

Reference Model for Energy Management Version 3

draft-quittek-eman-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?

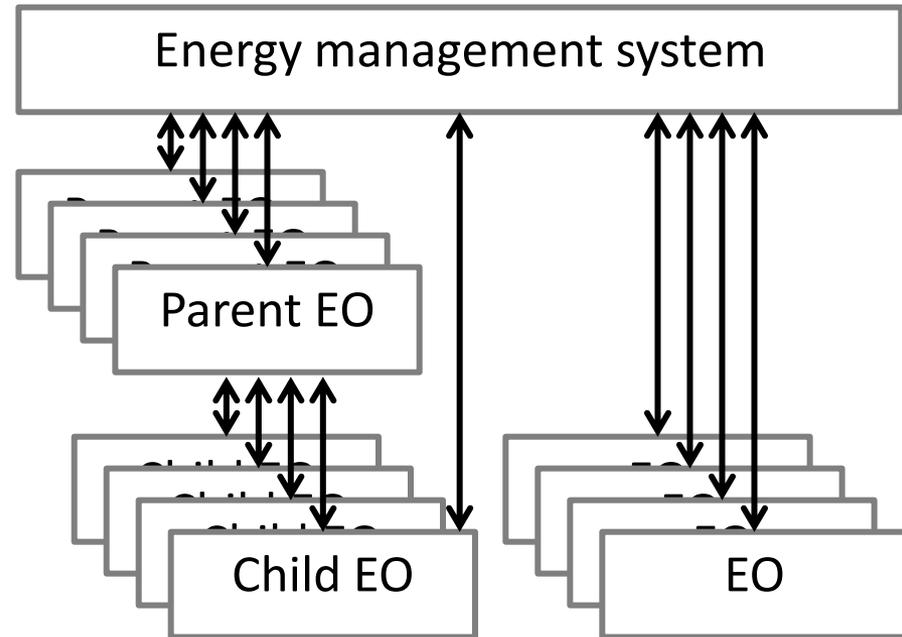
- Energy Management is still new to the IETF
- We are looking for new concepts and models, particularly for **devices reporting on other devices**
- This is not an easy search
 - ◆ drafts with models changed substantially until Quebec meeting
 - eman framework draft and previous versions of this draft
 - ◆ 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



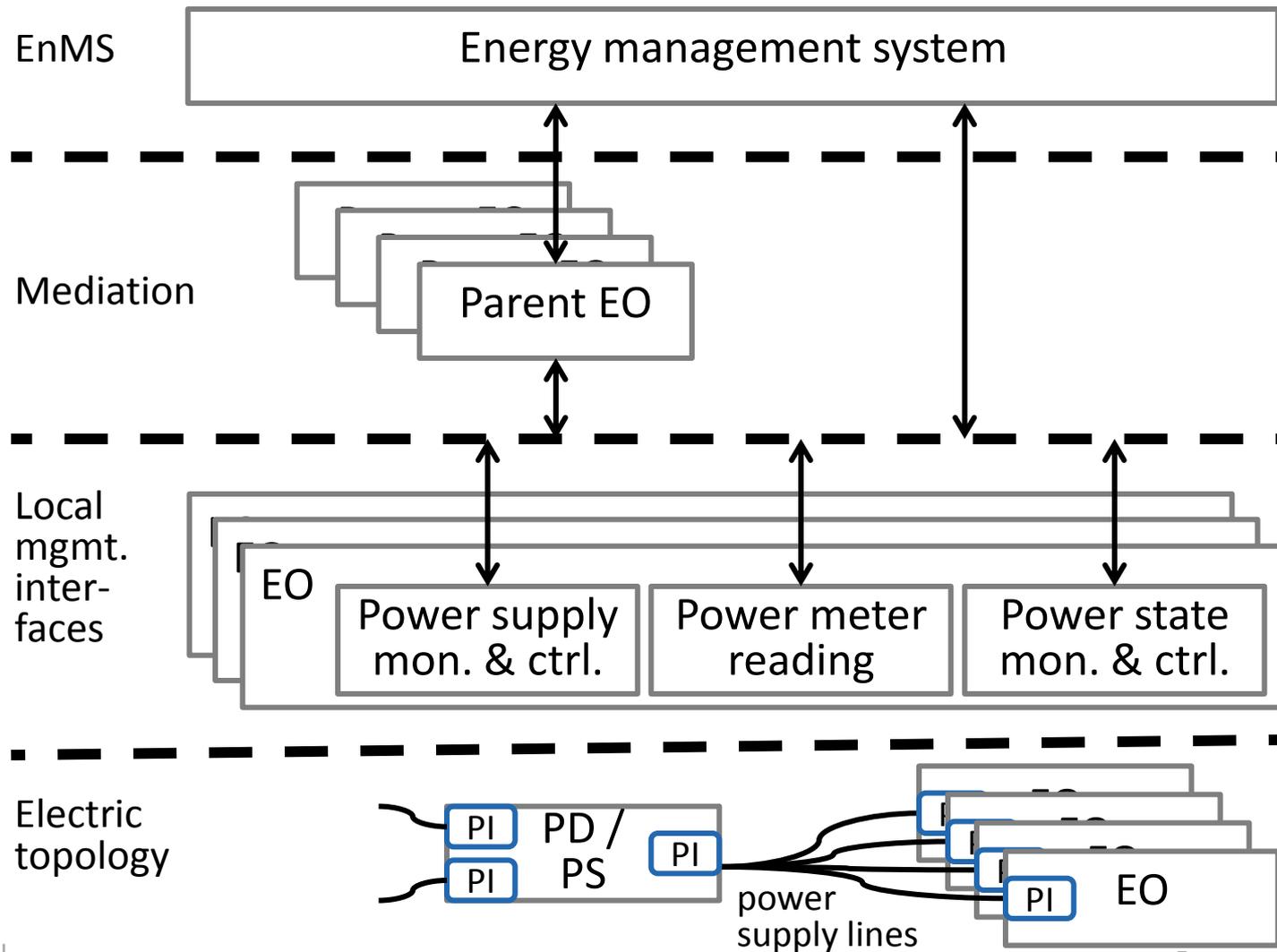
- Good model
 - ◆ covers several use cases
- But complex coverage of electric topology
 - ◆ lacking clear separation of topology and management functions

Proposed integration

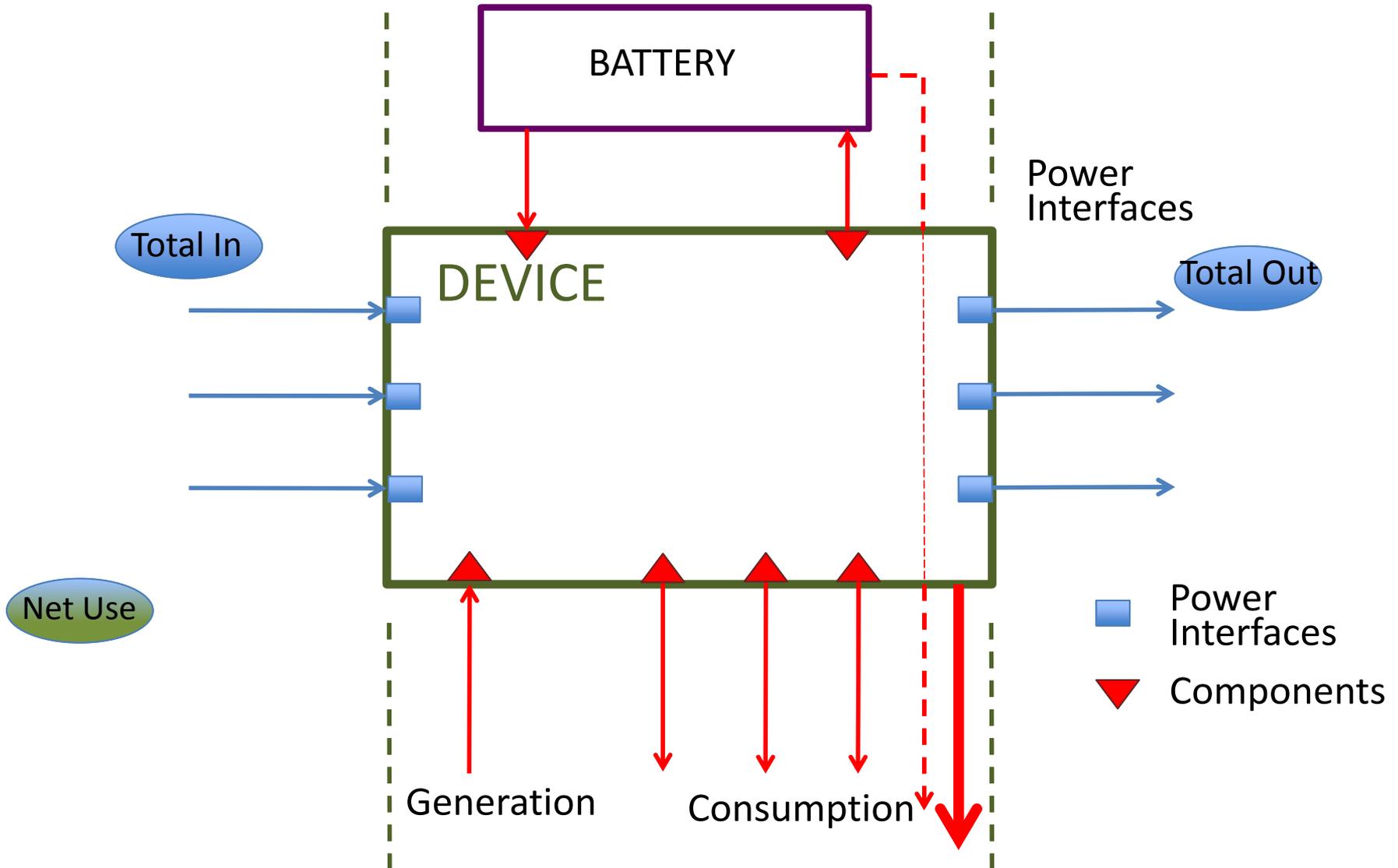
draft-eman-framework-03 + draft-quittek-eman-reference-model-03

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



Devices, components, interfaces



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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