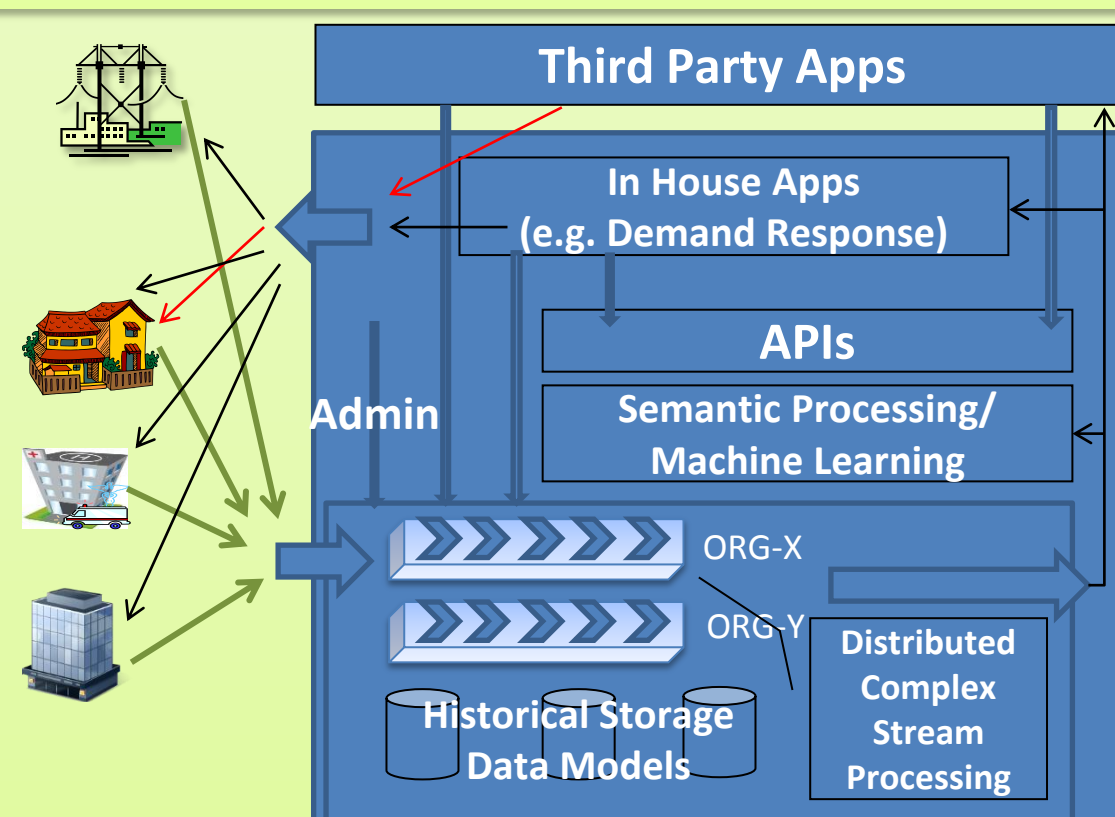


Security & Privacy in Smart Grid

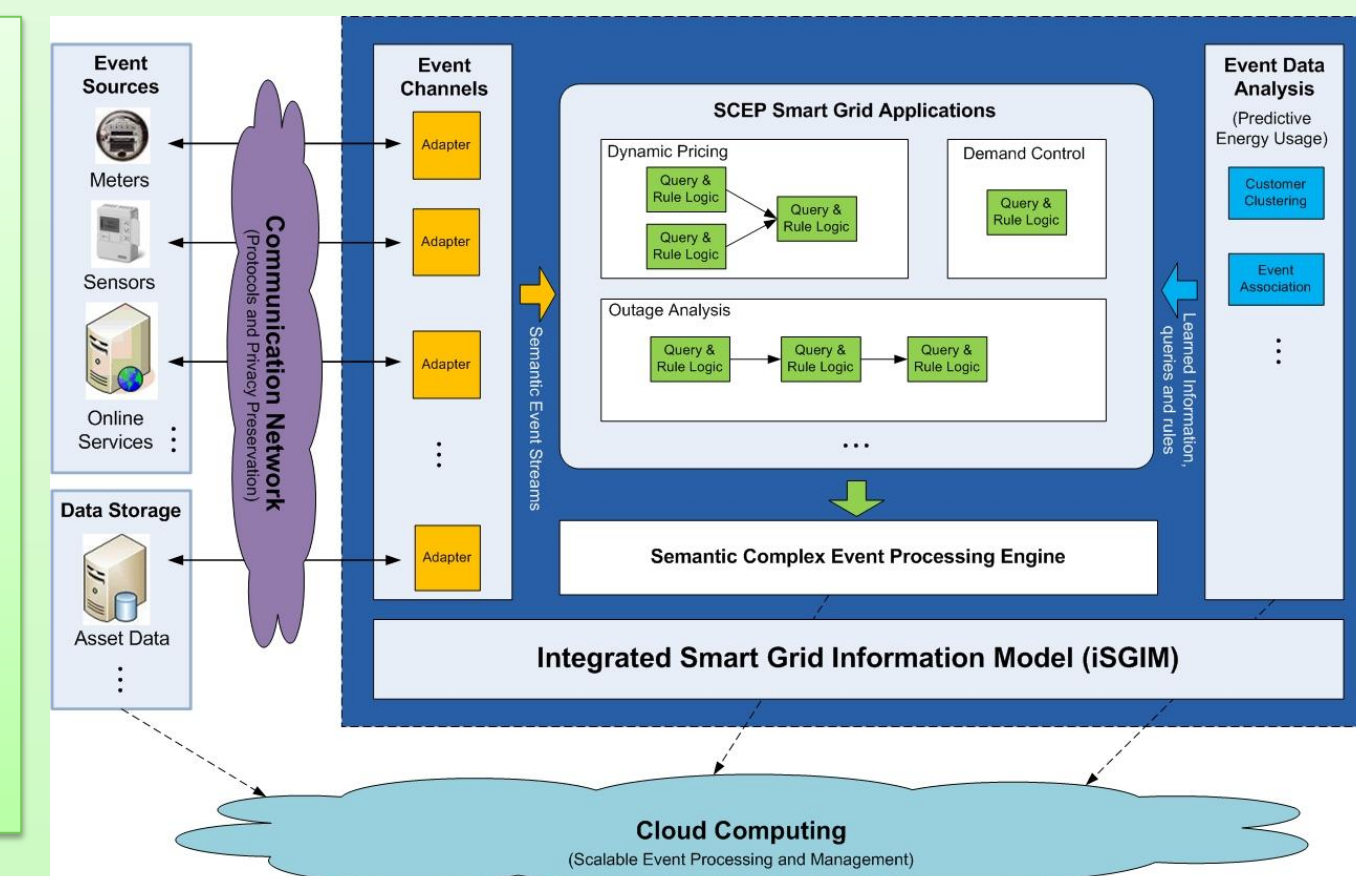
- Detect data sources, read data streams & *build usage pattern*.
- Send “constructed” data & *determine internal state* by analyzing output.
- *Impersonate* the system & get all users’ data stream; Send bogus responses back to the consumers.
- Connect to the system & *add/change queries* on application’s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



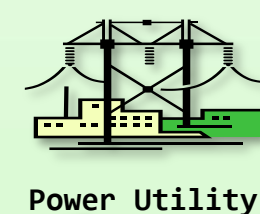
Semantic Event Processing & Information Integration

- *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

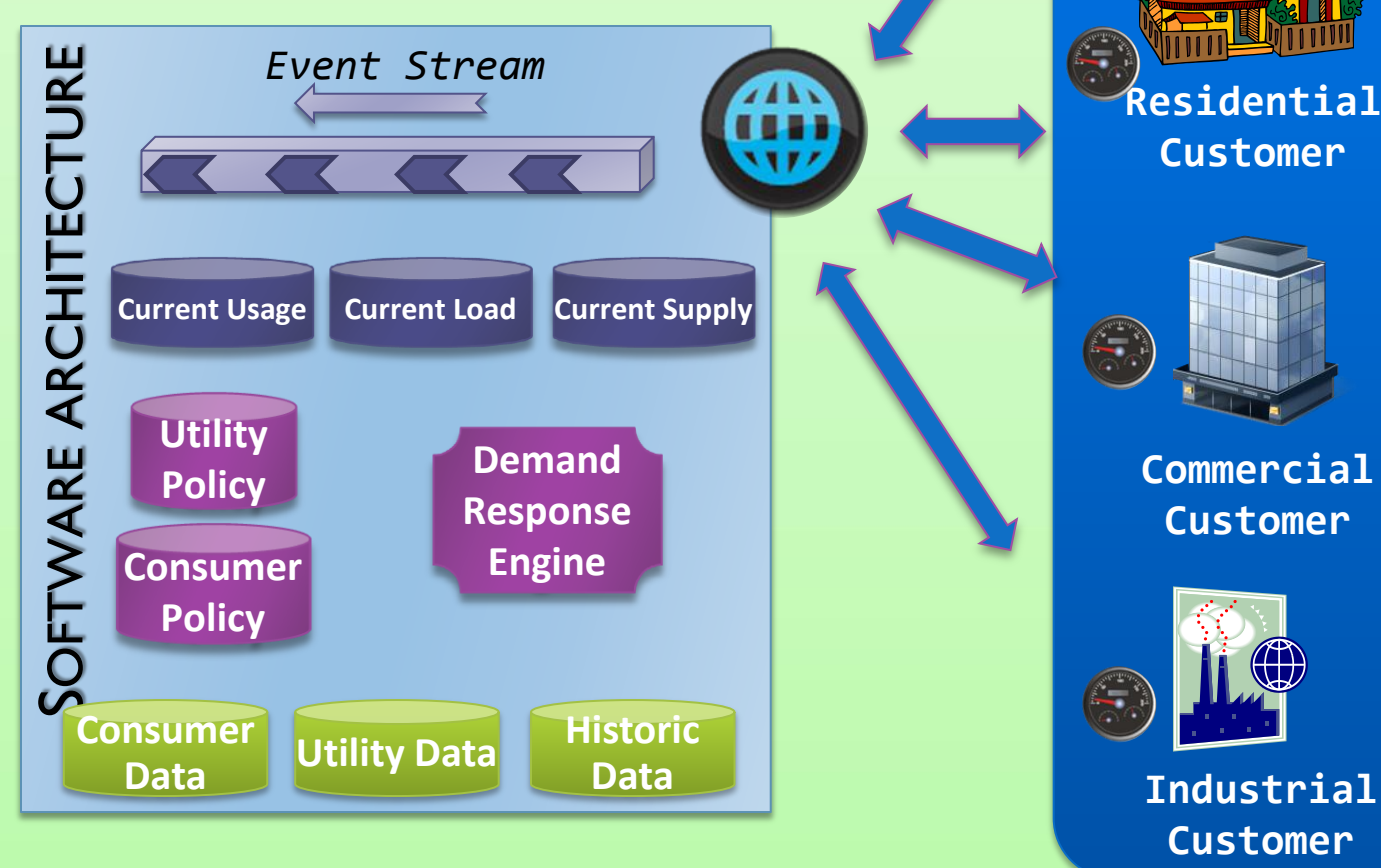


- *Semantic Complex Event Processing* for Smart Grid
- Abstract complex events & processing operations as *queries and rules* on top of iSGIM
- Provide *platform-independent* and scalable event processing
- Identify *meaningful events* within the information cloud
- *Analyze* their impact & take subsequent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

- 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*

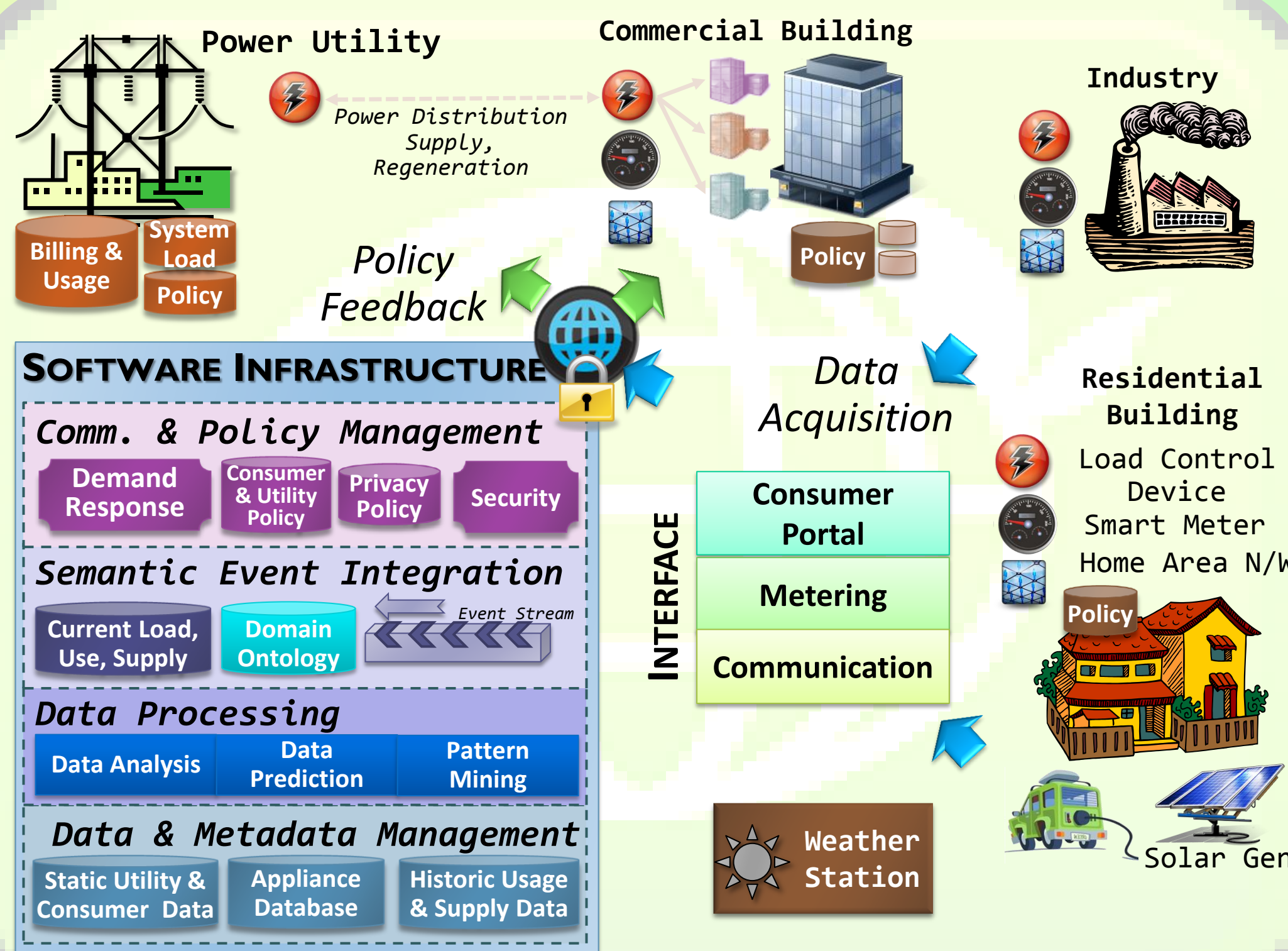


Power Utility

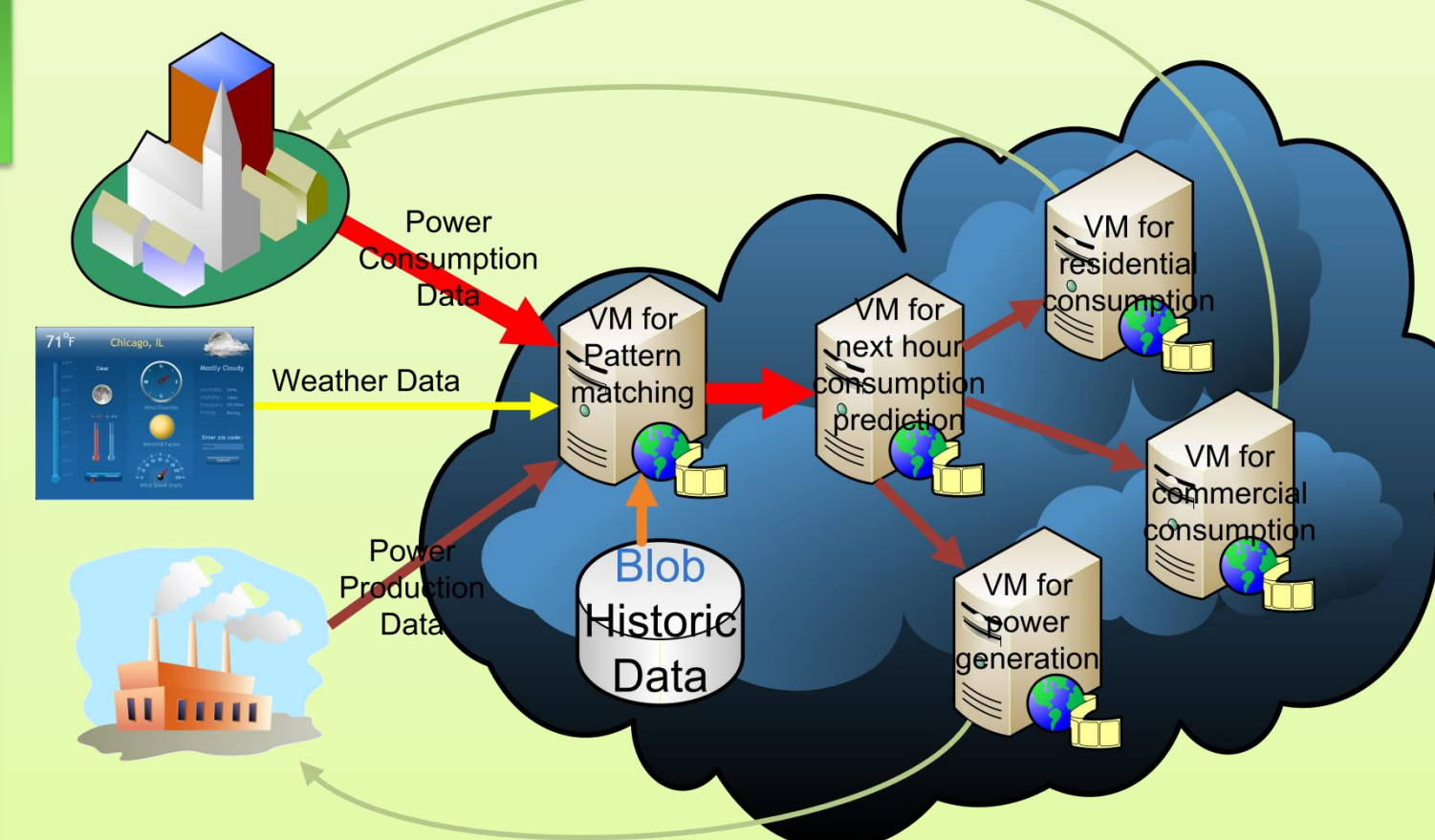


- Energy Monitoring tools
- Means for *sharing & comparing usage* data with other parties
- *Track consumption change* with change in appliances/equipment
- Provide appliance-level consumption details
- Explain *unusual usage activity*
- Learn from historical data to *predict energy use patterns*

Machine Learning for Predicting Energy Usage



- *Large-scale, high-frequency* data/metadata collections
 - Power consumption in residential, commercial area
 - Power production data, Weather data
- *Data storage challenge*: GB’s of data per day accumulating from 1000’s of sources
- *Computation challenge*
 - Real-time analysis of streaming data at scale
 - Historic data pattern matching for usage prediction



- 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

Cloud Computing for Scalable Info Management