

Smart Communication of Energy Use and Prediction in a Smart Grid Software Architecture

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Smart Grid Environment

- Advanced monitoring and metering systems provide real-time data on energy use
- Energy consumption data can be analyzed and fed back to consumers
- Improves consumer insight and engagement, and promotes energy conservation behavior

Energy Use and Prediction Modeling

Approach: Apply Machine Learning methods to model energy use by consumers

Services for Consumers:

- Energy Monitoring tools
- *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

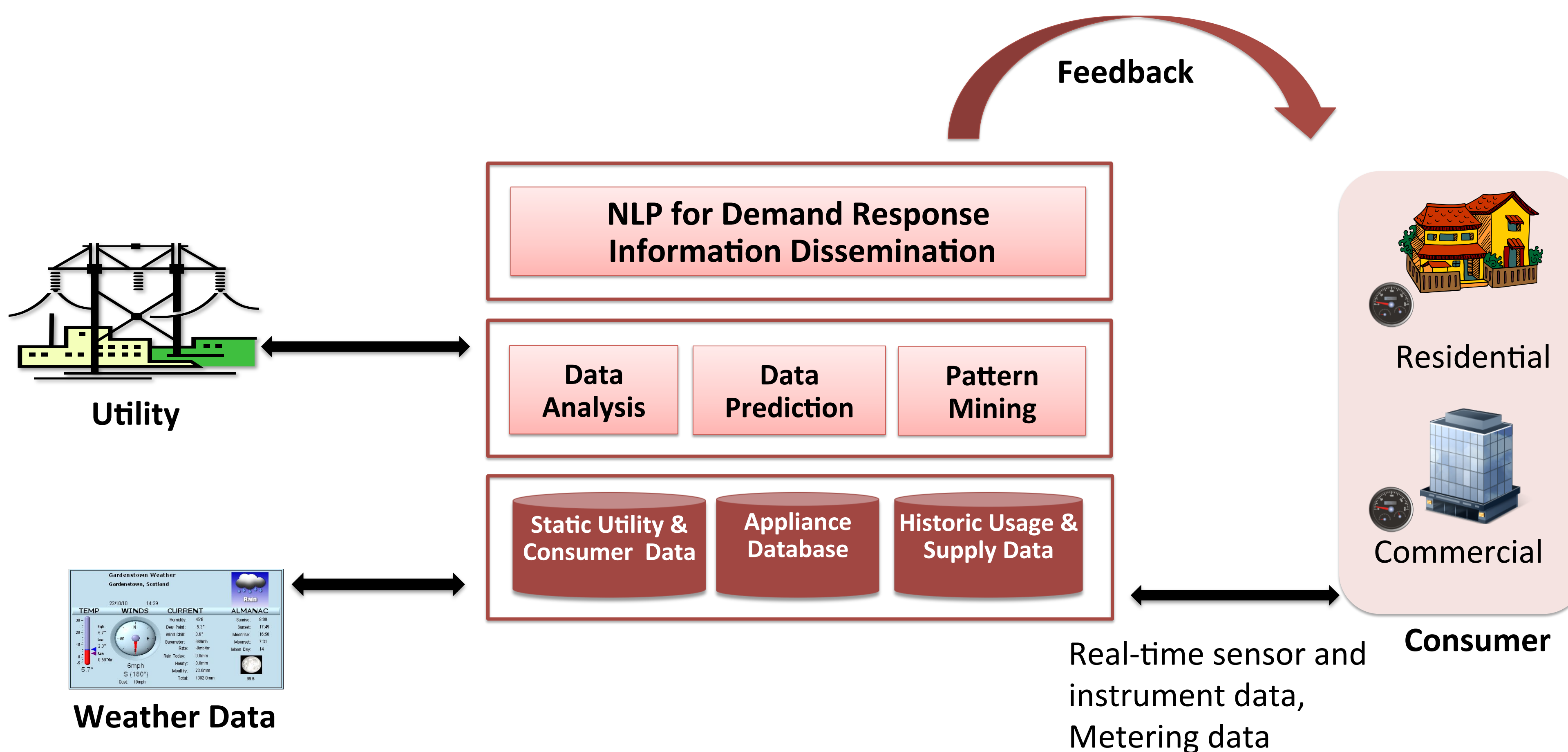
Tools for Utility:

- Predict *peak demand* on power grid
- Predict *usage* for new customers
- *Cluster* customers into sub-groups for targeted incentives
- Provide *individual usage* data & analysis
- Data mining for *fault detection*

Smart Communication with Consumers

Problem: Effective communication of energy use and prediction to the consumer

- Providing detailed consumption information in itself may not lead to a change in consumer behavior
- Need to provide aids for interpreting information and tips on specific actions to take



Smart Energy Use and Prediction Communication Model

Premise: Make information comprehensible, personalized and actionable

- Textual information to accompany numerical data in form of tables and graphs
- Consumers can sign up for routine messages:

- Energy usage and prediction information
- Demand Response and pricing messages
- Targeted incentives from the Utility
- Suggestions about specific actions to take
- Explanation of salient features of usage and any unusual usage

- Friendly reminders with contextual information
- Positive encouragement
- Competition among friends on energy savings
- Ranking of user on a 'green' scale among peers
- Advertisements from device and appliance manufacturers and retailers

Need: To automatically generate text messages based on the numerical data

- Advantages of using textual data:
 - Easy to comprehend; help interpret graphical data
 - Can be combined with Text-to-Speech (TTS) systems and Machine Translation (MT) systems

Center for Energy Informatics (cei.usc.edu)

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Research Challenges

- Modeling user information (needs to be continuously updated based on change in behavior)
- Predicting energy usage based on past consumption, user models and other contextual data
- Automatically generating information in natural language from structured numerical data
- Generating personalized feedback (tailored in 'content' and 'style' to individual users)