How is System Integration Achieved?

Erich Gunther

EnerNex Corporation

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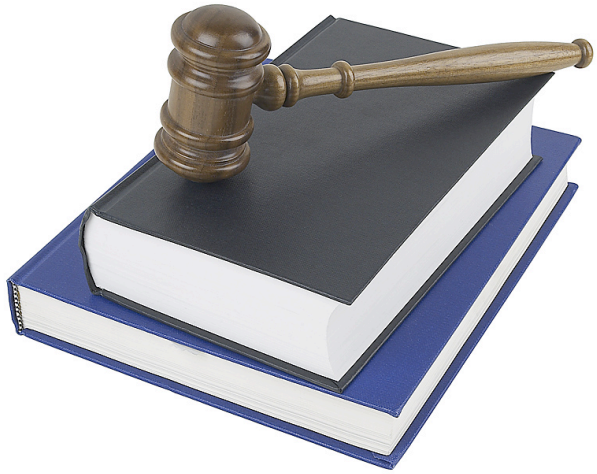
Analogy – Building a House

- **A house is an extremely complex,** *integrated system*!
- **Many people are involved in its creation**
  Town, developer, contractors, owner…
- **Many strict requirements to be met**
  Safety, security, insurance, contractual…
- **Many interconnecting systems**
  Structure, electrical, plumbing, telecom…
- **Many different organizations involved**
- **Many different processes underway**

Why does it work so well?

Factors in Achieving Integration

Policies

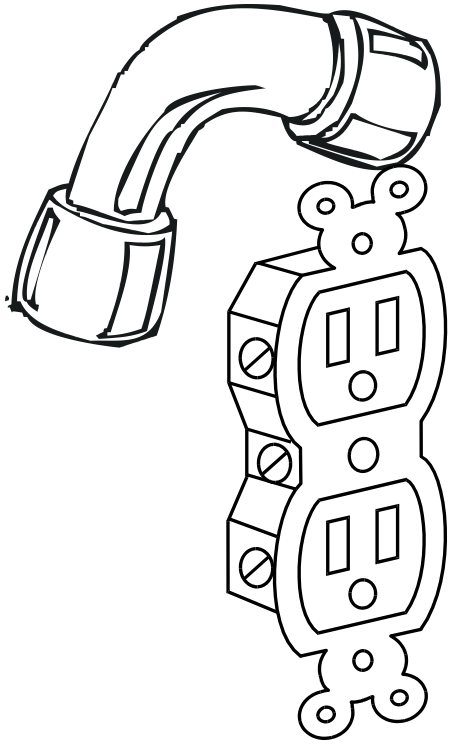


- **Laws passed to ensure**
  - Accountability
  - Responsibility
- **When building a house, e.g.:**
  - Insurance is required before sale
  - All homes must be inspected to be insured
  - Inspection must comply with building code
- **When deploying load control, e.g.:**
  - All homes must contain a PCT
  - PCTs must comply with regulations
  - Utilities must provide infrastructure

Set general principles of deployment

Standards

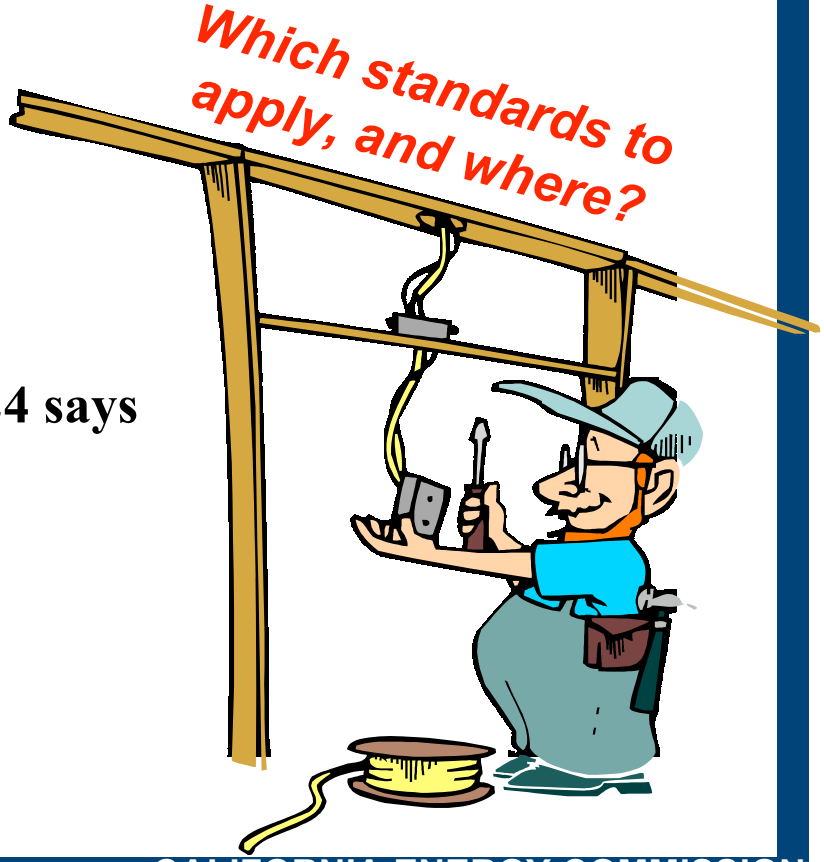
- **Define particular interconnections**
- **When building a house, e.g.**
  - Wire gauges
  - Pipe diameters and threads
  - Standard lumber sizes
  - Tests for smoke detectors
- **When deploying load control, e.g.**
  - Universal Serial Bus
  - Ethernet
  - Public Emergency System
  - Terminal strips
  - Information models



Previously agreed by industry – must be selected for use

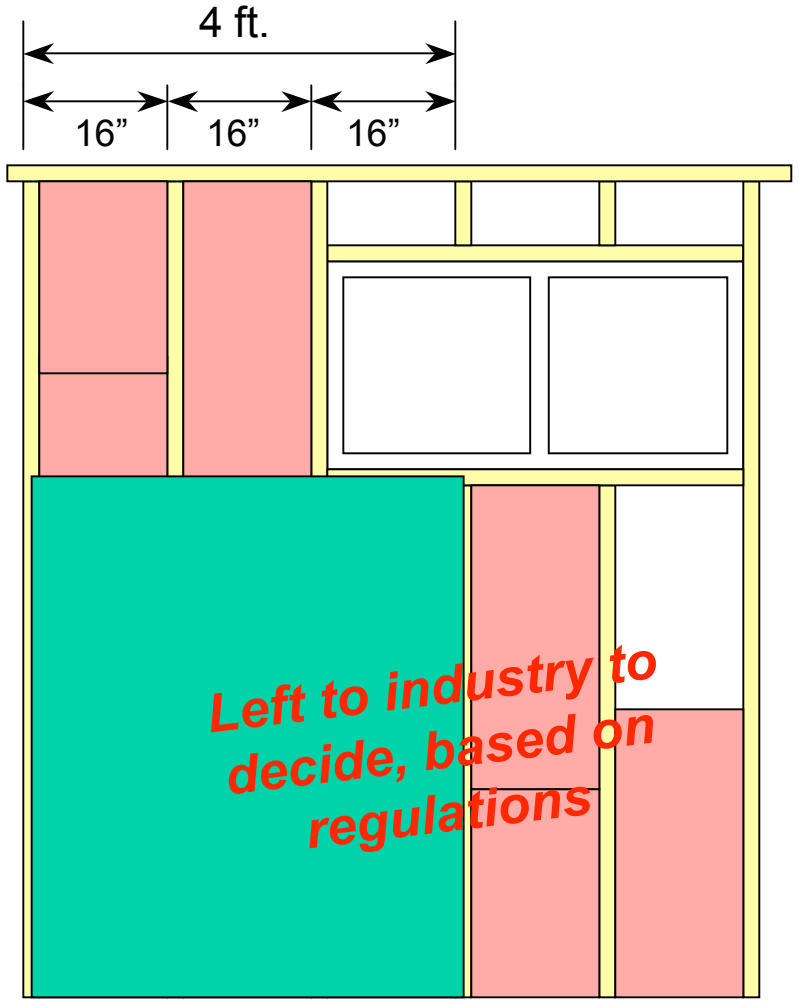
Regulations

- **Set minimums required for** *safety*, *security*, *expansion*
- **When building a house, e.g. building code says:**
  - Minimum 16” centers on 2x4 studs
  - Must use fireproof materials
  - Minimum wire gauges, wiring boxes
  - Maximum load on a circuit
  - Drain pipes must be bigger than supplies
  - Number of smoke detectors
- **When deploying load control,e.g. Title 24 says**
  - Minimum Number and type of ports
  - Must be secure
  - Must connect to HVAC and WAN
  - Minimum information to display



Industry Conventions & Products

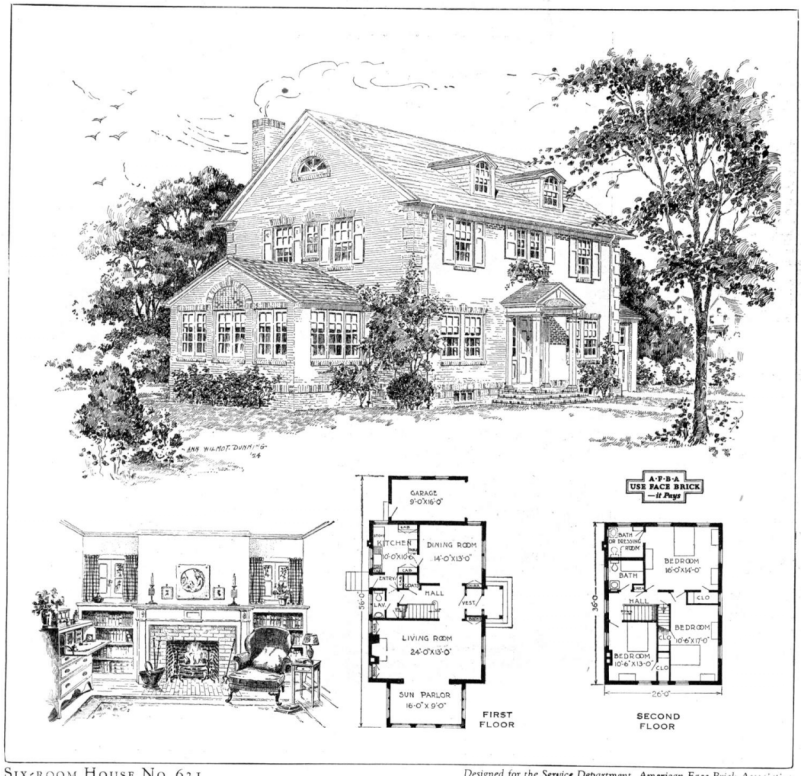
- **Compatibilities that "*suddenly appear*" due to regulations**
- **When building a house, e.g.**
  - 4x8 drywall fits on 16" centers
  - Insulation bats fit into 16" centers
  - Electrical boxes have ½" lip for drywall
  - Locks and hinges fit common door sizes
  - Electrical panel has expansion slots for circuits up to max service size
- **When deploying load control, e.g.**
  - Compatibility with AMI
  - Compatibility with T&D control systems



Project Plans

- **Requirements for a specific installation**
- **Choices from options provided by regulations**
- **When building a house, e.g.**
  - Street layouts
  - Architect's drawings
  - Architectural constraints
  - From ***developer/owner***
- **When deploying load control, e.g.**
  - Functional specifications
  - Project schedules
  - Vendor contracts
  - From ***utility/project manager***

Set the utility's goals for integration



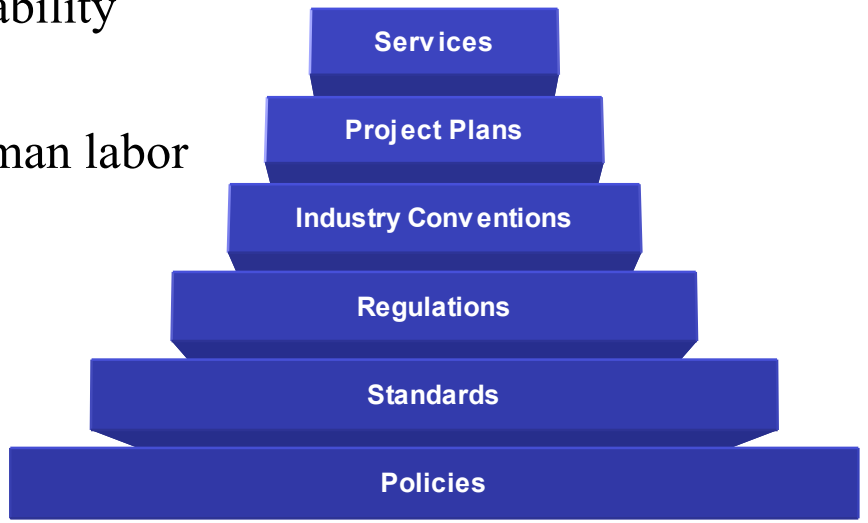
Services

- **New processes and infrastructure**
- **Business opportunities due to regulation**
- **When building a house, e.g.**
  - Building inspector, lawyer, real estate agent, insurance agent
- **When deploying load control, e.g.**
  - Test facilities
  - Contracted operators
  - Consultants
  - Installers
  - Maintenance companies

Integration through people's effort

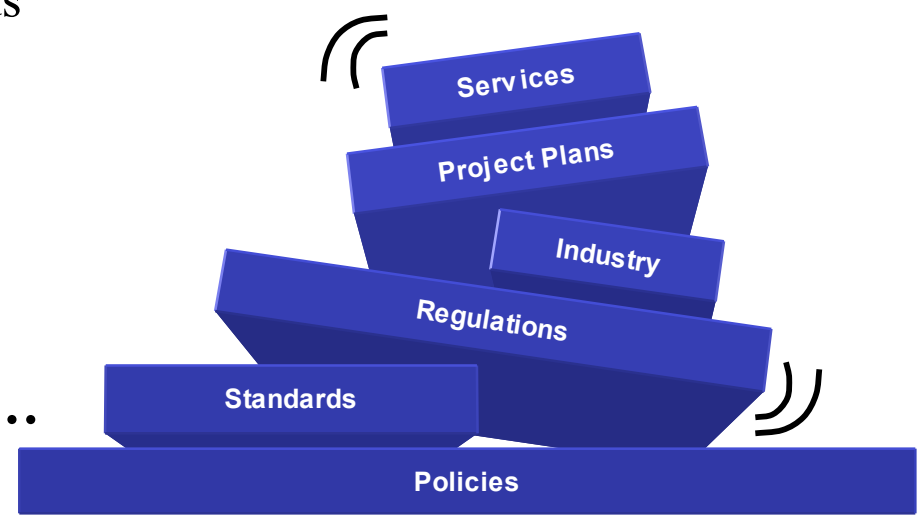
Summary so far….

- **Establish system integration through:**
  - Policies to set general principles
  - Standards to ensure compatibility
  - Regulations to select applicable standards
  - Industry conventions to ensure usability
  - Project plans to meet utility goals
  - Service organizations to apply human labor



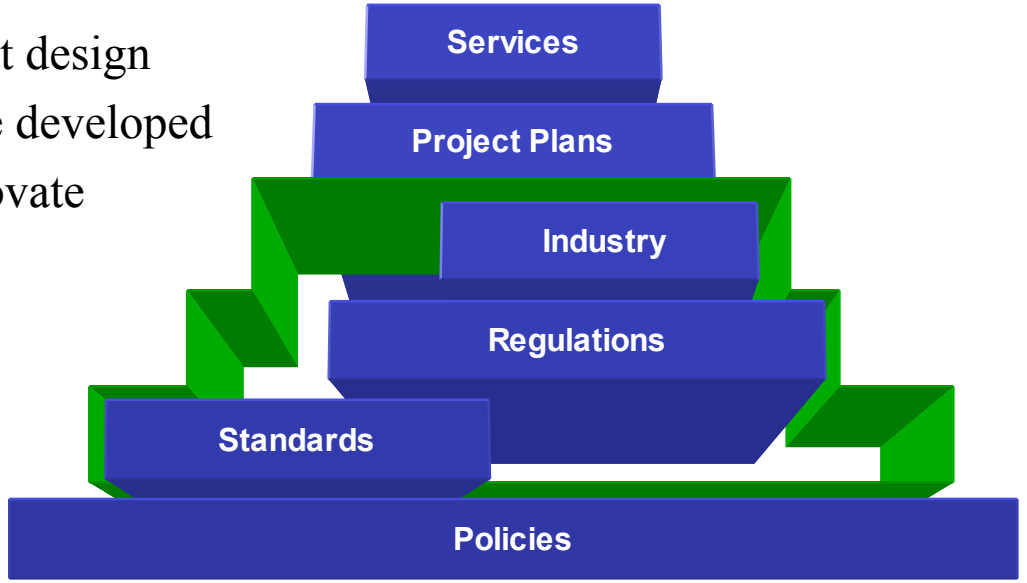
But There's a Problem…

- **No analogy is perfect**
- **Housing is a very mature industry**
- **Load control is just starting out**
  - Some of the necessary standards *don't exist*
  - Industry consensus on best practices is *still building*
  - Regulating in too much detail now could *stifle innovation*
- **Higher costs, incompatibility…**



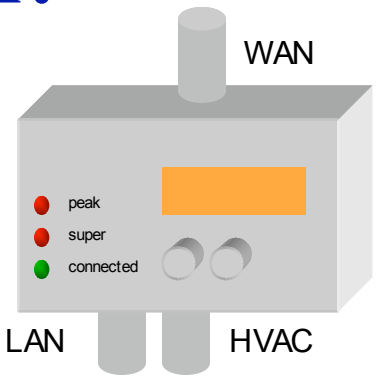
We Need Something New!

- **A *framework* for change**
- **An agreement between industry and regulators**
- **A general outline for a category of products**
  - Not too specific
  - Describes ***requirements***, not design
  - Permits new standards to be developed
  - Encourages industry to innovate
  - ***BUT*** ensures compatibility!

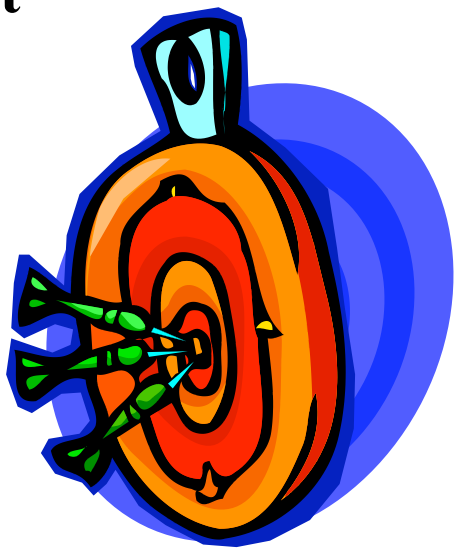


How Would It Work?

- Convene an industry group
- Define the framework in general
- Don't specify particular standards at first
- Define the *functions* of the device
- Get agreement on an approach
- Regulate more specifically later



Goals for the "Framework"

Define requirements for an entirely new *type* of product that:

- **Is Commercially feasible**
- **Fits a regulated environment**
- **Has a most basic version that is low cost**
- **Does no harm!**