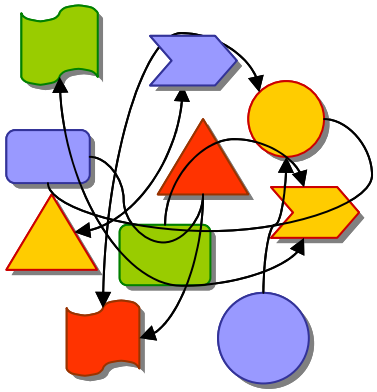
Semantic Integration in real life



Jürgen Angele

ESWC 2005

ontoprise

Founded: 1999 (Spin Off Univ. Karlsruhe)

Team: 40 Employees

Context: "Semantic Europe" (~ 200 R&D)
- AIFB Karlsruhe
- FZI, Karlsruhe
- DERI Galway, Irland
- DERI Innsbruck, Austria

Products: - OntoStudio, OntoBroker,...

Technology:

- Technology Leader (Gartner Group, Forrester Research)
- Vision: SemanticWeb

ontoprise

Our customers and partners

Introduction

Kinds of Integration Problems

It is generally estimated that for each $1 spent for an application, companies spend on average $5 to $9 for the integration. © IBM, Nelson Mattos

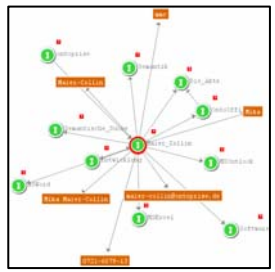
What is the **problem** of information integration?

- **structural heterogeneity** – different application systems store their data in different structures
- **semantic heterogeneity** – intended meaning of information items is different in the various application systems
- **inconsistency and redundancy problems** – data in different application systems might be partially inconsistent or redundant

What are Ontologies?

„People can‘t share knowledge if they do not speak a common language.“ [Davenport & Prusak, 98]

- Ontologies **standardize** and **formalize** the meaning of words through concepts
- Ontologies enable a better **communication** between
  - **Humans and/or**
  - **Machines**
- Ontologies **integrate** different conceptualisations



XSLT Transformation

```
<article>
    <articleid>a-5634</articleid>
    <category>printer</category>
    <name>hp81</name>
    <price currency='USD'>500</price>
    <producer>hp</producer>
    <resolution>1960 dpi</resolution>
    <type>laser</type>
....
</article>
```

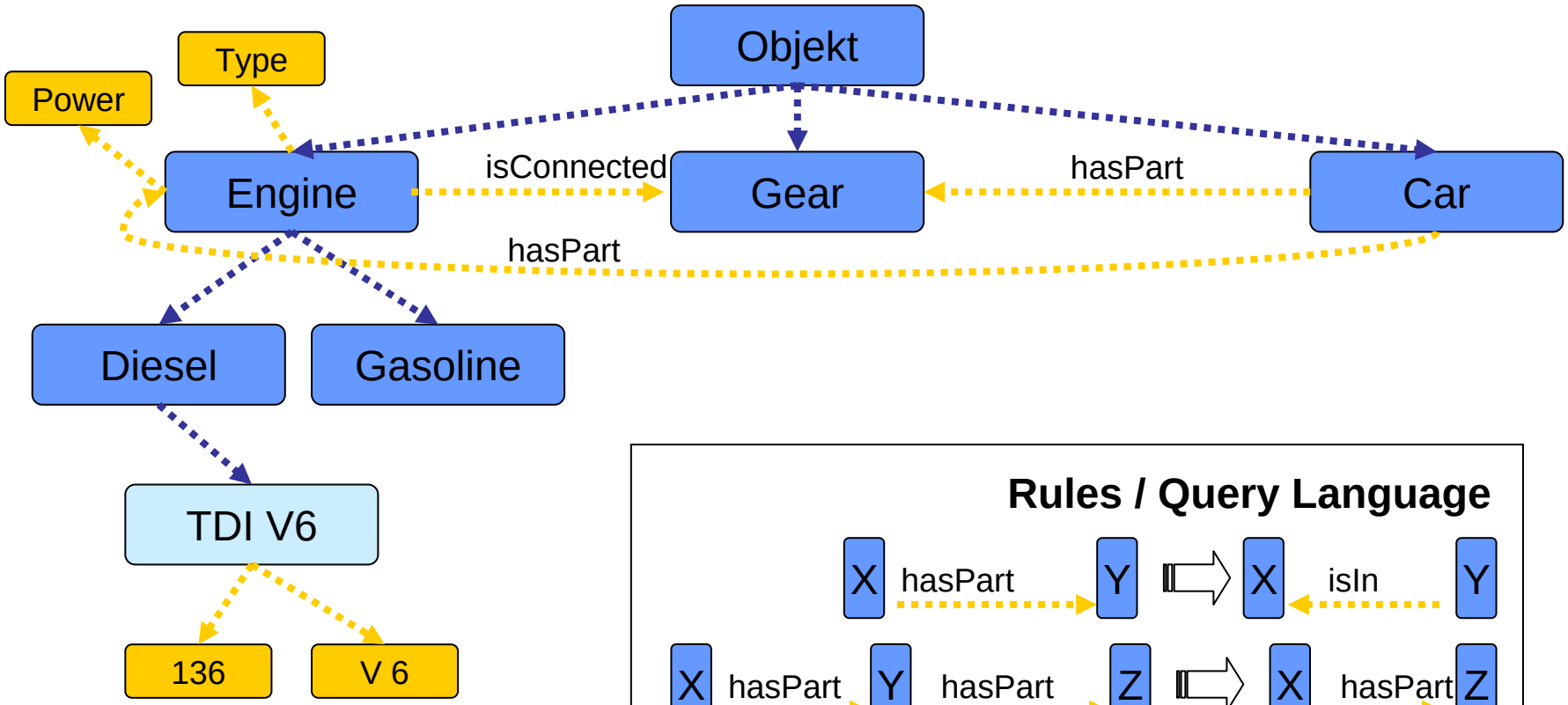
```
<Artikel ArtNr='a-5634'>

    <Typ>Laserdrucker</Typ>
    <Name>hp81</Name>
    <Preis Waehrung='E'>625</Preis>
    <Hersteller>hp</Hersteller>
    <Aufloesung>1960 dpi</Aufloesung>

....
</Artikel>
```

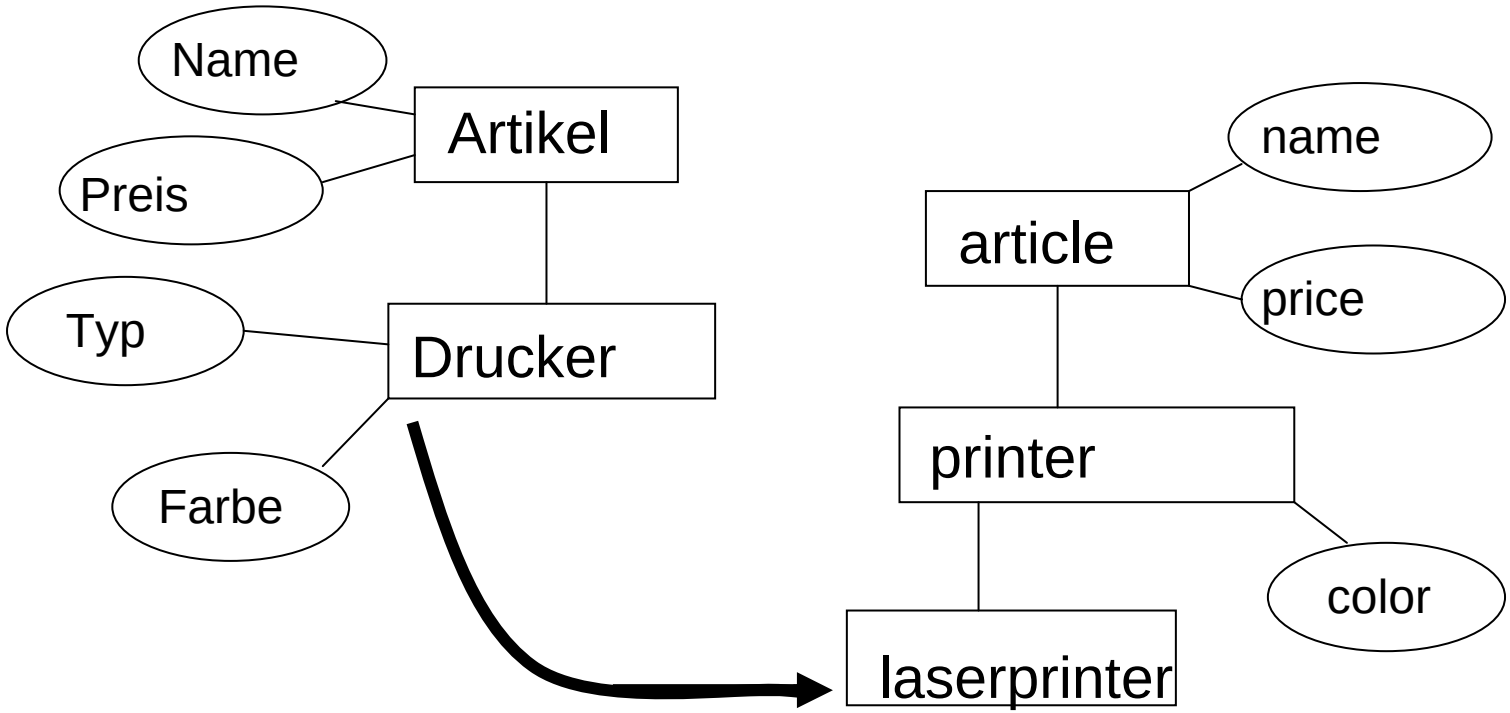
```
<xsl:template match="article">
 <Artikel ArtNr="{./articleid}">
    Name><xsl:value-of select="name"/></Name>
    <Typ><xsl:if test="./category='printer'">
  <Preis Waehrung="E"><xsl:value-of select="price*1.25"/></Preis>
            <xsl:if test="./type='laser'">Laserdrucker</xsl:if>
    Hersteller><xsl:value-of select="producer"/></Hersteller>
            <xsl:if test="./type='ink'">Tintenstrahldrucker</xsl:if>
    Aufloesung><xsl:value-of select="resolution"/></Aufloesung>
            </xsl:if></Typ>
 </Artikel>
</xsl:template>
```

Ontology



- **Representation Language: F-Logic, WRL**
- **standards: RDF, OWL**

Semantic Mapping



if X is a Drucker and hasTyp Laser, then X is a laserprinter

Motivation Semantic Information Integration

SII Challenges

End Users dealing with Multiple Systems

Customer Service Delays

Rising Costs

→ Multiple Interfaces

Inaccurate Information

Processing Delays

→ Different Formats

Incomplete View of Business

Reporting Delays

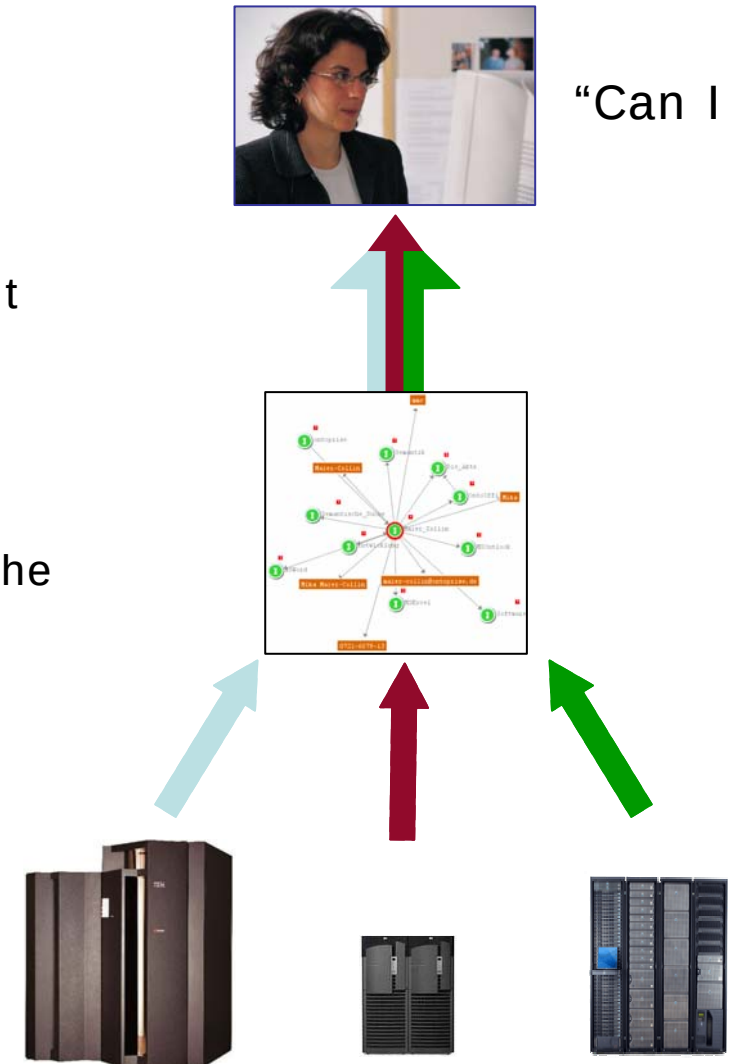
→ Different Meanings

EII Value Propositions

- Single View
- Business Agility
- Increased Productivity

Single View

- Aggregating data from multiple systems
- Presenting relevant information in the user's terminology
- Giving different perspectives into the same information

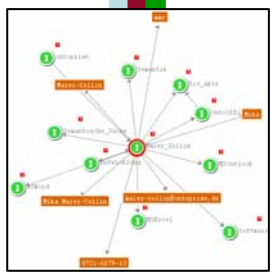


"Can I get a single view of ... ?"

...Customer?
...Citizen?
...Patient?
...Policy Holder?
...Revenue?
...Supply Chain?

...ANY Entity!
...ANY Process!

Business Agility



"What are $$ by Region?"

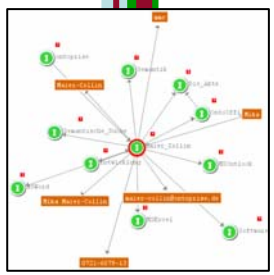
Reg1	$$
Terr1	$
Terr2	$
Terr3	$
Reg2	$$
Terr4	$
Terr5	$
Terr6	$
Reg3	$$
Terr7	$
Terr8	$
Terr9	$

Business Agility

- Minimizing impact of change
- Ease of maintenance
- Rapid implementation of new strategies

Restructure!

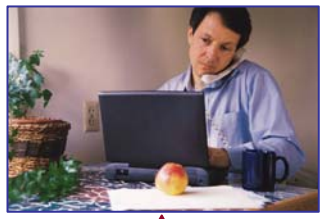
-Remove 1 Region
-Split Territories



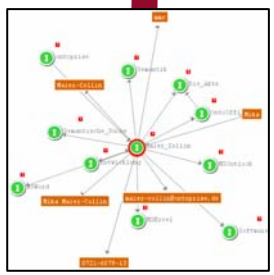
"What are $$ by Region?"

RegA	$$$
Terr1	$
Terr2	$
Terr3	$
Terr4	$
RegB	$$$
Terr5	$
Terr6	$
Terr7	$
Terr8	$
Terr9	$

Increased Productivity 1



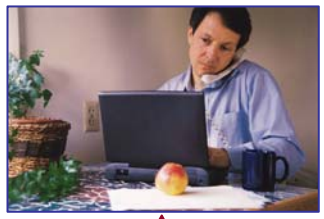
"Should this insurance policy be canceled ?"



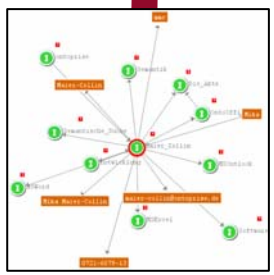
(it is a lousy payer,
but his cousin is CEO of an important customer)

Increased Productivity 2

- Capturing business rules directly in the Information Model
- Determining the optimal system access
- Bringing every user to the same level of effectiveness and productivity



"Authorize this charge?"



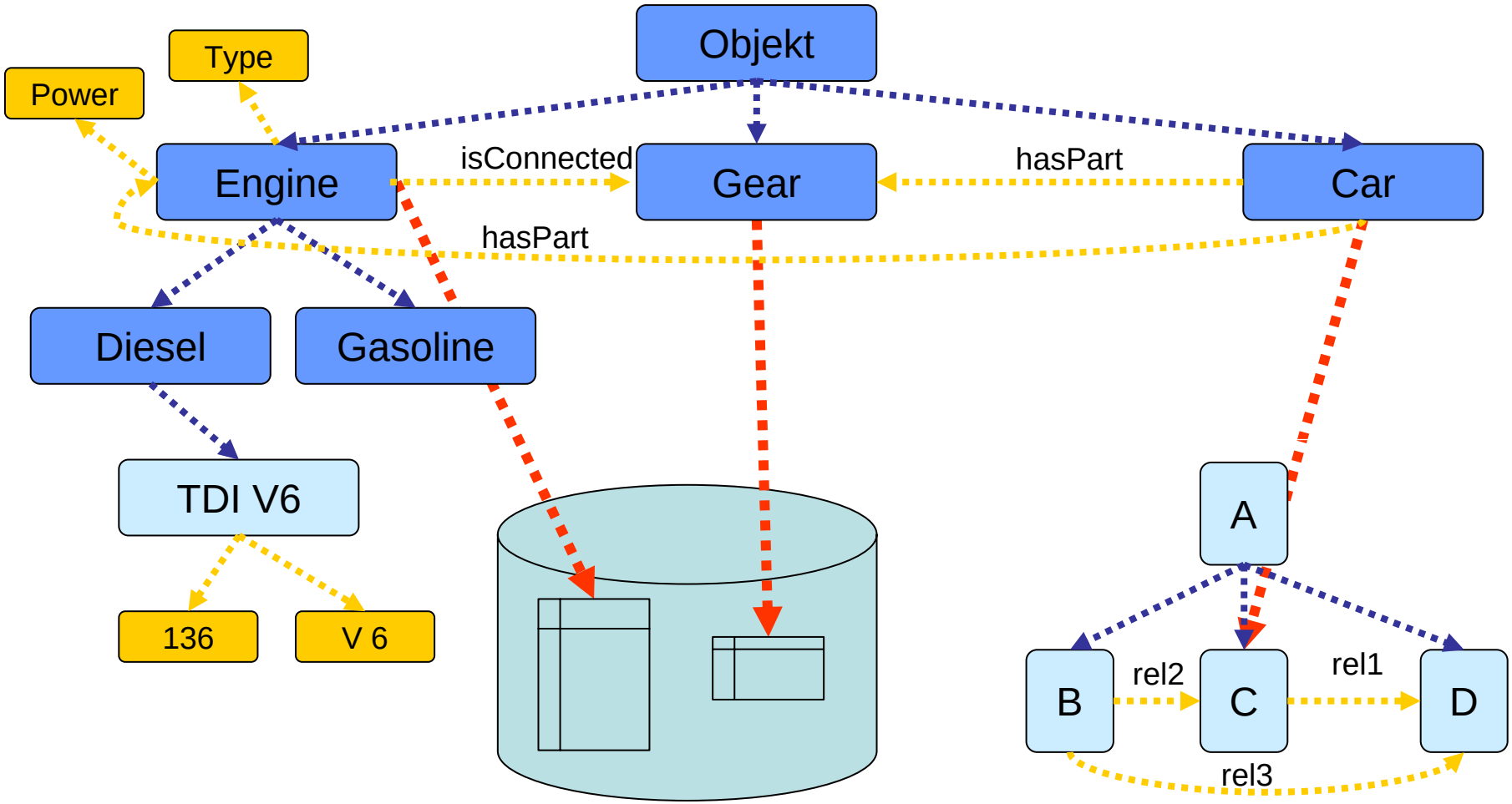
(Need to extend limit, check credit)

EII Value Propositions

- Single View
  - Aggregating data from multiple systems
  - Presenting relevant information in the user's terminology
  - Giving different perspectives into the same information
- Business Agility
  - Minimizing impact of change
  - Ease of maintenance
  - Rapid implementation of new strategies
- Increased Productivity
  - Capturing business rules directly in the Information Model
  - Determining the optimal system access
  - Bringing every user to the same level of effectiveness and productivity

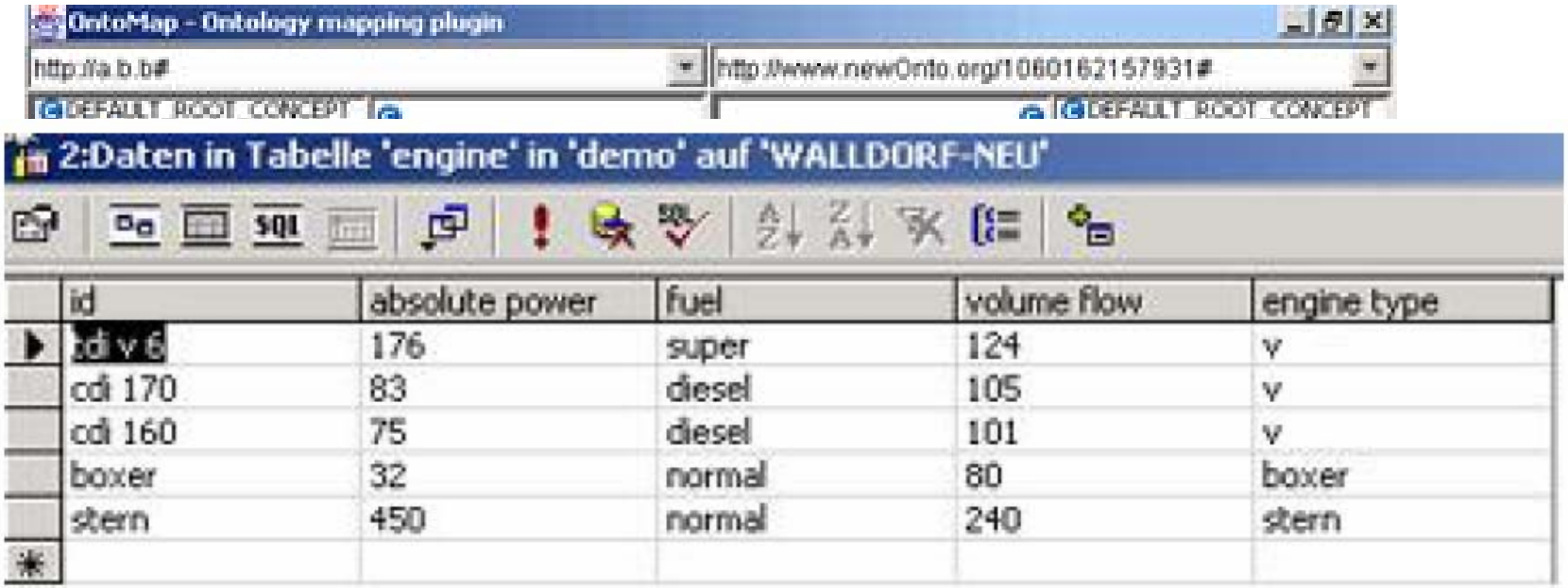
Concept

Relational Databases



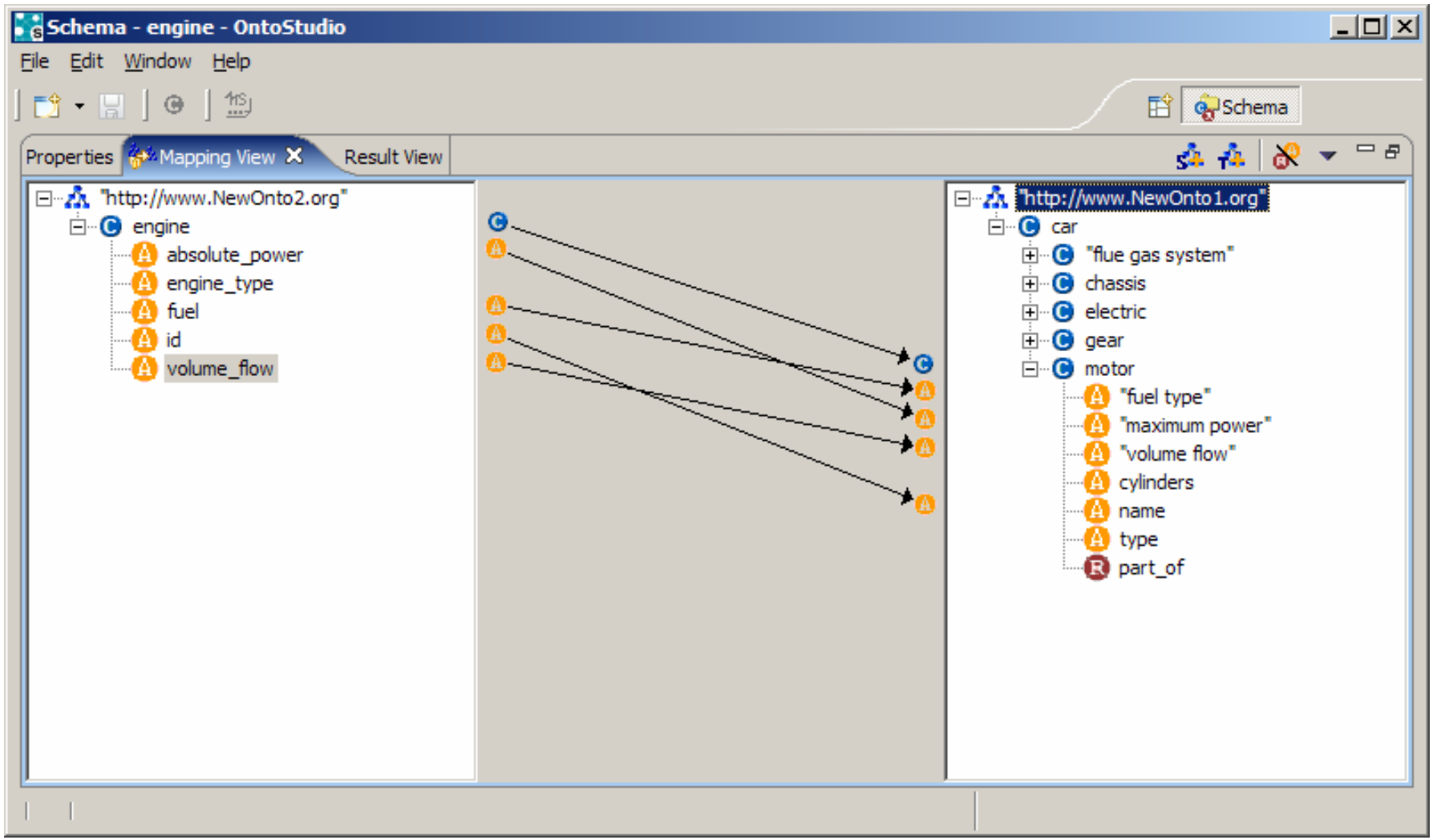
- **Mapping to Databases**
- **Mapping to Ontologies**

Mapping in OntoStudio

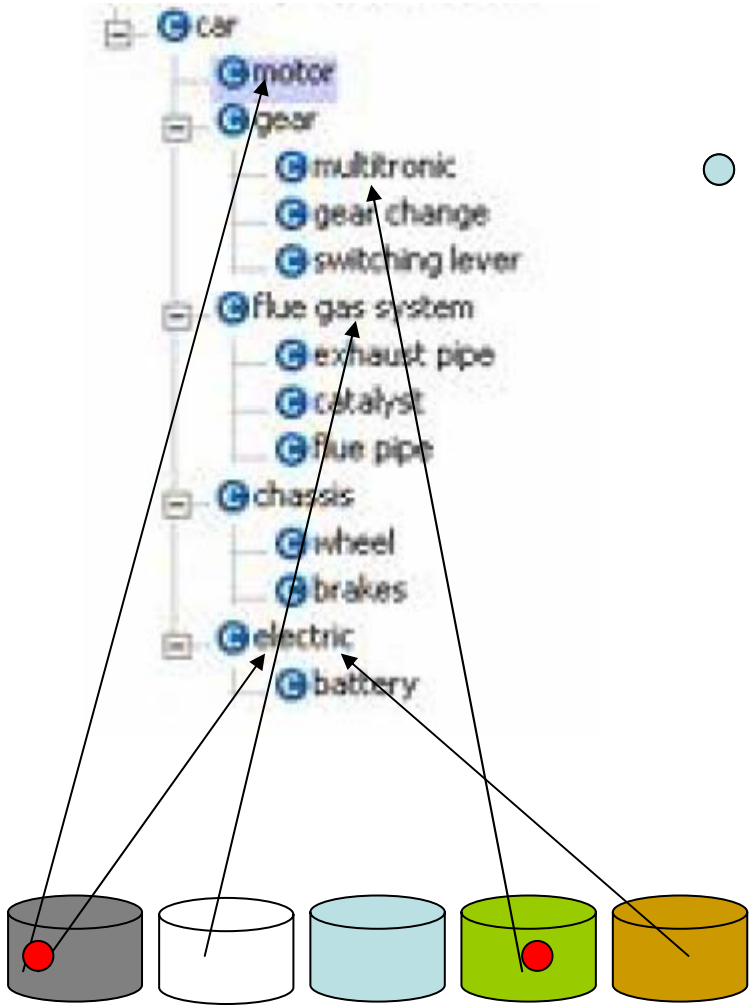


id	absolute power	fuel	volume flow	engine type
sdi v 6	176	super	124	v
cdi 170	83	diesel	105	v
cdi 160	75	diesel	101	v
boxer	32	normal	80	boxer
stern	450	normal	240	stern

Mapping in OntoStudio



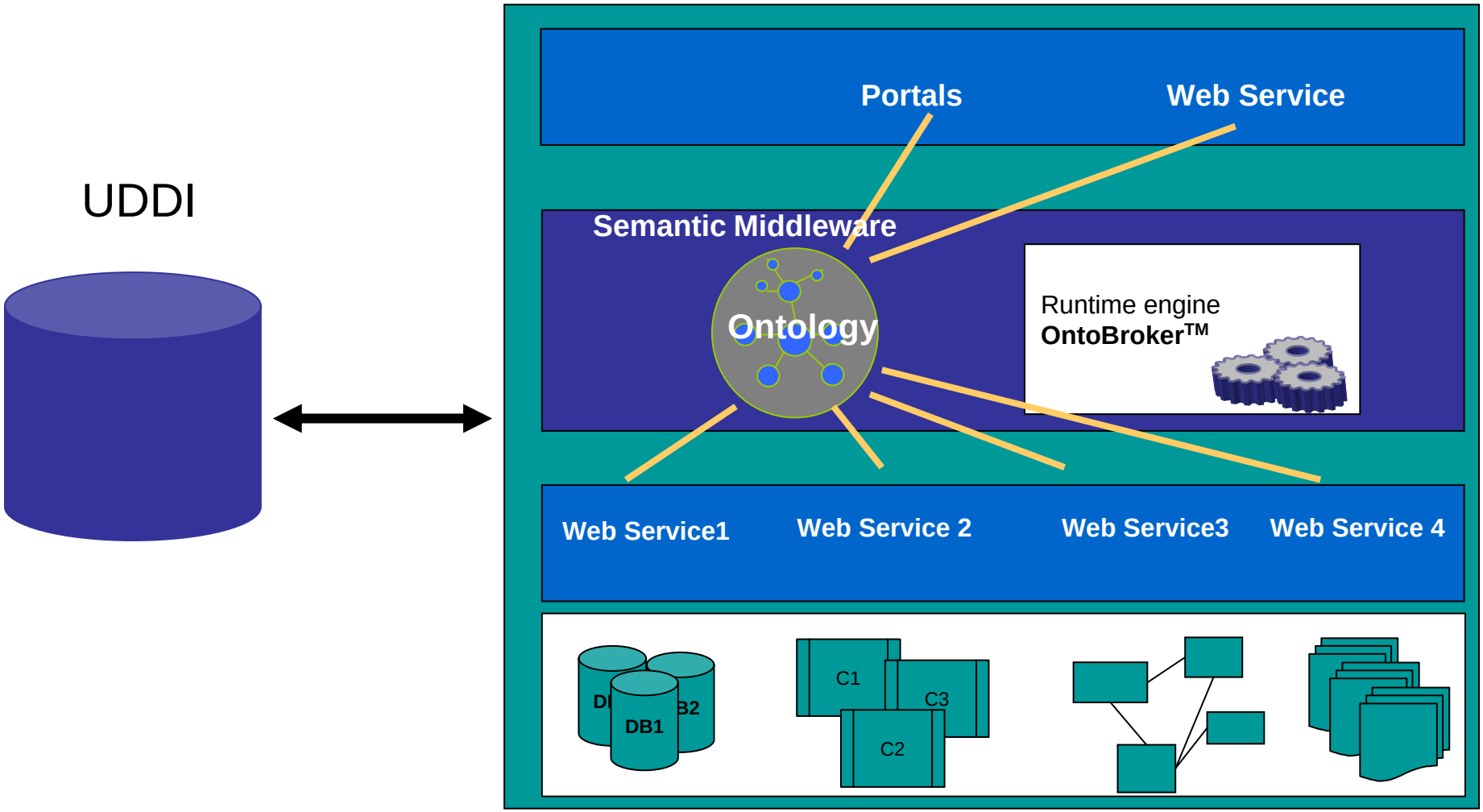
Integration of several databases



- which cars have a multitronic and an TDI V6 engine?

Car 54

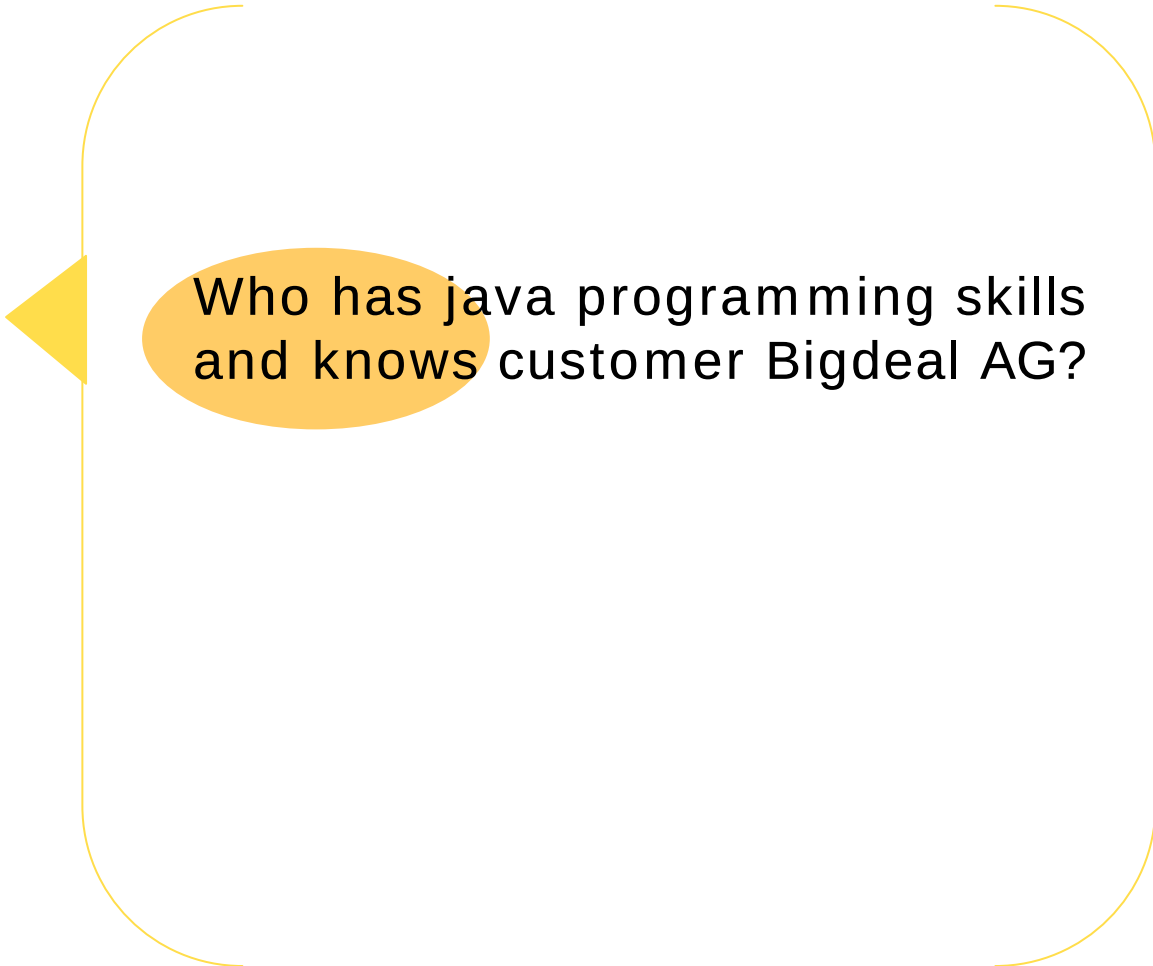
Web Services



A:Address[zip->>Z] and temperature(Z,T) and T > 25 -> warm(A).

Unstructured Information

example



Java skills?

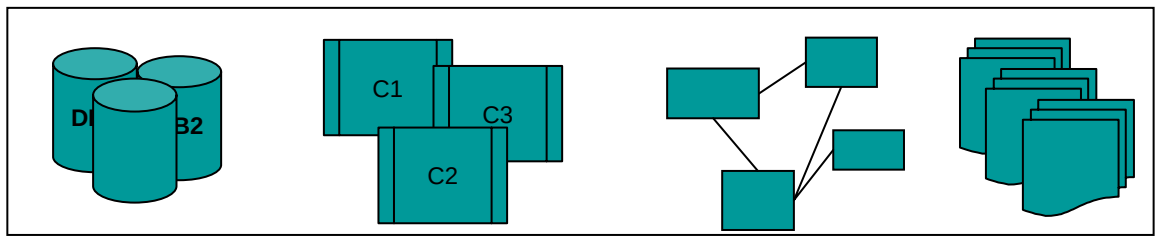
employees with java skills:

S. Maier maier@firma.de
G. Nial nial@firma.de
S. Uper uper@firma.de

employee-DB

```
H. Müller  müller@firma.de
S. Maier   maier@firma.de
F. Schmidt schmidt@firma.de
```

S.Maier: „ … In Java Version 1.4 this function has been implemented



Java skills? Bigdeal AG?

employees with java skills:

S. Maier maier@firma.de
G. Nial nial@firma.de
S. Uper uper@firma.de

answer:

S. Uper uper@firma.de

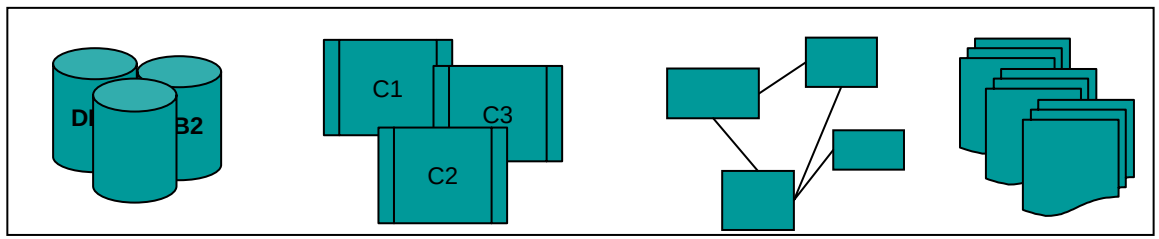
project reports

Titel: Effizienz mit Onto

Team: H. Fleissig
S. Uper

Kunde: Bigdeal AG

.....



Semantic Information Integration Applications

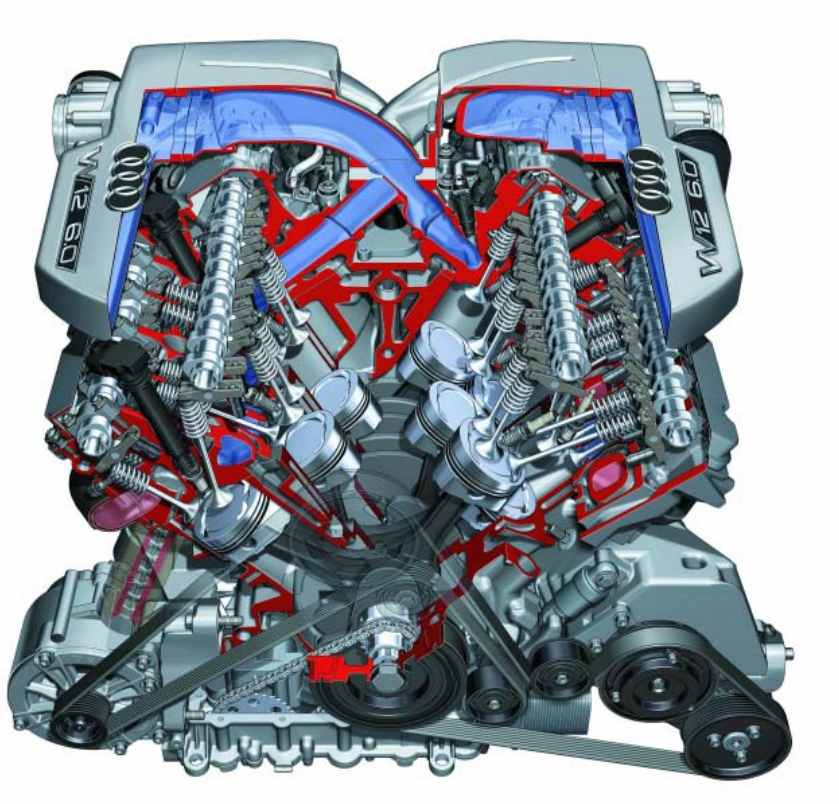
Audi: Semantic Testcar Configuration

Background

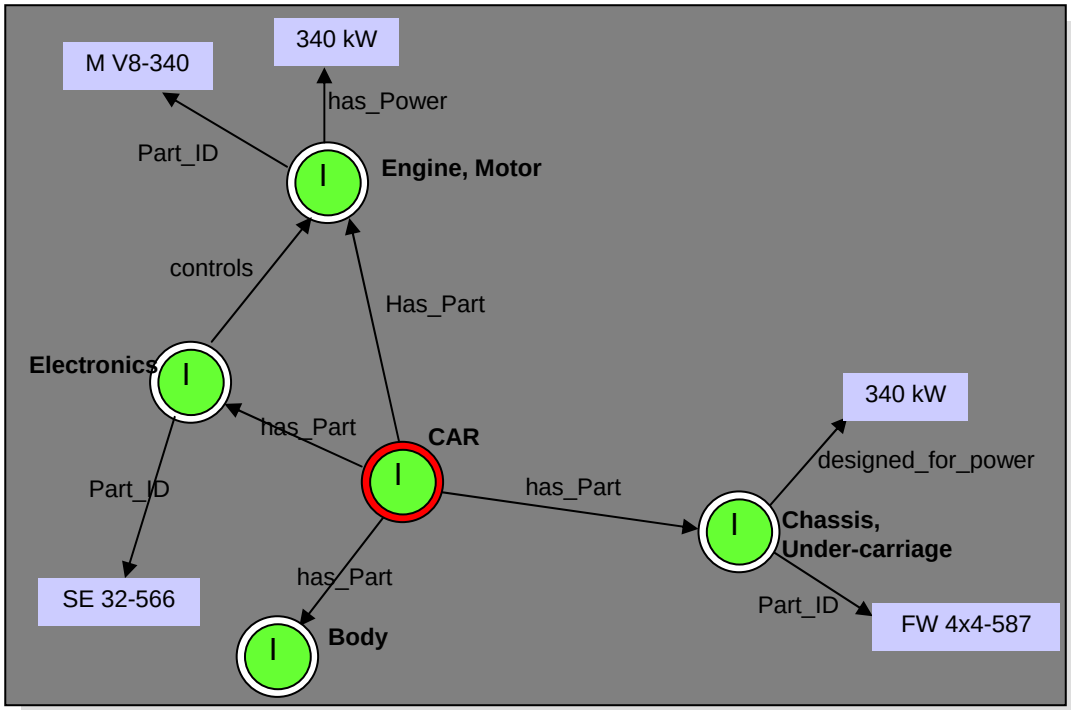
- Complex dependencies decrease the speed of development
- Knowledge is distributed over different departments

Goal

- Design of a Semantic Guide for
  - capturing the dependencies
  - Configuration of components
- Integration into existing order system
- Engineers can concentrate on creative efforts



Ontologies represent the meaning of information



Sample Ontology (Source ontoprise)

Represent the <u>meaning</u> of information

-Concepts and hierarchies (Car, has_Part, Engine, Body, …)

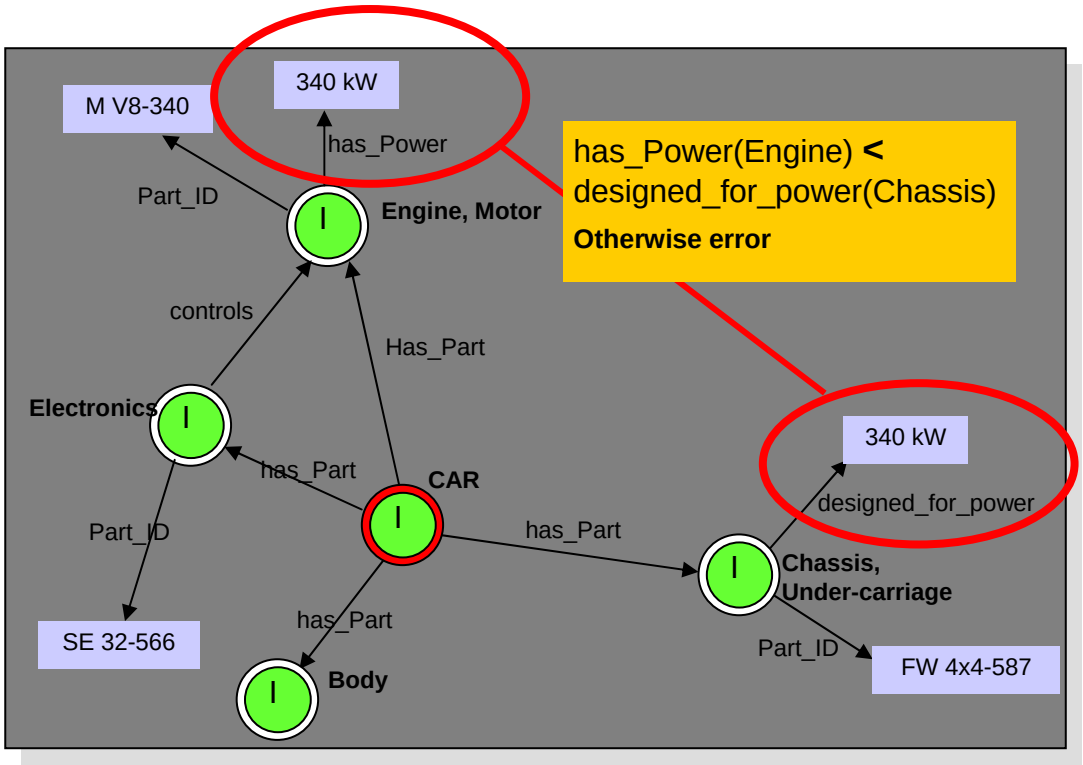
-Synonyms (Engine, Motor)

-Attributes and relations (Part_ID, designed_for_power, controls)

-other

"An ontology is a hierarchically structured set of terms for describing a domain that can be used as a skeletal foundation for a knowledge base." Swartout, Patil, Knight and Russ.

Ontologies represent the logic of information



Sample Ontology (Source ontoprise)

Represent the logic of information

-Rules to define constraints (Chassis has to be designed for the power of the engine)

-Rules for defining any functional, logical, geometrical, chronological dependencies (has_Power influences gearbox and tires)

-Rules for information integration (value “Engine has_power” is stored in “PDM p, Table t1”; value “designed_for_power” is stored in “CAT c, Table t2”)

-Rules to define different contexts

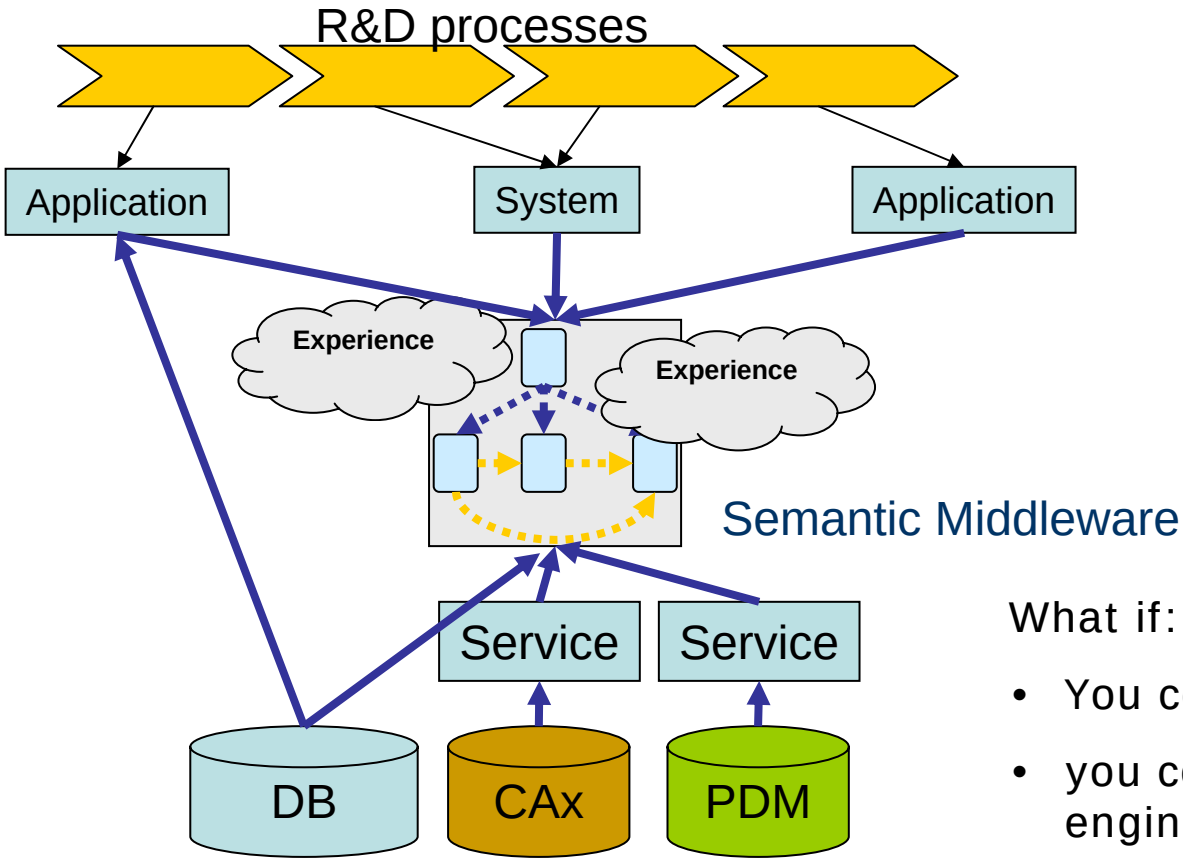
“Ontologies are the backbone of semantic technologies. They enable companies to integrate information, make them tangible and re-usable.” Prof. Dr. Rudi Studer.

Relationships/Constraints

Rule 2: *The maximum power of the motor must not exceed the one of the brakes: Pmotor < | Pbrakes |*

FORALL X,Y,Z1,Z2,Z3
message("The motor's maximum power exceeds the one of the brakes.")
<- X:motor[maximum_power->>Z1] AND
Y:brake[maximum_power->>Z2] AND
abs(Z1,Z3) AND lessorequal(Z2,Z3).

Problems with IT support of R&D processes



What if:

- You could integrate existing data
- you could add the experience of engineers to the applications

Accelerate R&D and Customer Service

Background

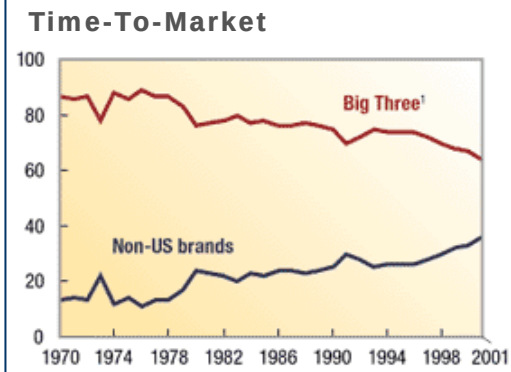
- Critical success factors for development of complex products
  - Time-To-Market
  - Service Quality

Problem

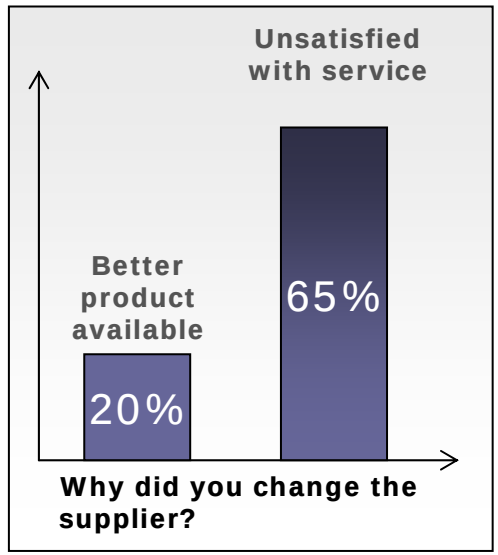
- Complex dependencies and variants
- Heterogeneous Sources
- Difficulty to transfer engineers' know-how

Solution

- Semantic Customer Service Support



¹Chrysler (DaimlerChrysler since 1998 merger), Ford, General Motors.
Source: *Wards Automotive Yearbook*; McKinsey analysis

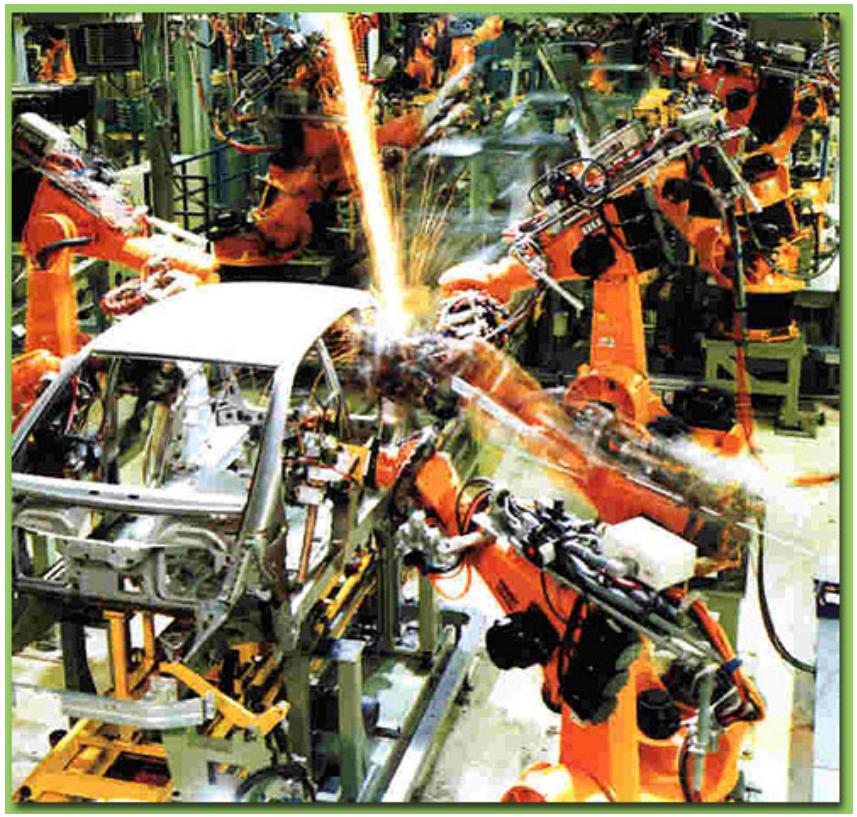


Customer Service Support

Background

- 65% of all customer in the manufacturing industry change their suppliers because there are not satisfied with the service

- Service engineers spend a lot of time with known problems

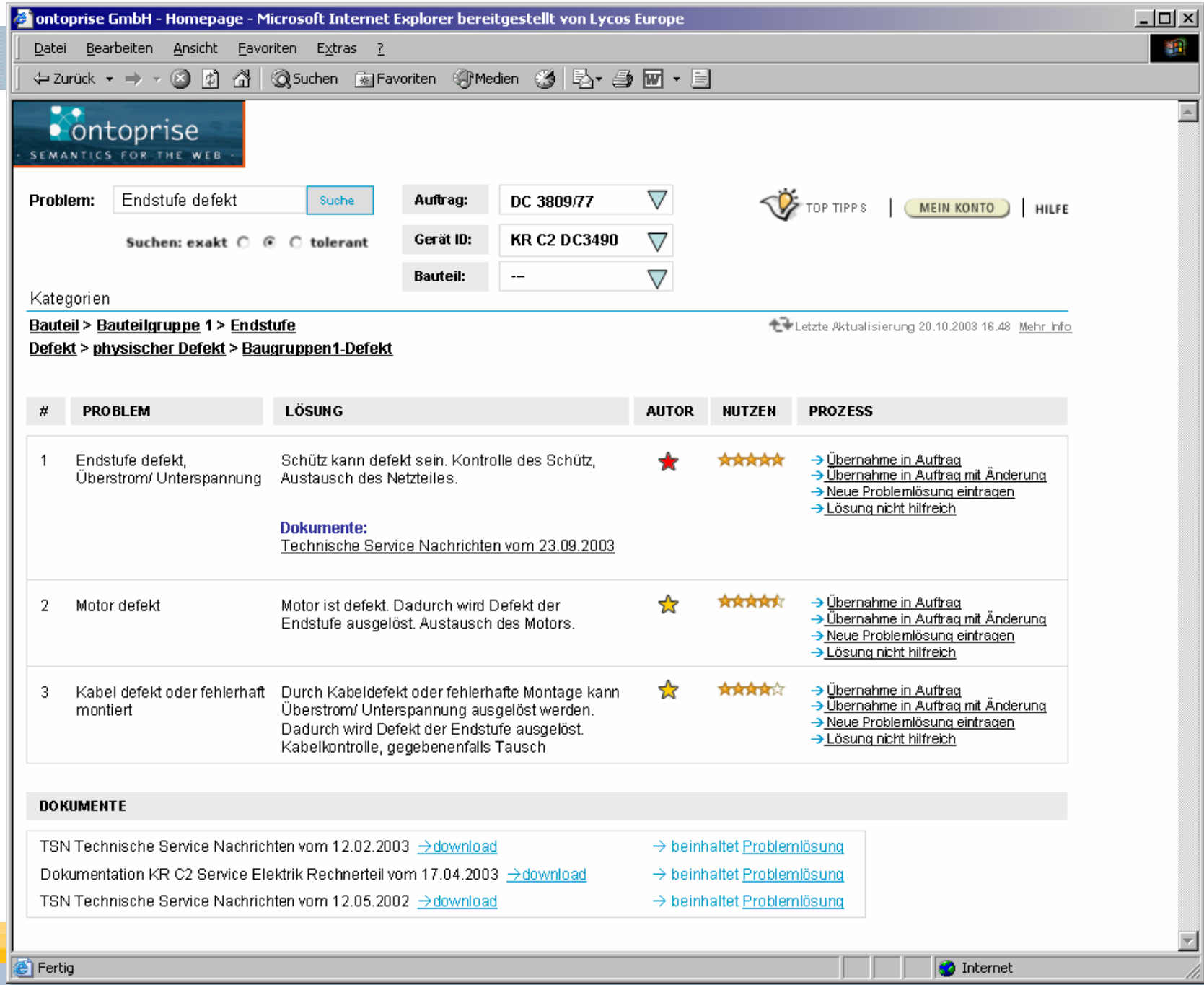


Goal

- Capturing and usage of engineers and experts know-how
- Decision support for choosing the right solution
- Increase customer satisfaction

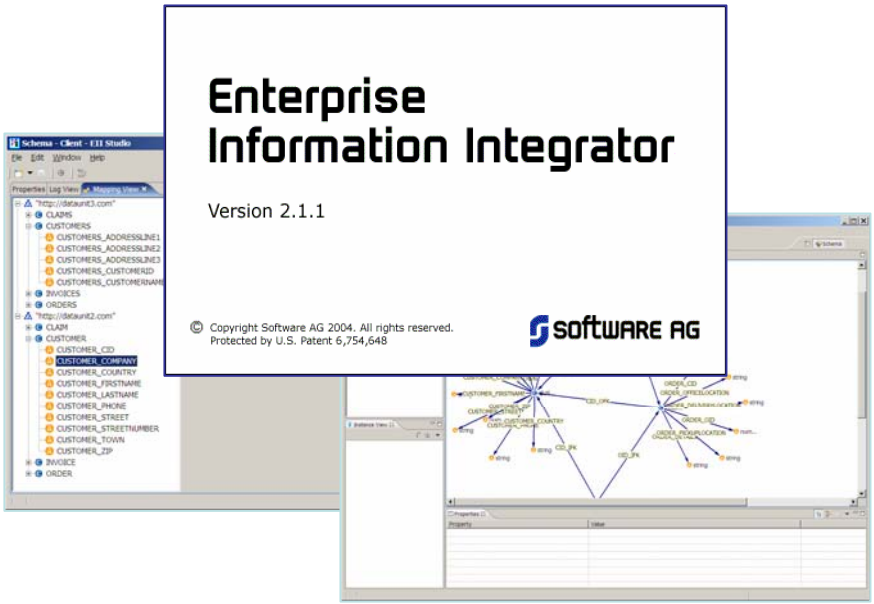
Implementation

- Semantic Customer Service Support

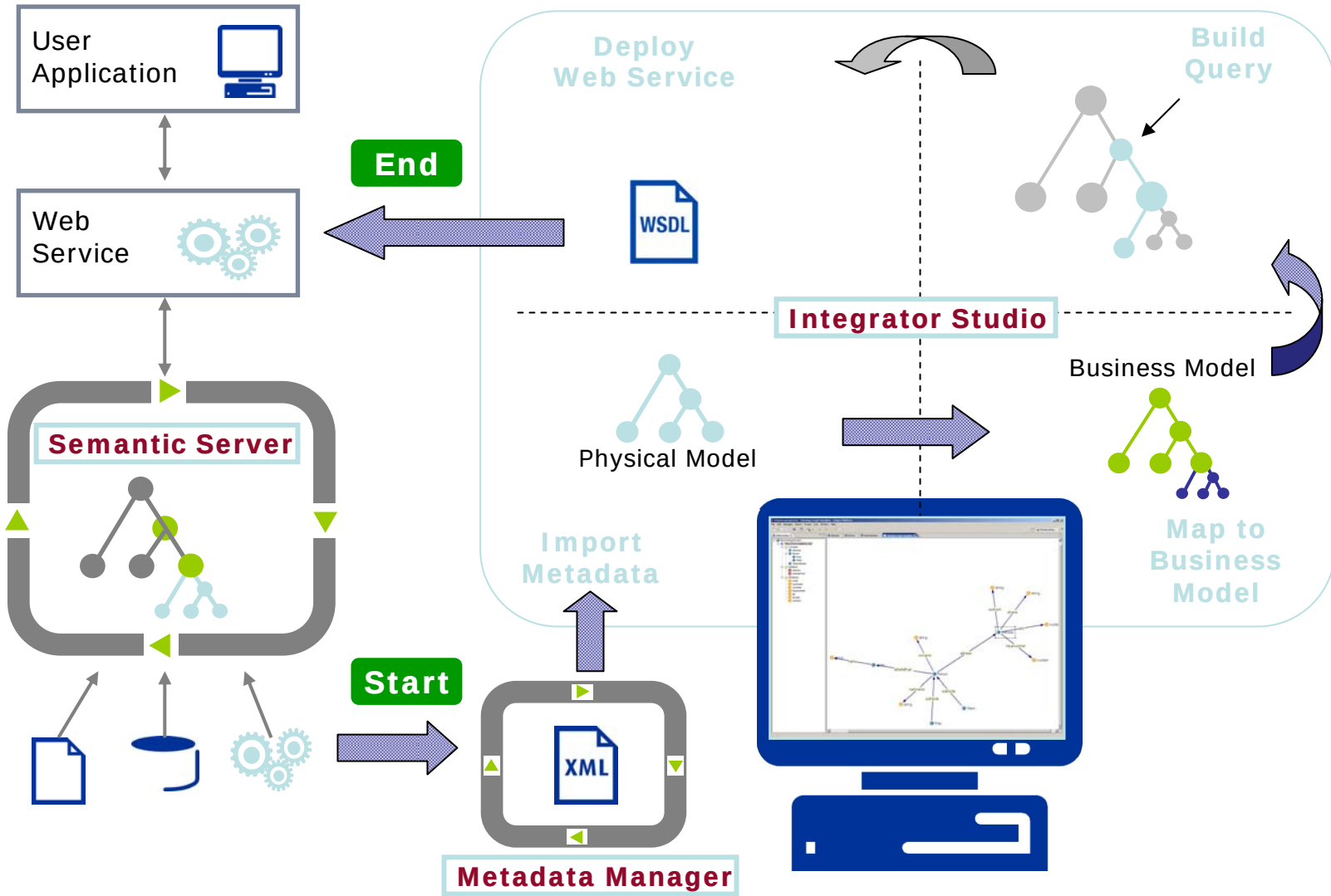

ontoprise GmbH - Homepage - Microsoft Internet Explorer bereitgestellt von Lycos Europe
Datei Bearbeiten Ansicht Favoriten Extras ?
Zurück Suchen Favoriten Medien
ontoprise
SEMANTICS FOR THE WEB
Problem: Endstufe defekt Suche
Suchen: exakt tolerant
Auftrag: DC 3809/77
Gerät ID: KR C2 DC3490
Bauteil: --
TOP TIPPS | MEIN KONTO | HILFE
Kategorien
Bauteil > Bauteilgruppe 1 > Endstufe
Defekt > physischer Defekt > Baugruppen1-Defekt
Letzte Aktualisierung 20.10.2003 16.48 Mehr Info
PROBLEM LÖSUNG AUTOR NUTZEN PROZESS
1 Endstufe defekt, Überstrom/ Unterspannung
Schütz kann defekt sein. Kontrolle des Schütz, Austausch des Netzteiles.
Dokumente:
Technische Service Nachrichten vom 23.09.2003
→Übernahme in Auftrag
→Übernahme in Auftrag mit Änderung
→Neue Problemlösung eintragen
→Lösung nicht hilfreich
2 Motor defekt
Motor ist defekt. Dadurch wird Defekt der Endstufe ausgelöst. Austausch des Motors.
→Übernahme in Auftrag
→Übernahme in Auftrag mit Änderung
→Neue Problemlösung eintragen
→Lösung nicht hilfreich
3 Kabel defekt oder fehlerhaft montiert
Durch Kabeldefekt oder fehlerhafte Montage kann Überstrom/ Unterspannung ausgelöst werden. Dadurch wird Defekt der Endstufe ausgelöst. Kabelkontrolle, gegebenenfalls Tausch
→Übernahme in Auftrag
→Übernahme in Auftrag mit Änderung
→Neue Problemlösung eintragen
→Lösung nicht hilfreich
DOKUMENTE
TSN Technische Service Nachrichten vom 12.02.2003 →download → beinhaltet Problemlösung
Dokumentation KR C2 Service Elektrik Rechnerteil vom 17.04.2003 →download → beinhaltet Problemlösung
TSN Technische Service Nachrichten vom 12.05.2002 →download → beinhaltet Problemlösung
Fertig
Internet

EII Product

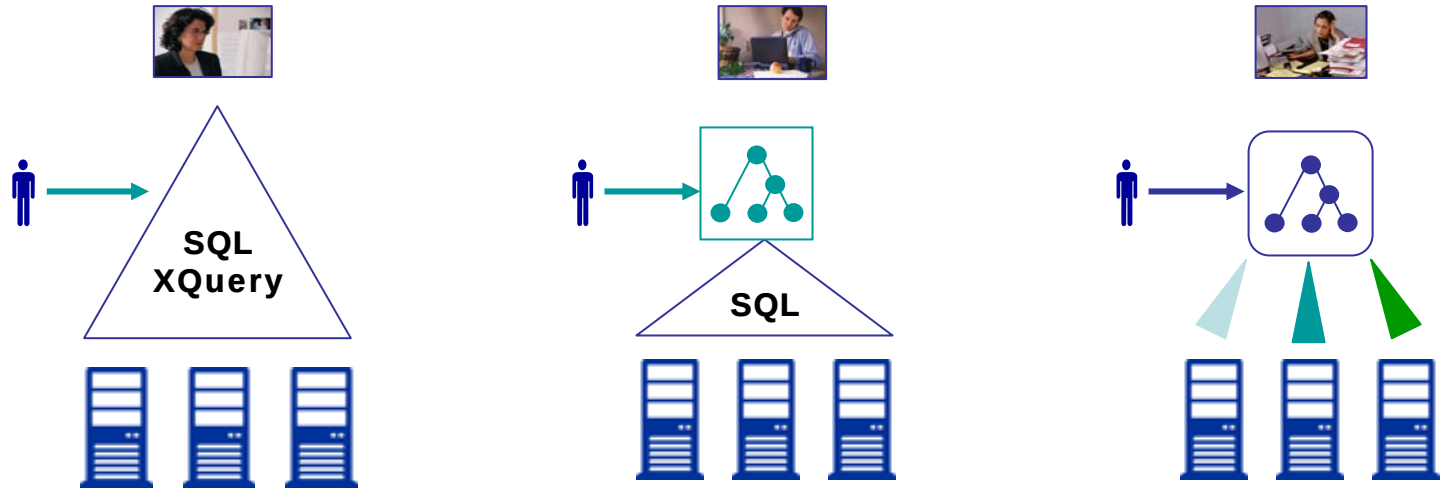
Software AG's
Enterprise Information Integrator 2.1



EII v2.1 Architecture



EII Differentiator



Virtual Federated DB	Model-Driven Virtual Federated DB	Model-Driven Semantic Integration
• Static Coded Queries • Very Brittle • Single Use Case	• Generated Queries • No Optimization • No Intelligence	• Dynamic Queries • Optimized Access • Intelligent Access • Multiple Use Cases

EII v2.1 Active Projects

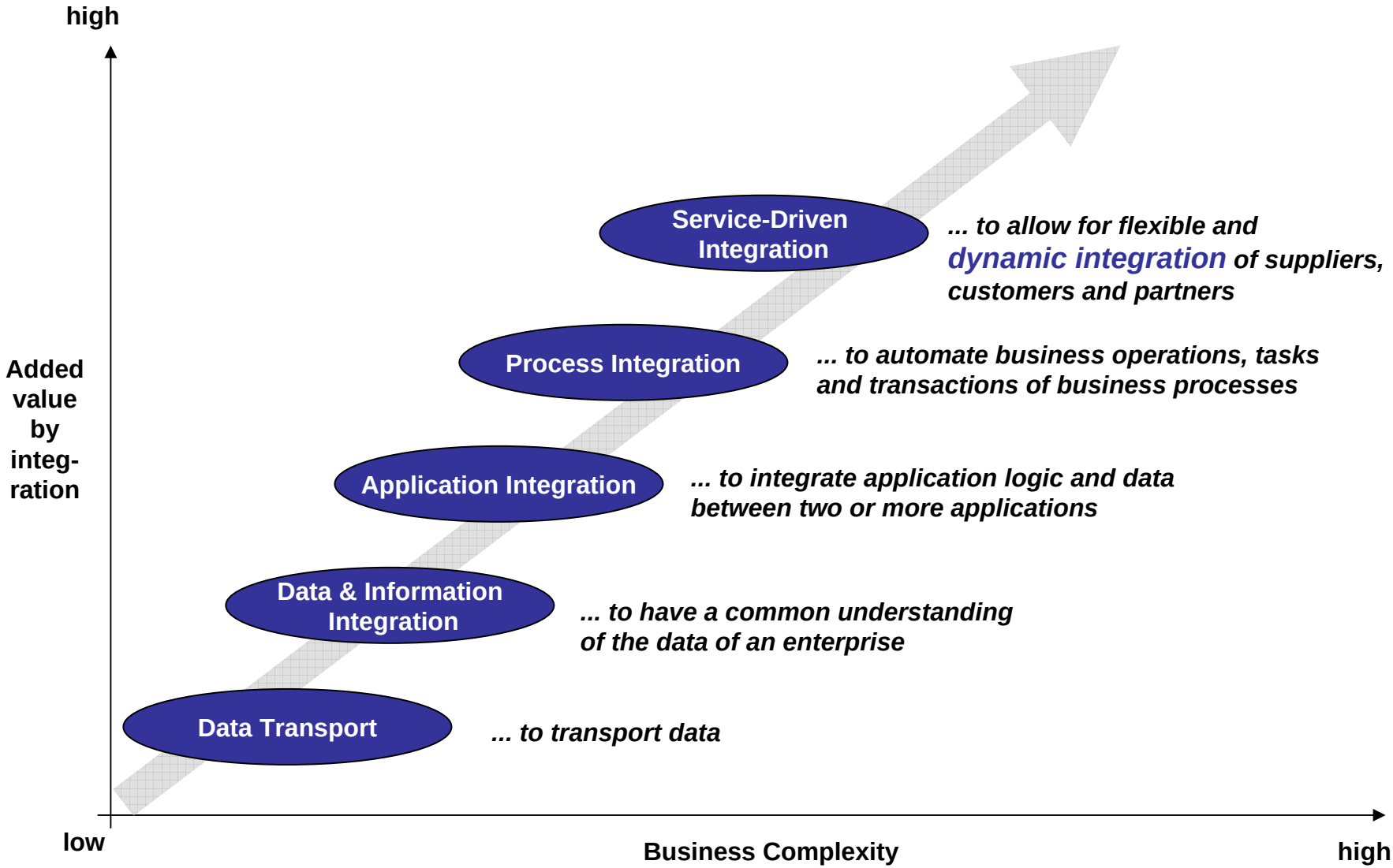
- Florida Community College of Jacksonville
  - Registration and Course Scheduling in Student Portal
- SIRVA
  - Financial Reporting, Single Customer View
- CompuCredit
  - Debt Collections, Single Customer View
- South Carolina Retirement Systems
  - Account Statement Generation, Single Customer View
- Alcatel
  - *Intelligent Storage System* – Mobile Services Single View
- CBIG (Internal Software AG)
  - Single Customer View
- Bundeswertpapierverwaltung
  - Part of BPM, Single Customer View

EII v2.1 Other Opportunities

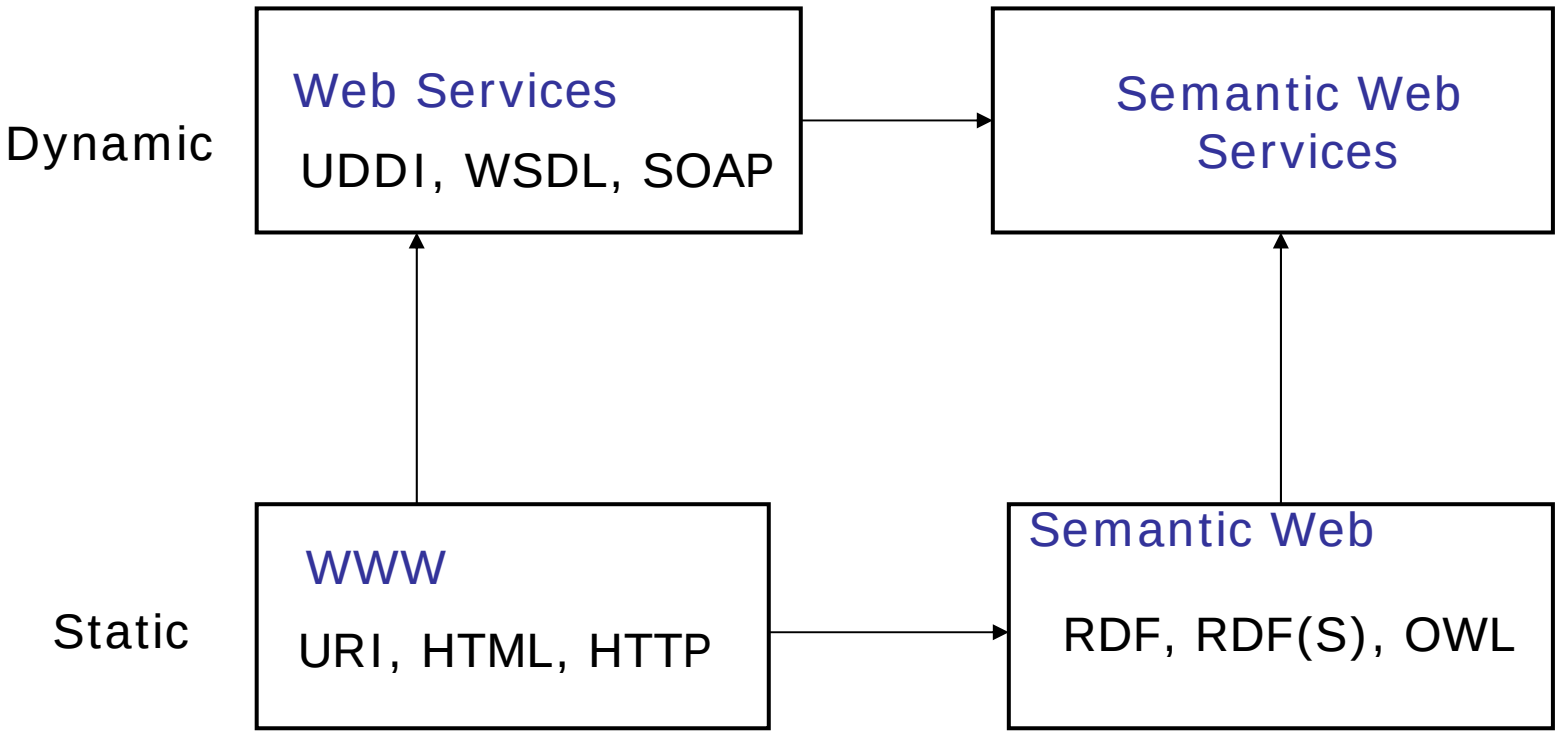
- Pharmaceutical
  - Single View of Brand Marketing Strategies
  - Financial Reporting of Product
- Large Grocer
  - Business Analytics
- 2 Very Large Insurance Companies
  - Single Policyholder Views
- Automobile Manufacturer
  - Semantic Matching
- US State Agency
  - Unemployment Compensation Fraud
- A National Bureau of Statistics
  - Single Citizen Views
- A National Security Agency
  - Metadata Repository of Services and an Enterprise Data Model
- Independent Software Vendor
  - Information Model and Business Rules Engine
- Global System Integrator
  - Multiple Projects

Future

The Future: Evolution of Integration



The Vision of a (Semantic) Web of Services



Thank you!

Prof. Dr. Jürgen Angele
angele@ontoprise.de
+49 (0)721 509 809 0