NATIONAL COUNCIL
ON ELECTRICITY POLICY

Annual Meeting 2019

Evolving Transmission, Distribution, and Customer System Coordination

Wednesday, September 11 –
Thursday, September 12

Austin, Texas

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

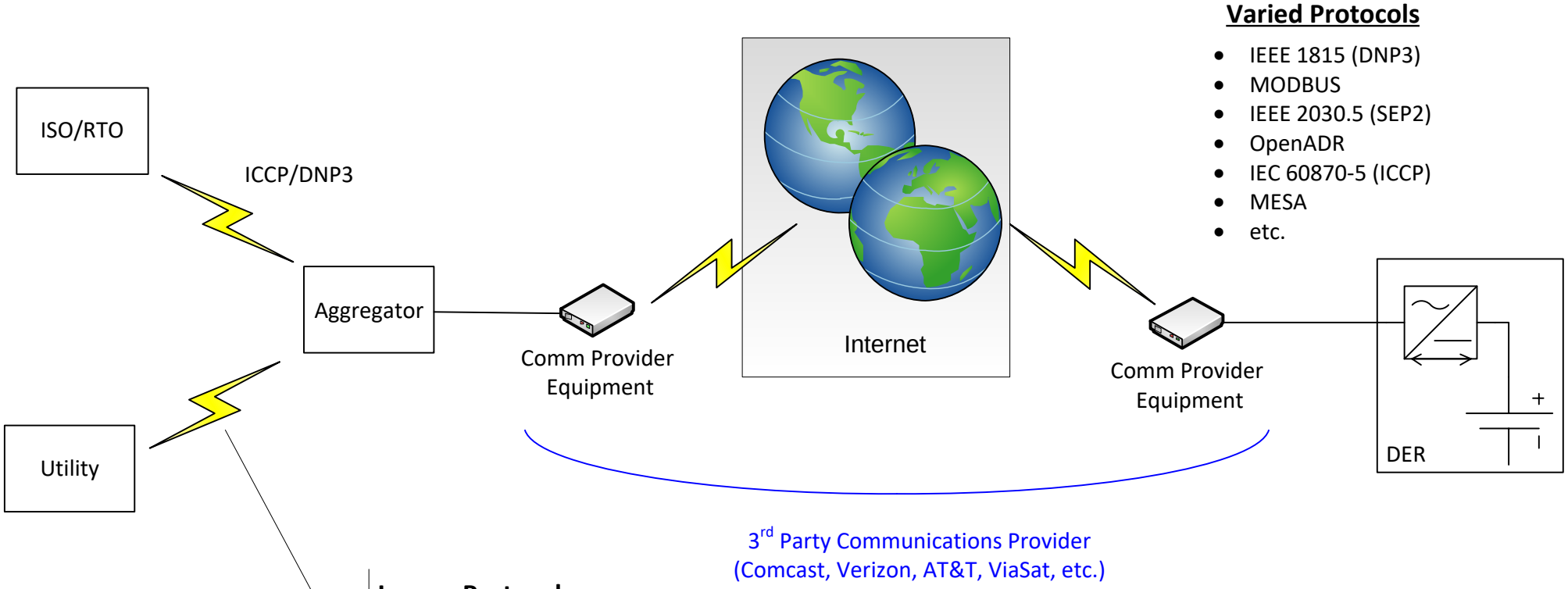
- If compatible communications exist, I can build a structural layer that
  - **Improves visibility**, enabling data exchange and coordination ("Situational Awareness")
  - **Lowers Costs** – embedded measurement, so do not need as many separate sensors
  - **Provides a "Flat" Structure** at the edge 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 <u>(command, measure, repeat)</u>**
- Smart inverters, with communications, ***<u>mitigate or reduce</u>*** many of these complexities, due to pending standards which enable interoperability

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

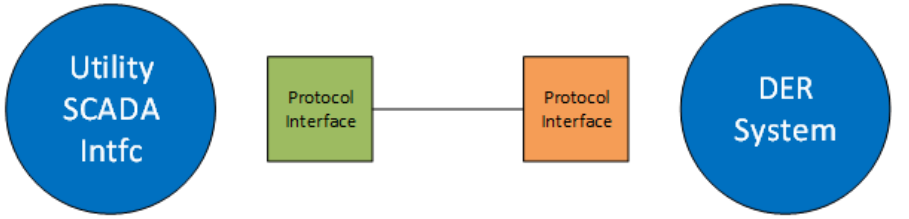


Industry is Making Progress at Standardization

- 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)



Unified Protocol

- IEEE 2030.5 (SEP2)

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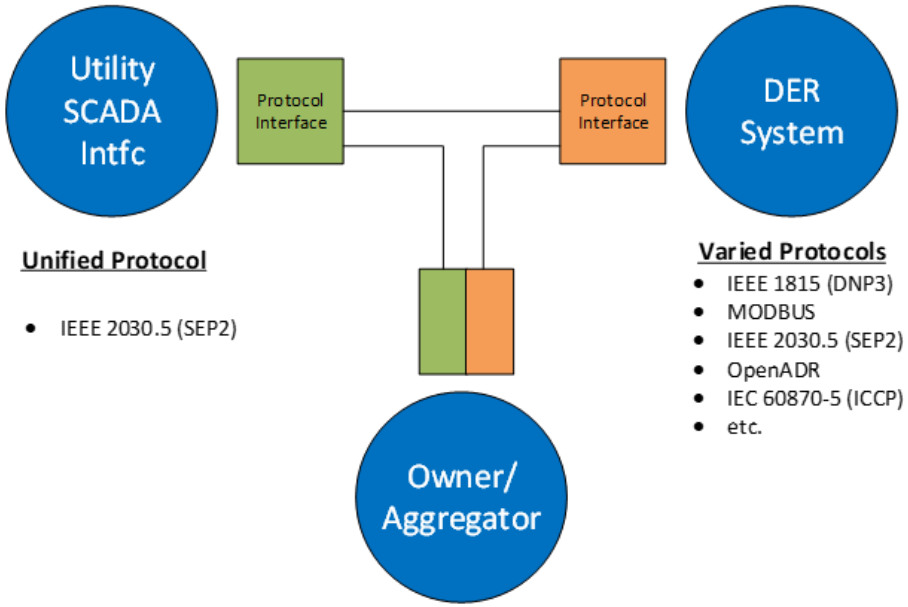
Utility / Aggregator / DER



Unified Protocol

- IEEE 2030.5 (SEP2)

Varied Protocols

- IEEE 1815 (DNP3)
- MODBUS
- IEEE 2030.5 (SEP2)
- OpenADR
- IEC 60870-5 (ICCP)
- etc.

* 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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