DERConnect DERMS Industry Use Case – DER Operations

Initial set of use cases is as follows:

1. DER Aggregation and Grouping
2. ADMS-Type System Manages DER Control, Command, Smart Inverter Configuration
    a. DER control and command should be done by the IoT platform
    b. Need clarification on “Smart Inverter Configuration”
3. DER Visualization and Situational Awareness
    a. Need to read PMU measurements (PMU protocol: IEEE C37.118)
    b. Detect abnormal oscillations, aged transformer
4. DERMS Performs Measurement and Performance Validation
    a. Clarify “Performance Validation”
5. DERMS Provides Reliability Services to the Distribution Grid
    a. Clarify “Reliability Service”
        i. Could be checking the availability of DERs, or other power devices
6. DER Dependability and Contingency Analysis (also related to the FLISR)
    a. Test different contingency policies including DERs, probably with real-time control
7. DERMS Performs Optimal Constraint Management
8. Automatic DER Lockout for Circuit Lockout Conditions
    a. SEL microgrid + IoT platform are responsible to this
9. DER Enhances Unplanned Outage Management for Distribution Operations (also related to the AMI)
    a. L3 microservice
    b. Can use IOTS for developing the algorithm
10. DERMS Supports Microgrid Coordination of DER Resources (also related to Energy Storage Coordination)
    a. Provide grid data to SEL PowerMax (Microgrid Coordinator)
11. Determining DER Distribution Reliability Commitments to Inform Market/ISO Bids
    a. Poviders (nodes) give constraints. Input rules into microservice to solve optimization to identify commitments for market
12. DERMS Aggregates DERs for A-Bank as a Virtual Power Plant
    a. Done at IoT Onesait
13. DSO Dispatches DERs Based on Resources Meeting Bid Prices
    a. L3 microservice

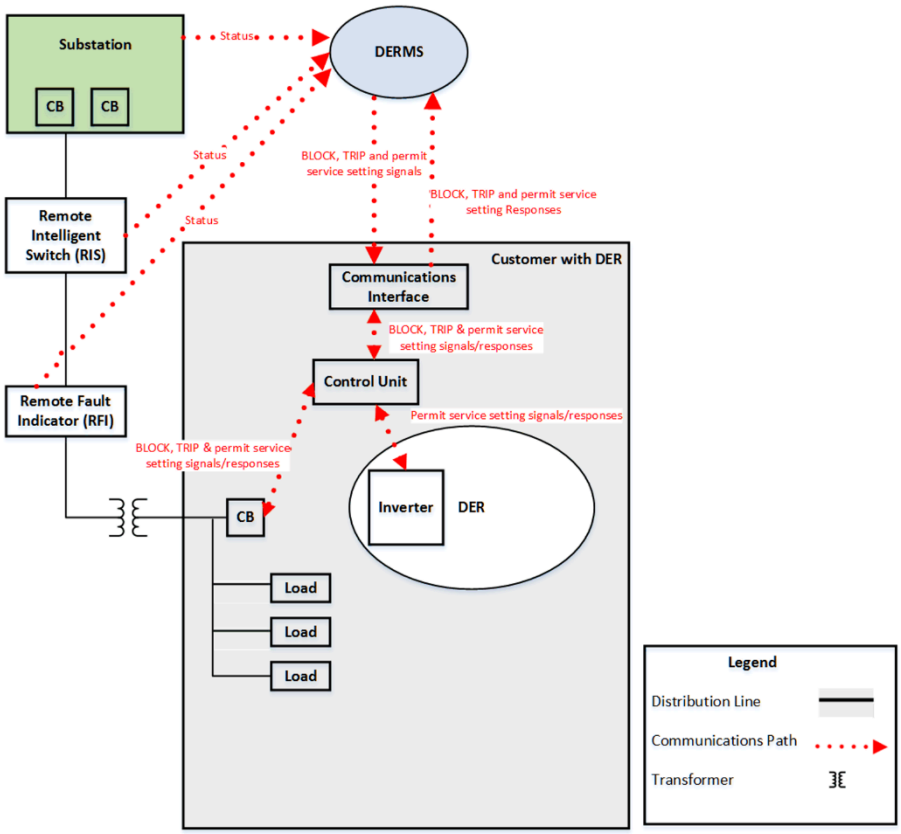
Sample Use Case 1: Automatic DER Lockout for Circuit Lockout Conditions

DERMS will monitor the status of distribution circuit breakers, remote intelligent switches (RIS), and remote fault indicators (RFI) and signal DER devices on affected circuits that they may not connect nor reconnect to the electric grid. To achieve this, during normal operating conditions the DERMS will send a permit service setting (as it is called in IEEE Standard 1547) to the DERs. In the event of a distribution system fault or a breaker or switch operation, the DERMS shall send a BLOCK command and disable the DER permit service setting. In the event that the DERS do not trip off or do not ride through the fault or outage (as appropriate for CA interconnection rules for DERs) the DERs will not attempt to reconnect to the grid until the DERMS begins sends the permit service setting and stops sending a BLOCK signal after the fault or outage has been resolved.

DER control units operating in accordance with this use case would not disconnect due to a loss of power or communications, because they would not reconnect until the permit service setting is received. DER may not reconnect until the permit service setting is enabled, and the presence of grid side voltage is detected indicating that the system has been restored.

A variant of this use case includes the DERMS sending a TRIP signal which might be requested by the ADMS/FLISR application to perform a transfer trip function for DER which should be signaled to trip off regardless of their ability to ride through the fault.

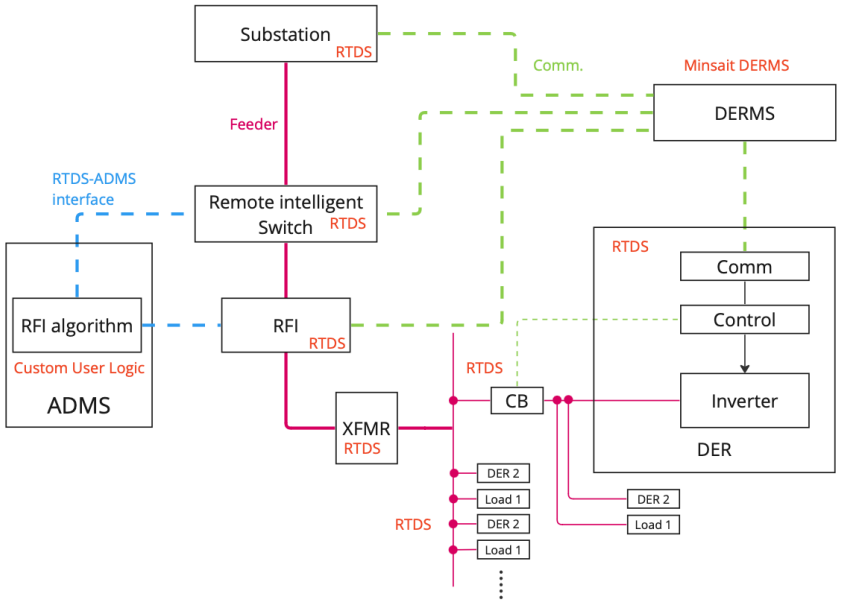
FLISR ties DER connected on the unfaulted part of the circuit and to a different circuit, then the processing needs to understand which circuit the DER is connected. This is necessary as the lockout logic needs to understand which circuit is affected and how to re-energize the DER.



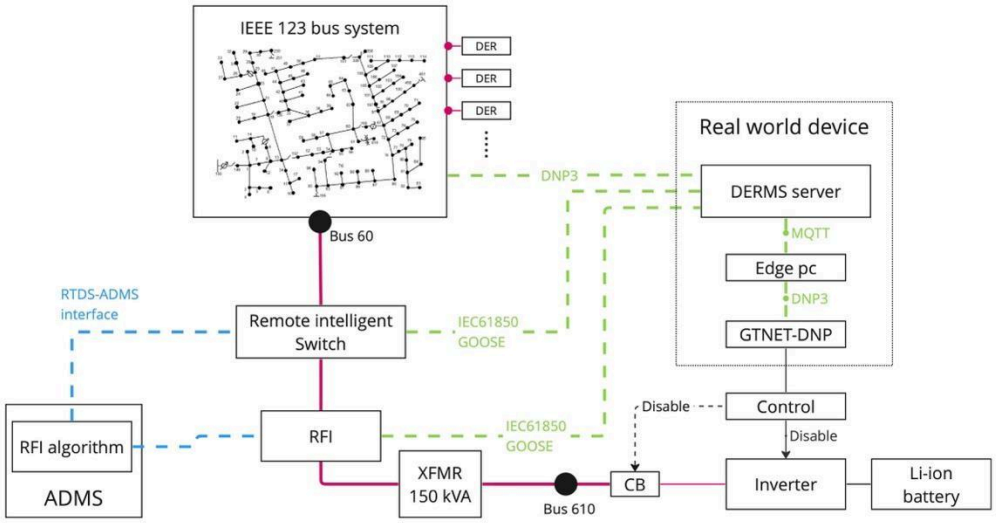
Basic assumptions are as follows:

- The distribution system is operating normally prior to the event that triggers the use case.
- DER installations over TBD (1MW?) shall be required to receive and process the BLOCK signal as described in this use case
- DERS will receive the signals based on a configuration in the DERMS
- The DERMS BLOCK signal may be sent directly to DER devices or indirectly through DER Aggregators
- DER Inverter shall get current permissive state when it re-energizes after an outage and won't revert to previous operating state

DERConnect test diagram:



Example test case setup:

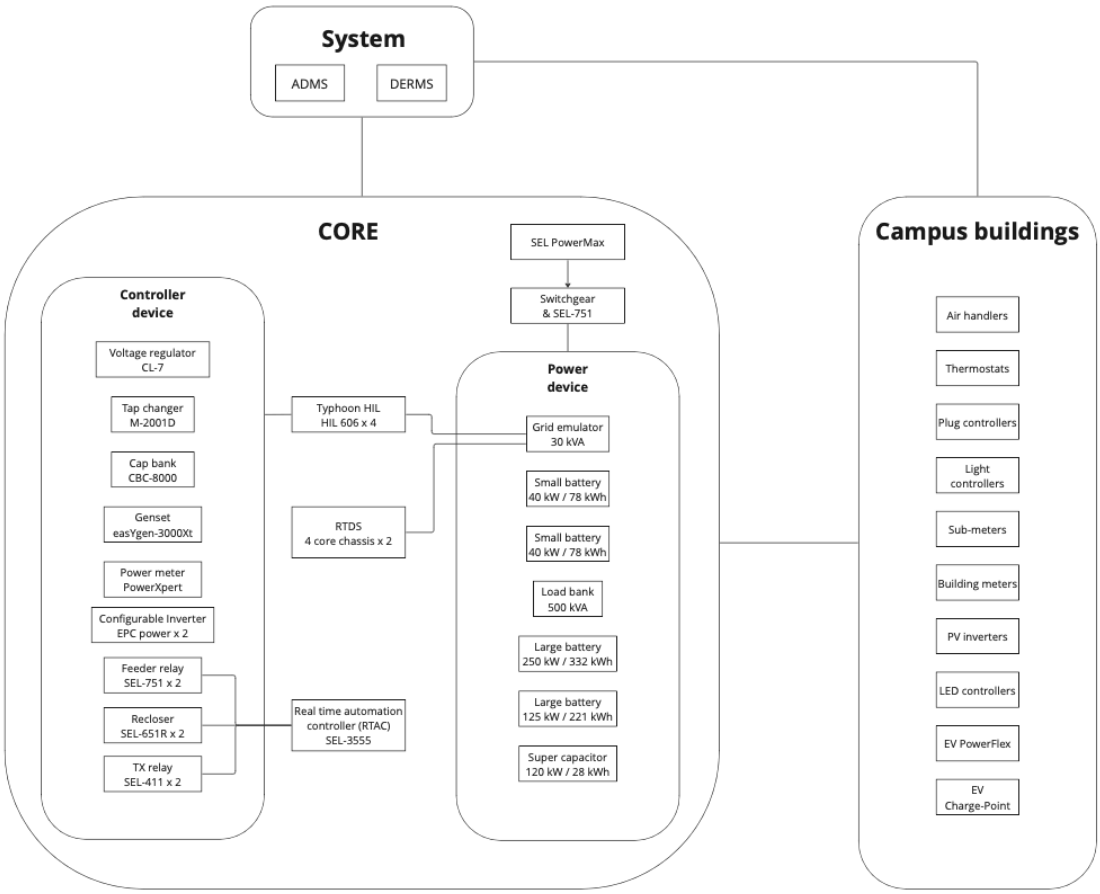


The DER lockout is demonstrated using a simulated medium voltage distribution system, DERConnect-DERMS, and the user's lockout algorithm. The RTDS simulates the IEEE 123 benchmark system with mixed ten of the battery and PV inverters connected in different buses. The remote intelligent switch and remote fault indicator are added between buses 60 and 610, talking IEC 61850 GOOSE to send fault-related information to the DERMS. Each inverter communicates with the DERMS to exchange measurements and lockout signal over DNP3. Additionally, another DNP3-based communication is used to monitor all of the system variables. There are some compatible options in this example:

- Typhoon HIL (HIL606) can replace the RTDS.
- User can bring their distribution system model for the test.
- Modbus can be used in the DER communication instead of DNP3.
- IEC 61850 SV, Modbus, and DNP3 can be used in the RFI and remote switch communication instead of IEC 61850 GOOSE.
- The algorithm to create the lockout signal can be implemented into the DERConnect as either hardware or software.

References:

DERConnect test facilities:



Reference:

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