
# IoT/PowerMatcher Test Bed

**1st International Semantic Web 3.0 Standard**
**for the Internet of Things (IoT)**

**William J. Miller**
**ISO/IEC/IEEE P21451-1-4**
**Chairman**
Transactive Energy Test Bed Team Leader

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# Internet of Things (IoT)


http://www.sensei-iot.org

# IoT/PowerMatcher for Smart Cities

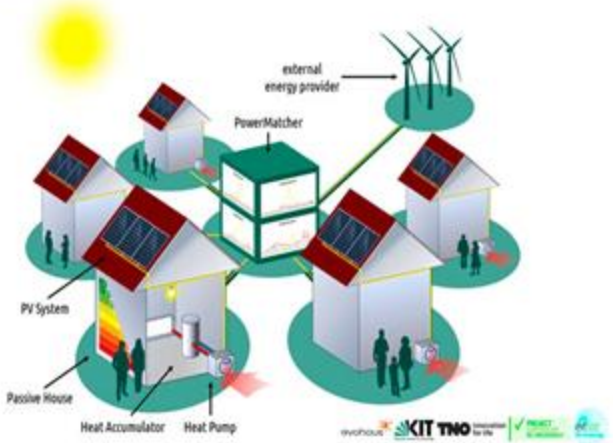
NIST Transactive Energy Challenge
NIST Global Cities Team Challenge II

# *Transactive Energy For Smart Cities*


GLOBAL CITY TEAMS CHALLENGE

2016

PowerMatcherSuite
Transactive Smart Energy




**Sensei/IoT*** XMPP

# NIST GCTC II / TE Test Bed Team

- TNO/Alliander – Netherlands
- SUSE SE – Sweden
- Esensors – Buffalo, NY
- MaCT USA – Washington, DC

# Smart Cities

- Buffalo State (Buffalo, NY)
  - Solar
- Rowan University (Glassboro, NJ)
- University of Ontario Institute of Technology (Oshawa, ON)
  - Solar and Wind

# Transaction Simulation via the Internet

- Carnegie Mellon University (Pittsburgh, PA)
- Vanderbilt University (Nashville, TN)

# IoT/PowerMatcher Test Bed

- Utilizes XMPP over Websocket and IoT Discovery/Provisioning
- Provides high performance to make energy transactions in a simulated energy micro market via the Internet
- Demonstrates the benefits of decentralized energy grid balancing

# IoT/PowerMatcher Benefits

- Benefits for Consumers
  - cost savings
  - maximum choice in consumer devices
  - prevent equipment lock-ins
  - enable micro energy market
- Benefits for Utilities
  - reduced complexity
  - shifting energy usage control to consumers for better engagement
  - balancing energy grid
  - support of renewable generation

# IETF RFC & XEPs

- IETF RFC7395 Sub-protocol XMPP over Websocket
- https://datatracker.ietf.org/doc/rfc7395/?include_text=1
- XEP-0305 XMPP Quickstart
- http://xmpp.org/extensions/xep-0305.html
- XEP-0347 IoT Discovery
- http://xmpp.org/extensions/xep-0347.html
- XEP-0324 IoT Provisioning
- http://xmpp.org/extensions/xep-0324.html
- XEP-0322 EXI Compression
- http://xmpp.org/extensions/xep-0322.html

# TE Test Bed Methodology

- Using PowerMatcher to demonstrate decentralized energy transactions
- Protect privacy of end-users and without exposing end devices
- Bi-directional data exchange to multiple PowerMatcher nodes with secure streaming metadata
- RE: IETF RFC & IoT XEPs in ISO/IEC/IEEE P21451-1-4 (Sensei-IoT*)

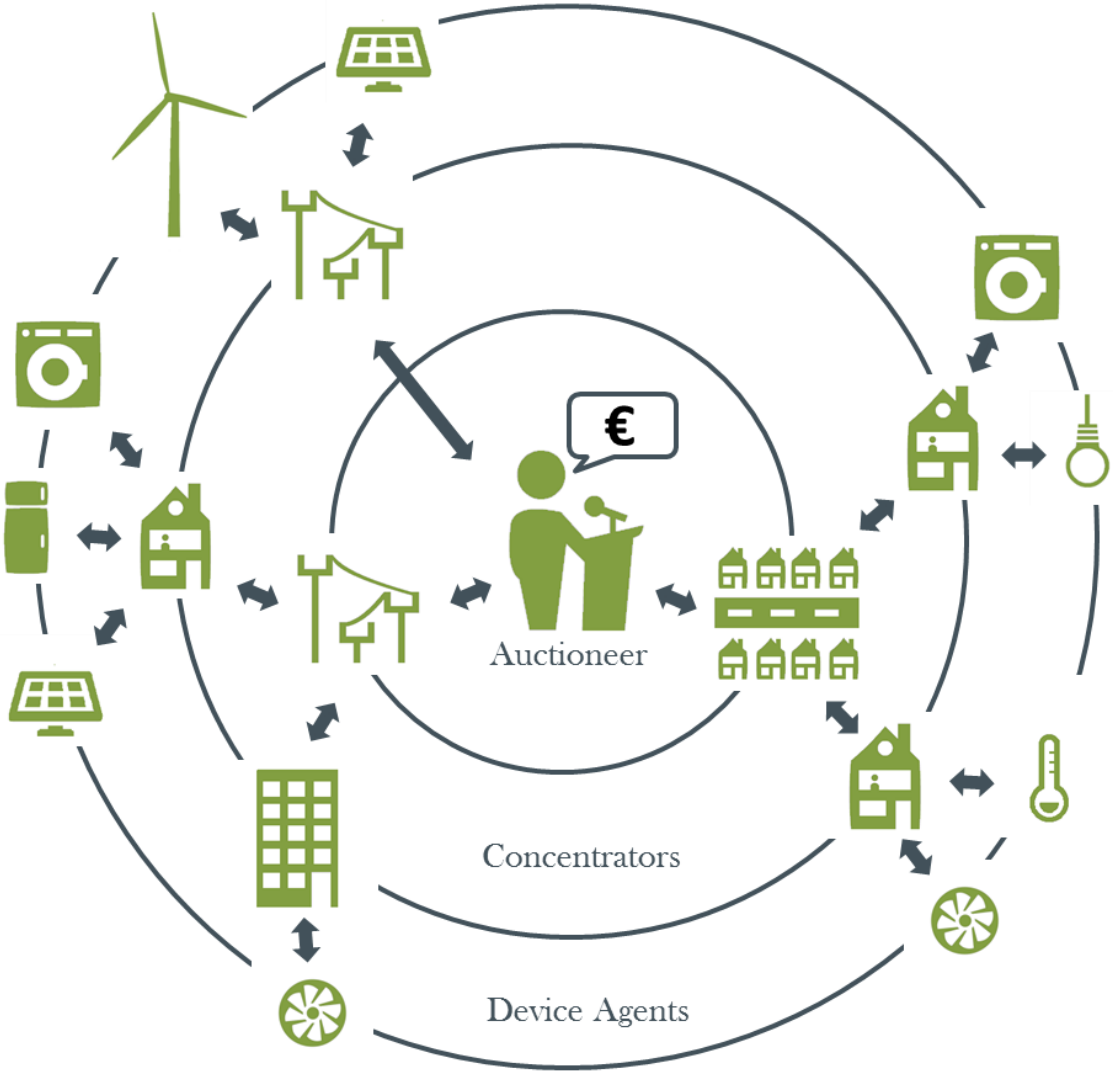
# TE Test Bed Methodology

- IoT/PowerMatcher Cities in the US and Canada
- The Smart Cities approach is similar to the pilots in the Netherlands
- Transaction metadata will be sent via the Internet
- PowerMatcher clients will communicate with the aggregator which interfaces with the simulated transactive energy grid

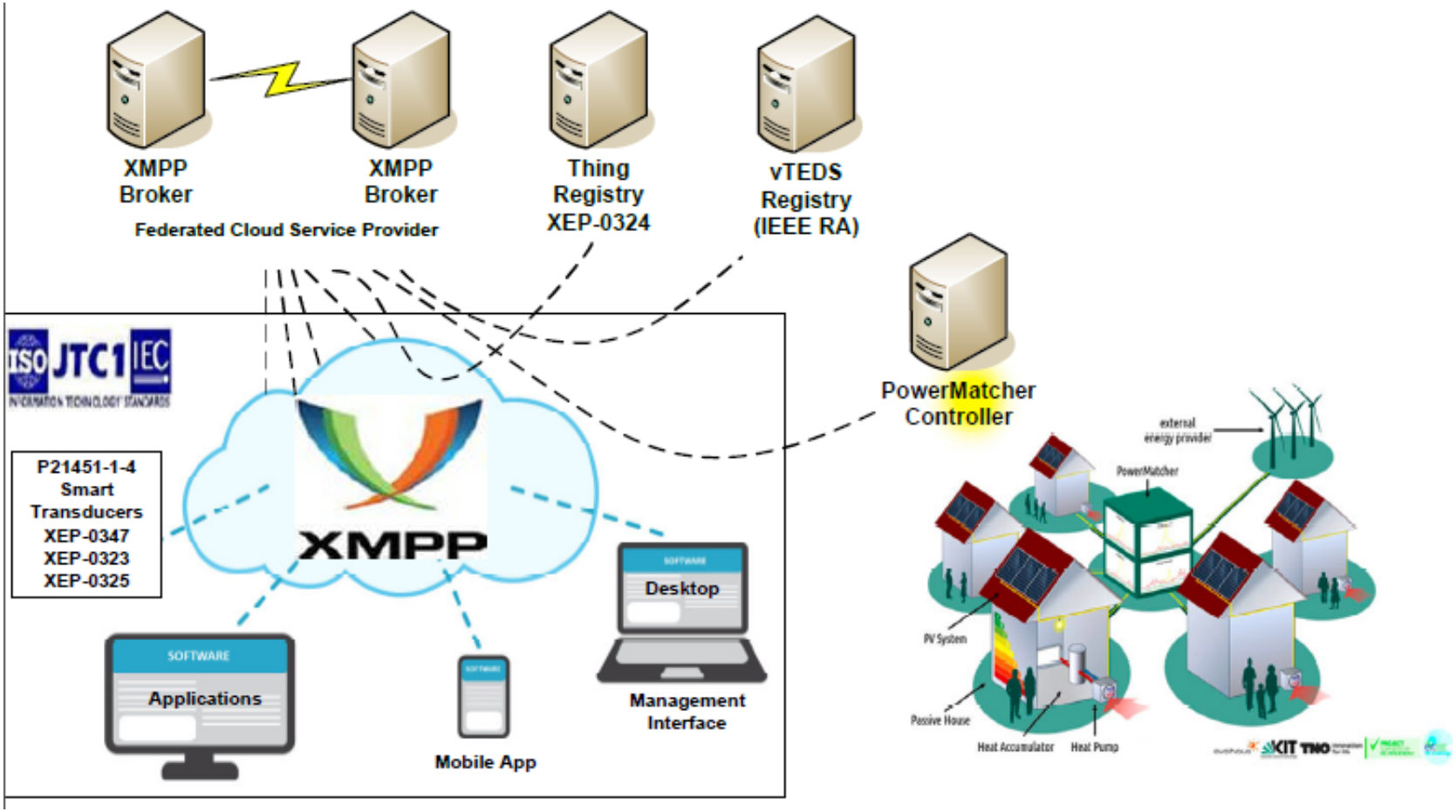
# TE Test Bed Devices

- Time-shifters – appliances or equipment that operate on discretionary basis to energy cost savings
- Buffers – devices that can store energy temporarily
- Uncontrolled loads or producers, such as wind and solar generation
- Energy storage - batteries or electric vehicles (EVs)

# PowerMatcher
## Energy Flexibility- Power Interface (EF-PI)



# Network Architecture
## for Transactive Energy (TE)






Fine-gained demo

# IPDX.NET
## IP Data Exchange Sensor Sharing Network

- **ISO/IEC/IEEE P21451-1-4** provides session initiation and protocol transport for sensors, actuators, and devices. The standard addresses issues of security, scalability, and interoperability. This standard can provide significant cost savings and reduce complexity for the Internet of Things (IoT).
  http://www.ipdx.net

Sensei/IoT* XMPP

ISO IEC IEEE dvancing Technology for Humanity

# Thank You!

William J. Miller
mact-usa@att.net