Reference Model for Energy Management Version 3

draft-quitteke-man-reference-model-03

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Key changes to reference-model-03

• Added a review of issues that energy management introduces, particularly regarding power supply and measurement of power and energy
• Explained in more detail how power interfaces represent power distribution topologies
• Introduced a layered presentation of the model, including a “mediation layer” that aggregates and proxies information from individual devices
• Added a discussion about how the relationships of parent child can be modeled on the reference model structure/topology
Why extend the reference model?

• Energy Management is still new to the IETF
• We are looking for new concepts and models, particularly for **devices reporting on other devices**
• This is not an easy search
  ⊘ drafts with models changed substantially until Quebec meeting
    ▪ eman framework draft and previous versions of this draft
  ⊘ experimenting with new concepts
    parent/child; power monitor/power controller, power interface, etc.
• This proposal bringing together all concepts and models presented at previous meetings
The parent/child model
draft-eman-framework-03

Concepts

• Energy Management System (EnMS)
• Energy Object (EO): involved entity
• Parent EO: EO acting as mid-level manager between EnMS and other (child) EO
• Child EO: managed EO for which at least one caring parent EO exists
• Parent EO – child EO relationships:
  ♦ power source relationship
  ♦ metering relationship
  ♦ proxy relationship
  ♦ dependency relationship
  ♦ aggregation relationship

• Good model
  ♦ covers several use cases
• But complex coverage of electric topology
  ♦ lacking clear separation of topology and management functions
Proposed integration

draft-eman-framework-03 + draft-quitteck-eman-reference-model-03

Additional concepts

- Powered Device (PD): managed entity (energy consumer)
- Power source: PD supplying others
- Power interface (PI): Power inlet or outlet of an EO
- Power supply line: connecting PIs

EnMS

Energy management system

Mediation

Parent EO

Local mgmt. interfaces

EO

Power supply mon. & ctrl.

Power meter reading

Power state mon. & ctrl.

Electric topology

Power supply lines

PD / PS

EO

PI

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Devices, components, interfaces

- BATTERY
- Total In
- Power Interfaces
- Total Out
- Net Use
- Power Interfaces
- Components
- Generation
- Consumption
Some key differences in models

- In Framework-03, power topologies can be represented in multiple ways
  - Ref Model-03, single method
- Framework allows power lines between devices, between components, or between device and component
  - Ref Model – power lines always between devices
- Framework allows relationships between arbitrary components
  - Ref Model – relationships always between devices
- Concept of power interface – absent in framework
- Parent/child relationship – relationships seem scenario specific (layer agnostic)
- Who can report on a device – Parent only or any device
  - Enables aggregation
Some key agreements in models

- Power/energy/power state reporting same for components and devices
- Reference model does not address
  - Power states
  - Entity identification and structure
  - Details of power/energy reporting
  - Domains
Reference model details - PIs

- All power flows into and out of a device via power interfaces (PIs)
- PIs consume no power
- Some PIs have integral switches (inlets and outlets)
- Some PIs have integral power meters
- PIs exist only on devices, not components
  - No internal representation of power topology
- Device net consumption is sum of all PIs
  - Outlets are negative numbers
- PIs can switch direction of power flow (though today this is rare)
Reference model details - Parent

• Can report and/or control on behalf of a child
• May have no direct power and/or network connection with the child
• The child may or may not know of the existence of the parent
Data implications

• Power data (meter) can be for a component, power interface, or whole device (in, out, net)
  – Special case of metering groups of PIs

• Some data only exists for device
  – Context, role, classification, ...

• Some data exists for device and component
  – Power state

• Data only for PIs
  – Wiring topology
Reference model details - Components

- Components are hardware and so consume power
- Components may be ‘final’ users of power, or redistribute to other components
- Components draw power from a pool of power in the device
Challenging power topologies

• Multiple power inlets (control)
• More than two devices on a wire
  – multiple outlets and/or multiple inlets
• Parallel paths between a supplying and a consuming device
• Bi-directional power interfaces
Proposed integration

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