

## The Smart Grid as a Semantically Enabled Internet of Things

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Full paper at <http://www.pointview.com/data/files/3/2433/2137.pdf>.

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The IOT envisions a network of devices of varying degrees of “smartness” which provide a distributed intelligence.



- Data that is self-describing can be automatically linked to other, related data.
- An ontology structures metadata tags, which are used to make data self-describing.
- Data with shared metadata is interoperable.
- When the ontology is a formal, logical model a reasoner can infer additional information, find inconsistencies, etc.
- An ontology is a solid foundation for rules.

# What are Smart Grid IT Challenges?

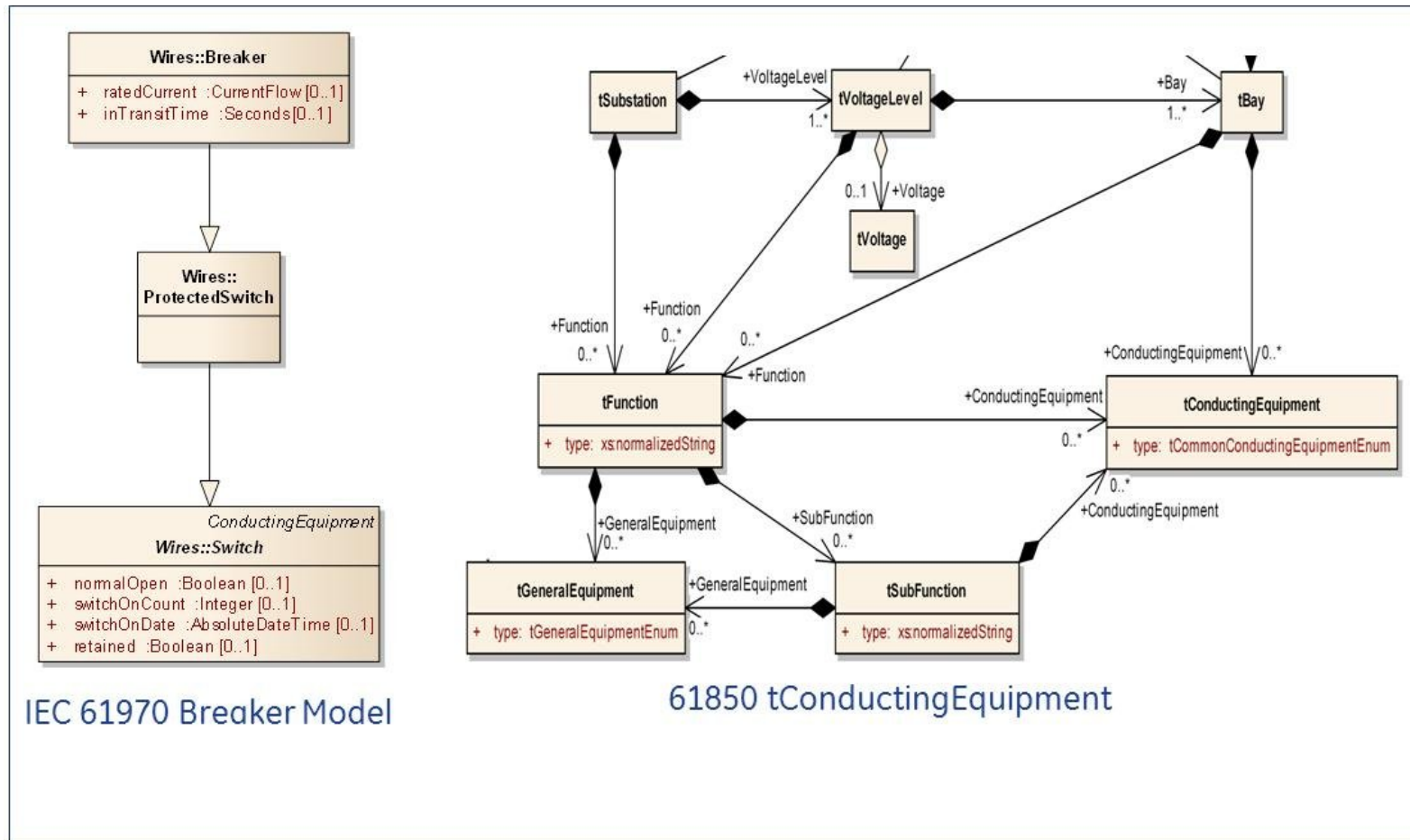


- Reliability—will the communication network provide the required quality of service?
- Security—think Stuxnet, or NYC as a billboard for satellite viewers.
- Scalability and Performance—some functions require near-real-time response
- Privacy—a burglar's dream?
- Complexity—what happens when you overlay two complex but different networks?



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  - Complexity—
- These are the same challenges faced by IOT or Semantic Web or both!
- overlay two complex but different networks?

- Rollup and Aggregate Data—a lot like Linked Data
- Validate Data, Infer Additional Information
- Facilitate Configuration Management
- Interoperate between Standards, e.g., IEC CIM and IEC 61850

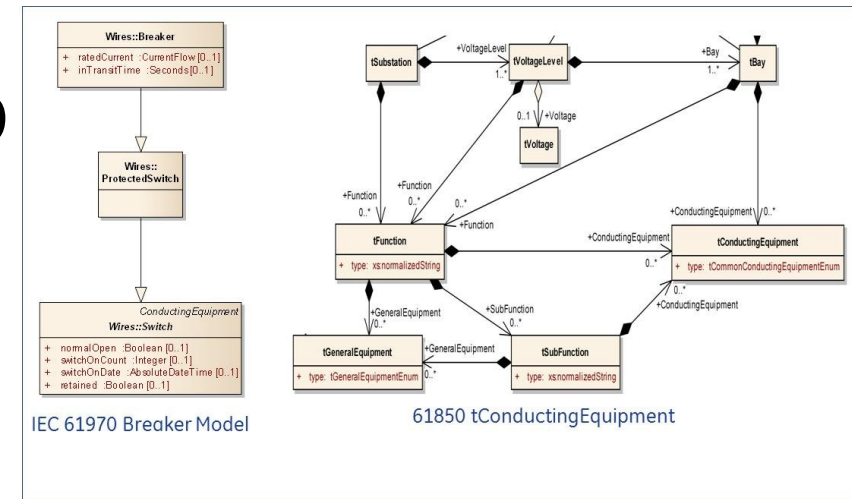


IEC 61970 Breaker Model

61850 tConductingEquipment

- CIM includes the notion of a circuit breaker class directly
- 61850 uses the generic notion of a **ConductingEquipment** class to be “cast” as type “circuit breaker” using the CBR enumerated type.

- Rebuild both standards to use common model (yeah, right!)



- Create a common, upper-level ontology with extensions for each standard
  - Map common elements axiomatically
  - Do rule-based translation of more difficult elements

- Reasoning Is Memory Intensive
  - Massive memory machines
  - RAM cloud
- Access Control
  - Model explicitly?
  - Model separately, provide as a service?
- Data Provenance
  - Implicit provenance by location insufficient
  - Can be modeled in parallel

- Smart Grid Is Not Unique but a Use Case of IOT with common goals and challenges
- Self-Describing Data Using Shared Ontologies (Linked Data) Enables
  - Distributed, autonomous smart devices
  - Interoperability across standards
  - High degree of configurability

Smart Grid developers should keep an eye on the IOT and Semantic Web technologies.