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Enabling Energy Efficiency – IntelliGrid

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Overview

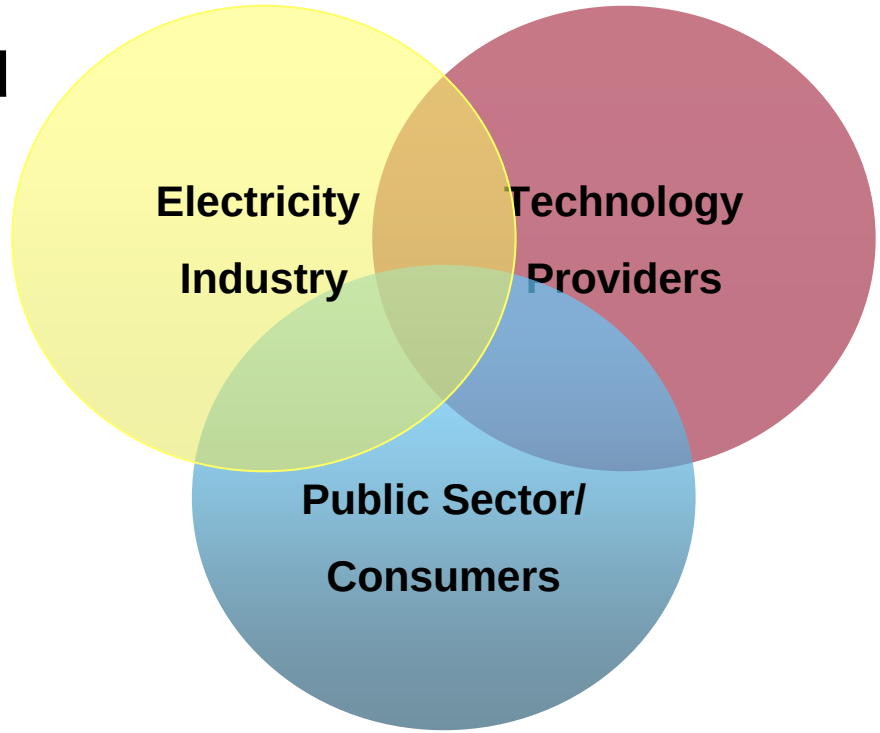
- Vision of the future power delivery system – the Intelligent Grid
- Examples of what an Intelligent Grid will enable
- Premise of how an Intelligent Grid will be created
- Barriers to creating an Intelligent Grid
- What you can do to help accelerate the transformation of the power delivery system

Background

Mission: To accelerate the transformation of the power delivery infrastructure into the intelligent grid needed to support the future needs of society

Pathway to the Intelligent Grid

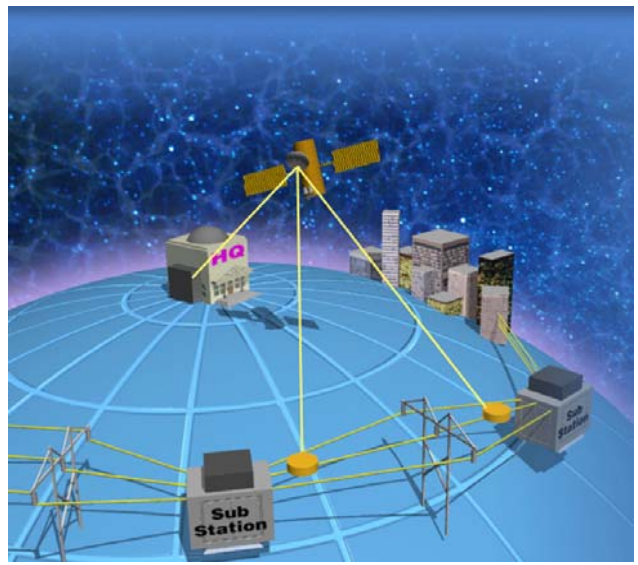
- Create the vision
- Identify the barriers for achieving the vision
- Conduct research, development and demonstrations aimed at overcoming the barriers



The Power Delivery System of the Future: *Characteristics*

To achieve benefits identified by stakeholders, the power delivery system of the future will be:

- *Interactive* with consumers and markets
- *Self-Healing* and *Adaptive* to correct problems before they become emergencies
- *Optimized* to make best use of resources and equipment
- *Predictive* rather than reactive, to prevent emergencies ahead rather than solve after
- *Accommodates* a variety of generation options
- *Integrated* to merge all critical information
- *More Secure*



Interactive with Consumer and Markets:
Innovative Demand Response

Air-Conditioning Scenario

- AC receives day-ahead hour-by-hour electricity prices and day-ahead weather forecast through the internet
- Consumer sets thermostat at 75° (-5°/+3°)
- AC “learns” rate of house cool-down/heat-up based on consumer habits, out-side temperature, time of year, etc.
- AC optimizes operation to minimize consumers energy costs
- AC measures hourly power consumption and communicates it to energy service provider through the internet

Interactive with Consumer and Markets:
Innovative Rates

Rates specifically designed to encourage purchase of new, more energy efficient devices

Example

5 year favorable rates “packaged” with purchase of specific new model of a smarter, more energy efficient air-conditioner, refrigerator, or major energy consuming device

"Self-Healing" Technologies Will Change The Way We Manage And Respond To Outages…

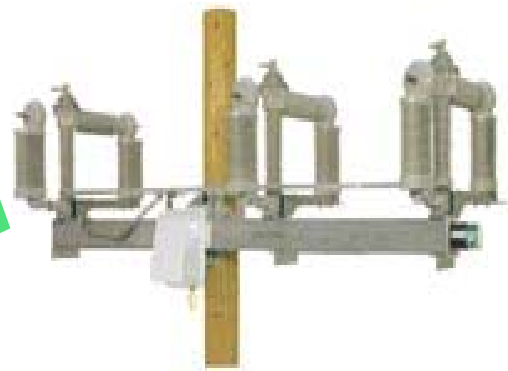
Old Way

1 Tree limb falls on line causing a feeder outage

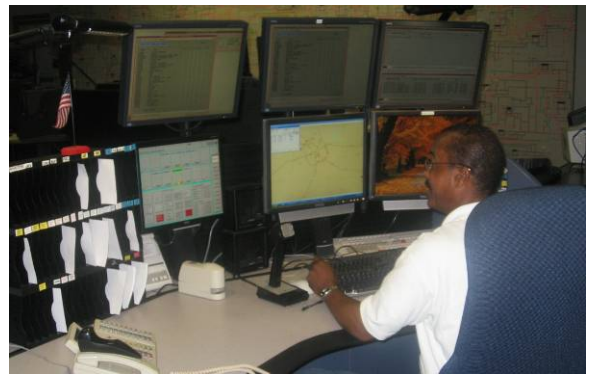
2 Customer calls outage in and Operations Center receives notification

3 Dispatcher notifies field technician who inspects entire feeder for outage source; average restoration time of 40 mins.

New Way



2 Automated switches reconfigure system to restore service to majority of customers within 1 min.

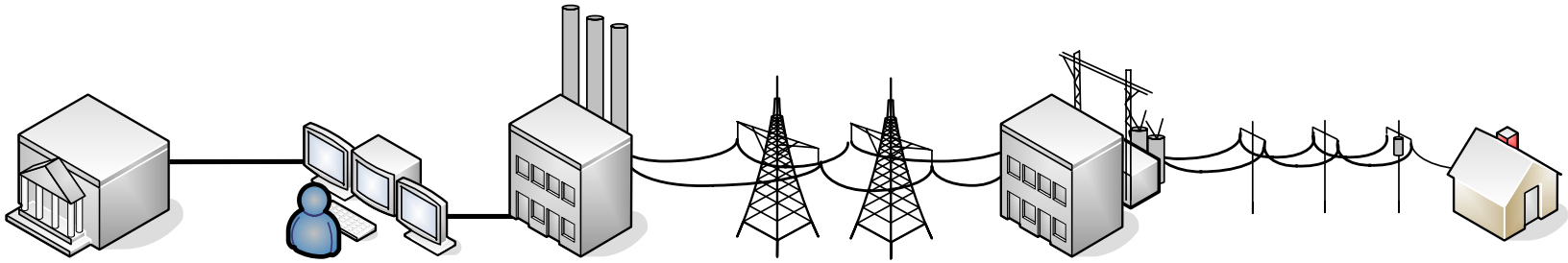


3 Disruption location pinpointed and service restored to remaining customers within 24 mins.

Slide courtesy of TXU

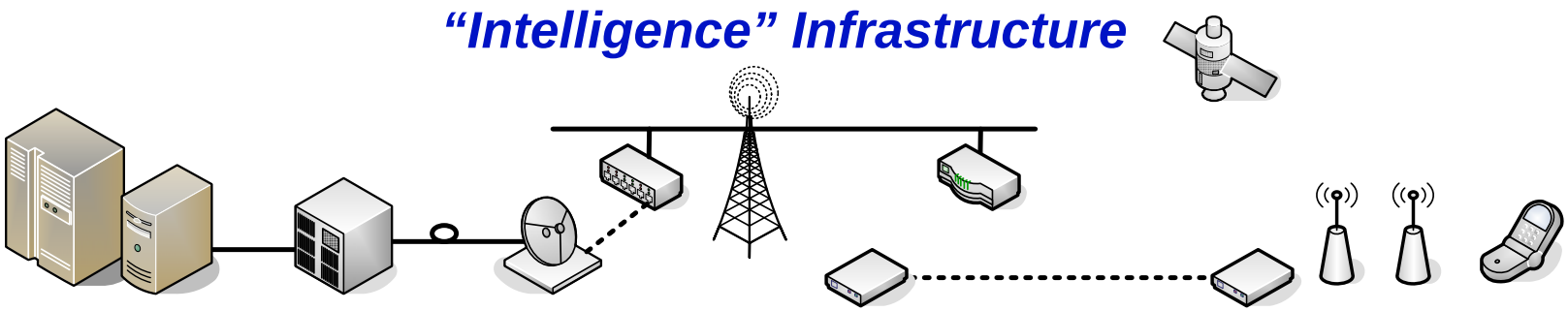
Where deployed, automation technology enhances customer service by eliminating sustained interruptions for 2/3 of the customers and reducing restoration time up to 40% for the remaining 1/3 of the customers

Achieving the Power Delivery System of the Future:
Integrating Two Infrastructures

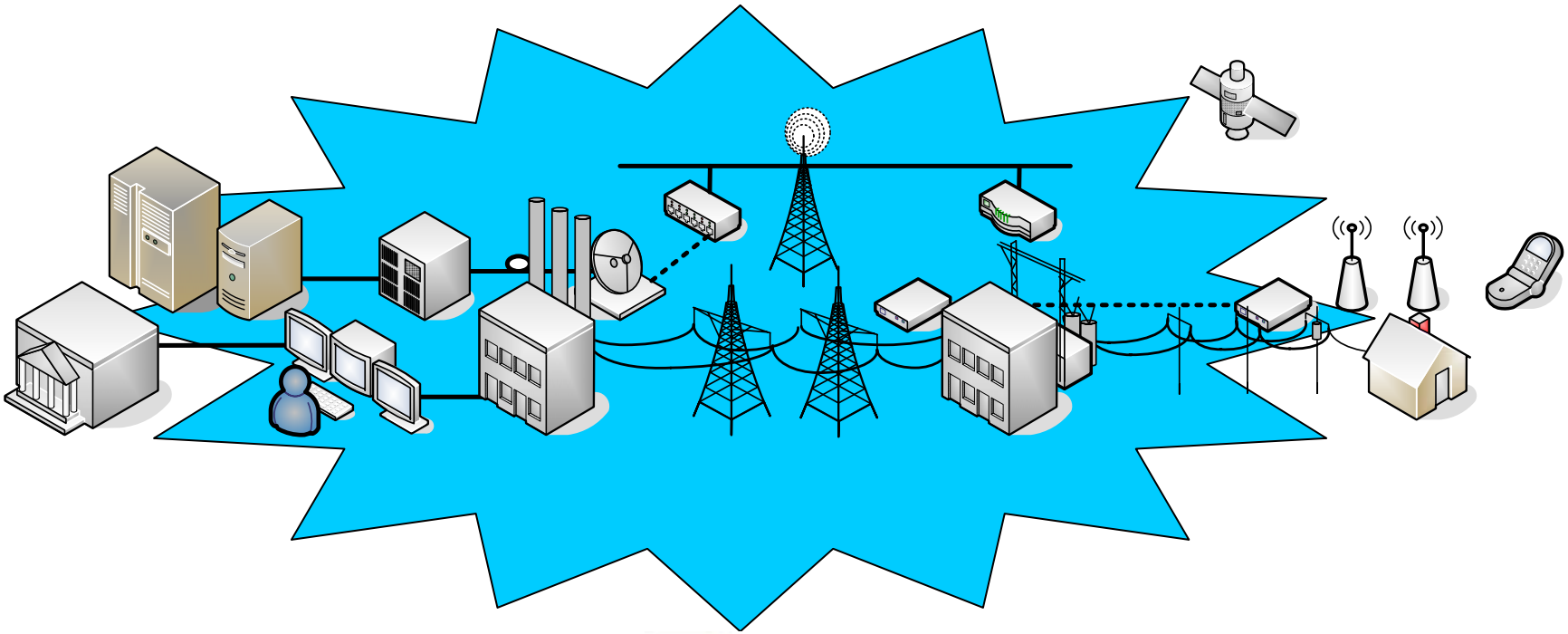


Electrical Infrastructure

"Intelligence" Infrastructure

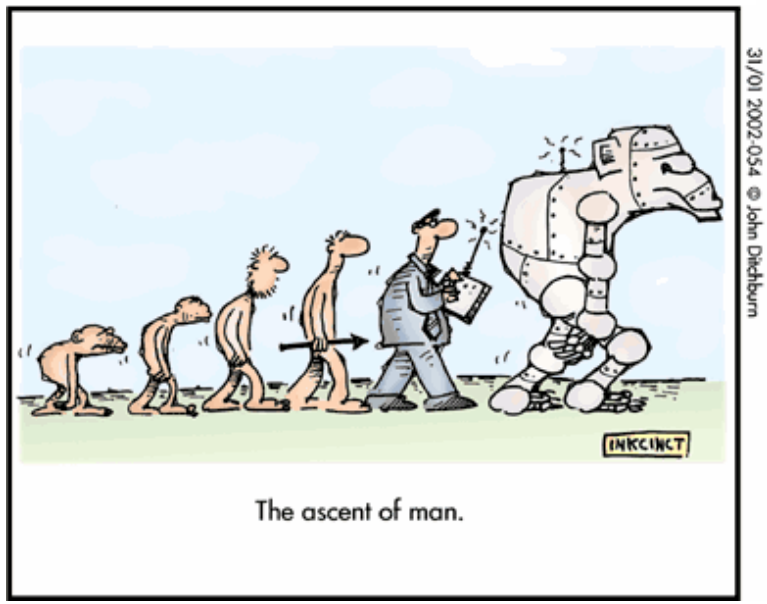


The Intelligent Grid

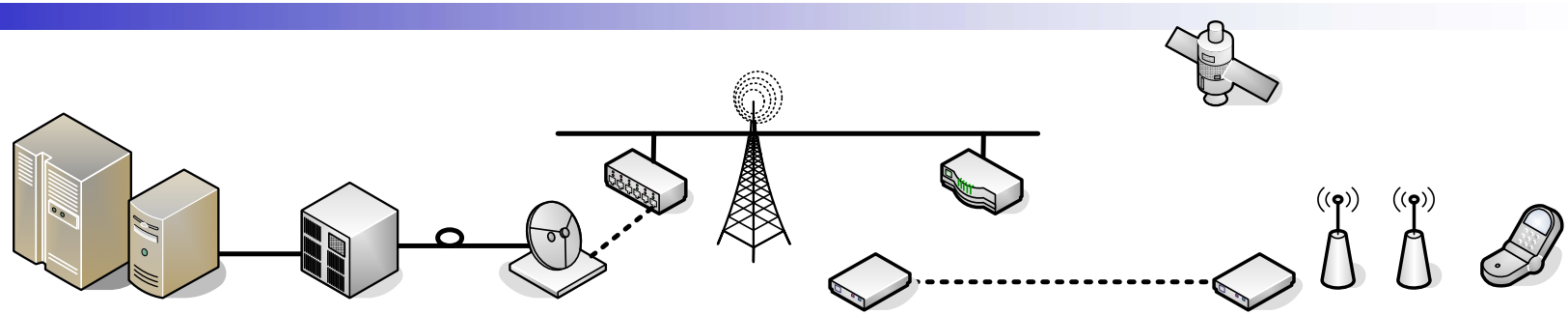


How is an Intelligent Grid Created?
The Premise

- Not created all at once – will ***Evolve*** over many years
- Created through the incremental deployment and integration of ***intelligent systems***
- Intelligent systems deployed to meet specific business and regulatory ***drivers***
- Each utility has
  - Different starting points
  - Different drivers
  - Different paths
  - Different deployment rates



Achieving the Intelligent Grid:
Barriers



Today

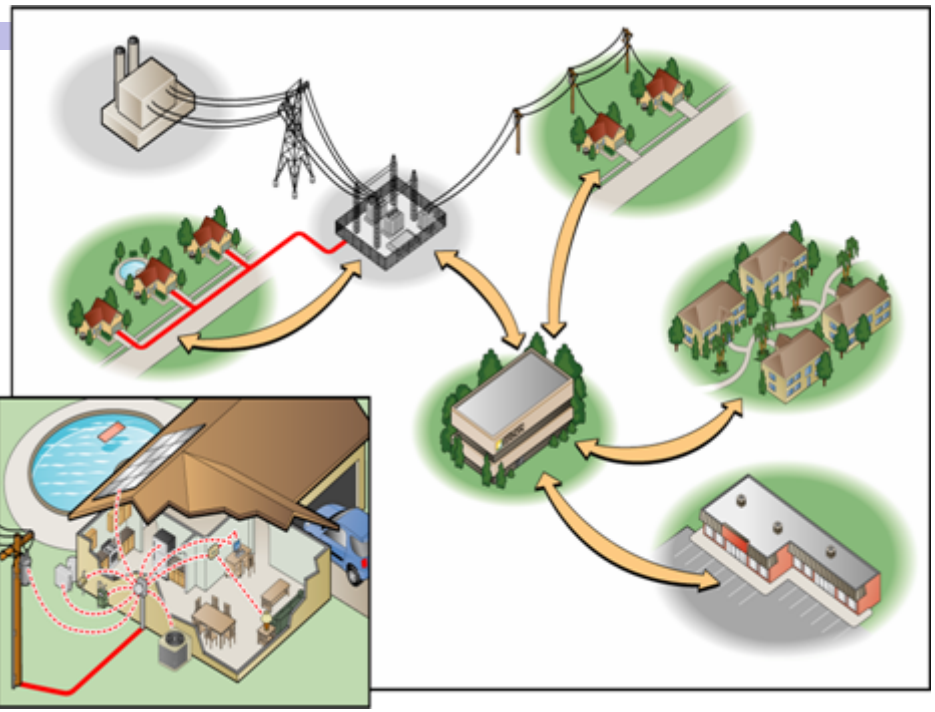
- Fragmented, Isolated systems
- Lack of standards
- Security and system management sometimes underestimated
- Integration of systems is difficult
- Vendors selling proprietary systems

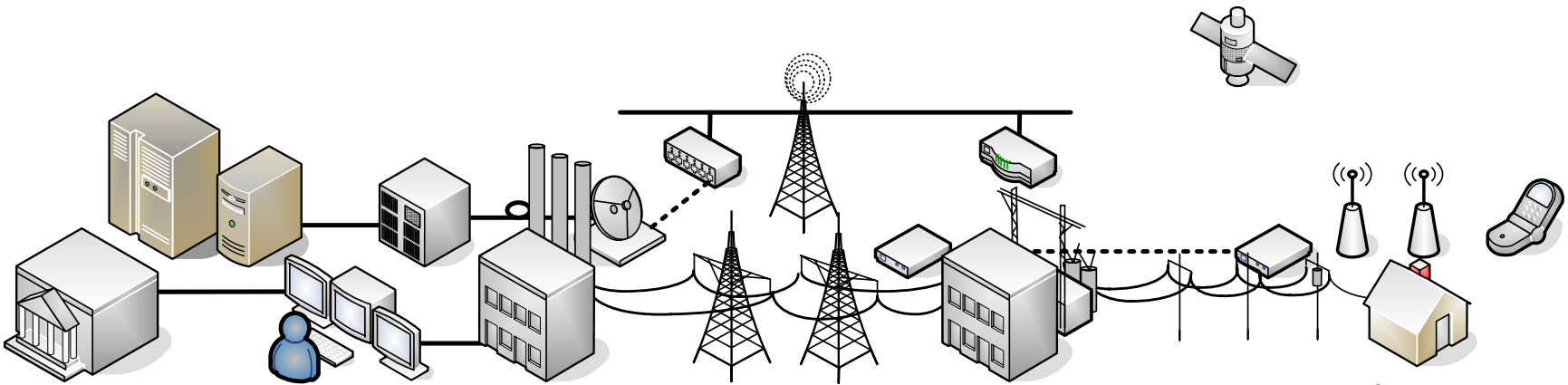
Future

- Requirements driven
- Interoperability
  - The ability to “plug and work” devices and software
- Open Architecture
  - Non-proprietary infrastructure means no vendor lock-in
  - Because vendors compete, innovations will result
- Based on Industry-Accepted Standards
  - Encourages confident infrastructure investment
  - Reduces risk of obsolescence

Advanced Metering

- Tremendous opportunity for creating the “intelligence” infrastructure needed to support energy efficiency and demand response





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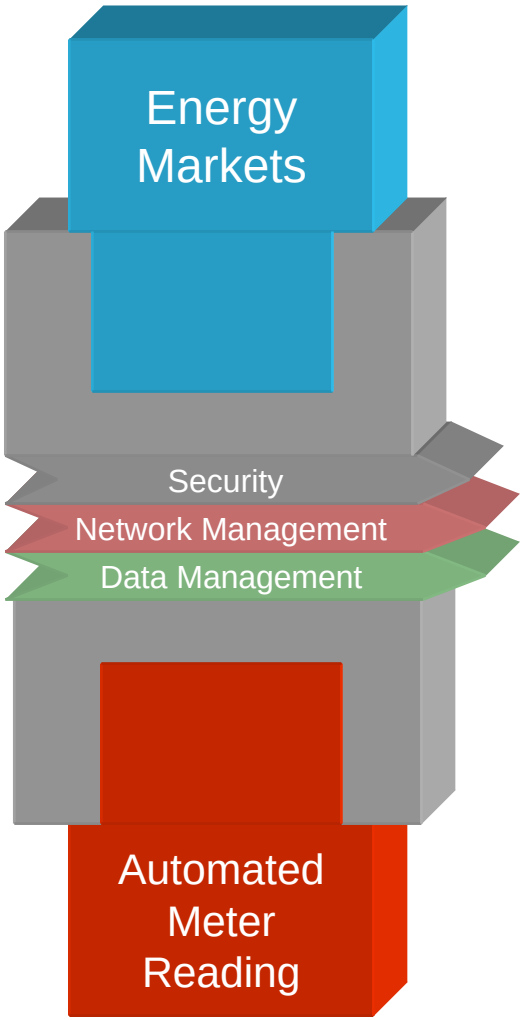
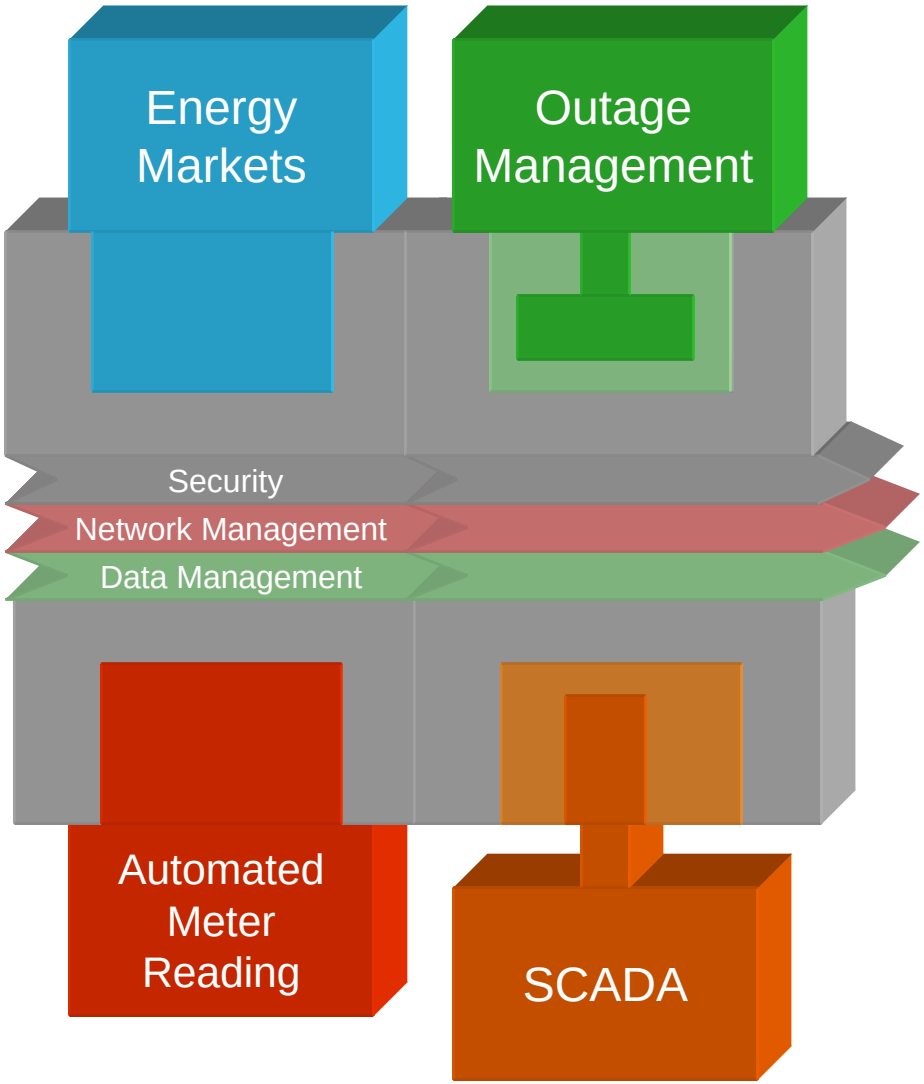
An Architected Approach to Integration



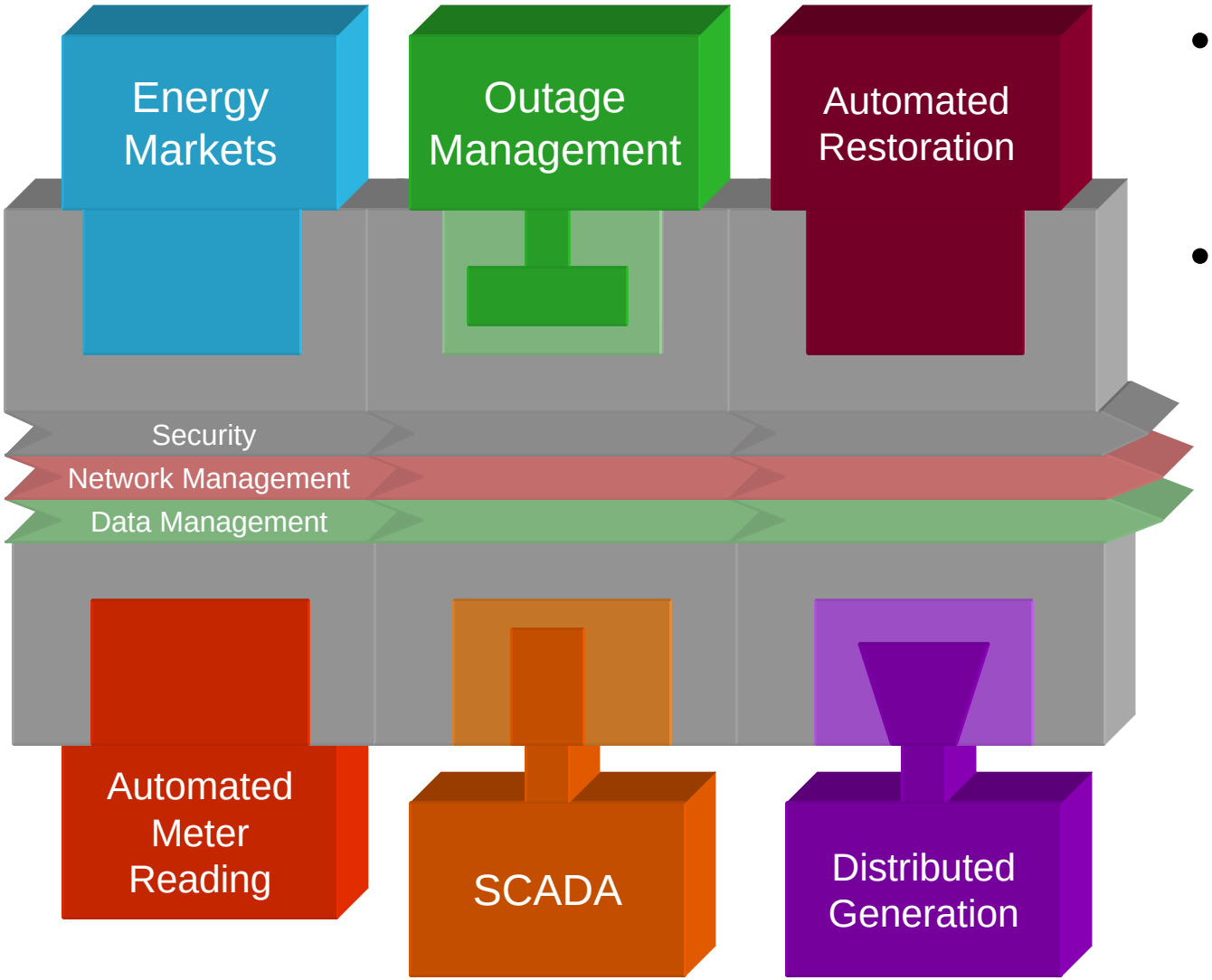
- Define standardized interfaces first
- Incorporate security, network management and other strategies right from the beginning
- Initial costs are a bit more than one-off integration, but not much more
- New applications can build directly to the new architecture

An Architected Approach to Integration:
The Next Phase



- Can re-use the development from the first phase
- Expansion was expected
- Adaptation to legacy systems was planned in advance
- Overall costs much lower

An Architected Approach to Integration:
And so on…



- Benefits INCREASE with time
- Opposite of the old way

Achieving the IntelliGrid Vision:
Barriers

- Business case for building infrastructure designed for the future utility
- Integration methods, tools and technologies
  - Effective tools for specifying, designing and procuring intelligent systems
  - Effective approaches for security, data and system management
- Standards
  - Incomplete set of standards (inter-standards issues)
  - Lack of maturity of key standards (intra-standards issues)
- Suppliers not providing products that comply with standards or promote integration

What's at Stake?

- It isn't a question of if an intelligent grid will be created – it's a question of how quickly and how efficiently will it be created.
- Utilities will spend billions of dollars in the coming years creating the intelligent grid
- It's in the best interest of everyone to do it right the first time

EPRI's IntelliGrid Program

- Develops the methods, tools and integrating technologies that enable utilities to efficiently and cost effectively deploy "intelligent system" today
  - Meet near-term needs while laying the foundation for the intelligent grid of the future
- Assists members in implementing results
  - Share lessons learned with other members
- Engages all stakeholders – utilities, suppliers and regulators
- Coordinates with other "smart grid" R&D activities
- Promotes key standards – contributes to standards development activities
- Raises awareness of all stakeholders

IntelliGrid Partners Cut Across All Stakeholder Groups

U.S. Utilities

- Alliant Energy
- Bonneville Power Administration
- Consolidated Edison Company
- Exelon
- Kansas City Power & Light
- Long Island Power Authority
- New York Power Authority
- Salt River Project
- Public Service Electric & Gas
- TXU
- We Energies
- Kansas City Power & Light
- Public Service New Mexico
- Tri-State G&T
- Arkansas Electric Cooperative
- Great River Energy
- Richmond Power & Light
- Dairyland Power Cooperative
- Golden Valley Electric Assn.
- Hoosier Energy Rural Electric Cooperative
- Lincoln Electric
- Hetch Hetchy Water & Power

International Utilities

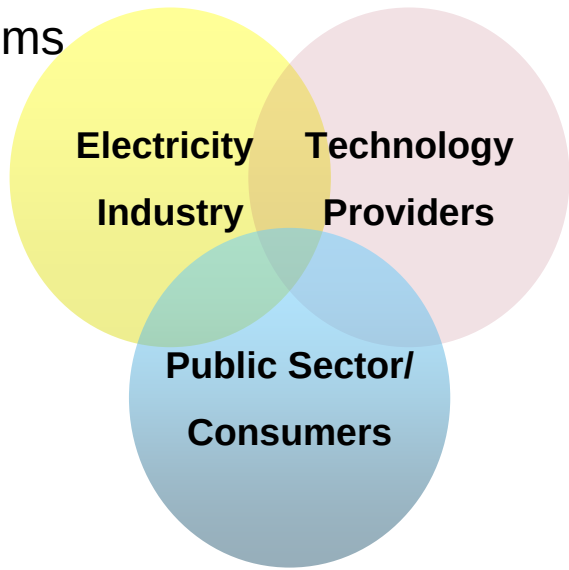
- Electricite de France
- Polish Power Grid Company

Public Agencies

- California Energy Commission
- U.S. Department of Energy

Manufacturers

- ABB
- CISCO Systems
- UTC Power
- Hitachi



Current and past partners

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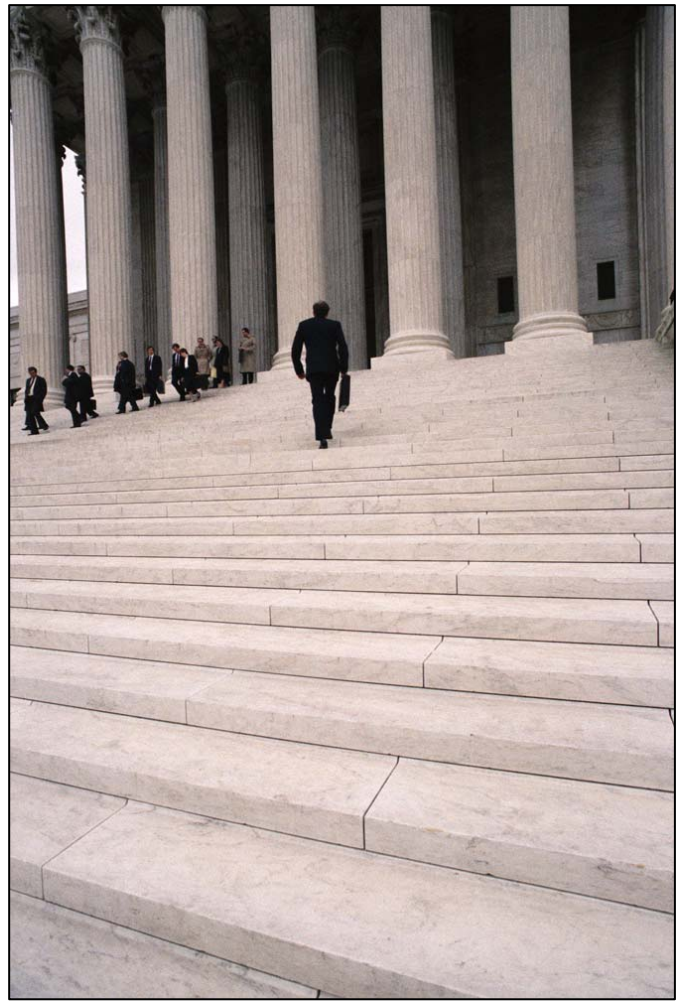
Public Advisory Group Provides Advice and Influences Acceptance

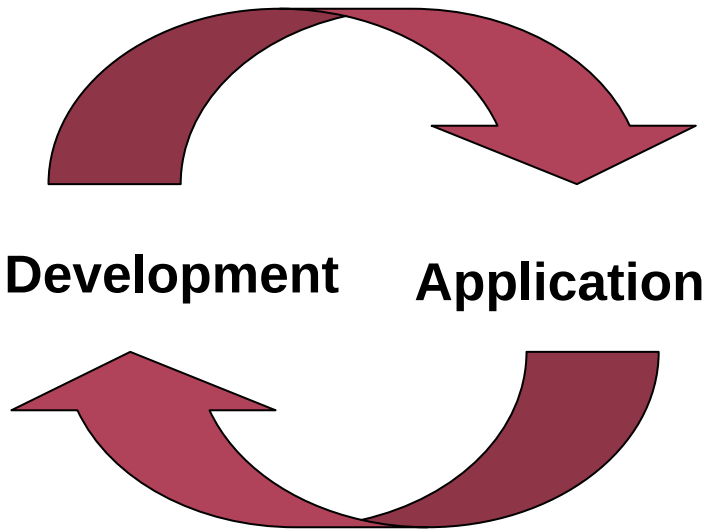
Representatives of:

- Association of State Energy Research and Technology Transfer Institutions
- International Brotherhood of Electrical Workers
- National Association of Regulatory Utility Commissioners
- National Association of State Energy Officials
- National Conference of State Legislatures
- National Governors Association
- State Energy Offices and Research Programs



Applications of the IntelliGrid Architecture

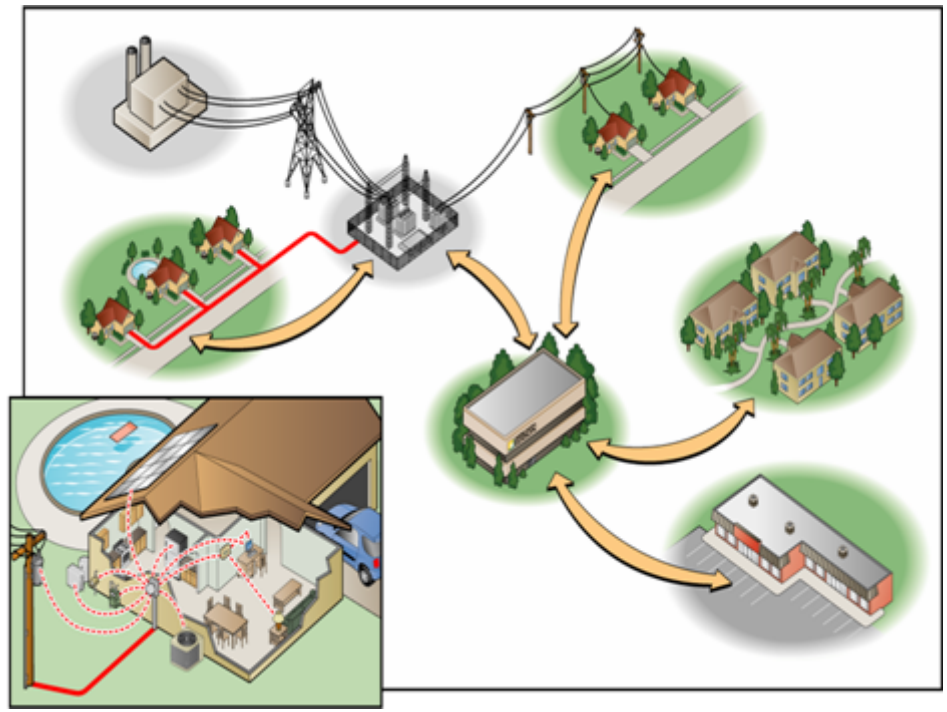
- **Southern California Edison** – *applying the IntelliGrid Architecture $1.5B AMI project*
- ***TXU*** *– applying IntelliGrid Architecture to $400M automated meter reading project*
- **Salt River Project** – *applying IntelliGrid Architecture for substation data integration*
- **Alliant Energy** – *Distribution Monitoring System*
- **Long Island Power Authority** – *Utility and Consumer Device SCADA via Broadband over Power Line (BPL) and Wireless Communications*



How is Southern California Edison Using IntelliGrid Results?

Advanced Metering Infrastructure

- Apply methods & tools to capture requirements
- Build on defined applications
- Apply recommendations for standards and technologies
- Contribute the results of their work to the industry



Actions Needed to Support IntelliGrid

- **Expand the IntelliGrid Consortium**
  - Participate in the IntelliGrid Public Advisory Group
  - Coordinate research programs with IntelliGrid
  - Encourage utilities and technology providers in your state to participate in IntelliGrid Consortium
- **Host an IntelliGrid demonstration in your state**
  Hosting entails
  - Participants, site, funding
- **Ensure future investments incorporate IntelliGrid Architecture**