TDWG B2: Current Tele-Communication Methods

December 8th 2023

Agenda

1. Overview of B2 Deliverable SOW
2. Overview of Distribution System (DX)
3. Current Measurements on DX systems
4. Communication Methods for DX Operations
5. Overview of Communication Requirements within the Technical Interconnection Requirements (TIR) for DER >50kV

B2 Communication Assessment - Categories

To be comprehensive, the ‘Communication Assessment’ deliverable will provide the following, for both the TDSO and Dual Participation Models:

- Identify key data interfaces among IESO, LDCs, and DER(A) for with respect to outages, thermal/voltage grid constraints, limits on DER(A), and dispatch of DER(A).
- Identify key data exchange nodes (DEN’s) of the network where telemetry is required, considering market locational price and utility demarcations. For each DEN and data interface, identify which party requires what data to be exchanged.
- Identify the available communication medium (s) that will be used to exchange the data in (near) real time.
- Provide a high level IT Infrastructure map needed for the data exchanges and communication, including infrastructure mapping that that will dovetail into the ‘Shared Platform Concept’ deliverable.
- Provide projected cost heat map (e.g., high, medium, low cost) for different IT infrastructure model.
- Consider implementation of the required data exchanges using open source frameworks cyber security protocols will also apply to all scenarios outlined in this deliverable.

Transmission System Operator

- Coordinates & monitors the operation of the TX System.
- IESO visibility into Distribution System is limited.

Transmitter (HONI)

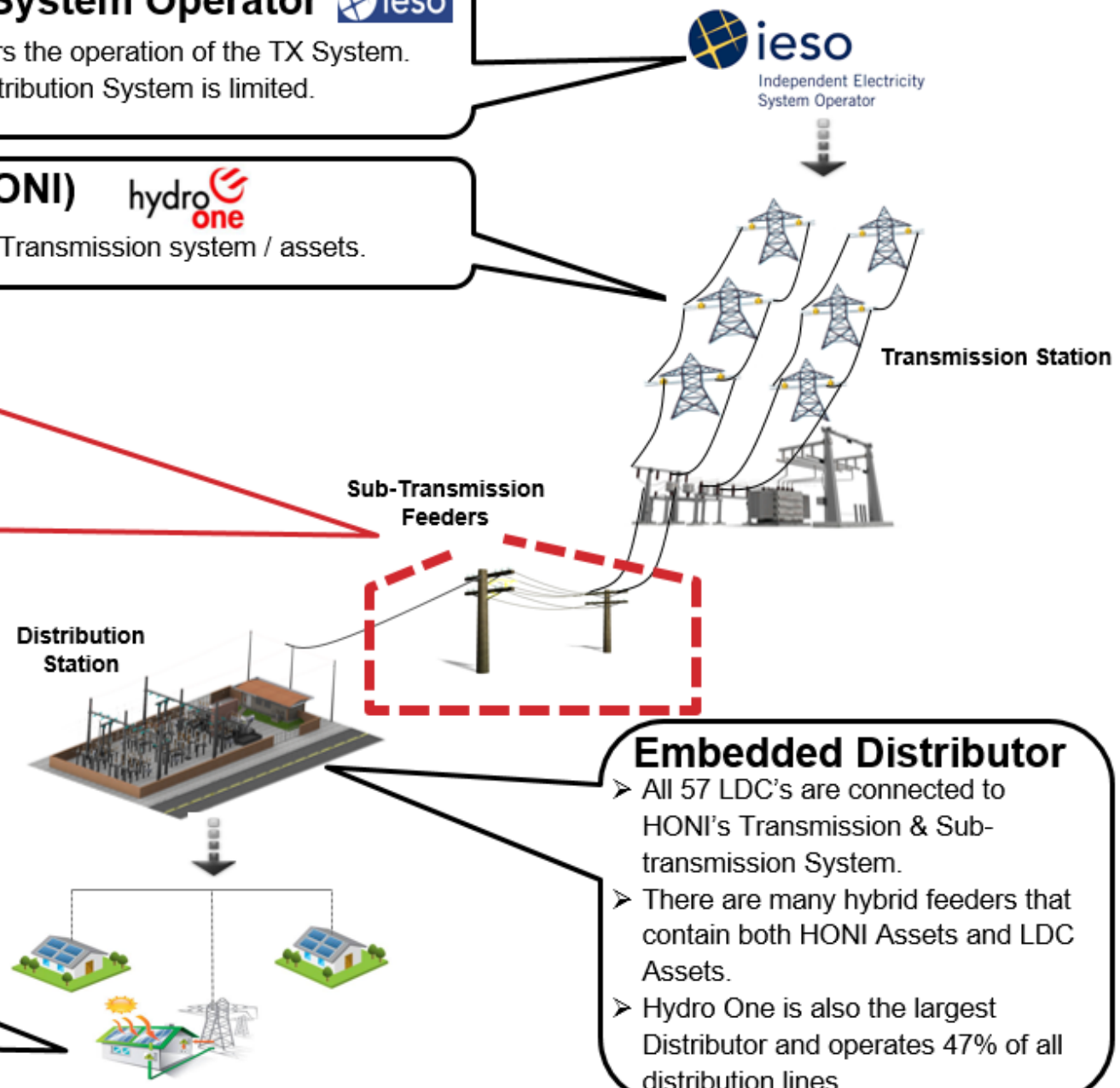
- Owns and Manages Transmission system / assets.

Host Distributor (HONI)

- Owns and operates the Sub-Transmission system that transmits power from transmissions stations to Distribution Stations, LDC's, & Large Customers.
- The IESO & LDC's do not have visibility into this system.
- This system is often reconfigured.
- This system can produce considerable thermal and voltage constraints.
- **Consideration of the Host Distributor is critical to the success of the future DER Market.**

DER's & Customers

- Customers use power from the system and DERs, and in future market scenarios could bid their DERs, alone or aggregated, into the IESO markets.

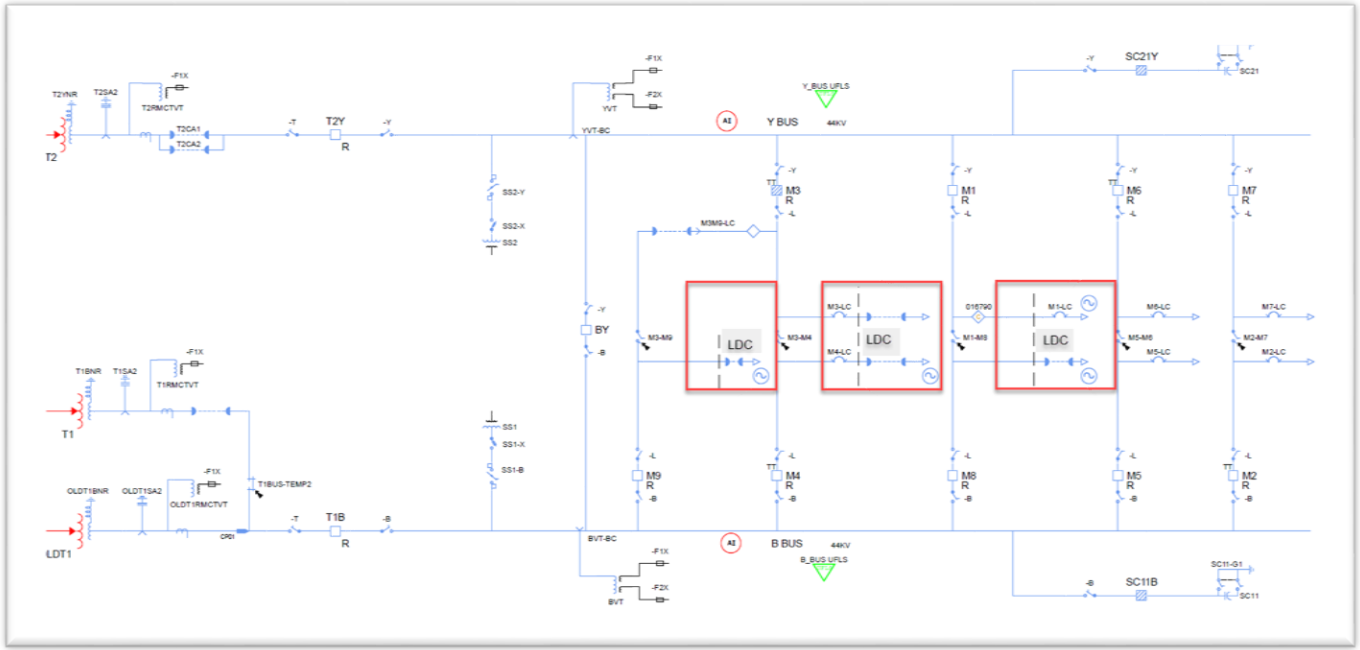


Embedded Distributor

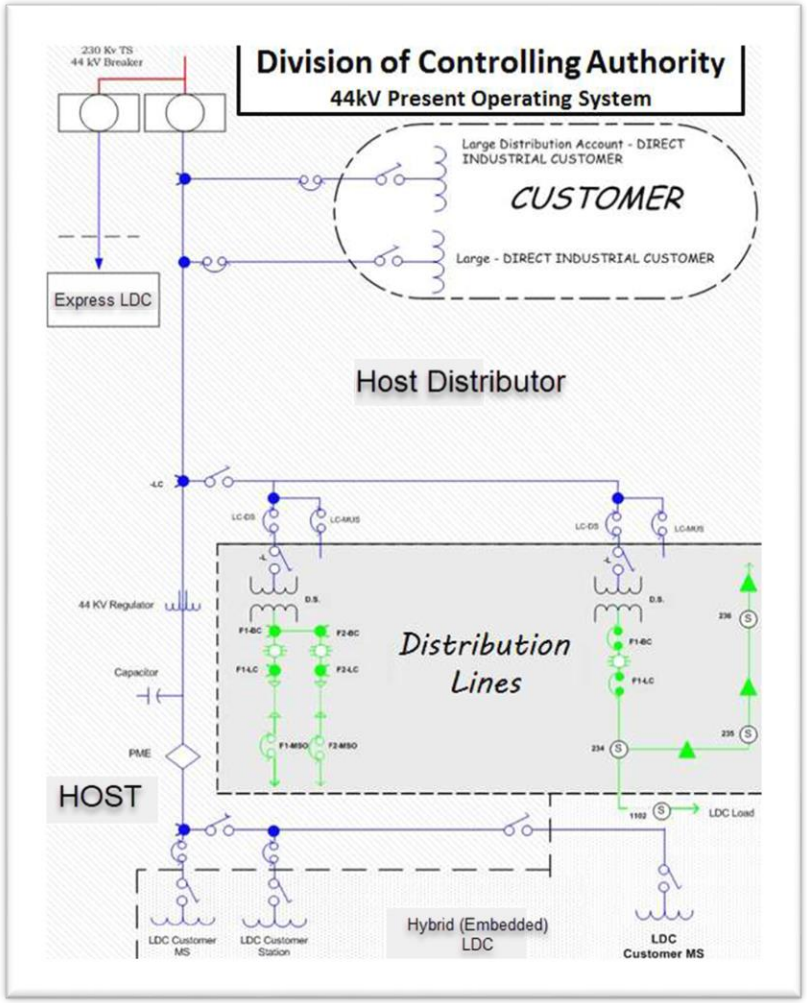
- All 57 LDC's are connected to HONI's Transmission & Sub-transmission System.
- There are many hybrid feeders that contain both HONI Assets and LDC Assets.
- Hydro One is also the largest Distributor and operates 47% of all distribution lines.

The Two Common D-D Interfaces

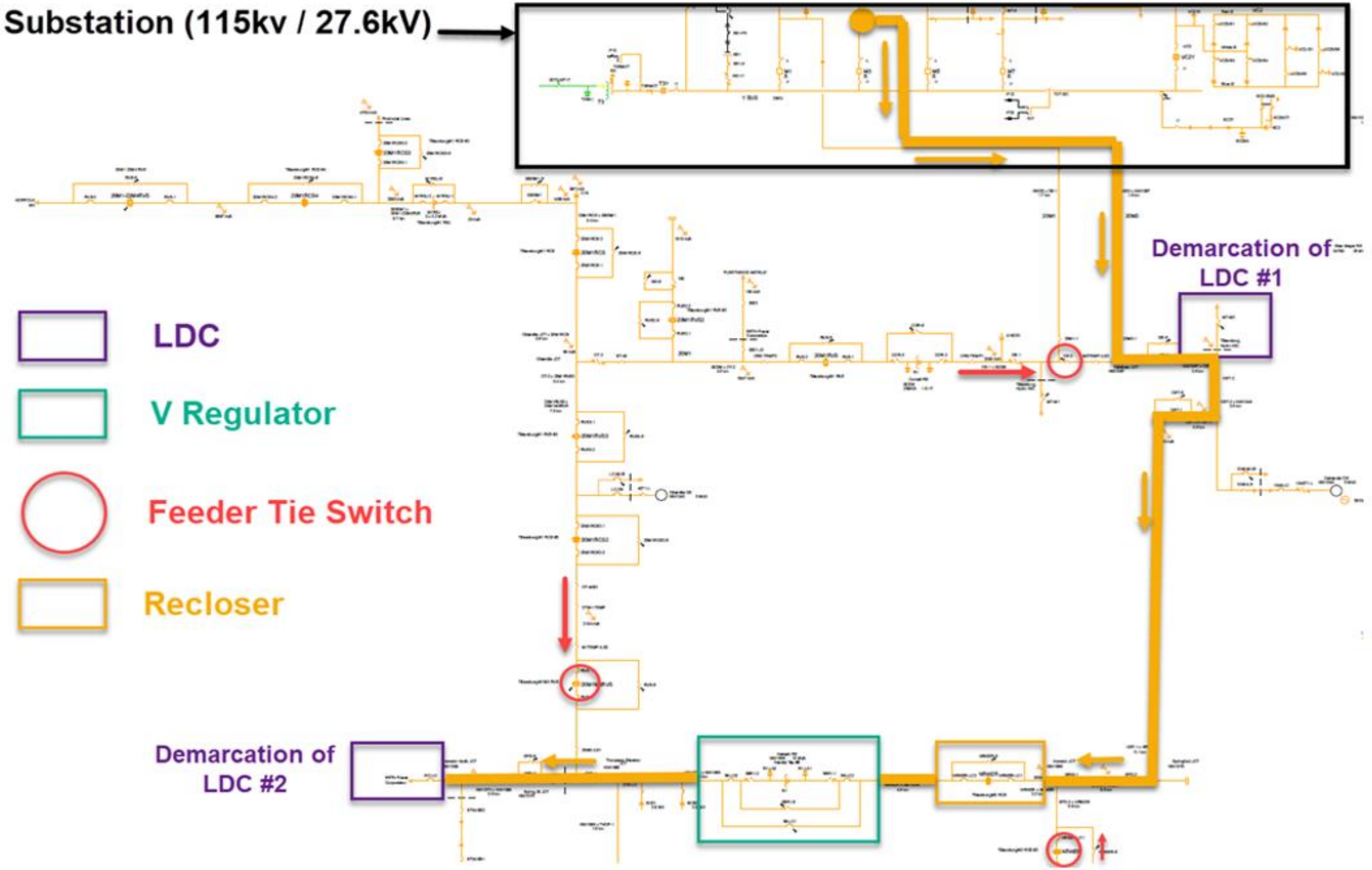
Express Feeders

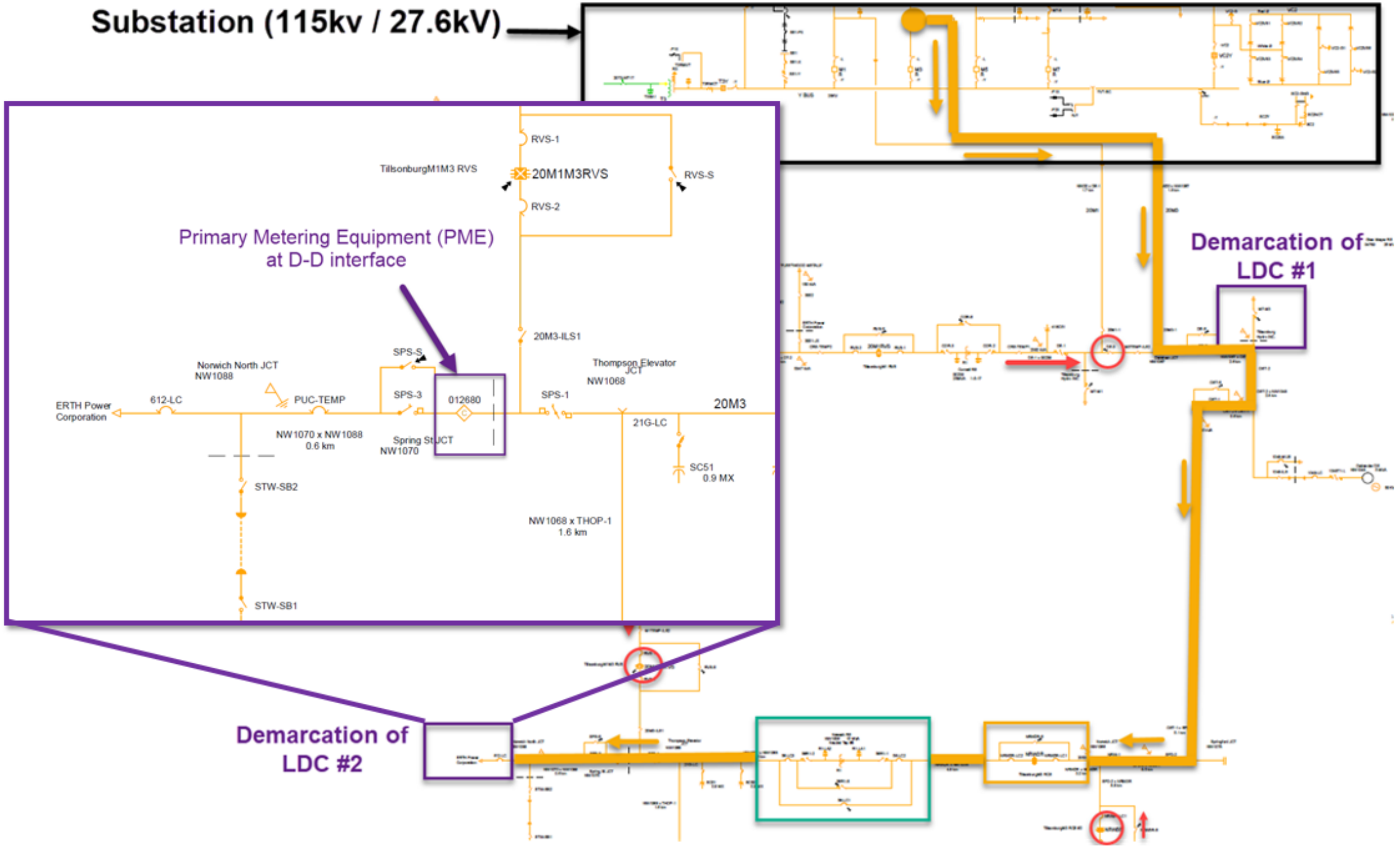


Hybrid (Embedded LDC) Feeders



NOTE: Hybrid Feeders, which contain Embedded Distributors, will likely require more complex data exchanges compared to Express Feeders. This is to support accurate constraint analysis.


Substation (115kv / 27.6kV)
Demarcation of LDC #1
LDC
V Regulator
Feeder Tie Switch
Recloser
Demarcation of LDC #2


Substation (115kv / 27.6kV)
RVS-1
TillsonburgM1M3 RVS
20M1M3RVS
RVS-S
RVS-2
Primary Metering Equipment (PME)
at D-D interface
20M3-ILS1
SPS-S
Norwich North JCT
NW1088
Thompson Elevator
JCT
NW1068
ERTH Power
Corporation
612-LC
PUC-TEMP
SPS-3
012680
SPS-1
20M3
21G-LC
NW1070 x NW1088
0.6 km
Spring St JCT
NW1070
SC51
0.9 MX
STW-SB2
NW1068 x THOP-1
1.6 km
STW-SB1
Demarcation of
LDC #1
Demarcation of
LDC #2

Operating Communication Methods - Types of Metering

Legend
- DNP3
- Cellular
- SMP+DNP3
- ICCP

IESO

LDC (Embedded Distributor)

Could include:
- MW, MX, I , V
- Control
- Switch Status
- Alarm Points

Hydro One (Transmitter / Host Distributor) Operating Control Software

Breakers

DER (<250kW)

Fault Indicators

Load Break Switches

ION Meters

Types of Distribution Metering Devices

Primary Metering Equipment (PME)
- ION Meters are used for LDC retail billing
- Can send real time (15 min interval) data to ADMS (DNP3 → SMP Gateway→ ADMS)
- Data sent to ADMS includes MW, MVAR, L-L Voltage (per phase), Amp (per phase)

Station Breakers
- Breaker Relay components used to measure the loading of the breaker
- Could be from PT's / CT's or from an IED relay
- Data sent to ADMS includes MW, MVAR, L-L Voltage (per phase), Amp (per phase), Fault Amps, PF etc.

Remote Load Break Switches
- GW Viper and S&C Alduti-rupter in line switches that provide SCADA to ADMS
- Data sent to ADMS includes MW, MVAR, L-L Voltage (per phase), Amp (per phase), Fault Amps, PF etc.

Distributed Energy Resources (DER's)
- DER <250kW required to send telemetry (2s polling) to Operating Centre as per TIR.
- Data sent to ADMS includes MW, MVAR, L-L Voltage (per phase), Amp (per phase), Fault Amps, PF etc.

CFCI's
- Eaton in line device that sends Amperage and Fault Data every 2 hours to ADMS.

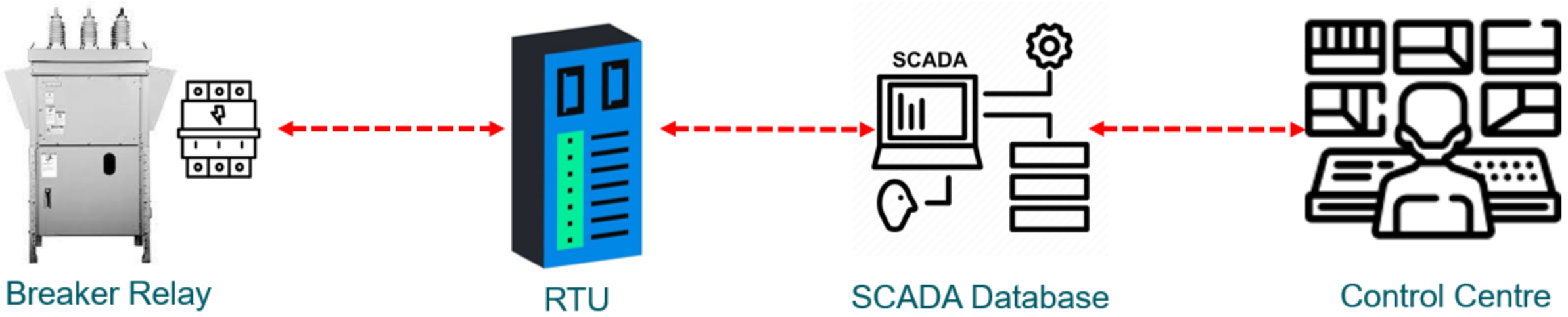
Inter-Control Center Communications (ICCP)

Inter-Control Center Communications protocol (ICCP), is used worldwide for utility control centre to control centre communications. It enables data exchange within the utility systems (ie EMS to ADMS) as well as between other utilities, independent system operators (ISOs) and generators. It allows for the secure exchange of data between parties, with each established point having only 1 way communication (parent / child).

ICCP allows for the exchange of real-time power system monitoring and control data. This includes measured values, control points, tagging and operator messages. Data exchange can occur between multiple control centres EMS/ADMS systems; and EMS to ADMS SCADA systems.

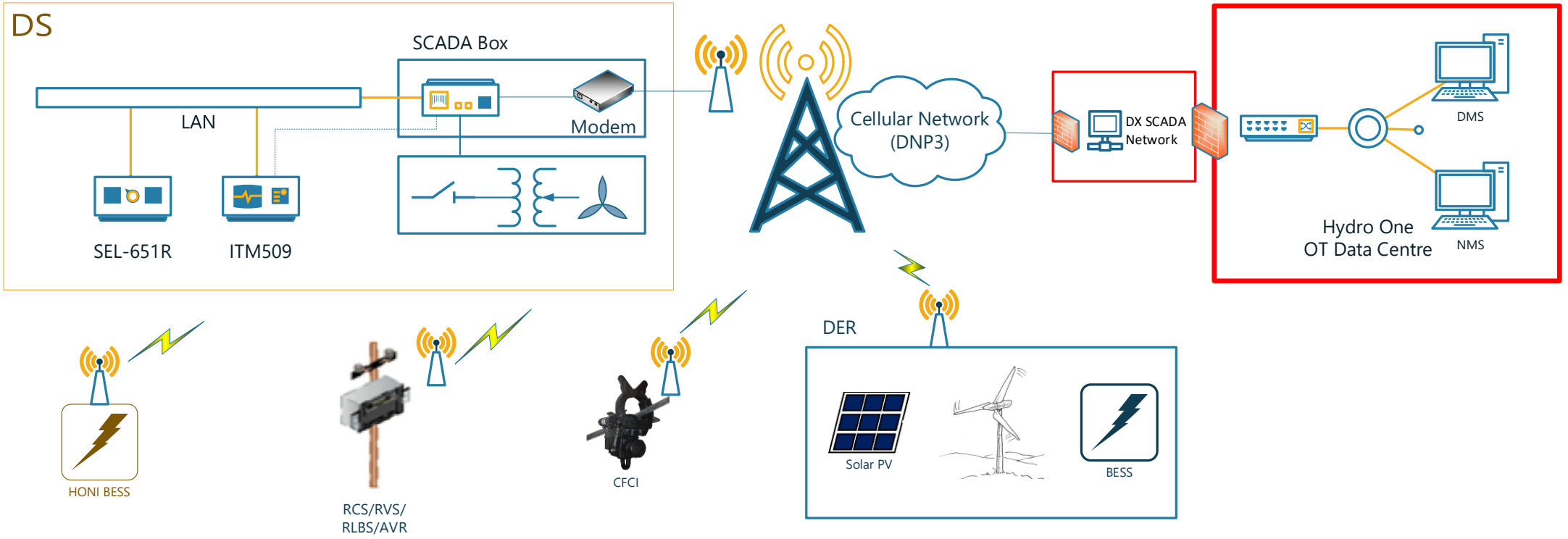
Distributed Network Protocol (DNP3)

Distributed Network Protocol 3 (DNP3) is a set of communication protocols designed for utilities, and is used to communicate between devices within utility systems. It was developed for communications between various types of data acquisition and control equipment. It plays a crucial role in SCADA systems, where it is used by SCADA Master Stations (ie. control centre), Remote Terminal Units (RTUs), and Intelligent Electronic Devices (IEDs). It is primarily used for communications between a master station and RTUs or IEDs. ICCP, the Inter-Control Center Communications Protocol (ICCP), is used for inter-master station communications.



Cellular Communications for Distribution Assets

Recently, Hydro One has been leveraging cellular tele-communications to provide SCADA functionality on its distribution (DX) system, which is monitored and controlled using the Advanced Distribution Management System (ADMS). This includes status and control of Remote Load Break Switches (RLBS's) and Reclosers. Communicating Fault Current Indicators (CFCI's) that will also provide real time measurement and fault data to the ADMS. It must be noted that latency requirements are not as stringent for the distribution system, when compared to the transmission system.

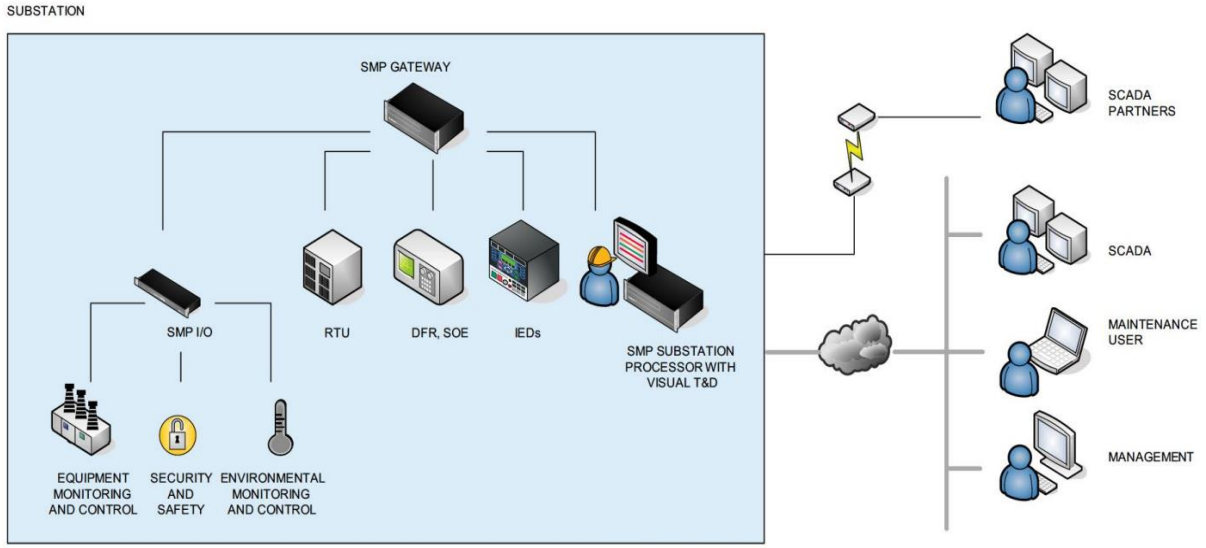


Substation Modernization Platform (SMP) Gateway

The SMP Gateway is used in substations to perform data acquisition and protocol translation to provide secure remote access to substation intelligent electronic devices (IEDs). It is a data concentrator that bridges devices to control centres, or enterprise systems. This data can also be extracted to csv / excel files etc. SMP also has various security measures including user profiles, multi factor authentication and secure firewall protection. Hydro One is currently utilizing this for its CFCI's, and ION Meters.

SMP products are designed to simplify substation integration and automation while giving utilities vendor independence:

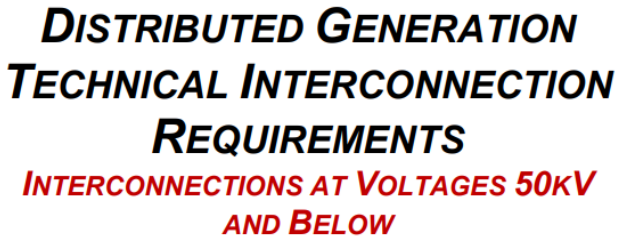
- Protocol translation
- Data concentration
- System-wide device automation and integration
- Automatic event file retrieval and file pushing
- Remote control and pass-through
- Data distribution
- Substation-hardened computing
- Substation I/O monitoring and control
- NERC CIP-compliant security



DER Technical Interconnection Requirements (TIR)

"For DG Facilities connecting to the Distribution System of an Embedded LDC, the Embedded LDC shall provide real-time operating information to Hydro One from the Embedded LDC's SCADA master. For DG Facilities connecting to the Distribution System of an Embedded LDC that are not monitored by the Embedded LDC, the DG Owner shall provide monitoring to Hydro One. Real time operating information provided to Hydro One may be from an Intelligent Electronic Device (IED) at the DG Facility's station to Hydro One's control centre using Distributed Network Protocol (**DNP 3.0 protocol):**

a) to Hydro One's wireless cellular data hub site and through the gateway to one of Hydro One's Control Centres, with the demarcation point being the wireless access point to the Service Provider's cellular network; or
b) where Item (ii)(a) above is not feasible, through a common carrier connection to one of Hydro One's Control Centres, with the demarcation point being the Central Office nearest to DG Facility's station; or
c) where Items (ii)(a) and (b) above are not feasible, Hydro One will suggest communication options available to a particular site.
d) Real time operating information provided to Hydro One may be from a SCADA master through Hydro One's SCADA master using Inter-Control Center Communications Protocol (ICCP). Where the Embedded LDC has an existing ICCP link to Hydro One, all telemetry for Embedded LDC connections shall be provided through the existing ICCP link."



DG Technical Interconnection Requirements (TIR)

Feedback Questions

Q: Are there other communication methods and protocols that you are using, that were not identified in this presentation?

Q: Does your company have a defined IT roadmap looking ahead 10+ years?

Q: Does your utility currently have ICCP linkages with IESO, Hydro One or other utilities?

Thank you

For more information, please contact me at james.mcgowan@hydroone.com