Enterprise Ontology

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ICEIS 2005
... es ändert sich viel, aber es bessert sich nichts ...

... there is a lot of change, but there is no improvement ...
Outline

• Introduction

• System and Model

• The $\Psi$-theory

• Enterprise ontology

• Prospects
Outline

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• Prospects
How to make enterprises intellectually manageable?

enterprise ontology

- business process
- workflow
- information systems
- ICT-infrastructure
- internal control
- staffing
- in/out sourcing
- quality control
How to achieve intellectual manageability?

“My hope [of computing science] became more articulate, when programming emerged as an application area par excellence of the techniques that are well-known because we struggle with the small sizes of our heads as long as we exist. They are roughly of three different forms:

1) separation of concerns and effective use of abstraction
2) the design and use of notations, tailored to one's manipulative needs
3) avoiding case analyses, in particular combinatorially exploding ones.

... In my experience they make the goal ‘intellectually manageable’ sufficiently precise to be actually helpful…”

Edsger W. Dijkstra
The 1970 revolution

- In the sixties, Börje Langefors, introduced the distinction between the *infological* view and the *datalogical* view on information systems.

- This important intellectual tool for the *separation of concerns* in information systems development (ISD) has led to many new approaches to ISD around 1970: Structured Analysis and Design, Structured Programming, Conceptual Database Schema etc.

- The distinction made the development of IS intellectually manageable since then.

- The remaining weak point was the connection of the information systems to the enterprise (e.g. requirements engineering).
What is enterprise ontology?

• The ontology (or ontological model) of an enterprise is defined as an understanding of its operation, that is completely independent of the realization and the implementation of the enterprise.

• In particular, an enterprise ontology should satisfy the next quality requirements (C₄E):
  • Coherent
  • Comprehensive
  • Consistent
  • Concise
  • Essential
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  • The $\Psi$-theory

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The two system notions

• The teleological system notion
  • Is about the function and external behavior of a system
  • Is the dominant system concept in the social sciences
  • Is perfectly adequate for using and controlling systems
  • Has the black-box model as the corresponding kind of model

• The ontological system notion
  • Is about the construction and operation of a system
  • Is the dominant system concept in the engineering sciences
  • Is perfectly adequate for building and changing systems
  • Has the white-box model as the corresponding kind of model
The black-box model

*function (de)composition*

- **car**
- **lighting system**
- **power system**
- **steering system**
- **brake system**

*the driver's perspective*

- **function**: (mathematical) relationship between input and output
- **functional behavior**: the manifestation of the function (through time)
The white-box model

**constructional (de)composition**

*the mechanic's perspective*

- **Construction**: the components and their interaction relationships
- **Constructional behavior**: the manifestation of the construction (through time)

```
  car
 /  \
/    \
chassis  wheels  motor  lamps
```
Business and organization

By the **business** of an enterprise is understood the **function** perspective on the enterprise. It is characterized by the products and services that are delivered to the environment.

A *business model* of an enterprise is a *black-box model* type of model.

By the **organization** of an enterprise is understood the **construction** perspective on the enterprise. It is characterized by the processes in which the products and services are brought about.

An *organization model* of an enterprise is a *white-box* type of model.
The business view on change

You have to operate more fuel efficient!!
The organization view on change

Let me see how I can fix it
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The Ψ-theory

The Ψ-theory is a theory about the operation of organizations.

Ψ is pronounced as PSI: Performance in Social Interaction, the paradigm on which the theory is founded.

The subjects (human actors) in an organization enter into and comply with commitments. This is the way in which collaboration takes place.

The Ψ-theory does justice to the fact that organizations are social systems, while at the same time providing a rigorous engineering type of framework for understanding them.
The roots of the \( \Psi \)-theory

- **Semiotics:**
  - Charles Peirce
  - Börje Langefors
  - Ronald Stamper

- **Speech Act Theory:**
  - John Austin
  - John Searle
  - Jürgen Habermas
  - Fernando Flores & Terry Winograd

- **Systemic Ontology:**
  - Mario Bunge
  - Ludwig Wittgenstein
The operation axiom

COORDINATION

ACCOUNT ROLES

PRODUCTION

RESPONSIBILITY

AUTHORITY

COMPETENCE

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The elementary coordination act

- Performer (P)
- Addressee (A)
- Intention
  - Request
  - Promise
  - Statement
  - Acceptance
- Proposition
  - A (possible) fact in the P-world

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Enterprise Ontology
The transaction axiom

request → desired new fact
accepted

promise

fact stated → fact promised → fact produced

O-phase → E-phase → R-phase

customer → producer

Enterprise Ontology
Example of a transaction

Order phase

I'd like to have such a bouquet
Very well, sir

A1: requests : A2 : person P has a bouquet B
A2: promises : A1 : person P has a bouquet B

Execution phase: the actual delivery of the bouquet

Result phase

Here you are
Thanks

A2: states : A1 : person P has a bouquet B
A1: accepts : A2 : person P has a bouquet B
The composition axiom

Transactions are clustered in hierarchies or trees, according to the **product structure** (cf. Bill of Material) of the products they are dealing with.

Such a cluster of transactions is called a **business process**.
The distinction axiom

COORDINATION ACTOR ROLES PRODUCTION

*exposing commitment* (as performer)
*evoking commitment* (as addressee)

*expressing thought* (formulating)
*educing thought* (interpreting)

*uttering information* (speaking, writing)
*perceiving information* (listening, reading)

*ontological production* (deciding, judging, manufacturing)

*infological production* (reasoning, deducing, computing etc.)

*datalogical production* (storing, transmitting, copying, destroying etc.)
The organization theorem

B-organization
I-organization
D-organization
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The definition of enterprise ontology

**enterprise ontology**

- **B-actor** (performa): speaking, listening, formulating, interpreting
- **I-actor** (informa): entering into and complying with commitments
- **D-actor** (forma): computing, reasoning, copying, storing, transporting
Design & Engineering

 DEMO®

Methodology for Organizations

essential and simple
The aspect models

Construction Model

Process Model

Information Model

Action Model

CM

PM

IM

AM
LIBRARY - Construction Model (1)
## LIBRARY - Construction Model (2)

<table>
<thead>
<tr>
<th>transaction type</th>
<th>resulting P-fact type</th>
</tr>
</thead>
<tbody>
<tr>
<td>T01 membership registration</td>
<td>PF01 membership M has started to exist</td>
</tr>
<tr>
<td>T02 membership fee payment</td>
<td>PF02 the fee for membership M in year Y has been paid</td>
</tr>
<tr>
<td>T03 reduced fee approval</td>
<td>PF03 the reduced fee for membership M in year Y is approved</td>
</tr>
<tr>
<td>T04 loan start</td>
<td>PF04 loan L has started to exist</td>
</tr>
<tr>
<td>T05 book return</td>
<td>PF05 book copy C has been returned</td>
</tr>
<tr>
<td>T06 loan end</td>
<td>PF06 loan L has ended to exist</td>
</tr>
<tr>
<td>T07 return fine payment</td>
<td>PF07 the late return fine for loan L has been paid</td>
</tr>
</tbody>
</table>
PERSON

P M
P is the member in M

MEMBERSHIP

M L
L has started to exist

YEAR

M
M has started to exist

PF01

PF02

PF03

Y

Y has been approved

the reduced fee for M in year Y has been approved

LOAN

L C
L has ended to exist

PF04

PF05

C
book copy C has been returned

L
the late return fine for L has been paid

PF06

PF07

YEAR

M

the membership fee for M regarding year Y has been paid

BOOK COPY

P is the member in M

the membership of L is M
What is made easier by enterprise ontology?

• Requirements engineering
• Business process (re)design and (re)engineering
• Intra and inter enterprise collaboration
• Interoperability of information systems
• Function/job identification and description
• IT portfolio management
Who needs enterprise ontology?

An enterprise ontology provides the common understanding of the operation of an enterprise to all stakeholders. In particular the next groups of stakeholders do need it:

- **Managers**: managing has become too complex for relying only on the function view on the enterprise. They need to have a global understanding of its operation too.
- **Designers**: for (re)designing and (re)engineering the organization of an enterprise, an explicit specification of the business processes is needed that is independent of their implementation.
- **Users**: why should the operation of an enterprise be fully opaque to its users? An enterprise ontology would provide the users the transparency they need too!
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The dawn of a new revolution?

- The *ontological* view on enterprises has the potential to give rise to new kinds of approaches to the analysis and design of enterprises (in which IS approaches can properly be embedded) because:
  - It focuses on the *essence* of business processes, being the entering into and complying with commitments by *human* actors.
  - It puts the role of the human being as social individual ‘on top of’ his being an intellectual individual. By doing this, it provides the fundamental link between organization and information.
  - It relates the notions of competence, authority and responsibility to the operation of an enterprise in a rigorous way.
A new discipline is needed

enterprise engineering
Contact?

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