The Semantic Object Model (SOM)
The Semantic Object Model (SOM) Method

- Modelling Method developed in the 1990s by FERSTL and SINZ, University of Bamberg

- „comprehensive, integrated and rigor modelling approach“

- Relevance
  - Strategic planning of a complete corporate system
  - Development of distinct information systems

- Paradigms
  - Object Orientation
  - Coordination with Transactions
  - Task model
  - System Theory
The corporation is seen as a system and therefore has structural and behavioral aspects.

External perspective:
Open, goal-oriented, social and technical system.

Internal perspective:
Distributed system, consisting of autonomous, loosely coupled objects cooperating to achieve a higher goal.
Enterprise Architecture

- To manage the complexity of the model corresponding to the object system (i.e. corporation and its environment comprising the modelling scope) it is divided in different layers.
- Each layer consists of a partial model of the object system.
- All partial models and its relationships form the Enterprise Architecture.

Procedure Model (Instructions)

- Describes the process of the model creation.
- Distinction of different phases.
- Each phase uses different model types.
1. Modelling Layer: Outer perspective of the corporate system

2. Modelling Layer: Inner perspective of the corporate system

3. Modelling Layer: Resource specification
1. Modelling Layer: Plan of the Corporation

- Partial Model from the *External Perspective of a Corporation*

- Specification of the global corporate task
- Distinction between *universe of discourse* and *universe of environment*
- Specification of the corporation’s substantive goals (what?) and objectives (how?)
- Specification of the corporate relationships between universe of discourse and universe of environment
- Specification of the resources needed

- Partial Model from the *Internal Perspective of a Corporation*

- Specification of a solution process to implement the Plan of the Corporation

- Idea of Business Processes: Self-coordination (through transactions) of corporate objects that form a corporate system in order to achieve a higher goal

- *Client-/Server-Paradigm*: Client-Process asks Server-Process to realize/produce a service/product/payment

- Stepwise refinement of business processes

- Modelling happens strictly on task-layer and not on task-performer-layer
3. Modelling Layer: Resource Model

- Partial model of the organizational structure, the information systems, and the facilities (machines, premises) of a corporation

- Specification of the organizational structure (e.g. organization chart)

- Specification of the information systems (Information systems as object oriented, distributed systems)

- Specification of facilities
The Enterprise Architecture comprises relationships between the three partial models.

Example:
- Modification of objective (1. Modelling layer): Reduction of cost prescriptions (e.g. for a business unit)
- Business Process Re-Design to lower costs (2. Modelling Layer)
- Lower resource consumption (3. Modelling Layer)
Different Views in the SOM Procedure Model (Instructions)

Structural Views
- Object System
- Interaction Scheme (IAS)
- Scheme of Conceptual Objects (SCO)

Behavioral Views
- System of Goals and Objectives
- Process Event Scheme (PES)
- Scheme of Process Objects (SPO)
1. Layer: Object System and System of Goals and Objectives

- **Structural View → Object System**
  - Discrimination in universe of discourse and universe of environment and their Corporate relationships
  - Textual description (informal model)

- **Behavioral View → System of goals and objectives**
  - Description of goals and objectives, strategies and framing conditions to their operationalization
  - Textual description (informal model)
1. Layer: Object System and System of Soals and Objectives – Example

**Object system**
- Accommodation with a given capacity of single and double rooms in different categories (e.g. economy, business, executive)
- Service: Provision of rooms and breakfast
- Guests book rooms directly at the tourist center
- For public security guest registration is obligatory

**System of goals and objectives**
- Goal: Accommodation of guests
- Objective: Combination of turnover and profit maximation
- Strategy: „Hotel Garni“
- Marketing Strategy: Combination of direct marketing and marketing with an intermediary
- Framing conditions: ruled by law

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2. Layer: Business Process Model

- **Structural View**
  - **Products, payments and services view:** A business process creates/processes products and/or services and/or payments for a contracting business process, which themselves contract other business processes.

- **Control View:** Coordination of objects involved in service/product provision by the use of transactions
  - **Negotiation Principle** (non-hierarchical coordination)
  - **(Closed Loop) Control Principle (Cybernetics)** (hierarchical coordination)

- **Model type:** *Interaction Scheme (IAS)*
2. Layer: Business Process Model

- Behavioural View → Procedural View
  - *Event-driven* processing of tasks that are associated with the coorporative objects and executed in processes

- Model type: *Process Event Scheme (PES)*
2. Layer: Business Process Model - Example

- **Structural View (IAS)**

  - Legend
  - Environmental object
  - Discourse object
  - Transaction

- **Behavioural View (PES)**

  - Legend
  - Task
  - Create
  - Receive
  - Internal Event
  - Transaction

  - Accommodation System
    - E: Public Security
    - E: Accommodation

  - Guest
  - Police
  - E: Accommodation

  - E: Public Security

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Excursion

Corporate objects in SOM
Transactions in SOM
Involves the concept of corporate task

Outside view

- Task object (changed while processing the task)
  - Consists of attributes of the internal object memory as well as incoming and outgoing transactions (products, services, payments), control
- Goal as well as one or more objectives
- Pre- and Post-Events

The execution of tasks transforms the task object´s pre-condition to a post-condition
The goal defines the desired post-conditions (WHAT has to be done)

**Internal view**
- Describes HOW and by which MEANS a task has to be performed
- Describes the solution procedure
- Relates to task performers
**Corporate Object**: Task cluster operating on the same task object (tight coupling) and pursuing the same goals and objectives

(Lose) coupling of two Corporate objects by means of *transactions*

- Communication channel between two objects
- For execution (product, service, payment) or control purposes
- Connection of internal object memories of the task objects
**Transactions (Cont.)**

- Transport product-/service-/payment-packages and control messages
- Product-/service-/payment-packages and control messages are bound to events
  - The event of a incoming package or message triggers, as a pre-event, the execution of a receiving object´s task
  - Task execution can result in post-events, again bound to packages, which in turn are send to other receiving objects
Coordination by means of Transactions in SOM

Refinement of transactions to reveal the coordination of corporate objects

**Negotiation Principle:**

Decomposition of transactions in:
- Initiating Transaction $T_i$
- Contracting Transaction $T_{ca}$
- Executing Transaction $T_e$

**Closed Loop) Control Principle**

- Object decomposition
  - Controller object
  - Controlled object
- Transaction decomposition
  - Control Transaction $T_{cl}$
  - Feedback Transaction $T_f$
Replacement Rules for Objects and Transactions

Replacement rules for object decomposition

1. \( O ::= \{ O', O'', T_d (O', O''), [ T_f (O'', O') ] \} \)
2. \( O ::= \{ O', O'', [ T (O', O'') ] \} \)
3. \( O ::= \{ \text{spec } O' \}^+ \)
4. \( O' | O'' ::= O \)

Replacement rules for transaction decomposition

5. \( T (O, O') ::= [ [ T_i (O, O') \text{ seq} T_{ca} (O', O) \text{ seq} T_e (O, O') ] \)
6. \( T_x ::= T_x \{ \text{seq } T''_x \}^+ | T_x \{ \text{par } T''_x \}^+ \)  
   (für \( x = i, ca, e, cl, f \))
7. \( T_x ::= \{ \text{spec } T'_x \}^+ \)  
   (für \( x = i, ca, e, cl, f \))
8. \( T_i | T_{ca} | T_e ::= T \)
9. \( T_{cl} | T_f ::= T \)

Legend

::= Replacement
[] Optional
| Alternative
{} Set
{}* Recurrence (1,n)
{} Recurrence (0,n)
seq Enactment in sequence
par Enactment in parallel
spec Specialization

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End of Excursion

Corporate objects in SOM
Transactions in SOM
2. Layer: Business Process Model – Example

Structural View (IAS)

Decomposition with rule (5)
2. Layer: Business Process Model – Example

Decomposition

Structural View (IAS)

Object decomposition with rule (2)
2. Layer: Business Process Model – Example

Decomposition

Structural View (IAS)

Transaction decomposition with rule (7)

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2. Layer: Business Process Model – Example

Decomposition

Structural View (IAS)

Transaction decomposition with rule (7)

Transaction decomposition with rule (7)
2. Layer: Business Process Model – Example

**Behavioural View (PES)**

Decomposition analogous to IAS

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2. Layer: Business Process Model – Example

“Second” Decomposition

Structural View (IAS)

Transaction decomposition with rule (5)

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2. Layer: Business Process Model – Example

“Second” Decomposition

Structural View (IAS)

Transaction decomposition with rule (6) and (5)
2. Layer: Business Process Model – Example

"Second" Decomposition

Structural View (IAS)

Object decomposition with rule (1)
2. Layer: Do’s and Don’ts

- Transaction decomposition before Object decomposition
- Create flat closed loop control hierarchies
- Mind completeness of negotiation structure
- No transaction without a relation to a product/service/payment
- Separate task layer and task execution layer
  → No „instances“ of any kind in a business process model, i.e. they must not contain concrete documents, existing information systems or persons
  → Why? This creates degrees of freedom

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3. Layer: Specification of Information Systems

- Identification of possible degree of automation of tasks and transactions (grey)
- Identification of effective degree of automation of tasks and transaction (black)
3. Layer: Specification of Information Systems

- Example: Tasks and transactions of the corporate object: “Reception”
- Potential for automation in some tasks and transactions
3. Layer: Specification of Information Systems

- The IAS and PES models on the Business Process layer are transformed into strictly object orientated software design models on the Information System layer.
- The Conceptual Object Model (COS) contains Conceptual Object Types (COTs) representing data objects (analogue to Entity Beans).
- The Process Object Scheme (POS) contains Process Object Types (POTs) controlling the interaction of COTs (analogue to Session Beans).
Some normative statements

- SOM has its strengths on the Business Process Model Layer providing a structural makro-view on business processes of a corporation.
- For the description of detailed, operational (low-level) processes modelling approaches like EPCs and BPMN have clear advantages (role association, readability, connectors, annotation of documents, etc.) to PES.
- SOM is an top-down approach adequate to create normative, ideal process models.
- The rigor character of SOM is a good „teacher“ for precise and proper business process model design and interpretation.
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