

ODYSSEUS ENERGY ONTOLOGY

February 2017

- Michel Böhms, TNO
- Jack Verhoosel, TNO
- Theo Rieswijk, Priva
- Véronique Couenberg, Priva



innovation
for life

ENERGY MODELLING, SCOPE

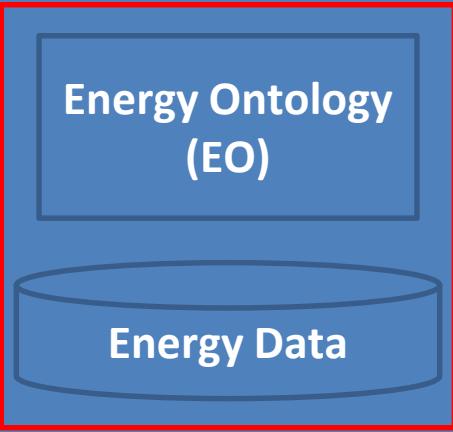
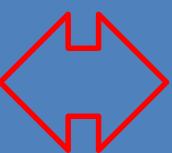
IS



apps



AI?



Open
Semantic
Big
Linked
Data

sensors

(IoT)

actuators

RS

Planning Level

- Strategic
- Tactical
- Operational

Energy Form

- Gas
- Heat
- Electricity

LOD

- Area
- Entity
- Device

Abstraction

- Conditions & Functions
- Energy Network
- Physical Network

ENERGY MODELLING, FIVE HIGHLY ENTANGLED WORLDS

World of Energy Objects

- ✓ Energy Networks
- ✓ Energy Nodes & Energy Connections
- ✓ Energy Contracts & Energy Pricing



World of Spatial Objects

- ✓ Geospatial Areas
- ✓ Conditioned Spaces like Building Spaces
- ✓ Locations & Weather



World of Information Objects

- ✓ Groups
- ✓ Quantities & Units
- ✓ Signals



World of Temporal Objects

- ✓ Activities
- ✓ Events



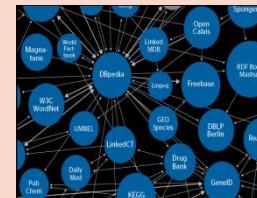
ENERGY MODELLING, SEMANTICALLY-ENHANCED LINKED DATA

Semantic
Level

Semantic Web



Linked Data



World Wide Web



Internet



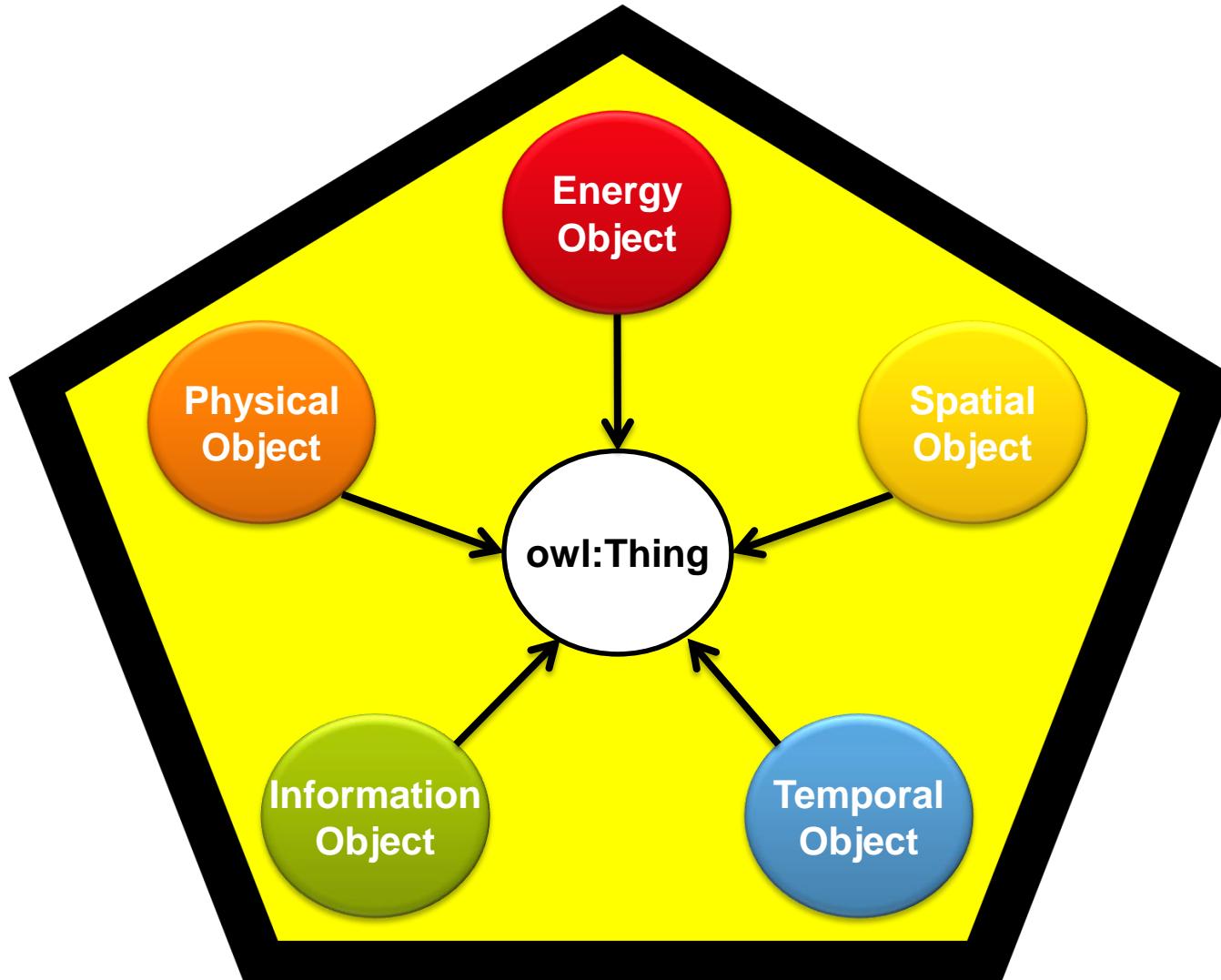
Linked Things
(Semantically-enhanced
Linked Data)

Linked Data

Linked Documents

Linked Computers

ENERGY MODELLING, THE TOP LEVEL TAXONOMY



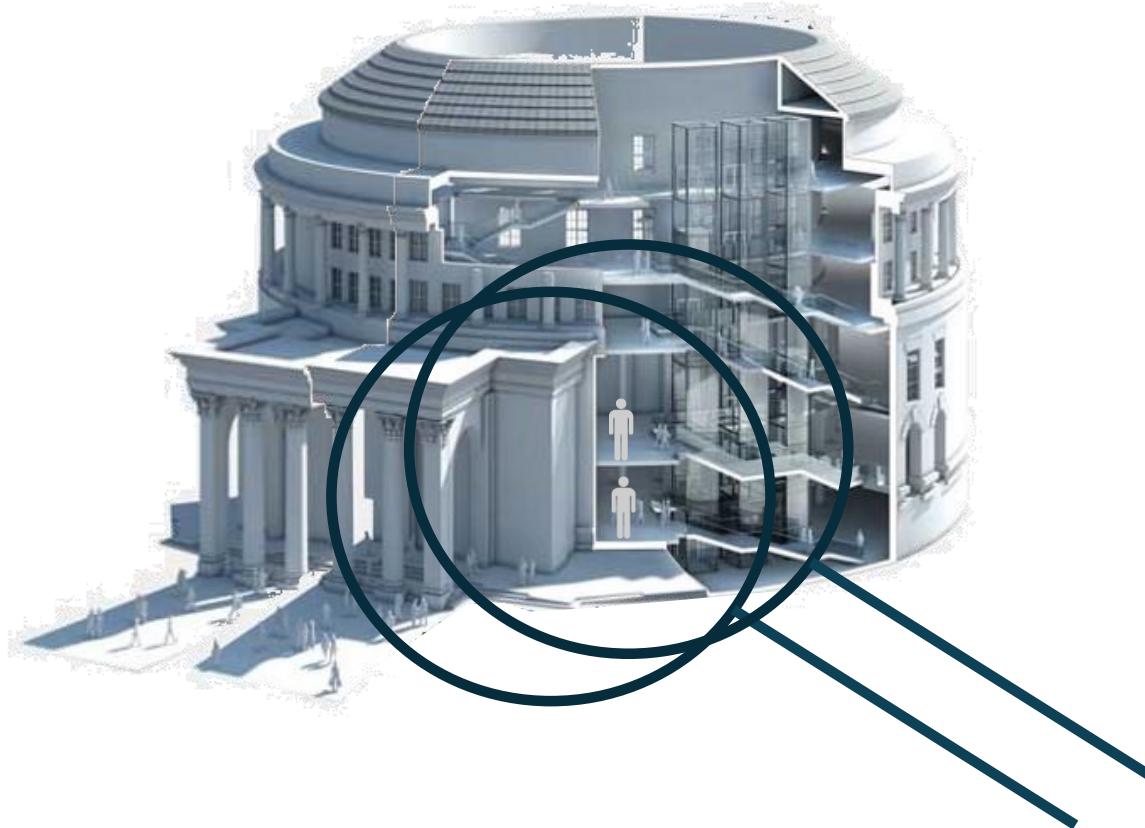
EXAMPLE FROM PRACTICE

What spaces are in the building?

How can the weather affect the conditions?

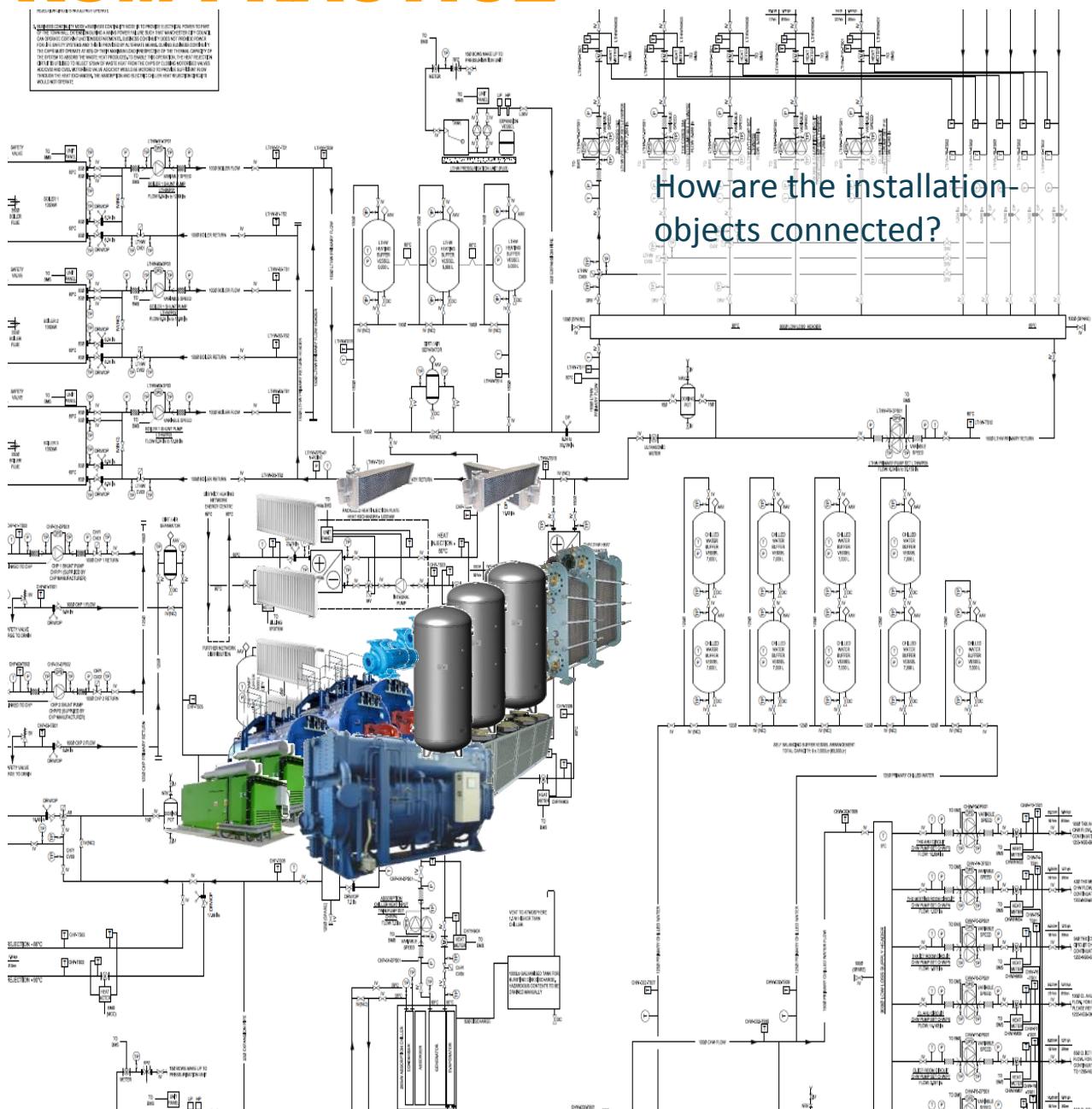
What installations are present?

Where are they located?



EXAMPLE FROM PRACTICE

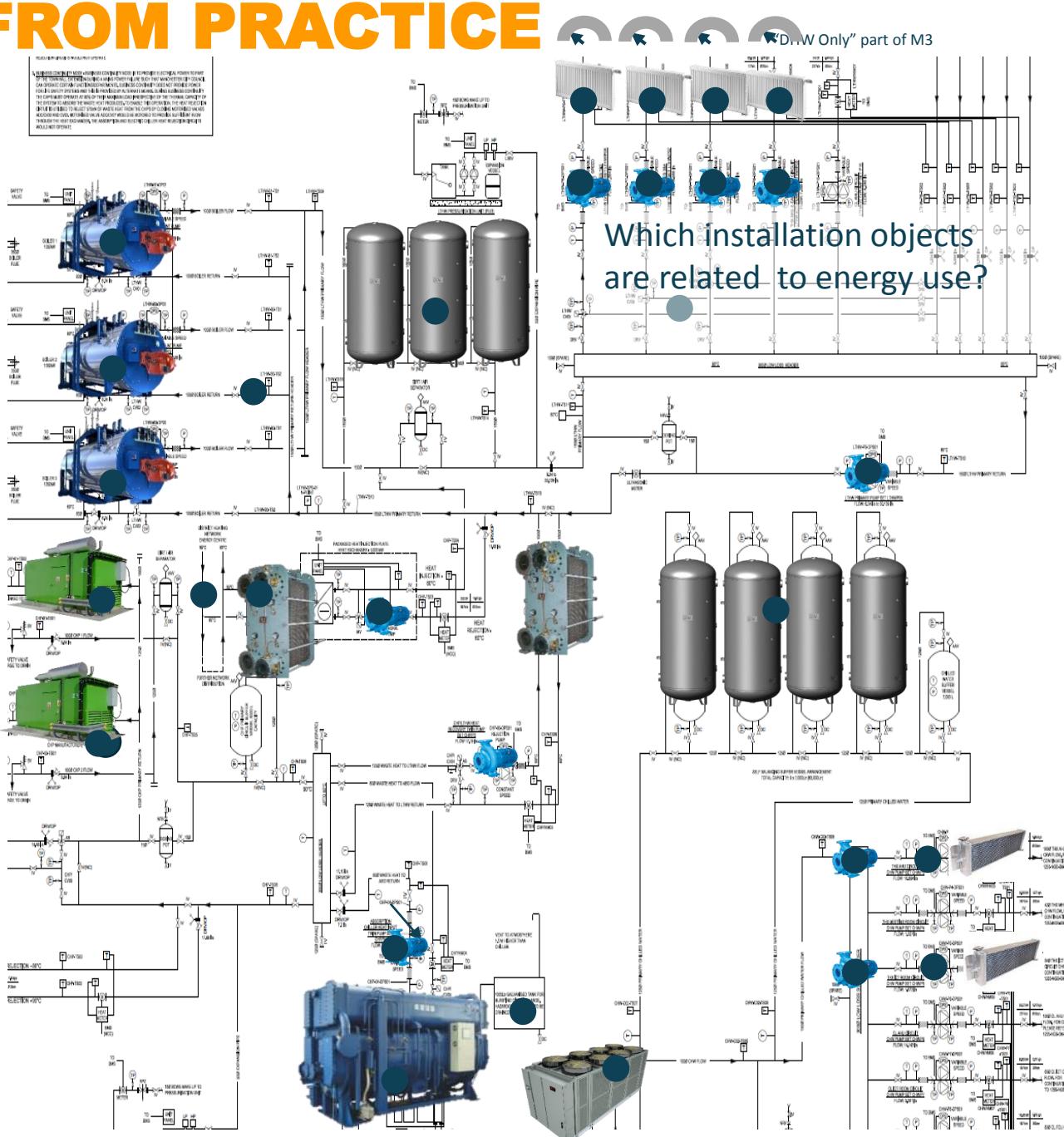
An installation scheme
With Boilers, CHP's,
Heat Absorber,
transport pumps,
heat / cold release systems



How are the installation objects connected?

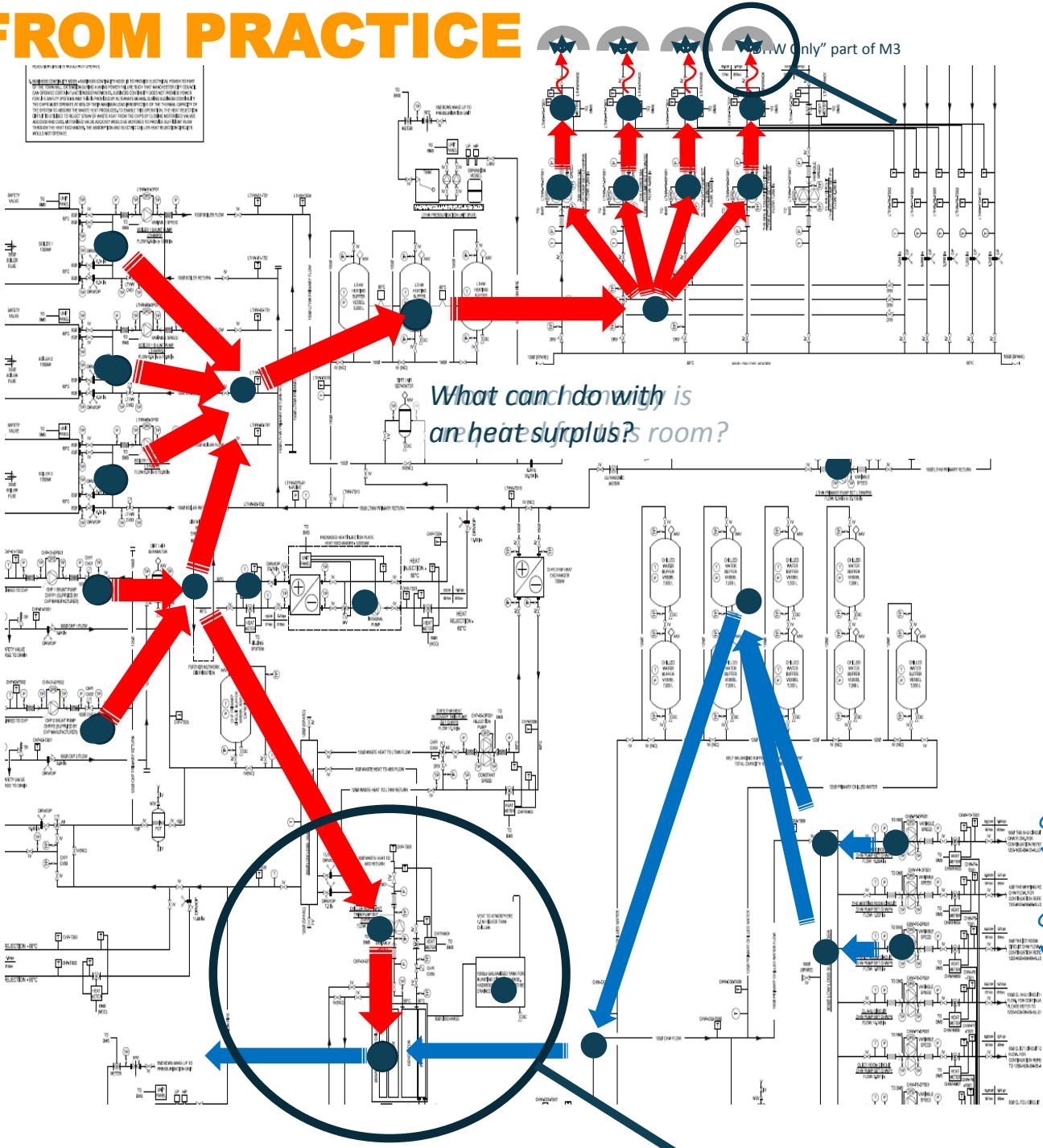
EXAMPLE FROM PRACTICE

An installation scheme
With Boilers, CHP's,
Heat Absorber,
transport pumps,
heat / cold release systems

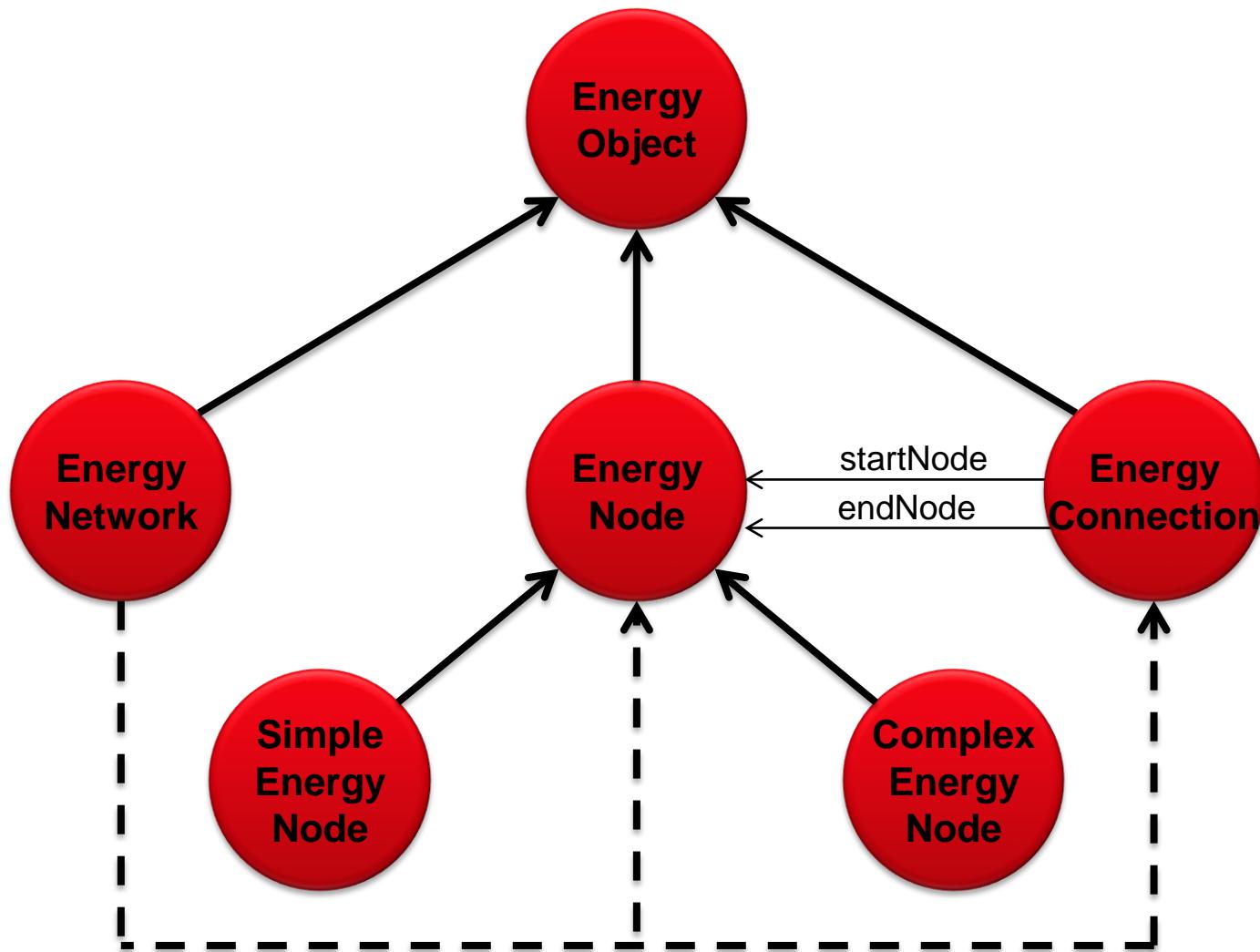


EXAMPLE FROM PRACTICE

An installation scheme
With Boilers, CHP's,
Heat Absorber,
transport pumps,
heat / cold release systems

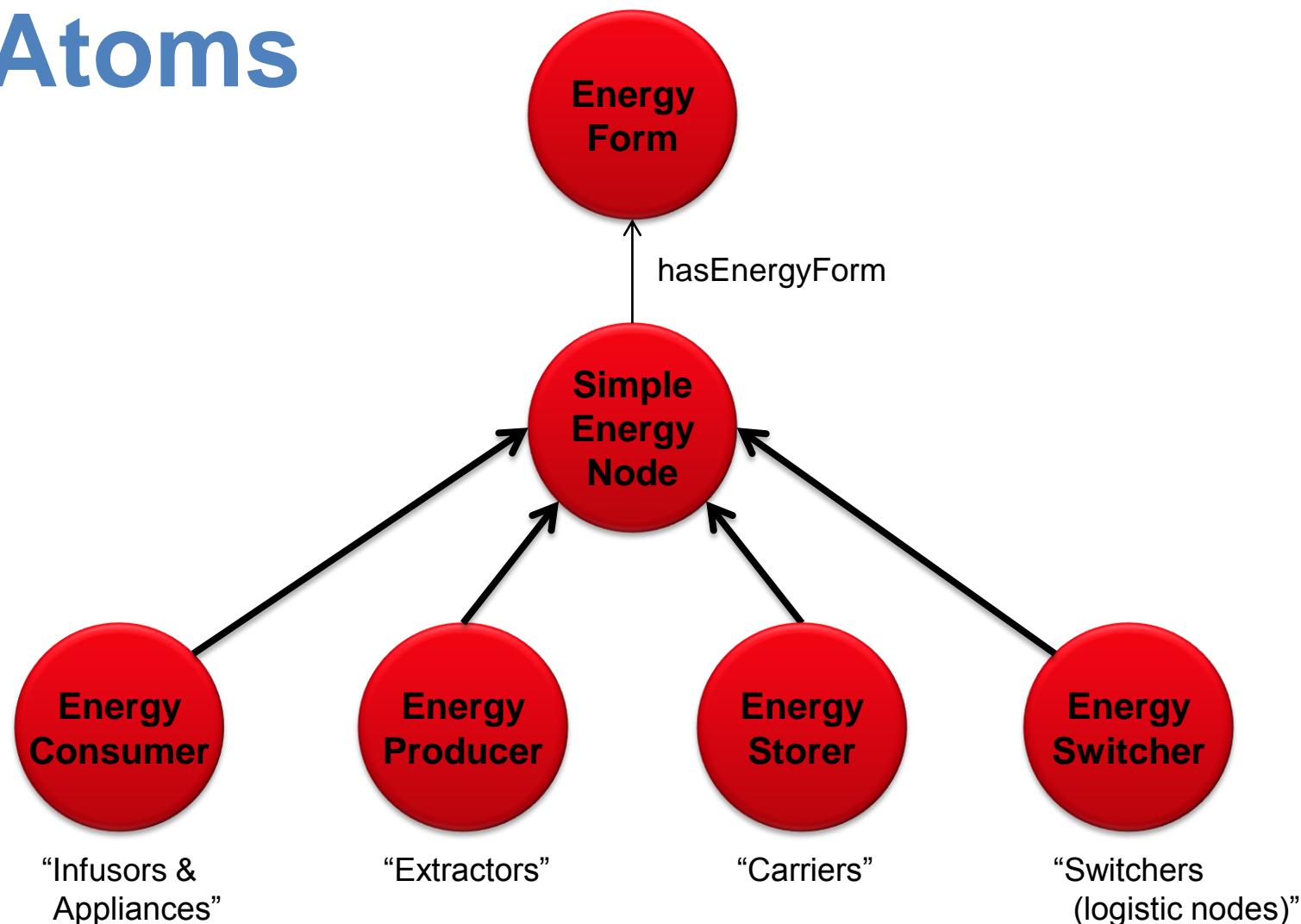


The Energy World



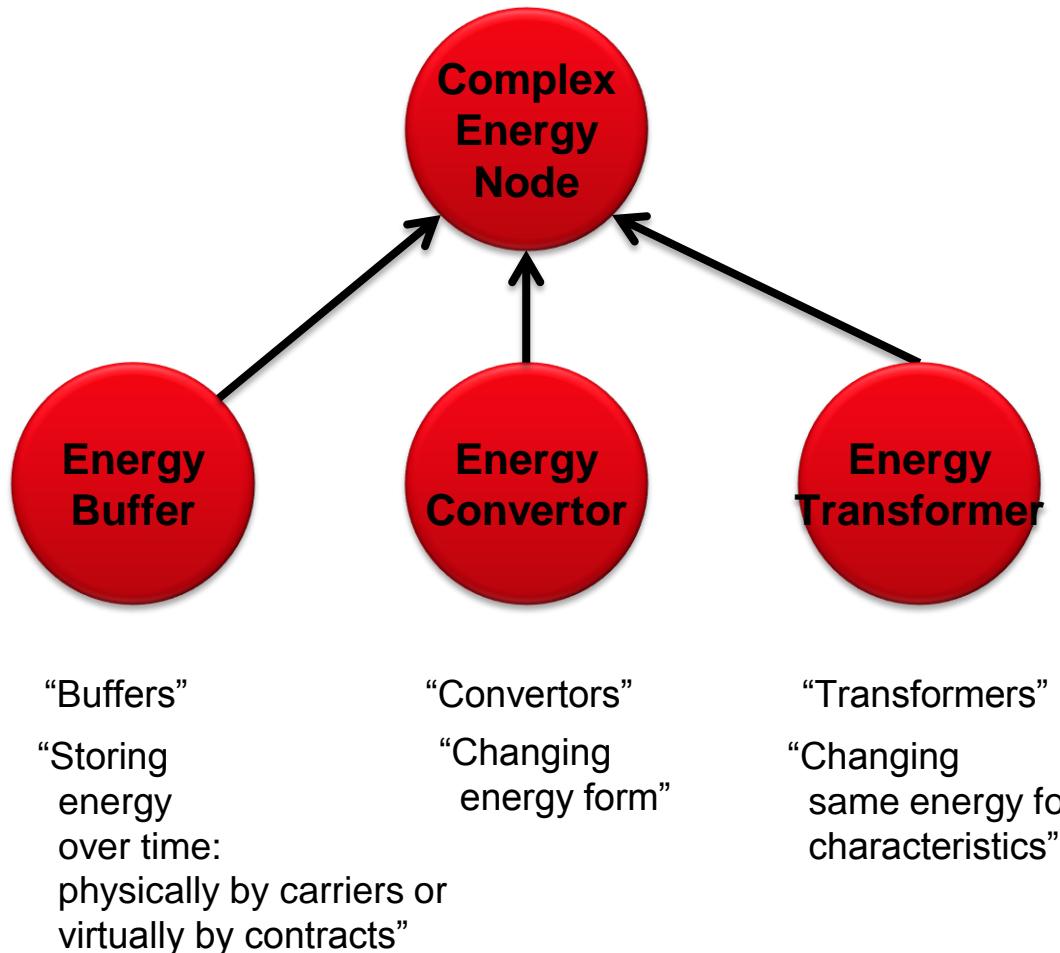
The Energy World

4 Atoms



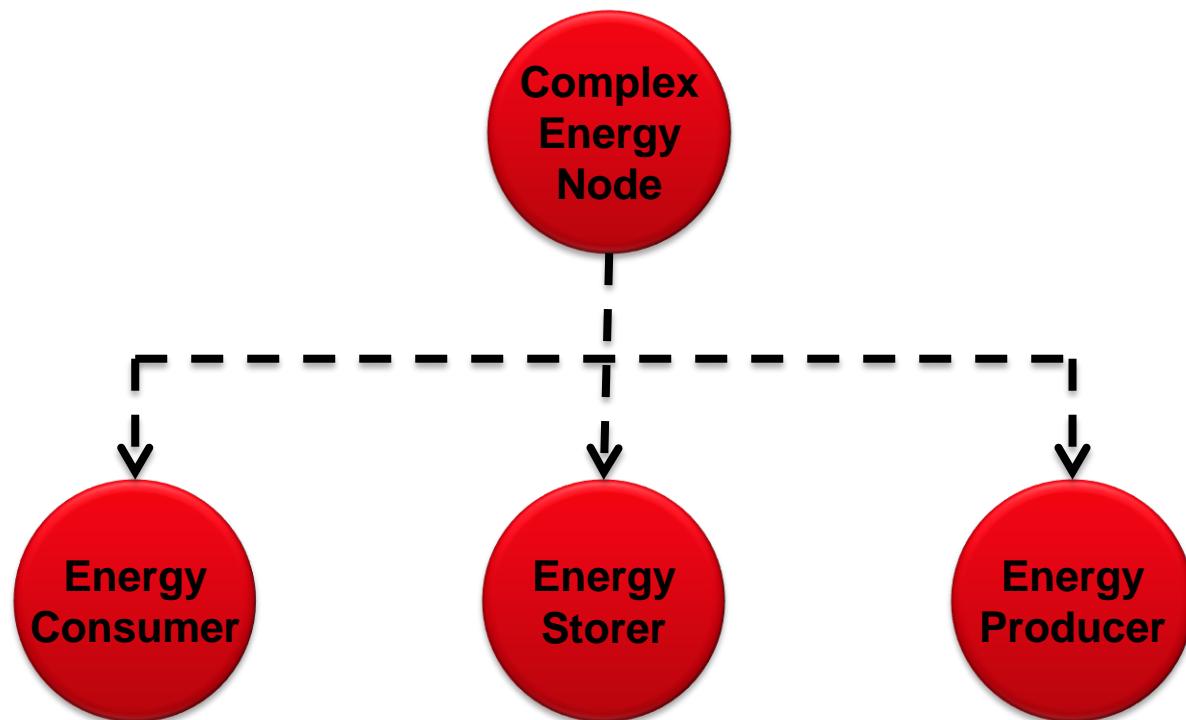
The Energy World

3 Molecules



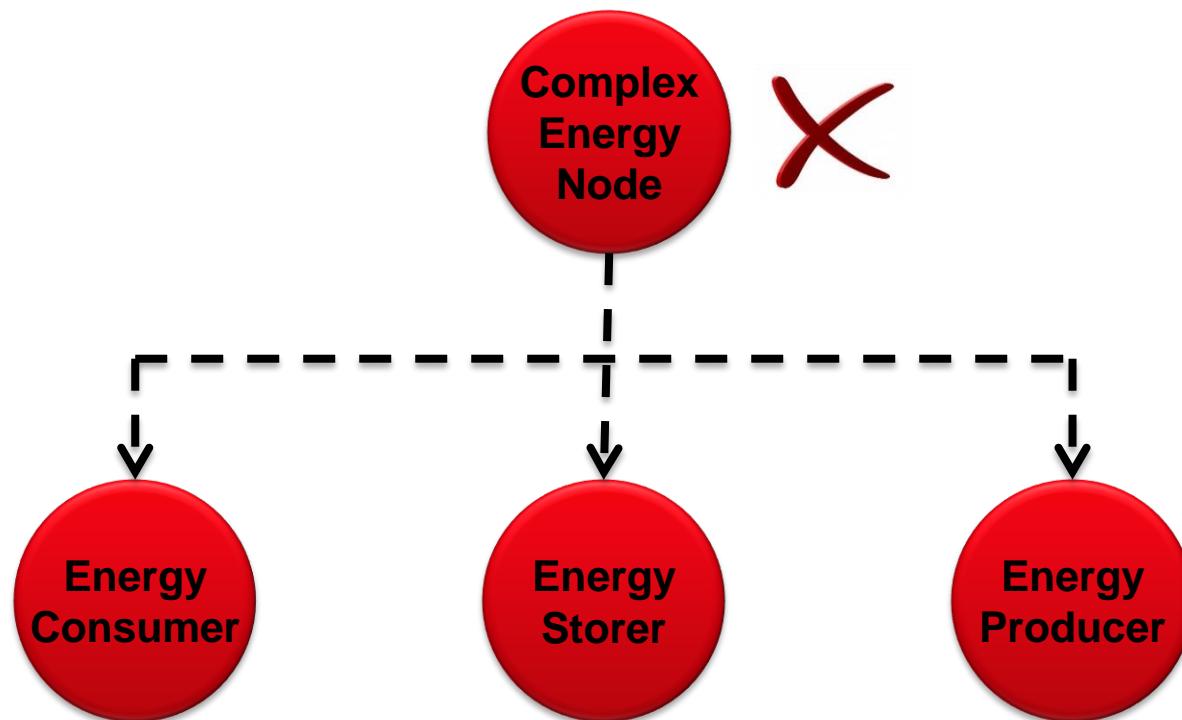
The Energy World

Molecules in Atoms, WhiteBox



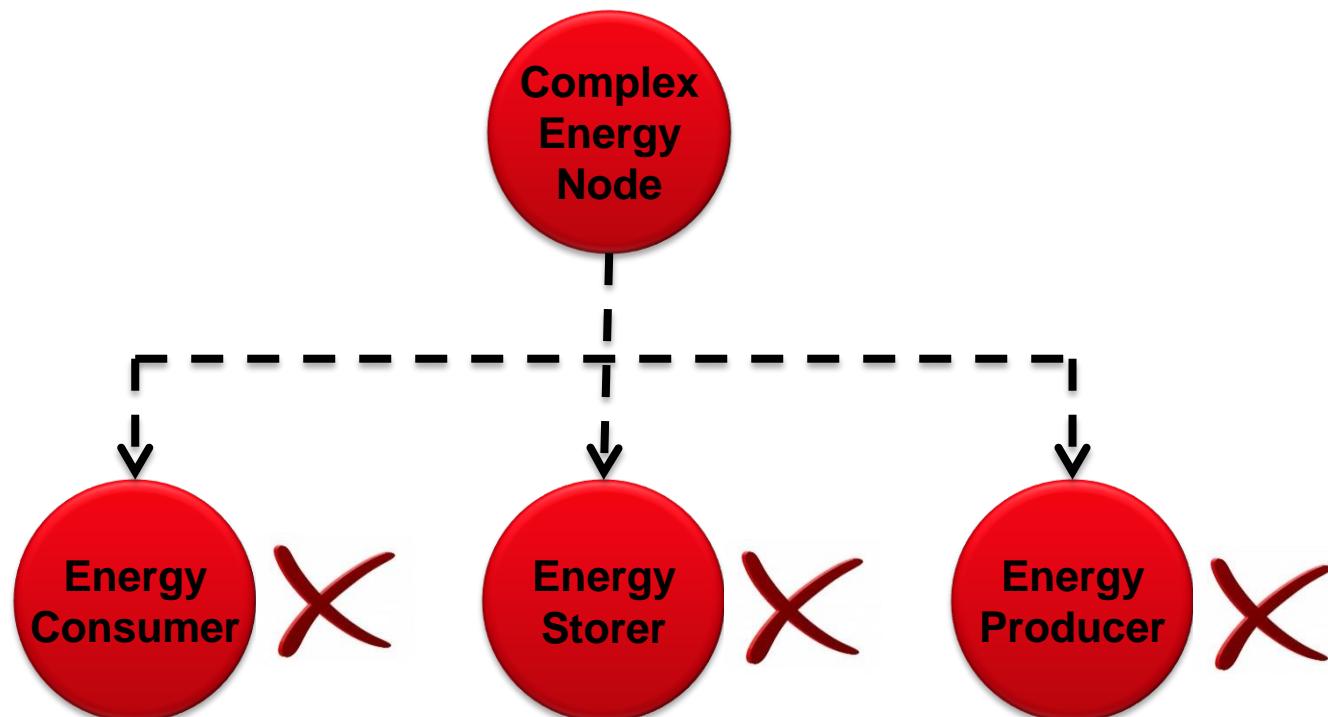
The Energy World

Molecules in Atoms, NoBox

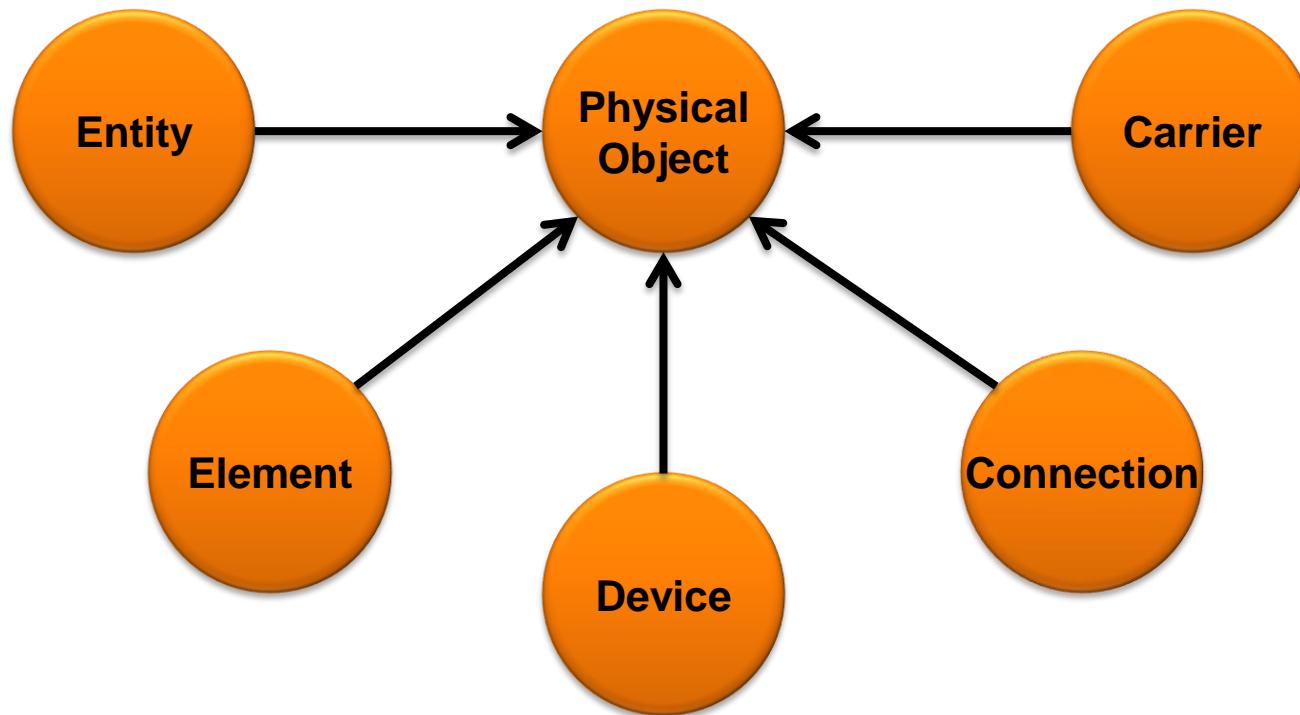


The Energy World

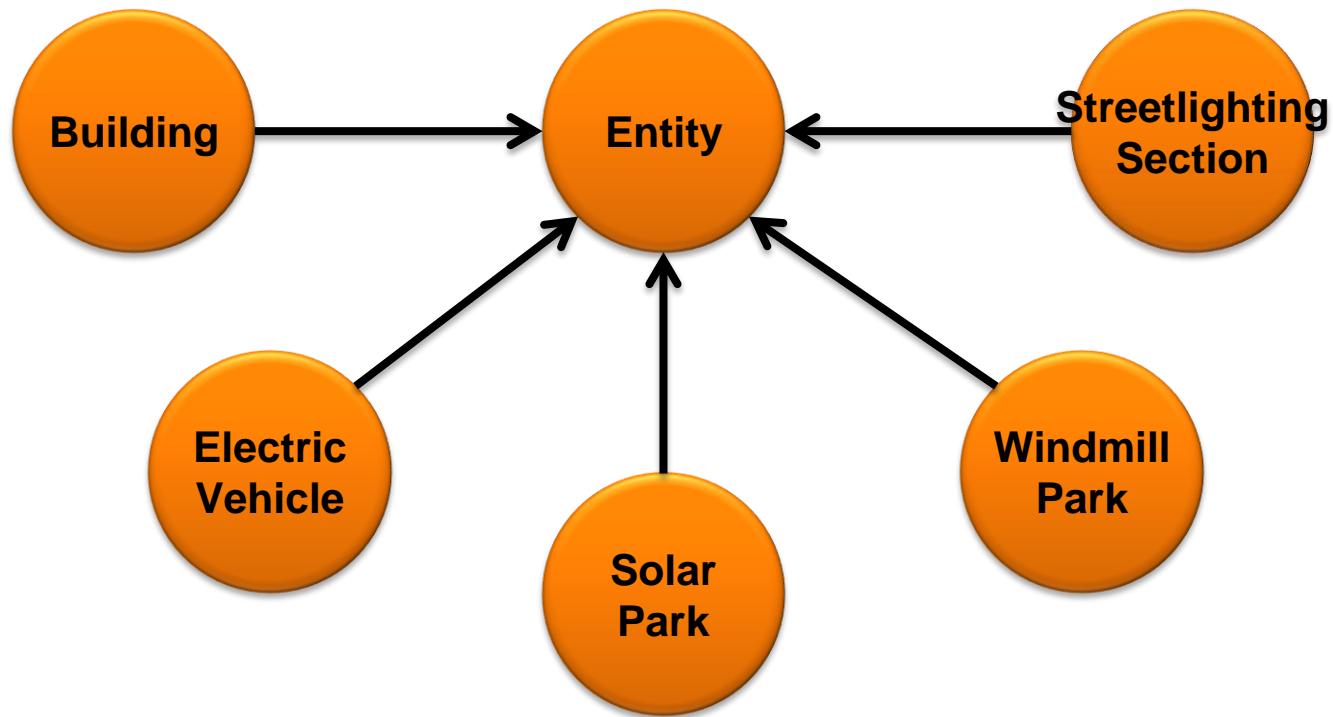
Molecules in Atoms, BlackBox



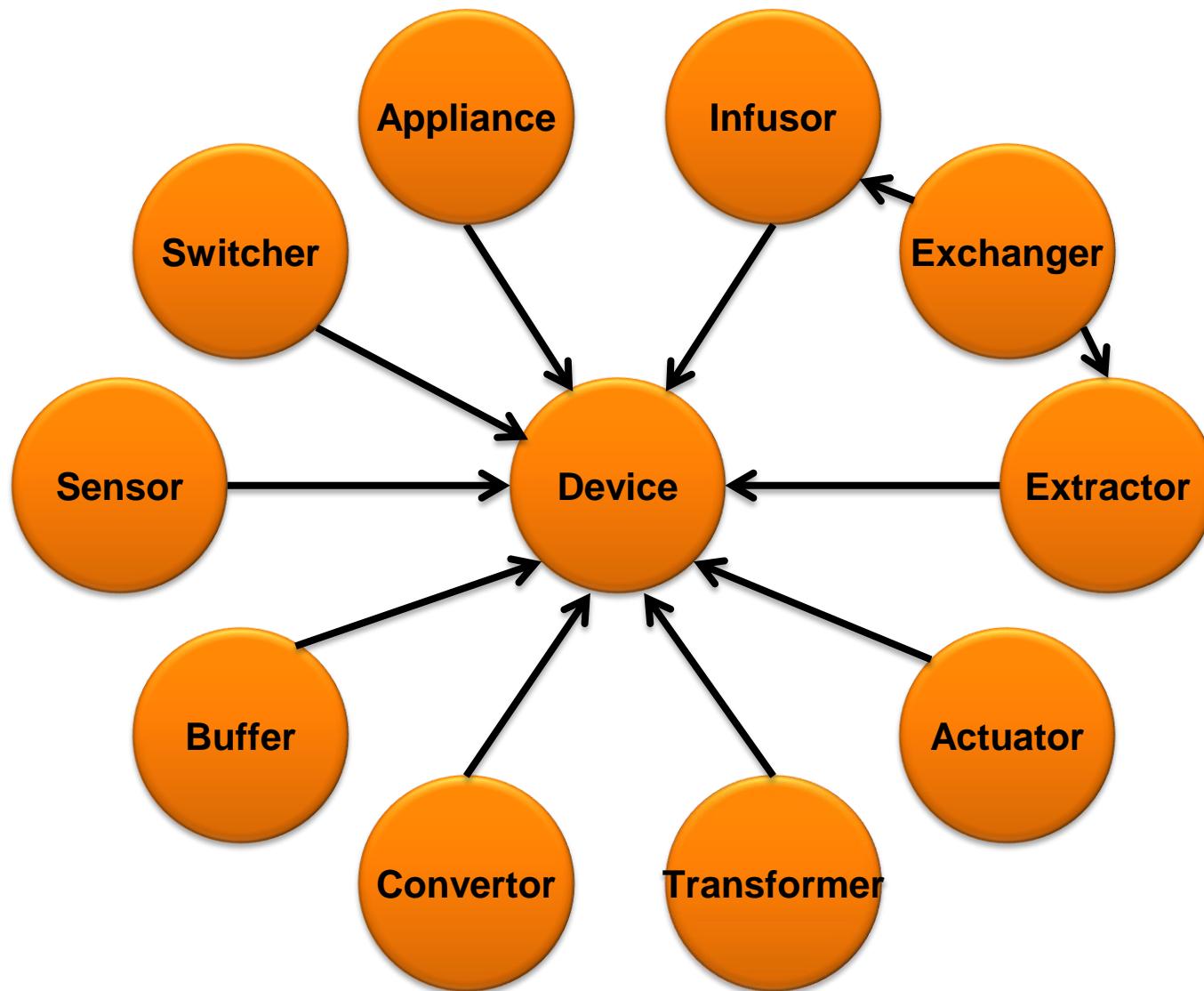
The Physical World



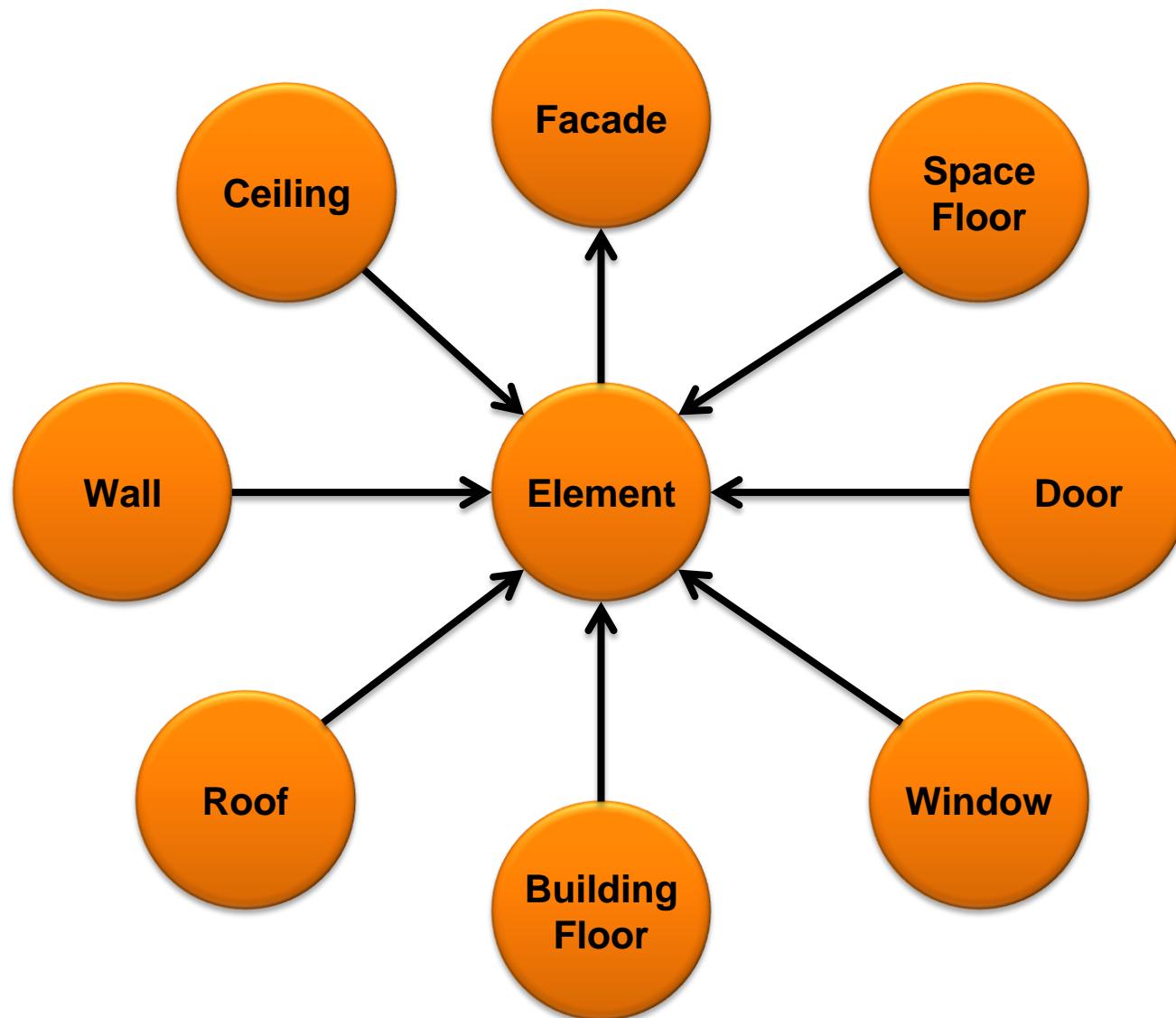
The Physical World



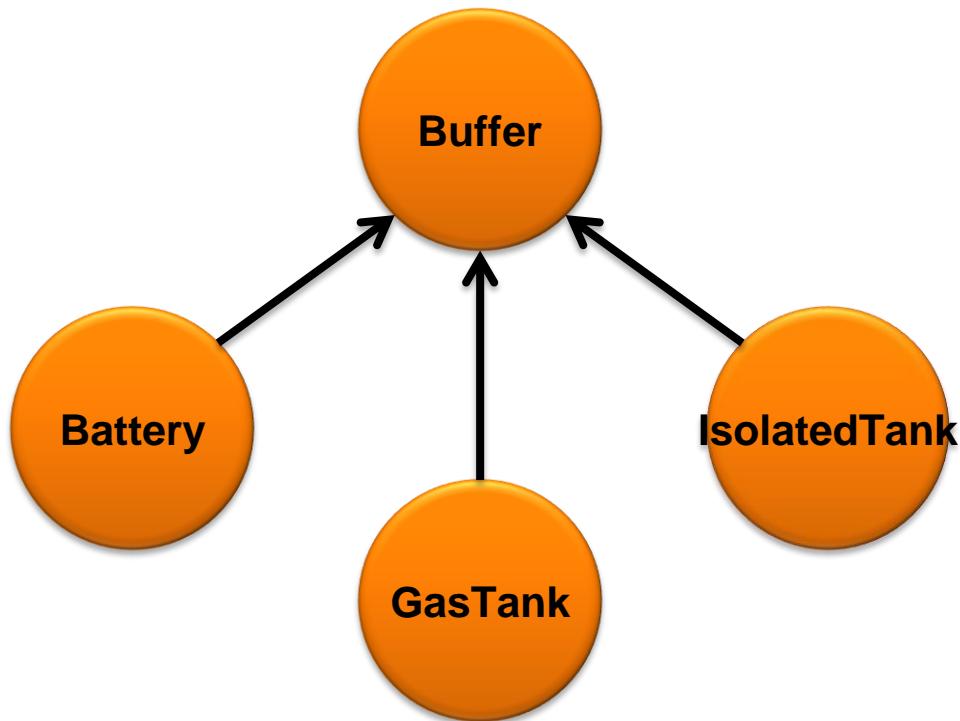
The Physical World



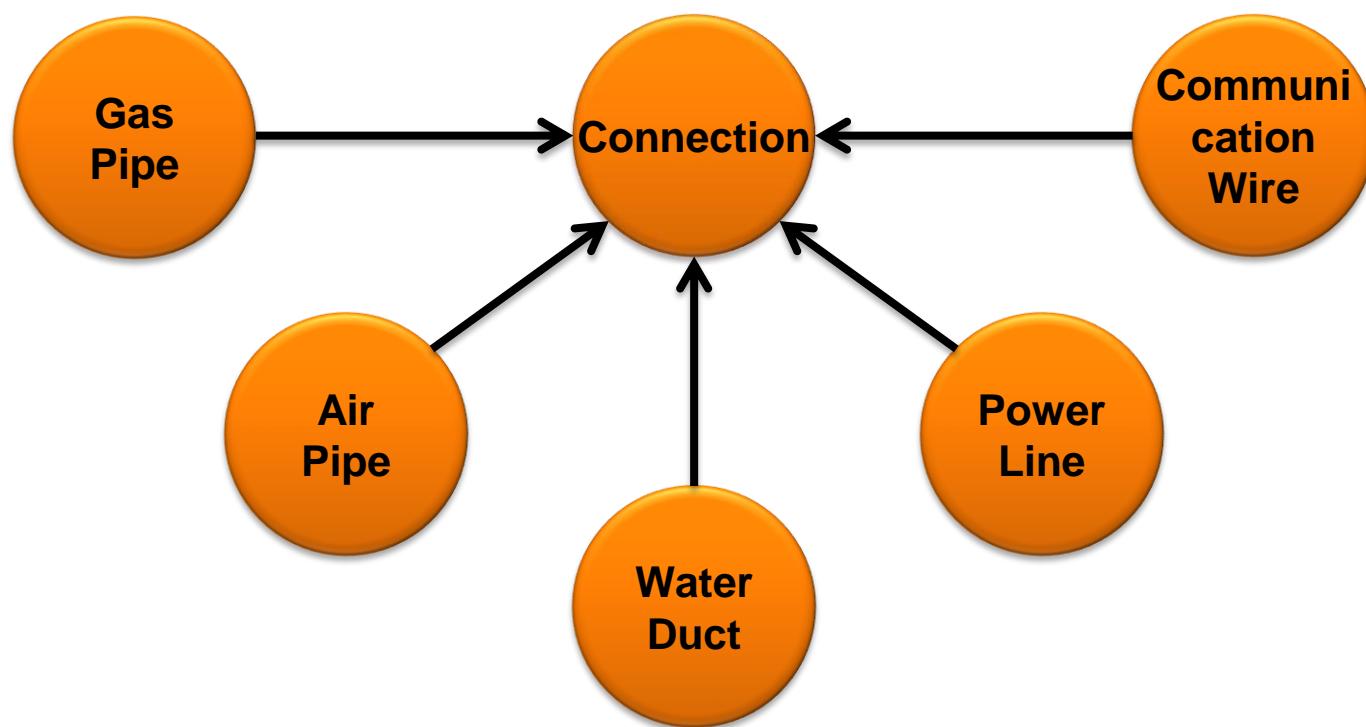
The Physical World



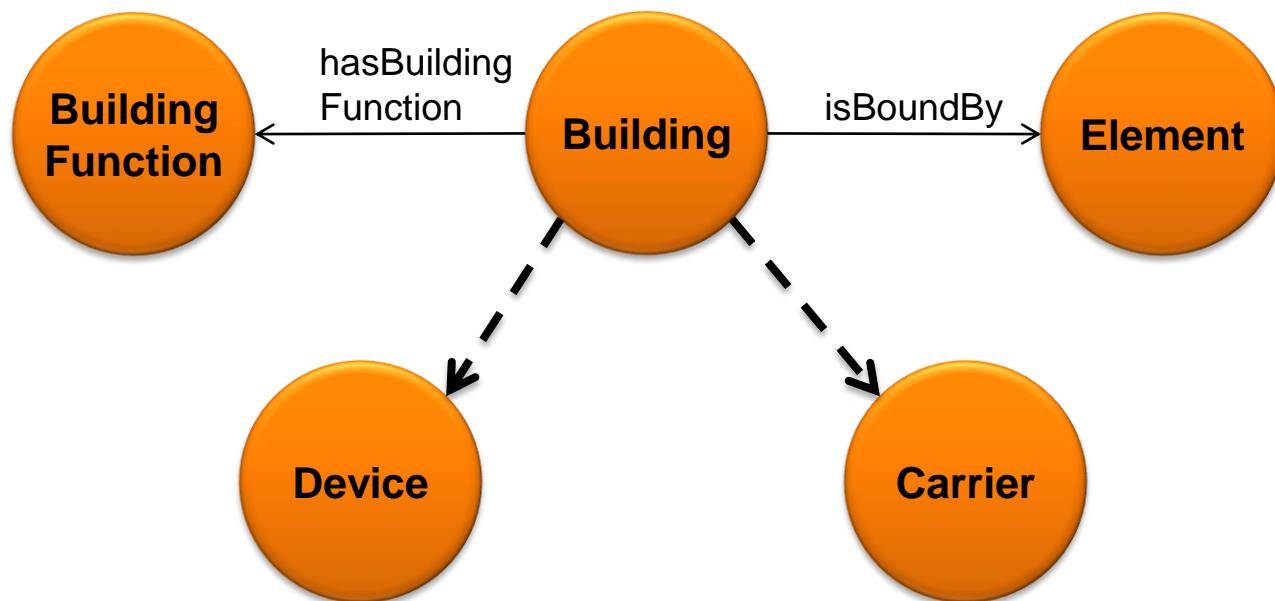
The Physical World



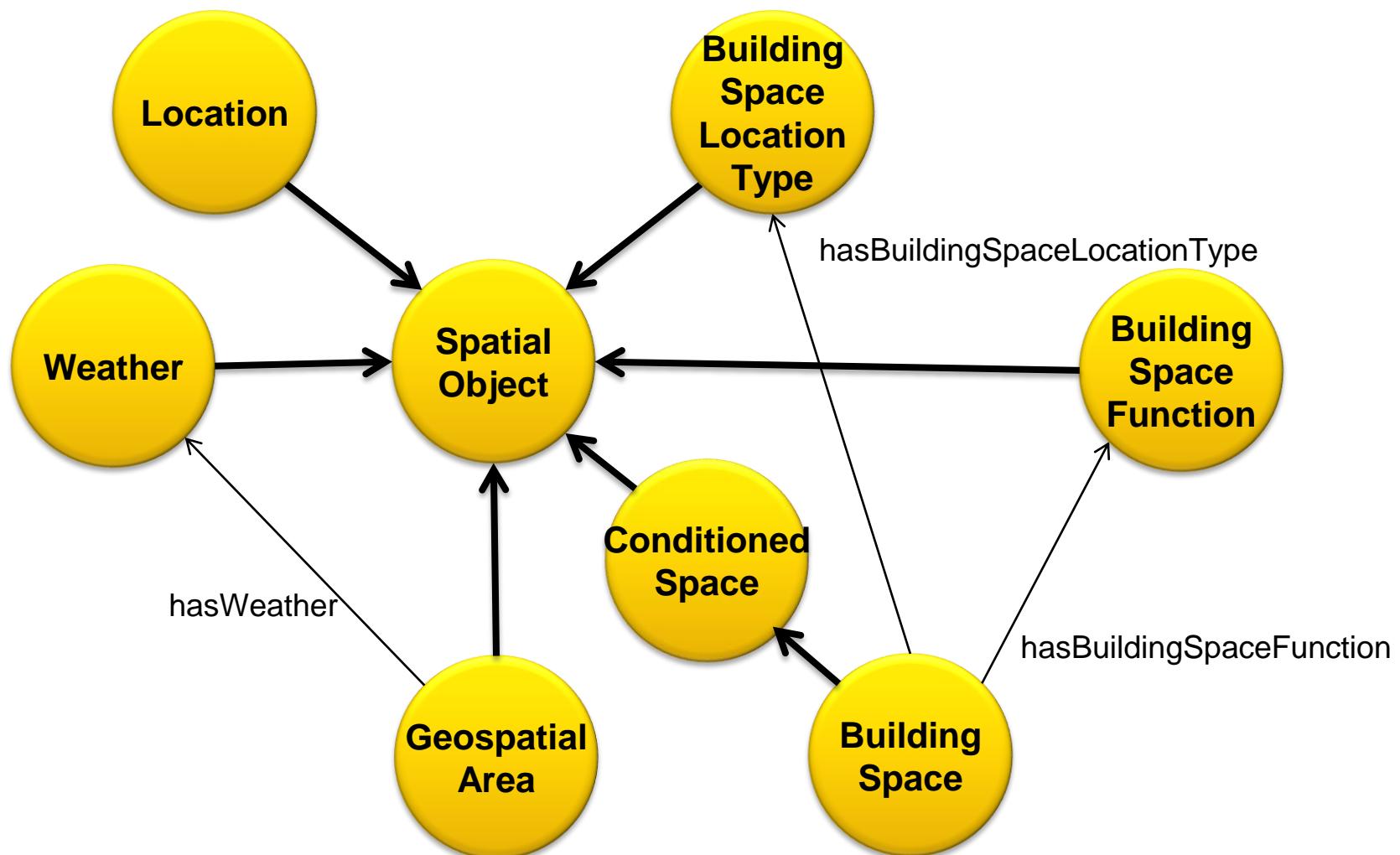
The Physical World



The Physical World

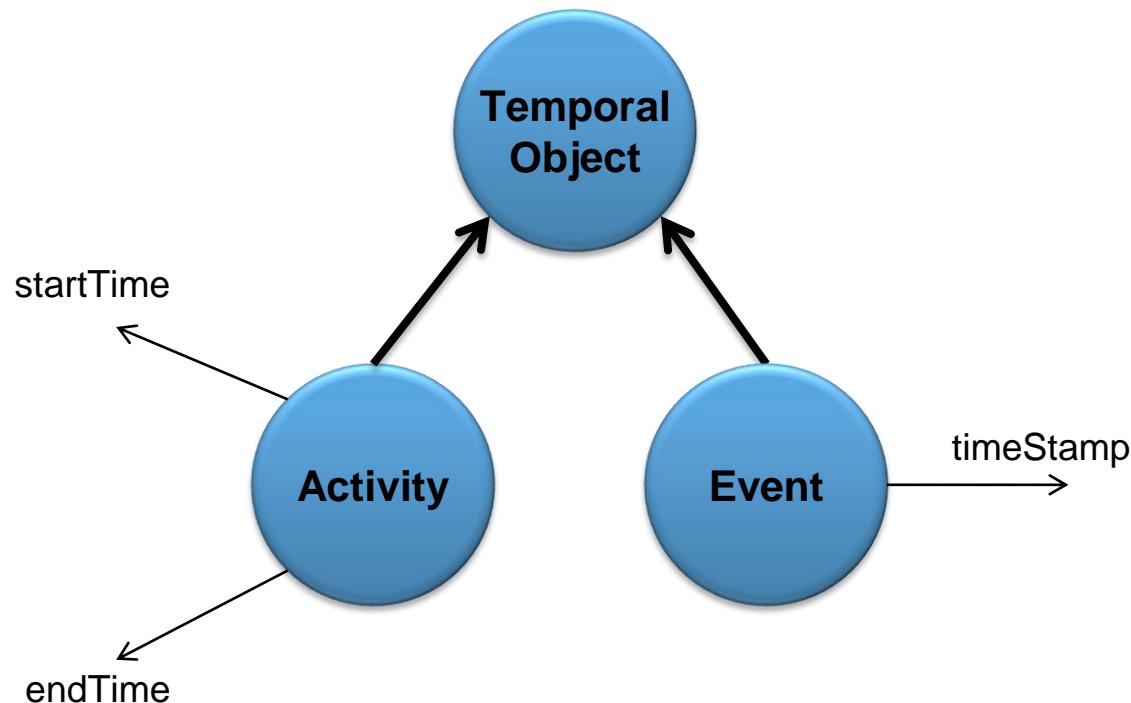


The Spatial World



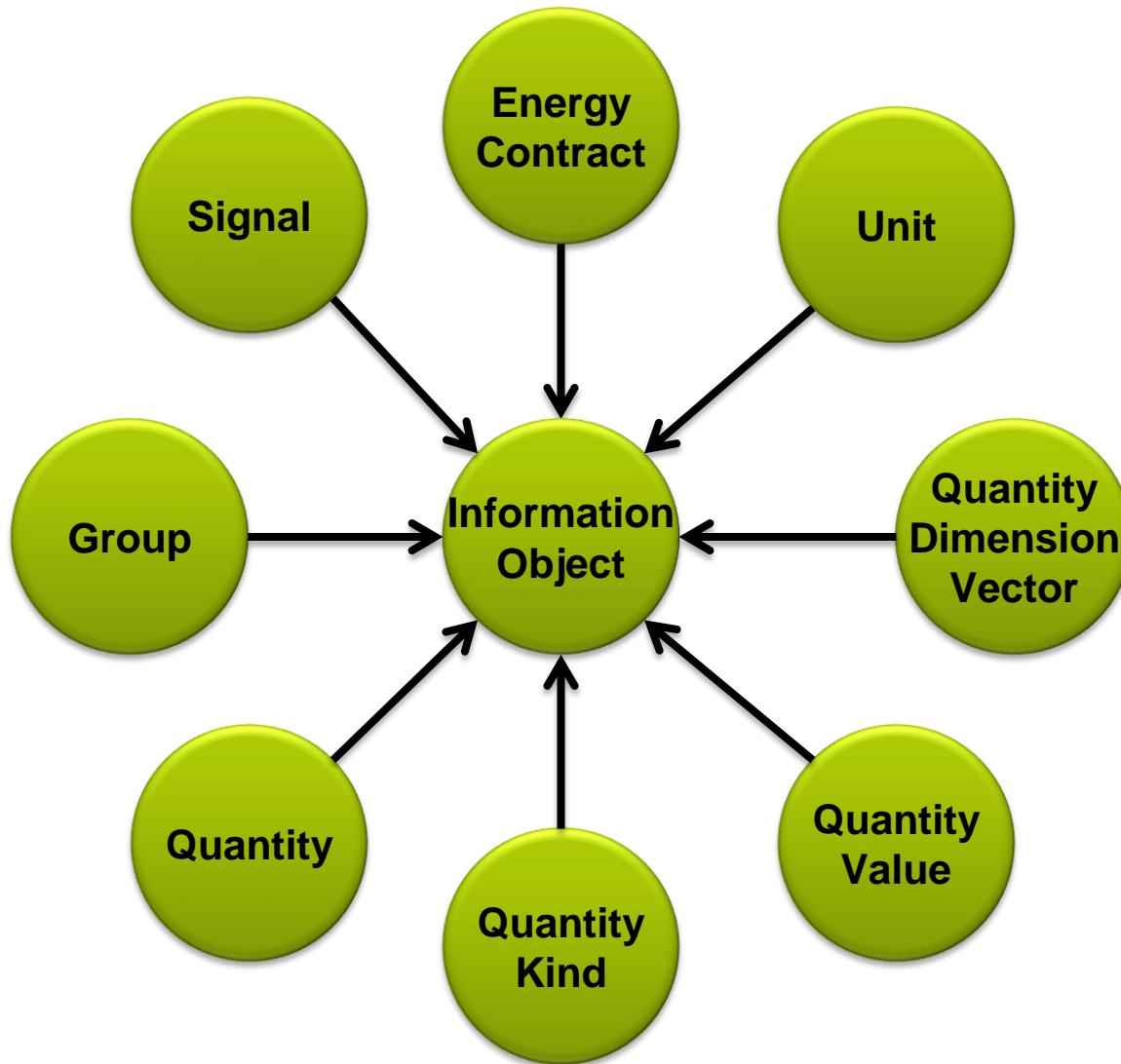
“Country, region, city,
district, neighbourhood,
site, ..”

The Temporal World

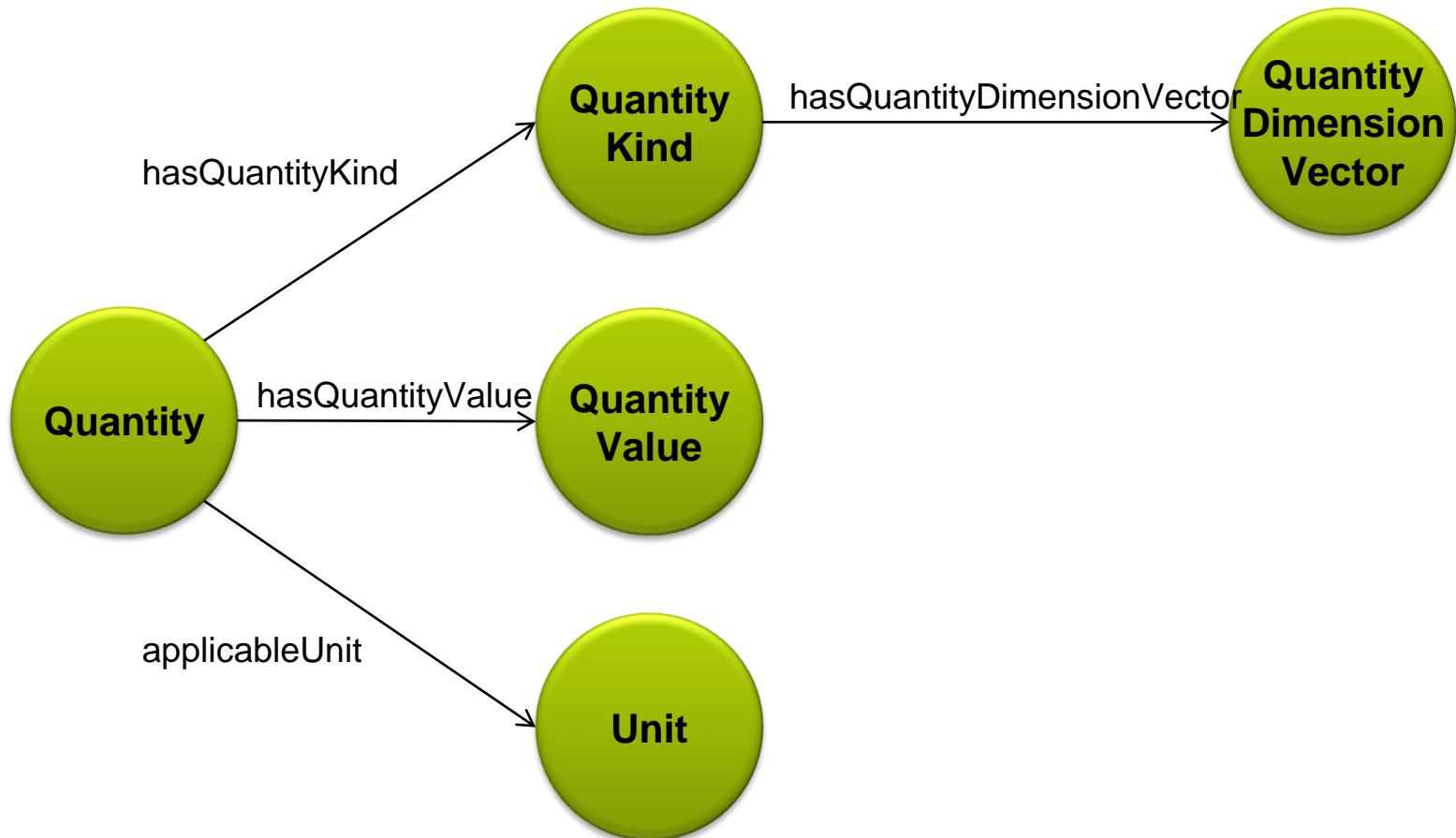


The Information World

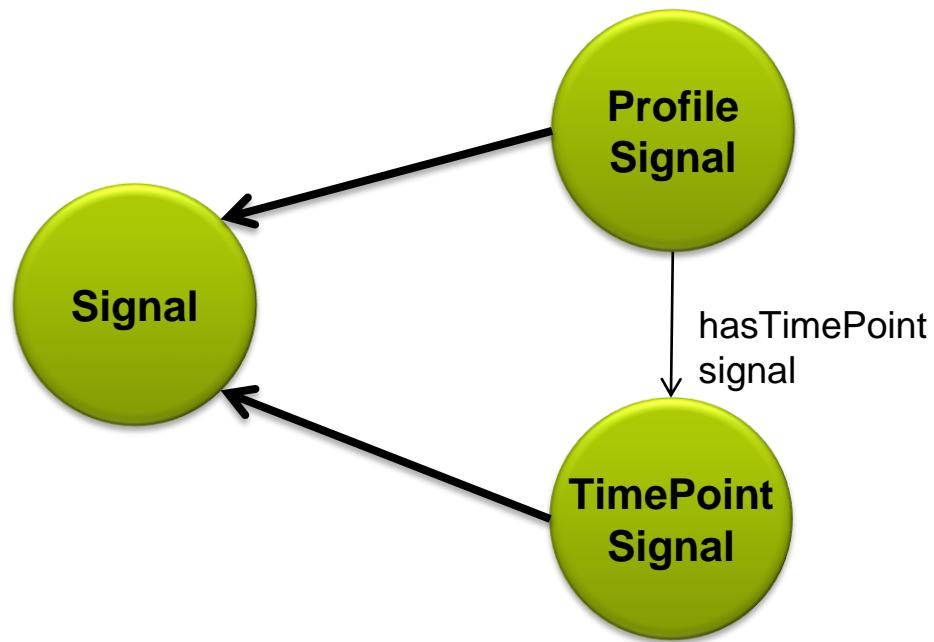
(quantities according to upcoming QUDTv2.0)



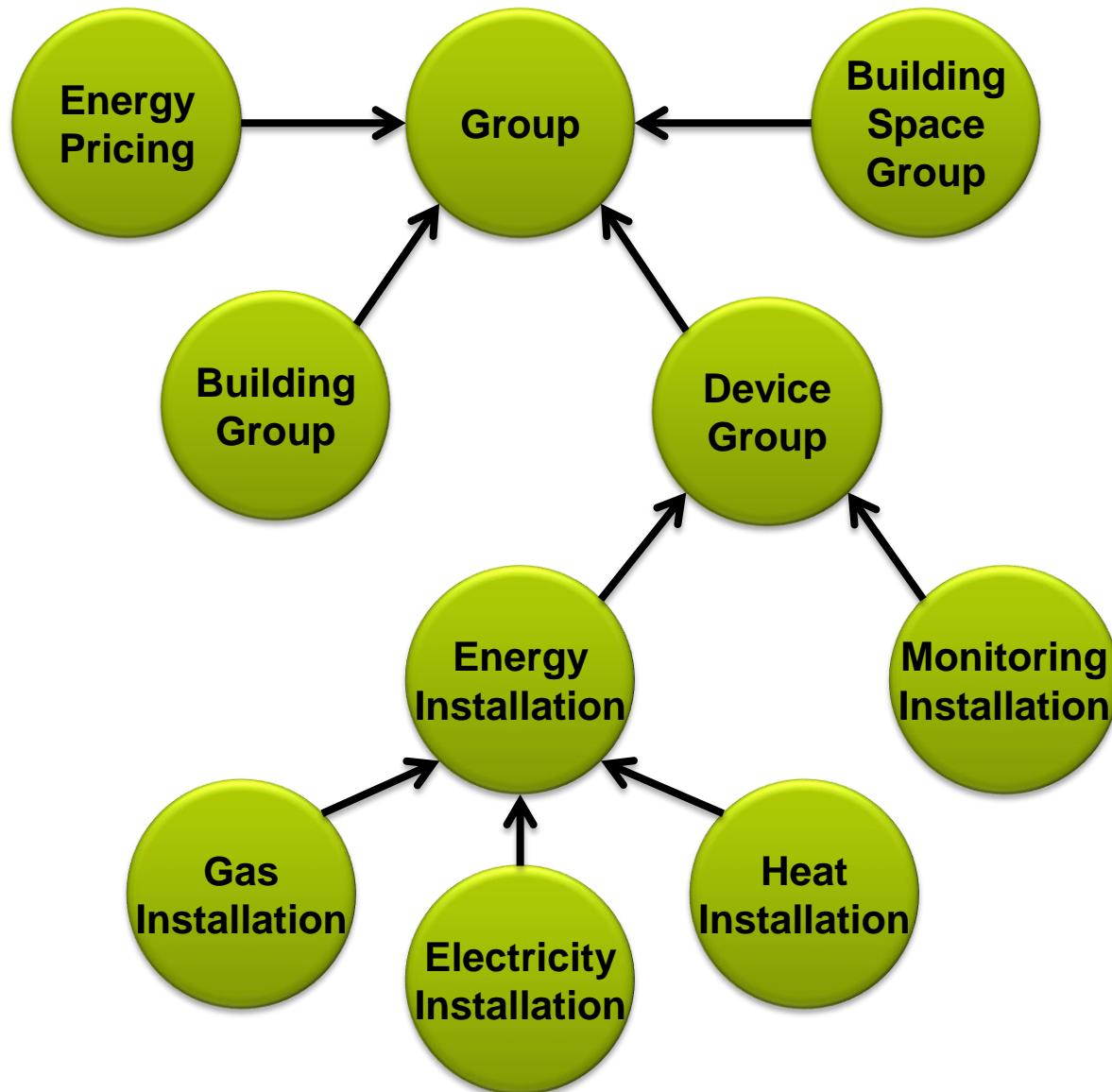
The Information World



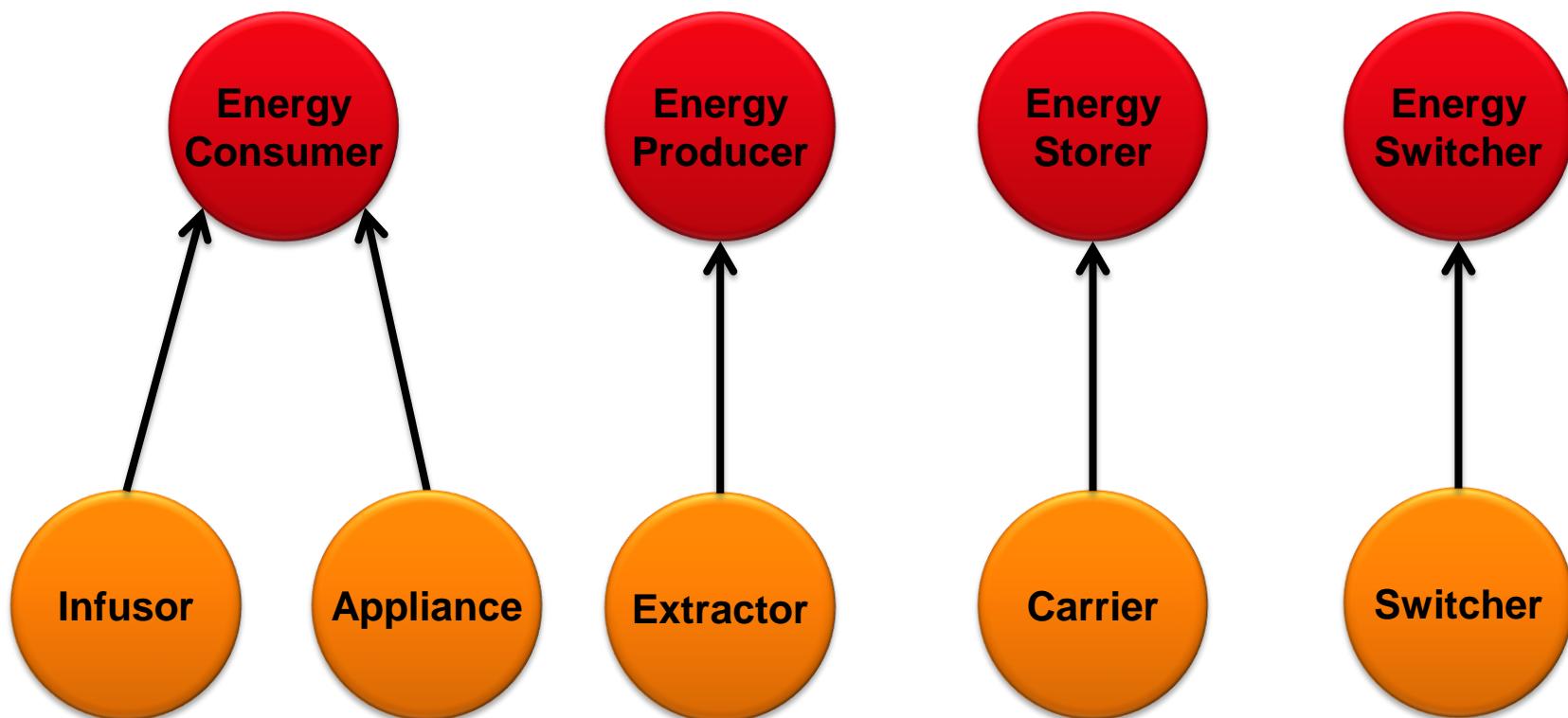
The Information World



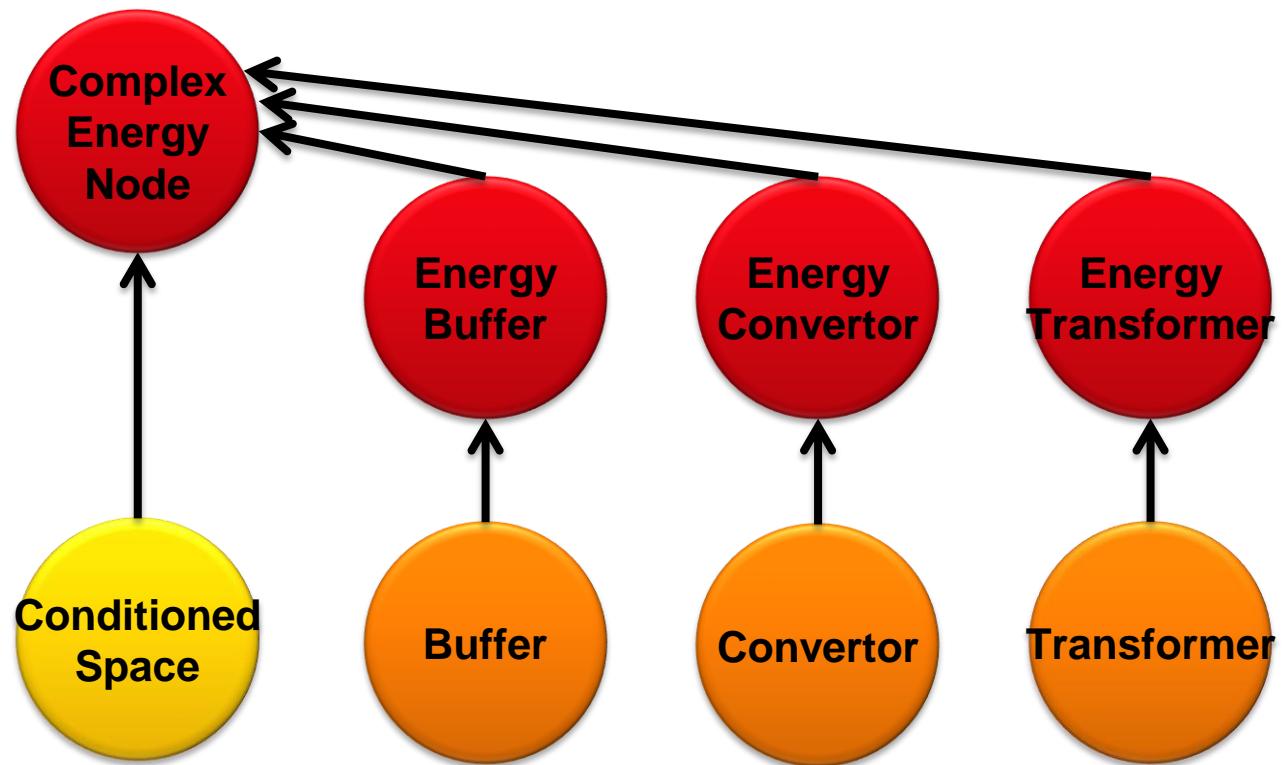
The Information World



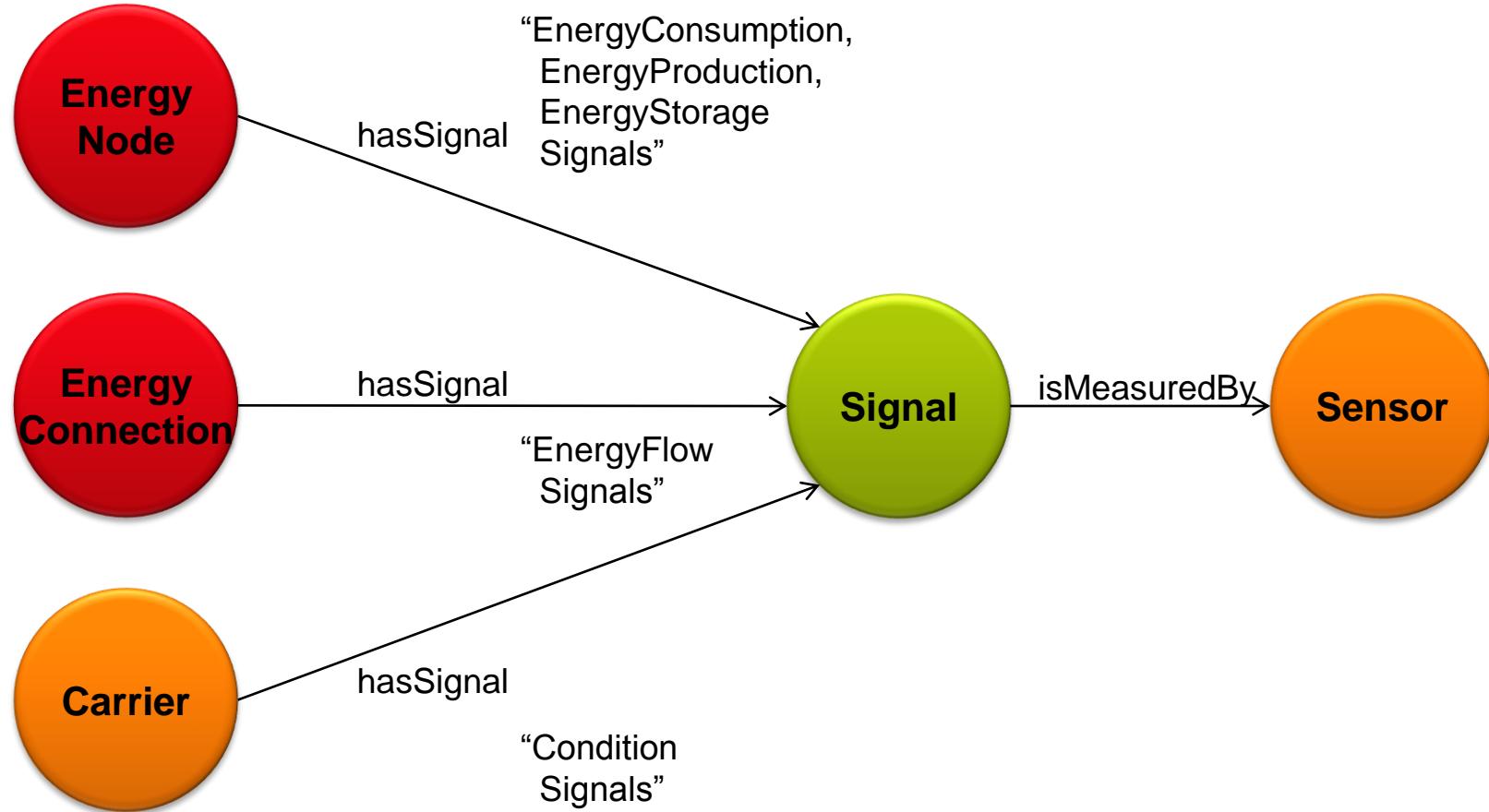
Interaction/1a



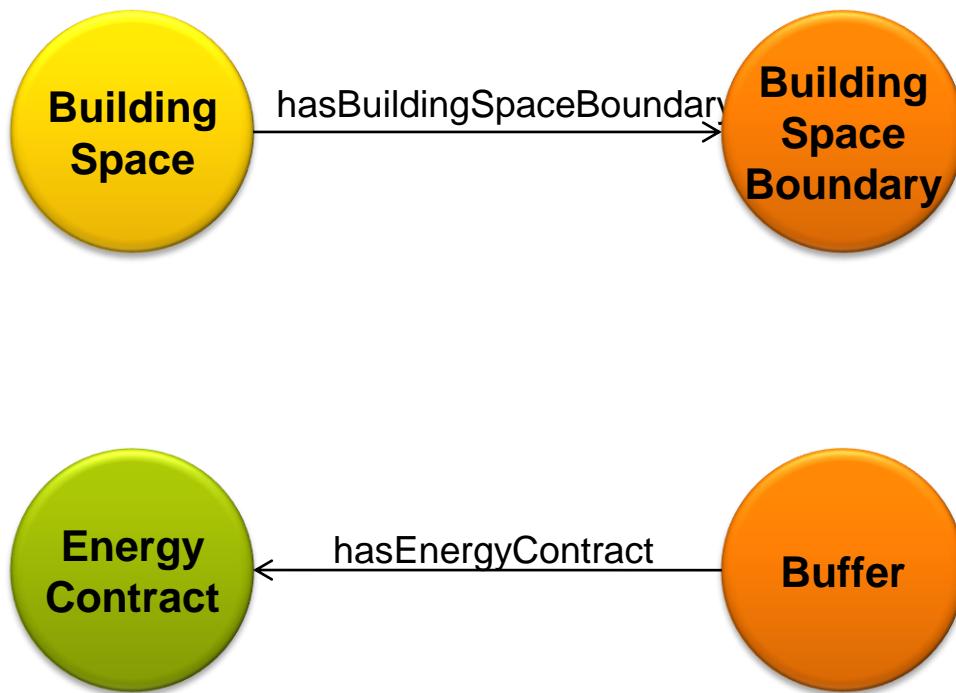
Interaction/1b



Interaction/2



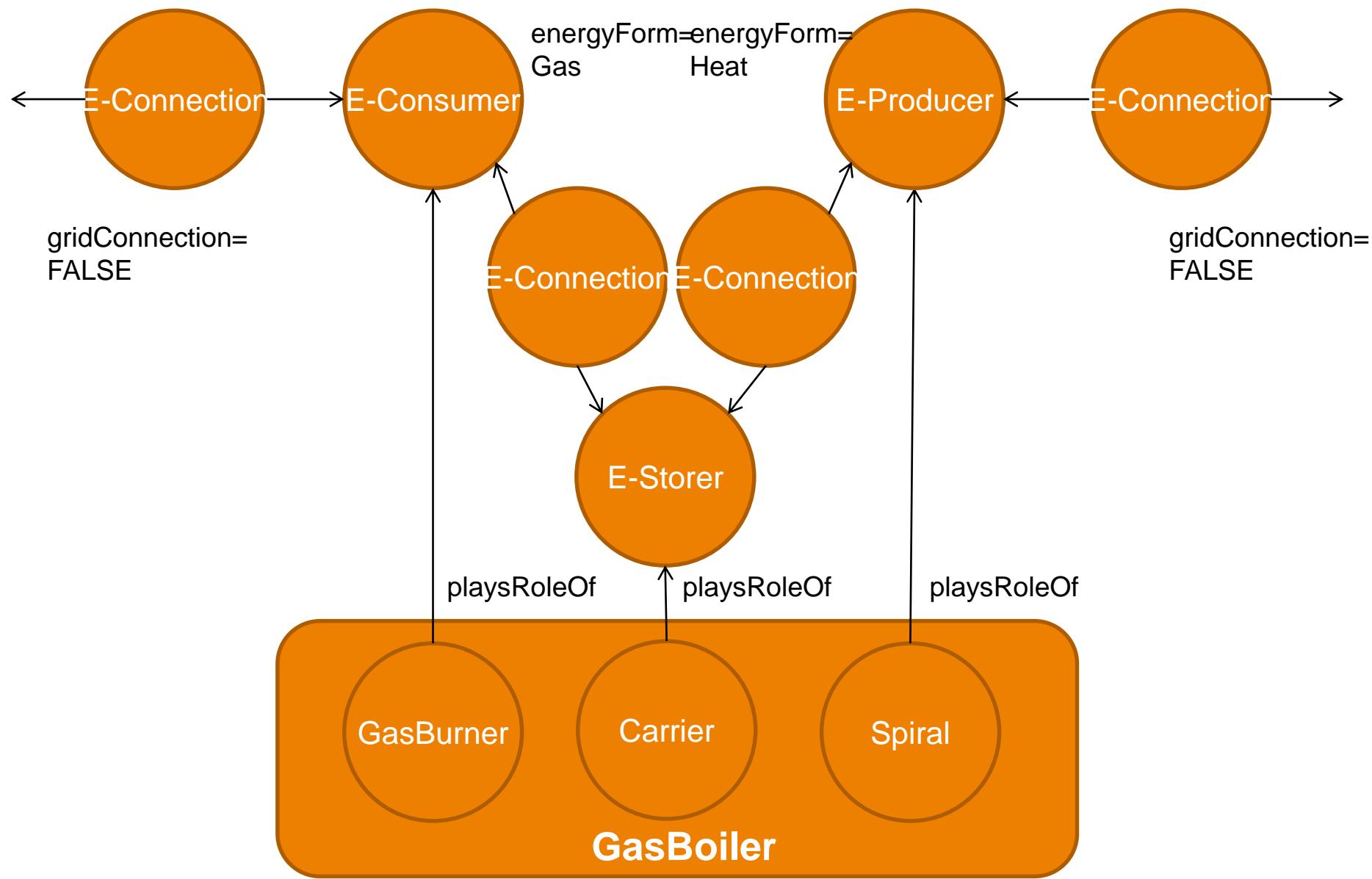
Interaction/3



Interaction/4



EXAMPLES FROM PRACTICE



(Energy) Infusor type	QuantityKind(s) increase	EnergyStorage role played by
Radiator	Temperature and/or RelativeHumidity	ConditionedSpace Carrier
Humidifier	RelativeHumidity	ConditionedSpace Carrier
LightingSystem	Illuminance	ConditionedSpace Carrier
Heater	temperature and/or relativeHumidity	ComplexDevice Carrier
Loader	Voltage, AmountOfSubstance or Temperature	ComplexDevice Carrier
Engine	Work	ComplexDevice Carrier
PV-Panel	Voltage	ComplexDevice Carrier
Collector	Temperature	ComplexDevice Carrier

(Energy) Extractor type	QuantityKind(s) decrease	ConditionalArea type
CoolingSystem	Temperature and/or RelativeHumidity	ConditionedSpace
Dehumidifier	relativeHumidity	ConditionedSpace
Deloader	Voltage, AmountOfSubstance or Temperature	ComplexDevice Carrier
Generator	Work	ComplexDevice Carrier

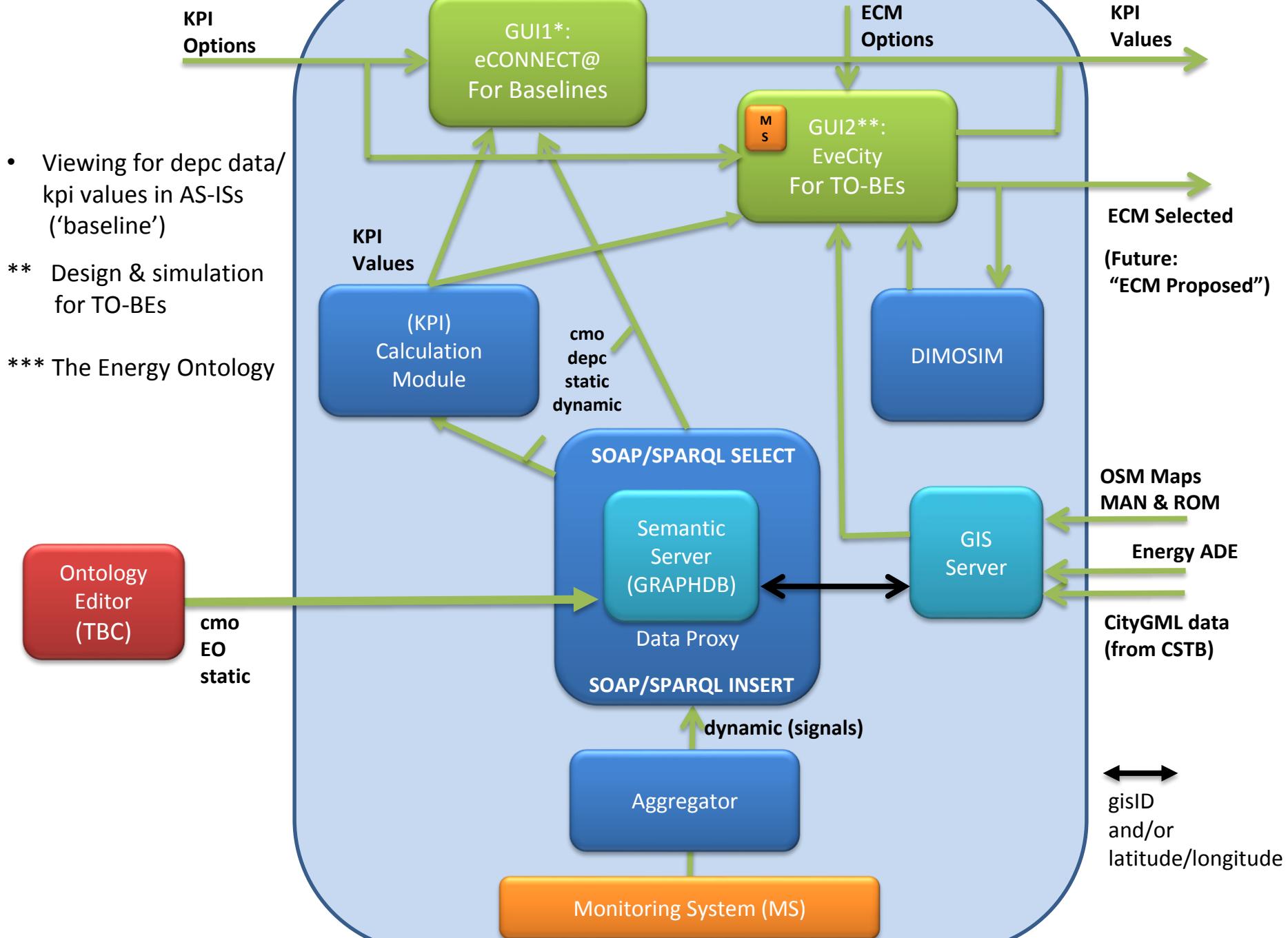
(Energy) Exchanger type	QuantityKind(s) increase/decrease	ConditionalArea type
LoaderDeloader	Voltage, AmountOfSubstance or Temperature	ComplexDevice Carrier
Spiral	Temperature	ComplexDevice Carrier
AirInOutlet	Temperature, RelativeHumidity and/or CO2Concentration	ConditionedSpace

IMPLEMENTATION TOOLS - LIVE

IDE:

TOPQUADRANT TOPBRAID COMPOSER

SEMANTIC SERVER (INCL. SPARQL ACCESS):
ONTOTEXT GRAPHDB





› **THANK YOU FOR
YOUR ATTENTION**

TNO

innovation
for life