

# DAIMLERCHRYSLER

## **Service Oriented Architecture (SOA)**

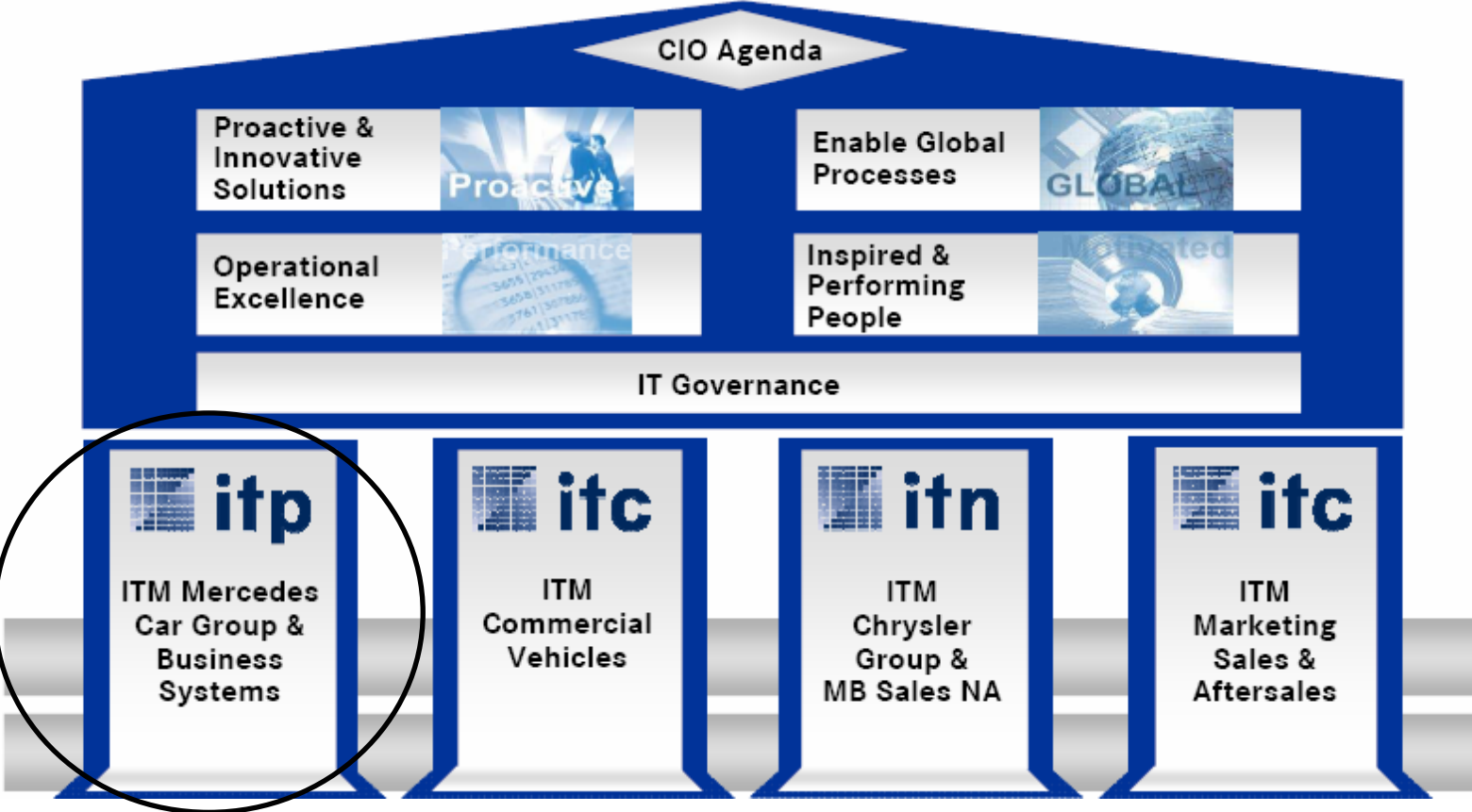
Michael Herrmann

Applying Semantics within SOA

# Agenda

- Common understanding
  - Definitions (selection) & Background
  - Big Picture
  - Services within SOA
  - Enterprise Service Bus (ESB)
- EMEO
  - Scenario I
  - Scenario II
  - WSDL-S
  - Symbolic + Inference
- Summary

# “Introducing” my working area



## Definition

„SOA is a technology neutral concept of Software architecture that represents one or more *business functions as a service*.

The *interface* description of a service is *platform independent*.

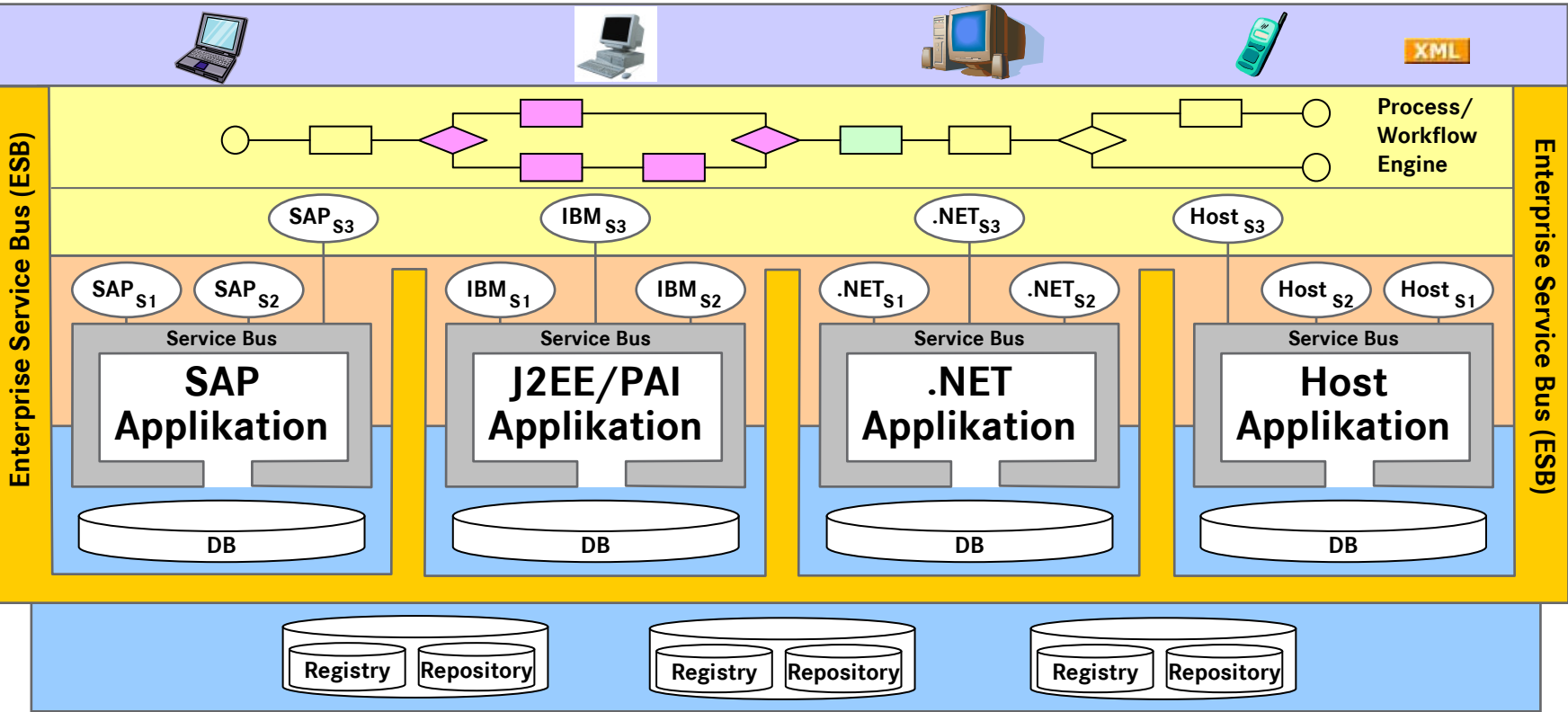
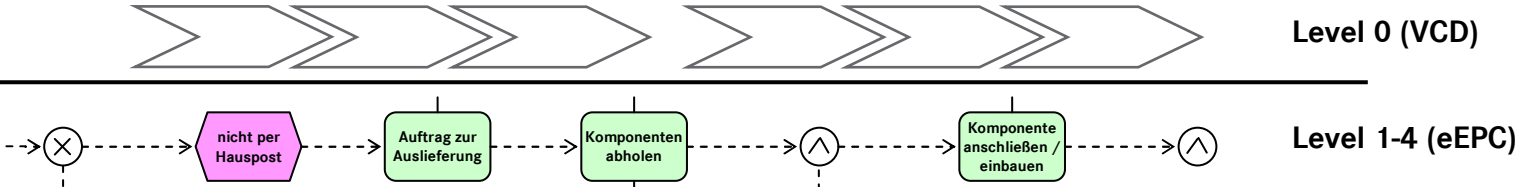
The implementations of the services are *reusable, encapsulated and loosely coupled*.

The service *interactions* are realized by a *standardized/uniformed* infrastructure.”

[DaimlerChrysler EMEA]

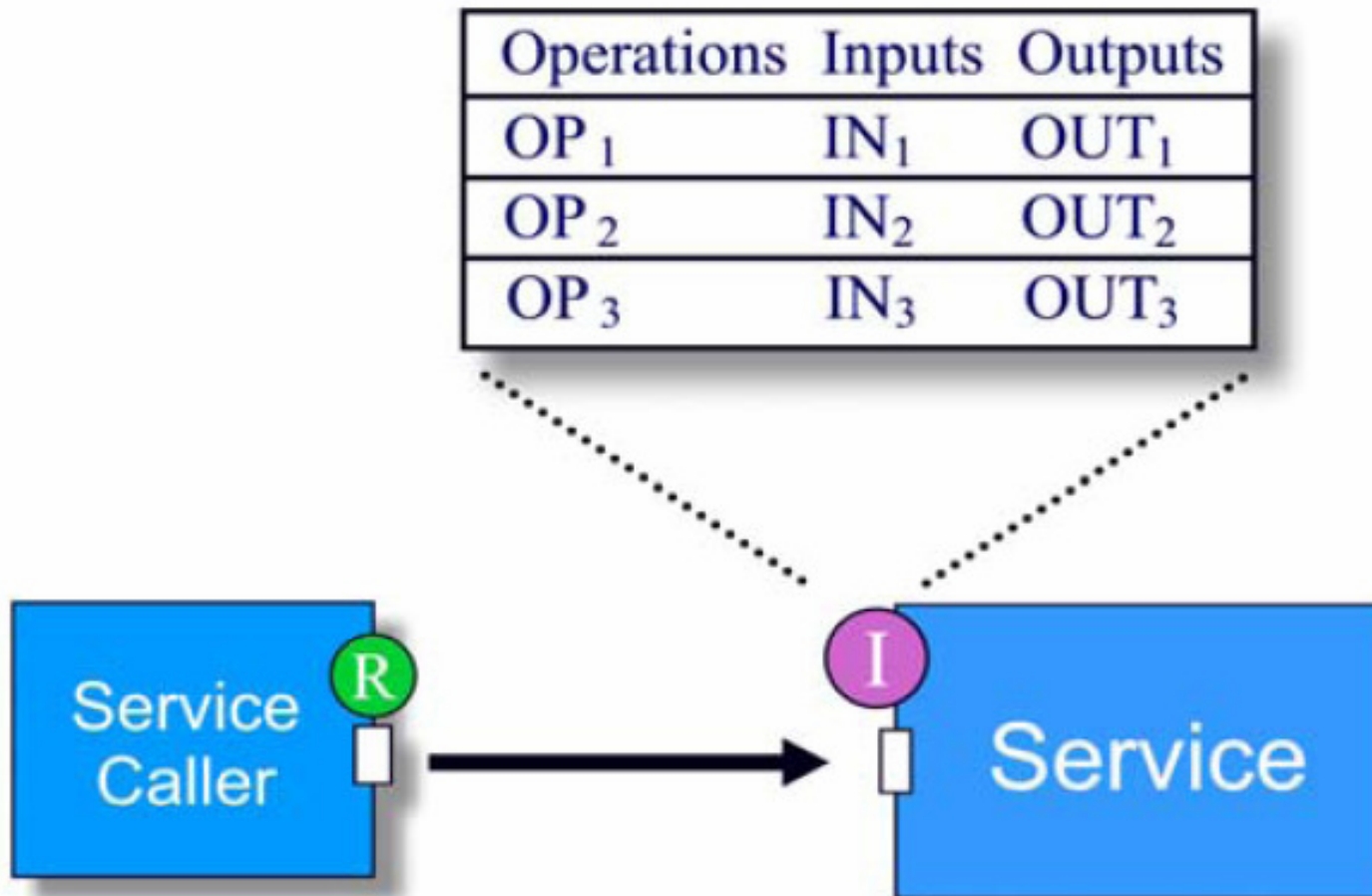
# SOA Big Picture

Modeled Business Process



Presentation Layer
  Enterprise Business Layer
  Platform specific Business Layer
  Infrastructure Layer

## Services inside SOA



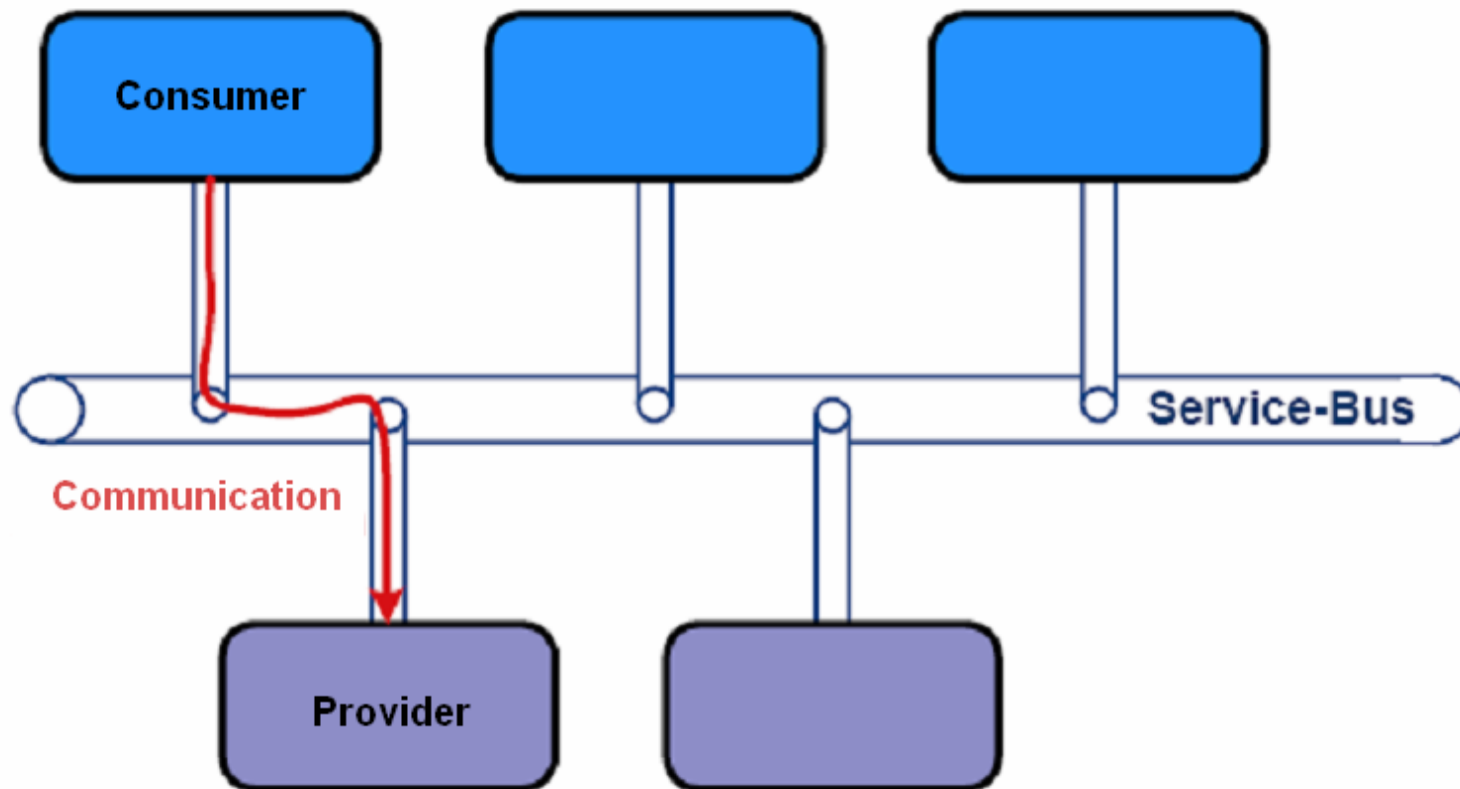
## Service within SOA

- A Service
  - is a unit of third party composition
  - has no (externally) observable state (encapsulates its state)
  - is described platform independent (Interface)
  - is potentially already deployed (deploy once, reuse several times)
  - is Black Box reuse
  
- Business Service is a Service
  - representing one ore more Business functions

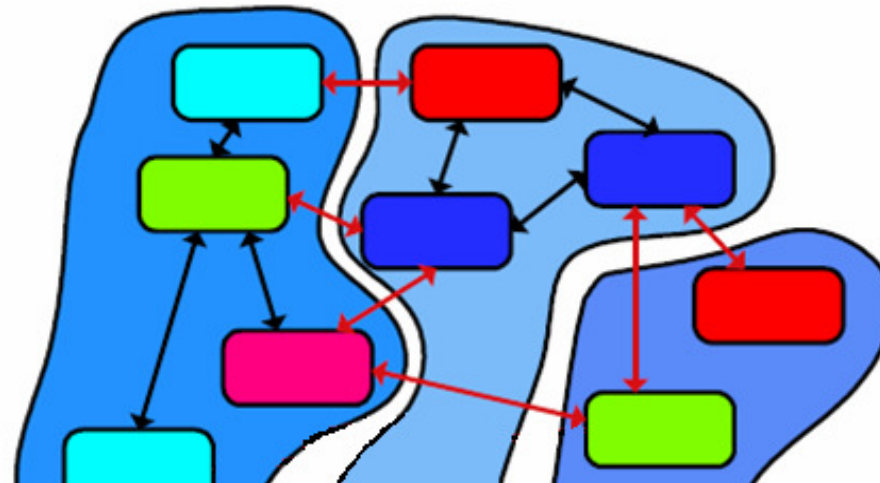
## Enterprise Service Bus (ESB)

- Transport and content-based routing  
(Brokerage: Publish-Subscribe)
- Multi-protocol communication
- Validation and transformation (messages)
- Supports
  - Event-handling
  - Security (Partial Security on the message layer)
  - Monitoring
  - Adapter-connectivity
  - Dynamic addressing and service binding (Registry)
- Mediation

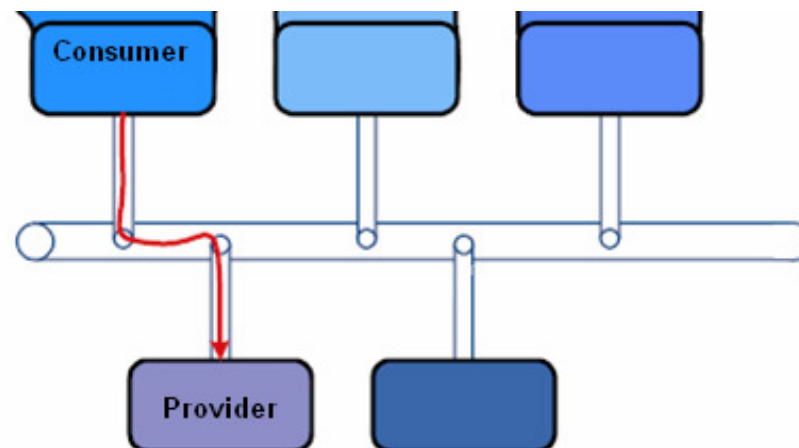
# SOA & ESB



# SOA & ESB & Semantics?!



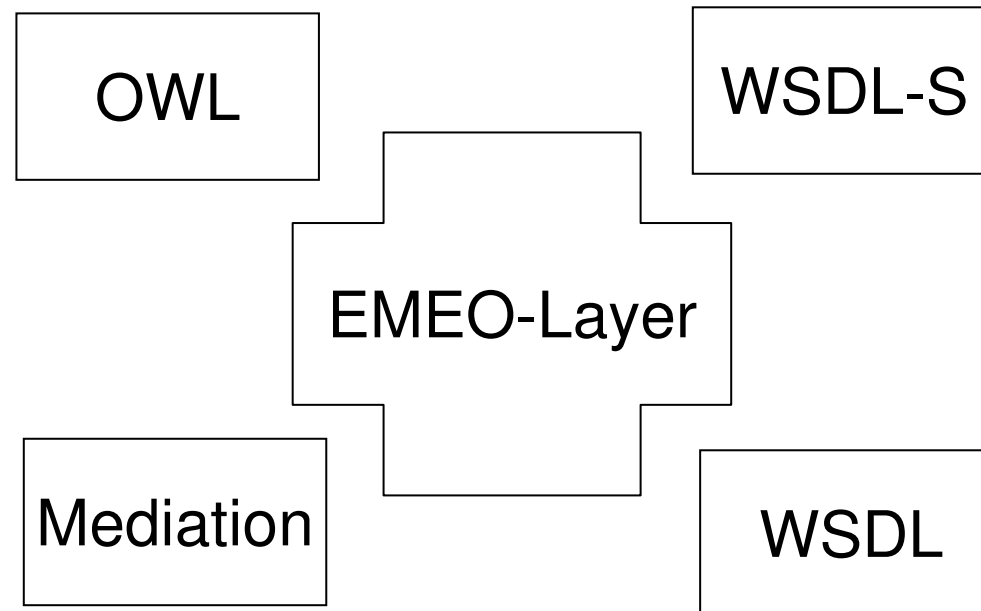
...reuse is depended upon the strengths of semantics...



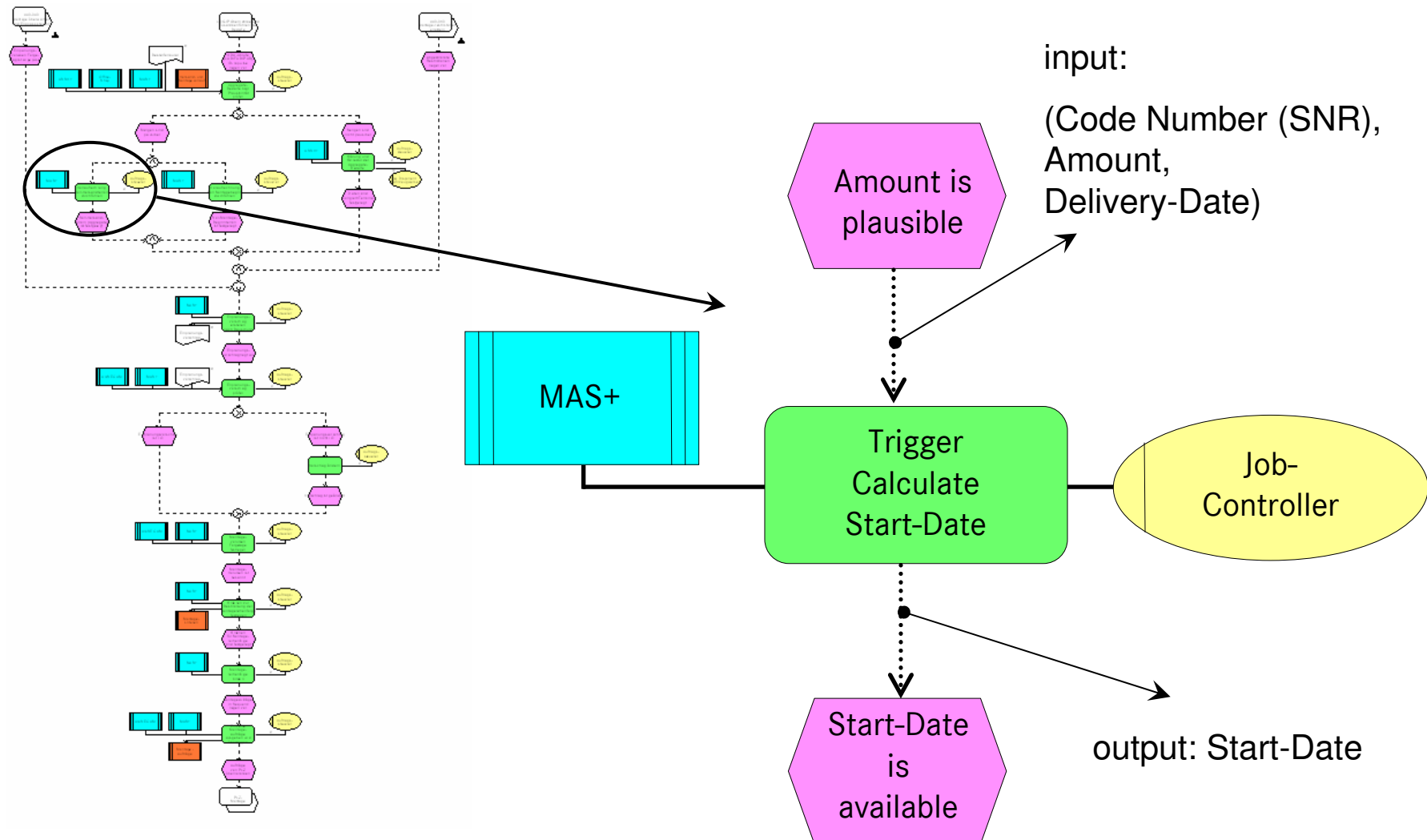
## Semantics with SOA (Approaches)

- SAWSDL (Semantic Annotations for Web Services Description Language Working Group)
- WSDL-S (Web Service Semantics)
- OWL-S (OWL-based Web Service Ontology)
- WSMO (Web Service Modeling Ontology)
- AI Planning
- Semantic Discovery Service (SDS)
- ...

## EMEO supports loose coupling

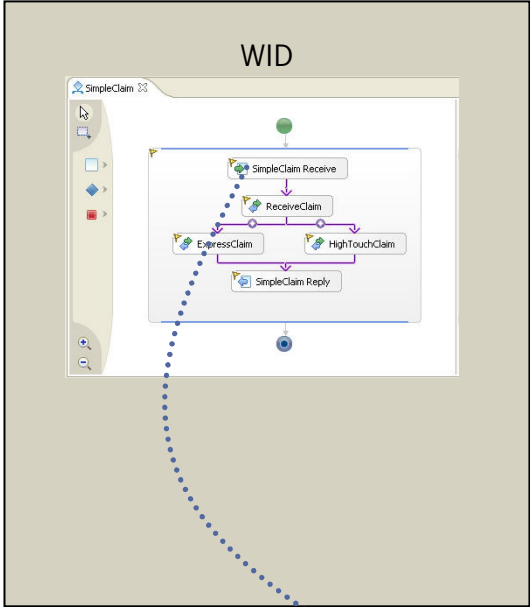


# Lab based study „440-020“ (IOPE)

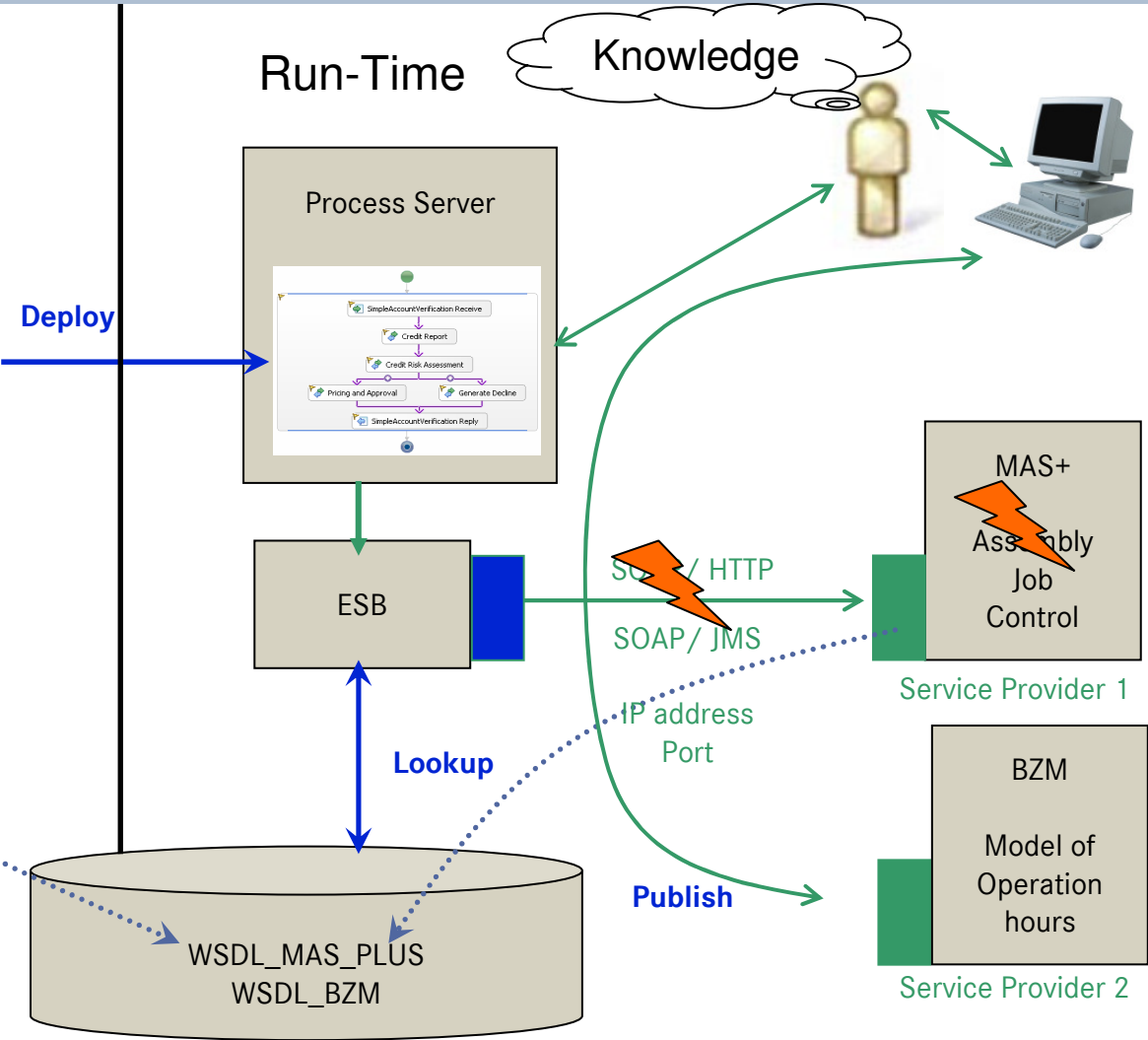


# Scenario I

## Design-Time

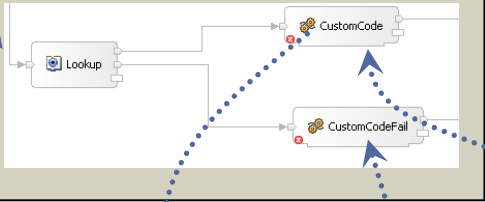
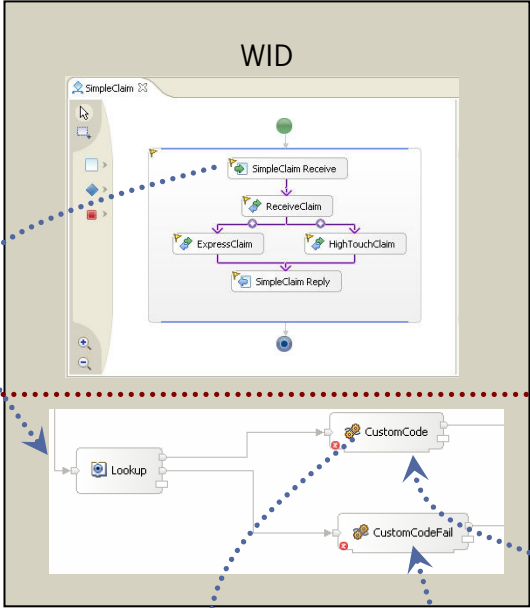


## Run-Time



# Scenario II (including EMEO)

## Design-Time



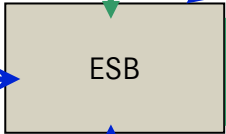
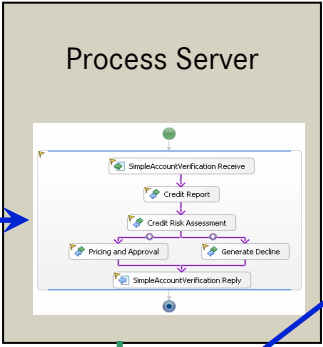
Interface-Map

Reasoner



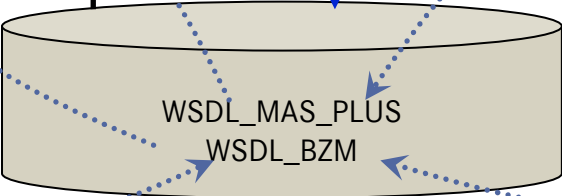
Michael Herrmann (ITP/AM)

## Run-Time

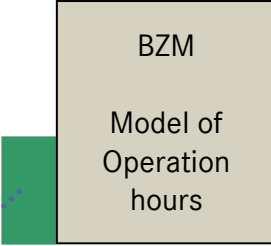
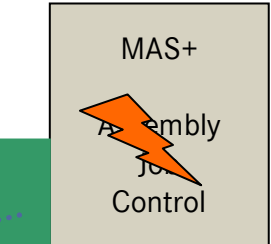
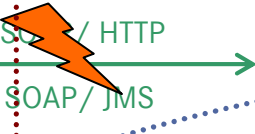


Deploy

Lookup



- Now() > 10am or Now() <= 10am
- Availability (repair work)
- Traffic



Publish

Inference

# WSDL within EMEO

```
<definitions>
  <types> ... </types>

  <message>
    <part>...</part>
  </message>

  <portType>
    <operation>
      <input>...</input>
      <output>...</output>
      <fault>...</fault>
      <documentation>...</documentation>
    </operation>
  </portType>

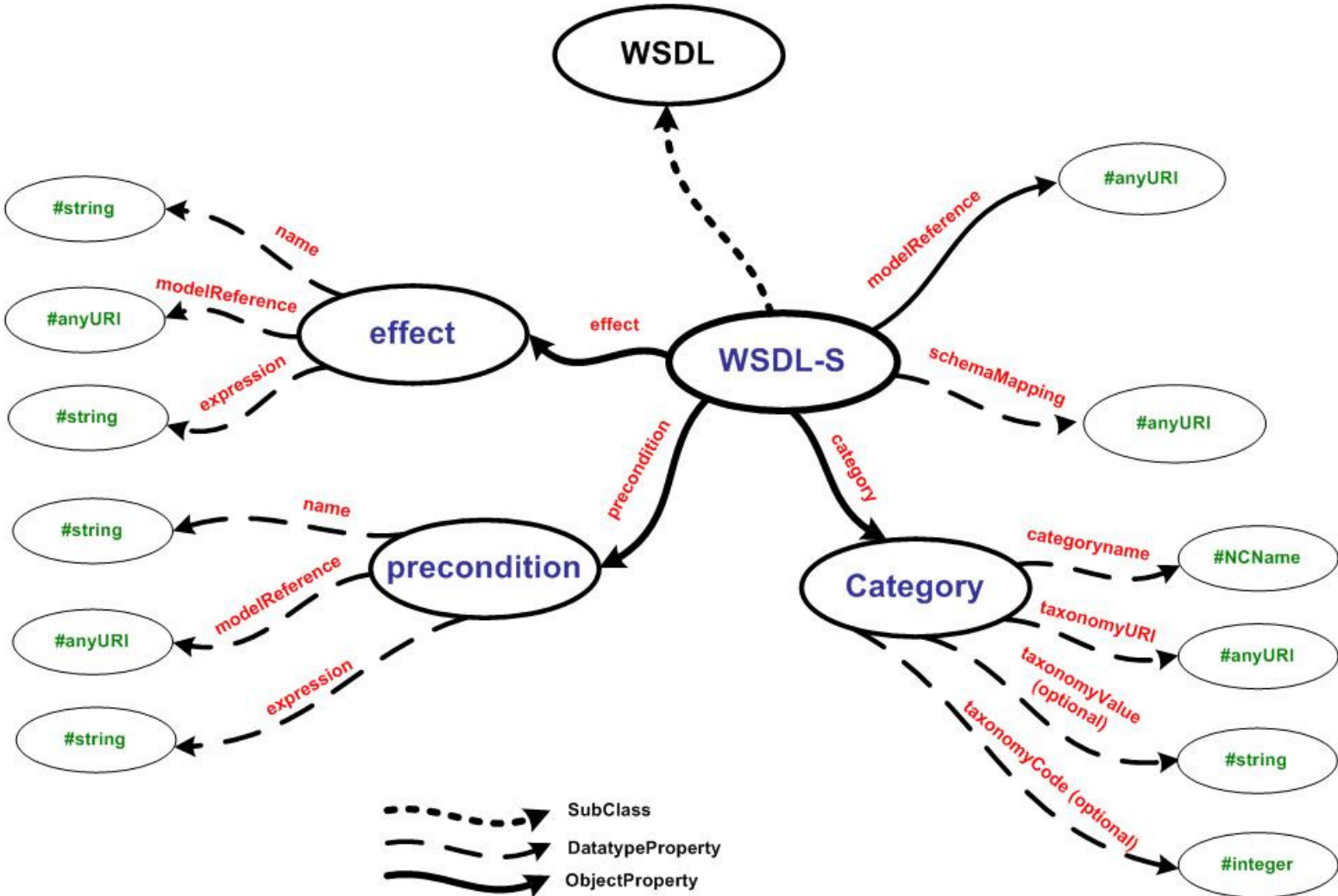
  <binding>
    <operation>
      <input>...</input>
      <output>...</output>
      <fault>...</fault>
    </operation>
  </binding>

  <service>
    <port>...</port>
  </service>
</definitions>
```

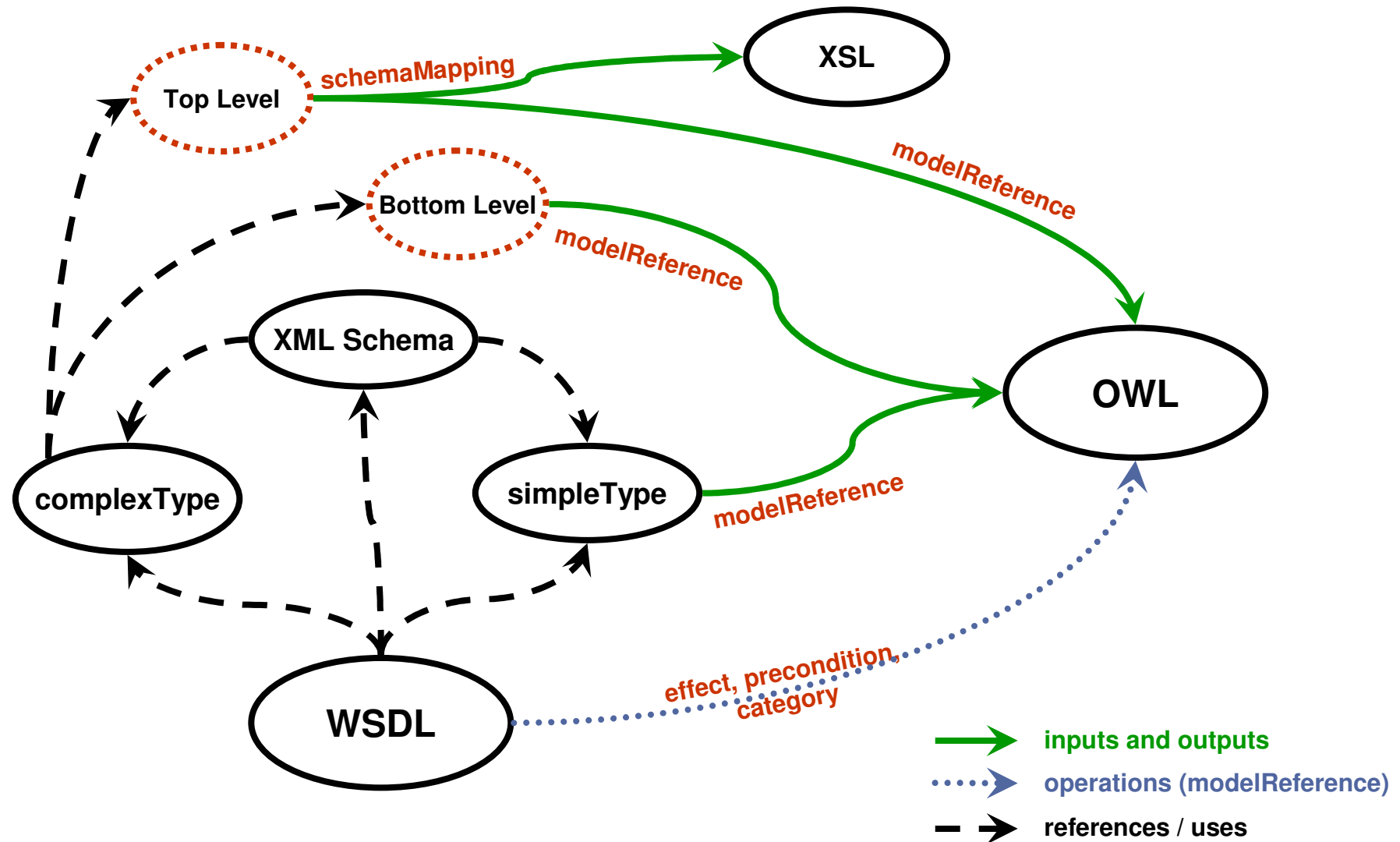
**abstract description**

**concrete description**

# WSDL-S within EMEO



# Connecting WSDL to OWL over WSDL-S



# Connecting WSDL to OWL over WSDL-S (exemplary)

XML Schema / WSDL

WSDL-S

OWL

```

<xsd:complexType name="...Response">
  <xsd:sequence>
    <xsd:... name="SNR" />
    <xsd:... name="amount" />
    <xsd:... name="date_of_delivery"/>
    <xsd:... name="plausible" />
  </xsd:sequence>
</xsd:complexType>

```

WSDL

```

<operation name="CheckPlausi">
  <soap:operation soapAction="..."/>
  ...
</operation>

```

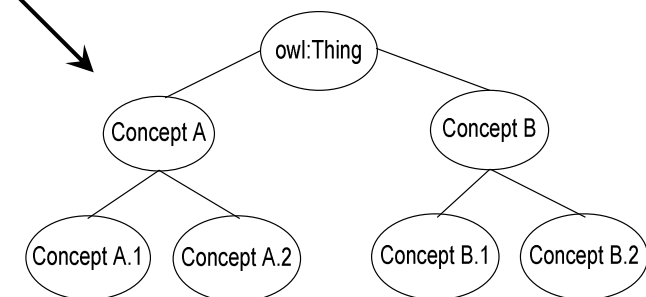
&lt;modelReference&gt;

&lt;schemaMapping&gt;

&lt;Category&gt;

&lt;precondition&gt;

&lt;effect&gt;



# WSDL-S @ DaimlerChrysler (Lab Approach)

...

```

xmlns:wssem="http://www.ibm.com/xmlns/Webservices/WSSemantics"
xmlns:dcx="http://www.dcx.com/xmlns/XMLSchema/DCX"
xmlns:AutomotiveDCX="http://www.dcx.com/xmlns/XMLSchema/DCX/AutomotiveDCX"

```

```

<xs:element name="SNR" type="xs:string"
  wssem:modelReference="AutomotiveDCX:#SNR"/>

```

...

```

<complexType name="CheckPlausiResponse">
  <sequence>
    <element name="SNR" nillable="false" type="dcx:SNR" />
  </sequence>
  <element name="amount" nillable="false" type="xsd:integer"
    wssem:modelReference="AutomotiveDCX:#Amount"/>
  </sequence>
  <element name="date of delivery" nillable="false" type="xsd:date"
    wssem:modelReference="AutomotiveDCX:#Date_of_delivery"/>
  </sequence>
</complexType>

```

Schema

OWL Ontology

```

<owl:Class rdf:ID="Amount">
  <owl:equivalentClass>
    <owl:Class>
      <owl:intersectionOf rdf:parseType="Collection">
        ...
      </owl:intersectionOf>
    </owl:Class>
  </owl:equivalentClass>
  <rdfs:subClassOf rdf:resource="#Cars"/>
</owl:Class>

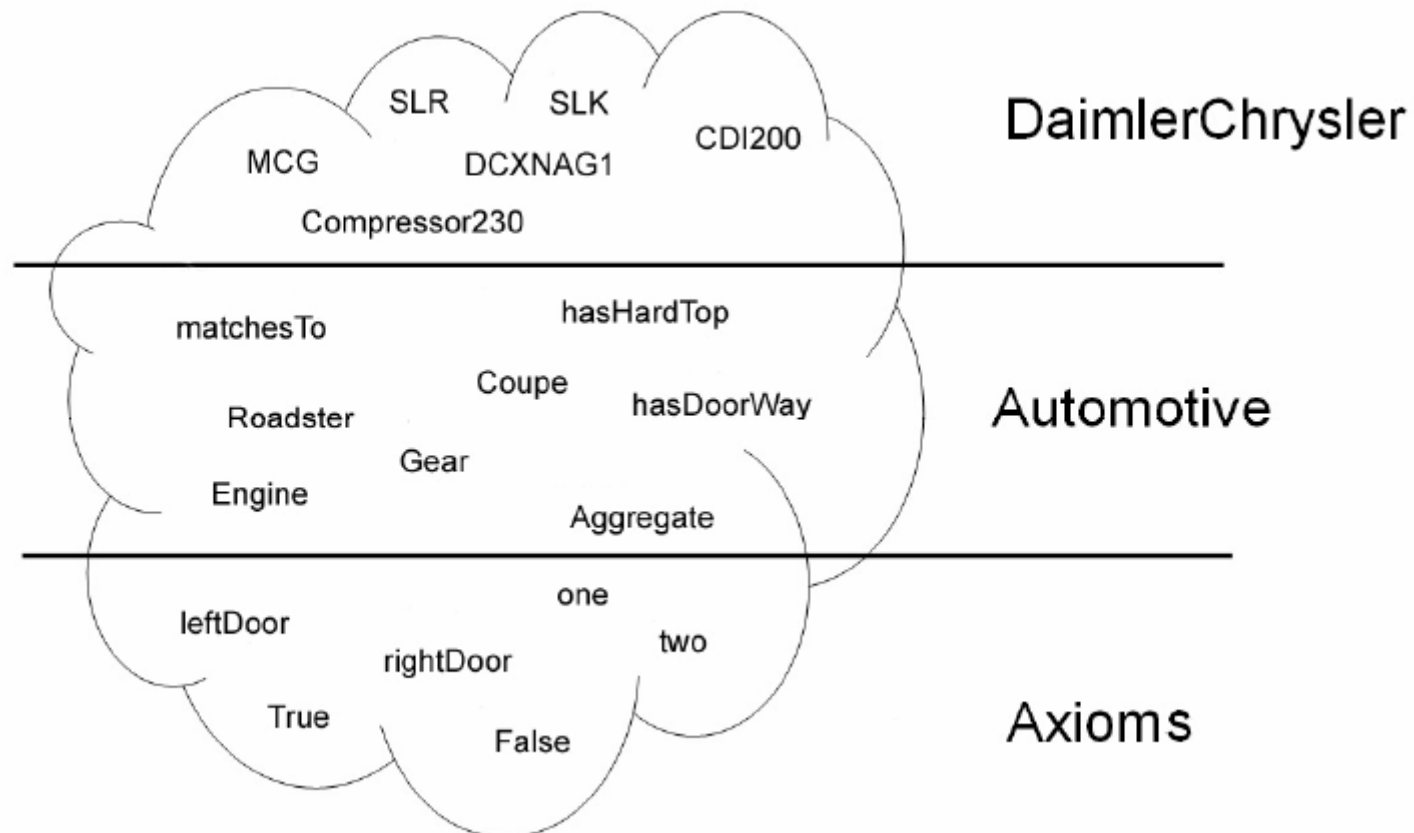
```

```

<owl:Class rdf:ID="SNR">
  <owl:equivalentClass>
    <owl:Class>
      ...
    </owl:Class>
  </owl:equivalentClass>
</owl:Class>

```

# Splitting our Domain into Areas



## Symbol stuff (extract)

$$\text{DoorWayValueParitition} \equiv \text{one} \cup \text{two} \cup \text{three} \cup \text{four} \cup \text{five} \quad (5.9)$$

$$\text{one} \subseteq \neg \text{two} \cap \neg \text{three} \cap \neg \text{four} \cap \neg \text{five} \quad (5.10)$$

$$\text{two} \subseteq \neg \text{three} \cap \neg \text{four} \cap \neg \text{five} \quad (5.11)$$

$$\text{three} \subseteq \neg \text{four} \cap \neg \text{five} \quad (5.12)$$

$$\text{four} \subseteq \neg \text{five} \quad (5.13)$$

$$\text{DCXCar} \equiv \exists \text{hasSeat} (\text{one} \cup \text{two} \cup \text{three} \cup \text{four} \cup \text{five}) \quad (5.41)$$

$$\text{DCXEngine} \equiv \exists \text{makesTo} . \text{DCXCar} \quad (5.42)$$

$$\text{DCXEngine} \equiv \forall \text{isAssambledIn} . \text{DCXCar} \quad (5.43)$$

$$\dots \quad (5.44)$$

# Inference (Protégé + RACER)

The image displays two hierarchical views of an ontology: 'Asserted Hierarchy' and 'Inferred Hierarchy'.

**Asserted Hierarchy:**

- owl:Thing
  - rdf:Property
  - Automotive
    - Aggregate
    - Engine
    - Gear
    - Vehicle
  - Axiome
    - ValuePartition
  - DaimlerChrysler
    - DCXCar
    - DCXEngine
    - DCXGear
      - DCXNAG1
    - DCXSysteme
      - BZM
        - AmountPlausibel
        - Amount
      - MAS\_PLUS
        - MengePlausibel
        - Menge
      - DCXMenge
      - DCXLieferTermin
      - DCXSachnummer

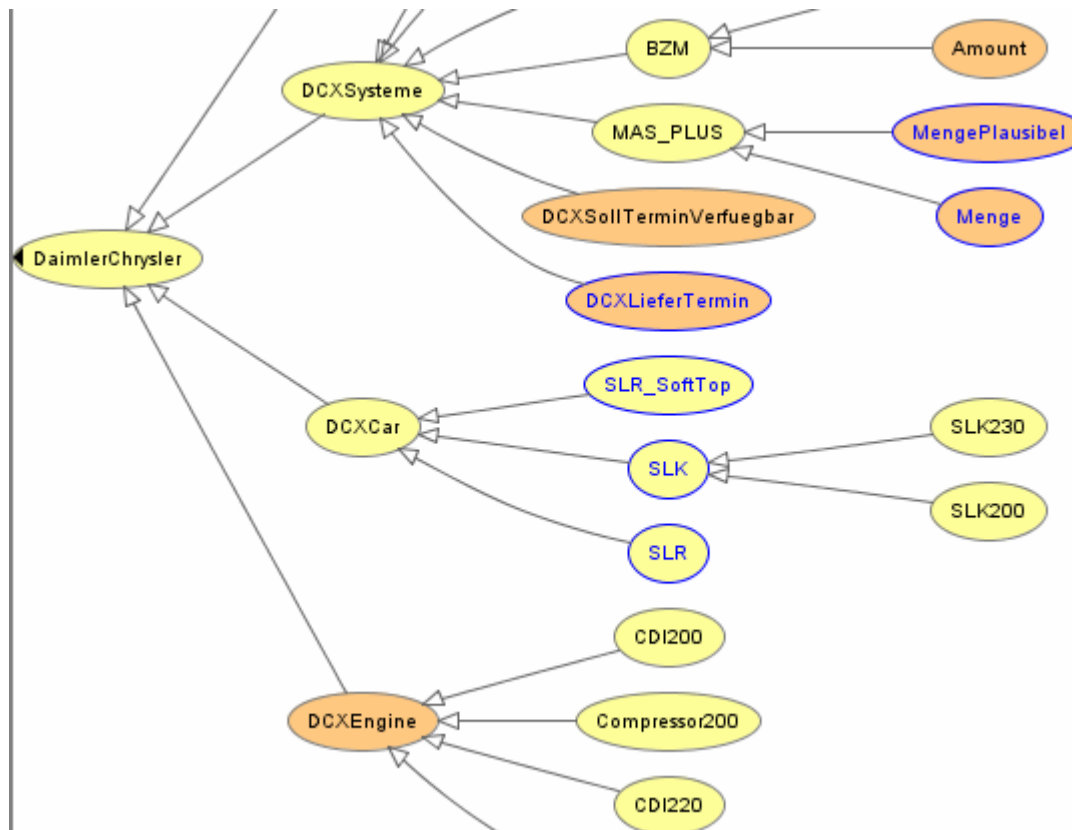
**Inferred Hierarchy:**

- owl:Thing
  - Automotive
    - Aggregate
      - Engine
      - Gear
        - DCXNAG1
    - Vehicle
  - Axiome
  - DaimlerChrysler
    - DCXCar
    - DCXEngine
    - DCXGear
    - DCXSysteme
      - BZM
        - Amount
          - Menge
        - AmountPlausibel
          - MengePlausibel
      - DCXLieferTermin ≡ DCXSollTermin
        - DCXSollTermin ≡ DCXLieferTermin
          - DCXLieferTermin ≡ DCXSollTermin (recursive)
      - DCXMenge
        - Menge
      - DCXSachnummer

**Change Log:**

- DCXLieferTermin: Added DataTypeValuePartition, DCXSollTermin
- DCXMenge: Added DataTypeValuePartition
- DCXNAG1: Added Gear
- DCXSachnummer: Added DataTypeValuePartition
- DCXSollTermin: Added DataTypeValuePartition, DCXLieferTermin
- Engine: Moved from Automotive to Aggregate
- Gear: Moved from Automotive to Aggregate
- Menge: Added DCXMenge, Amount
- MengePlausibel: Added AmountPlausibel
- SLK: Added Coupe
- SLR: Added Coupe

# Protégé (OWL Viz)



## Summary

- SOA is not JABOWS (“Just A Bunch of Web Services”)
- The Enterprise Service Bus (ESB) is not magic
- Semantics become more important in future
- Results are based on Lab

## Contact

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