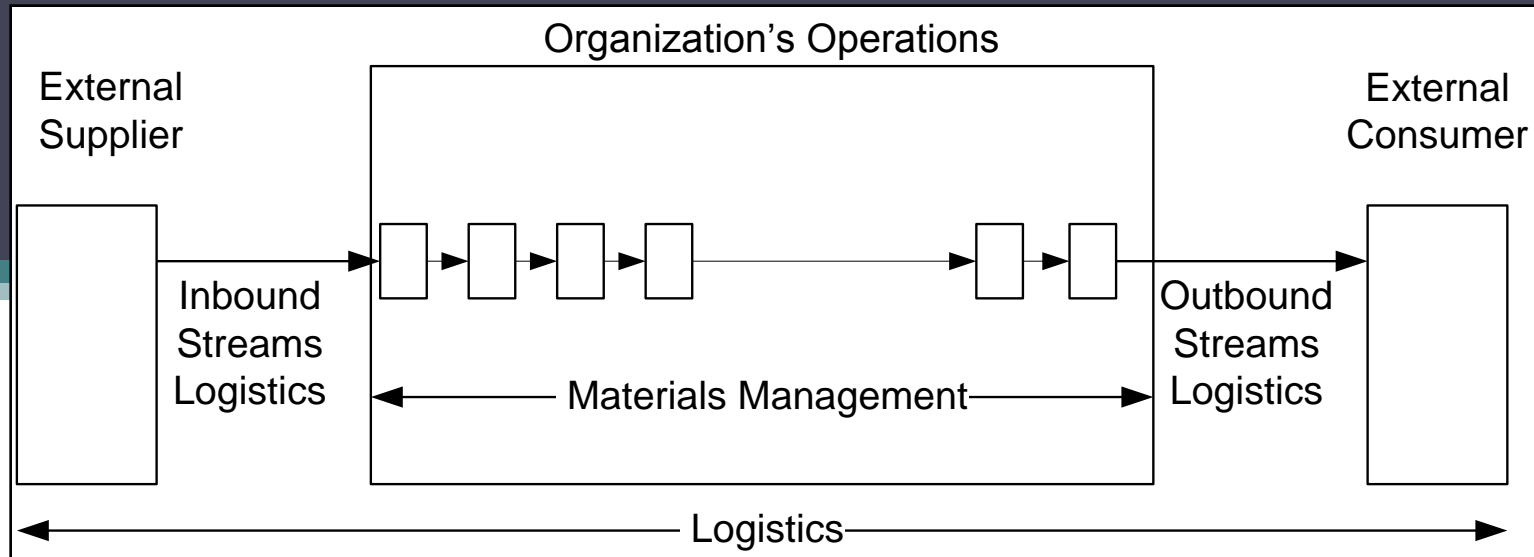


Semantic Technologies for Complex Logistic Applications



Agenda

1. Our Research Focus and Experience in Semantic Technologies
2. Commonalities and Specifics of Logistics
3. Relevant Standards and Ontologies
4. Details of CRISP and DEMO
5. Fusion of DEMO, ISO 15926 and BORO
6. Relevant Software Technologies

Semantic Interoperability Challenge

Organizational Interoperability

(model and coordinate business processes, consistency with internal goals, make services accessible and user-friendly)

Semantic Interoperability

(secure precise meaning and equal understanding of the exchanged data from both parties)

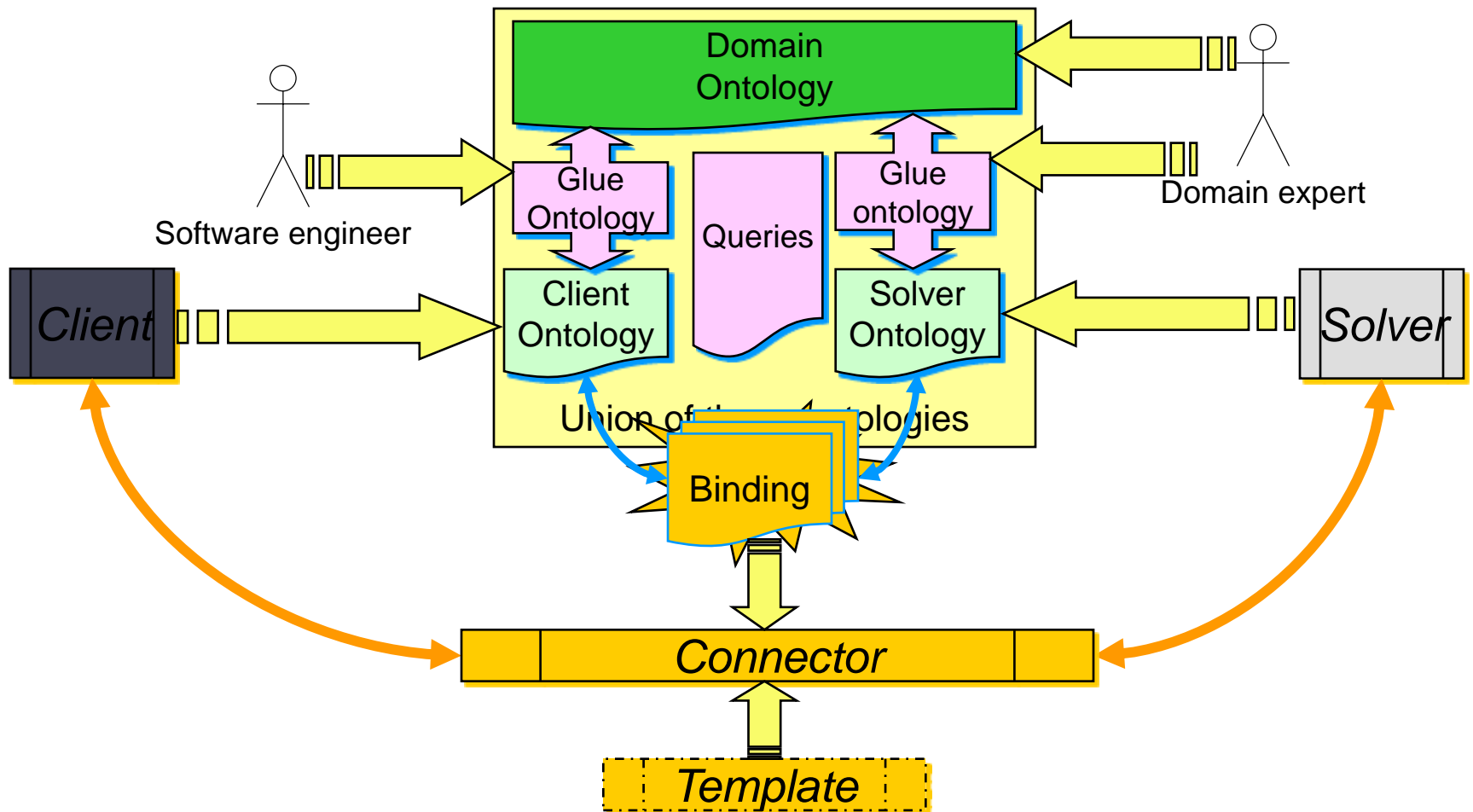
Technical Interoperability

(technical solutions for linking systems – the area of WebServices and SOA)

Ontologies

- *Philo*: « La Nature de la Connaissance »
- *Info*: A specification of a shared conceptualisation
- *Usage*: to construct an Ontology means: to model a domain, its relations, structures and properties ; to give a sens to termes... using standard languages which allow “machine-readability”

Semi-automated software integration using logical specifications (2000-2004)



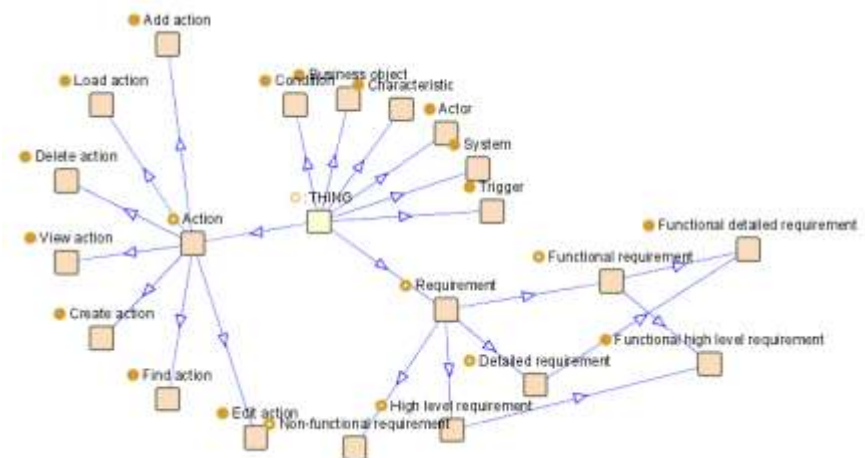
Ontology-based Methodology for Requirements Formalization (2007-2010)

RESEARCH GOAL

- Improve fit-gap analysis and provide automated configuration management for complex industrial information systems (SAP)
- Build an ontology based knowledge management system that will allow to
 - formalize company's requirements,
 - describe and abstract functionality of ERP system,
- Key challenge is to determine the ontology based approach to represent company's business requirements

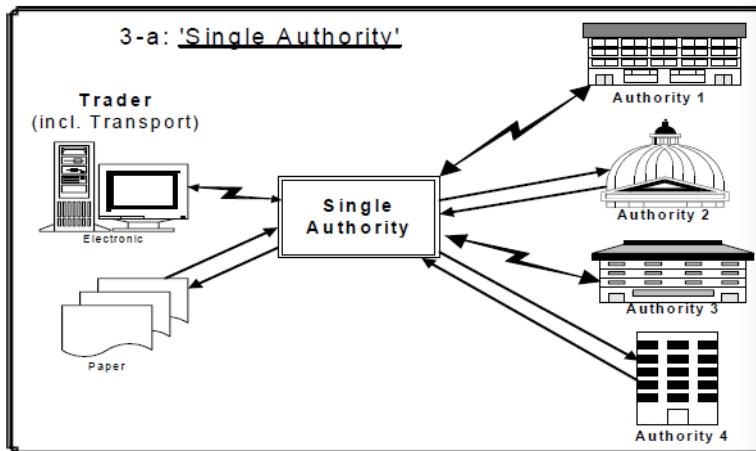
OUTCOME - CONF. MAN. FOR SAP CRM

- To prove the concept, we built an ontology for SAP CRM system using:
 - Protégé Editor
 - OWL Language
 - Jess Rule Engine
- Created ontology can be logically divided into following sub items:
 - Ontology of Requirements
 - Ontology of Master Data objects
 - Ontology of Configuration Objects



Logistics - Commonality

ECONOMIC COMMISSION FOR EUROPE
United Nations Centre for Trade Facilitation
and Electronic Business (UN/CEFACT)



**Recommendation and Guidelines
on establishing
a Single Window**

*to enhance the efficient exchange of information
between trade and government*

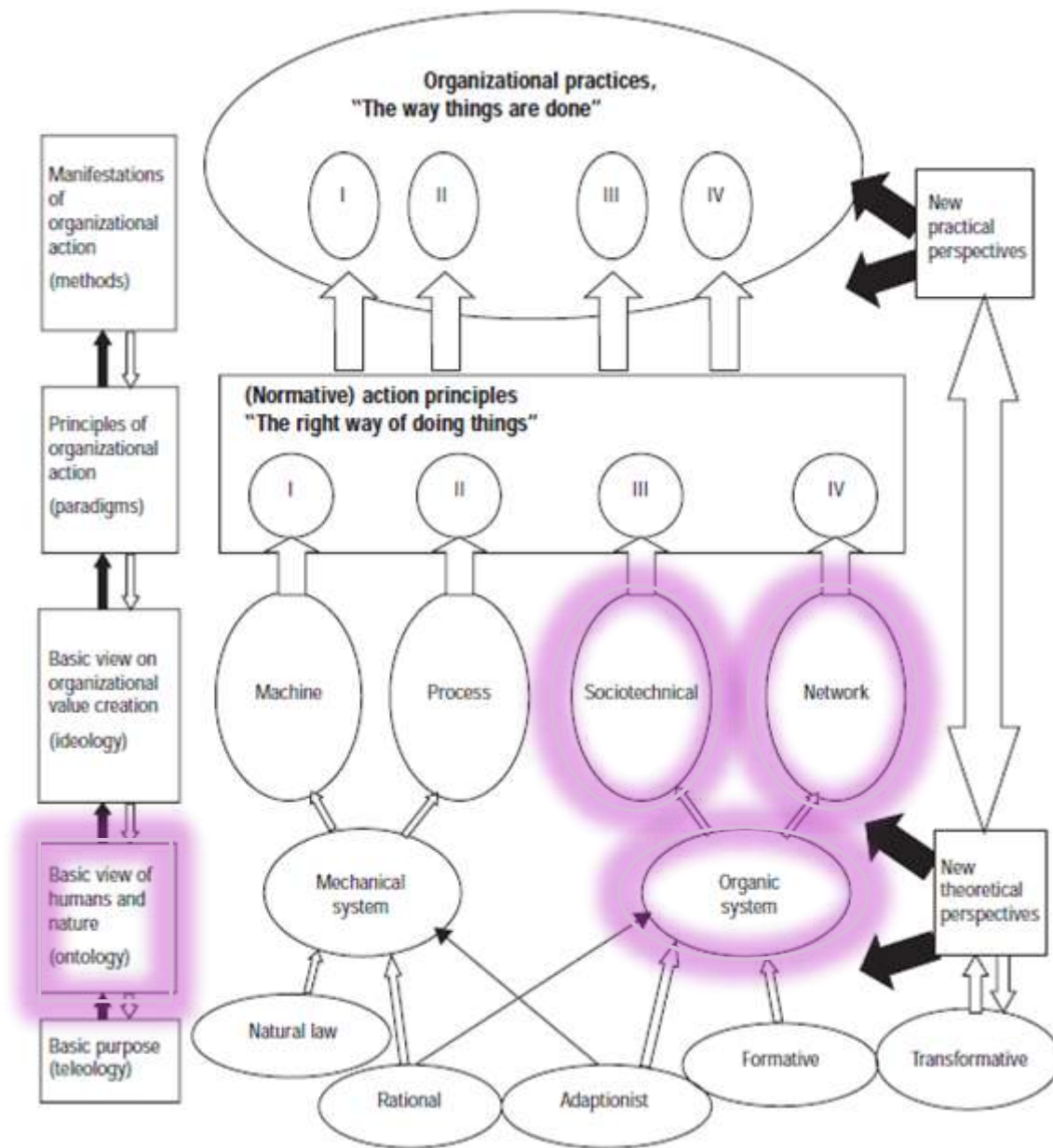
Recommendation No. 33

Logistics - Specifics

- Multiple Stakeholders
- Complex Life Cycle



- Human-centered modeling and system design



Software Engineering

System Engineering

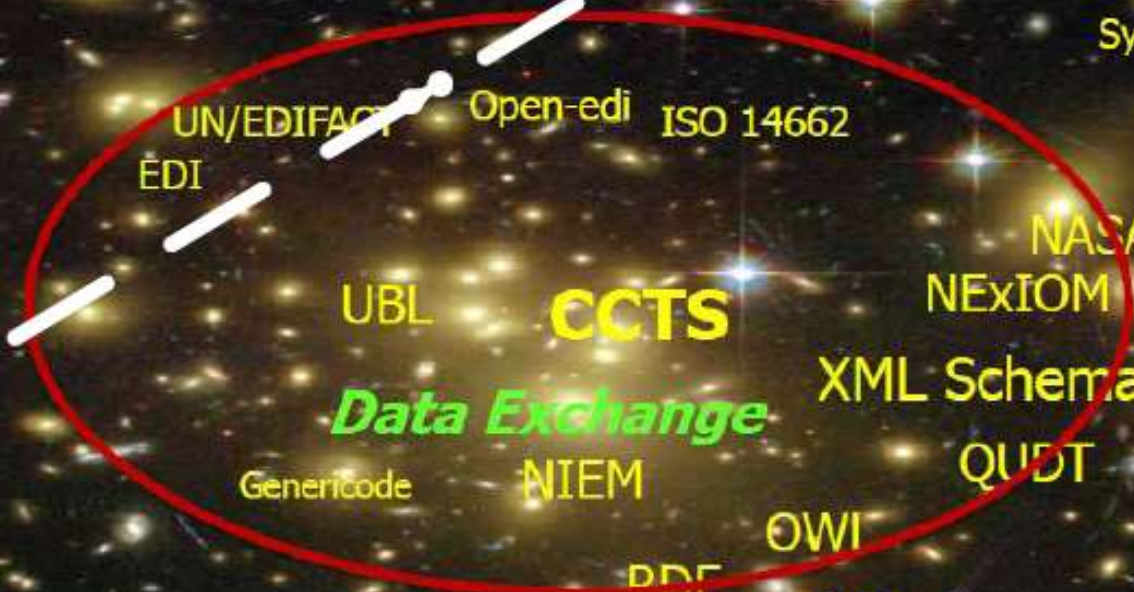
Deep Space- STScI-PRC2003-01a
UML

ISO 15926
STEP s1000d PLCS PDM
ISO 12006-3 AP-233 FIATECH PLM
SysML eOTD

eBXML

UN/EDIFACT Open-edi ISO 14662
EDI

SysMO



NASA CXDA

NEXIOM

UBL CCTS

XML SchemaPlus

Data Exchange

QUDT

Genericcode

NIEM

OWI

PDF

XSD

DEMO

XML

XSLT

XMDR

MoDAF

FEA

W3C and Semantic
Web Standards

ISO 11179

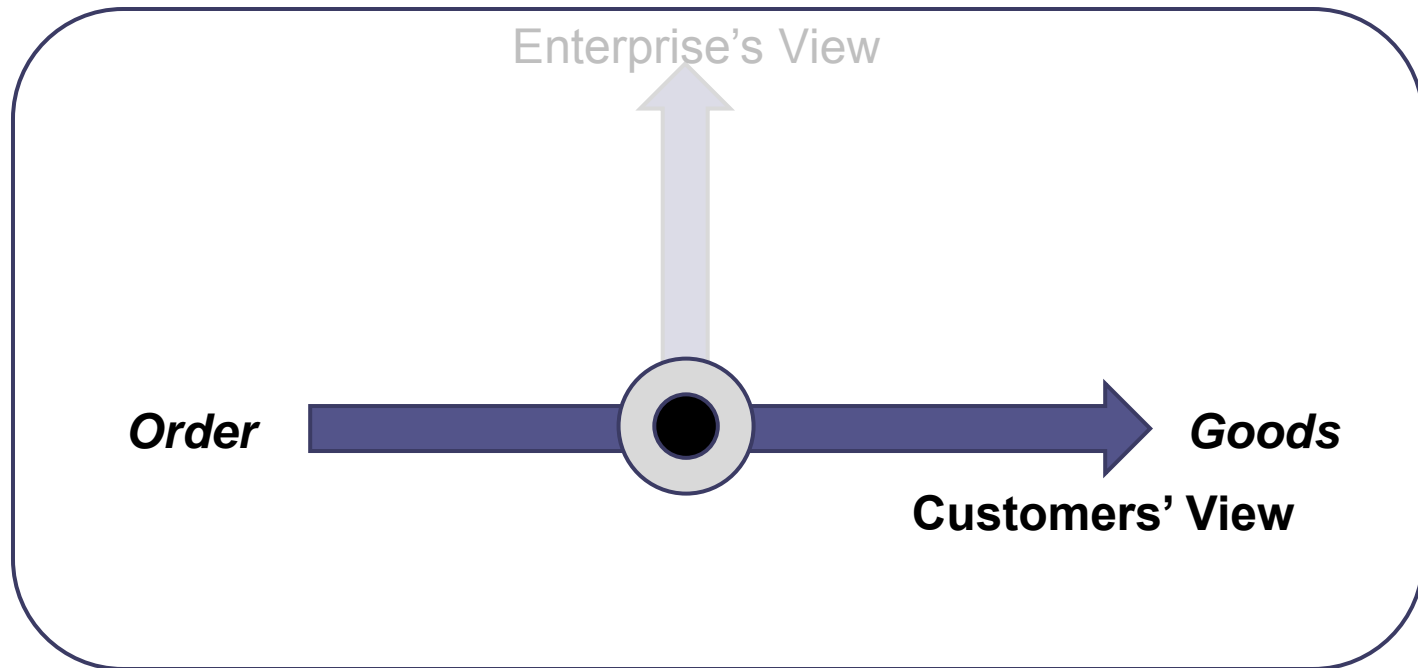
DoDAF

TOGAF

Enterprise Architecture

Metadata Standards

Relevant Standards



- Supply Chain Operations Reference Model (SCOR)
- ISO 15926

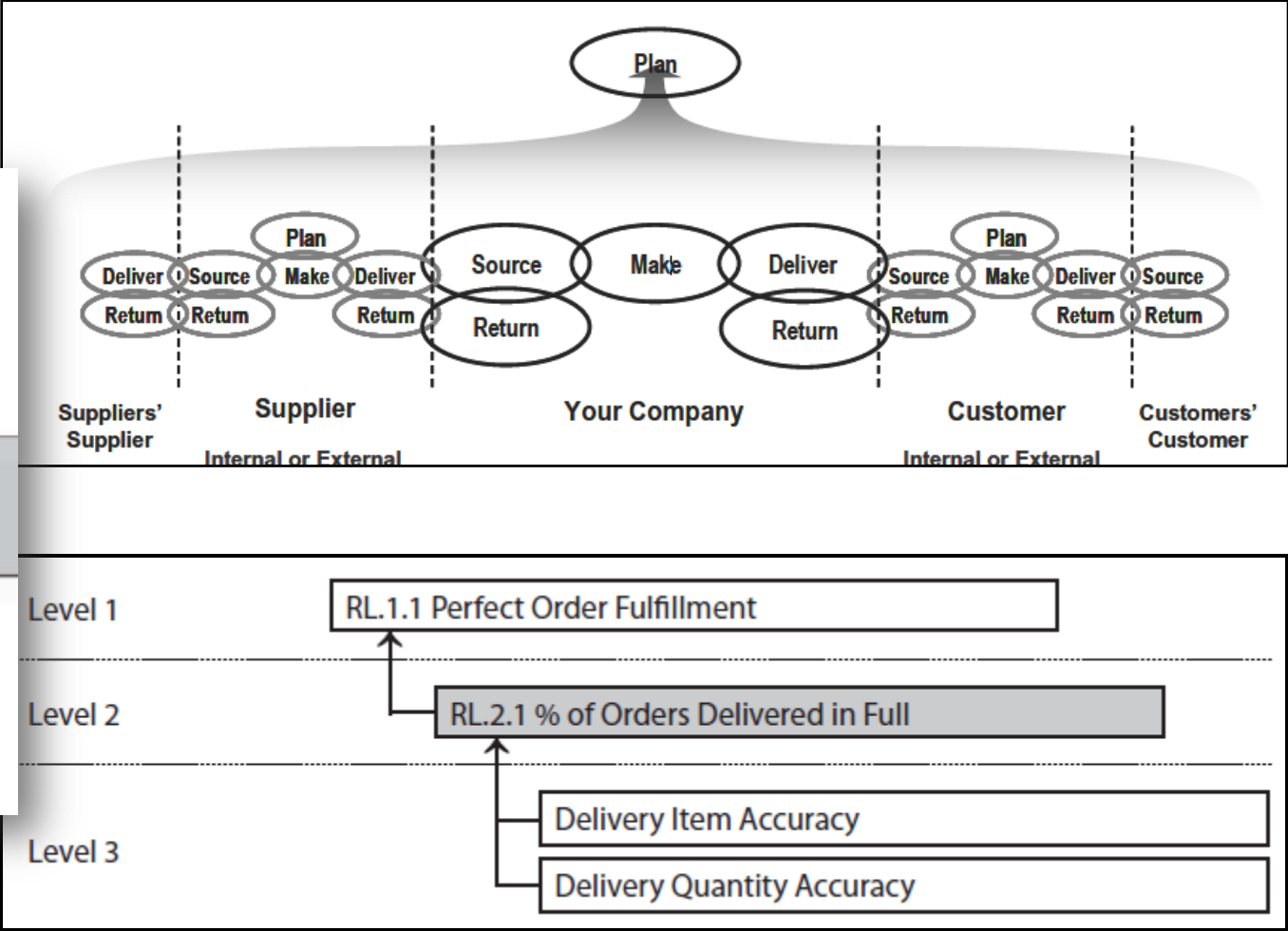
Reference Processes

SCOR®

Supply Chain Operations Reference Model

Version 9.0

Metrics

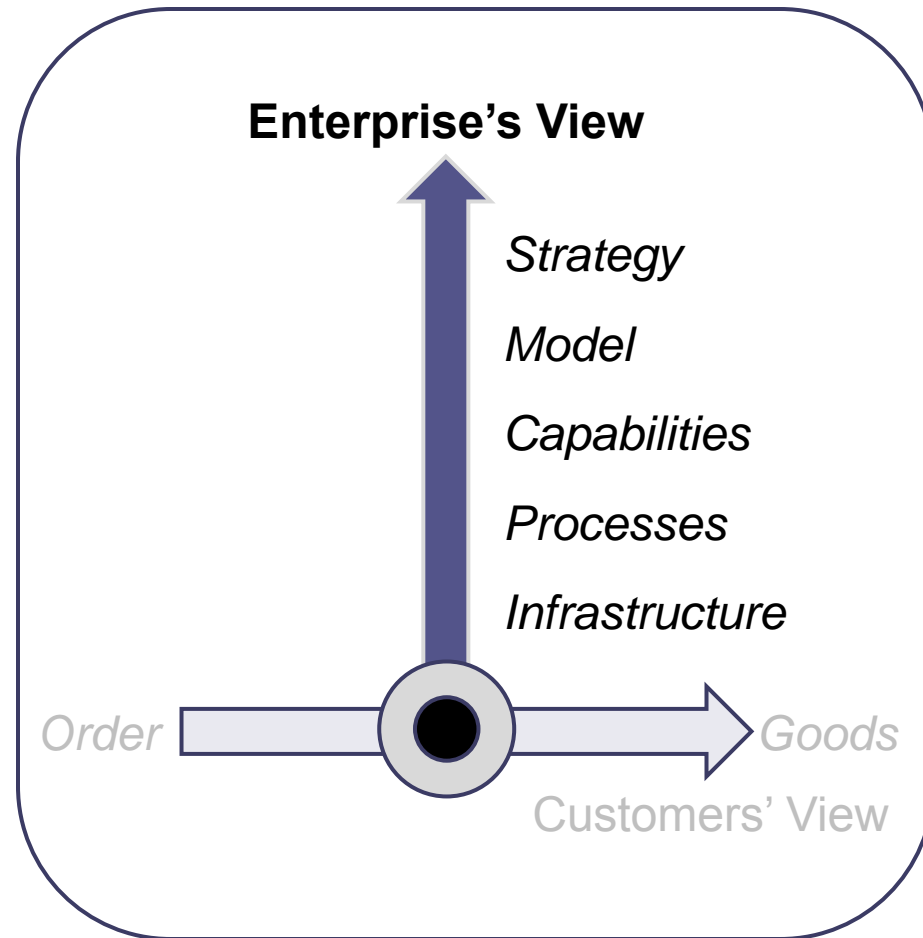


15926 Reference Library

- Level 1: Upper level ontology
 - Physical object
 - Activity
 - Inheritance
- Level 2: Core Classes of inter-org common sense
 - Person
 - Payment
- Level 3: Inter-org Standards
- Level 4: Real Data

Ontologies

- Relevant sources:
 - J. Gordjin
E3-value Ontology
(Business Strategy)
 - A. Osterwalder and Y. Pigneur
(Business Model Ontology)
 - J. Dietz
Enterprise Ontology and
DEMO
(Design and Engineering
Methodology for
Organizations)

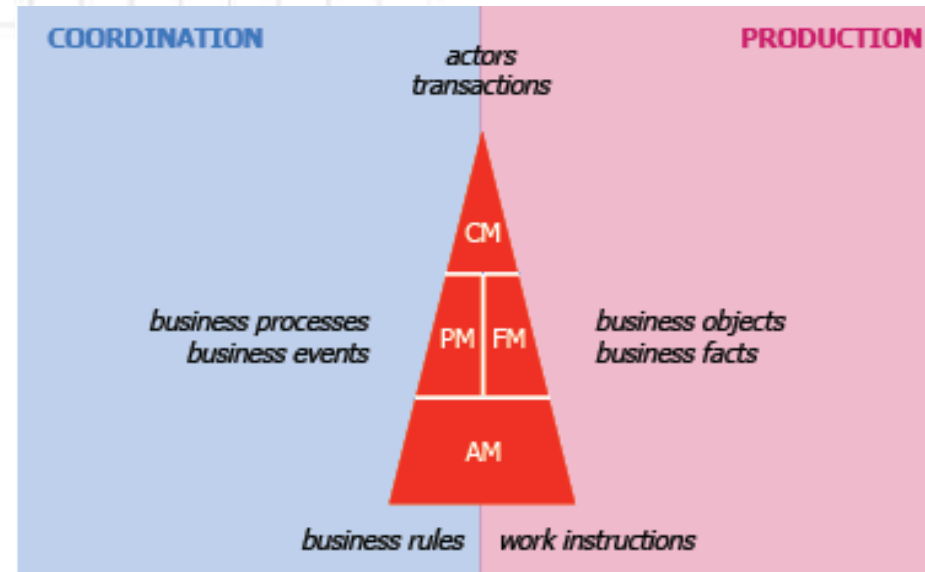




DEMO[®]

Design & Engineering
Methodology for Organizations

- Author - Professor Jan Dietz (TU Delft, the Netherlands)
- Separation of Concerns
- LAP Perspective:
“Communication is the thread of which Organisation is woven” (TCA, J. Habermas)
- Conceptual model expressed by PSI (Ψ) theory (Performance in Social Interaction) along with CRISP metamodel of organizations

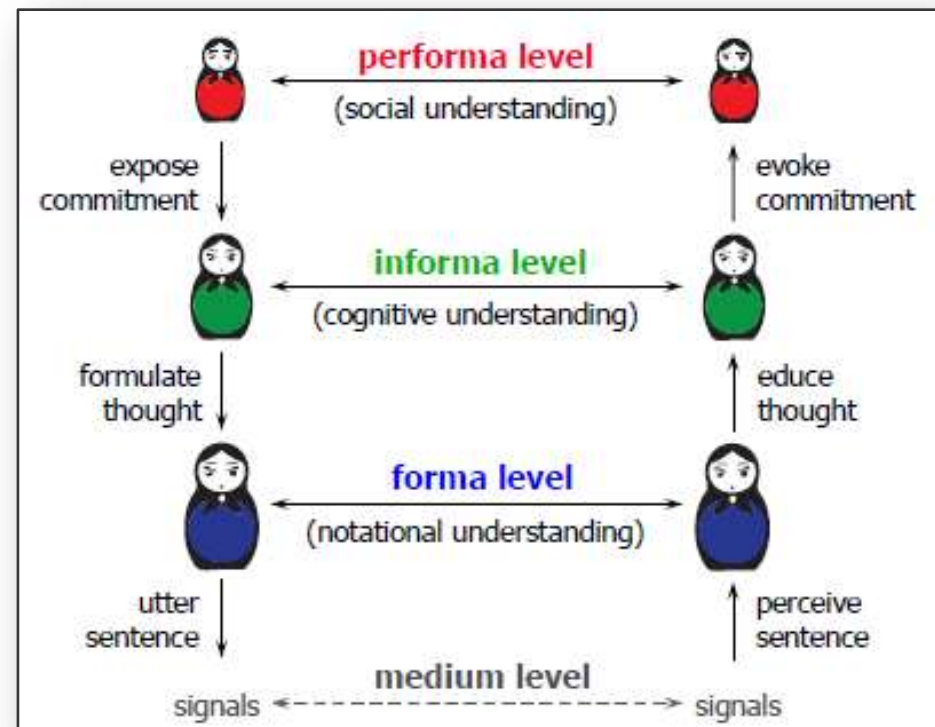




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DEMO[®]

Design & Engineering
Methodology for Organizations

*creating
deciding
judging*

*remembering
recalling
computing*

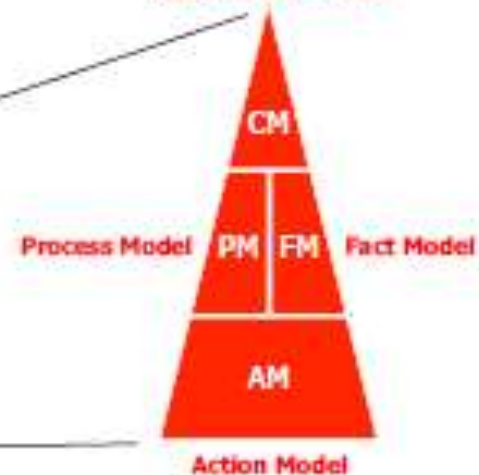
*storing
retrieving
transmitting*

B-organisation

I-organisation

D-organisation

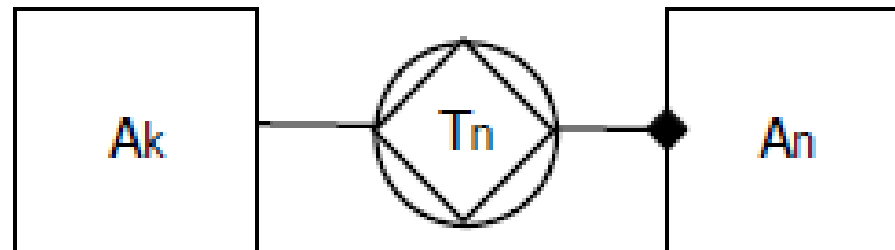
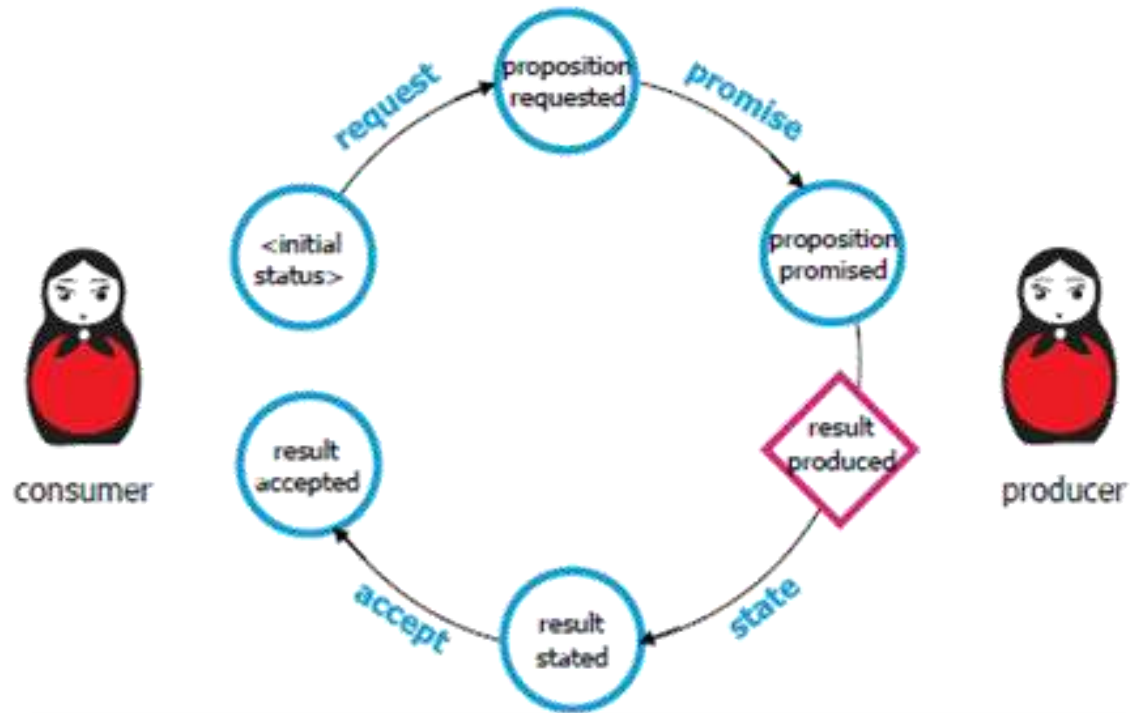
Construction Model



Enterprise Ontology of Organisation

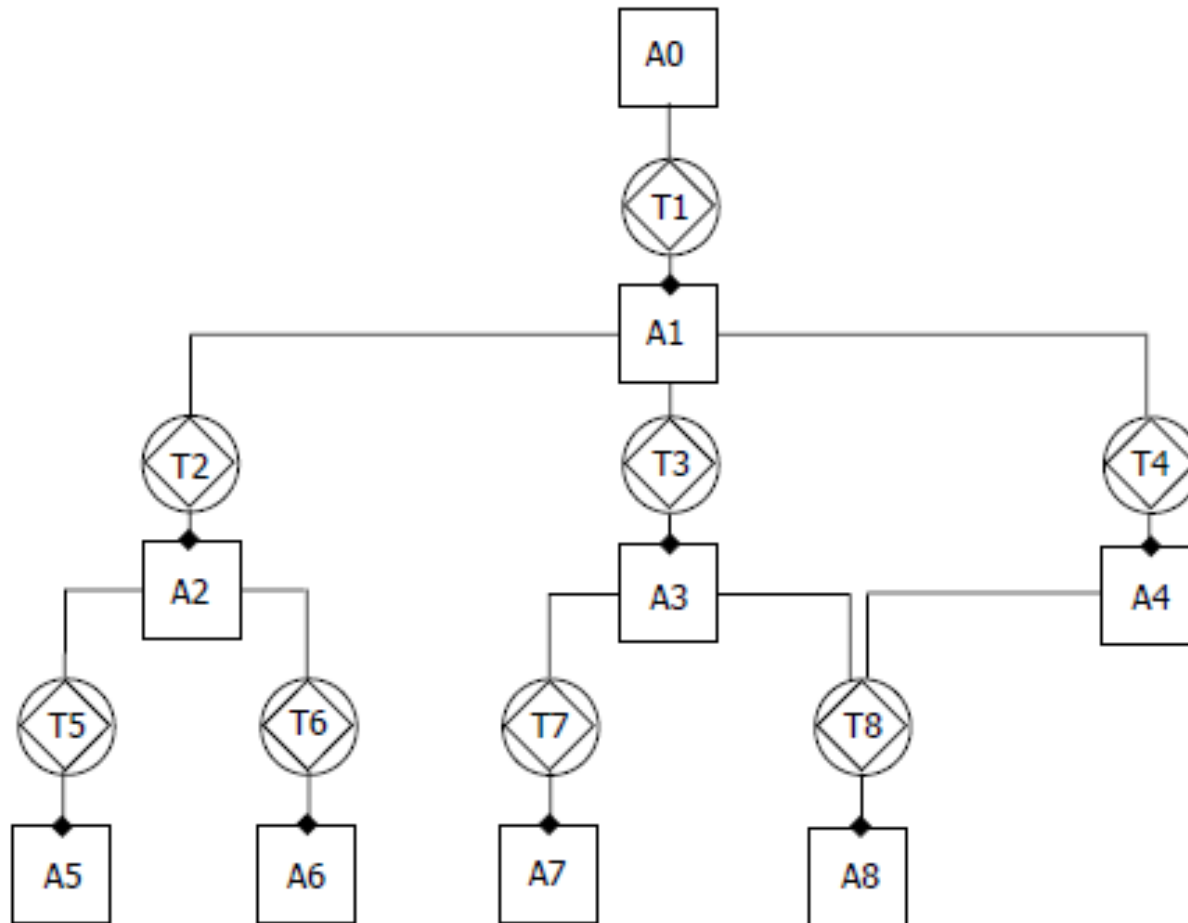


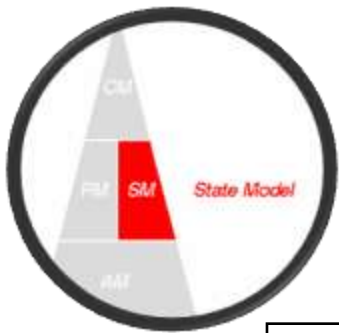
The DEMO basic transaction pattern



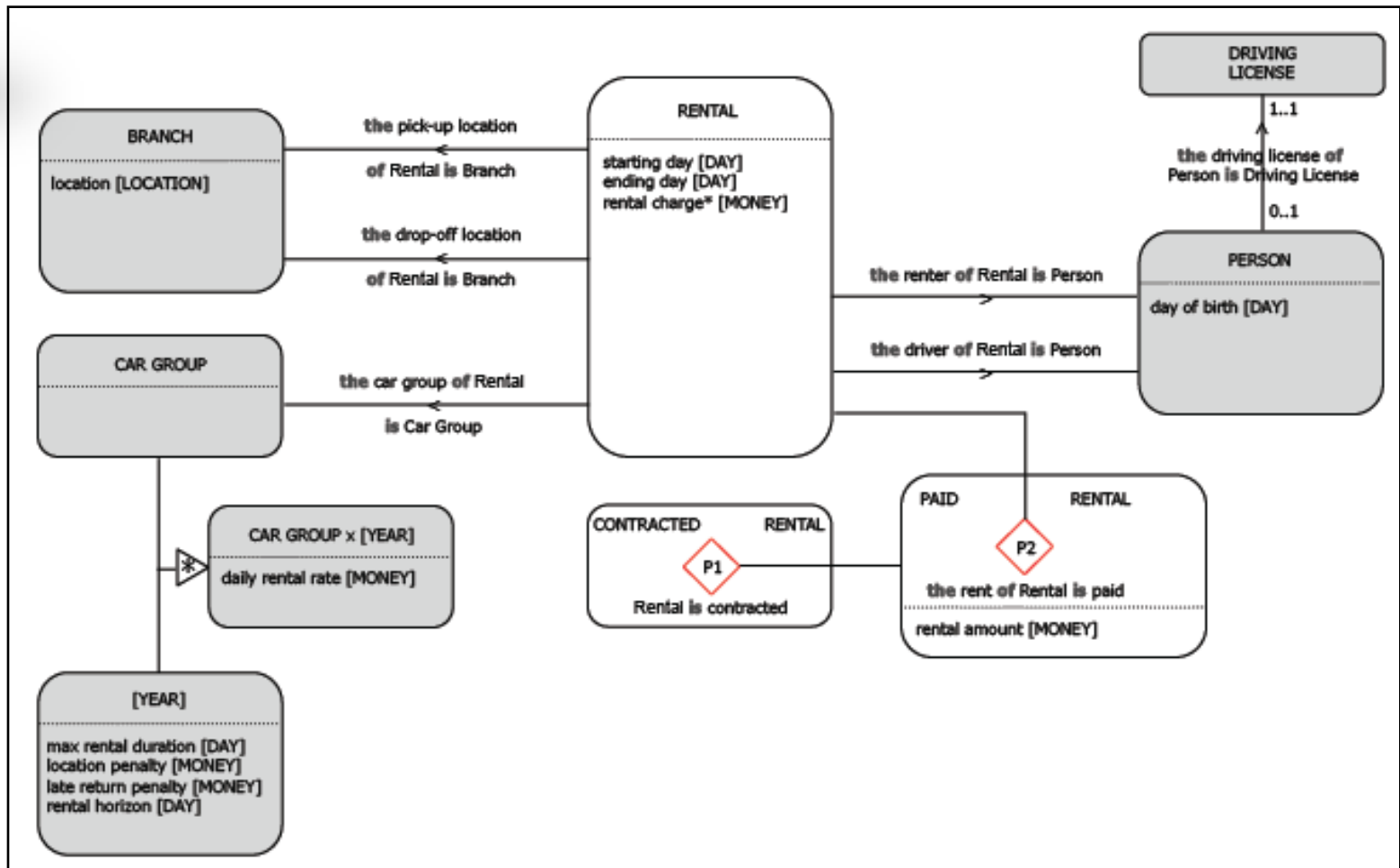


A Business Process as a DEMO Tree





DEMO Object-Fact Diagram





DEMO Action Rules

- Specification of communication acts and 3 main Claims (according to TCA by J. Habermas):
 - to Truth
 - to Sincerity
 - to Justice

when	membership payment for Membership <u>is stated</u>	(T2/st)
with	the amount paid of Membership is some Money	
assess	<i>justice:</i> the <u>performer</u> of the <u>state</u> is the payer for Membership;	
	<i>sincerity:</i> < no specific condition >	
	<i>truth:</i> Money is equal to the first fee of Membership	
if	<i>complying with statement is considered justifiable</i>	
then	<u>accept</u> membership payment for Membership	[T2/ac]
else	<u>reject</u> membership payment for Membership	[T2/rj]



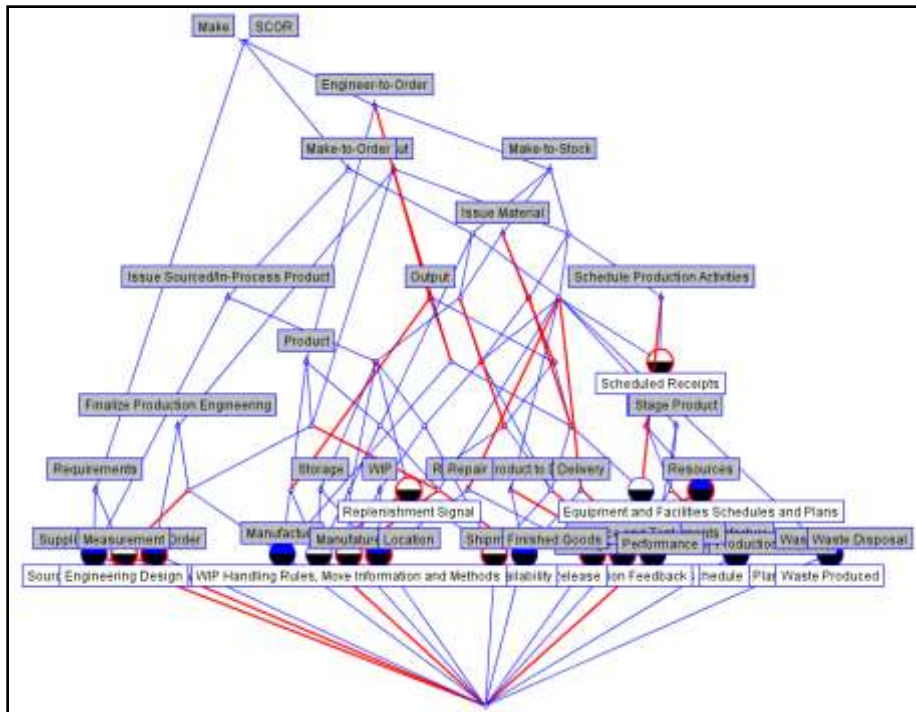
DEMO[®]

Design & Engineering
Methodology for Organizations

- Intellectual manageability, organizational concinnity and social devotion:
 - Separation of concerns
 - Use of abstraction
 - Devising proper concepts
 - Verification by instantiation
 - Validation from ontology
- Proved Business Benefits
 - AirFrance –KLM case
 - NL Water Management
 - IT Landscape Management in Portugal
- Visit for more information:
 - www.ciaonetwork.org
 - www.ee-institute.com

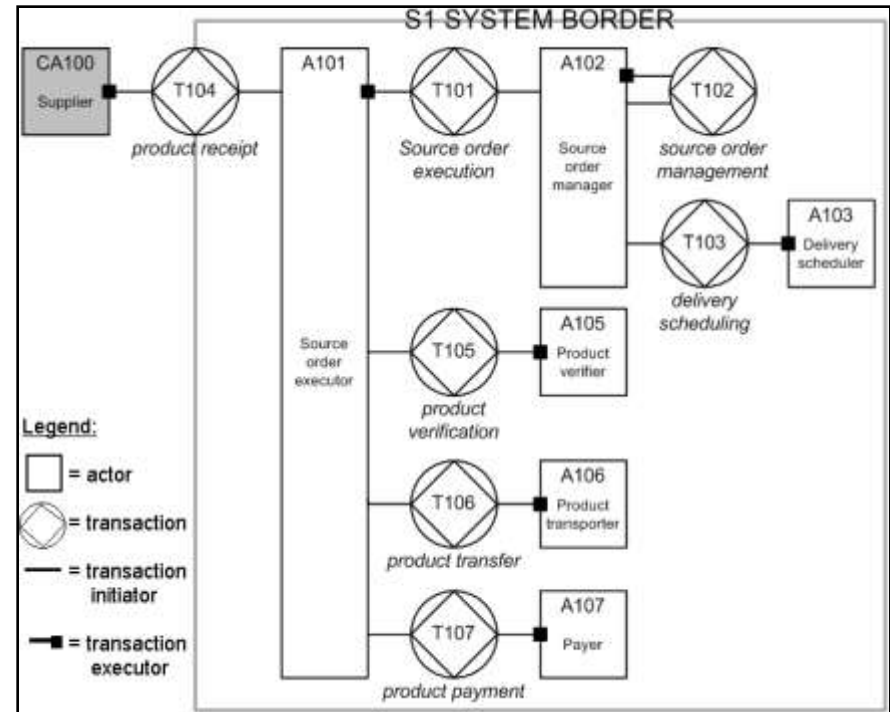
Translation of SCOR to DEMO

STAGE 1: Extraction of Concepts



SCOR Concepts Lattice produced as a result of application of Formal Concept Analysis (FCA)

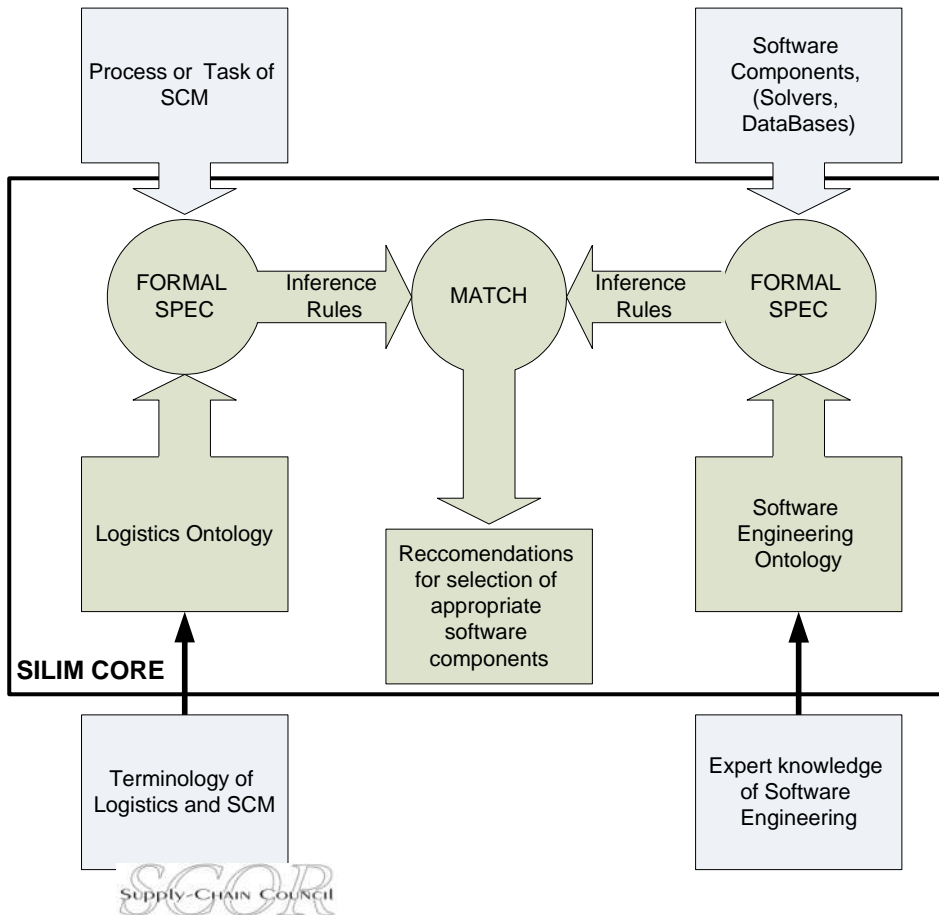
STAGE 2: Building DEMO Models



Construction Model of the SCOR Source Stocked Product process (S1) expressed in the DEMO Actor Transaction Diagram

SILIM – Semantic Interoperability of Information Models in Logistic Applications (2009-2011)

Essence of SILIM approach



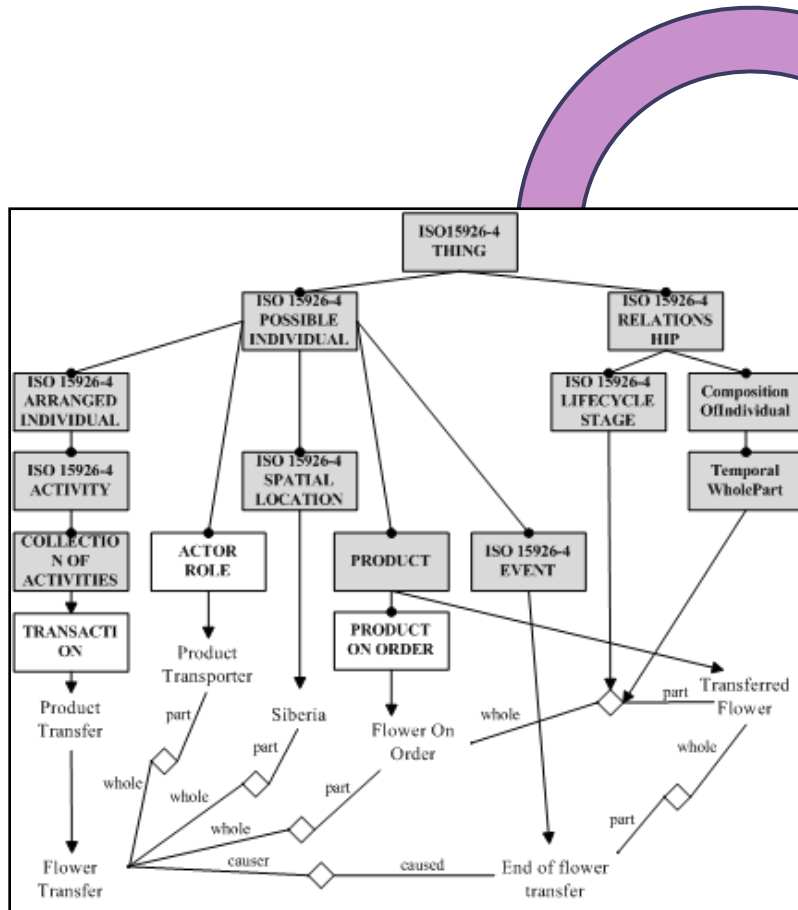
Terminological basis for development of Logistics Ontology

- SCOR-model was selected as a terminological basis (Supply-Chain Operations Reference-model)
- International cross-domain standard for SCM planning and management
- SCOR contains detailed description of business-processes, metrics, best practices and technological methods for support of unified interaction of SCM actors
- SCOR plays a role of a commonly accepted knowledge base for design of IS in logistics
- Some statistics:
 - 5 key processes with more than 400 input/outputs
 - 150 metrics, 430 best practices

Achieved Results

- Object Logistics Ontology was developed in OWL
 - 207 classes and 18 properties
- Process Logistics Ontology was developed in DEMO
 - 12 diagrams in DEMO language (CrispieNet)
- Core elements of Software Engineering Ontology were developed in OWL
- Basic Translator IBM ILOG OPL → SE Ontology was developed to create automatically instances of SE Ontology

Current Activity: Fusion of DEMO and ISO 15926



Ontology-based Framework for end-to-end Conceptual Modeling in the Traceability Domain

Organizational Interoperability

(model and coordinate business processes, consistency with internal goals, make services accessible and user-friendly)

Semantic Interoperability

(secure precise meaning and equal understanding of the exchanged data from both parties)

Technological Aspect: RDF Repositories

3Store
4store
ARC
AllegroGraph
Bigdata
ClioPatria
CumulusRDF
Djubby
Dojo.Data
Dydra
Euler
Intellidimension
Jena
LMF
Mondeca ITM
Strabon
StrixDB
TalisPlatform
USeekM
User:Opoirel
YARS

Mulgara
OpenAnzo
OpenLink Virtuoso
Oracle
Owlim
Parliament
Pubby
RDFEntityManager
RDFLib
RDFStore
Rapnetapi
RdfontheGo
Rdfstore-js
RedStore
SLRP
SeRQL
Semanticserver
Semwebrazor
Sesame
Stardog



YarcData
A DIVISION OF CRAY INC.

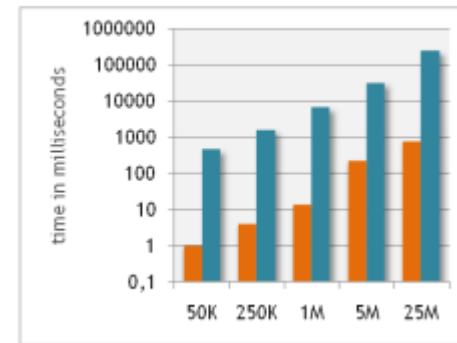
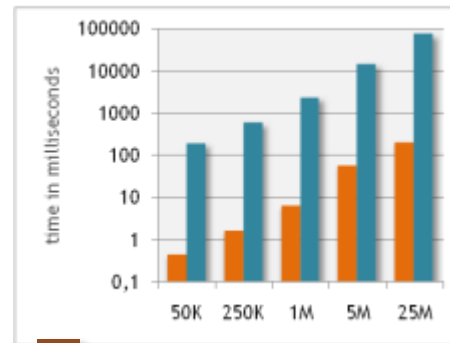
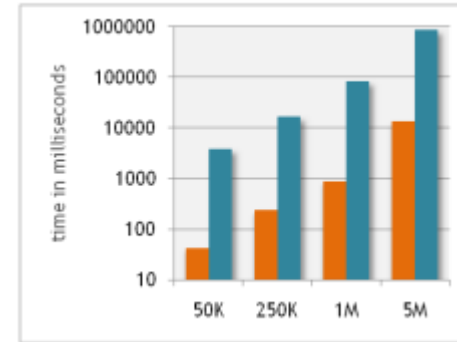
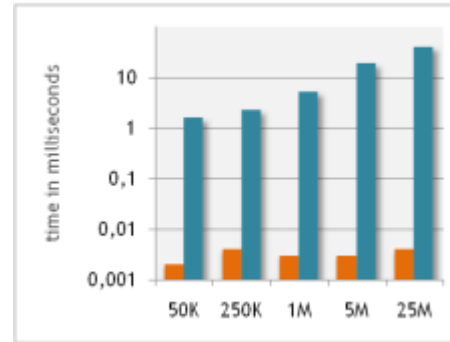
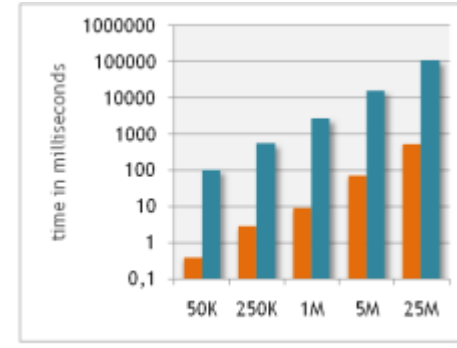
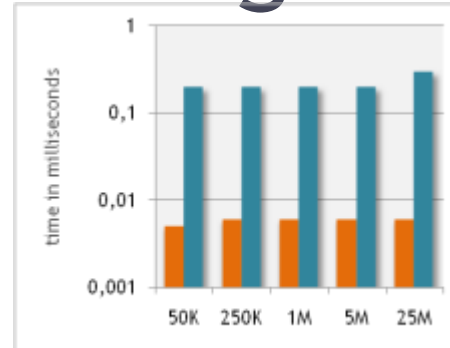
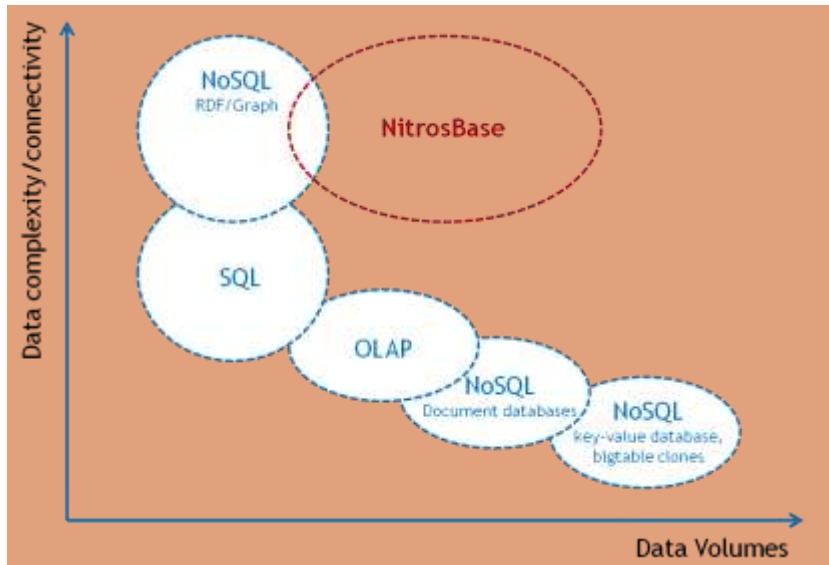
uRIKA = universal **RDF**
integration Knowledge
Appliance

Performance – a key issue and the major obstacle

Do effective RDF Storages exist ?



NitrosBase
RDF Server
www.nitrosbase.com



NitrosBase from 30 to 10 000 times faster Virtuoso

Conclusions

- Semantic and Organizational Interoperability – Important Enabling Technologies in Modern Logistics
- Several Standards and Enterprise-related Ontologies exist in isolation
- DEMO+ISO 15926 = Matured Modeling Framework
- Situation is still uncertain in the RDF Storage Technologies

Thank you for your attention



Should you have any questions, please do not hesitate to contact
Department of Information Systems and Technologies:
eababkin@hse.ru

The DEMO transaction pattern

