IEEE P2030 Smart Grid Interoperability Power Engineering Technology

Samuel C. Sciacca, PE

CG Automation

TF-1 Co-Chair

IEEE

P2030 Overall Goals

1. **Provide guidelines in understanding and defining smart grid interoperability of the electric power system with end-use applications and loads**
2. **Focus on integration of energy technology and information and communications technology**
3. **Achieve seamless operation for electric generation, delivery, and end-use benefits to permit two way power flow with communication and control**
4. **Address interconnection and intra-facing frameworks and strategies with design definitions**
5. **Expand knowledge in grid architectural designs and operation to promote a more reliable and flexible electric power system**
6. **Stimulate the development of a Body of IEEE 2030 smart grid standards and or revise current standards applicable to smart grid body of standards.**

IEEE

- **P2030 Draft Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation With the Electric Power System (EPS), and End-Use Applications and Loads. (PAR Approved March 19, 2009)**

Scope and Purpose

- Scope: **This document provides guidelines for smart grid interoperability.** This guide provides a knowledge base addressing terminology, characteristics, functional performance and evaluation criteria, and the application of engineering principles for smart grid interoperability of the electric power system with end use applications and loads. The guide discusses alternate approaches to good practices for the smart grid.

- **Purpose:** This standard provides guidelines in understanding and defining smart grid interoperability of the electric power system with end-use applications and loads. Integration of energy technology and information and communications technology is necessary to achieve seamless operation for electric generation, delivery, and end-use benefits to permit two way power flow with communication and control. Interconnection and intra-facing frameworks and strategies with design definitions are addressed in this standard, providing guidance in expanding the current knowledge base. This expanded knowledge base is needed as a key element in grid architectural designs and operation to promote a more reliable and flexible electric power system.

- http://grouper.ieee.org/groups/scc21/

IEEE

Three Task Forces Formed to Lead the Effort

- TF-1 Power Engineering Technology
  - Power and Energy Society Centric
  - Focusing on definition of the needs
- TF-2 Information Technology
  - IEEE Computer Society Centric
- TF-3 Communications
  - IEEE Communications Society Centric

Unprecedented collaboration of three IEEE Societies

Approximately 150 participants, evenly divided in the three Task Forces. Some common membership.

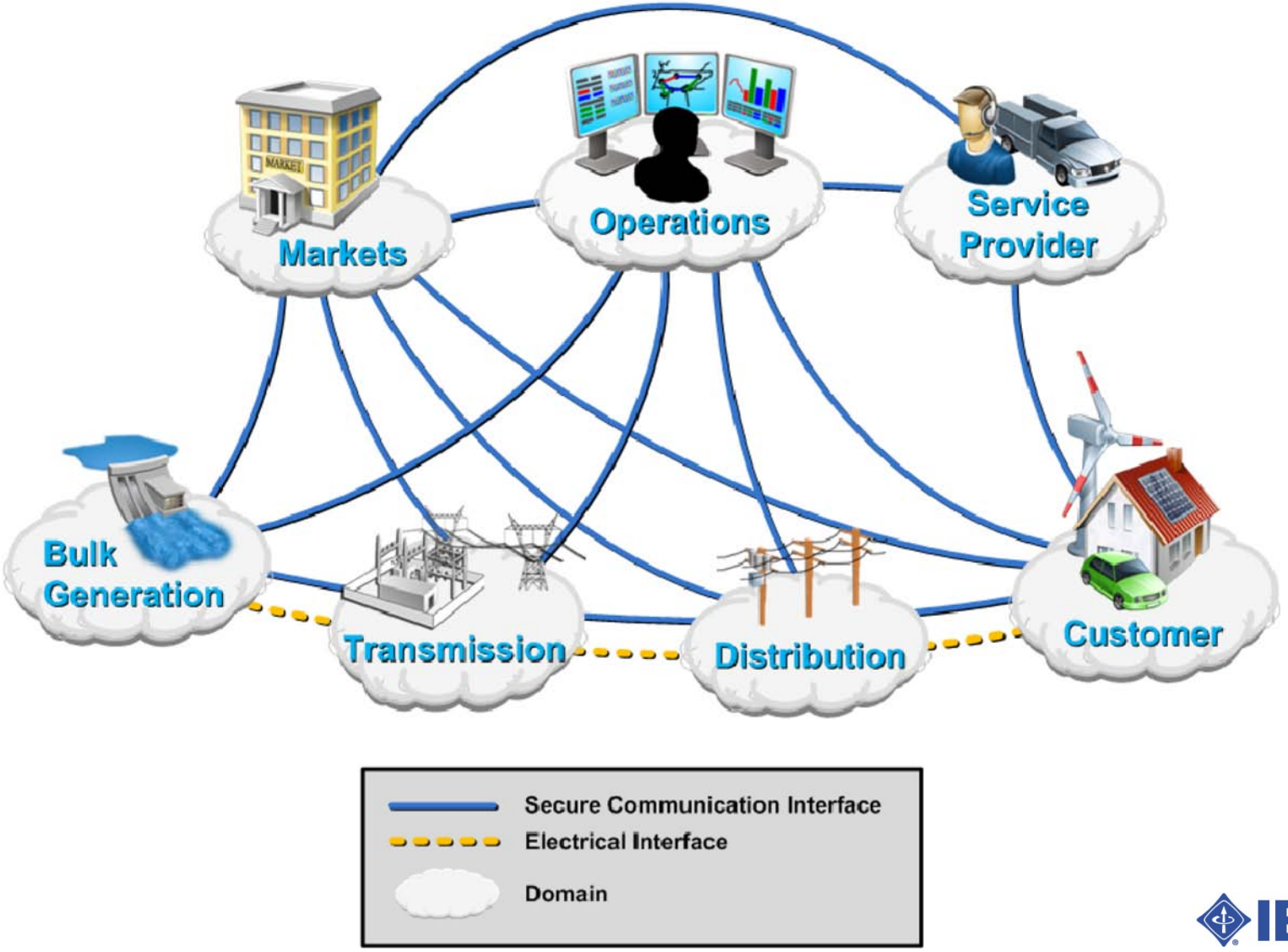
TF-1 Consensus of Direction

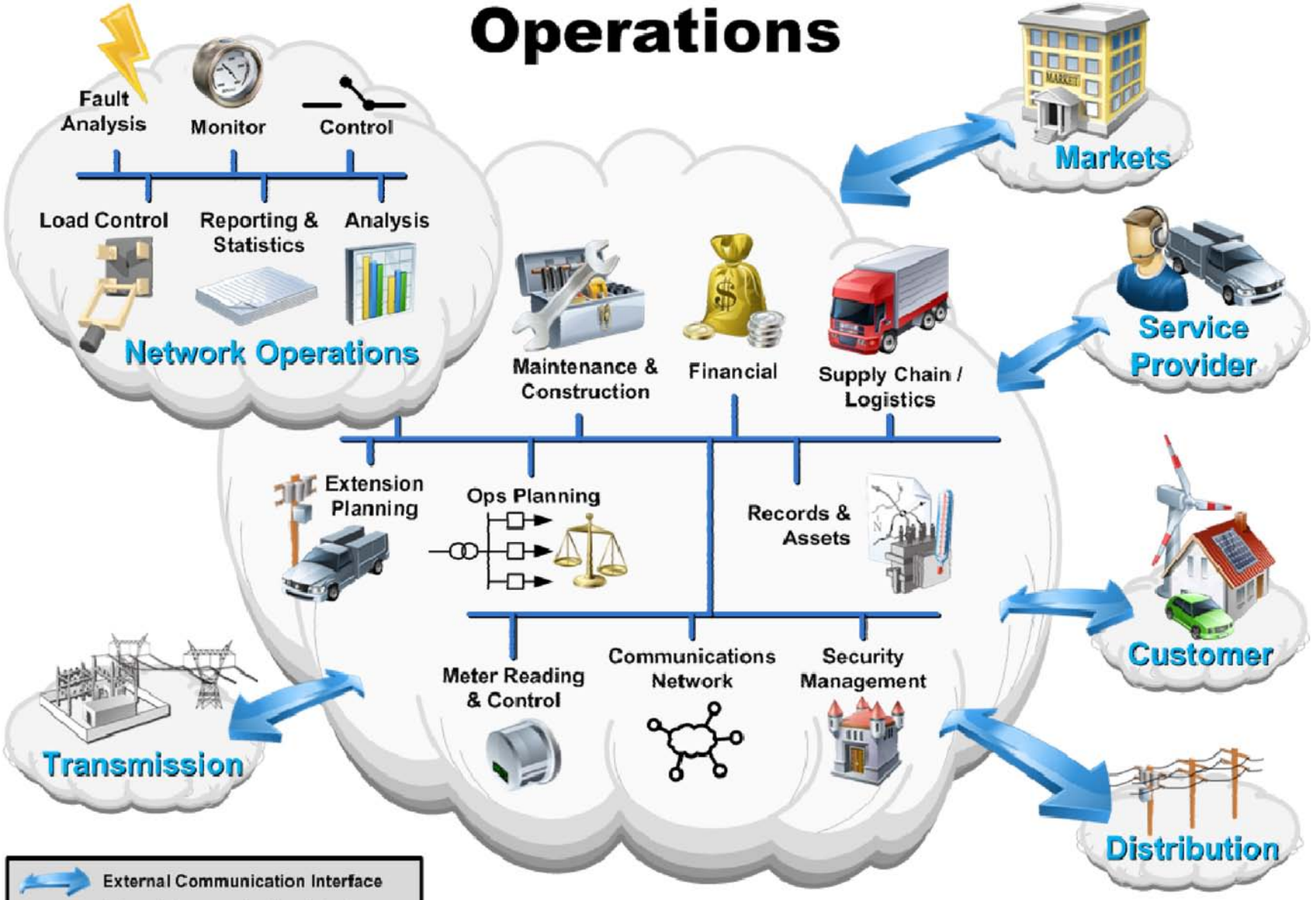
- TF-1 will focus on functional requirements of interoperability
- Draw as much as possible from existing/concurrent efforts of others (PES, ISA, GWAC, SGIP)
- Proactively Outreach for input/participation (e.g. EEI, NARUC, NEMA, IEC)
- Realtime Collaboration with TF-2 and TF-3 essential to every aspect of our effort
- Break from traditional thinking to “future-proof” the efforts
- Solutions must accommodate existing infrastructure (e.g., 80,000 – 90,000 existing substations)

TF-2 and TF-3

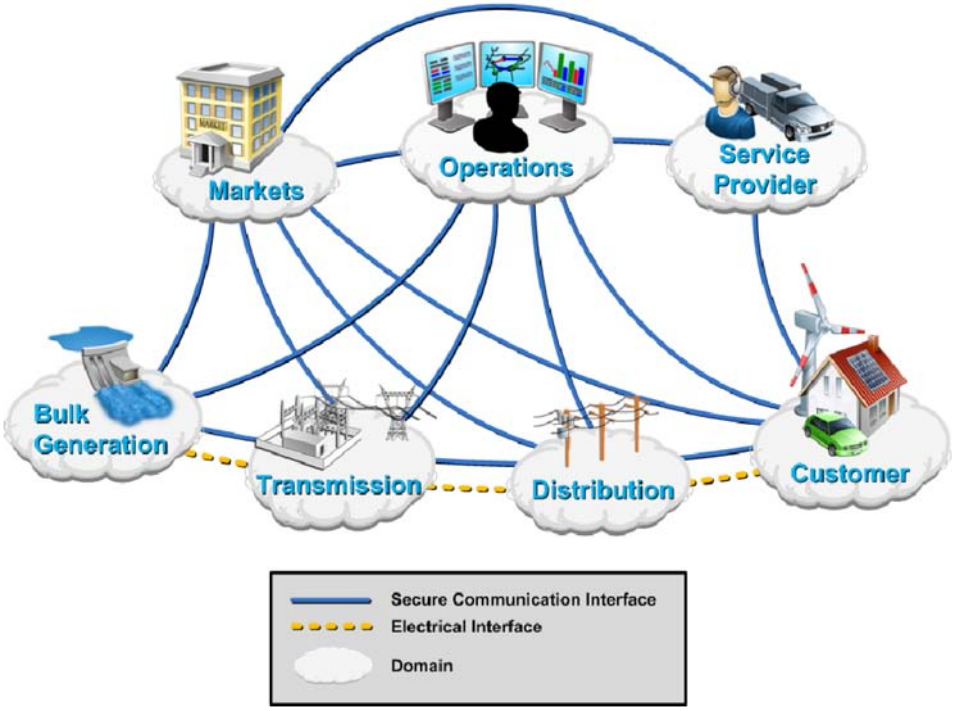
- Take the requirements developed by TF-1 and develop interoperability guidelines for:
  - Protocol
  - Architecture
  - Transport
  - Application
  - Security
  - Privacy
  - et. al

Conceptual Model




Operations
Fault Analysis
Monitor
Control
Load Control
Reporting & Statistics
Analysis
Network Operations
Markets
Service Provider
Maintenance & Construction
Financial
Supply Chain / Logistics
Extension Planning
Ops Planning
Records & Assets
Customer
Meter Reading & Control
Communications Network
Security Management
Transmission
Distribution
External Communication Interface
Internal Communication Interface
Electrical Interface
Domain

Conceptual Model



Today, every blue line you see is custom-developed on a per utility, per entity basis!

P2030 will attempt to uniformly define these elements to achieve interoperability

The Devil's in the Details!

What data set?
What accuracies?
What periodicity?
What data rates?
What protocol?
Client, Server, or both?
Polled or Unsolicited?
Multiple clients?
Remote Instruction/Control?
Dispatachable?

Request for Customer to Reduce Load

of Amps, # of Kilowatts, Percentage of load?

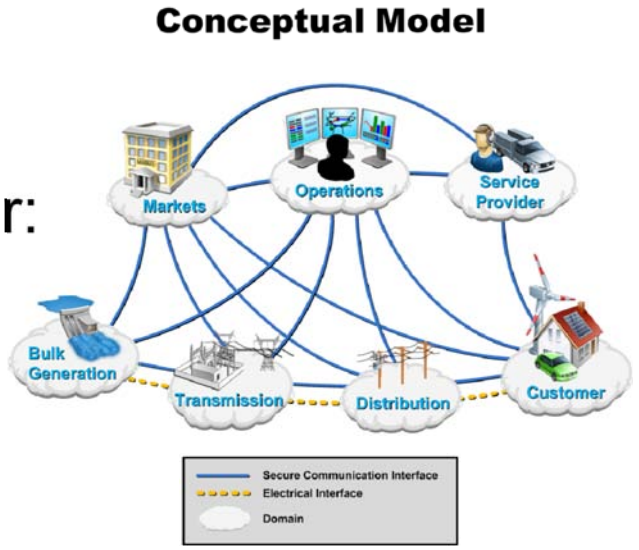
Instantaneous
Daily Average
Monthly Average

When: Now; 4 hours from now?

For How Long: One hour, One Day, Indefinitely?

Opt Out: Instantaneous, 5 minute excursion, 15 minute excursion?

Possible Model Refinement



- What adjustments should we consider for:
  - Individual Utilities
  - Independent System Operators
  - Aggregators
- What cloud sub-categories should we consider?
- Example: Customer
  - Residential
  - Industrial
  - Industrial with substation
  - Customer with generation

IEEE

Power Engineering Technology Divided into 6 Sub Tasks

- Energy Sources
- Transmission
- Markets
- Distribution
- Load Side/Customer Premises
- Cyber Security

Roughly Aligning with NIST Conceptual Model

IEEE

P2030 Activities To Date

- Initial meeting in Santa Clara
- Two Plenary Meetings, New York, Detroit
- Two Writing Committee Meetings
- Multiple Meetings in each TF and Sub Group
- Draft of several sections completed
- Outline of final guideline created
- Initial requirements of “blue lines” put to paper

				Communications Requirements				
Com Type	Latency	Data volume	Frequency	Reliability		Example		
A	low	low	cont	high		SCADA, Protection		
B	high	high	aperiodic	low		event files		
C	low	low	aperiodic	high		gen signal		
D	high	low	aperiodic	high		Customer price signals		
More (TBD)								
		Bulk Gen	Distribution	Transmission	Customer	Operations	Markets	Service Providers
Bulk Gen								
Distribution								
Transmission								
Customer								
Operations								
Markets								
Service Providers								

Immediate Feedback From TF2 & 3

- How many nodes?
- What distances?
- Define low vs. high latency
- What is SCADA?

Need for common terminology and basic technology understanding

Learning Another Language

TF-1	TF-2 and TF-3
AGC	PHY
PMU	MAC
IED	IPSEC
EMS/DMS	ISP
Volt/VAR Control	Aliasing
AMI	AES/DES
FACTS	NIC

Schedule Goal – Ballot in March 2011

- Why So Long?

A. Review many public and proprietary solutions already in the market place
B. Consider existing and new infrastructure
C. Build consensus among 150 P2030 volunteers, some who are proponents of certain solutions
D. Construct a solution for successful ballot of as many as 1000 participants worldwide (estimated).

Next Meeting

P2030 (all three TFs)

May 25th – 28th (San Jose)

Connectivity Week

Open to all participants who have an interest