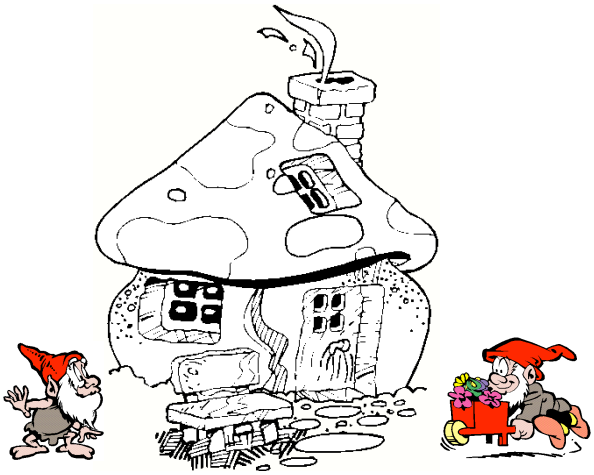
Tutorial Enterprise Ontology

The DEMO methodology



Jan L.G. Dietz

24 May 2005

ICEIS 2005

TU Delft
Delft University of Technology

Design & Engineering

DEMO®

Methodology for Organizations

essential and simple

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What does DEMO include?

1. The OER method for extracting the ontology (essence) of an enterprise from its implementation. The method is fully based on the Ψ-theory.
2. A coherent set of ontological aspect models in which the ontology of an enterprise is expressed.
3. A consistent set of diagrams and tables in which these aspect models are represented.

(Note. Other components are not included in this tutorial)

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The OER method

(**O**rganizational **E**ssence **R**evelation)

1. The *distinction axiom* based analysis
2. The *operation axiom* based analysis
3. The 1st *transaction axiom* based synthesis
4. The *composition axiom* based analysis
5. The 2nd *transaction axiom* based synthesis
6. The *enterprise* based synthesis

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The distinction axiom based analysis

1. Mark all **Performa** things red; these include the production acts and facts in the B-organization of the enterprise, as well as the performative coordination acts in the B-organization.

2. Mark all **Informa** things green; these include the production acts and facts in the I-organization of the enterprise, as well as the informative coordination acts in the B-organization.

3. Mark all **Forma** things blue; these include the production acts and facts in the D-organization of the enterprise, as well as the formative coordination acts in the B-organization.

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DA-analysis of case VOLLEY

One can become member of the tennis club Volley by sending a letter to the club by postal mail. In that letter one has to mention: the surname and first name, the birth date, the sex, the telephone number, and the postal address (street, house number, zip code, and residence). Charles, the administrator of Volley, empties daily the mailbox and checks whether the provided information is complete. If not, he makes a telephone call to the sender in order to complete the data. If a letter is completed, Charles adds an incoming mail number and the date, enters the letter in the letter book and archives it.

Every Wednesday evening Charles takes the collected letters to Miranda, the secretary of Volley. He also takes the member register with him then. If Miranda decides that an applicant will become member of Volley, she stamps "new member" on the letter and writes the date below it. This date counts as the commencement date of the membership. She then hands the letter to Charles in order to add the new member to the member register. This is a book with numbered lines. Each new member is entered on a new line. The line number is the so-called member number, by which the new member is indicated in the administration.

Next, Miranda calculates the membership fee that the new member has to pay for the remaining part of the calendar year. She finds the annual fees, as settled by the general meeting, on a piece of paper in the drawer of her desk. Then, she asks Charles to write down the amount in the member register.

If Miranda does not allow an applicant to become member (e.g. because he or she is too young or because the maximum number of members has been reached), Charles will send a letter in which he explains why the applicant cannot (yet) become a member of Volley.

If all applications are processed, Charles takes the letters and the member register back home and prepares an invoice to all new members for the payment of the first fee. He sends these invoices by postal mail. Payments have to be performed by bank transfers.

As soon as a payment is received, Charles prints a membership card on which are mentioned: the membership number, the commencement date, the name, the birth date and the postal address. The card is sent to the new member by postal mail.

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The operation axiom based analysis

1. Consider only the **Performa things**. Divide them into **production things** (thus **P-acts** and **P-facts**) and **coordination things** (thus **C-acties** of **C-feiten**).

   Mark the production things with a ◇

   Mark the coordination things with a ○

2. Mark all **actors** yellow: persons, organizational functions, and organizational units.

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OA-analysis of case VOLLEY

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The 1st transaction axiom based synthesis

1. Put the template of the transaction pattern over de set of 'red' P-things and C-things. In doing so, the P-things and C-things belonging to one transaction type are clustered, and thus all transaction types are identified.

2. Formulate for every identified transaction type the resulting **P-fact type**. Make a sentence that is unambiguous and that contains a minimal number of variables (preferably one). A variable is a placeholder for an entity.

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First TA-synthesis of case VOLLEY

transaction	transaction result
T01 membership_start	PF01 *membership M has started to exist*
T02 membership_payment	PF02 *the first fee for membership M is paid*
T03 fee_settlement	PF03 *the fee for year Y is settled*

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The composition axiom based analysis

The bringing about of a P-fact PF02 may be a condition for bringing about a P-fact PF01. In such a case PF02 is called a *component* of PF01. Likewise, T02 is called a component of T01.

On the basis of this part-of relationship, arbitrarily large tree structures may arise that are comparable to the bills-of-material (BOM) of material products.

The root of such a tree is the product or service that the organization delivers to its environment (Note that in fact these structures go across organizational boundaries).

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CA-analysis of case VOLLEY

From the description of the case Volley it appears that the existence of the P-fact PF02 (*the first fee for membership M is paid*) is a condition for bringing about the corresponding P-fact PF01 (*membership M has started to exist*). Consequently, PF02 is considered to be a component of PF01.

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The 2nd transaction axiom based synthesis

Determine for every transaction type the **actor role** that is the initiator and the **actor role** that is the executor. Use the tree structures that are the outcome of the CA based analysis. Recall that a transaction type has exactly one executor, and one or more initiators.

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Second TA-synthesis of case VOLLEY

transaction	initiator	executor
T01 membership_start	A?? aspirant_member	A01 admitter
T02 membership_payment	A01 admitter	A02 payer
T03 fee_settlement	A?? board	A03 general_meeting

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The enterprise based synthesis

In this last step the boundary of the enterprise under consideration is settled, and thus the **B-organization**.

This system boundary divides the actor roles into *internal*, *environmental*, and *external* actor roles, and the transaction types into *internal*, *interface* and *external* transaction types.

The not internal actor roles that are initiator or executor of the interface transaction types are the environmental actor roles.

The external transaction types as well as the external actor roles are disregarded. They do not belong to the enterprise.

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The enterprise based synthesis of case Volley

Internal actor roles:	A01 admitter
Environmental actor roles:	A?? aspirant_member
	A02 payer
External actor roles:	A?? board
	A03 general_meeting
Internal transaction types:	< none >
Interface transaction types:	T01 membership_start
	T02 membership_payment
External transaction types:	T03 fee_settlement

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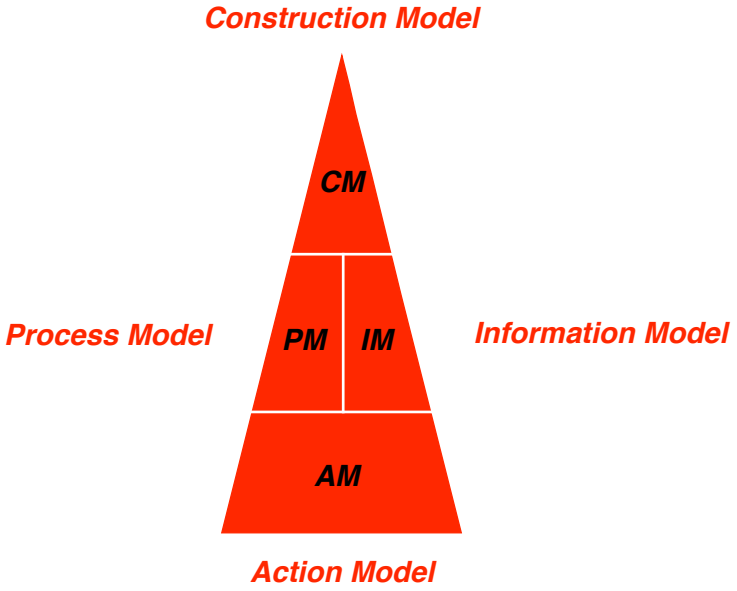
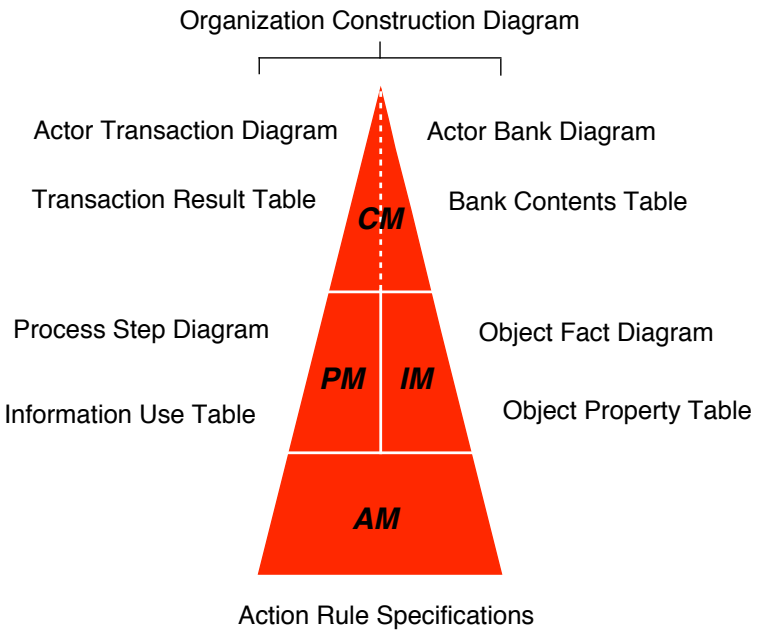
The aspect models



The model representations



The Construction Model (part 1)

- Specification of the active influencing relationships between the actor roles (*interaction*).
- Is expressed in the Actor Transaction Diagram (ATD) and the Transaction Result Table (TRT).
- The ATD specified the identifies transaction types, the corresponding actor roles (initiator, executor) and the system boundary.
- The TRT specifies for every transaction type the resulting production fact

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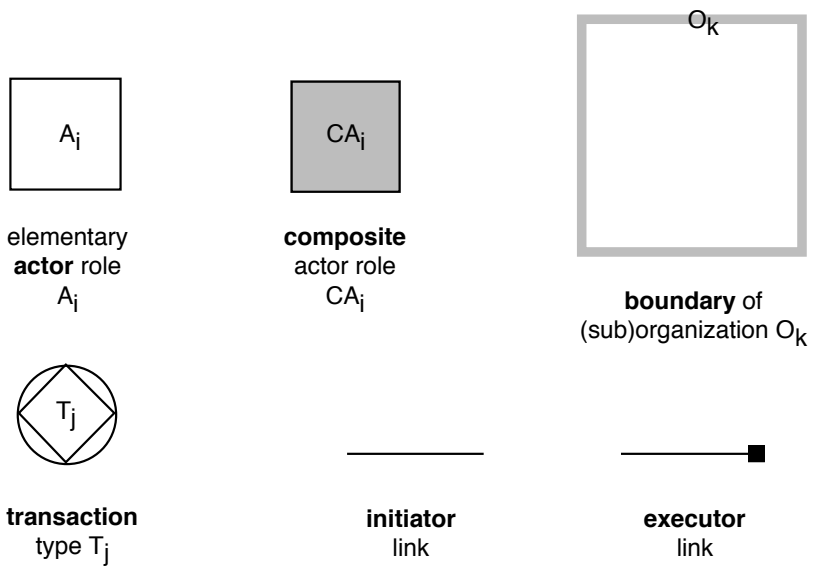
Legend of the Actor Transaction Diagram



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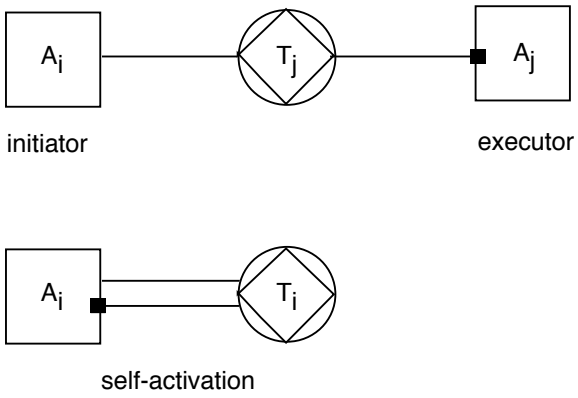
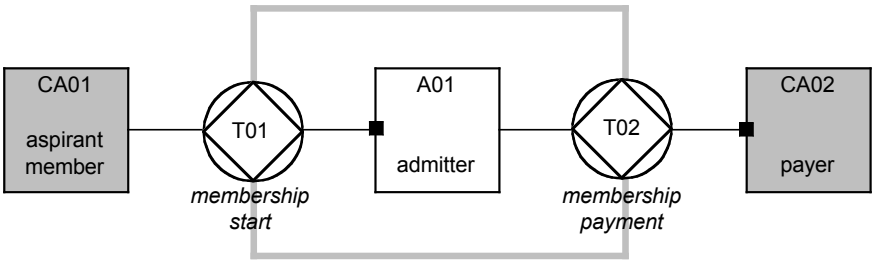
Basic constructs in the ATD



Volley: Actor Transaction Diagram



Volley: Transaction Result Table

transaction	transaction result
T01 membership_start	PF01 *membership M has started to exist*
T02 membership_payment	PF02 *the first fee for membership M is paid*

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The Process Model

- Specification of the trajectory space of the C-world, i.e. the lawful or allowed or possible sequences of C-world states, by means of the Process Step Diagram (PSD).
- In addition, for every process step the information that is used (object types and fact types) is specified in an Information Use Table (IUT).

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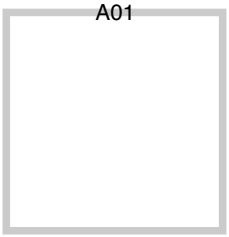
PSD - legend

C-act T01/rq and the resulting **C-fact** T01/rq

execution and result of transaction T01

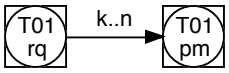
causal link

conditional link

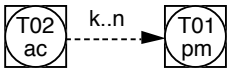


responsibility area of actor role A01

basic constructs:



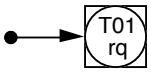
dealing with the agendum C-fact T01/rq **causes** performing C-act T01/pm, minimal k and maximal n times



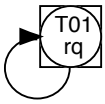
C-fact T02/ac is a **condition** forC-act T01/pm: performing C-act T01/pm has to wait for minimal k and maximal n creations of a C-fact T02/ac

Note: the *default value* for k and n is 1.

external activation



self-activation



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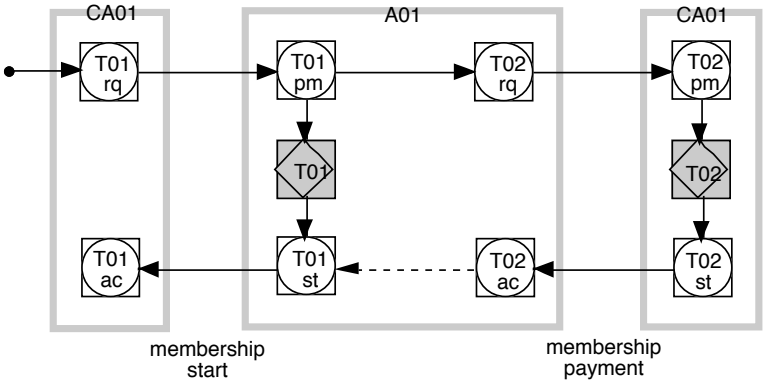
Volley: Process Step Diagram



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Volley: Information Use Table

fact type / object type	process step
MEMBERSHIP	T01/rq T01/pm T02/st T02/ac
the member of M is P	T01/rq
membership M has started to exist	*T01/ac*
the first fee for membership M is paid	*T02/ac*
minimal_age	T01/rq
annual_fee	T01/pm
maximum_number	T01/rq
PERSON	T01/rq
birth_date	T01/rq

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The Action Model

- For every internal actor role, there is an action rule for every agendum type which the actor role has to deal with.
- Action rules serve as a guidelines for the actors.
- Action rules may be specified formally, using a pseudo algorithmic language, or informally, using flow charts or just text instructions.

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Volley: Action Rule Specifications

actor	agendum		action rule
A01	**on**	requested T01 (M)	**with** P is member of new M **do** **if** age (P) < minimal_age(Current_Year) **or** number_of_members(Now) = maximum_number(Current_Year) **then** decline T01 (M) **else** promise T01 (M) **fi** **od**
A01	**on**	promised T01 (M)	**do** request T02 (M) **with** first_fee (M) < *decide to start membership M* > **od**
A01	**on**	stated T02 (M)	**do** **if** < payment is acceptable > **then** accept T02(M) **else** reject T02(M) **fi** **od**
A01	**on**	accepted T02 (M)	**do** state T01(M) **od**

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The Information Model

- Specification of the state space of the P-world: the object types, fact types, and existential constraints.
- Based on the ORM (Object Role Model).
- Distinction between 'real' fact types and properties (pure mathematical functions, mapping from an object type to a value scale).
- No identification schemes (name classes) are included.

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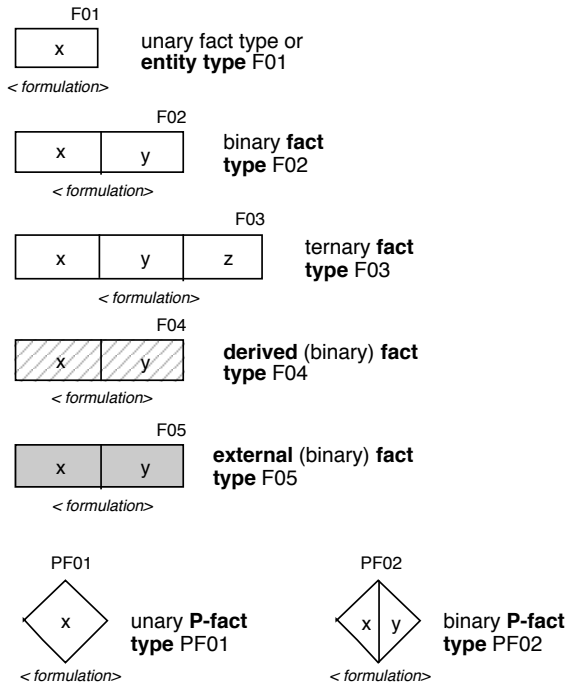
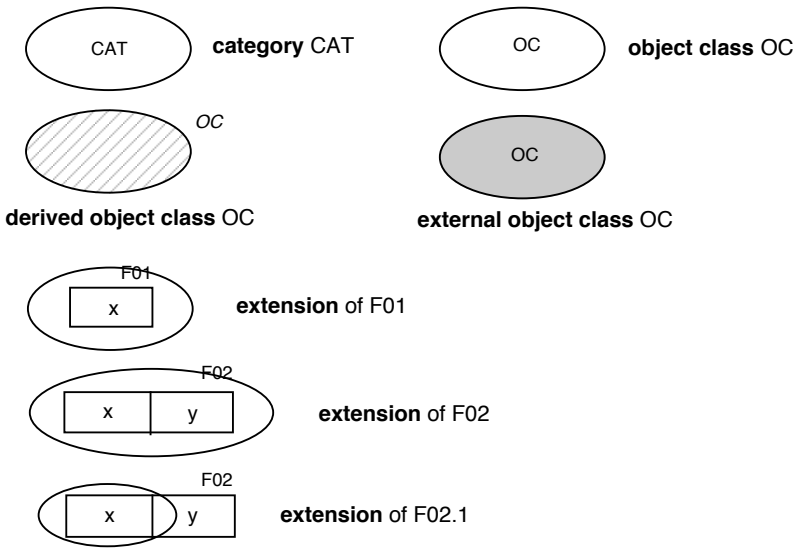
OFD - legend (1)



OFD - legend (2)



OFD - legend (3)

EXISTENTIAL LAWS

reference law (domain)

unicity law

dependency law

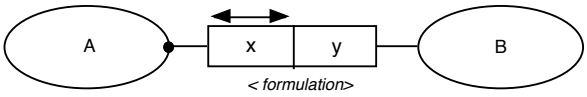
exclusion law

DERIVATION DEFINITIONS

union (generalization)

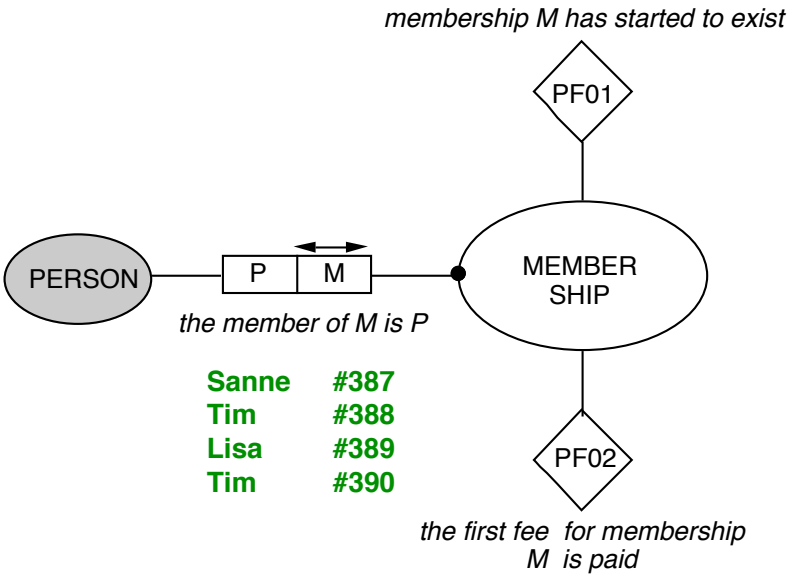
< derivation rule > ::=
< derived fact type > = < logical formula >

typical construct:



The domain of role x of fact type F is A.
The domain of role y of fact type F is B.
There is a unicity law for role x:
x can only appear once in the extension of F.
There is a dependency law for A:
for every a∈A there must be a pair <a,-> in F.

Volley: Object Fact Diagram



Volley: Object Property Table

property	domain	range	scale kind	O/D
minimal_age	TIME	NUMBER	Absolute	O
annual_fee	TIME	NUMBER	Absolute	O
maximum_number	TIME	NUMBER	Absolute	O
number_of_members	TIME	NUMBER	Absolute	D
first_fee	MEMBERSHIP	EURO	Ratio	D
birth_date	PERSON	DATE	Interval	O
age	PERSON	NUMBER	Absolute	D

derivation rules:

number_of_members (Time) = < number of persons for which there exists a membership >
first_fee (M) = ((12 - Current_Month#)/12) * annual_fee(Current_Year)
age(P) = < difference in years between birth year of P and current year >

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The Construction Model (part 2)

- Specification of the passive influencing relationships between actor roles (*interstriction*). Interstriction is expressed as information links between actor roles and banks (P-banks and C-banks).
- Is expressed in the Actor Bank Diagram (ABD) and the Bank Contents Table (BCT).
- The ABD may also be constructed as an extension of the ATD. This constitutes the Organization Construction Diagram (OCD).

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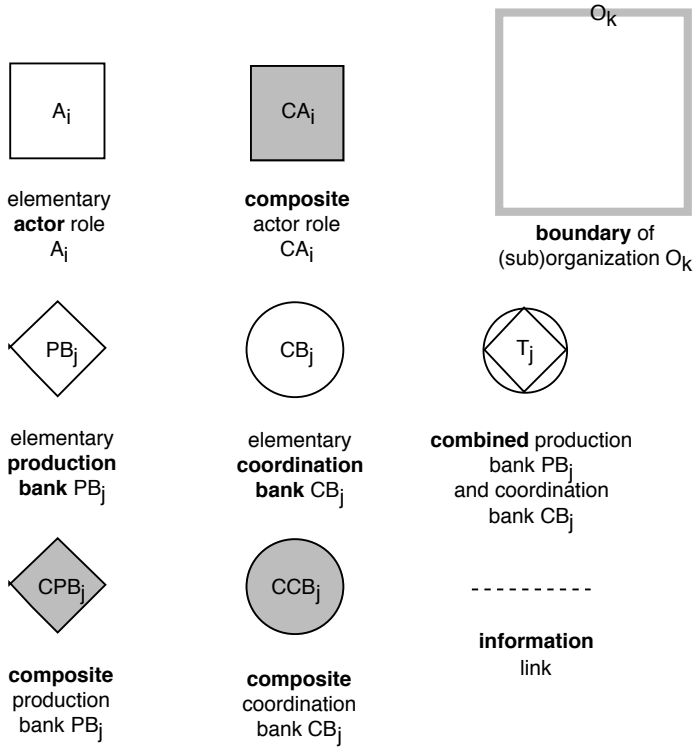
ABD legend



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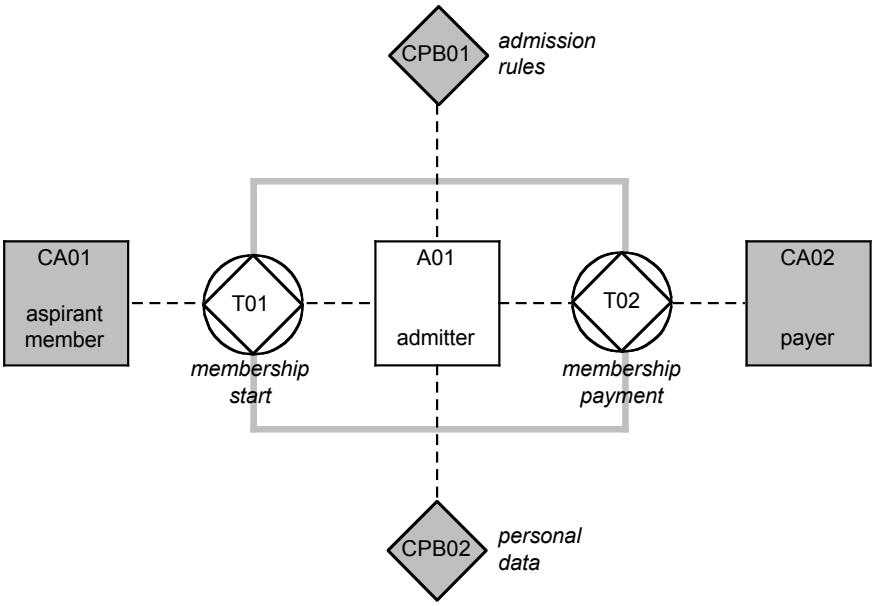
Volley: Actor Bank Diagram



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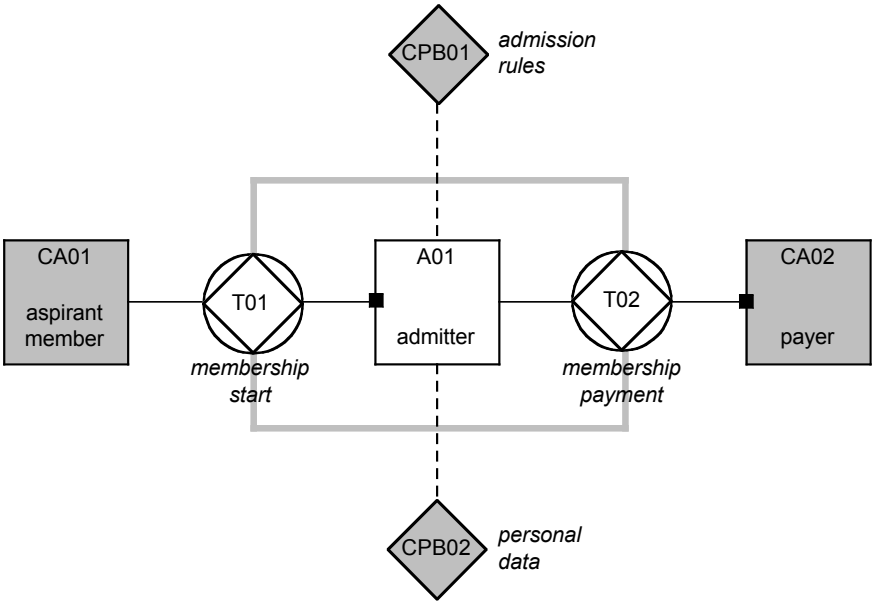
Volley: Organization Construction Diagram



Volley: Bank Contents Table

bank	fact type / object type
PB01	MEMBERSHIP
	the member of M is P
	membership M has started to exist
PB02	*the first fee for membership M is paid*
CPB01	minimal_age
	annual_fee
	maximum_number
CPB02	PERSON
	birth_date

What benefits does DEMO offer?

- **Essential** - DEMO extracts the ontological essence of an organization from its realization and (technology dependent) implementation
- **Complete** - the generic (socionomic) pattern of the DEMO transaction warrants completeness of the ontology
- **Modular** - DEMO presents organizations as compositions of universal 'atomic' and 'molecular' building blocks
- **Coherent** - The aspect organizations (ontological, infological, datalogical) of DEMO constitute an integrated whole
- **Consistent** - The common core of the distinct aspect models of DEMO warrants consistency
- **Objective** - There is no room for alleged 'creativity'
- **Participative** - The DEMO architect is a facilitator. The work is actually done in a learning process of the business people
- **Optimal** - DEMO projects costs much less in all resources (people, time, money).

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Want to know more ?

www.demo.nl

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