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NATIONAL LABORATORY

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# Data & Communications for Buildings: Interoperability to Enable Efficiencies Across the Energy Value Chain

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Technical Meeting on Data/Communication Standards and Interoperability of Building Appliances,  
Equipment, and Systems

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- ▶ Why are we here?
- ▶ Enabling building equipment and system interactions
- ▶ Framework for describing interactions
- ▶ Sample types of interactions
- ▶ Existing and emerging ecosystems to advance interactions
- ▶ Efforts to simplify integration and maintenance

# What are we trying to accomplish?

- ▶ Large-scale deployment of clean energy technologies requires advanced approaches to address grid integration
- ▶ Improved approaches to technologies and deployments of technologies offer new services if appropriately integrated
  - Examples include...advanced power electronics, “grid responsive” building technologies, vehicle-to-grid technologies
- ▶ Buildings (and their components) have a large role to play for grid services and variable renewable resource integration, BUT
  - Limited by existing control and coordination technology
  - Need to expand and scale advanced deployments beyond large buildings
- ▶ Integrated building solutions must think across the meter
  - Greater energy efficiencies and business efficiencies can be mined through co-optimization approaches

How? Engage stakeholders – Develop common platforms and frameworks –  
Leverage existing resources – Encourage partnerships

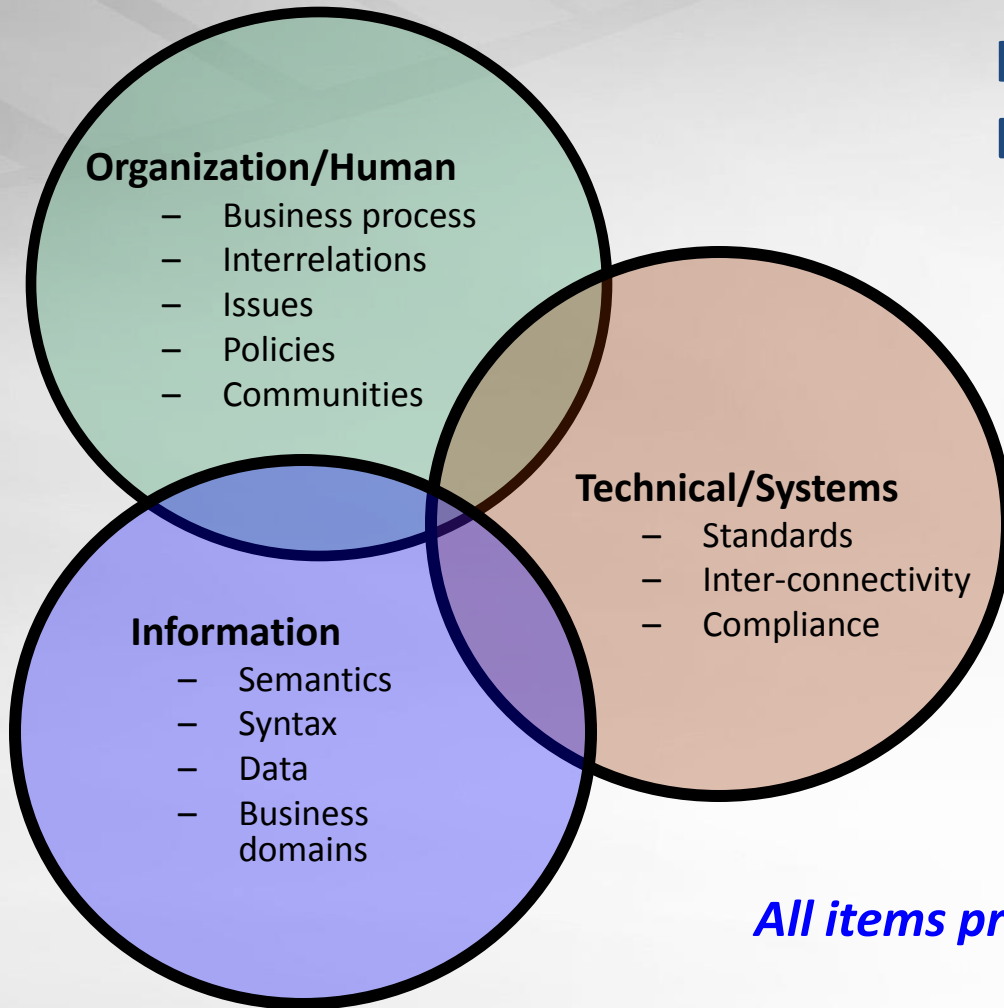
### What do we mean by interoperability?

- ▶ Exchange of actionable information
  - between two or more systems
  - across organizational boundaries
- ▶ Shared meaning of the exchanged information
- ▶ Agreed expectation, with consequences, for the response to the information exchange
- ▶ Requisite quality of service in information exchange
  - reliability, fidelity, security





# Interoperability Benefits

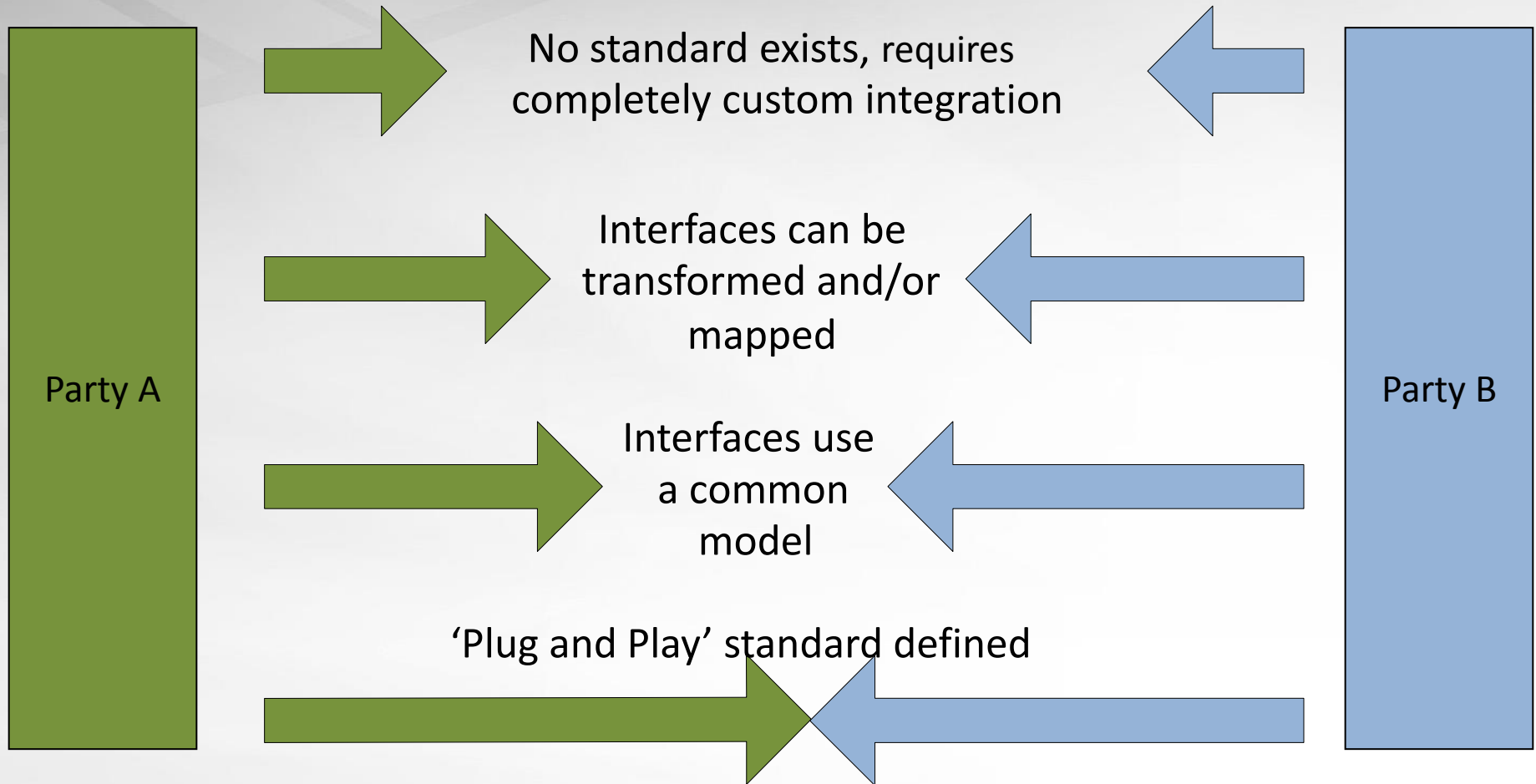


## Interoperable Software - Expected Impact:

- ▶ **Reduces integration cost**
- ▶ **Reduces cost to operate**
- ▶ **Reduces capital IT cost**
- ▶ **Reduces installation cost**
- ▶ **Reduces upgrade cost**
- ▶ **Better security management**
- ▶ **More choice in products**
- ▶ **More price points & features**

*All items provide compounding benefits*

# Reducing Distance to Integrate

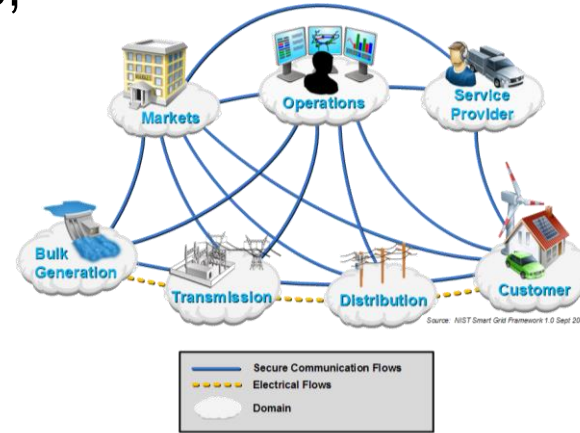


Credit: Scott Neumann, UISol GWAC position paper

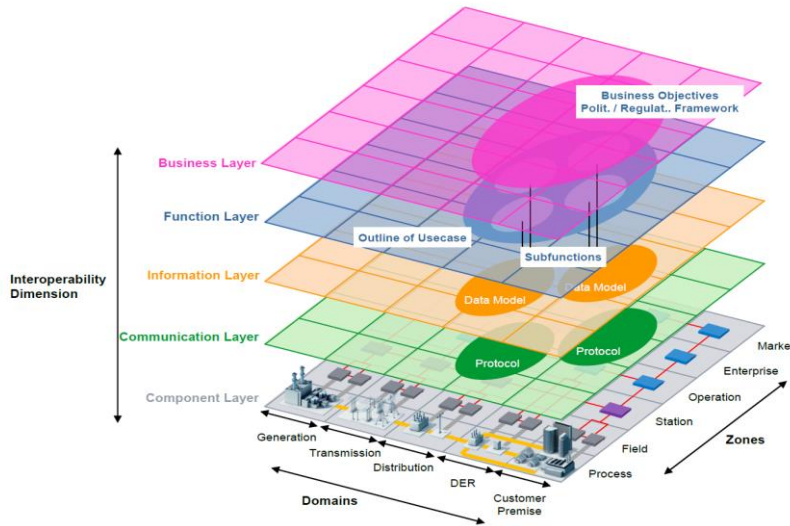
# Need a Framework for Describing Interactions



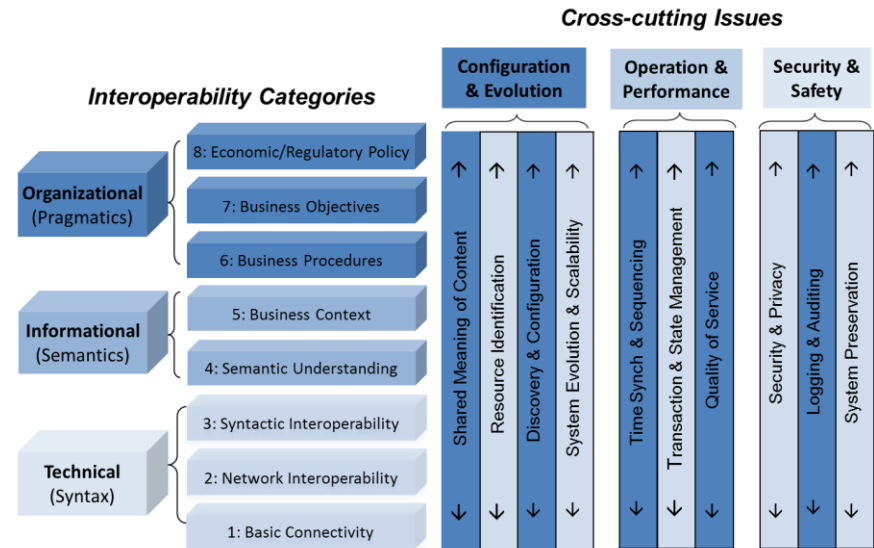
- ▶ Use case template: title, narrative, actors, information, interaction diagram, etc.
- ▶ Conceptual model or architecture
- ▶ Standards and guides
- ▶ Testing and certification
- ▶ Reference implementations



SGIP Smart Grid Conceptual Model



SG-CG Reference Architecture for the Smart Grid  
CEN, CENELEC, ETSI



GWAC Interoperability Context-Setting Framework

# Support a Broad Range of Interactions

Framework for interoperability must enable wide-range of information exchanges, at scale, that is simple, automatable and affordable

The range of exchanges that will become much more transaction-based include:

- ▶ Intra-building examples
  - Cap and trade roof-top units to mitigate peak demand charge
  - Tenant s exchange energy allowances from building owner to engage them in efficiency, comfort, and service co-optimization
- ▶ Building to third-party services examples
  - Campus microgrid coordination
  - Computation coordinated across data centers to minimize electric bill
  - Commissioning, diagnostics, and maintenance services based on problems corrected
  - Energy services contractor shares efficiency benefits from retrofits with building
  - Real-time management of air shed emissions based on surcharges
- ▶ Building to electric grid services examples
  - Building response to market transactions (real-time markets, bilateral contracts...)
  - Building contracts to provide ancillary services (e.g., spinning reserves) to service aggregator
  - Differentiated reliability services (premium paid for higher reliability levels)
  - Emergency power rationing and trading



## Framework & approaches for interoperability must:

- ▶ Be flexible
  - Future energy “mix” predictions are uncertain, but are certain to change over time
  - Technology & methods will evolve
- ▶ Focus on the interfaces – boundaries of responsibility
  - Energy system too big for central design or control
  - Coordinate at boundaries – organizations take internal responsibility
- ▶ Accommodate heterogeneity
  - Multiple applications seek integration
  - Multiple vendors with multiple products
  - Multiple versions and mixtures of technology
  - Overlapping representations/models
  - Interaction requires a shared process view
    - At the boundaries where transactions take place

# Existing and Emerging Ecosystems to Advance Interactions

- ▶ Reach across business sectors for alignment and harmonization
  - SGIP
  - ANSI
- ▶ Alliances formed to advance business through technology deployment
  - BACnet
  - LonMark International
  - OpenADR
  - CSEP
  - USNAP

## **Presentation Outline**

Overview of deployment initiative

Mission

Members

Standards deployment architecture

Standards development and maintenance process

Implementations and field experience

Interoperability testing and certification efforts

Gaps and areas of future development

- ▶ Standards bodies to codify definitions, agreements, best practices
  - ASHRAE
  - NEMA
  - CEA
  - AHRI
  - CEE
  - IEC
  - OASIS
- ▶ Independent testing agencies
  - Standards compliance
  - Interoperability certification
- ▶ Public policy encouragement
  - Performance targets
  - Policy and procurement guidelines
  - Adoption initiatives and incentives

## Presentation Outline

Overview of the organization

Mission

Members

Relevant standards and their status

Gaps and new areas of work

## Where are we going with this?

- ▶ Convene stakeholders in an effort to align on common goals understanding the different perspectives
- ▶ Help identify issues, gaps, synergies, and precedence relationships among interoperability and standards activities
- ▶ Consider the emerging ecosystem and tools to support their participants
  - E.g., interface registries, interrogation directories, ratings, libraries, test beds...
- ▶ Facilitate prioritization (bring focus and perspective) to near-term activities
- ▶ For each activity
  - Engage all those who need to be at the table
  - Establish “ownership” to appropriate organizations

## What is the federal role to support these activities, such as...

- ▶ Convene meetings and encourage participation
- ▶ Joint industry/government projects
- ▶ Host common repositories and governance groups (e.g., ICANN for Internet naming)