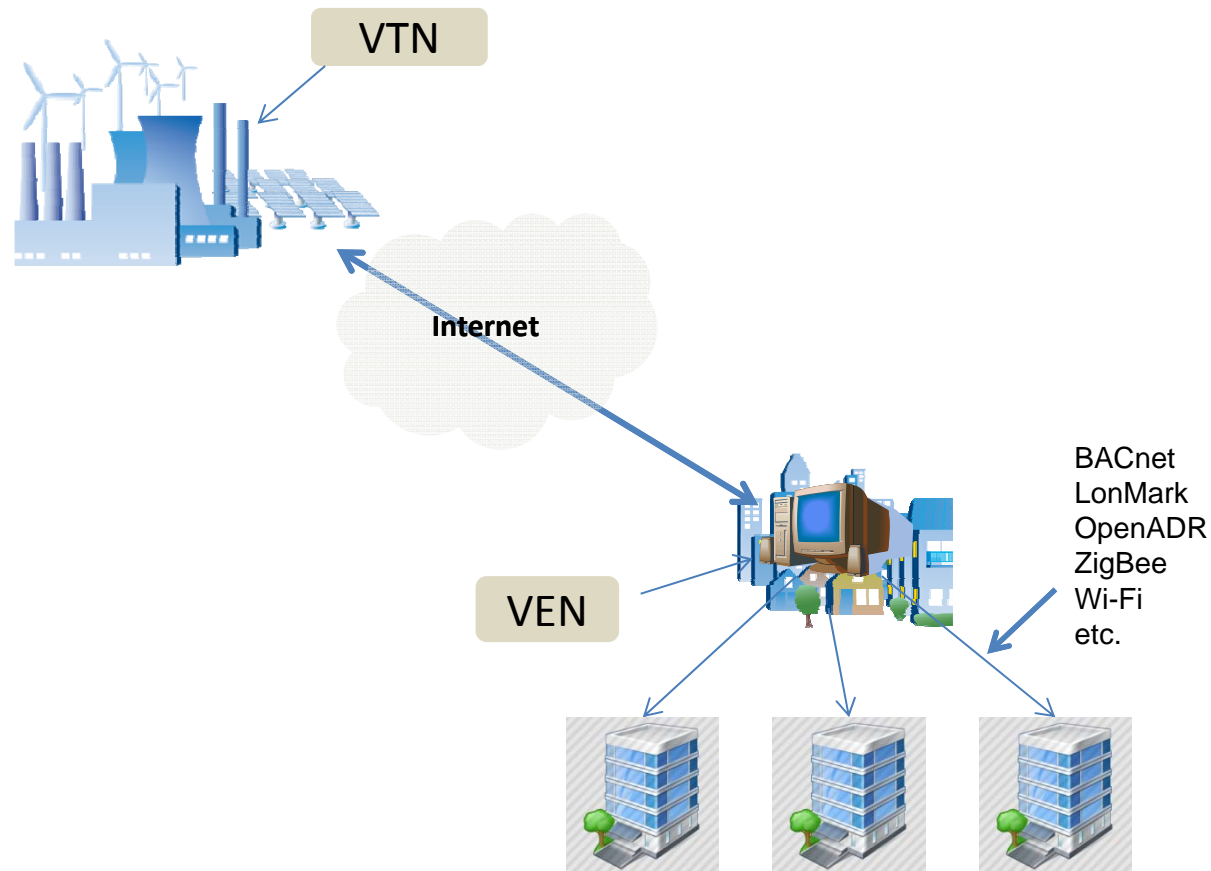
Implementation Configurations

- With EMS – Energy Management System
 - OpenADR 2.0a or b enabled
 - Retail or Operator provided
 - Easy config in cloud interface
 - Connection from cloud to device up to vendor
 - No resource constraints
 - Feedback possible



Implementation Configurations

- Commercial & Industrial



Special Thanks to

Barry Haaser, Managing Director



Steven Bushby, Chairman



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