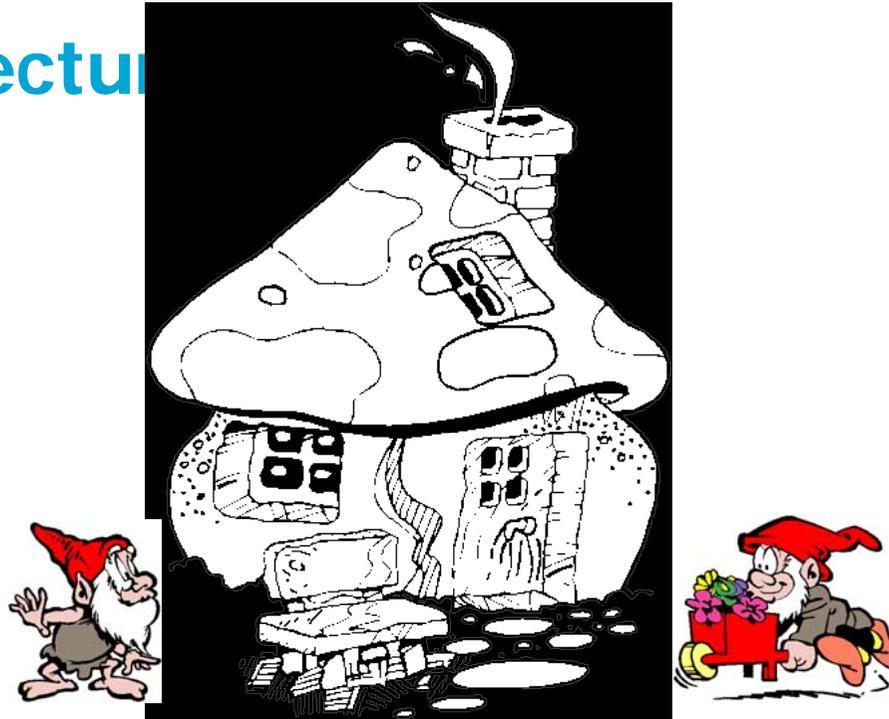


Enterprise Ontology

keynote lecture



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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 Ψ -theory
- Enterprise ontology
- Prospects

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How to make enterprises intellectually manageable?



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**

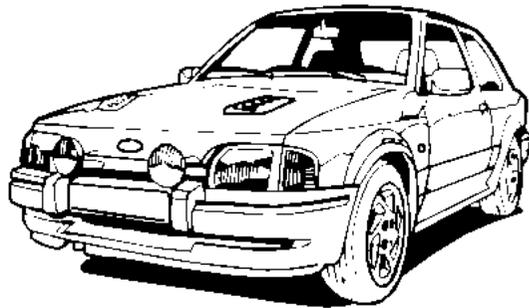
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The two system notions

- **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

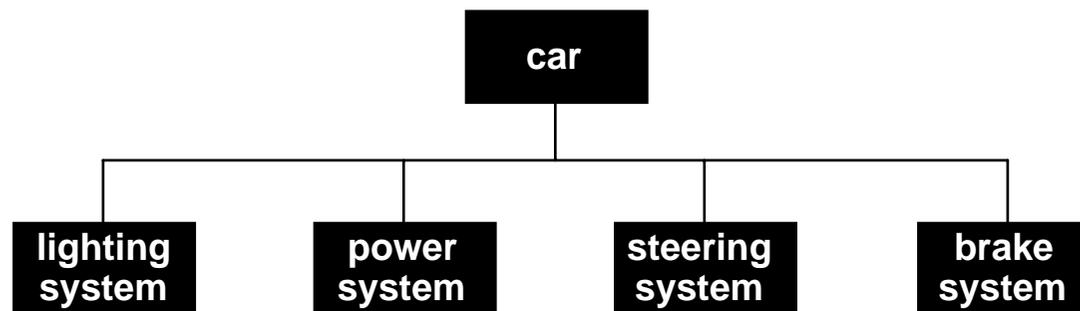


the driver's perspective

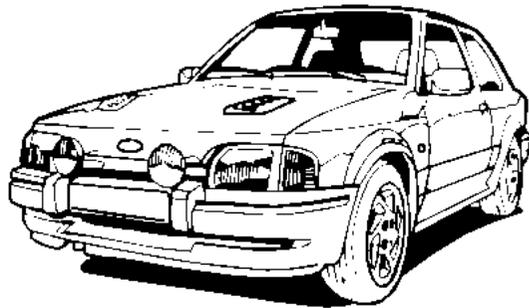
function :
(mathematical) relationship
between input and output

functional behavior :
the manifestation of the
function (through time)

functional (de)composition



The white-box model

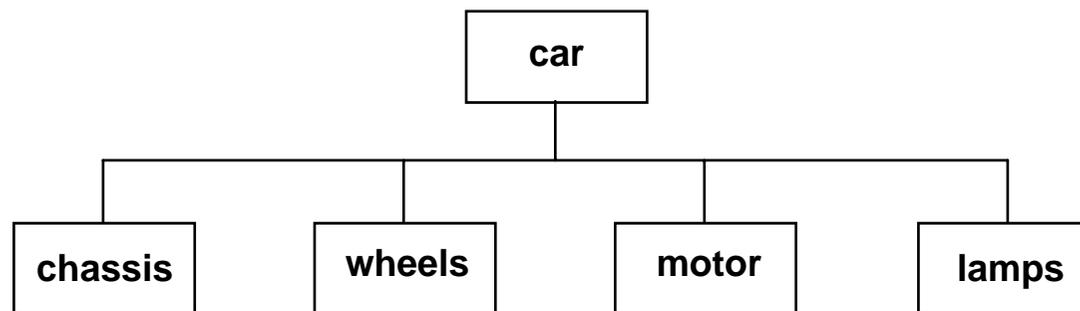


the mechanic's perspective

construction :
the components and their
interaction relationships

constructional behavior :
the manifestation of the
construction (through time)

constructional (de)composition



Business and organization

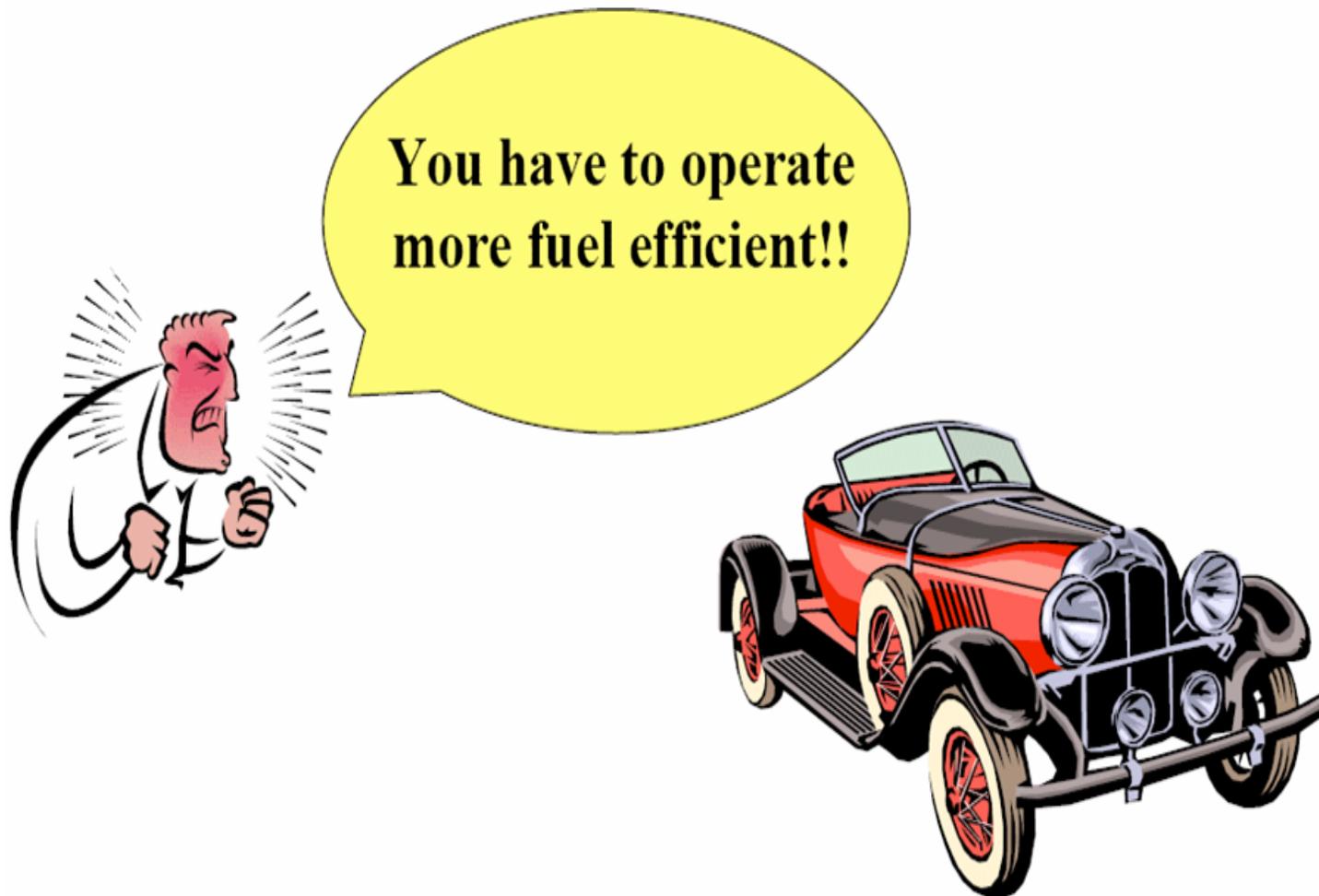
By the ***business*** of an enterprise is understood the *function* perspective on the enterprise. It is characterized by the products and services that are delivered to the environment.

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



The organization view on change



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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 Ψ -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

ACTOR ROLES

PRODUCTION

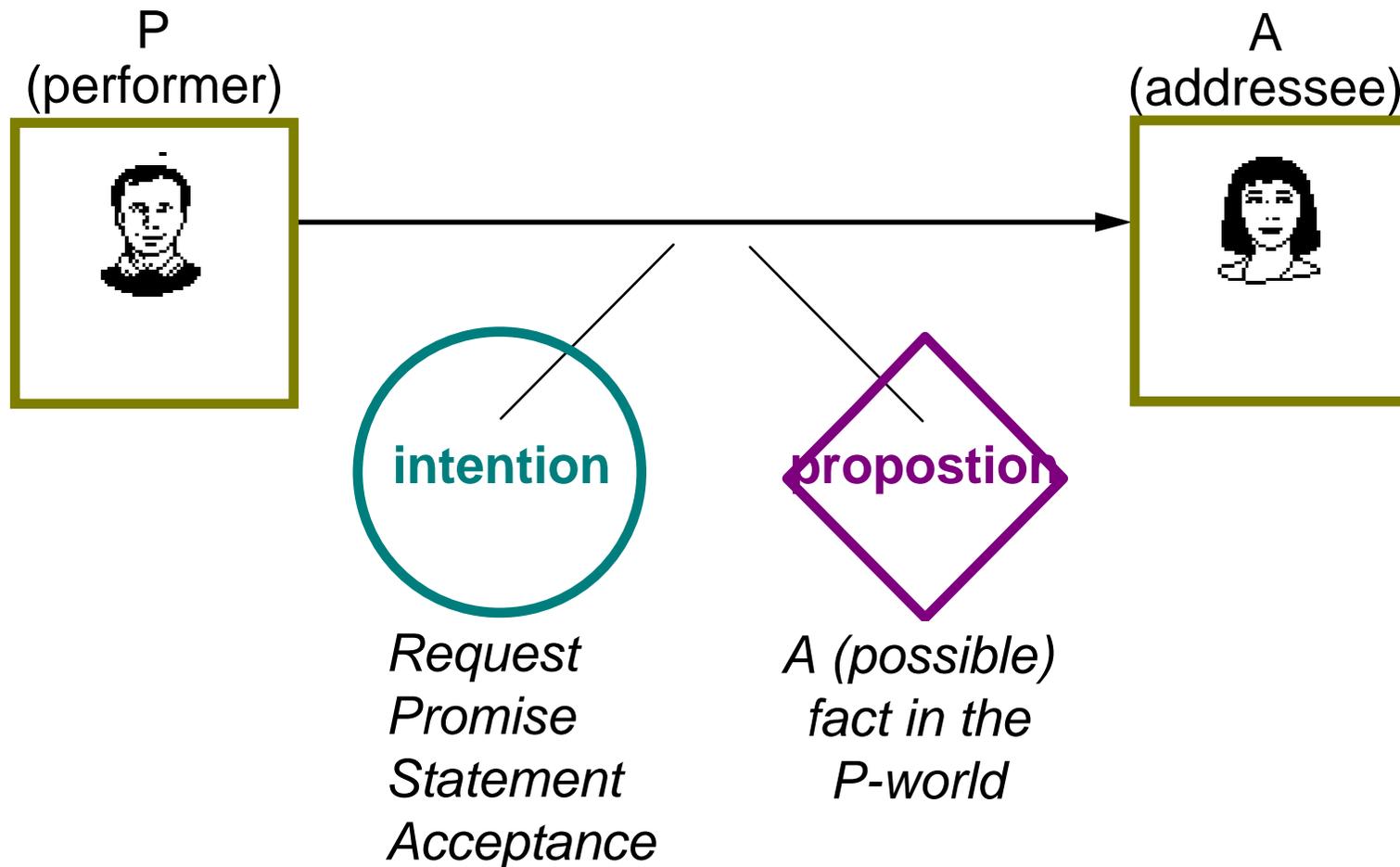


RESPONSIBILITY

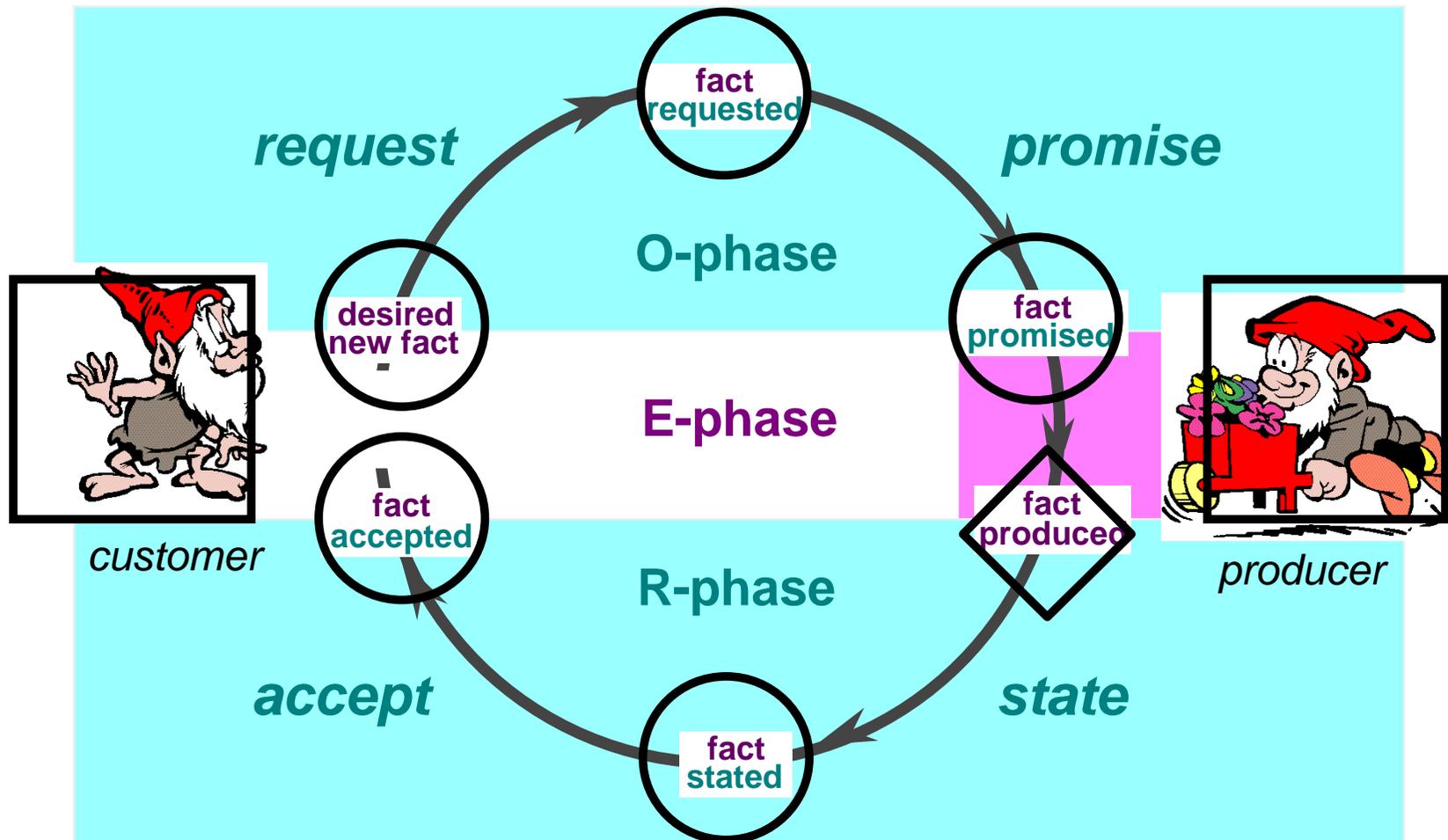
AUTHORITY

COMPETENCE

The elementary coordination act



The transaction axiom



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

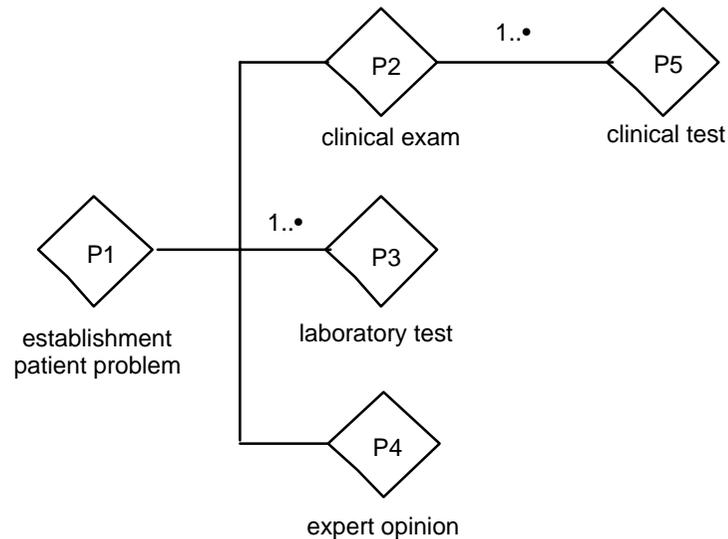
Result phase

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

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



performa

expressing thought
(formulating)
educing thought
(interpreting)



informa

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



forma

ACTOR ROLES

PRODUCTION

ontological production
(deciding, judging,
manufacturing)

infological production
(reasoning, deducing,
computing etc.)

datalogical production
(storing, transmitting,
copying, destroying etc.)

The organization theorem

B-organization

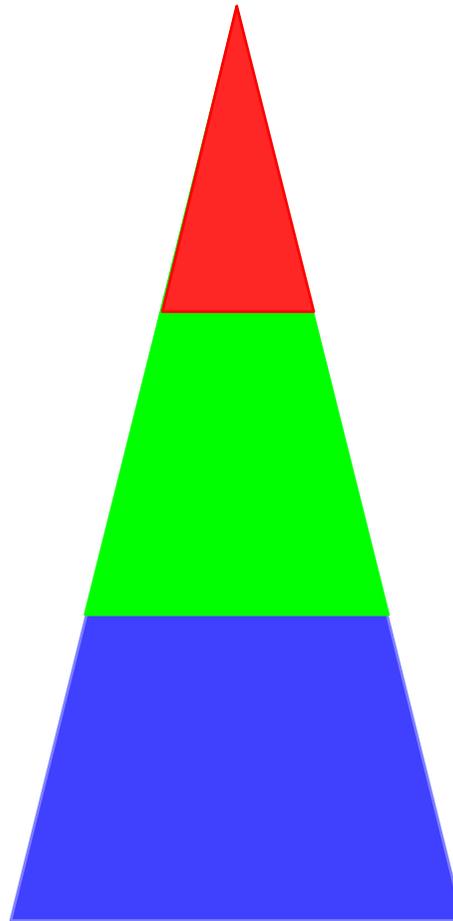
ontological
production

I-organization

infological
production

D-organization

datalogical
production



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The definition of enterprise ontology



enterprise ontology

formulating
interpreting

speaking
listening

I-actor
(*informa*)

D-actor
(*forma*)

computing
reasoning

copying
storing
transporting

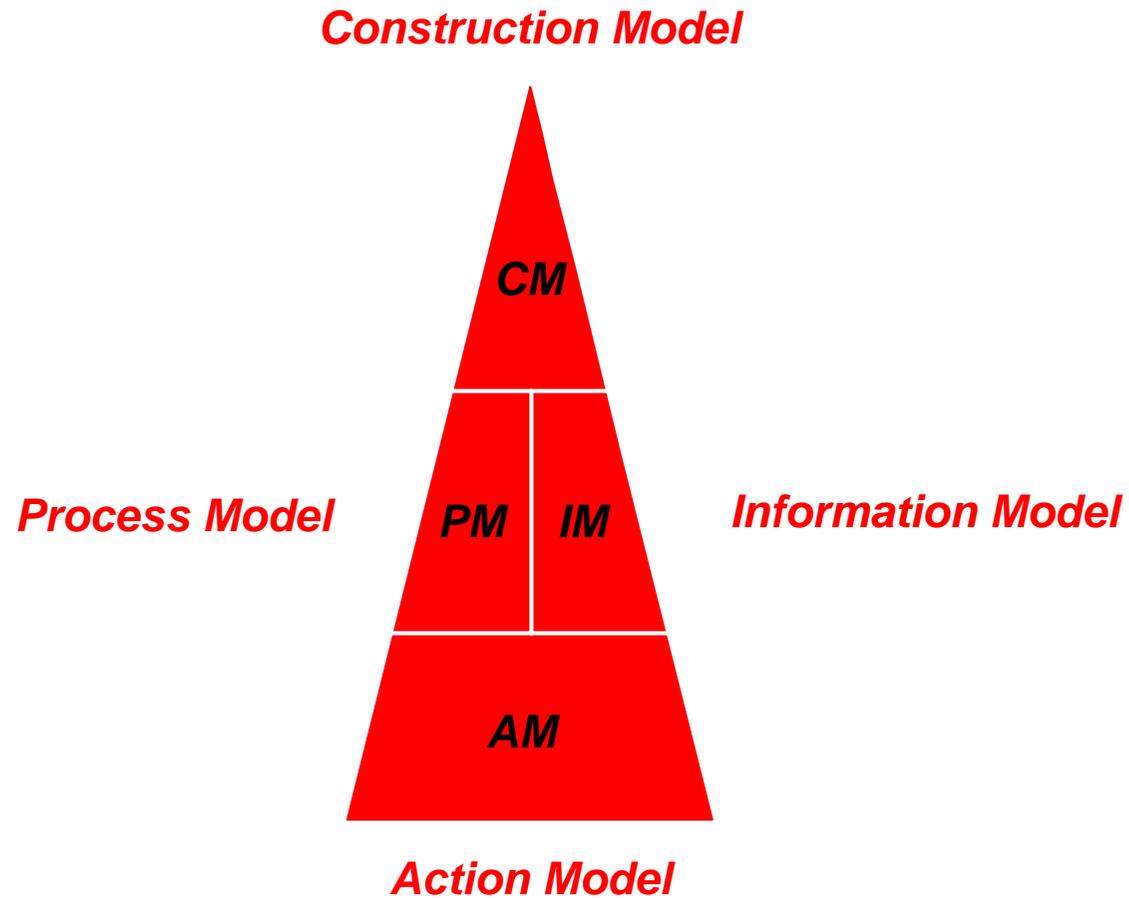
Design & Engineering

DEMO[®]

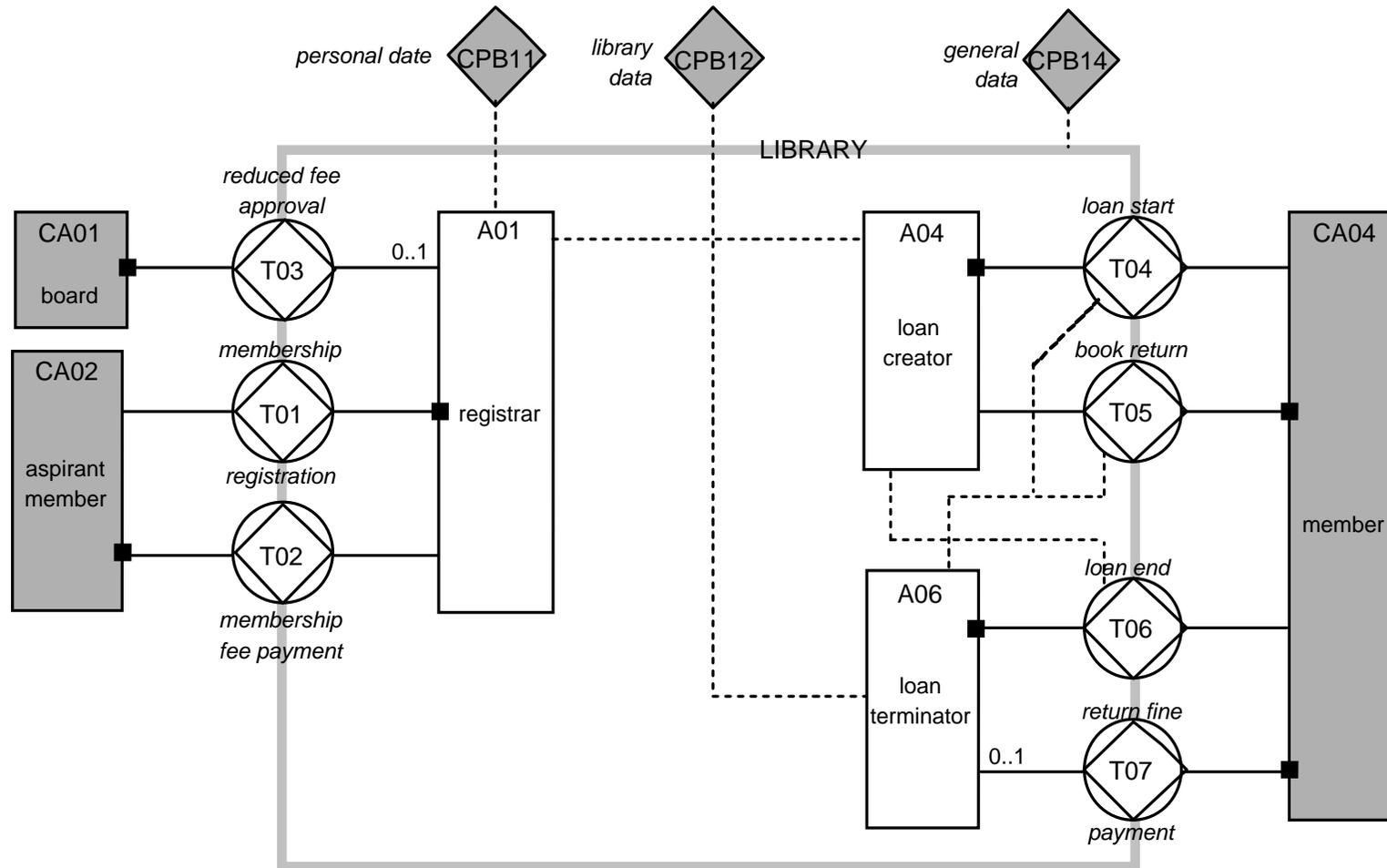
Methodology for Organizations

essential and simple

The aspect models



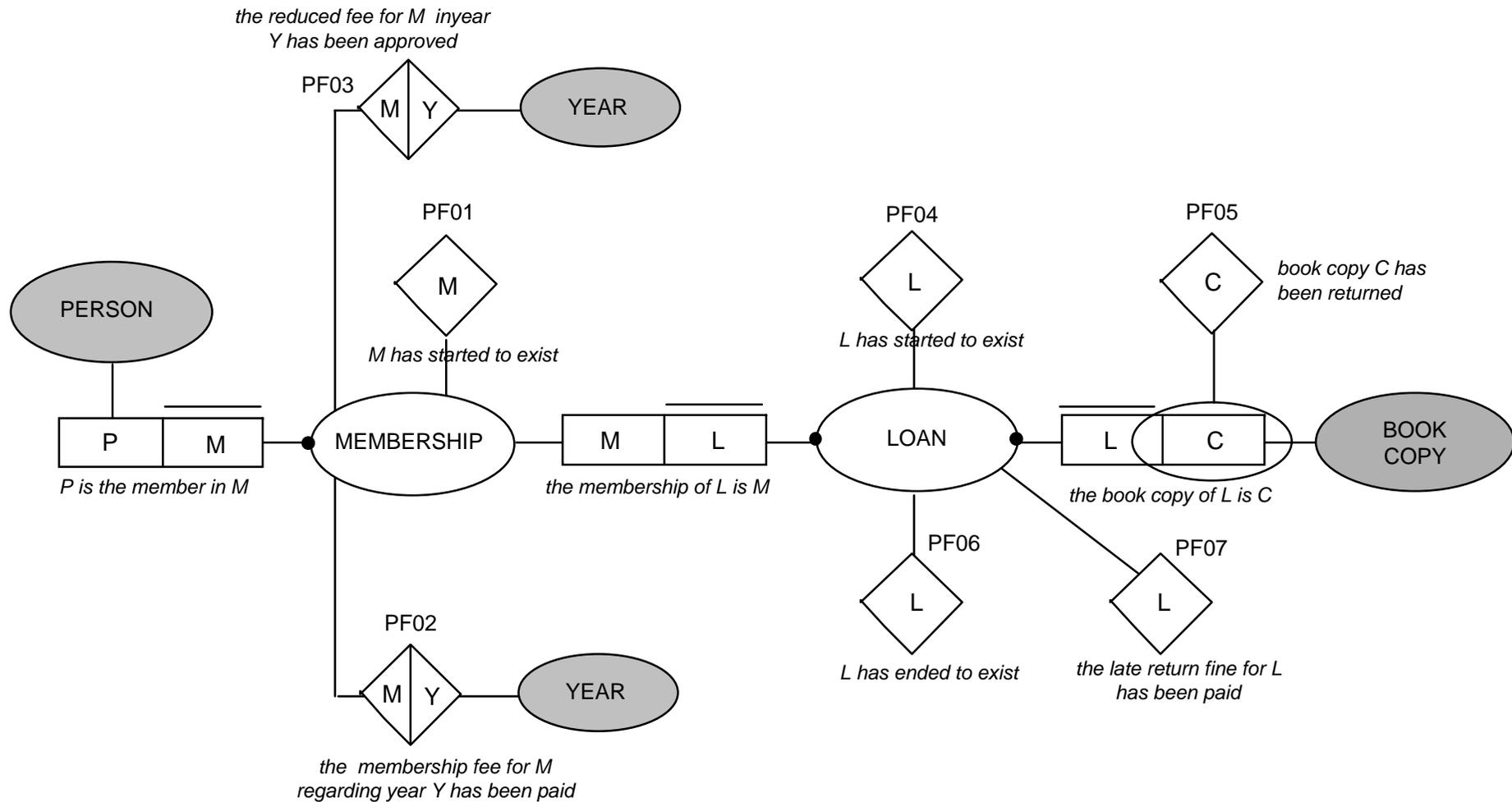
LIBRARY - Construction Model (1)



LIBRARY - Construction Model (2)

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

LIBRARY - Information Model



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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