



Advancing Grid Modernization

Architecture Element Categorization – Results Todate

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Agenda



- ▶ ADWP's Arch. Elements Categorization Key Contributors
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- ▶ Objective/Goal
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- ▶ Architectural Element Categorization Guidance
- ▶ Neutral Concepts Model Approach
- ▶ Next Steps

ADWP's Architectural Elements Categorization

Key Contributors



- ▶ Chair (2014-present): Dr. Elizabeth Sisley (Calm Sunrise Consulting)
- ▶ Dr. Steven Ray (Carnegie Mellon University)
- ▶ Ron Cunningham (AEP)
- ▶ Dr. Gerald Gray (EPRI)
- ▶ Stephan Amsbary (past member, previously ENERNEX)
- ▶ John Ruiz (past member/Chair, Johnson Controls)

Problem Statement(s)



Each IT Project tends to:

- ▶ if fortunate, have access to prior/related projects' artifacts to work from, but many times discover:
 - ▶ the same terms (or named things) are defined differently from one project to the next, or from one group/company to another; or
 - ▶ what are in reality the same thing are named differently, or
 - ▶ architectural contexts and abstraction level are not the same for those terms
- ▶ many projects end up identifying/naming/defining their own set of Actors, ServiceCompositions (~roles), Services used to document business scenarios, use cases, stories
- ▶ struggle to gain consensus in understanding with others, when integrating that project's application(s), data, and messaging with another group's/company's set of application(s), data, messages, or
- ▶ worse yet, make assumptions that the projects defined terms are interpreted the same with everyone else and finding out when in full production they are not

Objectives/Goals



- Provide Guidance/Examples on how to align from one project's set of architectural/business elements to another. Alternately encourage reuse of a reduced number of sets of architectural/business terms via understanding how setA-element relates to a setB-element
- Along the way start building up a common set of architectural/business elements and the relationships between them, that can be used, interpreted, and modeled the same way across projects and organizations
- Reduce the time/effort of each project's re-identifying/re-naming/re-defining Actors, ServiceCompositions (~roles), Services, relationships and associated missteps from one integration to the next
- help create a common vocabulary of terms and elements that is expected to make it easier to create new business use cases/stories that in turn are used to help identify the business requirements and services/capabilities that are used in project business scenarios and use case development, and advancing interoperability standards work.

Results To Date

Results To Date



- ▶ SGAC Architecture Development Working Party (ADWP), gathered set of Use Case elements from 18 organizations and performed initial categorization of elements to Conceptual, Logical, Physical architecture abstraction levels. Combined set contains:
 - ▶ ~ 180 Actors
 - ▶ ~ 230 ServiceCompositions (~role)
 - ▶ ~ 800 Services
- ▶ Created an OWL model (SOA focused), that shows the relationships of the elements across the Conceptual, Logical, Physical abstraction levels
- ▶ Currently working on:
 - ▶ using a specific real world use case set of Actors, Services, messages to vet out the OWL model;
 - ▶ relating the use case set of elements to the gathered set of elements using a “neutral concepts” OWL model of the business scenario that the use case came from;

Intent is to create the appropriate relating of one set of elements to another for the purposes of helping identify a common vocabulary of architectural/business terms and elements.

Architectural / Business Element Categorization Guidance

Conceptual Definition*



Conceptual Architecture models the actual business as the Owner conceptually thinks the business is, or maybe wants the business to be.

What are the services that are required to satisfy the future needs?

- Conceptual Services represent the goals of the stakeholder
 - What I want to do, which is driven by my mission.
 - What I need to do , which is often driven by regulations.
- Have a lot of attributes
 - Service levels and other non-functionals
 - Specifications of functionality
- Simplest questions to find them:
 - WHAT are the essential elements within scope?
 - Which services do I need to provide to the outside world to fulfil my mission ?
 - Which services from the outside world do I need to do that?

* Based upon Zachman Framework

Logical Definition



Logical Architecture models of the “systems” of the Business, logical representations of the Business that define the logical implementation of the Business. How is the Architecture (ideally) structured?

- **HOW** are basic elements related, according to the specific objectives and constraints of the architecture? (Logical Structure)
- Are descriptions of the ideal building blocks needed to run the business as defined in the Conceptual Architecture
- Building blocks are technology independent services.
- For the construction we need criteria to cluster the Services into these building blocks
- This is more about the interfaces than the technologies

Physical Definition



Physical Architecture is the technology-constrained, physical implementation design of the systems of the business. How is the Architecture (ideally) designed?

What software and processes are necessary?

- **Which** elements of structure will be realized, according to strategies and implications, and with **WHAT** can this be achieved?

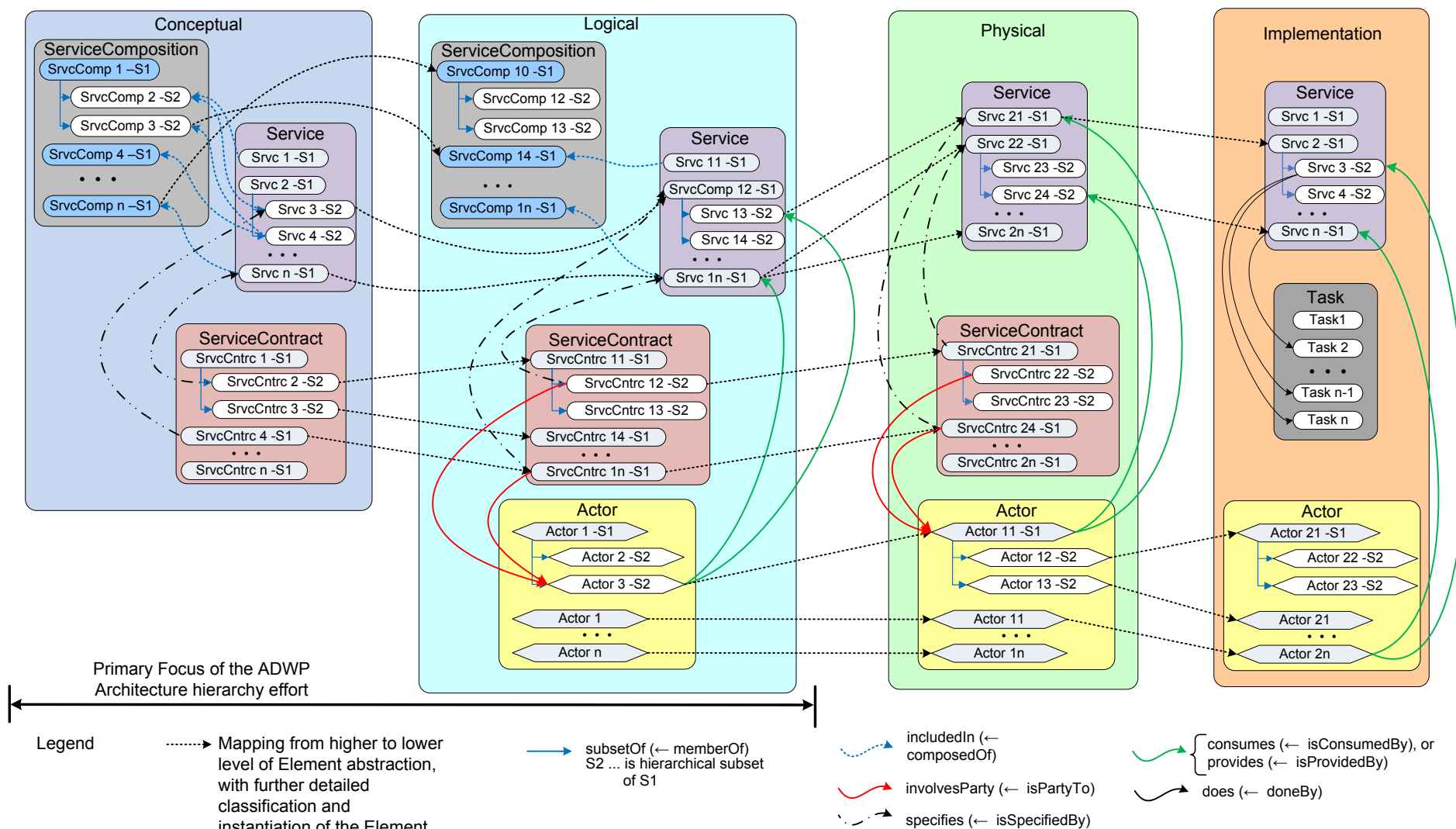
Describes implementation components necessary to implement. At this point technology choices are being made

Is a representation of components of building blocks an architect will use, like:

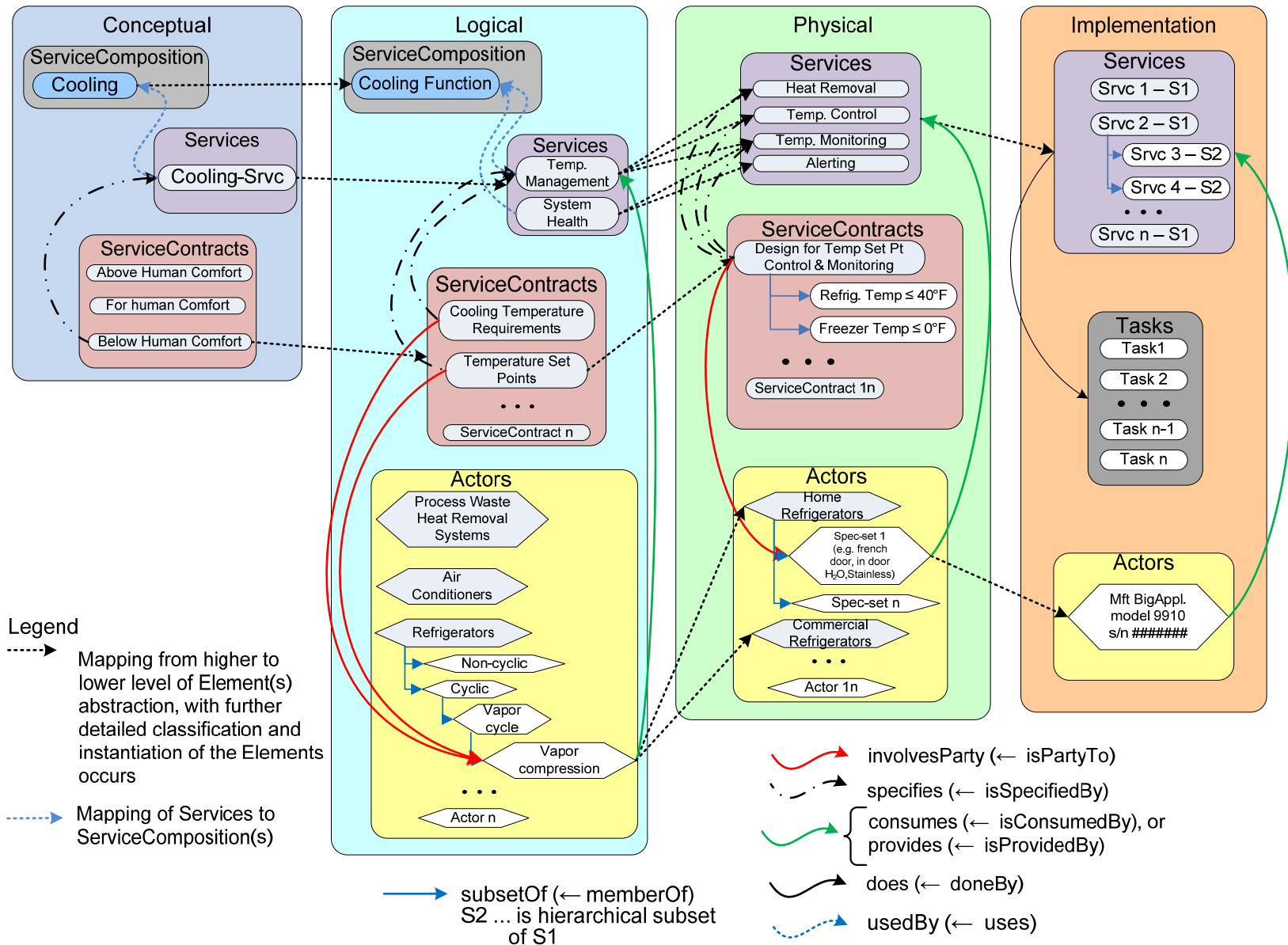
- A person
- A process
- A piece of software
- A piece of infrastructure

Provides implementation technical specifications; the details needed for white box development process (eg: ITIL, Rational Unified Process, SDLC, Agile), vendor solutions, and manual processes (TOGAF Phase E)

Abstraction Levels Applied to SOA



Cooling Example



Categorization Guidelines for the Elements



Categorize the original elements

- Identity elements as Actors, Services, ServiceCompositions, and ServiceContracts
- Architecture Levels
 - **Conceptual** - these are the business-to-business (B2B) relationships, the B2C (consumer), and the B2R (regulatory & policy). Thus a black-box view of the business.
 - **Logical** – this is where Actors come in, but there are also Services. This is a white-box view of the business, showing the internal elements and their relationships.
 - **Physical** - the representation of a Specification, where the required features (functional and non-functional) are included.
 - **Implementation** – actual technology and implementation configuration decisions are made.

Categorization Guidelines for the Elements cont'd



- Semantics should be explicitly documented to reduce ambiguity
- An Actor is considered to be a person, organization, or system that has at least one role (ServiceComposition) that initiates or interacts with other Actors. Actors may be internal or external to an organization
- A ServiceComposition (~role) is the usual or expected function, or context, in which an actor consumes/provides a service. An Actor may play a number of roles
- At the highest level, a Conceptual ServiceComposition represents the goals of the stakeholder (e.g.: Energy Provider). A Conceptual role (ServiceComposition) will have many defining characteristics
- A Logical ServiceComposition decomposes/partitions a conceptual role into functional components. At the Logical level is where the mapping from roles to Actors occurs
- There is no such thing as a Physical ServiceComposition (~role). At this level an Actor simply offers services according to advertised interfaces. Similarly, there is no such thing as a Conceptual Actor
- A Conceptual ServiceComposition maps to one or more Logical Service Compositions, which get related to one or more Logical Services which are consumed or provided by Logical Actors
- A Physical Actor is an instantiation of a Logical Actor. A Physical Actor performs a set of actions which is a Physical instantiation of a Logical role

Neutral Concepts Model Approach

Mapping Use Case Terms



AEP	American Electric Power	4.2 Demand Response	Document ID: Use case # 2.4
Title: Performing Real Time Price Auction Use Case			
Subject Matter Expert:		Author:	Reviewed by:
Don Taylor and Margaret Goodrich		Mark Wald	Tim Simmons, Don Taylor and Margaret Goodrich

Performing Real Time Price Auction

Acknowledgment: This material is based upon work supported by the Department of Energy under Award Number DE-OE0000193.

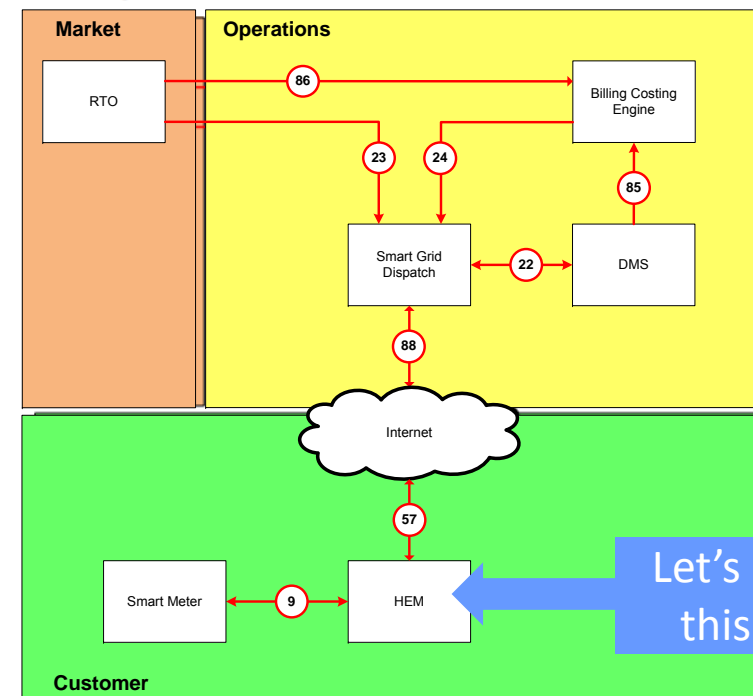
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Version History			
Rev.	Date	Author	Change description
A	06/14/2011	Mark Wald	Initial Release
B	07/21/2011	Mark Wald	First revision
C	08/08/2011	AEP workshop	Various updates
D	9/12/2011	Tim Simmons	Implement various updates
E	10/13/2011	Brian D. Green	Add Narrative, Interface Diagram and updated Actors and steps
F	10/20/2011	Barry Peirce	Minor word changes and added comments. Changes tracked.

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AEP	American Electric Power	4.2 Demand Response	Document ID: Use case # 2.4
Title: Performing Real Time Price Auction Use Case			
Subject Matter Expert:		Author:	Reviewed by:
Don Taylor and Margaret Goodrich		Mark Wald	Tim Simmons, Don Taylor and Margaret Goodrich

Interface Diagram:

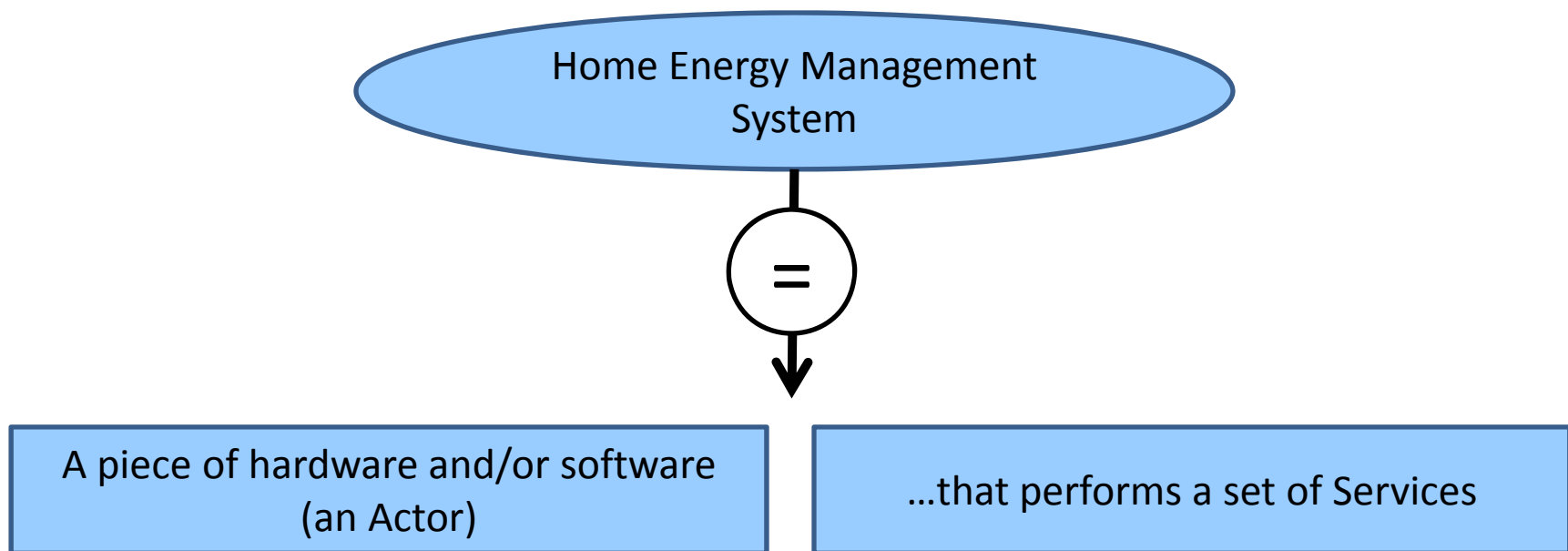


Let's look at this term

The HEM in the AEP/EPRI use case

HEM stands for “Home Energy Management System”

What does that really mean?



The HEM in the AEP/EPRI use case

A piece of hardware and/or software
(an Actor)

There are different kinds of hardware.
What kind of hardware?

Sensor hardware

Actuator hardware

Control hardware

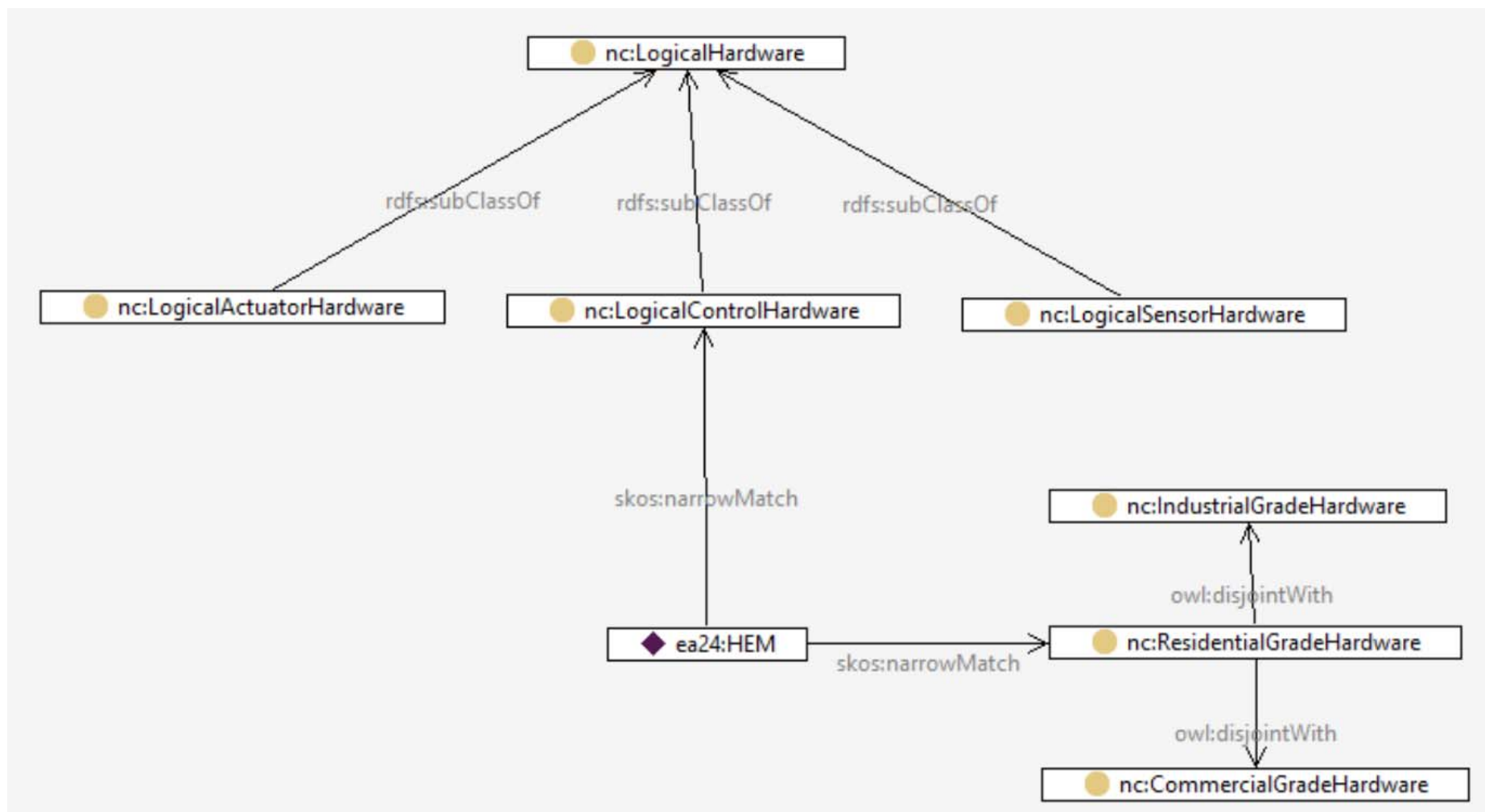
There are different grades of hardware.

Industrial grade

Commercial grade

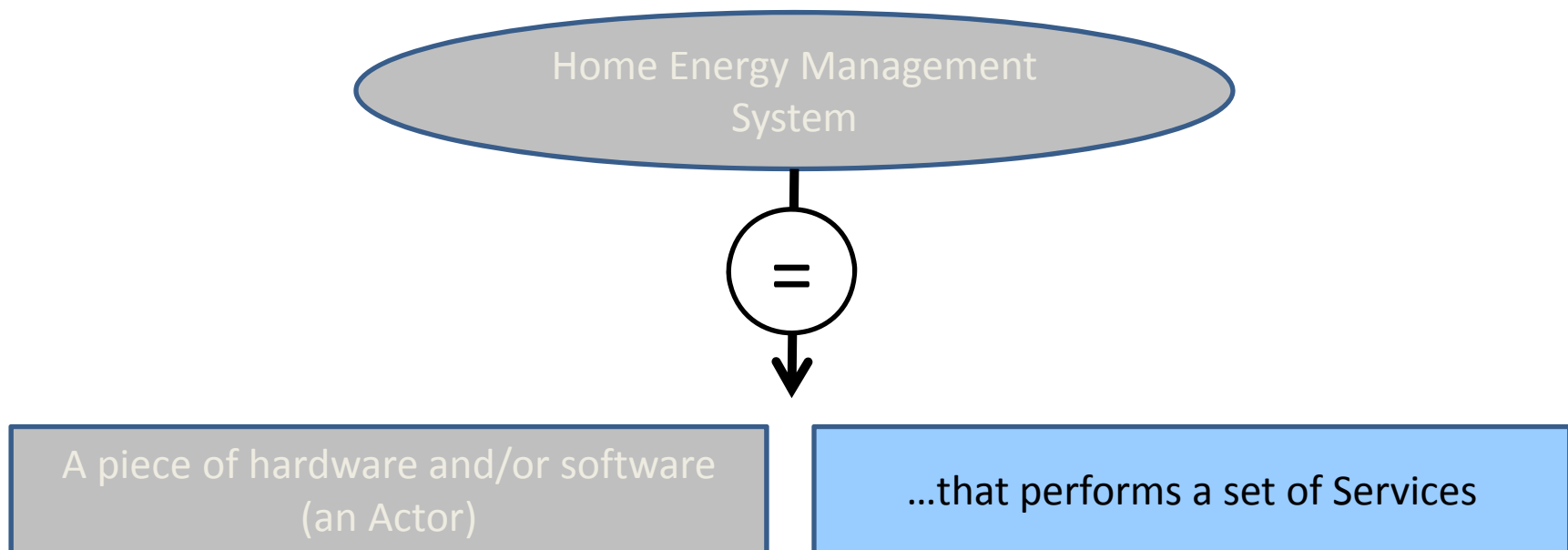
Residential grade

The HEM in the AEP/EPRI use case



The HEM in the AEP/EPRI use case

OK, we have characterized the hardware.
What about the Services it performs?

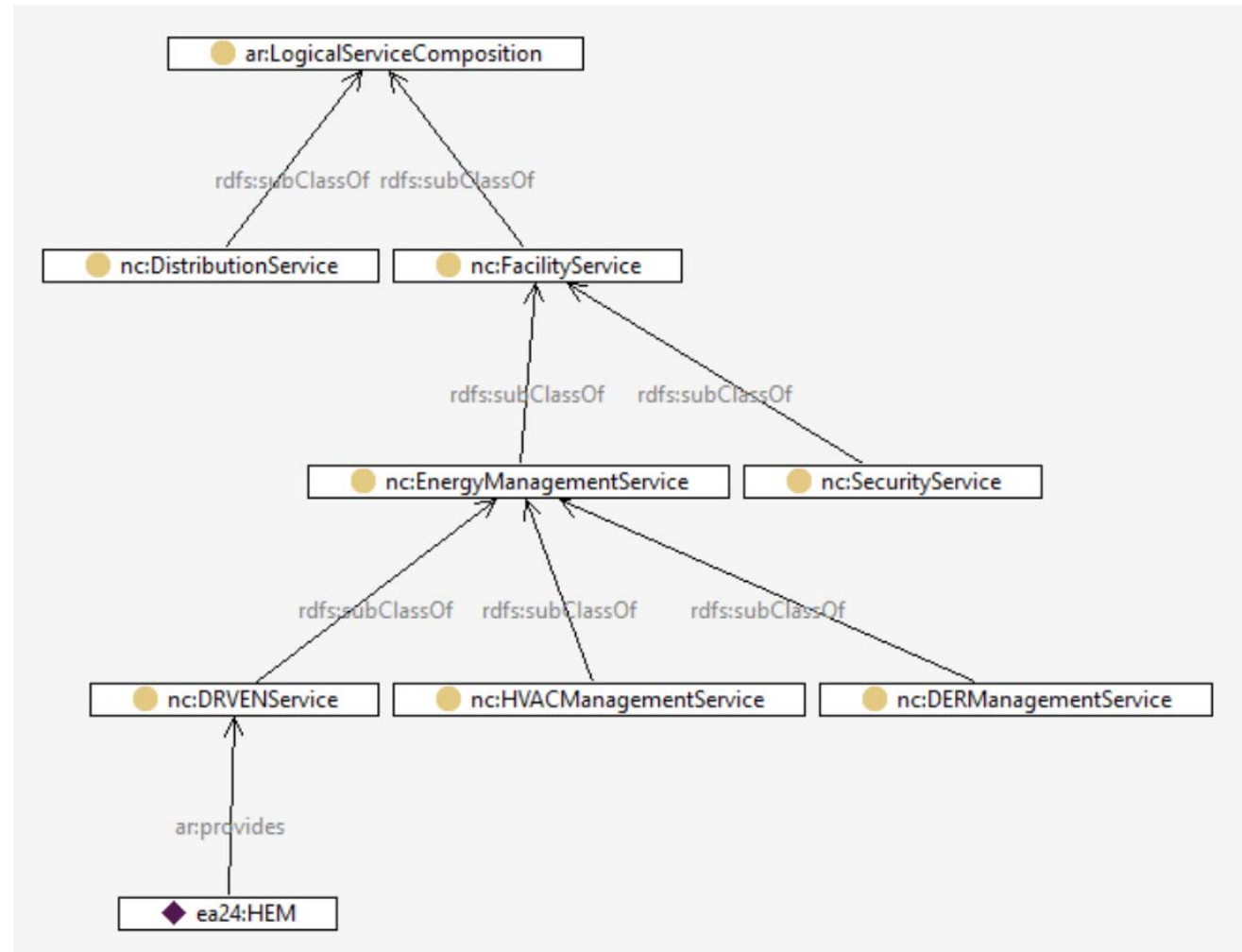


The HEM in the AEP/EPRI use case

Services

We can define a hierarchy of Services

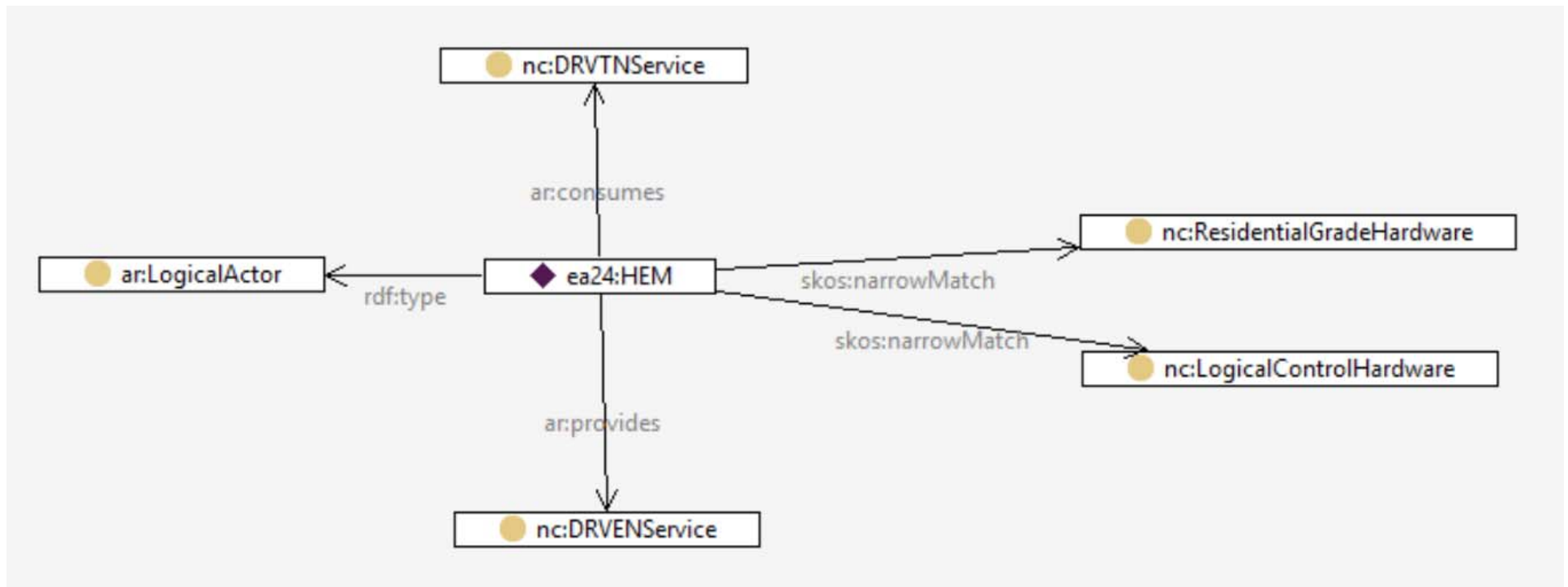
For this DR use case, we know the HEM provides at least a DR service



The HEM in the AEP/EPRI use case

Definition of HEM

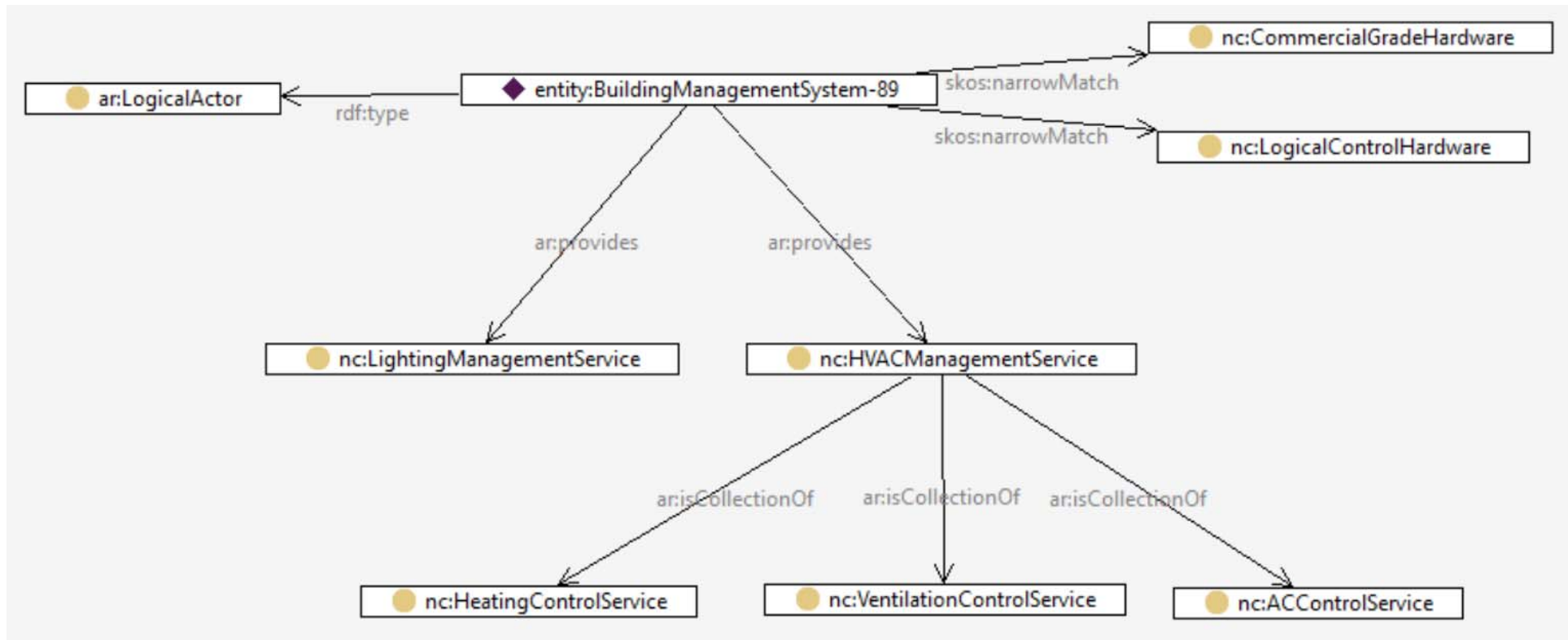
So, a definition of the HEM in this use case might be captured as follows:



“BuildingManagementSystem”

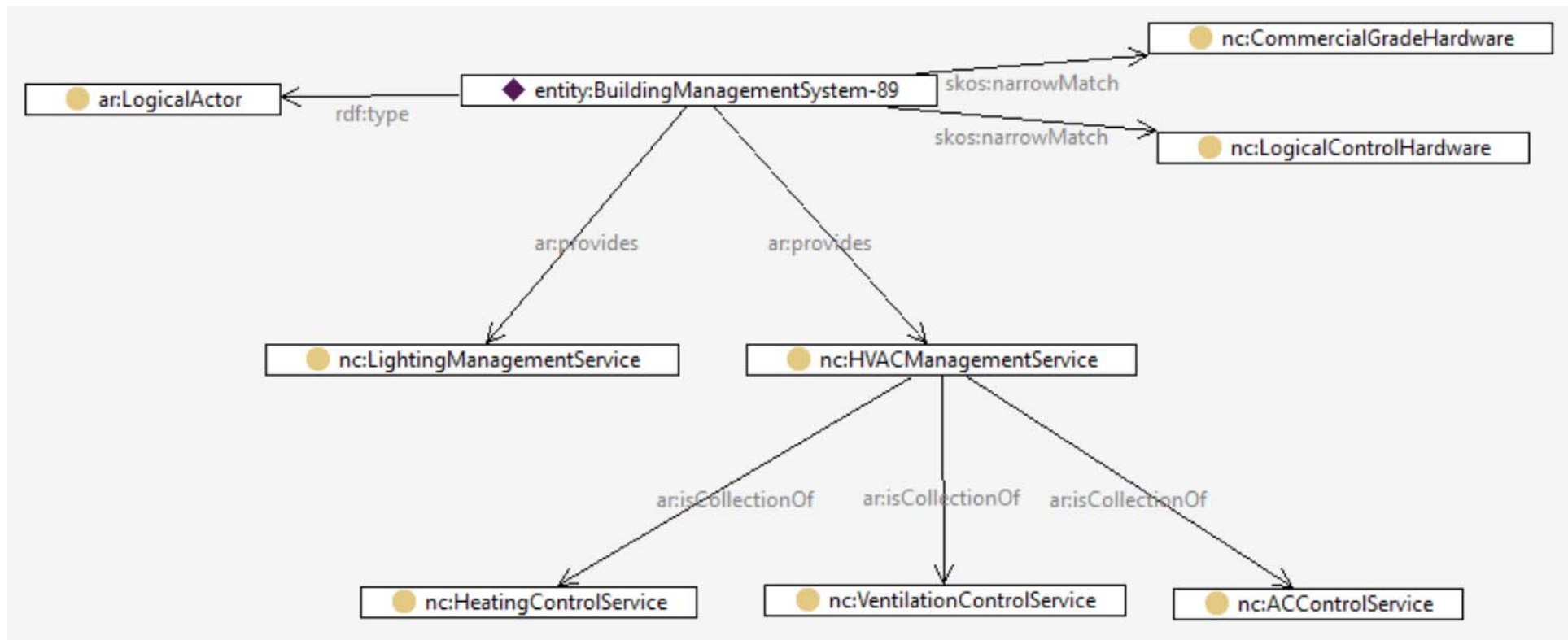
Definition from the EU

A system consisting of several decentralized controllers and a centralized management system to monitor and control the heating, ventilation, air conditioning, light and other facilities within a building.



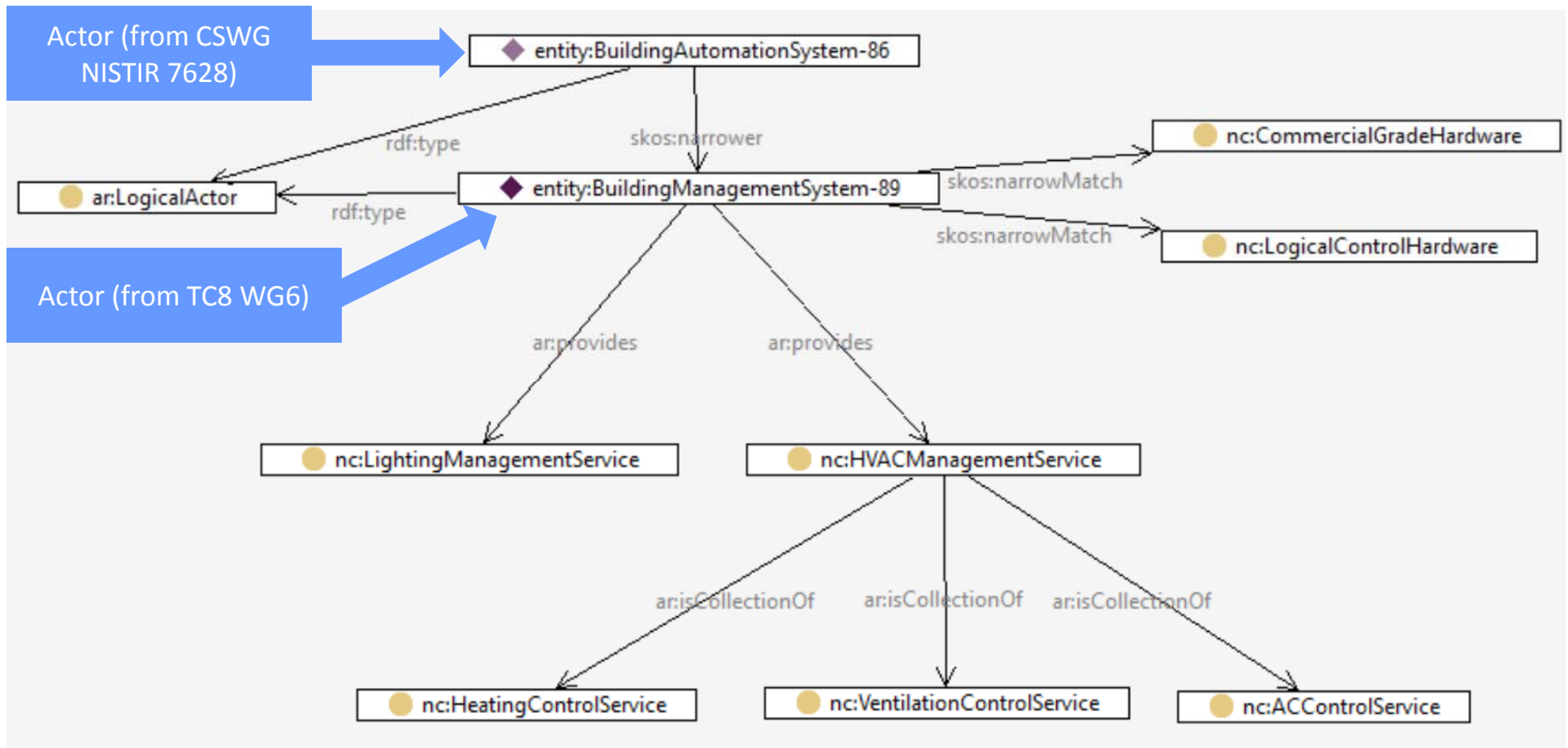
“BuildingManagementSystem”

How does this help? Because if you want to interface with something that provides HVACManagementService, then you are guaranteed that it can perform HeatingControlService (for example).



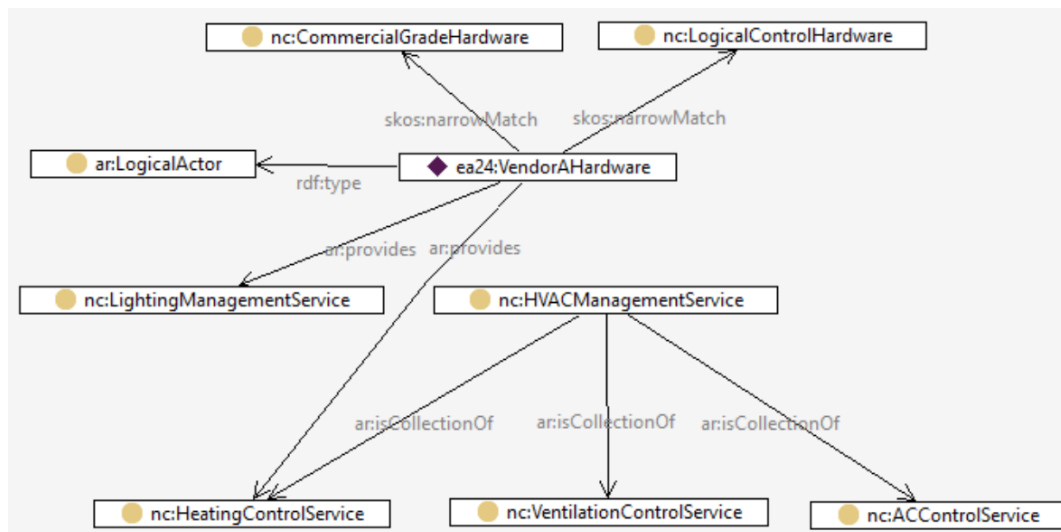
“BuildingAutomationSystem”

...and BuildingAutomationSystem can do everything BuildingManagementSystem can do because of the skos:narrower relation.

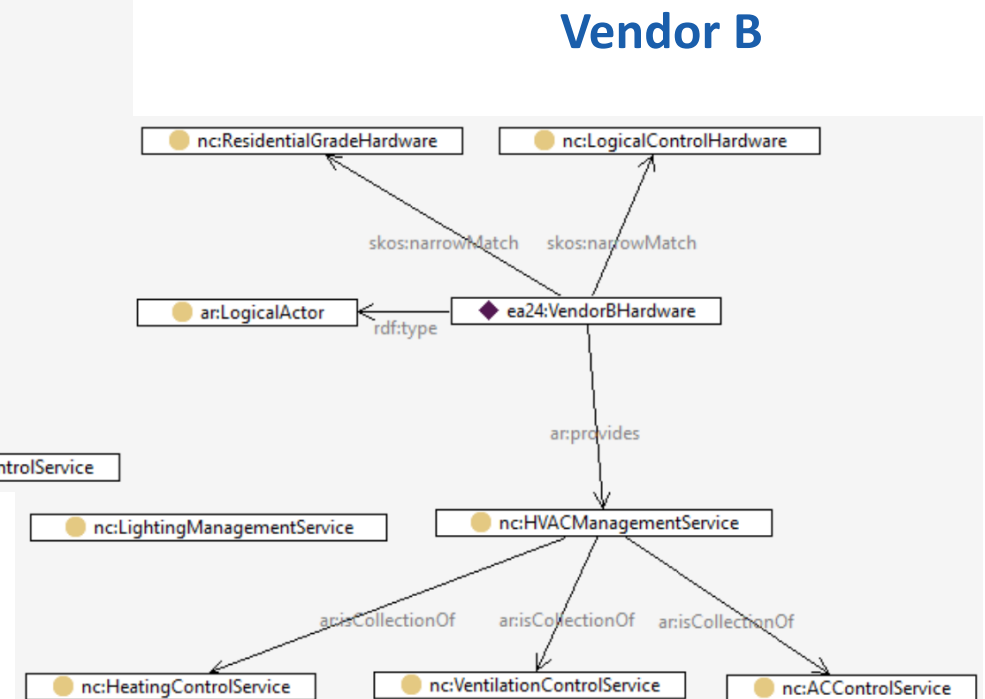


Implications

Because all this information is represented formally in a semantic language (OWL), it is possible to perform logical reasoning on it. Therefore, if we correctly categorize systems and services, we can begin to automatically identify where interoperability is possible, and where there will be problems.



Vendor A



Vendor B

Next Steps?
Let's Talk



Thank you!