Day 3: Modeling and ERP Reference Architectures
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Enterprise Reference Architectures

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ERP Methodology and Project Management
“Everything should be made as simple as possible, but not simpler”
– Albert Einstein
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Agenda

- Modeling Theory
- Reference Architectures
- ARIS Reference Architecture as a commercial example utilized by SAP
Definitions

- **Enterprise**: a complex set of business processes that can be designed to accomplish a specific set of objectives.

- **Architecture**: 
  - A description (often graphical) of the structure of something.
  - A structured plan, a framework on the basis of which a product or an organization of an enterprise can be constructed.

- **Reference model**: a general model that can be used as a base to derive other models from.

- **Reference Architecture**: is a structured set of models which represent the building blocks of the system.
Why we need ERP Reference Architectures

- ERP systems are complex and difficult to understand how they operate.
- A reference architecture is a model that describes ERP systems – helps people understand how they work.
- Use of reference architectures for:
  - Business Process Reengineering (both ‘AS-IS’ and ‘TO-BE’ modeling)
  - Training
  - Configuration
- Reference architectures capture, standardize, and represent the commonalities found in business process reengineering and enterprise integration projects (Vernadat 1996).
- Characterize the best-in-class management practices and software solutions; i.e. knowledge management.
- Inclusion of all elements.
- Leverage the previous work done in enterprise engineering; i.e., learning.
## Models

- An abstract representation of reality that excludes much of the world’s infinite detail.
- The purpose of a model is to reduce the complexity of understanding or interacting with a phenomenon by eliminating the detail that does not influence its relevant behavior.
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Abstraction
Modeling Point #1

- Modeling is the ‘art’ of abstraction, knowing what to include in model and what to leave out.
A model reveals what its creator believes is important in understanding or predicting the phenomena modeled.
But…Africa is more than 10 times larger than Greenland!

Mecator’s Projection
Peterson’s Projection: Area Accurate
Modeling Point #2

- All models are built with a purpose, the purpose is determined by the model creator.
- Standard models have built in purposes (for example, UML activity diagrams or role activity diagrams).
Figure 1. Front view of physical object
Figure 2. Two possible top views for the same front view
<table>
<thead>
<tr>
<th>CIMOSA</th>
<th>ARIS</th>
<th>Zachman</th>
<th>Curtis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Control</td>
<td>Data</td>
<td>Function</td>
</tr>
<tr>
<td>Information</td>
<td>Data</td>
<td>Process</td>
<td>Behavior</td>
</tr>
<tr>
<td>Organization</td>
<td>Function</td>
<td>I/O</td>
<td>Organization or resource</td>
</tr>
<tr>
<td>Resource</td>
<td>Organization</td>
<td></td>
<td>information</td>
</tr>
</tbody>
</table>
Enterprise Views

- A Reference Architecture for an ERP system requires the following views:
  - Information or Data view – describes the data structure of the entities or objects in the system.
  - Function View – describes the functions supported by the system (what the system does).
  - Process View – describes how the system completes the functions.
  - Organization View – describes how the enterprise is organized.
Modeling Point #3

- Systems tend to be complex, our models only abstract limited parts of the entire system (called a view).
- You need multiple views to understand the entire system. We use decomposition, but instead of a hierarchy into views.
- Views must be consistent!
Enterprise Modeling

- Enterprise modeling has to fulfill several requirements to achieve efficient and effective enterprise integration:
  - provide a modeling language easily understood by non-IT professionals, but sufficient for modeling complex industrial environments.
  - provide a modeling framework which:
    - covers the life cycle of enterprise operation from requirements definition to end of life.
    - enables focus on different aspects of enterprise operation by hiding those parts of the model not relevant for the particular point of view.
    - supports re-usability of models or model parts.
The Architecture for Information Systems (ARIS) developed in Germany and adopted by SAP.

- Adheres to enterprise concepts found in CIMOSA, GRAI, and other RA.
- Uses Event Process Chains to model processes.
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ARIS

Organizational view

Executive mgmt

Materials mgmt

Disposition

Inventory

Sales

Data view

Control view

Customer

Offer

Request

Request received

Request processing

Sales

Request processed

Offer processing

Request processing

Check Credit worthiness

Determine delivery date

Sales processing

Offer processing
**Event Process Chains**

- Event Driven Process Chains (EPC), which are one of the central components of the Architecture for Integrated Information Systems (ARIS) (Scheer 1995).
- Used by SAP in modeling business processes supported by their ERP package SAP R/3.
- EPC depict several important relationships in a business process.
  - Control Flow depicted as a sequence of event-function-event linkages.
  - Information flow which specifies where data is created, read, updated, or deleted by a function.
  - Organization assignment showing who does the function.
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CASE Tool based on EPC
### EPC Constructs

<table>
<thead>
<tr>
<th>Construct</th>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event</td>
<td><img src="event.png" alt="Event Symbol" /></td>
<td>An event describes a change of state in the system.</td>
</tr>
<tr>
<td>Function</td>
<td><img src="function.png" alt="Function Symbol" /></td>
<td>A function describes the transformation from an entry state to a target state.</td>
</tr>
<tr>
<td>Link Operators</td>
<td><img src="link.png" alt="Link Operators" /></td>
<td>The link operators describe the logical connection between events and functions or process paths.</td>
</tr>
<tr>
<td>Process Path</td>
<td><img src="process.png" alt="Process Path Symbol" /></td>
<td>A process path describes the link to another process.</td>
</tr>
<tr>
<td>Organization</td>
<td><img src="organization.png" alt="Organization Symbol" /></td>
<td>An organization describes who is responsible for completing the function.</td>
</tr>
<tr>
<td>Information</td>
<td><img src="information.png" alt="Information Symbol" /></td>
<td>An information object describes a real-world data structure (e.g., order form).</td>
</tr>
<tr>
<td>Information Flow</td>
<td><img src="flow.png" alt="Information Flow Symbol" /></td>
<td>An information flow describes either the creation, read, update, or deletion of the information object.</td>
</tr>
<tr>
<td>Control Flow</td>
<td><img src="control.png" alt="Control Flow Symbol" /></td>
<td>The control flow connects events and functions to show the sequence of activities.</td>
</tr>
<tr>
<td>Assignment</td>
<td><img src="assignment.png" alt="Assignment Symbol" /></td>
<td>The organization unit assignment shows who is responsible for completing the function.</td>
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</tbody>
</table>
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EPC for Latin American PrePaid Telephone Cards
Summary

- Reference Architectures describe how an ERP system is organized and operates.
- SAP makes the greatest usage of reference architectures, but other vendors use them as well.
- The reference architecture is used to configure, understand, and drive process redesign efforts.