CIM and 61850 Harmonization

Herbert Falk
Solutions Architect – SISCO

Common Information Model in Smart Grid, Distribution, Transmission Workshop

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The Holy Grail

An audience poll:

What is your primary concern?

- Operations
- Condition Based Maintenance
- Construction
- Selling Power

Properly designed intersection facilitates myriads of business applications.
Which Standard Provides What?

Some areas don’t really overlap

Some have overlap

Scope of EPRI project:
  • did not address Assets, but accommodates it.
  • addressed areas of overlap
Connecting different areas of the Enterprise

Applicability

EAI
TAI
Master-Master
Master-Device
Device-Device
Process Bus (Sensors)

CIM
Interfaces

IEC 61850
Process issue: Who has the correct information?

Some truisms:

• EMS one-lines do not accurately reflect the actual construction of a substation.

• Substation one-lines may have too much detail for the EMS.

• Neither top-down or bottom-up design methodologies work for an entire substation life-cycle.

• Harmonization of CIM and 61850 decided to address this issue through lossless conversion of 61850 Substation Configuration Language (SCL) to/from CIM.
One use case for CIM and 61850 harmonization?

61850 SCD File

- Topology (One Line)
- Communication Section

CIM

- Topology (One Line)

Control Center Functions

- Advanced Applications

Functions

- Protection
- Measurement
- Metering
- Wind and DER
- HydroElectric etc..

Logical Node Types

- Data Objects
- Common Data Classes
- Data Attribute Types
- Enumeration Types

Remote Unit

Measurements

SCADA
Aligning Topology/Connectivity

• Requires agreements on semantics of objects
  – Is a battery a consumer vs. asynchronous machine?
  – What is conducting, regulating, or just power equipment?

• CIM and 61850 already had similar constructs to electrically connect equipment.

• Equipment containership needed to be enhanced in 61850 to allow lines and plants to be containers.

• Need to agree that a WindFarm is a type of Plant.
The SCADA opportunity

- Decrease life cycle costs through the possibility of auto-configuration.

- Requires:
  - Communication Address information to be persisted and available to the EMS (comes from 61850).
  - Agreement about types of “control”
    - Direct, SBO, etc..
    - Defined and enumerated in 61850
    - Ability to freeze/control accumulator values
  - Linkage from 61850 object models to CIM Measurement model.
True SCADA requires communication addressing

• Communication addressing found in IEC 61850

• Proposed to add this to the harmonized model in such a way that the CIM SCADA package could use it.

• Extended to support addressing for DNP, IEC 870-5, as well as IEC 61850.
Measurement Model

• Proposed adding a “vector” MeasurementValue object so that magnitude and angle measurements are easily conveyed (needed for synchrophasors).

• Allowing a MeasurementValueSource to be a IED or Remote Unit (includes RTUs). This allows the auto-configuration of SCADA.
Reconciling Units of Measure (UOM)

• CIM based upon electrical quantities only.

• IEC 61850 uses full SI units to support:
  – Electrical
  – Hydro
  – Wind
  – DER
  – Weather
  – Etc..

• Proposed that CIM be aligned to support full SI units.
Ongoing efforts and results:

- Presented to the coordination working group a TC57 and believe have achieved consensus on the approach.
  - Resolving semantics were the key to consensus:
    - harmonization vs. unification

- IEC TC57 WG10 (owners of 61850) have endorsed the approach.

- Major players in IEC TC57 WG13 have endorsed the approach, hopefully full endorsement will be forthcoming from the upcoming meeting.

- Has been accepted as by PAP-8 and PAP-12 of the NIST Smart Grid initiative. It is becoming the foundation for semantic harmonization within the initiative.
Why is it important to Smart Grid

• Need for harmonization was identified early on in Roadmap:

“Develop a Common Semantic Model – …. The objective will be to unify the models of CIM (IEC61970, IEC61968) and IEC 61850 including correspondences with ANSI C12.19 and ASHRAE 135 to form a common representation of information models constructed by these standards efforts for the Smart Grid. “ [from Report to NIST on the Smart Grid Interoperability Standards Roadmap; page 91 of June 17, 2009 ]
One last important Smart Grid objective:

• “Extend IEC 61968 standard for DER: IEC 61968 needs DER models, but should be harmonized with the existing DER object models in IEC 61850-7-420,…” “[from Report to NIST on the Smart Grid Interoperability Standards Roadmap; page 143 of June 17, 2009]
Summary

The project meets/exceeds the objectives identified by NIST.

Gaining acceptance in TC57.

Gaining acceptance in the NIST Smart Grid process.

The work has been validated through implementation....
Validation of concept through implementation

Jay Mashburn
Principle Consultant for Wind Power

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Validation of concept

Actually worked with IBM to use concept for a IBM Wind Power solution.

Problem Case
• IBM created the Wind Power suite to help wind farm operators that have several disparate systems that provide a limited view of the field operations information.
  – There is typically no integrated set of applications that ties all of the various systems together to allow them to optimize and focus on running and maintaining the assets.
  – Incomplete information about the rapidly growing number of different kinds of turbines is hampering the operator’s ability to make effective decisions concerning the cost of operations.
  – Expensive Turbine Downtime. During a wind turbine’s expected 20-year service life, maintenance problems are not a question of "if," but "when." When maintenance problems ultimately occur, farms face the downside of exorbitant crane mobilization costs, lost energy production, escalating costs per kilowatt-hour and limited supplies of spare parts due to intense industry demand for components.
Challenge:
- Wind Farm operator has many different SCADA systems over the fleet of WTGs, from the various manufacturers to the different generations of WTGs within one manufacturer.

Solution:
- Transform into IEC 61400-25 standards to allow harmonizing into one normalized data set.

Result:
- Able to roll up views of the wind farms and compare different wind farms across the fleet.
Wind Company Farm example for demo purposes

Small Benbrook Wind farm

Control Room, Maintenance Shop, Substation, and Storeroom

North Area – 10 GE 1.5 MW Turbines – owned and maintained by Wind Company

South Area – 15 Vestas 1.8 MW Turbines – maintained by Wind Company

5 – Owned by True Wind Company
5 – Owned by Real Wind Company
5 – Owned by Windy Company
Could have done what has been done before:

Performing Custom Integration
IBM’s invests widely to develop and influence standards, enhance consumablity and drive standards-based business strategies.

- Early Customer Engagements
  - Competitive Initiatives
    - Products
    - Early Code (POC)
  - Partners
  - Competitors
  - Complementary

- Intellectual Property
  - Public Relations
    - Standards Bodies
    - Industry Groups
    - ISVs, Adjacent Standards

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But what standards to use: CIM and 61850 align with Smart Grid initiatives

Develop and implement consistent systems management and security policies

- R&D: Integrate and Harmonize
  - IEC 61850
  - IEC 61968
  - ANSI C12 Standards

- Develop and implement consistent systems management and security policies

Apply IEC 61970 and 61968 (CIM, GID) for Enterprise Data Sharing

Apply ANSI C12 for Revenue Metering

Apply ASHRAE BACnet™ for Building Automation

Apply IEC 61850 for Real-Time Controls
Monitoring Farm /Turbine Operations

1. Investigation of alarm management and detail drill down

2. Work Order Request is created, Dispatch of PM work to do while tech is at the turbine

3. Safety Permits signed on and work order completions

4. Operations verifies turbine restored to normal Operation

5. Work Order completion triggers Bill creation for work performed

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IBM’s Wind Power Suite Solution

Smarter power for a smarter planet

Deep Thunder
Real time Weather Forecast

Optimization and Forcasting

Analytics and Reporting

Analytic Tools / Reports

Enterprise Service Bus
incl. Complex Event Processing, Mapping, Mediation, ...

WebSphere

Workforce Mobility

Work Management

Inventory Purchasing

Asset Management

Geospatial

Various SCADA Management Systems

Real-time & Historical Database

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Where the standards are used

- Uses harmonized model
- CIM
- CIM, 61850, and extensions
- CIM messaging and interfaces

IEC 61400-25-2/61850
Summary

• Have proved that the Harmonized model allows a wide range of business opportunities.

• Have proved feasibility.

• Aligns with Smarter Planet initiatives across various industries
Together…Shaping the Future of Electricity