New Applications of Electronic Commerce Technology To Energy, Buildings, and Capital Management

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Agenda

- Introductions
- Markets
- Smart Grids + Smart Buildings
- Use Case
  - More Intelligence, More Information
- Pricing
- Agent Service Definition
- Realism
- eCommerce, Security, SOA
- Benefits
- A Challenge

Introductions

- Who am I (William Cox)?
  - Consulting enterprise software architect
  - Elected to OASIS Technical Advisory Board
    - OASIS is the leading eBusiness, Web services, and XML vocabulary standards venue
  - Skilled at building standards and products from ideas to adoption
  - Business, marketing, and technical background
  - http://www.CoxSoftwareArchitects.com/energy
- Toby Considine biography in paper, other talk in this session

Markets

- Markets Provide
  - Effective distributed management of resources
  - Economic rationale for demand management
- Energy Markets Today
    - Wholesale electric
    - Commercial and Industrial consumers (hourly, …)
    - Starting for residential consumers
- Consumer and Producer
  - Consumer = user of energy
  - Roles change quickly
    - Micro Grids, co-generation, office park solar, …

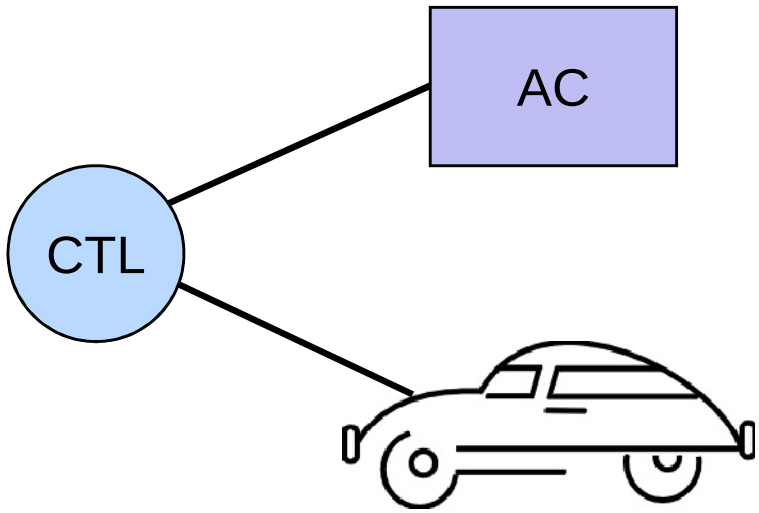
Smart Grids+Smart Buildings

- Electronic Commerce Technologies
  - Fine-grained security
  - Collaboration, messaging, publish-subscribe
- Building Technologies
  - Control and monitoring of building systems
  - oBIX, agents, coming semantic services
- Apply standards we already have to solve new problems

Use Case—Cars+AC

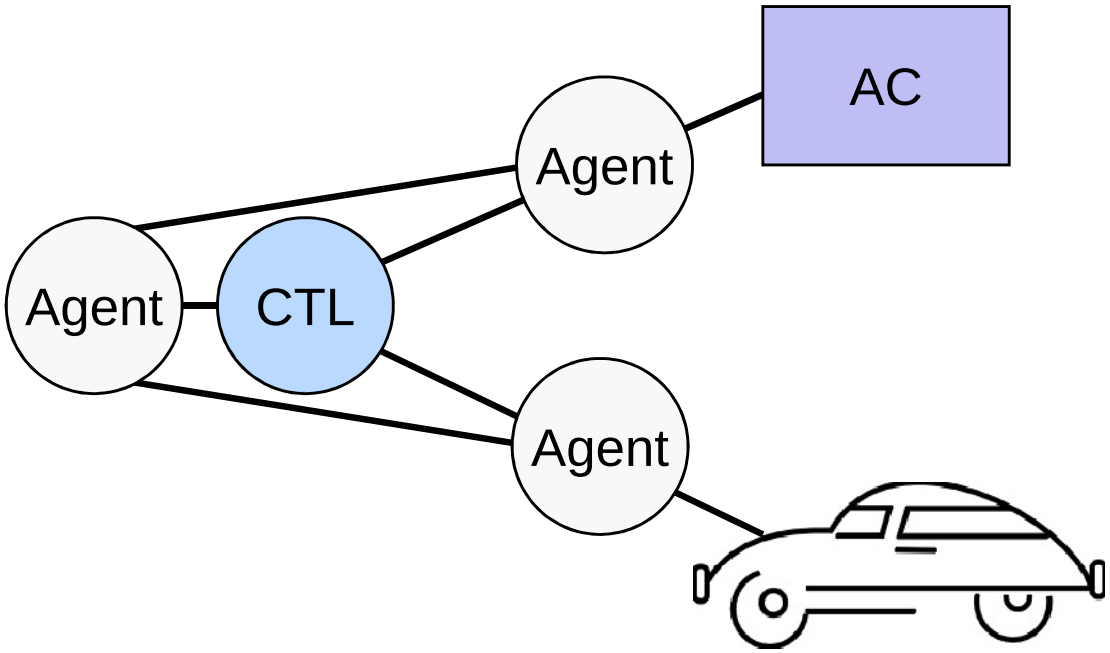
- Significant energy demand
- Not generating capabilities (PEHV)

- Wrong Timing:
  - Come home at 6pm
  - Plug in car to charge
  - Flip on air conditioner
  - Peak demand increases (more power)
  - Cost to deliver increases (higher peak)



More Intelligence

- Include Agents
- Services provided
  - Time of day info
  - Occupancy info
  - Communication
- Agents for each consuming appliance
- Pricing



Pricing (1)

- Static Pricing
  - Pricing varies in manner known in advance
  - Often months in advance
- Varieties of Static Pricing
  - Flat-Rate pricing (FR)
  - Seasonal rates (SR)
  - Time-of-use pricing (TOU)
  - Critical Peak Pricing (CPP)
    - Less notice

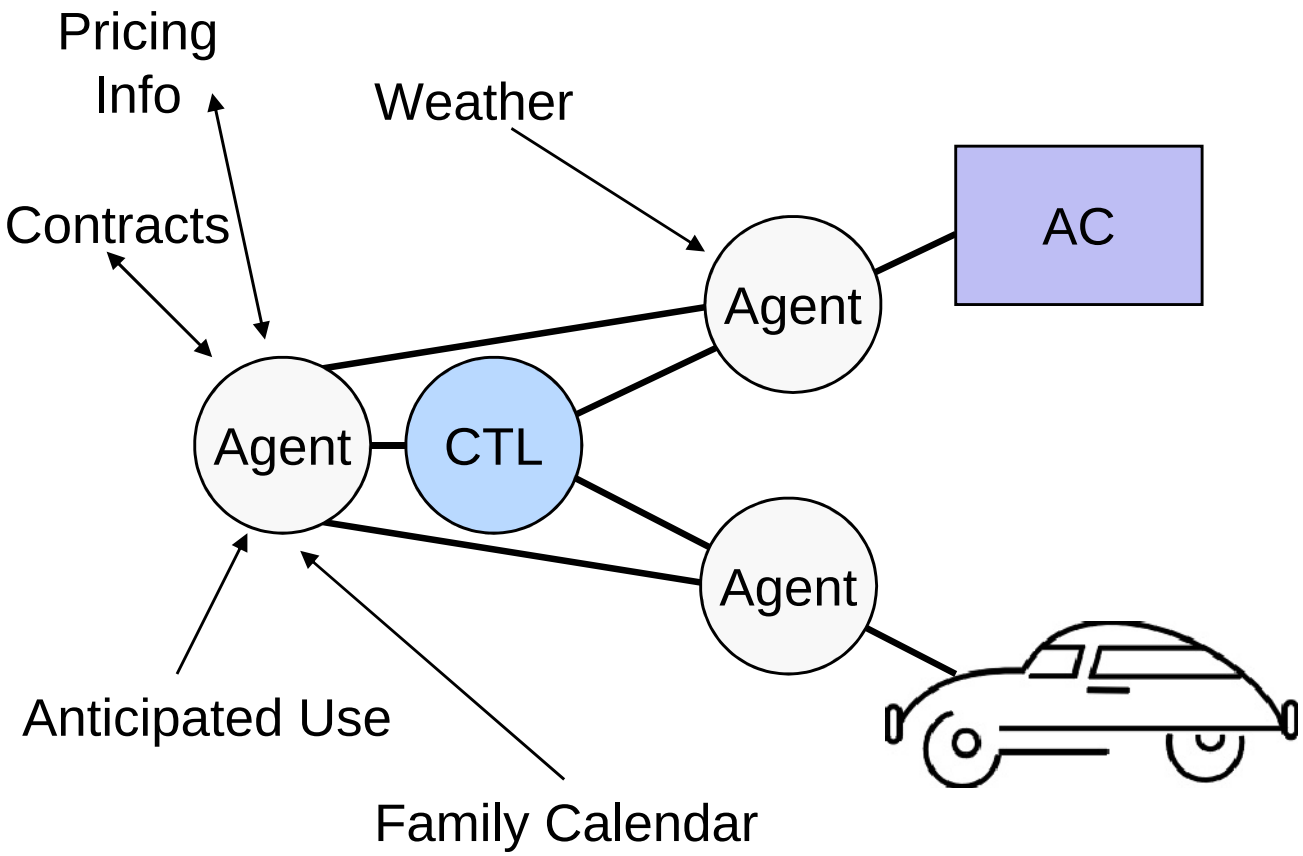
Pricing (2)

- Dynamic Pricing
  - Pricing varies but not definitely known in advance
  - Must query, subscribe, be notified
- Varieties of Dynamic Pricing
  - Real-time Pricing (RTP)
  - Price-ahead (P-A)
- Future Pricing
  - Orthogonal
  - Static and Dynamic can be known in advance
  - Think *Futures Market*

Agent Service Definition (1)

- Manage energy purchases
- Manage energy consumption
- Inputs (so far)
  - Pricing information
- Outputs (so far)
  - Control signals for car charging station
  - Control signals for Air Conditioner

More Information (1)



More Information (2)

- Current information
  - Weather
    - Outdoor reset controls
  - Occupancy
    - IR Sensors
  - Usage
- Anticipated information
  - Weather
    - Forecast of temperature, wind, cloud cover
  - Occupancy
    - Calendars
  - Usage
    - Calendars

More Information (3)

- What is anticipated use of car?
  - Charge time 4 hours
  - Pick up son at 7:30pm
    - Buy more expensive power to charge now
    - Top up battery now so have reserve for trip
  - OR no use until morning
    - Buy less expensive power in forward market
- What is anticipated use of Air Conditioner?
  - Going out at 7:30pm?
    - Pre-cool at cheaper rates
    - Cycle compressor to keep comfortable

Agent Service Definition (2)

- Manage energy purchases
- Manage energy consumption
- Inputs (so far)
  - Pricing information (and forward markets)
  - Intended use and range for car
  - Weather, intended use for AC
- Outputs (so far)
  - Control signals for car charging station
  - Control signals for Air Conditioner
  - Purchases and purchasing decisions

Realism of the Models

- Can be implemented today
  - Controllers off-the-shelf
  - Sensors
  - Information flows need to be defined
  - Agents
    - Single board computer, embedded, or shared
  - Calendar information
- Pricing information and markets not mature
- eCommerce, Security implementations widely deployed
- Communications thru AMI, internet, phone

eCommerce, Security, SOA

- Who has the authorization to execute contracts?
  - Authentication, authorization, delegation, privacy
- Consistent contracts
- Agency and negotiation
- Web services for weather, pricing, contracts
- Calendaring and event standards for usage
- SOA provides simpler scalable view
- Easier communication of other considerations
  - Kids home for Thanksgiving?
  - Budget limits and tradeoffs?
- Economic information drives demand decisions

Benefits

- Consistent with GridWise Interoperability Principles (details in paper)
- Infrastructure doesn't need expensive expansion
- Home/Business owner in control
  - Pricing limits costs while ensuring desired comfort
- Markets provide best communication and fastest response

Where Next?

- Extend to Industrial and Commercial
- Refine the architectural model
- Elaborate the service definitions
- Validate that the same SOA will work
  - With elaborations in service definitions
  - With composition of needed security, reliability…
- Examine demand elasticity effects

A Challenge

- New energy and building technologies need to consider eCommerce/enterprise issues
  - Enable economic interaction and solutions
  - Move from Command & Control to markets
- OASIS Blue Initiative
  - Energy, buildings, eCommerce technologies
  - blue@oasis-open.org
- Join us in applying these techniques to Smart Grids and Smart Buildings

Questions

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