

Interoperability Framework for Energy Storage System

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PROJECT PROFILE

Topic: Interop Platform | Vertical: Grid Integration & Field Validation

Strategic Pathway: Optimize, Grow

Project start and finish: FY25-FY26

PROBLEM

Energy Storage Systems (ESS) improve grid stability, resilience, and service delivery. Their cost-effective deployment and coordinated operation require standardized communication and control frameworks.

- Protocol implementation challenges
- Vendor-specific interoperability and delayed deployment & integration risks

APPROACH

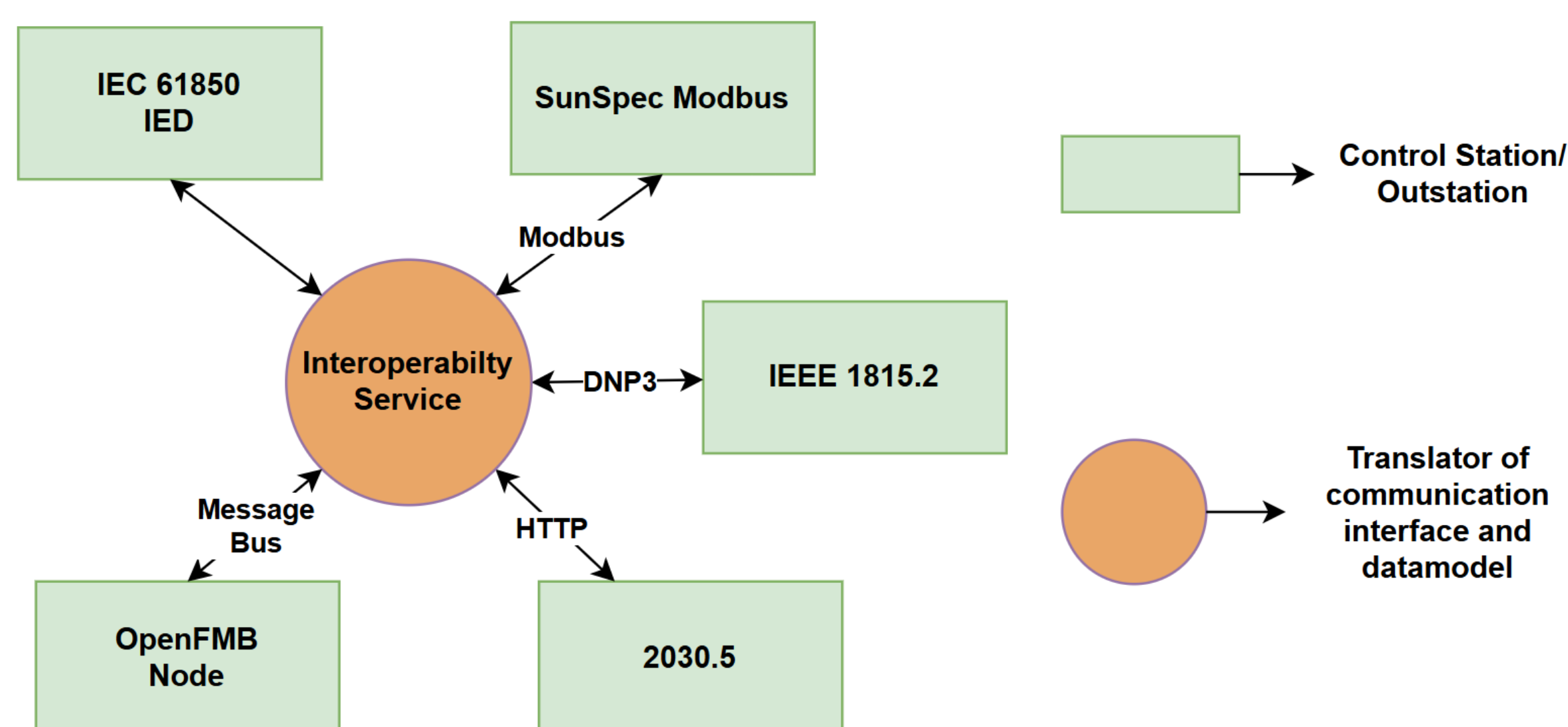


Fig. 1. Transparent inter-protocol messaging.

Provide templates for standards-based. communication and reduce integration complexity:

- Reduces vendor-specific integration effort and deployment risks.
- Supports interoperability across protocols including SunSpec Modbus, IEEE 1815.2, IEEE 2030.5, IEC 61850-7-420, and OpenFMB.
- Translates communication interfaces and data models to enable seamless device-to-application interaction regardless of native protocol.

Enable protocol-agnostic control and reference implementations:

- Decouples control applications from underlying communication protocols.
- Ensures reliable and consistent operation across multiple ESS and DER vendors.

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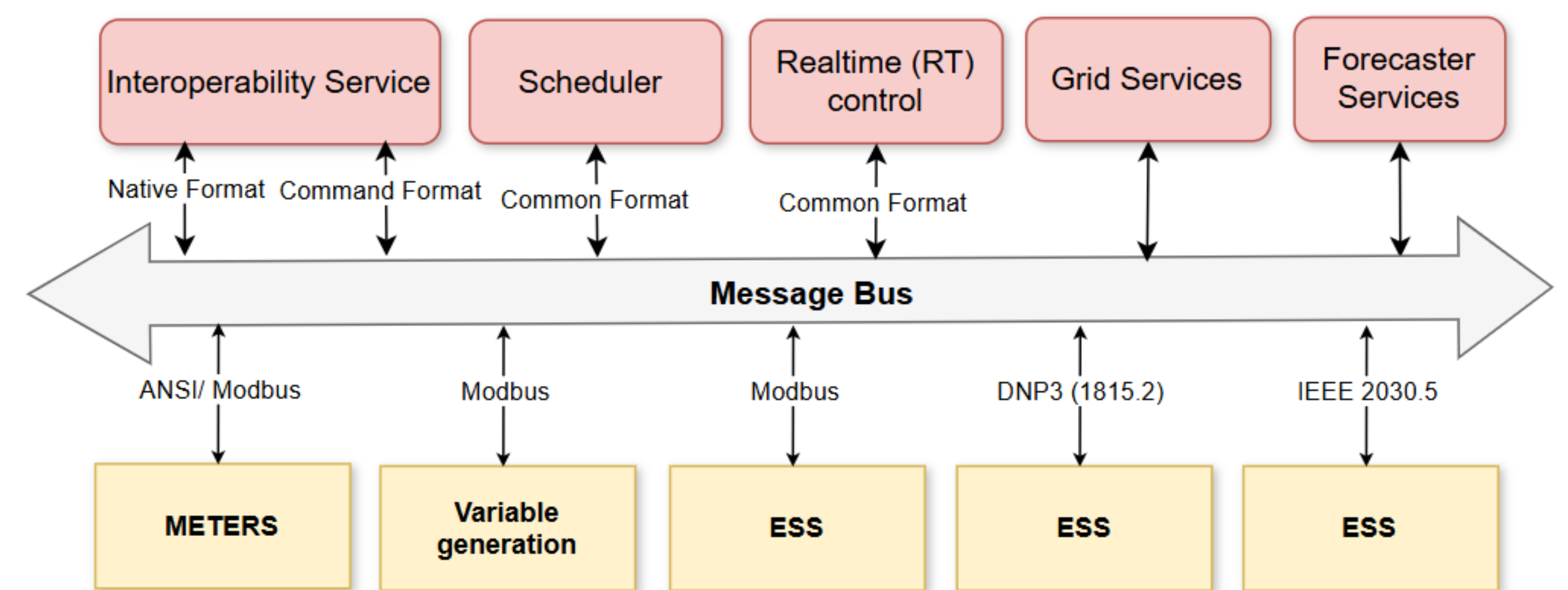


Fig. 2. Protocol agnostic communication via interoperability services

RESULTS

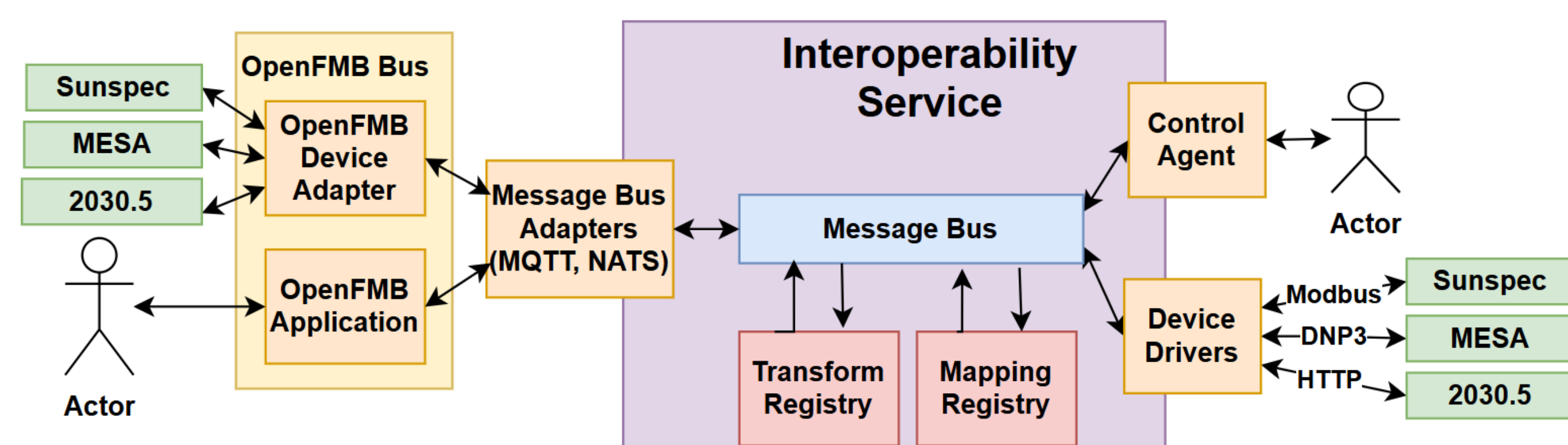


Fig. 3. Devices of any supported protocol can be made available to controllers using any other.

Enhanced OpenFMB integration for scalable coordination includes:

- Adapters that relay messages between the internal message bus and NATS or MQTT.
- Drivers enabling direct, point-to-point connections with devices and controllers.
- Identifier mapping and data structure transformations to enable communication across any two supported protocols.

Testing:

- Validated using the commercially available Eaton EdgeAP device.
- Tested and integrated with PNNL's VOLTTRON platform.

CONCLUSIONS & IMPACT

- Reduce integration costs by providing standards-based control applications and interfaces.
- Streamlines ESS integration with interoperable, agent-based control supporting diverse vendors, protocols, and operating modes.
- Demonstrated interoperability across both commercial and research-grade edge control platforms

FUTURE DIRECTIONS

- With industry partners, deploy and test the interop framework across various commercially available hardware and software.