Semantic Web Applications

Michael Erdmann
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Agenda

- **Ontoprise**
  - Examples for Semantic Web Application
    - Semantic Guide @ KUKA Robots
    - Configuration of Test Cars @ AUDI
    - Fish Stock Depletion Assessment System @ FAO of the UN
know how to use Know-how!

Ontoprise is leading producer of semantic technology to make the know-how of companies visible and usable

Founded in: 1999  
Team: 56 employees  
Based in: Karlsruhe, Germany  
Market: >50% of biggest German enterprises are ontoprise customers  

Strategic partner of Oracle, SAP and Software AG
Ontoprise Customers by Country

- Customers
- Customers since 2006
- Downloader
What are the Problems out there?

The Problem:
- „Models“ are „hidden“ in a lot of places
- It is hard to represent unstructured, dynamic information.
- If the goals or assumptions of applications change, the database structure and implemented code must be changed, too.
- Different views and vocabularies exist (even in one company) on the same dataset

The solution:
- Make models explicit using a declarative formalism
- Formulate business logic in rules
- Relevant structures can be derived via rules
- Declarative (semantic) models help in maintaining the system
- **System = model + rule-processor**
- Rule-processor is stable and can be reused even if models change
- Defined vocabularies with rules can be used to provide different views and mediate between them
Opportunities for Semantic Web App's

1. **Access to existing knowledge**
   - Integration of distributed sources
   - Support of retrieval tasks by providing background knowledge

2. **Acquisition of expert knowledge**
   - (Semi-) automatic structuring of knowledge by analysis of knowledge processes
   - Creation of knowledge base for complex domains

3. **Application of semantic knowledge**
   - E.g. guided analysis to identify and explain errors in car configurations
   - E.g. provision of potential maintenance tasks for industry robots
Ontologies integrate various sources according to their semantics and networked structure.

Ontologies provides context and background knowledge for effective semantic search.

For certain tasks ontologies are extended by user feedback.

Basic information is not duplicated and stays in source systems.

Processing logic kept separate from underlying data storage.
Ontoprise Products

- OntoBroker
  - FLogic-based inference engine
  - Geared towards performance and handling of big data sets
  - Extendible interfaces for adding procedural attachments and for accessing external data sources
  - SOA-ready

- OntoStudio
  - Ontology engineering environment
  - > 7,000 installations worldwide
  - Basic technology for many research projects (Theseus, SIMDAT, SmartWeb etc.)
  - Forms the base for the NeOn Toolkit

- SemanticMiner
  - Semantic Search Engine
  - Implementing elaborated semantic search algorithms
  - Easy to configure, customize and extend
OntoBroker 5.0 Architecture

Application Layer
- Semantic Integrator
- Semantic Guide
- Semantic Miner
- ...other Applications

Semantic Middleware
- Web Service Interface
- Kaon2 API
- Extensions (Built-Ins)
  - Procedures
  - Linguistics
  - Mathematics
  - ...

OntoBroker
- Connectors

Data Sources
- Relational Databases
- Search Engine
- Web Services
- ERP-Systems
- Other Data sources
- External OntoBroker

API
- Java

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OntoStudio 2.0 Architecture
SemanticMiner Architecture

Application layer
- Intra-ontology search incl. multi-word recognition
- Semantic query expansion
- Document search
- Collocation analysis

Middleware
- ZOPE Web Application Server
  - Visualizations
    - Visualizer
    - Explorer
    - Navigator
- OntoBroker
  - SemanticMiner rules
  - Connectors
    - X-IIP, Verity, MS SharePoint, MS Search, Altavista, Seekport, Google Desktop,
    - Oracle, MS SQL Server, DB2

Data sources
- Databases
- Documents
SemanticMiner Architecture (in development)

Presentation Layer
- SemanticMiner, SemanticGuide Components in JSF, .NET
- (Web-)OntoStudio

WebService
- AJAX

Service Components
- SemanticMiner Components
- SemanticGuide Components
- Ontology Modeling and General Components

J2EE Webcontainer
- Built-Ins
- OntoBroker
- Connectors

Mapping
- Databases

Soft-Mapping Query
- Documents
Agenda

- Ontoprise
- **What are Semantic Web Applications?**
- Examples for Semantic Web Application
  - Semantic Guide @ KUKA Robots
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What is a Semantic Web Application?

According to CfP of the Semantic Web Challenge
http://challenge.semanticweb.org

The meaning of data has to play a central role
- Formal descriptions to represent meaning
- Manipulate/process data to derive useful information
- Semantic information processing achieves things alternative technologies cannot do (as well)

The information sources used should...
- have diverse ownerships (no control of evolution)
- be heterogeneous (syntactically, structurally, and semantically), and
- contain real world data (no toy examples)

Application should assume an open world (information is never complete)
Desiderata for Semantic Web Applications

http://challenge.semanticweb.org formulates additional desiderata:

- **Rigorous evaluations** have taken place
- Application should be **scalable** (amount of data, # of distributed components working together)
- Functionality **goes beyond pure information retrieval**
- The application has clear **commercial potential**
- Contextual information is used for **ratings or rankings**
- There is a **use of dynamic data** (e.g. workflows), perhaps in combination with static information
- Multi-media documents are used in some way
- There is support for **multiple languages**
Not a Requirement

- Use RDF, RDF Schema, or OWL is not a requirement
Agenda

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- What are Semantic Web Applications?
- Examples for Semantic Web Application
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Oil leakage!
Kuka: Knowledge-Based Advisor

Customer
- Kuka is one of the three largest manufacturers of industry robots in the world.

Background & Challenges
- 65% of all customer in the manufacturing industry change their suppliers because they are not satisfied with the service
- Service engineers spend a lot of time with known problems
Process Oriented Knowledge Support

Goals

- capture and re-use knowledge from experienced service engineers
- decision support in problem solving
- automated feedback from customer service to development
- finally: Increase customer satisfaction
Customer Satisfaction and Competitiveness

Value proposition

**Reduced costs:**
- No more trial and error
  - Reduced „Time To Fix“ and
  - Increased „First Time Fix“
  - Reduced „Spare Part Overtake“

**Improved Quality:**
- Guided and quality assured problem solving

**Motivation of Service Engineers:**
- Easier handling compared to paper
- Less paper work

“The project was completed successfully, due to the close collaboration with ontoprise and due to highly reliable and high quality of work from ontoprise”

Alwin Berninger:
Director Customer Support
KUKA Roboter GmbH
Error: oil leakage
(error number, error message or description of problem occurred)
Error: oil leakage

Robot type: KR6/1
Controller: KRC2
Software: KRC 4.0.09

<table>
<thead>
<tr>
<th>Error</th>
<th>Error message</th>
<th>Hit</th>
<th>Use</th>
<th>Ranking</th>
<th>Select</th>
</tr>
</thead>
<tbody>
<tr>
<td>F_M_0006</td>
<td><strong>Oil in the arm housing</strong></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>
Error: F_M_0006 - Oil in the arm housing

Robot type: KR360 L280
Software: KR C 4.0.09
Controller: KR23
Option:

Solutions: 5
Characteristic: greenish dark-colored oil emerges?

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
<th>more Info</th>
<th>attach</th>
<th>Ranking</th>
<th>successful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal grease present</td>
<td>Remove protective grease</td>
<td></td>
<td>Note</td>
<td>1.0</td>
<td>yes ♢</td>
</tr>
<tr>
<td>Locking screw loose</td>
<td>Tighten the screw plug</td>
<td></td>
<td>Feedback</td>
<td></td>
<td>no □</td>
</tr>
<tr>
<td>Liquid through periphery environment</td>
<td>Cleaning it and ensuring tightness</td>
<td></td>
<td>Note</td>
<td>0.5</td>
<td>yes ♢</td>
</tr>
<tr>
<td>Radial shaft seal on the input shaft and/or gear unit input shaft</td>
<td>Exchanging the radial shaft seal and gear unit input shaft</td>
<td></td>
<td>Feedback</td>
<td></td>
<td>no □</td>
</tr>
<tr>
<td>Wrist leaking</td>
<td>Replacing the wrist</td>
<td></td>
<td>Note</td>
<td>0.3</td>
<td>yes ♢</td>
</tr>
</tbody>
</table>
### Error: F_M_0006 - Oil in the arm housing (2)

**Characteristics:**
- **NO** greenish dark-colored oil emerges
- **YES** Leakage at the wrist (visual check under maintenance cover A0)

### Cause

<table>
<thead>
<tr>
<th>Cause</th>
<th>Solution</th>
<th>more Info</th>
<th>attach</th>
<th>Ranking</th>
<th>successful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal grease present</td>
<td>Remove protective grease</td>
<td>Note</td>
<td>10.0</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Locking screw loose</td>
<td>Tighten the screw plug</td>
<td>Note</td>
<td>0.5</td>
<td>yes</td>
<td></td>
</tr>
</tbody>
</table>

**Controller:** KRC2

**Robot type:** KR360 L260  
**Software:** KRC 4.0.09  

**Sort criteria:** Ranking
Error: F_M_0006 - Oil in the arm housing (9) → Note → Feedback

Robot type: KR200 L200
Controller: KRC2
Software: KRC 4.0.09
Option:

Characteristics:
- NO: greenish dark-colored oil emerges
- YES: Leakage at the unit (visual check under maintenance cover A2)

Solution:
- Tighten the screw plug

Description:
1) If necessary, remove motor A3
2) Tighten the screw plug (note special tightening torque).
3) If the plug is leaking, exchange the screw plug, or apply additional sealant with Drei Bond 1118.
4) If a large amount of lubricant has emerged, drain the gear unit of oil and refill it.

Cause:
- Locking screw loose

Component:
- Main axis drive with oil

Robot:
- KR100P - Series 2000
- KR30 - KR60 /1 /2
- KR30 - KR60 /3
- KR350/2
- KR360/1
- KR450PA/1
- KR500/1
- KR570PA/1
- KR60P - KR100P /1 /2

Documents:
- AA 09 02 07 (Screwed connections)

Searchterms:
- Lubrication
- Screwing to motor units
<table>
<thead>
<tr>
<th>Action</th>
<th>Result</th>
<th>Undo</th>
</tr>
</thead>
<tbody>
<tr>
<td>New search started</td>
<td>oil leakage</td>
<td></td>
</tr>
<tr>
<td>Input of searchterm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New search started</td>
<td>KR360 L280</td>
<td></td>
</tr>
<tr>
<td>Selected robot</td>
<td>KR360 L280</td>
<td></td>
</tr>
<tr>
<td>Selected controller</td>
<td>KRC2</td>
<td></td>
</tr>
<tr>
<td>Selected software</td>
<td>KRC 4.0.09</td>
<td></td>
</tr>
<tr>
<td>Input of searchterm</td>
<td>oil leakage</td>
<td></td>
</tr>
<tr>
<td>Error: F_M_0006 - Oil in the arm housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error: F_M_0006 - Oil in the arm housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error: F_M_0006 - Oil in the arm housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New search started</td>
<td>KR360 L280</td>
<td></td>
</tr>
<tr>
<td>Selected robot</td>
<td>KR360 L280</td>
<td></td>
</tr>
<tr>
<td>Selected controller</td>
<td>KRC2</td>
<td></td>
</tr>
<tr>
<td>Selected software</td>
<td>KRC 4.0.09</td>
<td></td>
</tr>
<tr>
<td>Input of searchterm</td>
<td>oil leakage</td>
<td></td>
</tr>
<tr>
<td>Error: F_M_0006 - Oil in the arm housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristic: greenish dark-colored oil emerges?</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Characteristic: Leakage at the wrist (visual check under maintenance cover A3)?</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Solution: Tighten the screw plug</td>
<td>correct</td>
<td></td>
</tr>
</tbody>
</table>
### Fehlermeldungen

<table>
<thead>
<tr>
<th>Fehler (6)</th>
<th>Fehlermeldung</th>
<th>Treffer</th>
<th>Nutzen</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>F_M_004</td>
<td>Leckage an Grundachse A2</td>
<td>76</td>
<td>2.87</td>
<td>○</td>
</tr>
<tr>
<td>F_M_006</td>
<td>Öl im Armreihause</td>
<td>78</td>
<td>1.00</td>
<td>○</td>
</tr>
<tr>
<td>OH_2873</td>
<td>LTO: Initialisierung teilgeschlagen (Grund: %1)</td>
<td>Meldung</td>
<td>0.90</td>
<td>○</td>
</tr>
<tr>
<td>OH_2899</td>
<td>Start blockiert (Steuerung: %1, Grund: %2)</td>
<td>Meldung</td>
<td>0.90</td>
<td>○</td>
</tr>
<tr>
<td>F_M_007</td>
<td>Druckverlust Hydropneumatischer GWA</td>
<td>Meldung</td>
<td>0.87</td>
<td>○</td>
</tr>
<tr>
<td>F_M_008</td>
<td>Druckverlust Gas-GWA</td>
<td>Meldung</td>
<td>0.87</td>
<td>○</td>
</tr>
</tbody>
</table>
Feedback Questions to Refine Results

<table>
<thead>
<tr>
<th>Fehler:</th>
<th>F_M_006 - Öl im Armgehäuse (79)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lösungen:</td>
<td>8</td>
</tr>
<tr>
<td>Frage:</td>
<td>Merkmal: grünlich-dunkles Öl tritt aus?</td>
</tr>
<tr>
<td>Sortierung:</td>
<td>Zeit, Kosten, Nutzen, Ranking</td>
</tr>
</tbody>
</table>

- Lösung: Montagefett entfernen
  Ursache: Montagefett vorhanden
  -- Details: Zeit: 1, Kosten: 1, Nutzen: 1%, Ranking: 1.0
- Lösung: Säubern und Dichtigkeit herstellen
  Ursache: Flüssigkeit durch Peripherie-Umgebung
  -- Details: Zeit: 2, Kosten: 1, Nutzen: 0%, Ranking: 0.5
- Lösung: Verschlusschraube anziehen
  Ursache: Verschlusschraube lose
  -- Details: Zeit: 2, Kosten: 1, Nutzen: 0%, Ranking: 0.5
- Lösung: Teijin-Leckage Eingangswelle (Leckmaß)
  Ursache: Fehlerhafte Schweißnaht an Getriebe-Eingangswelle
  -- Details: Zeit: 2, Kosten: 1, Nutzen: 0%, Ranking: 0.5
Ranking with Different Dimensions

- Robototyp: KR30/1
- Steuerung: KRC3
- Software: KRC 1.1.10b
- Applikation: Präsen-
- Suche

- Merkmale: NICHT "grünlich dunkles Öl mit aus"

- Fehler: F_M_006: Öl im Armgehäuse (79)
- Lösungen: 2
- Frage: Merkmal: Leckage an der Hand (Sichtkontrolle Wartungsdeckel A2)?
- Sortierung: Zeit, Kosten, Nutzen, Ranking

-- Details --

- Lösung: Montagefett entfernen
- Ursache: Montagefett vorhanden

- Lösung: Säubern und Dichtheit herstellen
- Ursache: Flüssigkeit durch Peripherie-Umgebung

-- Details --

- Feedback - Neue Lösung

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Details for Actual Solution

KUKA Xpert - Suche / Anzeige - Erweiterte Suche
eingeloggt als

- Robotertyp: KR30/1
- Steuerung: KRC3
- Software: KRC 11.10b
- Applikation: Präsen
- Suchkriterien: gründliche Recherche
- Merkmale: NICHT "grünlack-dunkles Öl tritt aus"

- Fehler:
  - Lösungen:
    - 2
  - Frage:
    Merkmal: Lackage an der Hand (Sichtkontrolle Wartungsdeckel A3)?
    - ja
    - nein
  - Sortierung:

- Lösung: Montagefehler entfernen
  - Ursache: Montagefehler vorhanden
  - Details: Montagefehler
  - Beschreibung:

- Feedback - Neue Lösung

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User Feedback: New Solution

- Vorschlag für neue Lösung anlegen
  - Fehlernummer: F_M_006
  - Fehlermeldung: Öl im Armehaus
  - Lösung:
  - Ursache:
  - Beschreibung:
  - Kommentar:

- Autor: hansi
- Roboter: KF30/1
- Steuerung: KRC2
- Software: KRC 1.1.10b

Abmelden
# Embedded History in SAP CS & MAM

## KUKA Xpert - Suche - Historie

<table>
<thead>
<tr>
<th>Datum / Uhrzeit</th>
<th>ID</th>
<th>Aktion</th>
<th>Ergebnis</th>
<th>Rücksprung</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.02.2005 12:16:05</td>
<td>Suche</td>
<td>Suche gestartet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.02.2005 12:16:05</td>
<td>Suche</td>
<td>Roboter ausgewählt</td>
<td>KR30/1</td>
<td></td>
</tr>
<tr>
<td>15.02.2005 12:16:05</td>
<td>Suche</td>
<td>Steuerung ausgewählt</td>
<td>KR63</td>
<td></td>
</tr>
<tr>
<td>15.02.2005 12:16:05</td>
<td>Suche</td>
<td>Anwendung ausgewählt</td>
<td>Firma</td>
<td></td>
</tr>
<tr>
<td>15.02.2005 12:16:05</td>
<td>Suche</td>
<td>Software ausgewählt</td>
<td>KRC 4.1.04</td>
<td></td>
</tr>
<tr>
<td>15.02.2005 12:16:05</td>
<td>Suche</td>
<td>Suchbegriff eingereicht</td>
<td>achse leckt</td>
<td></td>
</tr>
<tr>
<td>15.02.2005 12:20:05</td>
<td>Fehler (&quot;50&quot;)</td>
<td>Fehler: E_M_006 - Öl im</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

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Architecture of KUKA Xpert

Server

Maintenance
Advisory
Web Server
Onto Broker
Onto Broker

Search engine
CRDB
SAP CS DB

SAP CS UI
SAP Business Module

Notebook (mobil)

SAP MAM GUI
SAP Mobile Infrastructure
Onto Broker
Web Server

SAP MAM DB
Search engine

SemanticGuide
semantics?
Architecture

1. Concept Model

- Development
- Commissioning
- Service

SAP CS
CRDB
RedSys
FileStore
Representing Domain Knowledge with OntoStudio
Architecture

Development
Commissioning
Service

1. Concept Model

2. Import Schema Information

SAP CS
CRDB
RedSys
FileStore
Importing from a Database

Schema - Eclipse SDK

Import Database Schema

Import
Name: NewOntologyProject
Namespace: http://www.robot.org

Attributes
Project: NewOntologyProject
Database: oracle
Database name: crdb_failures
Host: localhost
Port: 1521
User name: sa
Password: supersecret
Module: ...
Namespace: http://www.robot.org

Relations
Properties: Mapping View
Result View
Result

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Architecture

1. Concept Model

2. Import Schema Information

3. Mapping Rules

- SAP CS
- CRDB
- RedSys
- FileStore
Architecture

Development
Commissioning
Service

1. Concept Model
4. Rules

3. Mapping Rules
2. Import Schema Information

SAP CS
CRDB
RedSys
FileStore
Rules!
The Living Inference Engine

- Axis 48 is part of Robot 0714
- Robot 0714 has Engine 12 as a part
- Is Robot 0714 damaged?
  - Axis 48 is damaged
  - Robot 33 has Engine 12 as a part
Rules!

Edit rule: "http://www.robot.org"#failure_transition

Diagram: Part has failure → Failure

Options:
- Palette
- Namespaces on
- Modules on
- Variables on
- Zoom In
- Zoom Out
- Select
- Selection Box
- Connection
- New Component

Diagrams:
- Diagram
- Stylized English
- F-Logic Paraphrase

Buttons:
- OK
- Cancel
semantics!
Criteria for Semantic Web Application fulfilled?

- The **meaning of data** has to play a central role ✅
  - Formal descriptions to represent meaning ✅
  - Manipulate/process data to derive useful information ✅
  - Semantic information processing achieves things alternative technologies cannot do (as well) ✅

- The **information sources** used should...
  - have diverse ownerships (no control of evolution)
  - be heterogeneous (syntactically, structurally, and semantically)
  - contain real world data (no toy examples) ✅

- Application should assume an open world (information is never complete)
Desiderata for Semantic Web Applications Fulfilled?

- Rigorous evaluations have taken place  
- Application should be scalable (amount of data, # of distributed components working together)  
- Functionality goes beyond pure information retrieval  
- The application has clear commercial potential  
- Contextual information is used for ratings or rankings  
- Use of dynamic data (e.g. workflows), perhaps in combination with static information  
- Multi-media documents are used in some way  
- There is support for multiple languages
Agenda

- Ontoprise
- What are Semantic Web Applications?
- Examples for Semantic Web Application
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  - Configuration of Test Cars @ AUDI
  - Fish Stock Depletion Assessment System @ FAO of the UN
The Context

- **Our client – Audi**
  - One of the top German car manufacturers
  - TestLab that tests cars and components, esp. *Electronic Control Units (ECU)*

Some slides are extracted from:
Motivation

- Today’s challenges in automotive development:
  - Increasing functional complexity
  - Growing product diversification
  - Sharpening quality demands
  - Shortening development lifecycles
  - Tightening regulatory requirements
- Lots of innovations in electronics and software
- Demand for efficient and automated testing methods for *Electronic Control Units (ECU)*
The Application Domain

- Hardware-in-the-Loop (HiL) tests
  - Test of physical ECU in virtual car environment
  - Validation of specification and user requirements
  - Huge amount of data recorded during tests
  - Analysis of test results mostly manually
Analyis the Test Results

- Problems while analyzing test results:
  - Complex functionality and dependencies
  - Distributed knowledge (tacit, within experts, documents)
  - Large volumes of data
  - Hardly any tool support
Challenge: Distributed Knowledge

To trigger an actuator must not take longer than 2 ms.

No more than one actuator per cylinder must be triggered at the same time.

Documentation:
Requirements documents, Feature descriptions (Word, Excel, PDF)
Approach Using Ontologies and Rules

Domain experts – knowledge about ECU

Specification – formal model of ECU

Extraction

Interviews

Ontology-based model of ECU

- Provide uniform domain vocabulary using ontologies
- Formulate the rule-like functionality of controllers using natural language (German)
- Translate to formal rule language (F-Logic)
- Use actual data from HiL experiments as fact of ontology
- Analyze facts with inference support (OntoBroker), comparing to pre-defined expected results
Use Case for Prototype

- Audi Valvelift System (AVS)
- 2 different Cam Contours for small and large Valve Lift
- Increases Engine Efficiency (more Power, lower Fuel Consumption)
- Controlled by Engine Management System
  - Deterministic Finite Automaton
  - $S_1, S_4$ - small, large Valve Lift
  - Transition Functions $\delta_n$
Domain Ontology

- Observable Variables during HiL Tests
- Snapshots at different Times

<table>
<thead>
<tr>
<th>time (ms)</th>
<th>var₁</th>
<th>var₂</th>
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- Ontology Reflects Data Structure recorded during HiL Tests
- Introduces Terms as known to Experts (e.g., engineSpeed)

```
Situation
index::Integer
nextIndex::Integer
state::State
desireEngineSpeed::Integer
tempOil::Number
...

State
successorState::State
internalValue::Integer
```
- ECU Specification: „If the engine speed is greater than 4000, the valve lift system must switch to S4 if it is in S1.”

- Calculation of expected next State:

\[
\text{FORALL } S, V \ S[nextState->S4] <- S:\text{Situation}[state->S1; \text{engineSpeed}->V] \text{ AND greater}(V, 4000).
\]

- Define Error Situations:

\[
\text{FORALL } S, SS, X \ \text{Error}(S) <- S:\text{Situation}[nextState->X; \text{successor}->SS] \text{ and not } SS[state->X].
\]

- Experts: „At idle speed the small valve lift must be used.“

- Define Error Situations:

\[
\text{FORALL } S \ \text{ERROR}(S) <- S:\text{Situation}[\text{zustand}->S4; \text{IDLE}->1].
\]
Structuring rules

Falls die Motoranzeige größer als der Schwellwert für die Anzeige ist, muss der Motor nach STATE_4 wechseln, bzw. in STATE_4 bleiben.

Dokumentation

Letzte Änderung: 2007-01-24

Zugewiesene Regeln: Constraint_1A, Constraint_1B, Explain_Constraint_1A, Explain_Constraint_1B

Regelcode:
1. \text{FORALL} X, Y, V1, C \ \text{ERROR}(Y) \leftarrow
2. X: \text{Situation}[\text{state} \rightarrow \text{STATE}_1] \ \text{and}
3. X: \text{Situation}[\text{nextSituation} \rightarrow Y; \text{state} \rightarrow \text{STATE}_1]; \text{EngineSpeed} -
4. \text{ENGINE\_SPEED\_THRESHOLD}(C) \ \text{and}
5. \text{greater}(V1, C).

Dokumentation

Erklärung: 

Inaktiv

Materialisieren
Simulation and Data Generation
# Data Analysis

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## Status Information

Starte Simulation...

Analyisiert Messdaten

[Abbrechen] [Details >>]

## Erklärung

Zusammenfassung

Gesamtscore

Keine Fehler gefunden...
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**Explanation of Errors**

### Explanation of Constraint Violation

In situation S2, the state is still STATE_4. The last situation was STATE_4, and the speed was greater than the motor speed limit (5000.0 > 4000.0). Therefore, a state transition should have been performed.

### Summary

- **Situation:** S2
- **State:** STATE_4
- **Previous State:** STATE_4
- **Speed:** 5000.0
- **Motor Speed Limit:** 4000.0
- **Action:** Transition to STATE_1

---

**Anzahl der aufgetretenen Fehler:** 1
Advantages of this Approach

- Rules can be easily extracted from the specification documents
- Rule set can be gradually enhanced in iterative cycles
- Rule knowledge is not hidden in program code
- Rules are accompanied with explanations
- Additional knowledge can be integrated (e.g. based on additional requirements)
- Differences between computed and expected results (that are modeled with the ontology) can be detected and explanations generated
  - Executable/verifyable specification
Criteria for Semantic Web Application fulfilled?

- The **meaning of data** has to play a central role ✓
  - Formal descriptions to represent meaning ✓
  - Manipulate/process data to derive useful information ✓
  - Semantic information processing achieves things alternative technologies cannot do (as well) ✓

- The **information sources** used should...
  - have **diverse** ownerships (no control of evolution)
  - be **heterogeneous** (syntactically, structurally, and semantically)
  - contain **real world data** (no toy examples) ✓

- Application should assume an **open world** (information is never complete)
Desiderata for Semantic Web Applications Fulfilled?

- Rigorous evaluations have taken place ✓
- Application should be scalable (amount of data, # of distributed components working together)
- Functionality goes beyond pure information retrieval ✓
- The application has clear commercial potential ✓
- Contextual information is used for ratings or rankings
- Use of dynamic data (e.g. workflows), perhaps in combination with static information ✓
- Multi-media documents are used in some way
- There is support for multiple languages
Agenda

- Ontoprise
- What are Semantic Web Applications?
- Examples for Semantic Web Application
  - Semantic Guide @ KUKA Robots
  - Configuration of Test Cars @ AUDI
  - Fish Stock Depletion Assessment System  @ FAO of the UN
FSDAS...

- Fish Stock Depletion Assessment System
  - Decision support system for fisheries managers for discovering and assessing resources related to stock depletion.

- FAO
    - Knowledge and Communication Department
    - Fisheries Department
  - Leads one use case in the NeOn project

Parts of this presentation are based on:
OBI 2007, Dartmouth, Canada
Fish Stock Depletion Assessment System

- FSDAS will be the result of the current process at FAO of export and alignment between classification systems:
  - Species: ISSCAAP, FAO taxonomic
  - Vessel types: ISSCFV
  - Gear types: ISSCFG
  - Thesauri: AgroVoc, ASFA
  - Areas: FAO statistical area
  - Commodities: ISSCFC, EU Harmonized, ISTC
  - Land areas: ISO, UN
  - Fact sheet schemas: FIGIS
Classification Systems “Ontologized”

- species
- water areas
- territories
- gears
- commodities
- vessels
- AgroVoc

www.ontoprise.de © 2007 ontoprise GmbH
Domain ontologies cross-mapped to create compound ontologies

- fish lives in water area
- fish is fished with gear
- gear is on vessel
- commodity originates from fish
- commodity
- vessels
- water areas
- territories
- water area is governed by territory
- species
- gears
- AgroVoc
- fish has synonyms and names in other languages
Information systems will be mapped to ontologies.

- **AgroVoc**
- **synonym expansion**
- **fish stocks**
- **commodities**
- **species**
- **water areas**
- **document repositories**
- **time-series statistics**
- **geo-spatial data**
Ontologies and FAO...

- Part of an institutional trend.
  - The NeOn work of the fisheries department fits into an FAO movement to centralize and standardize classifications and thesauri.
  - FAO already hosts a set of downloadable ontologies.

- FAO corporate initiatives for 2008:
  - Deployment of an ontology registry.
  - Deployment of the ontological version of the multi-lingual AgroVoc thesaurus
  - Extension of AgroVoc web services to the ontological version of AgroVoc.

- Fisheries department initiatives for 2008:
  - Continue development of fisheries ontologies.
  - Deploy first version of FSDAS.
FSDAS-Architecture

- FSDAS requirements:
  - networked ontologies
  - live access to fishery DBs
    - status of fish stock
    - factors affecting fish depletion
  - used within web applications
- Ontology lifecycle requirements:
  - life-size distributed ontologies
  - multilingual
  - model, populate, maintain currency, map
  - ontology experts, subject experts, developers
Ontology Lifecycle

- Building
  - from existing thesauri, classification schemes, glossaries, etc
- Editing
  - multiple ontology editing
  - workflow
  - annotations
- Population from existing RDBMS
  - Biological species: 44,100
  - Water bodies: 1,500
  - Land areas: 25,000
  - ASFA thesaurus: 22,000
  - AGROVOC thesaurus: 300,000
  - Commodities: 6,000
Demonstration
Scientific classification

From Wikipedia, the free encyclopedia

For other uses, see Scientific classification (disambiguation).

Scientific classification or biological classification is a method by which biologists group and categorize species of organisms. Scientific classification can also be called scientific taxonomy, but should be distinguished from folk taxonomy, which lacks scientific basis. Modern classification has its root in the work of Carolus Linnaeus, who grouped species according to shared physical characteristics. These groupings have since been revised to improve consistency with the Darwinian principle of common descent. Molecular systematics, which uses DNA sequences as data, has driven many recent revisions and is likely to continue to do so. Scientific classification belongs to the science of taxonomy or biological systematics.
What have we seen?

- Create new basic ontology including rules
- Import of RDBMS-schema and translate into ontology
- Query Knowledge Base
- Import application ontology
- Map between DB ontology and application ontology
- Model rule (for complex mapping)

Plug-ins

- Ontology Navigator
- Ontology Import
- Graphical Rule Editor
- DB-Schema Import
- OntoMap
- Query Tool
Criteria for Semantic Web Application fulfilled?

- The **meaning of data** has to play a central role ✓
  - Formal descriptions to represent meaning ✓
  - Manipulate/process data to derive useful information ✓
  - Semantic information processing achieves things alternative technologies cannot do (as well) ✓

- The **information sources** used should...
  - have diverse ownerships (no control of evolution) ✓
  - be heterogeneous (syntactically, structurally, and semantically) ✓
  - contain real world data (no toy examples) ✓

- Application should assume an open world (information is never complete) ✓
Desiderata for Semantic Web Applications Fulfilled?

- Rigorous evaluations have taken place
- Application should be scalable (amount of data, # of distributed components working together)
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