NATIONAL COUNCIL
ON ELECTRICITY POLICY

Annual Meeting 2019

Evolving Transmission, Distribution, and Customer System Coordination

Wednesday, September 11 – Thursday, September 12

Austin, Texas

Welcome to Day 2
NCEP Annual Meeting 2019

The Honorable Paul Kjellander, President of NCEP and President at the Idaho Public Utilities Commission (PUC)

Discussion of Day 1

All Attendees in the room.

All Attendees on the phone.

Thoughts

Takeaways

Questions

Resources

Examples

Discussion of Day 1

All Attendees in the room.
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Thoughts

Takeaways

Questions

Resources

Examples

- ✓ New regulations in place for new entrants?
- ✓ DER impacts on harmonics? Are there costs at substations and how do you pay?

Physical System & Operating Essentials

Chris Villarreal, Moderator

Paul Duncan

Paul Alvarez

Lorenzo Kristov

Mark Knight

Communications Across the Grid

Using Smart Inverters to Standardize Visibility
and
Lower Costs at the Grid Edge

Paul Duncan
MPR Associates, Inc.
pduncan@mpr.com
(703) 509-5332

What problem(s) are we trying to solve?

- What have we heard the past two days?
  - **We've inherited a complex system** → integrating new technologies is expensive
  - **The old way of business deployment/operations – silos** (aka "cylinders of excellence") – are a major impediment because of unsupportive structure
  - **New participants bump against old (or non-existant) business processes:** Aggregators, Cloud Connectivity, IoT, Transactive, NWAs
  - **New regulatory frameworks introduce uncertainty:** Storage Mandates, NY REV, CA Rule 21/Smart Inverters, etc.

Commonalities between these problems

- **We lack visibility** to what is happening, especially at the edge as we move away from the bulk electric system (Tx → Dx)

- **Information is not transportable** between problems – lack of interoperability

- **Observability is poor** → Above the Meter, Below the Meter, Aggregations

- **Lack of scalability** (or spend large amounts when trying to scale)

Addressing the Future

- Building **structure** to enable data exchange and coordination

- **Lowering the cost** of solutions by serving multiple roles

- **Enabling the layering** (horizontal) of the solution to reduce (vertical) silos

- There are numerous approaches to address these business problems, but one stands out: *the role of the communications and the smart inverter to simplify edge visibility and interoperability*

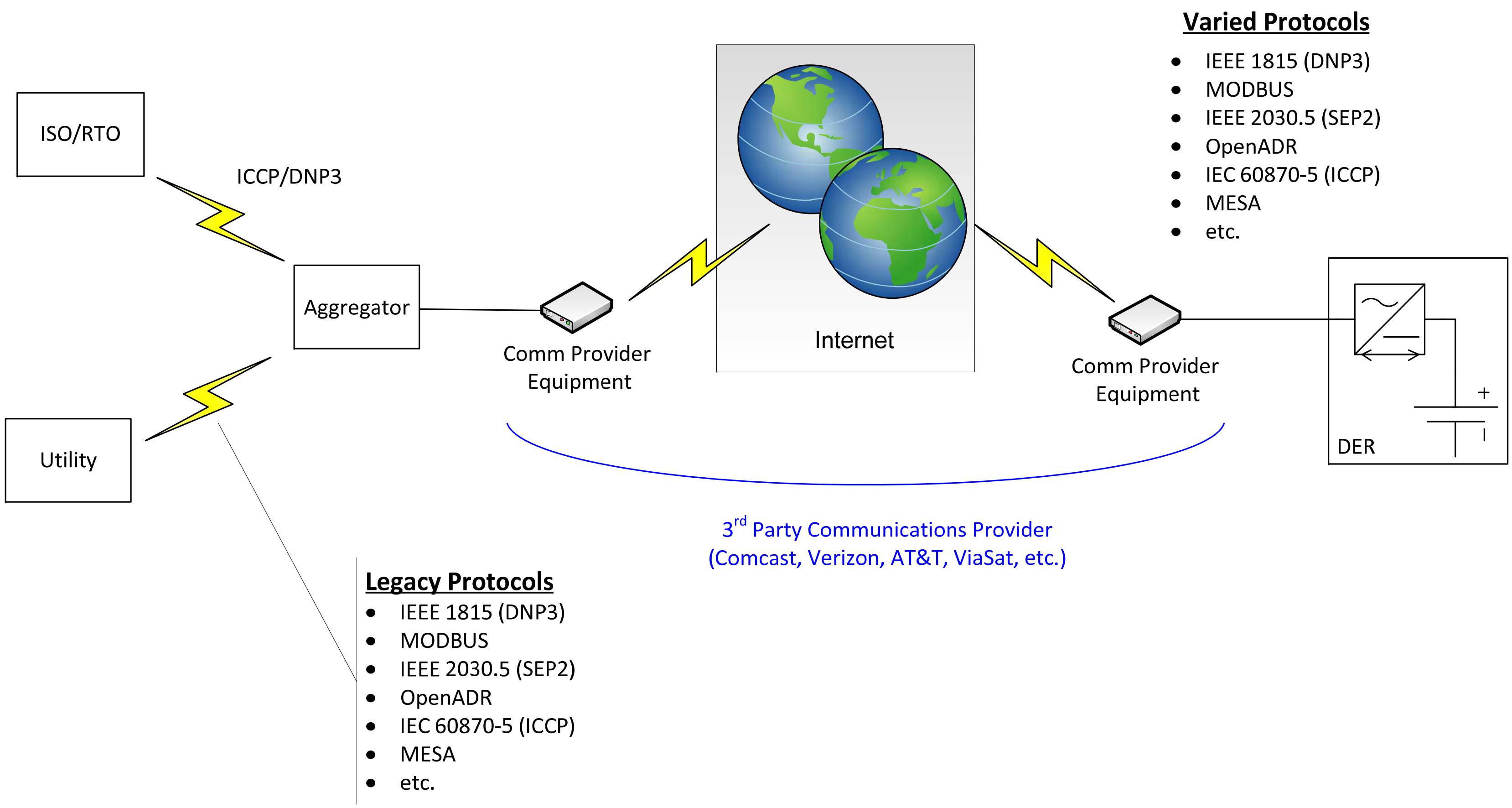
What is the Role of a Smart Inverter?

- Converts energy from one form to another so that it is usable in some role that provides value
- "Smart" is because of **embedded functions** and (possibly) **communications** in the inverter
- If compatible communications exist, I can build a structural layer that
  - **Improves visibility**, enabling data exchange and coordination ("Situational Awareness")
  - **Lowers Costs** – embedded measurement, so do not need as many separate sensors
  - **Provides a "Flat" Structure** at the edge of the grid
- Standardizing the Interconnection

Standardizing the Interconnection

- Every state has some form of a rule for connecting generation to the grid
- Most interconnection rules are focused on generators (reciprocating engines, solar, perhaps some energy storage)
- Historically, PV interconnection generally was non-interactive → commission and "forget"
- Energy storage ***operationalizes*** the interconnection, and introduces complexities.
  - PV → commission and forget
  - ES → commission and **operate** **(command, measure, repeat)**
- Smart inverters, with communications, ***mitigate or reduce*** many of these complexities, due to pending standards which enable interoperability

How do We Standardize? 2019: It's the Wild West …



Industry is Making Progress at Standardization

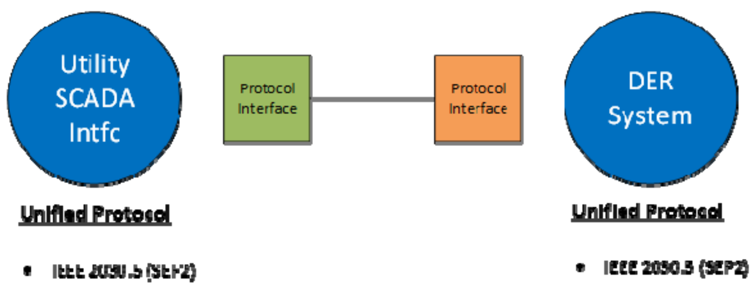
- CA Rule 21 is forcing harmonization in the industry
  - Manufacturers are adopting functions defined in IEEE 1547-2018, the SunSpec Common Smart Inverter Profile (CSIP), IEEE 2030.5, etc.
  - Test labs are preparing to certify smart inverters for common functions

- Intent is to address many of the problems identified in this 3-day workshop:
  - How to enable a flat structure enabling coordination
  - How to reduce costs for monitoring, control, visibility, etc.

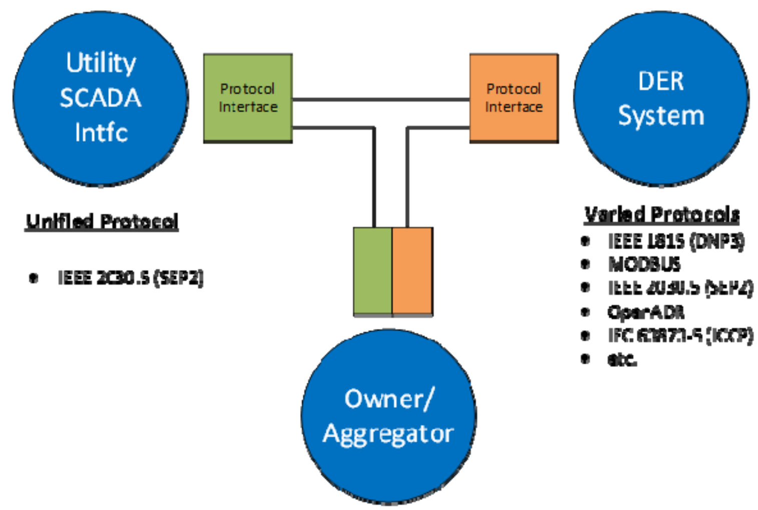
- Not a perfect solution, but significant progress is being made

Near Term Picture (2020) Could Look Like This:

Utility / Distributed Energy Resource (DER)



Utility / Aggregator / DER



* IEEE 2030.5 may be replaced under mutual agreement between the utility and aggregator / asset manufacturer

Talking Points on DER Standardization & Communications

- What is the utility's smart inverter interconnection strategy? (PV, storage, EV, etc.).
  - Goal is to develop a flat structure at the edge with common and broad capabilities (defined by standards)

- What is the utility's ability to leverage public and private communications networks to enable the flat, common structure at the edge?
  - Goal is to advance progress on standardizing integration from devices as well as multiple aggregators.
  - Conversation will certainly include discussion of cyber, vendors, penetration testing, etc.

Talking Points on DER Standardization & Communications (con’t)

- How familiar is the utility with various standards and the availability of various certification tests to enable their DER integration capabilities?
  - Goal is to get the utility to “skate to the puck” in context of the availability of approved devices, updating interconnection rules with requirements, etc., so that they can leverage these technologies and address gaps

Questions?

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BURNS & McDONNELL

Interoperability

Communications Across the Grid Panel

Mark Knight

Senior Technical Consultant

National Council on Electricity Policy
Annual Meeting

Austin, TX
September 12, 2019

in·ter·op·er·a·bil·i·ty

- Interoperability is ***"The ability of two or more systems or components to exchange information and to use the information that has been exchanged"****
- Who wouldn't want that?
- Interoperability with quicker and cheaper integration.
- How do we do that?
- It's not as simple as just specifying standards
- *Interoperability is the desired result, integration is the process to get there*
- That depends on what you buy and how you bolt it together

* Source: ISO/IEC/IEEE 24765: Systems and software engineering — Vocabulary. International Organization of Standards. 2010.

GWAC Interoperability Context Setting Framework


ISO IEC

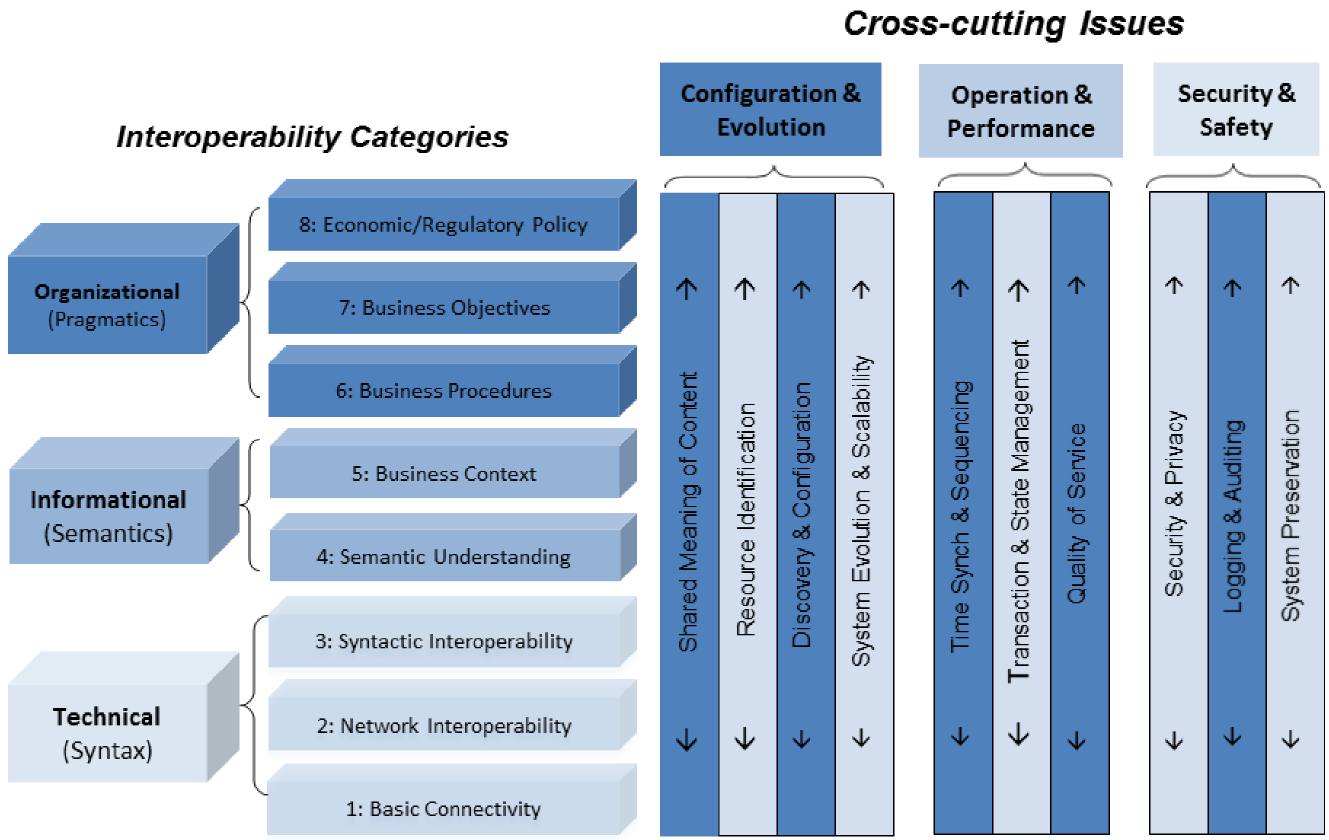
ISO/IEC TR 15067-3-2

Edition 1.0 2016-11

TECHNICAL REPORT

colour inside

Information technology – Home electronic system application model –
Part 3-2: GridWise – Interoperability context-setting framework



GWAC STACK

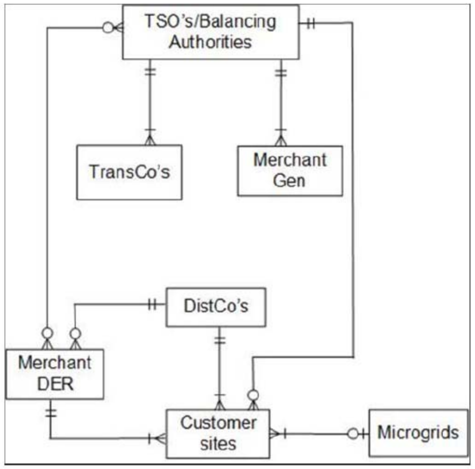
Driver	*Layer*	*Description*
Organizational (Pragmatics)	**Economic/Regulatory Policy**	Political and Economic Objectives Embodied in Policy and Regulation
	Business Objectives	Strategic and Tactical Objectives Shared between Businesses
	Business Procedures	Alignment between Operational Business Processes and Procedures
Informational (Semantics)	**Business Context**	Awareness of the Business Knowledge Related to a Specific Interaction
	Semantic Understanding	Understanding of the Concepts Contained in the Message Data Structures
Technical (Syntax)	**Syntactic Interoperability**	Understanding of Data Structure in Messages Exchanged between Systems
	Network Interoperability	Mechanisms to Exchange Messages between Multiple Systems across a variety of Networks
	Basic Connectivity	Mechanism to Establish Physical and Logical Connections between Systems

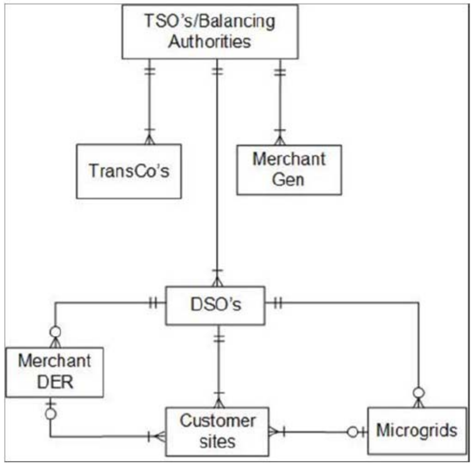
Why is interoperability important

- The grid is a cyber physical system.
- Smart systems that consist of highly interconnected networks of physical and computational components [NIST]

- More devices plus more communication = more simple?
- How do we do that?
- How do we secure that?
- It's an obvious need yet it's not a budget line item so how to get traction?

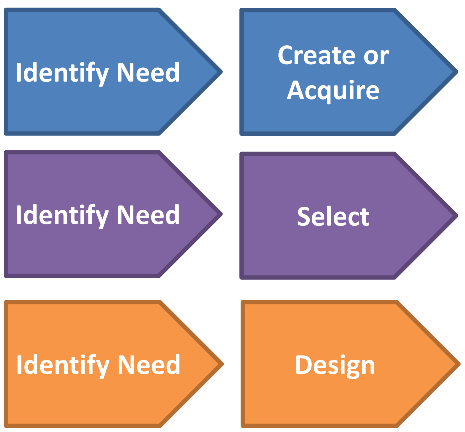
- Improved interoperability increases potential for customer engagement





Tip: Start at the Beginning

Afterthoughts and add-ons are less effective and more expensive



How do you acquire assets? Procurement language

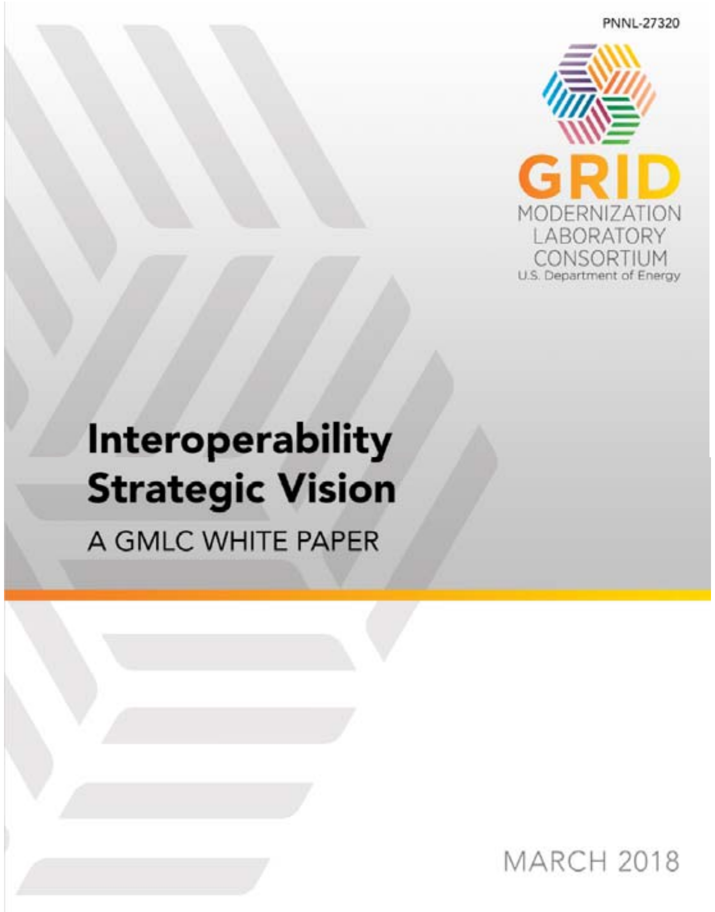
How do you select assets? RFP process and procurement language

How do you identify and communicate design needs? Procurement language

Adapted from: Asset Management – an Anatomy V3, The Institute of Asset Management

GMLC Interoperability Project

- Interoperability Strategic Vision
- Interoperability Maturity Model
- Interoperability Roadmap
  - IEEE 2030.5 ecosystem:
    driven by PV smart inverter integration in CA, HI
  - EV charging ecosystem:
    driven by EV charging systems integration in US and EU
- Reference Interop Procurement Language
- Plug & Play DER Challenge (SEPA, EPRI, NIST)

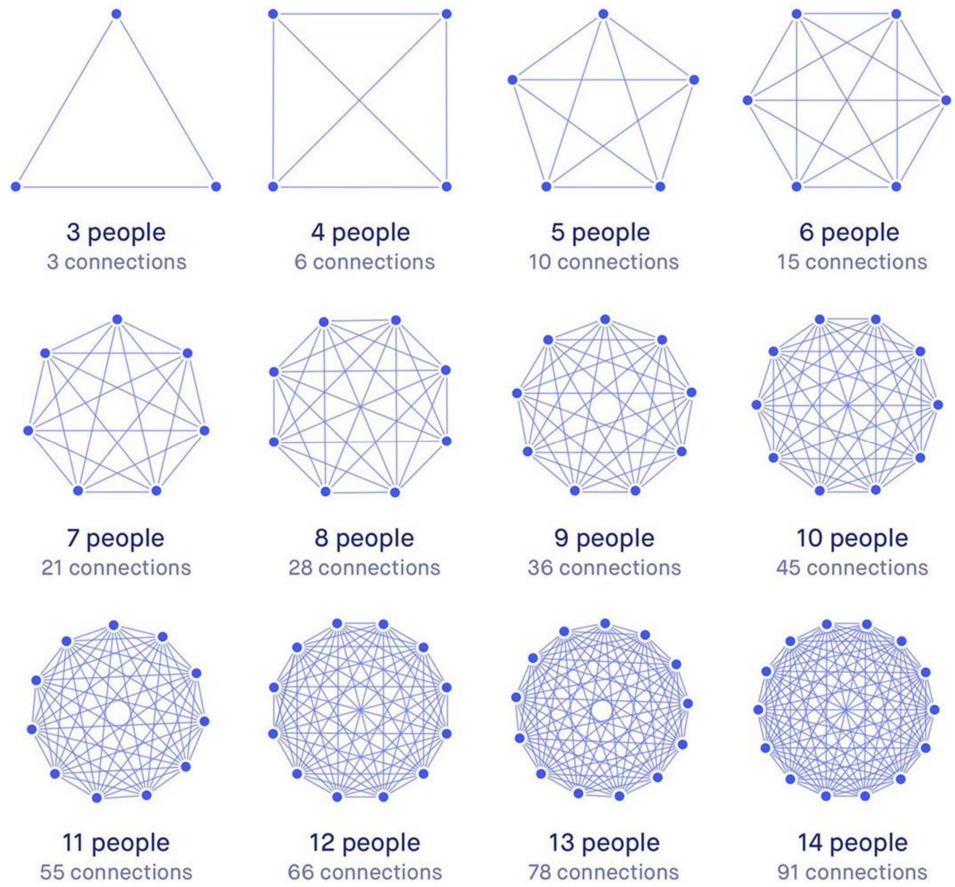


Energy Independence and Security Act of 2007

1. Increased use of **digital information** and controls technology to improve reliability, security, and efficiency of the electric grid.
2. **Dynamic optimization** of grid operations and resources, with full cyber-security.
3. Deployment and **integration of distributed resources** and generation, including renewable resources.
4. Development and **incorporation** of demand response, demand-side resources, and energy-efficiency resources.
5. Deployment of "smart" technologies (real-time, automated, interactive technologies that **optimize** the physical operation of appliances and consumer devices) for metering, **communications** concerning grid operations and status, and distribution automation.
6. **Integration** of "smart" appliances and consumer devices.
7. Deployment and **integration** of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning.
8. Provision to consumers of **timely information and control options**.
9. Development of standards for communication and **interoperability of appliances** and equipment connected to the electric grid, including the infrastructure serving the grid.
10. Identification and **lowering of unreasonable or unnecessary** barriers

Metcalfe’s Law

Metcalfe's law states the value of a telecommunications network is proportional to the square of the number of connected users of the system (n^2).



Thank You

- Mark Knight
  Senior Technical Advisor
  Burns & McDonnell
  (o) 617-657-9590
  (m) 617-335-9590
  mrknight@burnsmcd.com
- GWAC Emeritus [member / chair / administrator]
- Chair SEPA transactive energy working group

CREATE AMAZING.

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Physical System & Operating Essentials

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The What and Why of C-D-T Communications

Panel on "Communications Across the Grid"

Lorenzo Kristov, PhD
Electric System Policy, Structure, Market Design

National Council on Electricity Policy, Annual Meeting 2019
September 12, 2019, Austin, Texas

The electric power system is evolving from a commodity delivery system to an interactive network.

- End-users care about energy services, not kWh
- Scalable technologies create a new "behind-the-meter market"
  - End-users customize reliability, quality, resilience & cost-effectiveness
  - The grid & wholesale commodity market become the residual supply
  - Resisting the evolution & rising infrastructure costs may drive customers to defect (first movers will be larger C&I and affluent residential customers)
- Instead, we can enable every POI (end-users, DERs & aggregations) to become a grid & market participant
  - DERs offer cost-effective substitutes for grid infrastructure
  - Flexibility services from inverter-based DER, hybrid resources & microgrids can eventually eliminate need for conventional generation
  - DERs can smooth variability at the source rather than export to the TSO

An overlooked (until now) arena of energy transition activity is urban planning.

Cities across the country are taking initiatives to reduce GHG emissions and become more resilient to severe disruptions

Decarbonization must address the factors that produce GHG:

- The stuff of urban planning: housing density, zoning & land use, all-electric new building codes, electric mobility services, transit-oriented development

- Resilience is enhanced with local electricity systems:
  - Disruptive impacts are local => loss of critical services; threats to life
  - Community energy resources, microgrids on critical facilities
- Electrification of fossil fuel uses increases electricity demand, changes load shapes, & can challenge grid operations unless orchestrated

Yet today, urban planning and power system planning are separate siloes.

Key policies, following principles of grid architecture, can facilitate energy transition for greatest societal benefit.

Enable customers to participate in the network rather than defect

- Create a framework & implement necessary technologies for customers & DER providers to transact & be compensated for grid services
  - Customers/DERs need predictable revenue streams & clear rules
  - DSOs need the tools to operate their systems reliably with high DER
  - TSO needs confidence that dispatched DERs will deliver in real-time

Integrate urban planning and power system planning

- Structure & incentivize collaboration between distribution utilities (DSOs) & local governments to develop local energy systems to meet 3 goals:
  1) Address local priorities, such as resilience, local jobs, efficient buildings, etc.
  2) Advance broader decarbonization/electrification/equity goals
  3) Support grid operations and infrastructure investment deferral

Clear policy objectives then drive the communication needs.

Operating time frame

C/DERs need to know about current distribution conditions that will constrain their provision of services

DSOs need to know about TSO dispatches of C/DERs, and which C/DERs are available to support distribution operations

TSO needs to know when participating C/DERs are distribution constrained

TSO & DSOs need accurate short-term forecasts of net load at T-D interfaces & at key distribution circuits/substations

TSO & DSOs need to know how dispatch response of a DER aggregation will be distributed

Planning time frame

C/DERs need T&D planning data to develop NWA & grid-friendly resources

TSO & DSO need methods to estimate DER growth scenarios & forecast DER impacts on net load

Thank you.

Lorenzo Kristov
LKristov@cal.net

Electric System Policy, Structure, Market Design

Physical System & Operating Essentials

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Break with Refreshments

Resume 10:15 AM

State Examples of Communication Network Coordination

Michael Dowd, Moderator

Ted Ko

Tricia DeBleeckere

Marcus Hawkins

Jason Allnutt

DER Communications Policy Themes

National Council on Electricity Policy
September 2019

stem

Stem Overview

Stem operates the world's smartest and largest digital energy storage network

Founded:	**2009**
Headquarters:	**Millbrae, CA**
Employees:	**140+**
Operations In:	**CA, HI, NY, TX, MA, Japan, ONT**
Pipeline & Installed:	**900+ sites, 250+ MWh**
Installed:	**400+ sites, 3.5M+ device hours**
8 utility contracts:	**350 MWh**
Project Finance:	**$650 MM**

High Caliber Global Investors

ANGELENO GROUP

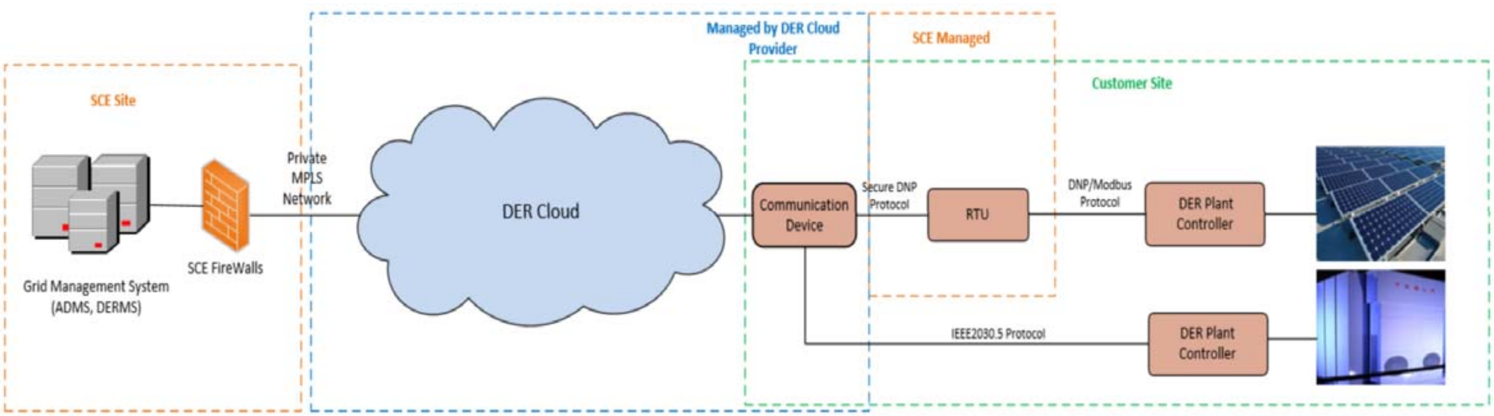
Distinguished Honors & Awards

Greentech Media: 2018 Grid Edge Innovation Award
SEPA Power Player 2017: Innovative Partner of the Year

Needs vs Costs

Communications Regulations should come from Engineering Design Requirements

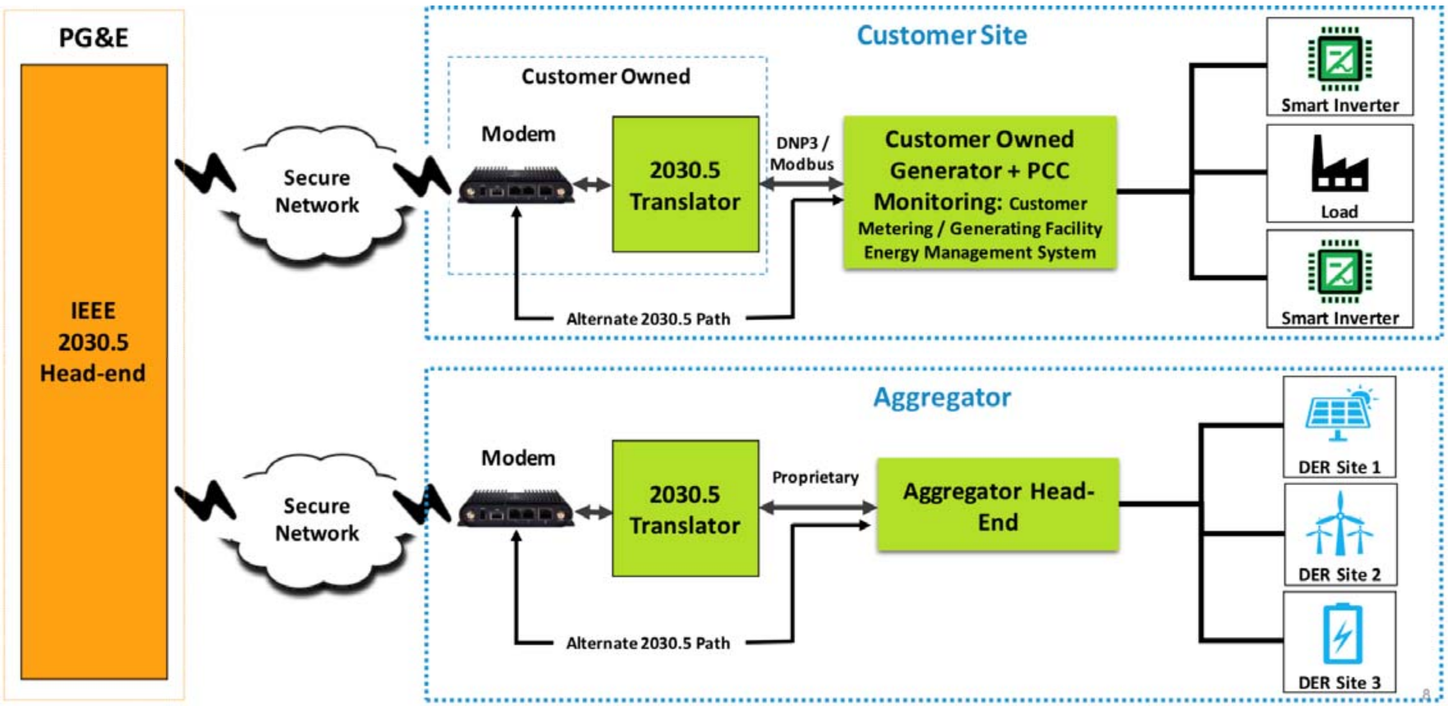
- What data, how often, how fast => WHY?
- California Rule 21 – Telemetry required for installations > 1 MW
- Proposal to reduce threshold to 250 KW and eventually require for all
- CPUC required utilities to file cost-benefit analysis



Southern California Edison Telemetry workshop presentation June 2019

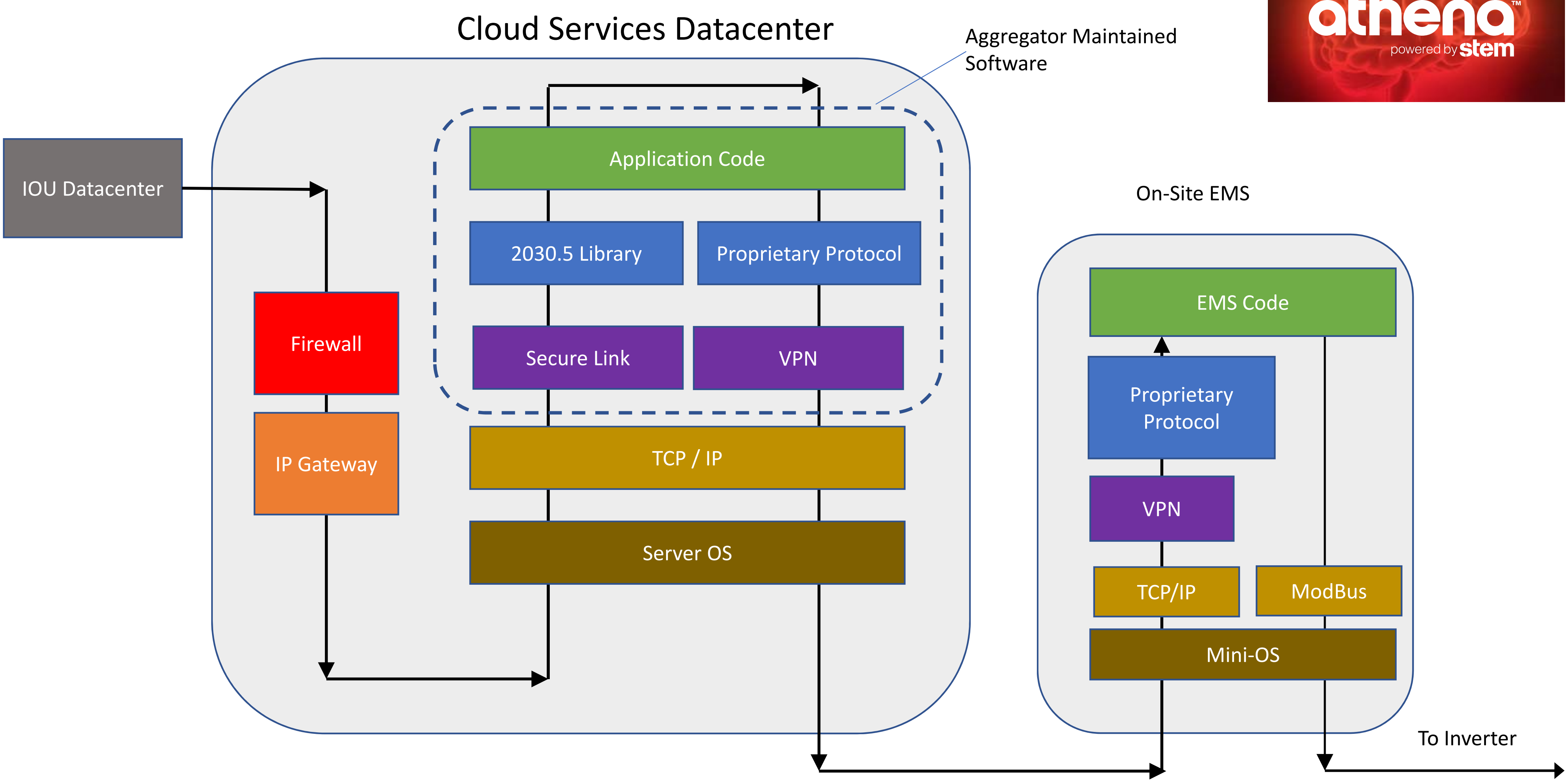
Capability vs Operational

Operation of communications unnecessary until grid operator will receive and use information



Pacific Gas & Electric
Telemetry workshop presentation
June 2019

Hardware vs Software



State Examples of Communication Network Coordination

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DER Communication from Customer to RTO

Marcus Hawkins

NCEP Austin, TX

September 12, 2019

Organization of MISO States

Background: Strategic Priority of DER

…while the transmission system and wholesale markets are primarily under federal jurisdiction. The state regulators are uniquely situated to facilitate the exchange of information between MISO, the utilities, and the broader stakeholder community to develop policy on this issue.

Proper information sharing between the distribution and transmission systems concerning DER location and operation is essential to ensure that DERs are efficiently and reliably integrated into both systems.

- OMS Approach on DER, June 2017

• Organization of MISO States •
OMS
• Established 2003 •

There are many different ways DER information is communicated from DERs to RTO

- 17 separate retail regulator jurisdictions
- There are currently over 10 GW of Load Modifying Resources within MISO
  - 50% are demand response
- There are many different paths for DER participation at both retail and wholesale
  - Indirect participation
  - Direct through utility
  - Direct through aggregator
  - Retail program only
- Some can register as multiple products

A recent example of a communication breakdown

January 30, 2019 Max-Gen Event – Communication Tool Issue

- First time MISO has deployed Load Modifying Resources (LMRs) in North & Central Regions
- LMRs provided an average of 75% of scheduled MWs
- 21% met Measurement and Verification (M&V)
- Penalties assessed based on M&V
- Lesson Learned: MISO's current Market Communication System (MCS) is not well suited for DER

HR Ending		09	10	11	12	13
MISO Regions		North & Central			North	
Total SI Requested by MISO (MW)	(a)	2496.3	3438.2	3862.4	770.5	825.8
Scheduled by MPs to Meet SI (MW)	(b)	3420.5	4203.1	4125.8	954	893
Total Delivered by MPs (MW)*	(c)	2345.6	3030.0	3175.4	841.4	863.1
MW Delivered vs Scheduled by MP	(c/b)	69%	72%	77%	88%	97%

MISO conducted assessment of LMR issues

- Operational impacts with self-scheduled use: As MISO moves through the stages of an Emergency, LSEs can and do respond by calling on their LMRs voluntarily. Over-commitment issues and other reliability impacts can arise. Also, MPs can, at any time, voluntarily use their LMRs, either during MISO calls for conservative operations, for local reliability issues, or to mitigate exposure to high LMPs. MISO has little situational awareness of these actions. MISO should have better situational awareness of MPs' use of LMRs at all time periods, codifying a requirement to do so in the tariff.
- MISO lacks knowledge and use of the detailed location of LMRs which could support more efficient and reliable operations, and should be pursued for better congestion management at a minimum. Further investigation of appropriate level of communications protocols for LMRs should also be pursued.

OMS

Changes are underway at MISO to improve communication between customers, utilities, & MISO

- MCS tool improvements (March 2019 task team)
  - User experience
    - Open simple API structure
    - Designing modern platform
  - Settlement process automation
  - Enhanced messaging
  - Streamline DR registration and updates

Recent OMS-supported changes:

- Load forecasting process
  - Incorporation of 20 year EE, DR, and DER information
  - Reliance on third-party input
- New requirements for LMRs
  - Availability
  - Testing

OMS
Organization of MISO States
Established 2003

Ongoing action to further coordination

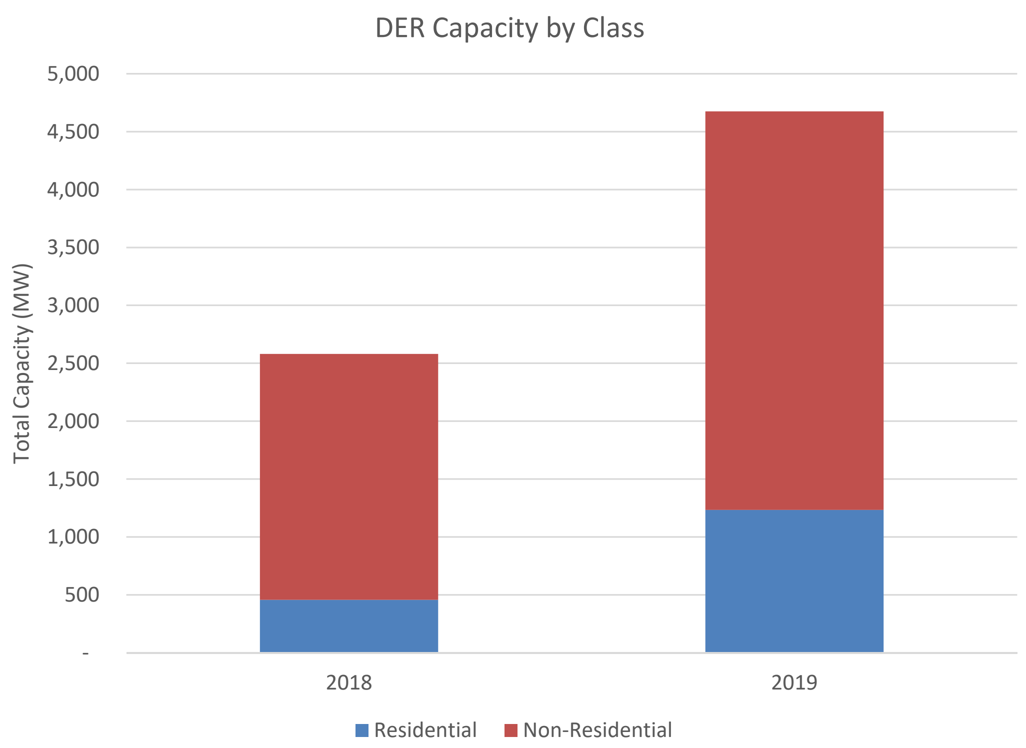
Key Activities

- Educational workshops
- Joint priorities with MISO
- Information exchange workshop
- OMS DER Survey
  - Data gathering
  - Insight into utility visibility and communication capabilities
- Development of IEEE 1547 guideline
  - EPRI, states, stakeholders, and MISO

Why does this matter?

- In other regions you see DER taking the easiest path forward (DR). Issues that are present for relatively simple demand response deployment will only become more prevalent if not fixed.
- Many states are working independently on grid modernization efforts and future interaction with the wholesale market may need to encompass variety of communication methods

Improving communication will only grow in importance



2019 Survey Results showed a big jump in DER

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(PDF)

ICAP Program Pilot Projects – IEEE 1547 Conformity Assessment

National Council of Electriciy Policy Annual Meeting 2019

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Jason Allnutt

The Institute of Electrical and Electronic Engineers

The world's largest professional association advancing technology for the benefit of humanity.

Members – Over 374,000

Countries – Over 160

Conferences – 1200+ per year

Publications – 30% of the world's electro-tech literature

Standards – 1,300 Active Standard and 500 Active Projects

IEEE Standards Association (IEEE-SA)

- Leading member driven consensus based Standards Development Organization (SDO) in technology
- Governed by our Board of Governors (BOG) who are elected by IEEE-SA Members
- Standards Development process is open to members AND non-members of IEEE-SA
- Actively engages in the global standards communities i.e., IEC, ISO and ITU among others

MAC Address Registration Authority

80:7B:85:FE:10:95

NESC

IEEE Standards Development Lifecycle

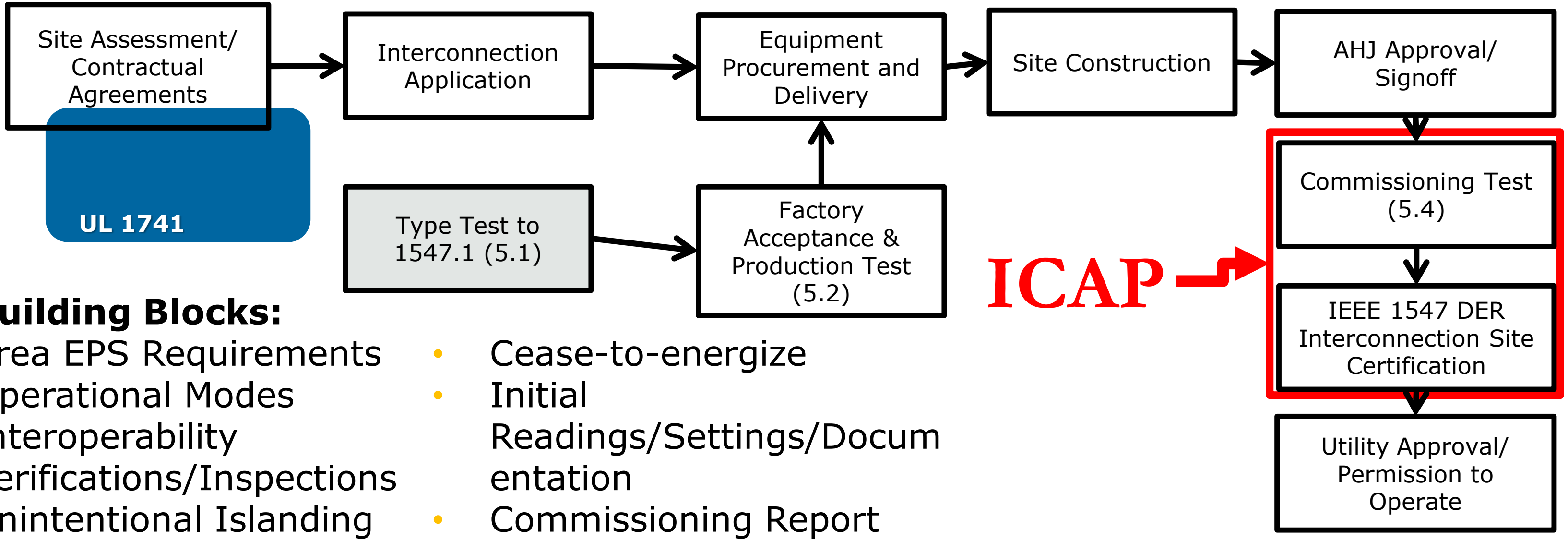
ICAP is a division of IEEE-SA that works closely with the Standards Working Group Liaisons to address the needs of standards development groups through conformity assessment.

Conformity Assessment Program Benefits

- Increase Standards Adoption
- Provide Use-case examples for Standard's revision
- Creates market advantage for certified devices
- Gives end-user greater purchasing power
- Increases Interoperability
- Provides a point of contact for requirement inquires

The IEEE 1547 Commissioning CA Program

PROGRAM OBJECTIVE: Develop a Site Certification [process] with respect to DER Interconnection that Emphasizes <u>All</u> Essential Aspects of IEEE 1547/1547.1 over the <u>life of the Interconnection</u>.



- **Building Blocks:**
- Area EPS Requirements
- Operational Modes
- Interoperability
- Verifications/Inspections
- Unintentional Islanding
- Cease-to-energize
- Initial Readings/Settings/Documentation
- Commissioning Report

NC Pilot - 6 MW Solar Installation

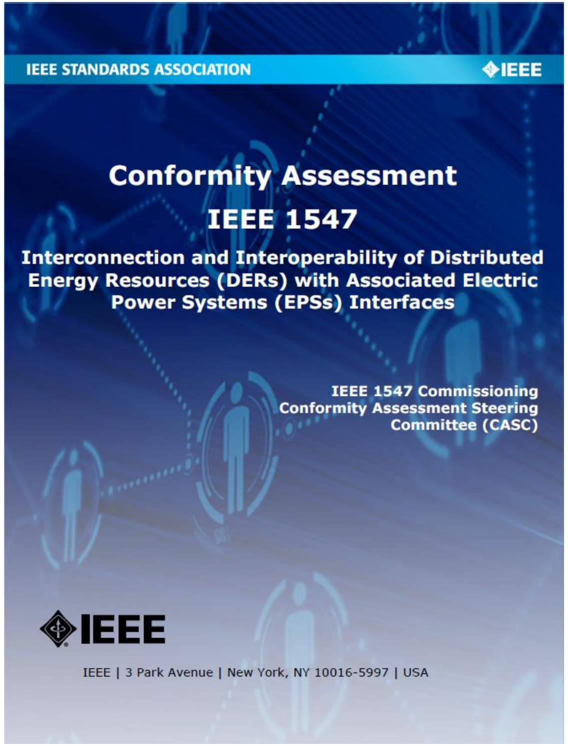
- Utility scale 6 MW Solar PV Installation with 3 three-phase inverters connected to Area EPS distribution network
- Commissioning of the interconnection for its compliance with IEEE 1547 in accordance with the approved Interconnection Agreement
- Multi-step process: 1) Document review, 2) On-site Inspection (de-engergized), 3) On-site System Performance Evaluation
- Documentation review and On-Site inspection found that “Enter Service” parameters of the inverters were not correctly applied and action was taken by the developer.
- Conformity Assessment was successfully completed Jun 2019

IN Pilot - Solar & Battery Installation

- Mixed Asset DER Site – 2.7 MW Solar PV, 4.588 MWH Energy Storage Capacity
- Assessment based on requirements in IEEE 1547a-2014 Clause 5.3 Interconnection Installation Evaluation and 5.4 Commissioning tests referenced in ICAP’s IEEE 1547 CA Document
- Evaluation highlighted the need for clear documentation resources to ensure a successful commissioning of a mixed asset DER

Conformity Assessment IEEE 1547

- Consensus approved Conformity Assessment Document for the commissioning of DER Interconnection to IEEE 1547.
  - IEEE Xplore - https://ieeexplore.ieee.org/document/8786948
  - Techstreet - https://www.techstreet.com/ieee/standards/ieee-white-paper?gateway_code=ieee&vendor_id=10111&product_id=2078911
- IEEE 1547 Workshops
  - Content and discussion geared toward Regulators and Policy making for IEEE 1547
  - Workshops at MN PUS, KY Office of Energy Policy, NERC, and FERC
  - Presentations included IEEE 1547 experts from NREL, NERC, EPRI, National Grid, and IEEE
- Online re-watch of Workshop - https://ieeetv.ieee.org/ondemand/ieee-standards-1547-workshop
- Digital Community for Regulators to discuss and share on IEEE 1547 related topics coming soon.



Thank you

IEEE Conformity Assessment Program

http://standards.ieee.org/about/icap/index.html

IEEE Conformity Assessment Program (ICAP)
Technical Director - Ravi Subramaniam
R.Subramaniam@ieee.org
Program Manager - Jason Allnutt
J.Allnutt@ieee.org

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Minnesota Statewide Interconnection Standards Update
Interoperability Considerations with IEEE 1547-2018

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PUBLIC UTILITIES COMMISSION

https://mn.gov/puc

Minnesota Distributed Generation Workgroup Topics & Timeline

2017	PHASE I In-Person Topics
June 2	Pre-app report; Application requirements; Queue type & process; Material Modification Definition; Fast Track; Site Control
July 28	Definitions; Transmission Provider's role; Engineering screens; Study process; process timelines/extensions; dispute resolution
Sept 15	Insurance; Disconnect Switch; metering; Commissioning/inspection, testing, authorization; Design, procure, install, construct facilities/upgrades; advanced inverters
Nov 3	Interconnection Agreement; process for updating; Transition issues; any outstanding issues
Dec 1	Webinar for feedback on some of the draft staff recommendations and descriptions of outstanding issues

2018	PHASE II Web Meeting Topics
March 23	Scope/Overview; Inventory of Definitions to Discuss
April 13	Performance Categories; Response in Normal and Abnormal Conditions; MISO Bulk Power System
May 18	Reactive Power and Voltage/Power Control Performance; Protection Requirements
June 8	Energy Storage; Non-export; Inadvertent export; Limited export
Aug 24	Interoperability (Monitor and Control Criteria); Metering; Cyber security
Sept 14	Test and Verification; Witness Test Protocol
Sept 21	Full Day In Person to Revisit and Reconcile Edits
Oct 3	References; Definitions; 1-line diagram requirements; Agreements

Scope of Interoperability in IEEE 1547-2018

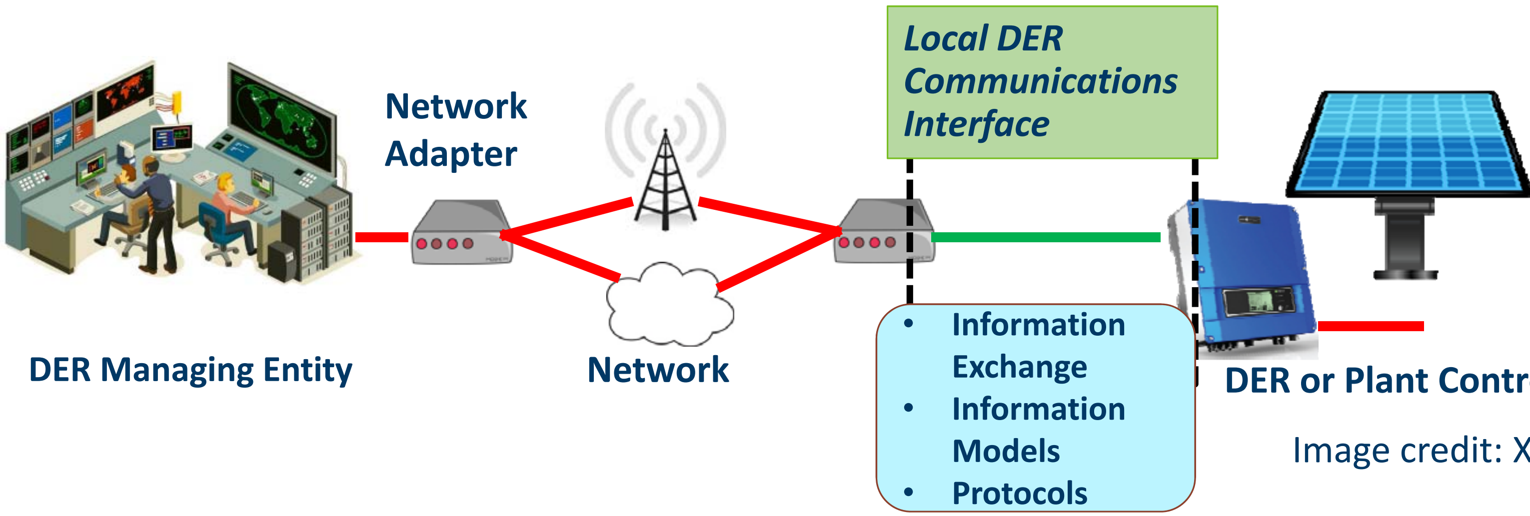


Image credit: Xcel Energy

Interoperability Consideration	IEEE 1547-2018
Clear price signals for participation or contributions.	Not in scope.
Interface between the DER and the Utility can exchange and use information securely and effectively.	In scope.
DER's "grid services" and utility operations are in sync throughout the entire system.	Not in scope.

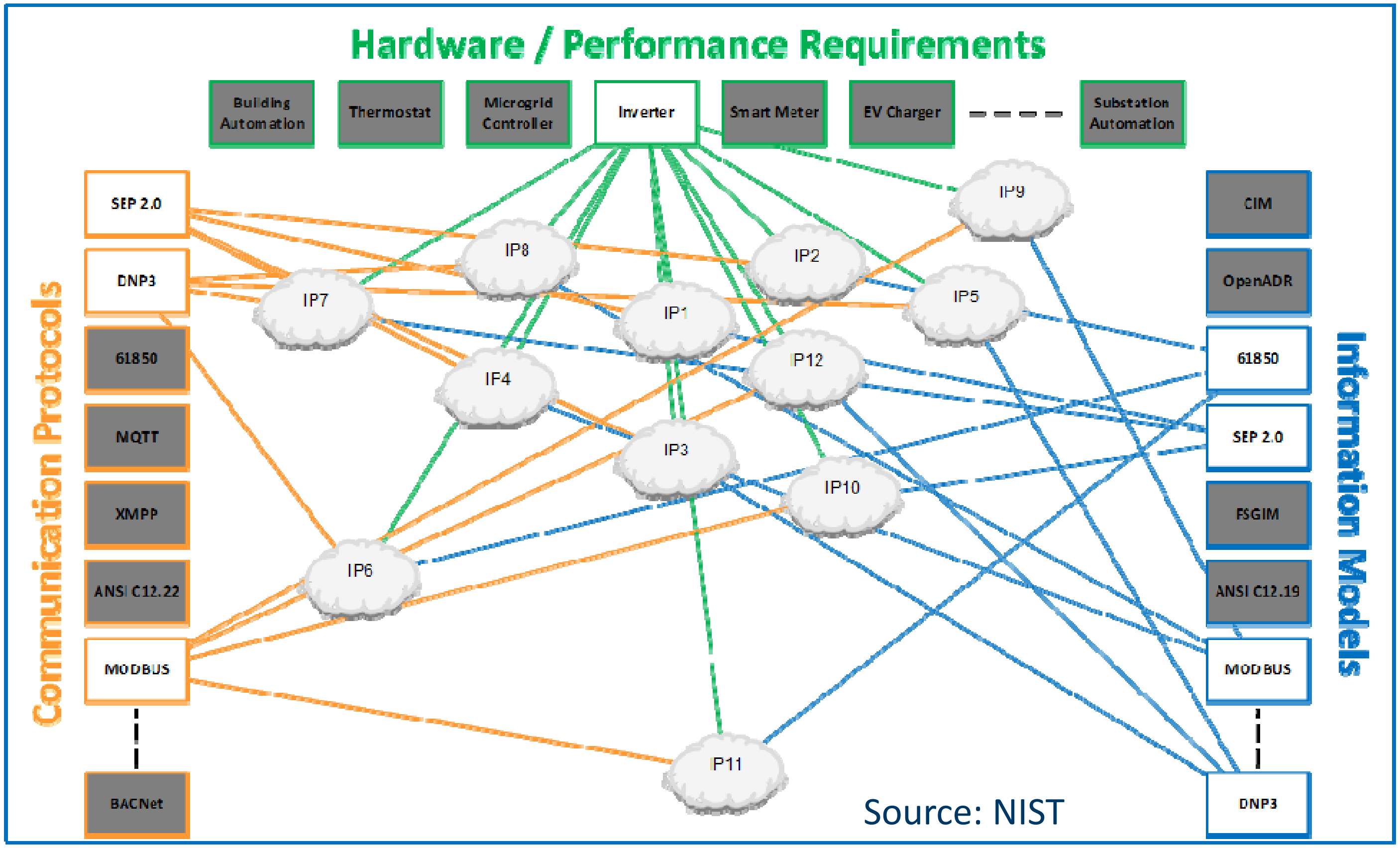
IEEE 1547-2018 Definitions

interoperability: The capability of two or more networks, systems, devices, applications, or components to externally exchange and readily use information securely and effectively. (IEEE Std 2030®) (source: IEEE 1547-2018 p. 23)

local DER communication interface: A local interface capable of communicating to support the information exchange requirements specified in this standard for all applicable functions that are supported in the DER. (source: IEEE 1547-2018 p. 24)

Remote Monitoring =/= Interoperability

NIST on IEEE 1547-2018 Optionality



MN Utility Summary of Pros/Cons

- Upside: The ***simplicity*** leads to better chances of success with implementing true interoperability and effective information exchange between all applicable DER and Utilities in the state.
  - Potential to streamline integration for Developers, Installers, and Utilities
- Downside: The ***timing*** of the MN update means that market forces have not begun to converge on one of the protocols
  - The IEEE 1547 working group had anticipated some consolidation over time.
  - Expectation is that many manufacturers will offer just one of the three protocols. This aligns with standard requirements

Working hypothesis: Standardizing under a single protocol may be practical in the longer term, and assists in effective interoperability, but we need to better understand vendors offerings and back-end system integrations for all affected parties before making this a statewide requirement.

Staff Lessons Learned re: Interoperability

Interoperability standards help, but don’t solve the issue.

- Select from options in standards during implementation – likely by project type and utility today.
- To use the capabilities enables by standards may mean new costs (e.g. upgrades to utility or DER system outside the interface, operational considerations, etc.)
- Standards are emerging, and not all have testing and certification.
- Certification of individual equipment does not necessarily mean when put together they will perform as certified (IEEE 1547 has testing guidance for the interface of composite DER systems.)
- Who ensures the standards are being met at the time of initial interconnection and ongoing operations?

Resources

- IEEE 1547 discount for Commissions and educational resources: http://sites.ieee.org/sagroups-scc21/standards/1547rev/
- Minnesota Statewide DER Interconnection Process and Agreement (MN DIP/DIA): https://mn.gov/puc/energy/distributed-energy/interconnection/
  - Technical Subgroup's **Draft** Technical Interconnection and Interoperability Requirements: https://bit.ly/30veiwG
  - Phase II (IEEE 1547) Meeting Materials: https://mn.gov/puc/utilities/interconnection/

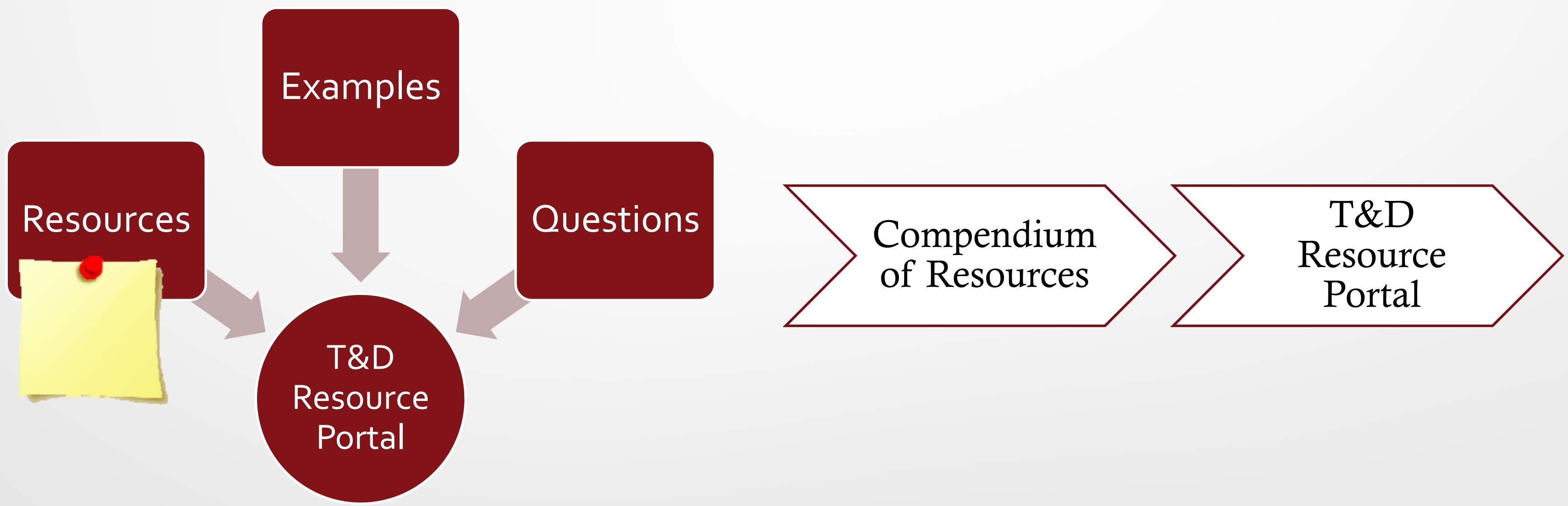
MINNESOTA
PUBLIC UTILITIES COMMISSION

Thank You!

State Examples of Communication Network Coordination

Michael Dowd, Moderator
Ted Ko
Marcus Hawkins
Jason Allnutt
Tricia DeBleeckere

Day 2 Discussion Facilitation Overview



Minimum: Considerations

Parking Lot

1.

Pecan Street Site Visit

Boxed Lunches

NATIONAL COUNCIL
ON ELECTRICITY POLICY

Adjourn Day 2

Annual Meeting 2019
Evolving Transmission, Distribution, and Customer System Coordination

September 12, 2019
Austin, Texas