OpenADR Transactive Services

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Who Is The Energy Mashup Lab?

- Open Source Foundation in startup mode
- Transactive Energy
  - IoT Transactive Resource Framework—AllSeen Alliance
  - Common Transactive Services
- Transactive Energy Agents
- http://theenergymashuplab.org
- Join us!
  - Newsletter
  - Memberships
  - Projects
Who Am I?

- Consulting Software Architect
- Structuring systems and service definitions
- Standards
  - Co-Chair with David Holmberg of OASIS Energy Interoperation
  - Co-Chair of OASIS Energy Market Information Exchange
  - Architect for OpenADR to OpenADR2/EI evolution
  - Lead on WS-Calendar Platform-Independent Model
  - Lead on IEC OpenADR2b-CIM Demand Response Interoperation
- Selected Frameworks and projects
  - Publishing on transactive energy from before we called it that
  - NIST Smart Grid Framework architecture section, co-wrote business section

http://CoxSoftwareArchitects.com
Main Points

- Transactive Energy Principles
- Transactive Energy Benefits
- Common Transactive Services
- Transactive Microgrids built with OpenADR
- What changes are needed?
- What advantages are gained?
- Strategic questions answered
## Transactive Energy Principles

<table>
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<tr>
<th>Highly automated coordinated self-optimization</th>
<th>Transactive energy systems should provide for non-discriminatory participation by qualified participants</th>
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<tr>
<td>Transacting parties are accountable for standards of performance</td>
<td>Transactive energy systems should be observable and auditable at interfaces</td>
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<tr>
<td>Maintain system reliability and control while enabling optimal integration of renewable and distributed energy resources</td>
<td>Transactive energy systems should be scalable, adaptable and extensible across a number of devices, participants and geographic extent</td>
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Source: [GridWise Architecture Council](https://www.gridwise.org)
Transactive Energy Benefits

- Not transactive control
  - We use a more specific definition than the GridWise Architecture Council’s Transactive Energy Framework

- Only Transactive Energy addresses surplus and shortage
  - All mechanisms address shortage

- Each actor’s goals are different—one size does not fit all

- Highly Automated coordinated self-optimization
  - Each actor buys or sells energy consistent with their business/personal goals and needs
Common Transactive Services

- Enables interoperation across all examine TE Systems
  - TeMIX
  - Pacific Northwest SG Demo Project
  - PowerMatcher
  - IEC 62325

- Simplest complete set of transactive services

- Transactive profile included in OASIS Standard

- Being advanced in IEC (62939-3 in process)
<table>
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<tr>
<th>Common Transactive Service</th>
<th>Description</th>
<th>Other Names Used</th>
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<tbody>
<tr>
<td>Quote</td>
<td>Provide or request a price quotation on a product</td>
<td>Price quote, quote</td>
</tr>
<tr>
<td>Tender</td>
<td>Make a tender to buy or sell a product. Tenders may be binding or non-binding.</td>
<td>Offer, bid</td>
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<tr>
<td>Transaction</td>
<td>Accept a Tender, agreeing to and creating a Transaction binding on the parties.</td>
<td>Acceptance, contract, clearing</td>
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<tr>
<td>Delivery</td>
<td>Meter the actual delivery quantity</td>
<td>Verify, certify, meter, read meter</td>
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What Changes are Needed?

- Add two services
  - EiTender (offer/bid)
  - EiTransaction (acceptance/contract)
  - Much simpler than EiEvent
- See OASIS Energy Interoperation (IEC 62939-3 in process)
- See the Common Transactive Services for details

- The OpenADR Alliance has already defined security profiles, interaction profiles, and test & certification
  - Apply the security profile set
  - Fit the Energy Interoperation standard to the OpenADR2 RESTful services
  - Determine when certification is needed
What Advantages are Gained?

- Build on OpenADR2’s installed base
- First mover advantage—one of first to a broad market
- 100% compatible with OpenADR2b
- Adds Transactive Energy to Demand Response strength
- Adds Demand Response strength to Transactive Energy
- Gives Alliance members the opportunity to experiment and innovate with Transactive Energy in advance of the competition
Answers to the Strategic Questions

My advice to the OpenADR Alliance

- How could OpenADR enable Transactive Energy Systems?
  - Build from DR strength
  - Improve Transactive Energy with back off DR
    - To soft management rather than less acceptable hard control
  - Conforms to the Common Transactive Services
    - See NIST TEC Common Transactive Services Report and TES 2016 paper

- Are Transactive Energy initiatives and demonstrations leveraging OpenADR?
  - Transactive Microgrid design (TEC) extends transactive capability in a microgrid implemented with OpenADR2
    - Design and requirements completed
    - See NIST TEC Microgrid Group and TES 2016 paper
  - EPRI California Energy Commission project extends OpenADR
  - At least one other CEC project is using standards-based Transactive Energy
  - Most are “roll your own” inventions, technology explorations
Answers to the Strategic Questions (2)

My advice to the OpenADR Alliance

- What is OpenADR’s competition when it comes to Transactive Energy Standards?
  - Standards: only IEC 62325 series
  - Others are proposed to be used but not standardized
  - Only OpenADR is an IEC document and can have transactive capability

- How should the OpenADR Alliance address Transactive Energy?
  - Do nothing different?
  - TE relevant branding and positioning? **YES**
  - Technical improvements to support TE? **YES**
  - Make transactive services available anticipating growth in Transactive Energy
  - Help fuel that rapid growth by having a standard TE systems that maps to all other transactive systems
Thanks!

Questions and comments welcome—I’m looking forward to the continued conversation
References

- The Energy Mashup Lab – open source foundation for Transactive Energy and Energy Agents (including IoT)

- Transactive Energy Challenge Papers and Presentations

- OASIS Energy Interoperation (IEC 62939-3 in process)

- Common Transactive Services paper and report for details on the services

- William Cox papers
  [http://coxsoftwarearchitects.com/Pages/C_New.html](http://coxsoftwarearchitects.com/Pages/C_New.html)

- GridWise Architecture Council Transactive Energy Principles