

# Best Practices in Collaborative Ontology Engineering

The Service Ecosystem Ontology in the THESEUS/TEXO project

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**SAP RESEARCH**

THE BEST-RUN BUSINESSES RUN SAP™



# Agenda



1. **SAP Research**
2. THESEUS/TEXO
3. Service Ecosystem Ontology
4. Conclusion



## Our Vision

**Be a world-class thought leadership partner to SAP and SAP's customers & partners**

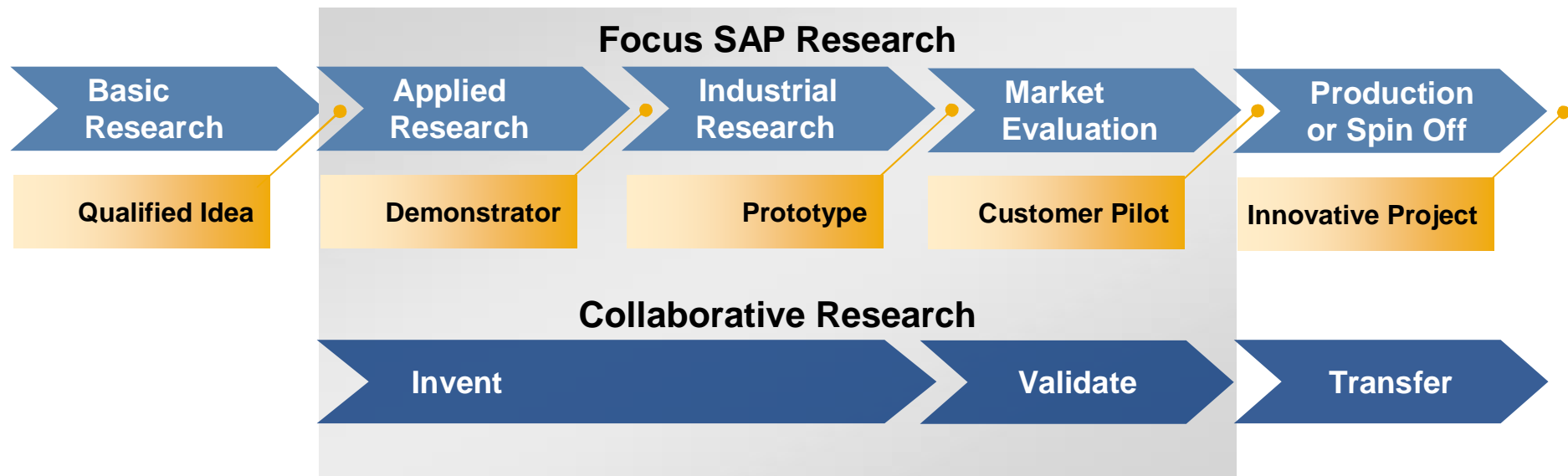
## Our Mission

**Prepare the groundwork for SAP's future growth**

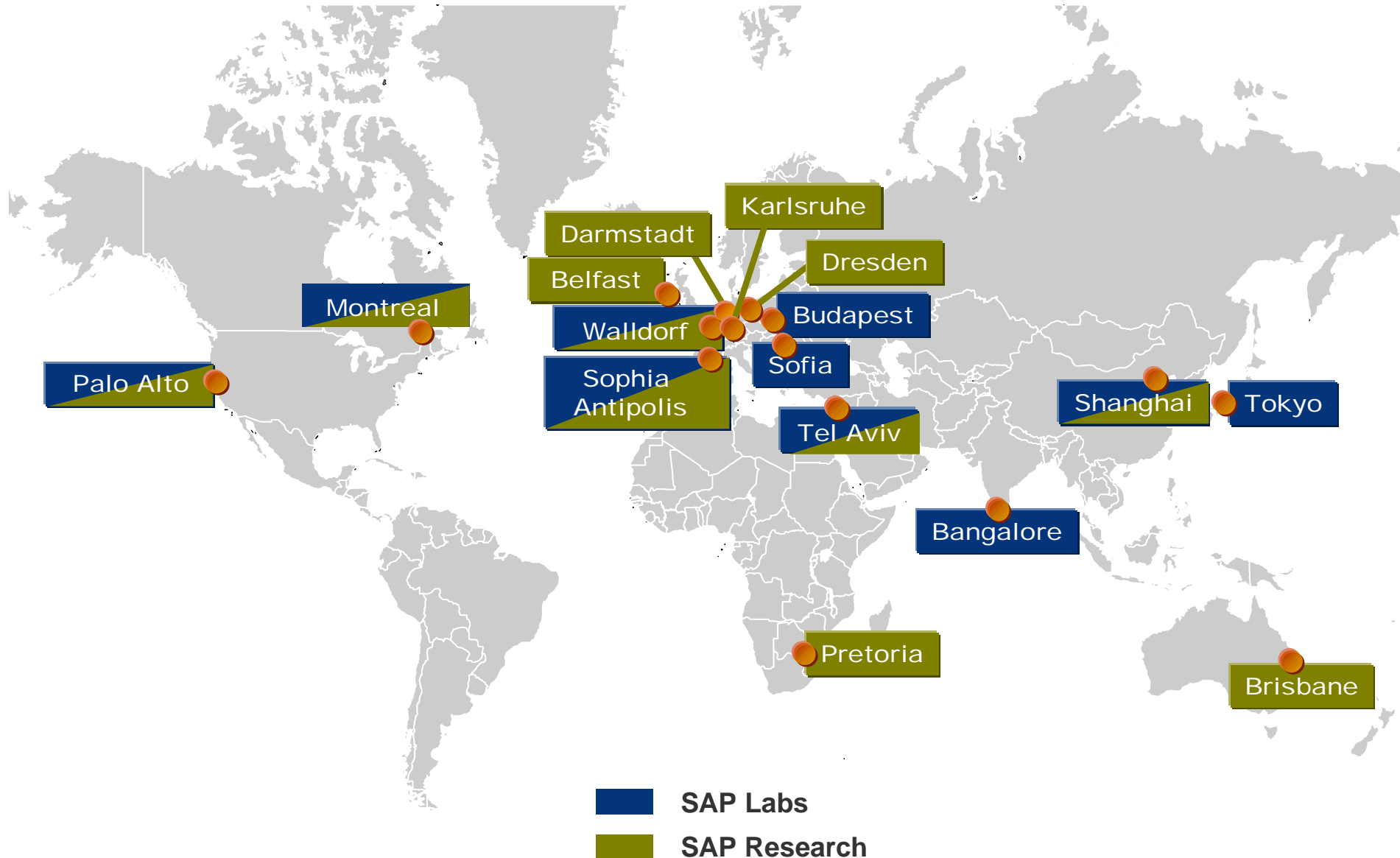
- **by acting as SAP's IT trend scout identifying emerging IT trends**
- **by researching and developing in strategically important SAP business areas as well as**
- **by leveraging entrepreneurial inventive talent**

# SAP Research Process

## - From Idea to Innovative Product



# SAP's Research & Development Network



# The CEC Karlsruhe



- Campus-based Engineering Center
- Since 1999
- Birthplace of SAP Research
- About 100 employees
  - (Senior) Researchers
  - PhD students
  - Students
  
- Interfacing with “Semantic Karlsruhe”
  - PhD supervision
  - Bilateral cooperation
  - Cooperation in publicly funded projects

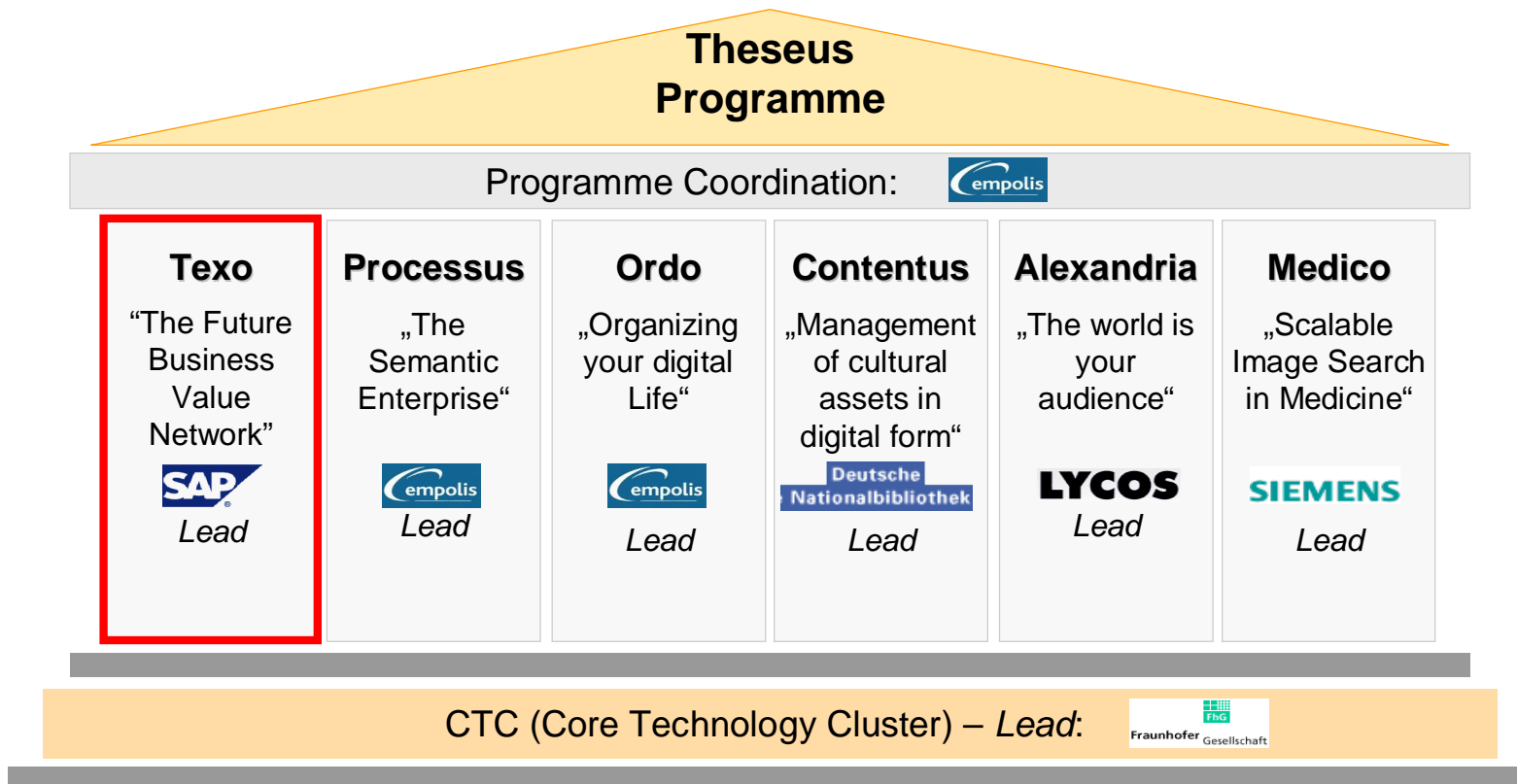


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1. SAP Research
- 2. THESEUS/TEXO**
3. Service Ecosystem Ontology
4. Headaches/Outlook

# THESEUS Programme 2007-2011



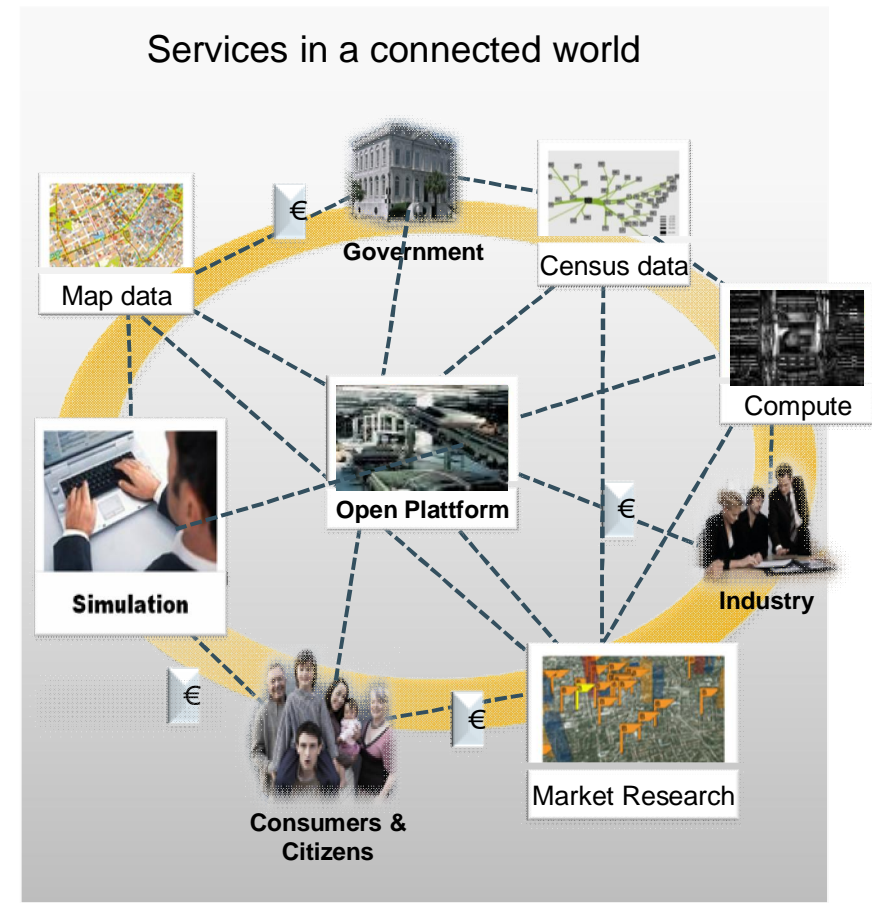


Services will

- become **tradable**
- **composed** of services of different providers
- be offered, delivered & executed automatically & **supported by IT**

Internet of Services

- Worldwide, trusted **Service Ecosystem** of Service Providers, Consumers and Brokers
- For **buying, selling, repurposing and composing services** for different needs
- New way of **organizing the interaction** between partner ecosystem & customer base



# The Internet of Services and Business Webs



## Internet of Services

<b>Business Services</b>	<b>Service Discovery</b>	<b>Information Integration</b>
<b>Application (de)composition</b>	<b>Rich service descriptions</b>	<b>Information mash-up</b>
<b>Service Architectures</b>	<b>Semantic Technologies</b>	<b>Web2.0</b>
<b>Technical Aspects</b>		

<b>Innovation</b>	<b>Business Models</b>
<b>Network effects</b>	<b>Business collaboration</b>
<b>Attractiveness</b>	<b>Business Value</b>
<b>Business Aspects</b>	

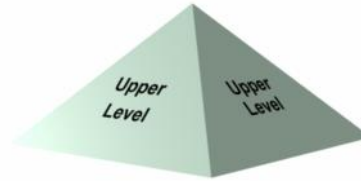
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1. SAP Research
2. THESEUS/TEXO
- 3. Service Ecosystem Ontology**
  - 1. Motivation**
  - 2. Walkthrough**
  - 3. Collaborative Modeling**
  - 4. Modeling Guidelines**
4. Conclusion

# Motivation: Comprehensive Service Description





- Foundational Ontology
- Avoid modeling from scratch
- High-quality starting point
- Ontology Design Patterns

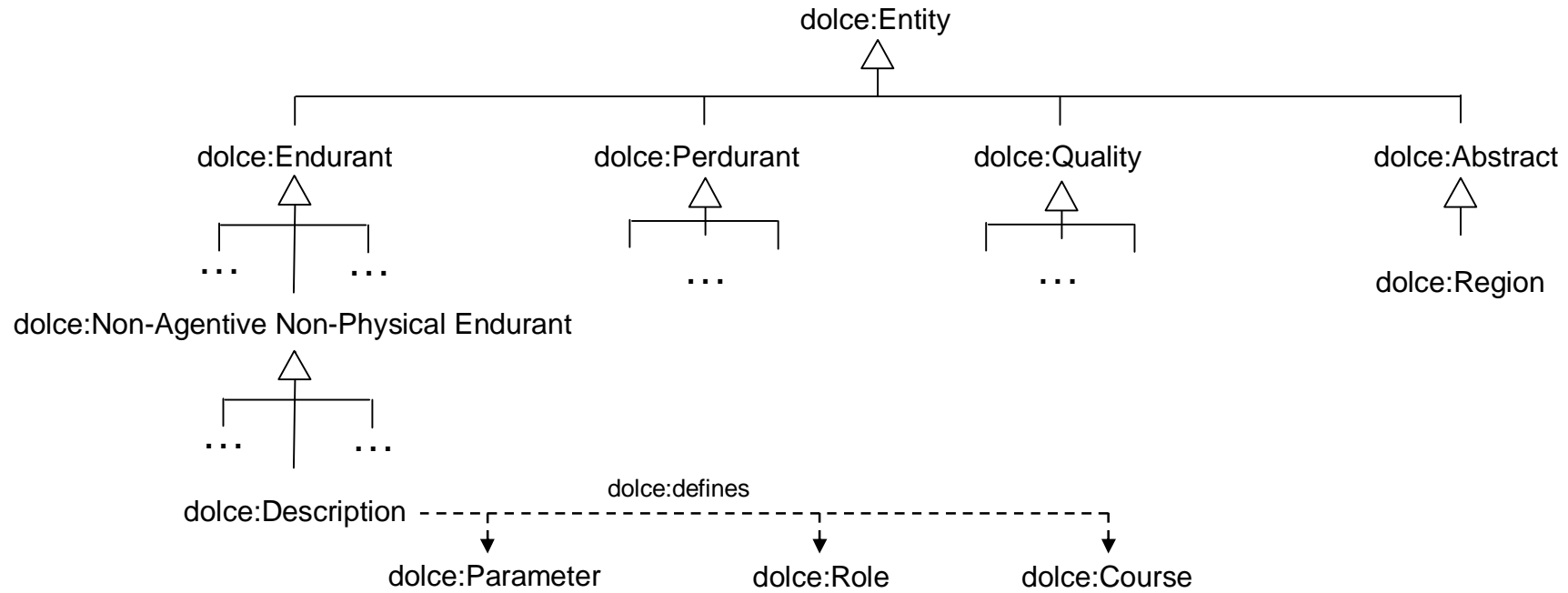
# Choice of Upper Level

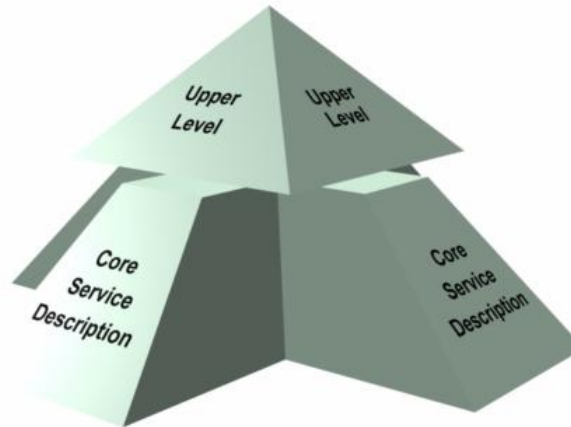


		BFO	DOLCE	OCHRE	OpenCyc	SUMO
Ontological Choices	<b>Requirement \ Alternative</b>					
	<b>Descriptive vs. revisionary</b>	Revisionary	Descriptive	Revisionary	Descriptive	Unclear
	<b>Multiplicative vs. reductionist</b>	Reductionist	Multiplicative	Unclear	Unclear	Unclear
	<b>Possibilism vs. Actualism</b>	Actualism	Possibilism	Possibilism	Unclear	Unclear
	<b>Endurantism and Perdurantism</b>	Both	Both	Perdurantism	Unclear	Unclear

		BFO	DOLCE	OCHRE	OpenCyc	SUMO
Extrinsic Properties	<b>Requirement \ Alternative</b>					
	<b>OWL DL Version</b>	Yes	Yes	Yes	Yes	Yes
	<b>Ontology Design Patterns</b>	No	Yes	No	No	No
	<b>Modularization</b>	Yes	Yes	Yes	Yes	Yes
	<b>Maturity</b>	Yes	Yes	No	Yes	Yes

# Upper Level - DOLCE

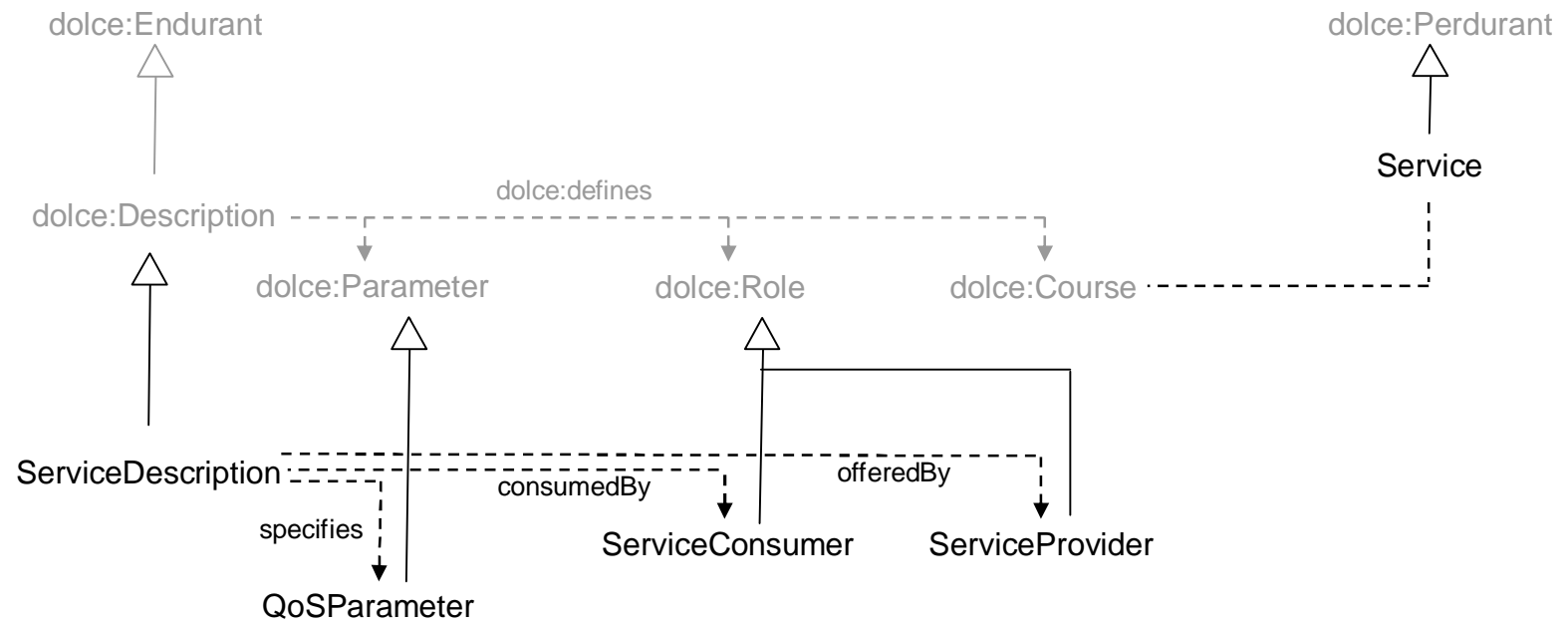




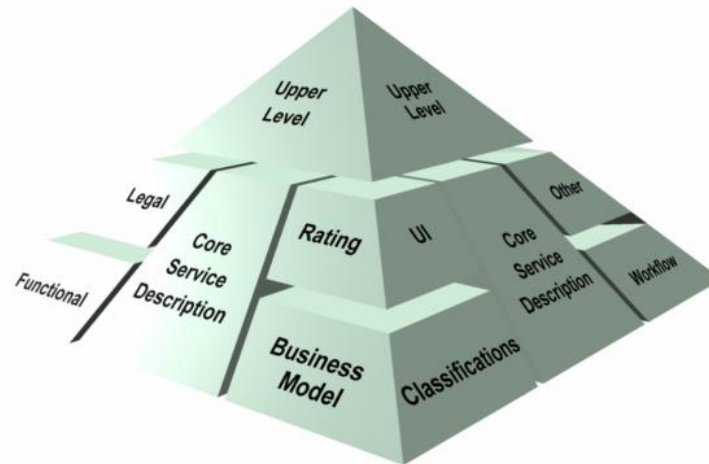
- Core Service Description module contains information common to every service
- Service, Service Description, Service Provider, Service Consumer, etc.
- Ontological Foundations of Service Science [Ferrario, Guarino 2008]



# Core Service Description

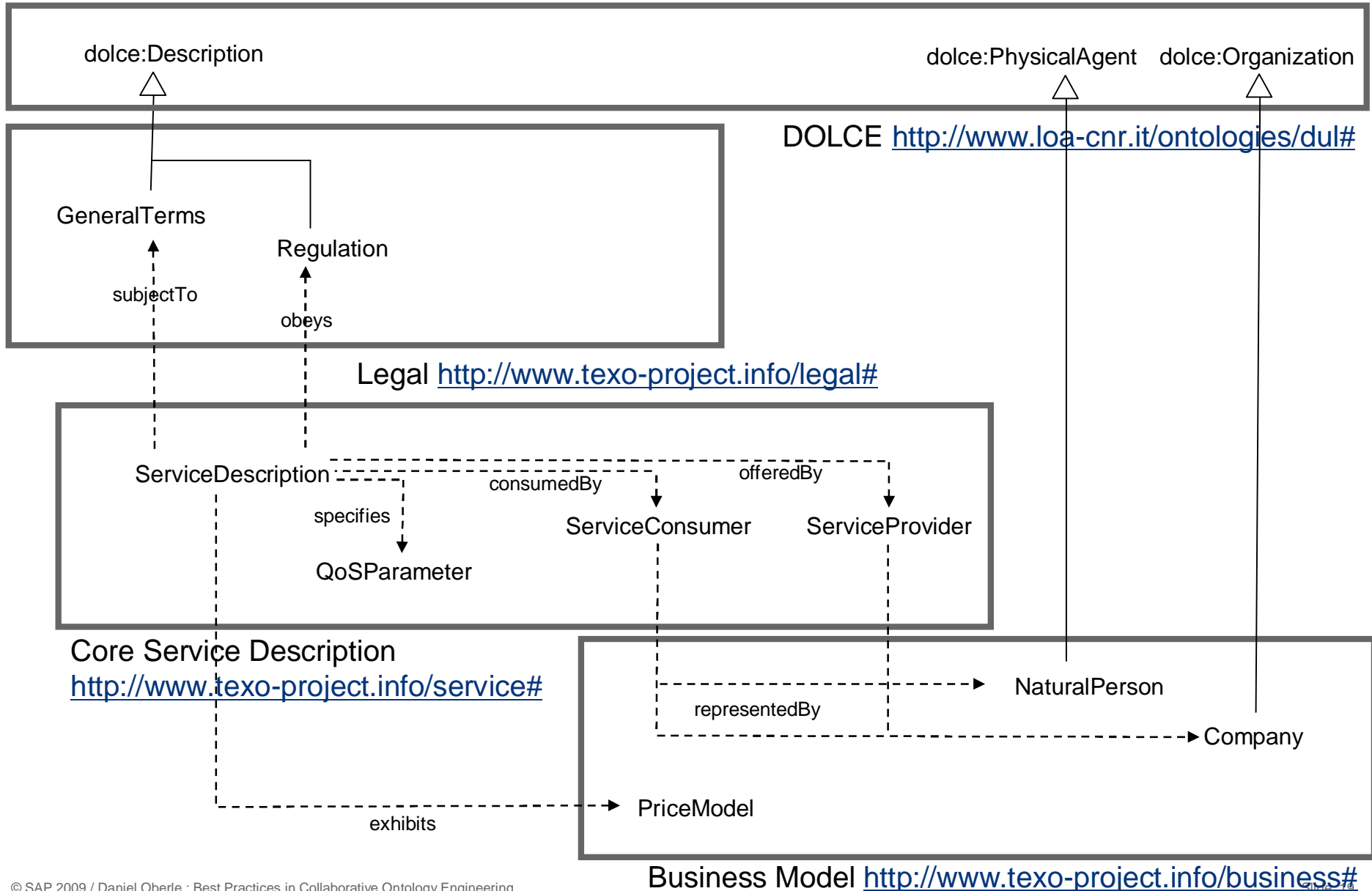


# Core Modules

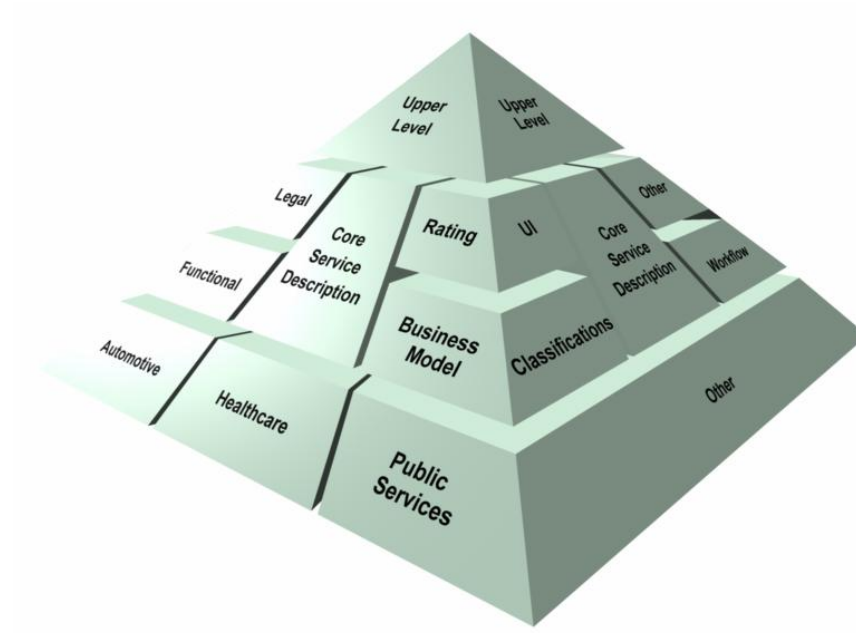


- Different aspects are devoted their own ontology module
- Each module is contributed by a different domain expert
- Modules import each other and can be omitted

# Core Modules



# Industry Modules



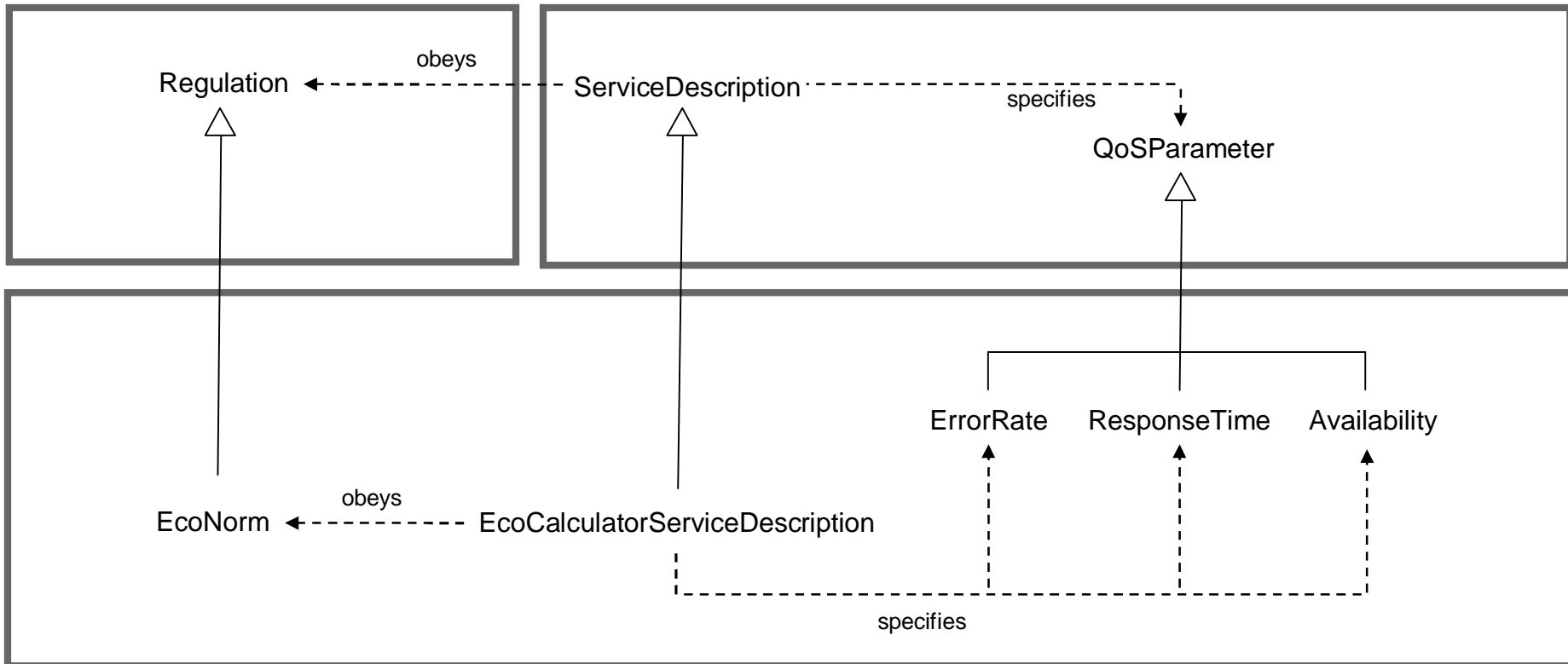
- Introduce industry-specific taxonomies of service categories
- Formal and natural language documentation



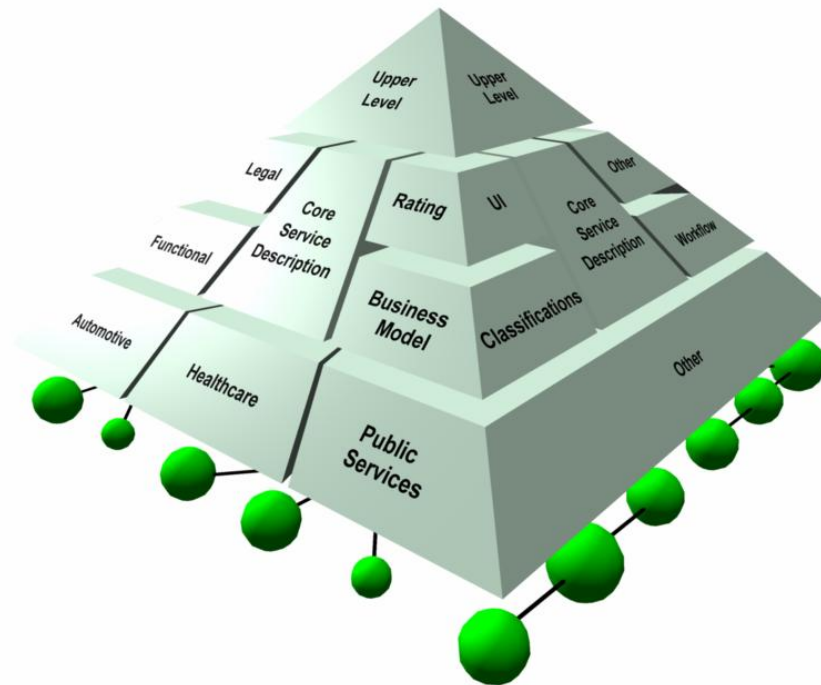
## Legal

<http://www.texo-project.info/legal#>

## Core Service Description <http://www.texo-project.info/service#>



Automotive Industry Module <http://www.texo-project.info/industry/automotive#>

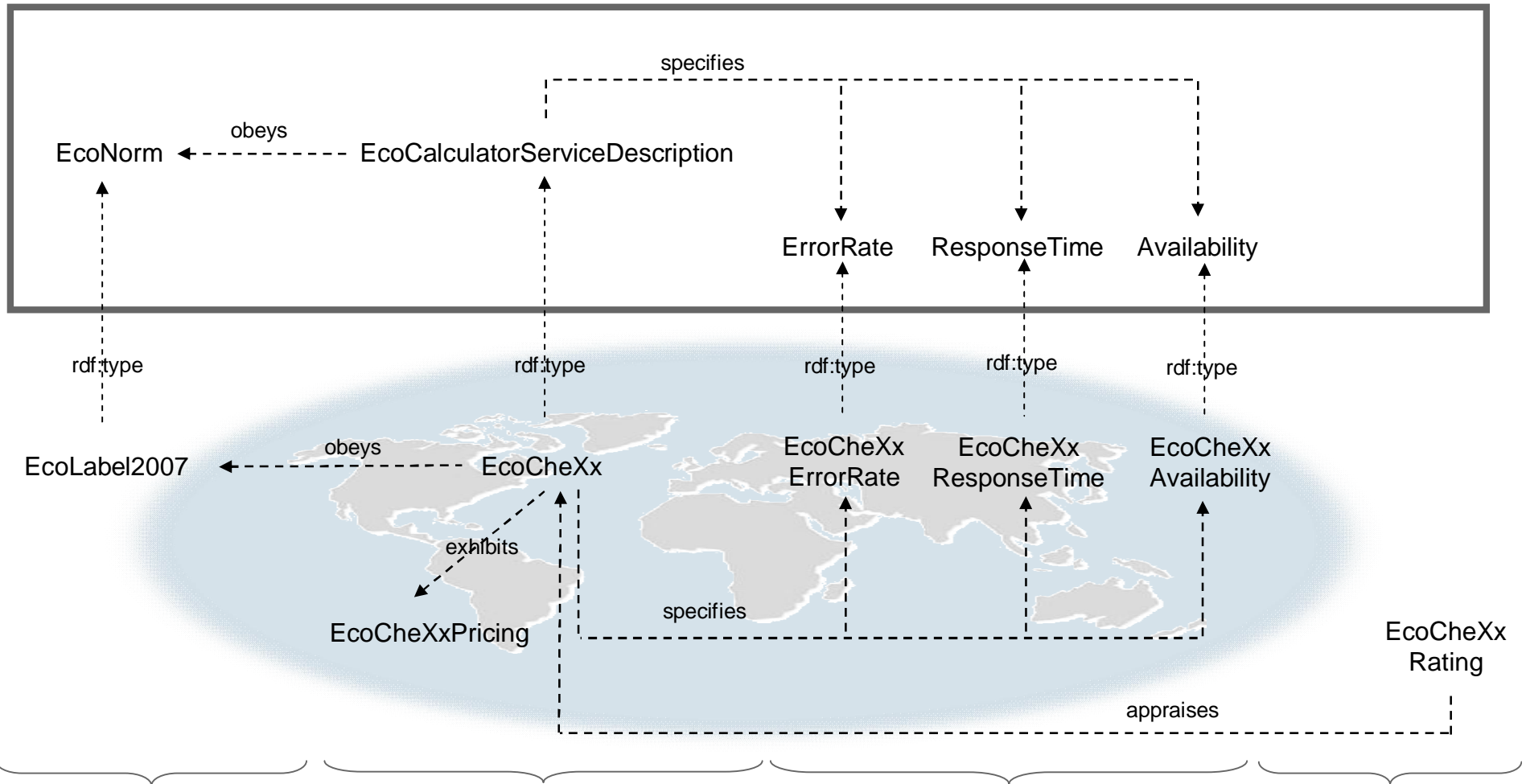


- Specific service descriptions are represented as instances
- Instances are created by service providers
- Instances can be spread and interlinked on the Internet of Services

# Instances



Automotive Industry Module <http://www.texo-project.info/industry/service#>



<http://eur-lex.europa.eu/>

<http://www.ecochexx.com>

<http://www.broker.com>

<http://www.ratings.org>

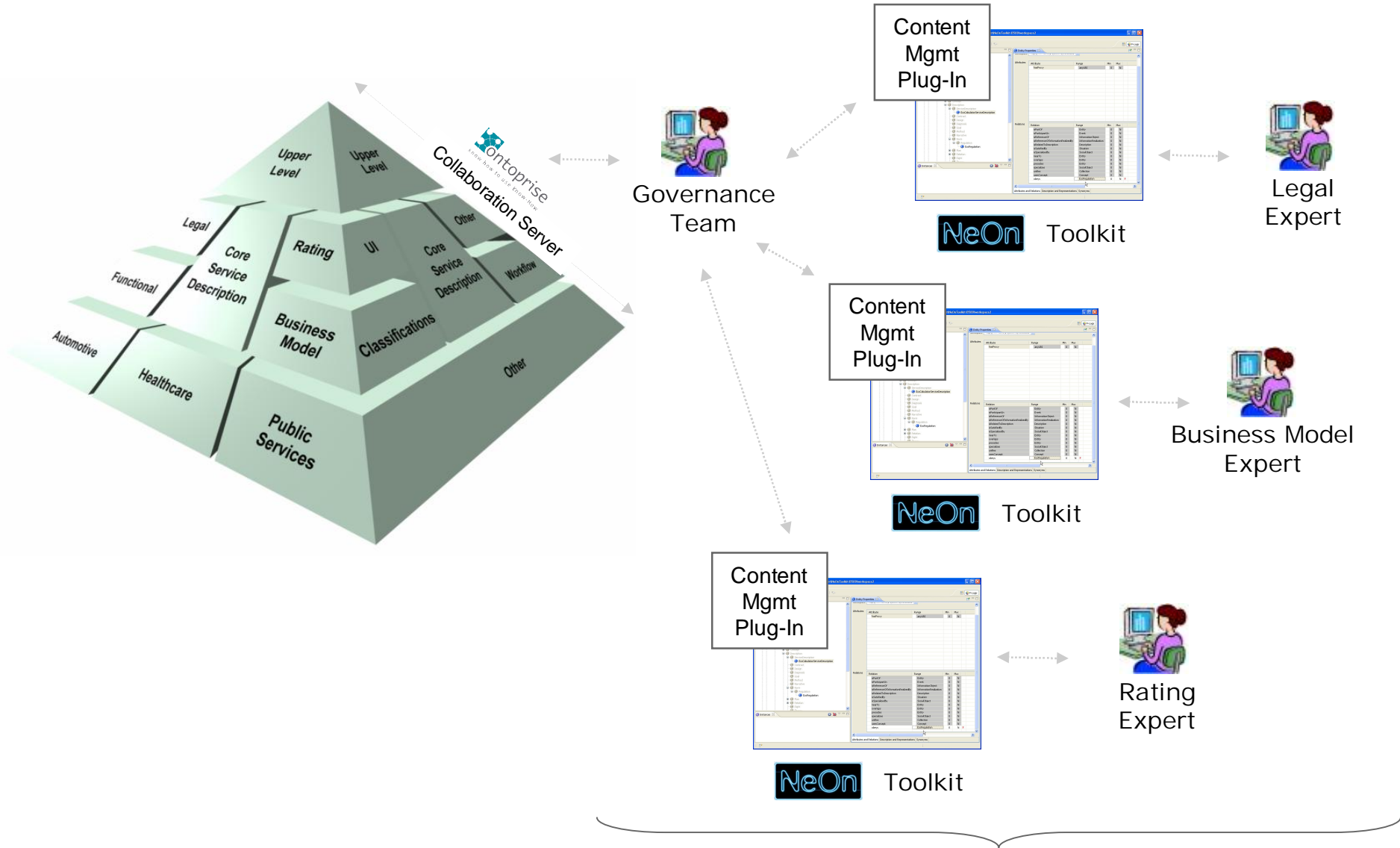
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# Collaborative Modeling



# Content Mgmt Plug-In



OWL - NeOn Toolkit - F:\My Documents\NeOn Toolkit\binaries\NeOnToolkit-1.1-B588-extended\workspace

File Edit Navigate Search Project Run Registry Window Help

Ontology Navigator

- myOWL [OWL]
  - http://www.ida.liu.se/~da
    - Classes
      - OntologyDomain
      - OntologyTask
      - FileType
      - ContainableThing
      - ServiceProvider
      - Role
      - Effect
      - ElectronicDocumen
      - Information
      - OwnableThing
      - Owner
      - Service
      - Notification
      - Agent

Entity Properties

Change Log View Draft View To Be Deleted View Approved View To Be Approved View

Refresh Changes List

Ontology	Change Type	Related Entity	Author	Time	Status	Last Action
<input type="checkbox"/>	RemoveObjectPropertyPa...	transformsDocument	Mauricio Espinoza	10/1/08 6:00:35 PM	Draft	Update by Mauricio Espinoza
<input type="checkbox"/>	RemoveSubClassOf	DataStorageDevice	Mauricio Espinoza	10/1/08 6:00:35 PM	Draft	Update by Mauricio Espinoza
<input type="checkbox"/>	RemoveObjectPropertyDo...	FileType	Mauricio Espinoza	10/1/08 6:00:36 PM	Draft	Update by Mauricio Espinoza
<input type="checkbox"/>	RemoveObjectPropertyPa...	storesElectronicDocum...	Mauricio Espinoza	10/1/08 6:00:36 PM	Draft	Update by Mauricio Espinoza
<input type="checkbox"/>	RemoveDisjointClass	Coordinates	Mauricio Espinoza	10/1/08 6:00:37 PM	Draft	Update by Mauricio Espinoza
<input type="checkbox"/>	RemoveDisjointClass	FileType	Mauricio Espinoza	10/1/08 6:00:37 PM	Draft	Update by Mauricio Espinoza
<input type="checkbox"/>	RemoveObjectPropertyDo...	holdsInformation	Mauricio Espinoza	10/1/08 6:00:37 PM	Draft	Update by Mauricio Espinoza
<input type="checkbox"/>	AddClass	LexicalEntry	Mauricio Espinoza	10/1/08 6:02:32 PM	Draft	Insert by Mauricio Espinoza
<input type="checkbox"/>	AddClass	Lexicalization	Mauricio Espinoza	10/1/08 6:02:35 PM	Draft	RejectToDraft by Peter Haase
<input type="checkbox"/>	AddClass	OntologyTask	Raul Palma	10/1/08 6:02:43 PM	Draft	Insert by Raul Palma
<input type="checkbox"/>	AddObjectProperty	hasLexicalEntry	Mauricio Espinoza	10/1/08 6:02:50 PM	Draft	Insert by Mauricio Espinoza
<input type="checkbox"/>	AddClass	OntologyDomain	Raul Palma	10/1/08 6:02:51 PM	Draft	Insert by Raul Palma
<input type="checkbox"/>	AddDataProperty	partOfSpeech	Mauricio Espinoza	10/1/08 6:03:03 PM	Draft	Insert by Mauricio Espinoza
<input type="checkbox"/>	AddObjectProperty	hasDomain	Raul Palma	10/1/08 6:03:22 PM	Draft	Insert by Raul Palma
<input type="checkbox"/>	AddDataPropertyDomain	partOfSpeech	Mauricio Espinoza	10/1/08 6:03:28 PM	Draft	Update by Mauricio Espinoza
<input type="checkbox"/>	AddObjectPropertyDomain	hasLexicalEntry	Mauricio Espinoza	10/1/08 6:03:52 PM	Draft	Update by Mauricio Espinoza
<input checked="" type="checkbox"/>	AddObjectPropertyDomain	hasDomain	Raul Palma	10/1/08 6:04:01 PM	Draft	RejectToDraft by Peter Haase
<input checked="" type="checkbox"/>	AddIndividual	OntologyTask	Raul Palma	10/1/08 6:04:21 PM	Draft	Insert by Raul Palma

Delete Submit Changes To Be Approved

```

hasPreviousChange: http://www.ida.liu.se/~dae/ontubi.owl?location=;change=374A417F190E12AA6C2776ED87DFF664ACCAE532
appliedToOntology: http://www.ida.liu.se/~dae/ontubi.owl
hasAuthor: Raul Palma
appliedAxiom:
  objectProperty: objectProperty: http://www.ida.liu.se/~dae/ontubi.owl#hasDomain
  domain: OWLClass: http://www.ida.liu.se/~dae/ontubi.owl#OntologyTask
}

OMVChange {
  type:Addition
  URI: http://www.ida.liu.se/~dae/ontubi.owl?location=;change=B6A91207EDCD1F284CAA4A8423B13167790E8346
  date: 10/1/08 6:04:20 PM
  hasPreviousChange: http://www.ida.liu.se/~dae/ontubi.owl?location=;change=A2B777C6E49CF6CB62B00D759E024A5F87E32E61
  appliedToOntology: http://www.ida.liu.se/~dae/ontubi.owl
  hasAuthor: Raul Palma
  appliedAxiom:
    OWLClass: OWLClass: http://www.ida.liu.se/~dae/ontubi.owl#OntologyTask
    individual: individual: http://www.ida.liu.se/~dae/ontubi.owl#Annotation
  }
    
```

Logging: 1 ontologies

- Classes must be named in English in CamelCase
  - e.g. *ServiceDescription*
- Relations must be named in English in CamelCase with non capital letter
  - e.g. *offeredBy*
- Descriptions for relations should be meaningful verbs
  - e.g., "*describes*," "*obeys*," etc.
- Model the inverse relation and declare the inversivity in the editor
  - e.g., *offers* and *offeredBy*
- Classes and relations from imported ontology modules must be specialized with the current module's namespace. This is necessary to enable a sound modularization where the individual modules can also "live on their own" without the imported modules.

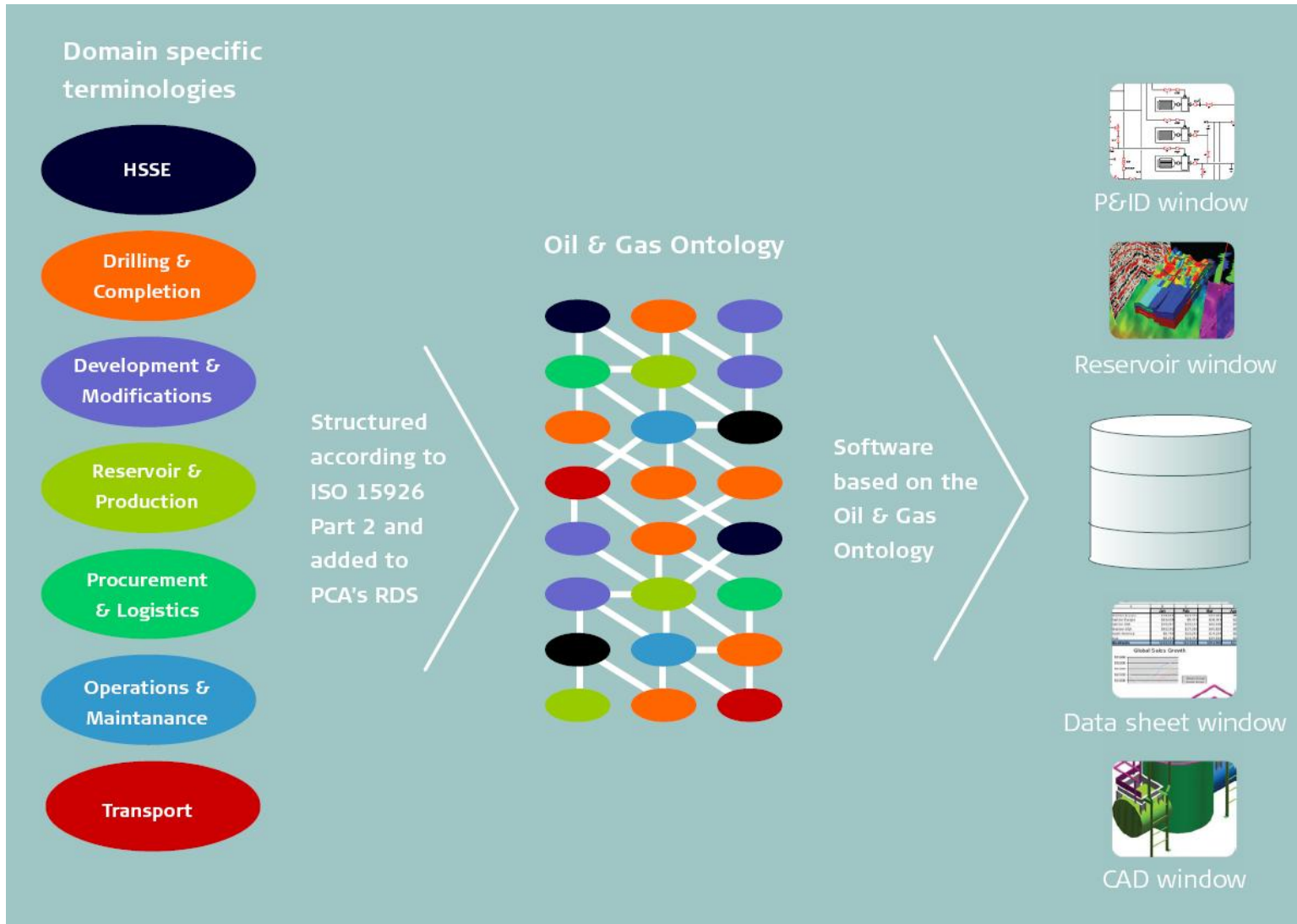
- Explanatory and verbose descriptions must be provided in English and German for each class and relation in line with the formal axiomatization
- e.g. EcoCalculatorServiceDescription
  - rdfs:label de : Ökokalkulator
  - rdfs:label en : Eco-calculator
  
  - rdfs:comment en: “  
*An Eco-calculator service description is a service description with the following constraints*
    - *it obeys an eco regulation*
    - *it specifies all of the following three quality of service parameters:*
      - *availability*
      - *response time*
      - *error rate”*
  
- rdfs:comment de: ‘...‘

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# Why is this relevant to IOHN?



[Integrated Operations and the Oil & Gas Ontology, OLF + PCA]

- Maturity of tools
- Expertise missing
- Modeling expensive
- Danger of over-engineering
- Experts do not really model
- Large effort to collaborate and streamline
- How to evaluate whether design is realistic?

Questions?



# Q&A





Thank you!