Security & Privacy in Smart Grid

- Detect data sources, read data streams & build usage pattern.
- Send "constructed" data & determine internal state by analyzing output.
- Impersonate the system & get all users’ data stream; Send bogus responses back to the consumers.
- Connect to the system & add/change queries on application’s behalf.

- Production data accessible only to ORG-X’s processing system & In-house apps.
- Consumer devices & usage pattern not to be disclosed.
- Adapt to on-demand change in privacy policies.
- Control access to specific objects – streams, attributes, operators – based on admin/consumer policies.
- Control access to APIs based on the contracts with the applications.

Semantic Event Processing & Information Integration

- Integrated Smart Grid Information Model (iSGIM) – modular & extensible domain ontologies.
- Provide common semantics for Smart Grid data and concepts.
- Support intelligent applications using heterogeneous information sources
  - Smart meters, Household appliances, weather forecast service

- Semantic Complex Event Processing for Smart Grid
- Abstract complex events & processing operations as queries and rules on top of iSGIM
- Provide platform-independent and scalable event processing
- Identify meaningful events within the information cloud
- Analyze their impact & take subsequent realtime actions

Machine Learning for Predicting Energy Usage

- Predict peak demand on Utility
- Predict usage for new customers
- Cluster customers into sub-groups
- Provide users with individual usage data & analysis
- Data mining for fault detection

- Energy Monitoring tools
- Means for sharing & comparing usage data with other parties
- Track consumption change with change in appliances/equipment
- Provide appliance-level consumption details
- Explain unusual usage activity
- Learn from historical data to predict energy use patterns

Cloud Computing for Scalable Info Management

- Cloud storage for historic data
- Tailor Cloud VMs to various roles
  - Pattern matching on streams
  - “Hub-Spoke” VMs for response propagation to consumer AMIs
  - VMs to inform Utilities of power demand predictions
- Research
  - Mapping DR apps to compute
  - Optimize VM usage for cost