industrial internet CONSORTIUM

Applying DDS to the Microgrid Testbed

Dec 2016

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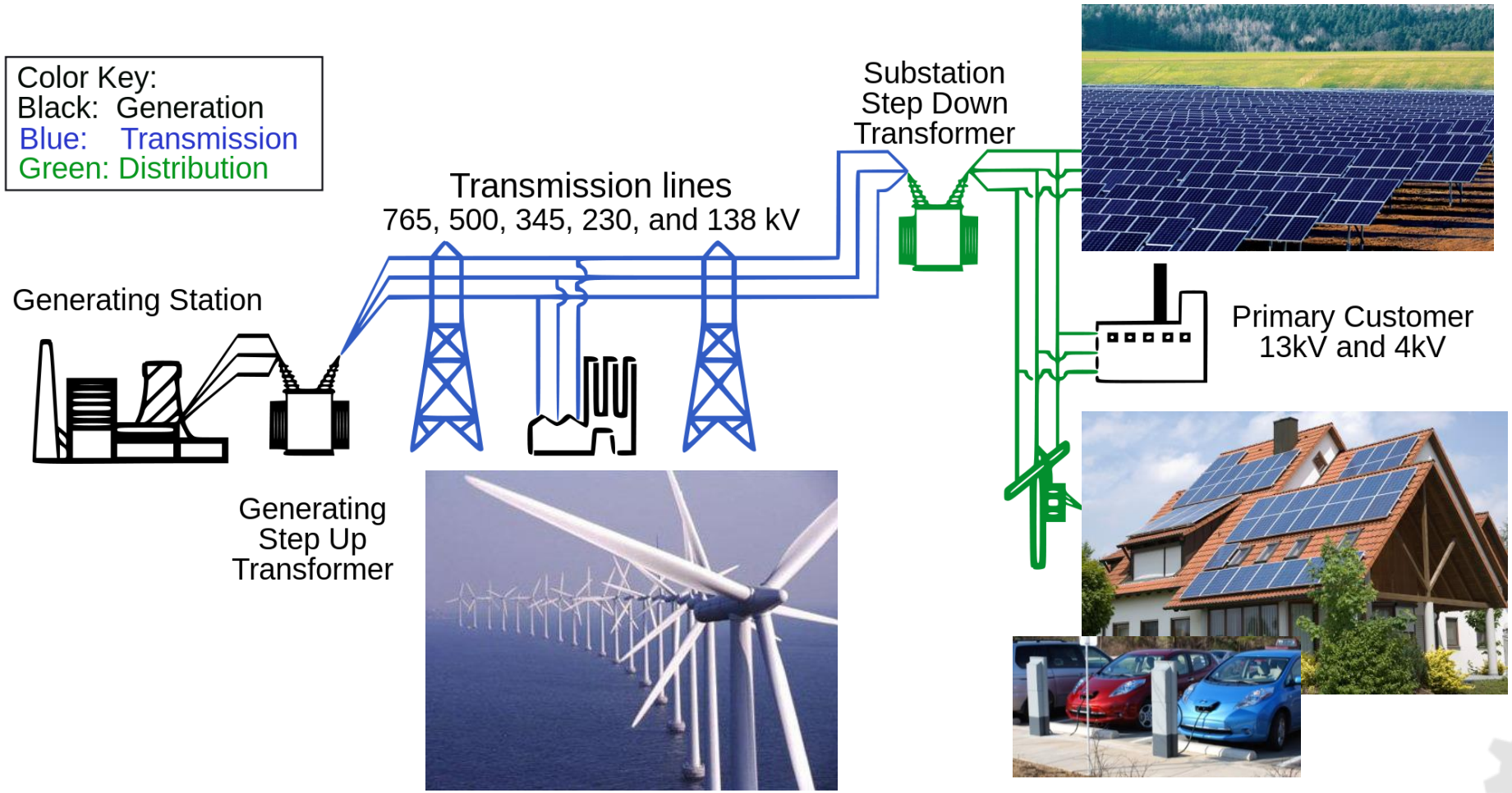
The Grid is Changing



Microgrid: A Smart Grid Microcosm

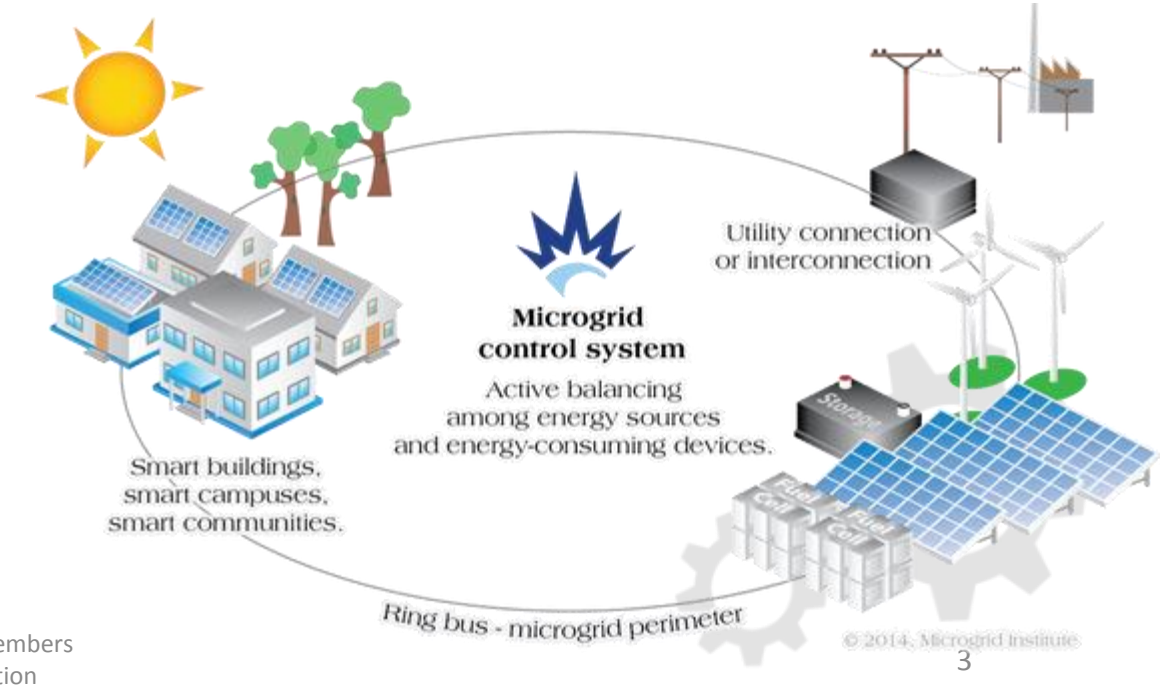
Microgrids are sections of the grid that contain both load and generation and can operate independently from the grid at large

Generation capability is frequently from renewable sources like wind or solar

Energy storage is typical in microgrids – challenging new subsystems

Microgrids are important to smart grid research

- Encompass most of the elements of a full sized grid
- Offer a good representation of the challenges grid operators are facing



Testbed Overview:
Communication and Control for Microgrid Applications

Collaborators

- Leads: RTI, NI, Cisco
- External: CPS Energy (San Antonio)
- Advisors: Duke Energy, SGIP

Market Segment

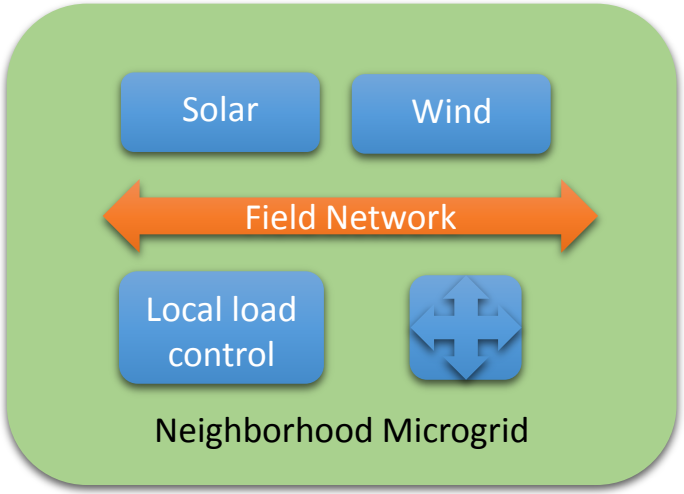
- Smart grid, especially integrating solar, wind, storage, and EVs

Goal

- Prove the viability of a real-time, secure databus and distributed control architecture in a real-world power system

Features & Commercial Benefits

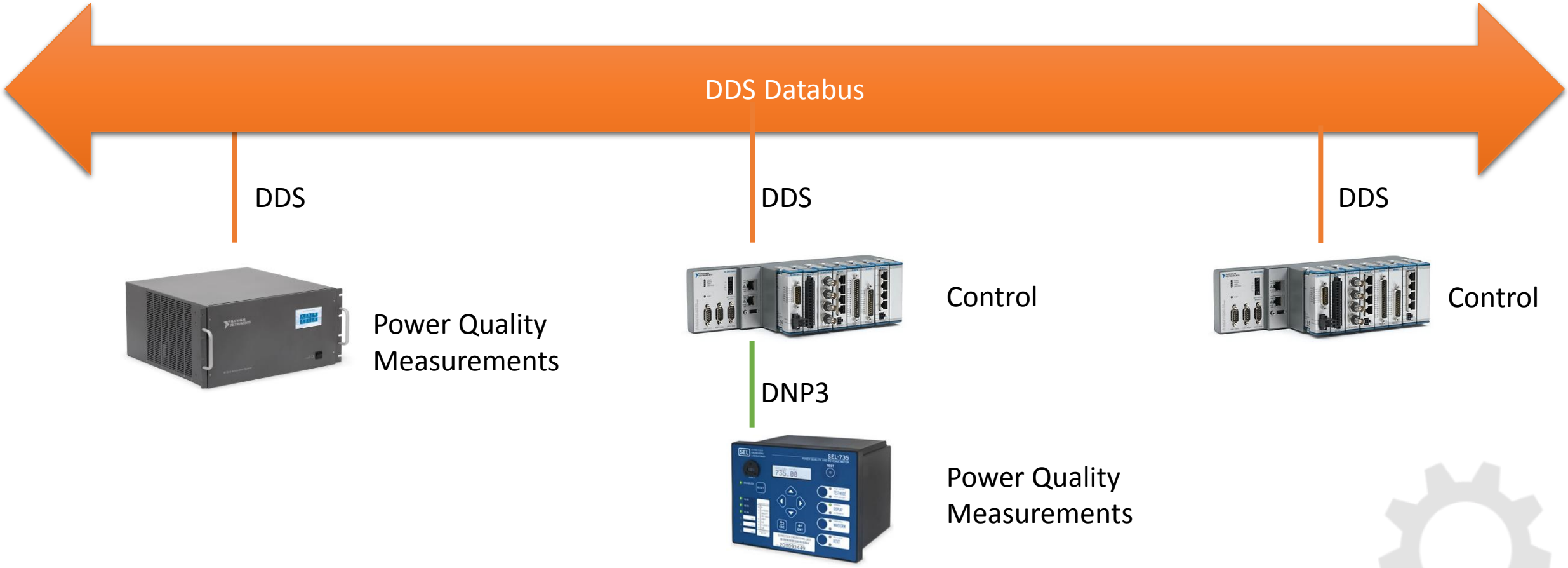
- Enable efficient integration of solar, wind, & EVs into the grid
- Create a dynamic, open marketplace for smart grid vendors
- Break the standards blockage holding back the industry



Phase 1: Testbed / Lab at NI HQ in Austin

Finishing construction in the NI IIoT Lab
Jan 2017

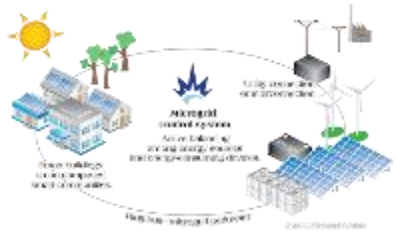
Phase 1: Data & Controller View



Phased Approach for Proving Viability of a Microgrid

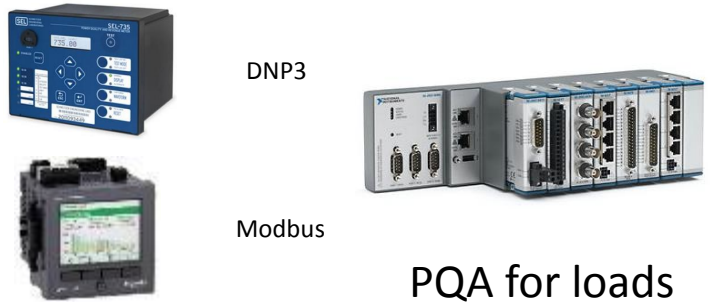
Communication and Control Framework:

- Phase 1 – Proof of Concept at National Instruments Lab
- Phase 2 – TSN-based Distributed Control for Renewables
- Phase 3 – Real-World Microgrid at CPS Energy



Incrementally develop.
Test and refine.
Deploy in real-world.

Microgrid Testbed – Phase 2



DDS Databus
(Potentially on TSN in the future)

PMU for Frequency
(both sides of main tie)

Resistive Loads

Inductive Loads

Time Sensitive Networks

Wind Turbine Inverter

Time Sensitive Networks

Energy Storage Inverter

Time Sensitive Networks

Solar Inverter

Time Sensitive Networks

Main Grid Connect

New partner: Oak Ridge National Labs

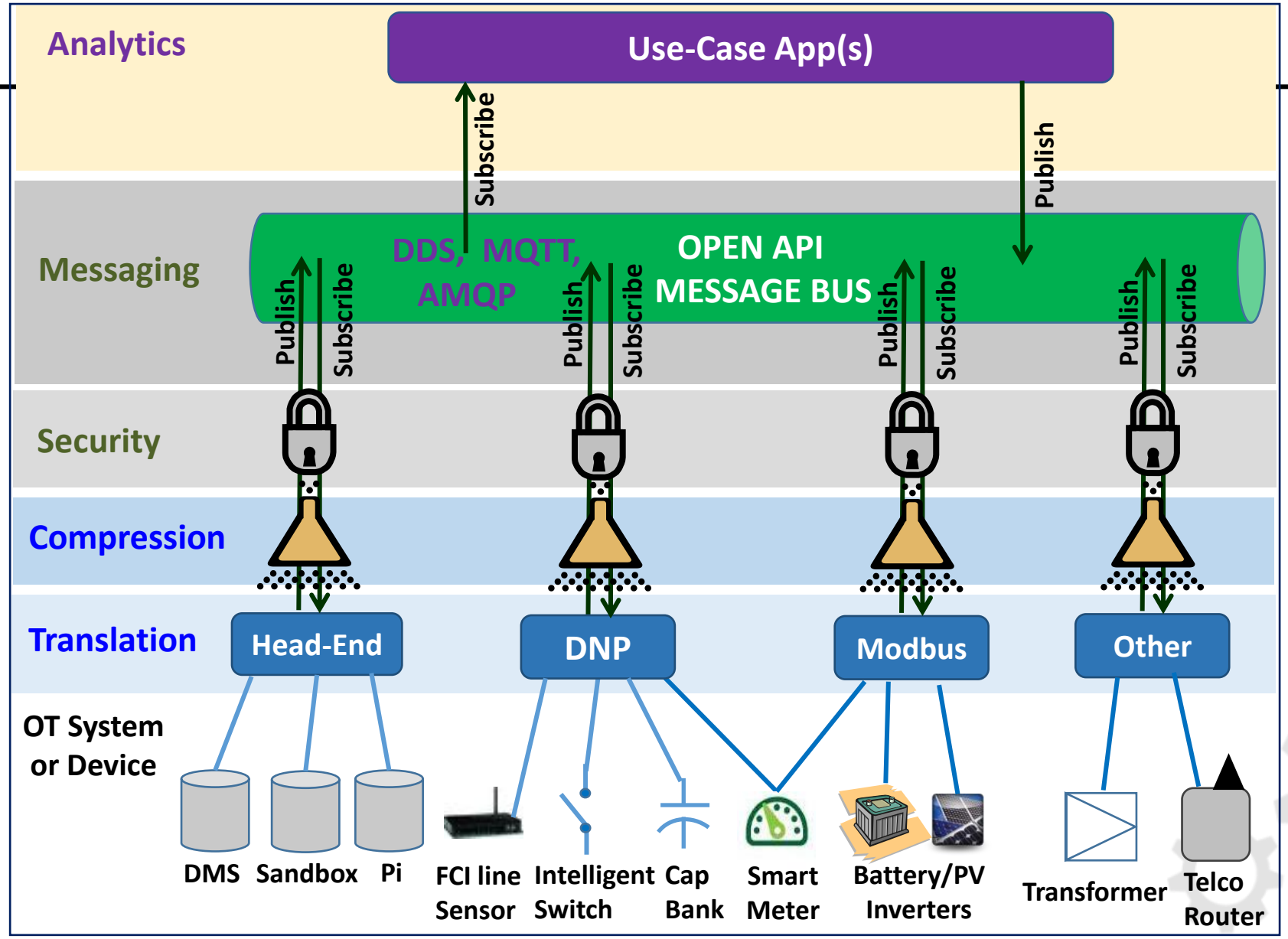
Phase 3: CPS Energy JBSA Microgrid Use Cases

In initial use case discussions for JBSA microgrid testbed in San Antonio, TX

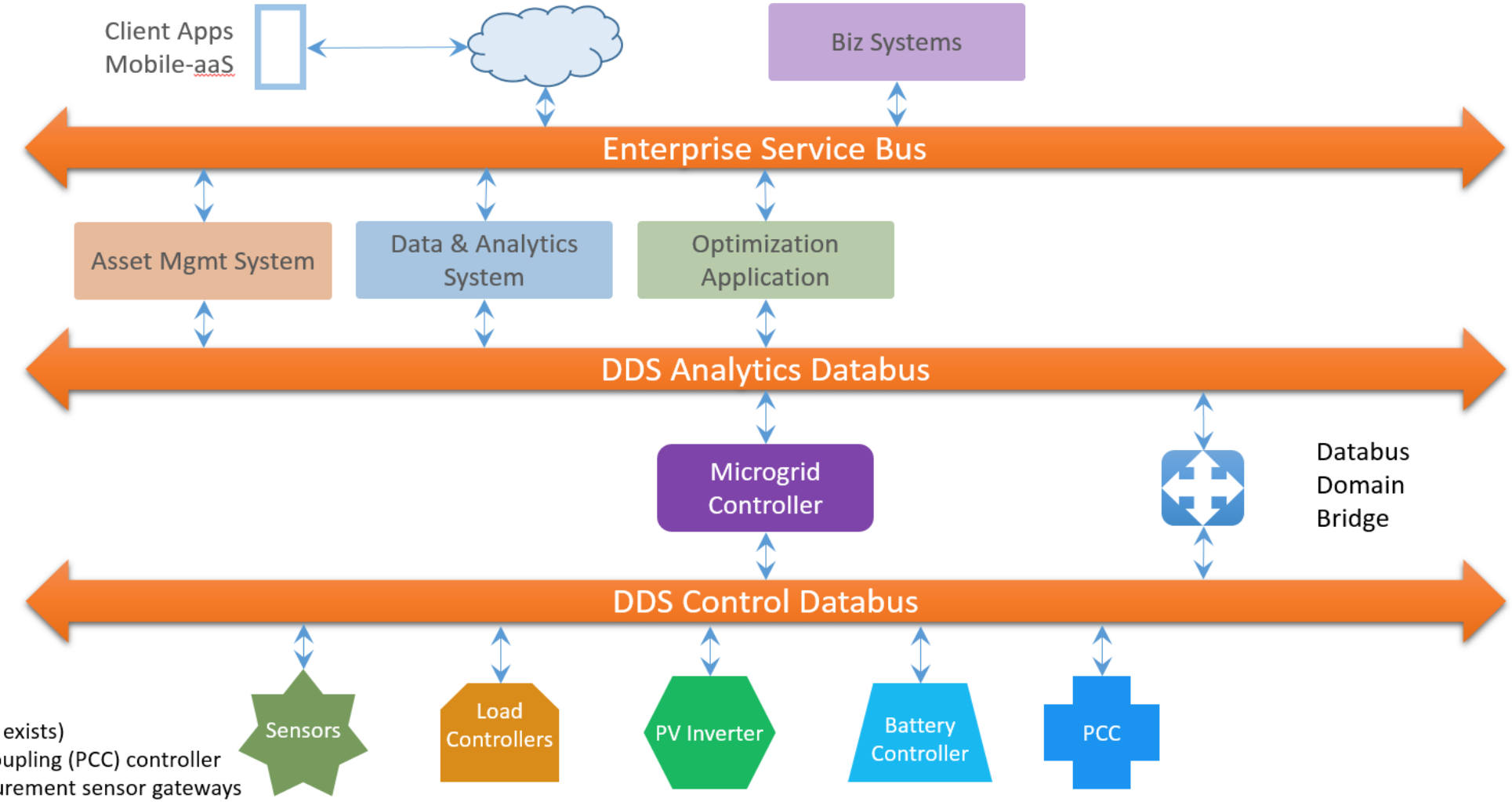
- Seamless islanded microgrid re-synchronization
- Secure communications and endpoints – test site

OpenFMB architecture implementation (Open Field Message Bus standard for smart grid distributed control)

Convergence of OT and IT



DDS-based Architecture for the Testbed: Vision for the Future



- Battery controller
- Solar array inverters
- Wind controller (if it exists)
- Point-of-common-coupling (PCC) controller
- Power quality measurement sensor gateways
- Various load equipment

Thank You

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Real Time Innovations

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