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Energy SIG Summary to IETF EMAN

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(Derived from Rich Morgan et al to SIG)

Summary

- Organizations are working on parallel paths in different industries
- SIG and EMAN are tackling same the problem domain
- Similar information models

Key items that form consensus between groups

1. **Phases Monitor, Control, Interface**
2. **Power Reporting**
3. **Optional Quality and Accuracy**
4. **Accommodation for Fixed readings and Capabilities**
5. **Need for Aggregation and/or Proxy**
6. **Need for States for Context and Control**

What is the ODVA

Organization of Businesses

- 274 Member Companies
- > 8 (by my count) Active in SIG for Energy Applications

Responsible for defining

- Common Industrial Protocol (CIP™)
- Industrial network Adaptations of CIP – including EtherNet/IP™ and DeviceNet™ among others

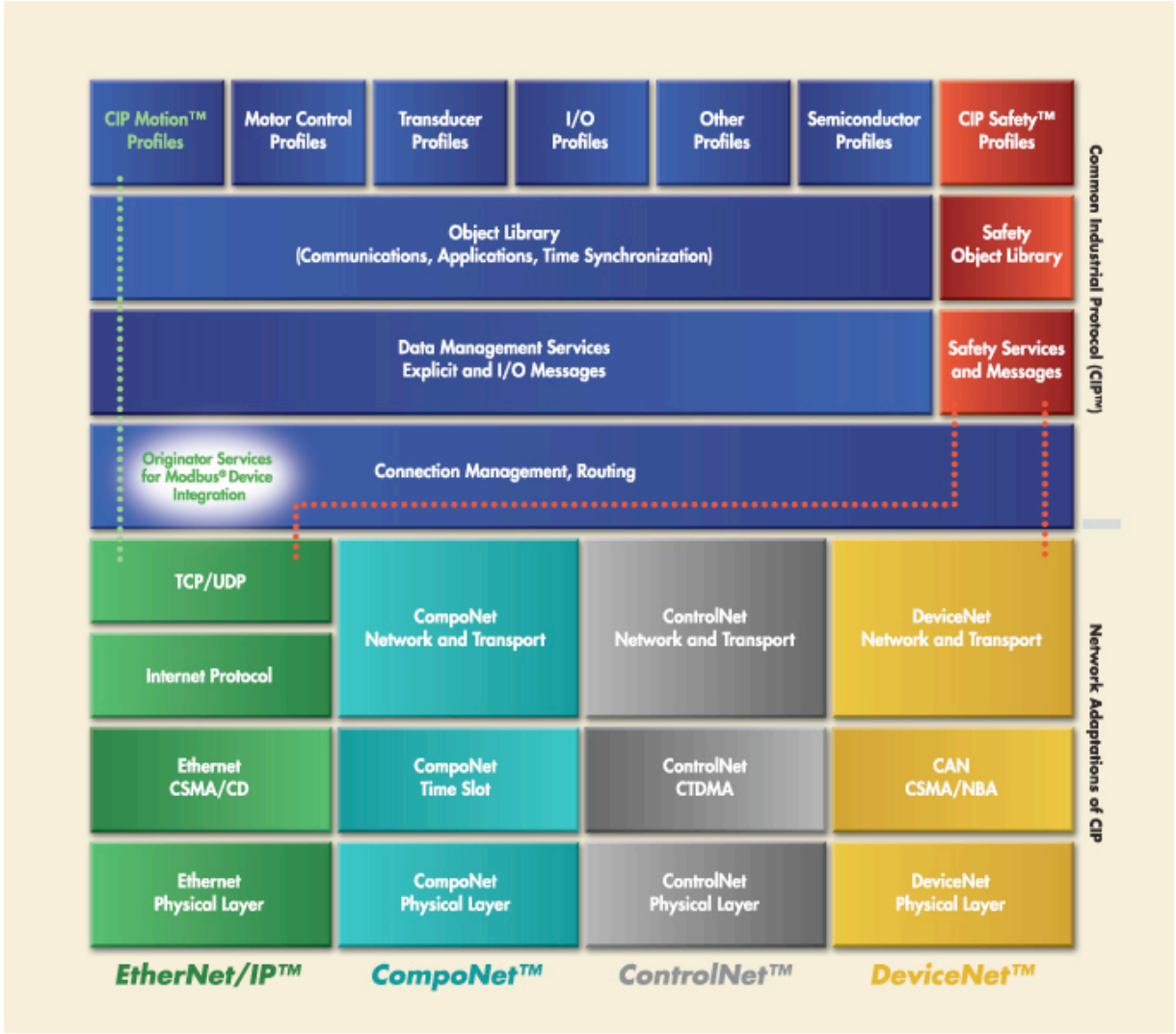
ODVA investigating an official IETF liaison request

Comparison to IETF & EMAN Current WG Items

IETF Organization of Professionals	ODVA Business League
EMAN WG	SIG for Energy Applications (Energy SIG)
Telecommunication	Industrial
Charter (6) •Monitoring •TBD	Goals (3) •Monitor •Control •Procurement
SNMP	CIP
MIB	CIP Objects, Services, Profiles

NOTE: All SIG Items are still WIP and unpublished as yet.

CIP and its Family of Industrial Networks



CIP

Industrial Networks

Energy SIG

Energy SIG objective

- Develop CIP specification enhancement to integrate Optimization of Energy Usage enabling technologies
- Must be simple for the simple devices

Items

- 1: **Awareness** of energy usage
  - Monitor: Standard energy reporting and methods
- 2: Consuming energy more efficiently
  - Control: Commanding equipment to conservation **states** and controlling peak demand
- 3: Procuring energy at the lowest cost
  - Interface: to the Smart Grid

Energy Basics

Energy **(W) is a resource that enables work to be done**

- Units of measure: Joules, kilowatt-hours, British thermal units, calories, etc.
- Prefix kilo (x1000), mega (x10^6), giga (x10^9), etc.

Power **(P) is the rate of converting energy to work per unit of time**

- Units of measure: Joules per second, Btu per hour, kilowatts

Demand

Considered Not Applicable

Basic Metaphor

Time is part of the energy unit: kilowatt-hour

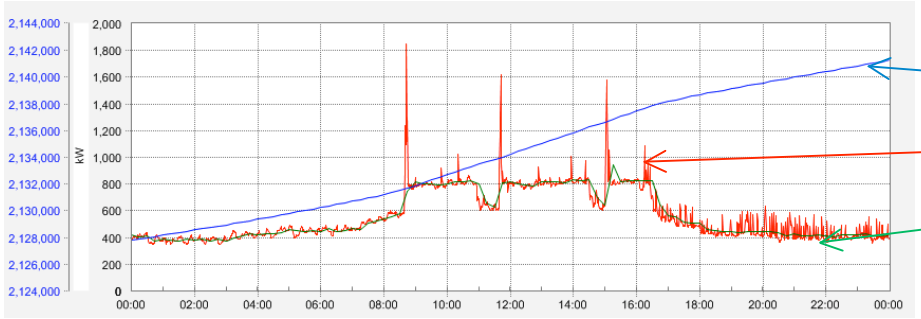
- Most other units put time in the power unit: J/s

How to visualize energy and power

- Energy usage like an odometer
- Power is like the speedometer

And then there's demand…

Demand is the average rate of energy consumed per interval of time, in kilowatts



Utilities charge for the highest interval demand in a month, $10 - $20 per kW

- Demand is figured at each main incoming meter
- Demand acknowledges equipment capability to absorb short-time overloads
- Demand charges add uncertainty to cost forecast

Energy object hierarchy

Energy object – highest level

- Produces normalized consumption expressed in kWh

kWh selected as required normalized unit

- True global standard for electrical energy
  - Joules not widely used in US
- Majority of ODVA members are electrical device vendors
- Majority of global energy standards reference kWh, MWh, etc.

Alternate normalized reporting supported

- Optional set of attributes

EMAN WG Items:

✓Define power units in Watts with exponent.

Energy sub-objects

Electrical energy object

- Native engineering units: kWh, kW, etc.
- Accommodates unique character of electricity
  - Alternating nature leads to real and reactive values
  - Poly-phase nature produces per-phase and total values

Non-electrical energy object

- Covers resources other than electricity

EMAN WG Items:

X Assumes all are electrical objects

✓**Contains same optional power quality values**

X No modeling of non-electrical devices

Power in the Energy Object

Power is expressed as a REAL (floating point) value

- Positive means energy consumed
- Negative means energy generated

Power Readings may need power state to provide trending. Will be addressed in control phase.

Demand data not considered to be required

EMAN WG Items:

✓Same constructs for power reporting

✓Same recognition that states provide context and control.

Energy in the Energy Object

Energy expressed as 5-integer odometer

- Widely used, combines precision with wide range

Array[4]	Array[3]	Array[2]	Array[1]	Array[0]
Terawatt-hours (kWH x 10^9)	**Gigawatt-hours (kWH x 10^6)**	**Megawatt-hours (kWH x 10^3)**	**Kilowatt-hours (kWH)**	**Watt-hours (kWH x 10^{-3})**

Three energy buckets

- Consumed and generated – unsigned values
- Total = (consumed – generated), signed value

Values will eventually roll over to zero

- Data consumers must correctly handle rollovers

EMAN WG Items:
✓Demand object covers this as optional one value field. This approach is clever for small devices

Support of simple devices

Energy odometer is conditionally required

- Required if device reports time-varying rate of energy transfer
- Requires a clock and non-volatile memory
- Simple integer arithmetic

If energy odometer not used, may not be compliant with some vendor's systems

Simple devices with fixed estimated or rated power may report a power value in watts

EMAN WG Items:
✓Same recognition for devices that are unable to report power or energy

Nominal / fixed energy usage

Data from measurements should be encouraged

- Fixed and estimated values dilute aggregation accuracy
- Nominal values based on device ratings may overstate actual usage

User setting attribute added

- Use to be defined by vendor
- May represent fixed power, offset value, etc.

EMAN WG Items:
✓**Recognition of same problem with same solution for fixed devices**

Energy capabilities attribute

Energy Measured –device produces measured energy data to a specified accuracy

Energy Derived – value produced is a function of measured, estimated, process states, etc.

Energy Fixed – value produced is a fixed estimated or nominal value

Energy Aggregated – value produced by a "parent device", the combined usage of its "children"

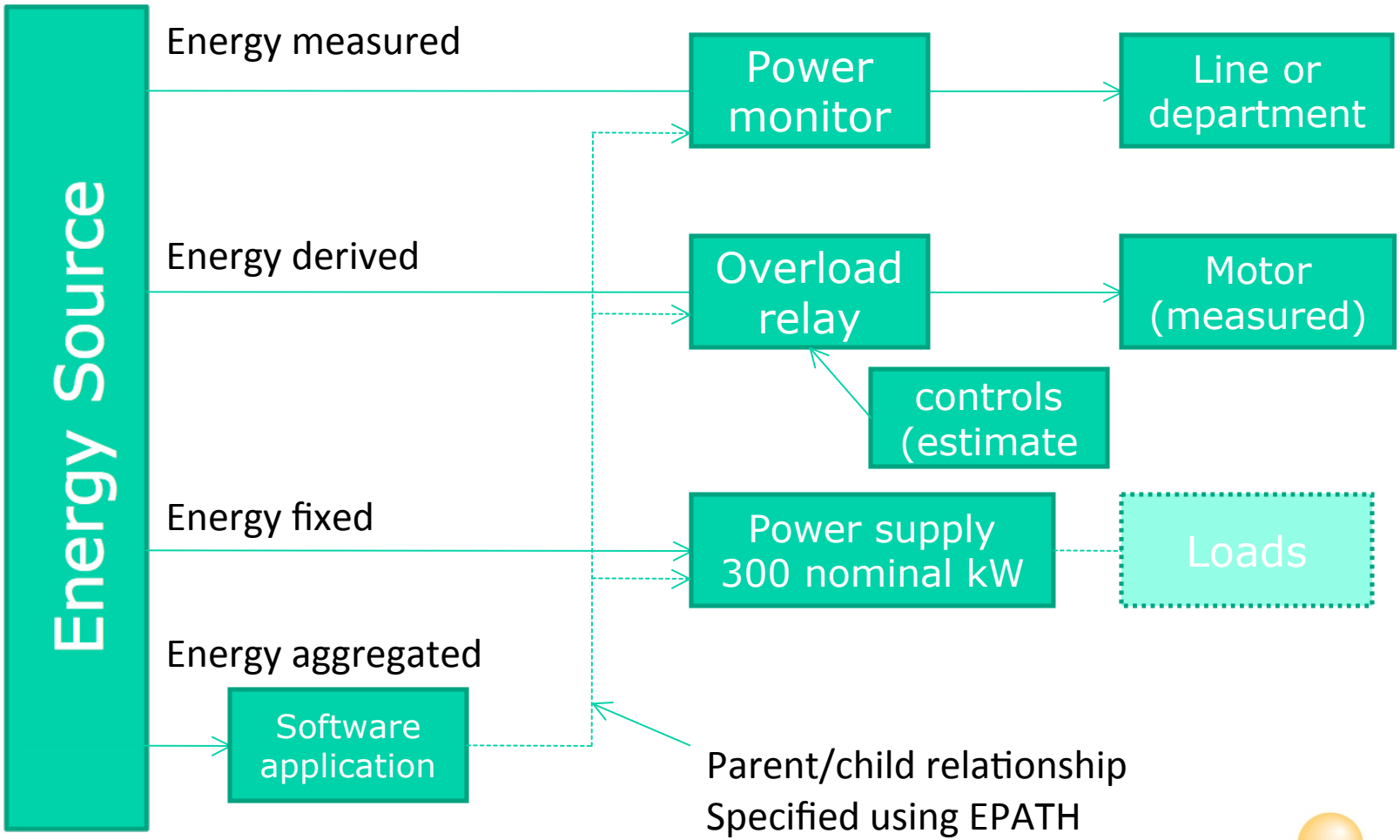
EMAN WG Items:

✓Congruent solution to the caliber field which rates the reading.

(This rates the devices capability of producing a reading versus the caliber of a reading)

✓**Same identification of Aggregator**

Energy capabilities examples



Energy accuracy percentage

Required attribute; expresses data accuracy

Examples:

- Revenue electric meter: 0.2, 0.5, 1.0 %
- Overload relay: ~5%
- Frequency drive: ~10%
- Simple device reporting fixed power: 50% +

Aggregated data reports blended accuracy

- Function of accuracy and contribution of source (child) devices

EMAN WG Items:
✓**Same identification of accuracy for non fixed readings.**

Energy Aggregation

Aggregators need to accommodate

- Energy odometer data from devices with time-varying energy transfer
  - Engineering units normalization
  - Correct handling of data rollover
- Fixed power (energy transfer rate) devices
  - Energy = Power integrated over time

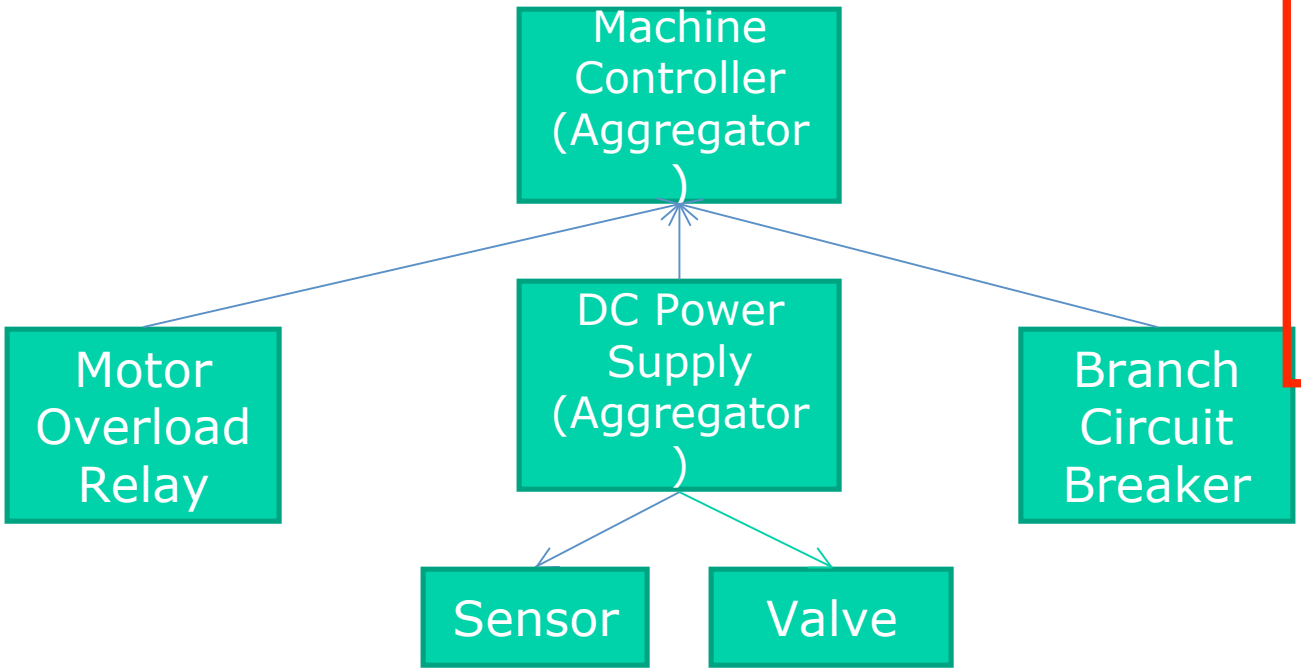
EMAN WG Items:

✓Same identification of need for Aggregator and/or Proxy

✓Expressed as Parent/Child

Aggregation relationships

An aggregation "EPATH" type attribute is used in the Energy Object to define a "CIP Energy Aggregation Tree". Think of the Aggregation EPATH as a set of pointers to various CIP Energy Objects that can be located in various CIP devices on a network (for Aggregation).



EMAN WG Items:

✓Same recognition of Parent/Child for Aggregation (Implemented as a sort of URI)

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Thank You

Questions?

