Enterprise Architecture Management

Introduction & sebis Research Results

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www.matthes.in.tum.de
Our research agenda since 2002: Socio-technical innovations

Systems of Systems - Enterprise Architecture Management

Social Software

Transfer Projects

Domain-Specific Software Architectures
EAM research cannot be done in an university lab only
Today’s application landscapes consist of $10^2 - 10^3$ networked information systems

- Complexity ~ number of relationships
- IT agility does not keep pace with the increasing dynamicity of the business
- Number of services >> number of applications (smaller granularity + versioning)
- Extended enterprise: Coalitions, mergers, carve-outs, …
Application landscape ⇔ city

Shared characteristics
- networked system of semi-autonomous systems
- alive, mostly growing, unbounded lifetime
- people are key elements of the system
- created and managed by people
- to be financed by people
- a long-term balance of interests has to be achieved
- a holistic and long-term perspective is required (as-is, plan, to-be)
- heterogeneity: managed core & evolutionary periphery

Challenges specific to application landscapes
- documentation of **ownerships** and derived **rights and obligations**
- system benefit vs. individual benefits ➔ value & utility functions
- shared vocabulary for communication ➔ holistic view
- problem-specific abstractions to master the inherent complexity ➔ diagrams and views
Application landscape management requires a holistic view

- Technical, social and economic aspects
- Layers and crosscutting concerns
- Relationships are more important than element details (has, consists of, depends on, uses, controls, owns, produces, consumes, …)

⇒ Enterprise Architecture

Where to start? Which level of detail? Best practices?
The evolution of an application landscape can be improved by supporting management processes

**IT-Governance Processes**

What are successful governance structures & management practices?
**Definition: Enterprise Architecture Management**

**EA management** is a continuous and self-maintaining management function seeking to improve the alignment of business and IT in an (virtual) enterprise. Based on a holistic perspective on the enterprise furnished with information from other enterprise-level management functions, it provides input to, exerts control over, and defines guidelines for these enterprise-level management functions. The EA management function consists of the activities envision EA, document EA, analyze EA, plan EA, and enforce EA.

- **Envision EA** is concerned with creating a target (ideal) EA based on the business and IT strategies that the enterprise seeks to implement.
- **Document EA** is concerned with creating a description of the current (as-is) EA.
- **Plan EA** derives intermediary architecture plans (to-be EAs) that are realized by corresponding projects.
- **Analyze EA** is responsible for making the architectures comparable to prepare a subsequent decision on the architecture to pursue.
- **Enforce EA** provides EA deliverables, which are used to steer, guide, and influence other enterprise-level management processes.

For more than 44 other definitions see [http://www.matthes.in.tum.de/wikis/sebis/ea-definitions](http://www.matthes.in.tum.de/wikis/sebis/ea-definitions)
Architecture
Fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution.

Architecture description
Collection of products to document an architecture and is addressed to the system’s stakeholders to answer their architectural concerns about the system. An architectural description is organized into one or more views of the system, thereby each view addresses one or more concerns of the stakeholders.
Outline

1. Introduction & Overview

2. Research results 2002-2009
   - Software cartography & SoCaTool
   - EAM tool surveys
   - EAM pattern catalog

3. Research topics in Enterprise Architecture Management
Principles of software maps illustrated by example

The layering principle
- Problem-specific map type (base map)
- Rule-based layout of visual elements
- Hide / show details based on layers

key performance indicators
information flows
application systems
base map

See [http://wwwmatthes.in.tum.de/wikis/sebis/syca](http://wwwmatthes.in.tum.de/wikis/sebis/syca) for more information
Information visualization on software maps (1)

Legend

**Map Symbols**

- **A**: Organizational Unit
- **B (1)**: Business Application

- **Conforms to architectural standards**
  - Yes
  - No

**Visualization Rules**

- **A**: Organizational Unit hosting Business Application

<table>
<thead>
<tr>
<th>Munich</th>
<th>Hamburg</th>
<th>Garching</th>
<th>London</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Shop (100)</td>
<td>Product Shipment System (Germany) (400)</td>
<td>Inventory Control System (200)</td>
<td>Monetary Transactions System (Great Britain) (350)</td>
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<tr>
<td>Human Resources System (700)</td>
<td>POS System (Germany/Munich) (1500)</td>
<td>POS System (Germany/Hamburg) (1620)</td>
<td>Customer Complaint System (1300)</td>
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<tr>
<td>POS System (Germany/Munich) (1600)</td>
<td>POS System (Germany/Hamburg) (1720)</td>
<td>Price Tag Printing System (Germany/Hamburg) (1730)</td>
<td>POS System (Great Britain) (1650)</td>
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<td>Fleet Management System (900)</td>
<td>Supplier Relationship Management System (1200)</td>
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<tr>
<td>Monetary Transactions System (Germany) (300)</td>
<td>Document Management System (1100)</td>
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<tr>
<td>Accounting System (500)</td>
<td>Worktime Management (Germany) (1320)</td>
<td></td>
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</tr>
<tr>
<td>MIS (1300)</td>
<td>Worktime Management (Germany/Hamburg) (1320)</td>
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<td>Costing System (600)</td>
<td>Campaign Management System (1500)</td>
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<tr>
<td>Financial Planning System (1400)</td>
<td>Customer Relationship Management System (2100)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Information visualization on software maps (2)

Application does not conform to architectural standards

Application conforms to architectural standards

> 99,5 % // 99,5 – 99,0 % // < 99,0 %

Availability per day

Online Connector

Offline Connector

Manual Connector

Response time in seconds

Online Connector

Offline Connector

Manual Connector
SoCaTool creates software maps based on customizable layout rules

A Model of a System of Systems
relevant elements, their properties, and relationships between them

Information Model
classes of elements, possible properties, and possible relationships

A Meta Model
classes, properties, and relationships

SoCaTool

Selection, Transformation, and Layout Rules

A Software Map Model
classes of map elements, possible properties, and possible relationships

A Software Map
areas, lines, layers, their properties (form, size, position, color, …) and relationships between them

A based on B

A → B

Data flow from A to B

A → B
Visualizing and interpreting metrics on a map

Legend

- Grey rectangle: domain
- White rectangle: subdomain
- Colored rectangle: application
- Color of rectangle:
  - serviceAvailability: high               low
- Size of rectangle: small ←→ large
  - failureImpact: low                    high

Identify critical business applications
- large and red
Visualizing cost and benefit of a change proposal

Legend
Map Symbols
- Trading
- CUS

Value of effort indicator:
- low
- high

Effort indicator:
- low
- high

Platform named Trading
Domain named CUS

Efficiency of average Service Availability

Visualization Rules
- Domain is deployed on Platform
- Effort indicator describes a platform-specific effort

Platform named Trading
Domain named CUS
Efficiency of average Service Availability

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EAM
Introduction & Overview

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EAM
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Outline

1. Introduction & Overview
2. Research results 2002-2009
   - Software cartography & SoCaTool
   - EAM tool surveys
   - EAM pattern catalog
3. Research topics in Enterprise Architecture Management

See [http://www.matthes.in.tum.de/wikis/sebis/eamts2008](http://www.matthes.in.tum.de/wikis/sebis/eamts2008) for more information
# Tool selection based on customer interested

List of 2008 compared to 2005

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>alfabet AG</td>
<td>planningIT</td>
</tr>
<tr>
<td>IDS Scheer</td>
<td>ARIS IT Architect</td>
</tr>
<tr>
<td>Telelogic</td>
<td>System Architect</td>
</tr>
<tr>
<td>Troux Technologies</td>
<td>Troux Transformation Platform</td>
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<tr>
<td>* IDS Scheer</td>
<td>ARIS ArchiMate Modeler</td>
</tr>
<tr>
<td>* Hewlett Packard</td>
<td>Mercury Project and Portfolio Management Center</td>
</tr>
<tr>
<td>* Casewise</td>
<td>Corporate Modeler Suite, IT Architecture Accelerator</td>
</tr>
<tr>
<td>* IBM</td>
<td>Rational Software Architect</td>
</tr>
<tr>
<td>MEGA International</td>
<td>MEGA Modeling Suite</td>
</tr>
<tr>
<td>BOC</td>
<td>ADOit/ADOxx</td>
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<tr>
<td>Adaptive</td>
<td>Adaptive EAM</td>
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<tr>
<td>Metastorm</td>
<td>Metastorm ProVision</td>
</tr>
<tr>
<td>Embarcadero</td>
<td>Embarcadero EA/Studio</td>
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<tr>
<td>BEA AquaLogic</td>
<td>Enterprise Repository</td>
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<tr>
<td>CA</td>
<td>Clarity</td>
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<tr>
<td>Comma Soft</td>
<td>infonea</td>
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<tr>
<td>Agilense</td>
<td>EA WebModeler</td>
</tr>
<tr>
<td>QualiWare</td>
<td>EAM Suite</td>
</tr>
<tr>
<td>Primavera</td>
<td>ProSight</td>
</tr>
<tr>
<td>process4.biz</td>
<td>process4.biz</td>
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<tr>
<td>Avolution</td>
<td>ABACUS</td>
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<tr>
<td>Sparx Systems</td>
<td>Enterprise Architect</td>
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<tr>
<td>ASG</td>
<td>ASG Enterprise Management/Rochade</td>
</tr>
<tr>
<td>pulinco</td>
<td>TopEase Suite</td>
</tr>
<tr>
<td>Visible Systems Corporation</td>
<td>Visible Enterprise Products</td>
</tr>
</tbody>
</table>
Evaluation process and evaluation criteria

9 tools evaluated by 3 teams, project duration: 12 months

**Functional Evaluation**
- Questionnaire processed by each vendor
- Tool test based on a catalog of functional scenarios

**Management Task-Oriented Evaluation**
- Tool test based on a catalog of EAM scenarios
- One scenario per EA management task

Final evaluation based on documented results (380p)
→ Ranking of the tools for each of the **8 + 9 dimensions**
Qualitative results of EAMTS 2008

- The out-of-the-box functionality of the tools has improved significantly
- No specific SOA support
- Many tools cannot derive the planned landscape from the as-is landscape and an existing project portfolio
- Limited versioning capabilities
- Significant differences in the approaches to managing model histories (revisions)
- Collaboration support has been enhanced significantly
  - triggering & notification
  - web-based access (read & write)
  - customizable workflows
- There is no common (semantic) format for information exchange between specialized tools
- There is no shared understanding of the meta model for EAM

[Ma08]
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Introducing EAM in an enterprise is a challenge: Lack of standardized EAM viewpoints

**Software Engineering**: Established viewpoints for recurring and known problems
- modularity, deployment, interaction, …

**Enterprise Architectures**: Emerging modeling languages and viewpoints, e.g.
- ArchiMate (http://www.archimate.com)
- Softwarekartographie (http://www.softwarekartographie.de)

Many organization-specific viewpoints:
- rarely documented
- visibility limited to a single organization
Introducing EAM in an enterprise is a challenge: Information models are too complex

Specific examples:
- ~ 50 classes (vendor A)
- ~ 54 classes (vendor B)
- ~ 220 classes (vendor C)
- ~ 470 classes (vendor D)
- At least twice as many associations
- Numerous attributes per instance
Introducing EAM in an enterprise is a challenge:
EA frameworks provide only limited support
Peer knowledge exchange advances EAM

- EUROFORUM, IIR, NETACAD conferences and seminars
- EAM Tage, act consulting
- SOA Innovation Lab, Deutsche Post
- CEISAR, Paris
- Systemkartographie Stammtisch, sebis
- IT Management Days, iteratec
- Cap Gemini sd&m EAM events
- EAM Think Tank, Syracom
- ...

How to capture, disseminate and apply this empirical knowledge?
Contributors to the EAM pattern catalog
The idea behind the EAM pattern catalog

Tailor the EAM to the specific situation (*pains*) of the enterprise and follow an incremental strategy based on **EAM patterns** representing proven practices.

Systematically document the dependencies between

- **individual management concerns**,  
  Which concern is relevant for which stakeholder?

- **methodology patterns (M-Pattern)**,  
  Which processes and roles are required to address a concern?

- **viewpoint patterns (V-Pattern)**, and  
  Which viewpoints help stakeholders to collaboratively perform the activities?

- **information model patterns (I-Pattern)**  
  Which information has to be available to generate a view?

- **anti patterns**  
  Which solutions have shown not to work in practice?

Draw attention to the consequences implied by a pattern (labor, required information, *political* resistance, …)
Overview of the pattern catalog version 1.0

- Basis: literature, experience from sebis research projects, structured interviews of 25 enterprise architects
- Selection based on relevance and adoption by an extensive online questionnaire
  ➔ 43 concerns, 20 M-Patterns, 53 V-Patterns, and 47 I-Patterns
EAM Pattern Catalog Wiki

The objective of the EAM Pattern Catalog is to complement existing Enterprise Architecture (EA) management frameworks, which provide a holistic and generic view on the problem of EA management, and to provide additional detail and guidance needed to systematically establish EA management in a step-wise fashion within an enterprise.

The EAM Pattern Catalog identifies the dependencies between

» individual management concerns (Which goal is to be achieved for which stakeholders?),
» management methodologies (Which activities are required to address a given concern?),
» supporting viewpoints (Which diagrams, figures, tables, listings, etc. help stakeholders to collaboratively perform these activities?), and

» information models (Which information is required to generate a particular viewpoint?).

Methodologies, viewpoints and information model fragments are called EAM patterns: They describe possible solutions for recurring problems that can and may have to be adapted to a specific enterprise context.

The EAM Pattern Catalog identifies best practices by focusing on concerns, methodology patterns (M-Patterns), viewpoint patterns (V-Patterns) and information model patterns (I-Patterns), which are considered relevant by experienced practitioners and are also supported by literature. Anti patterns document recurring solutions, which have proven not to work in practice in order to prevent typical mistakes in EA management. These patterns are accompanied by a comprehensive glossary defining the concepts used therein.

The EAM pattern graph shows the dependencies between Concerns, M-Patterns, V-Patterns, and I-Patterns. Its evolution can be seen by clicking the following image.
Using the EAM pattern catalog

1. Develop enterprise-specific EA management processes, governance structures, and meta models
2. Evolve and assess existing EA management approaches in an enterprise
3. Conduct scientific research
   - Evolve and validate individual patterns
   - Develop domain-specific patterns (financial sector, health care, …)
   - Analyze relationships between management patterns, maturity models, …

- Over 1400 downloads of version 1.0, released February 2008, 300+ pages
- 572 registered users
- 50 visitors per day
- [http://www.matthes.in.tum.de/wikis/eam-pattern-catalog/home](http://www.matthes.in.tum.de/wikis/eam-pattern-catalog/home)
Use of enterprise architecture management frameworks

- There seems to be nobody using a framework out of the box
- Initially, many organizations look at Zachman or TOGAF

Service-oriented architecture (SOA)

- SOA is relevant, but only a few companies are really actually embracing it
- Opinions in respect to SOA
  - We are migrating to SOA
  - SOA is nothing new, we have been doing this for a long time
  - We are waiting for experiences of other companies or results of pilot projects
  - Telecommunication companies have embraced SOA early

Metrics and KPIs

- Basically an interesting subject
- Only vague ideas of relevant quality attributes for application landscapes
- Metrics systems at the application landscape level are rarely implemented
  - Field is still immature
- People fear the “control” aspect of metrics
Who is the driver of EAM?

- EAM is still very much IT driven
- Business involvement is regarded as important
- Getting business involved is often difficult
  - There is no best practice on how to achieve it

Information gathering and data quality

- How can data about an enterprise architecture be gathered
  - Projects have to update data during their execution
  - Data is updated in certain intervals (e.g. half a year)
  - ...
- Currently no best practice has been established
- High interest in automated data gathering
- CMDB, systems management

Tendency: business requirements overrule requirements from enterprise architecture management
Outline

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Ideas, feedback & partners welcome!
Topics of interest in EAM (2010+)

- **Patterns in enterprise architecture management**
  - empirical knowledge, pattern languages, pattern communities,…
  - Pattern language for EAM (Open access), PEAM workshops

- **Enterprise architecture performance modeling and management**
  - dynamics, KPIs, SLAs, monitoring, simulation, evolution, prediction, 2D/3D visualization,…
  - EA supported strategic performance management models, methods & tools

- **Enterprise architecture management methodology library (EAMML)**
  - best practice methodologies for main activities in EA management ~ ITIL
  - Library with configurable methodologies for EA documentation, planning, analysis,…

- **Languages for enterprise architecture management**
  - languages used for main activities in EA management, e.g. analysis or documentation
  - Integration guidelines and techniques for a holistic EA description language

- **IT transformations triggered by mergers & acquisitions (banking / finance)**
  - understand state of the art, document lessons learned, identify potential for improvement
  - models of federated data landscapes, data migration strategies & methodologies
Thank you for your attention!

More information: [www.matthes.in.tum.de](http://www.matthes.in.tum.de)
Selected literature


More …