Outline

L5-1: Service Innovation (Per Pedersen, NHH)
- An introduction to services, service science, service innovation and new service development

L5-2: Enterprise Architecture and Models (AJB)
- Zachman, TOGAF, DODAF-MODAF-NAF (UPDM)
- VDM – Value Definition Metamodel
- BMM - Business Motivation Model
- BPMN 2.0 and SoaML
- CMPM – Case Management Meta Model
Content

- Enterprise Architecture Modeling with OMG Standards – Implementing Enterprise Architectures via UML Profiles
- EA and the Zachman Framework
- Architectural Frameworks - (IEEE/1471/ISO 42010, ADL, UML 2.x, TOGAF, UPDM (DODAF/MODAF), SoaML (SHAPE), DSLs)
- UPDM
- Service modeling and Service oriented views

- Tool support, Metamodels and UML profiles – No Magic, Magic Draw

Business Model Frameworks – with Modeling support – from NEFFICS

<table>
<thead>
<tr>
<th>Building block</th>
<th>Incremental innovation: 'Do what we do but better'</th>
<th>Radical innovation: 'Do something different'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value proposition</td>
<td>Offering 'more of the same'</td>
<td>Offering something different (at least to the company)</td>
</tr>
<tr>
<td>Target customer</td>
<td>Existing market</td>
<td>New market</td>
</tr>
<tr>
<td>Value chain architecture</td>
<td>Exploitation (e.g. internal, lean, continuous improvements)</td>
<td>Exploration (e.g. open, flexible, diversified)</td>
</tr>
<tr>
<td>Competences</td>
<td>Familiar competences (e.g. improvement of existing technology, HR, organizational system, culture)</td>
<td>Disruptively new, unfamiliar, competences (e.g. new emerging technology, new HR skills, organizational systems, culture)</td>
</tr>
<tr>
<td>Network Partners</td>
<td>Familiar (fixed) network</td>
<td>New (dynamic) networks (e.g. alliance, joint-venture, community)</td>
</tr>
<tr>
<td>Relations</td>
<td>Continuous improvements of existing relations (e.g. channels)</td>
<td>New relations, relationships (e.g. channels physical, digital, virtual, personal)</td>
</tr>
<tr>
<td>Profit formula</td>
<td>Existing processes to generate revenues followed by or incremental processes of retrenchments and cost cutting</td>
<td>New processes to generate revenues followed by or disruptive processes of retrenchments and cost cutting</td>
</tr>
</tbody>
</table>
Building block evolution

- Architecture Vision
- Information Management
- Business Architecture
- Technology Architecture
- Requirements Management
- Operational Models
- Information Policies
- Operational Policies
- Operational Security
- Operational Solutions
- Operational Infrastructure
- Operational Information
- Operational Processes

Service categories

- Infrastructure Applications
- Business Applications
- Application Platform Interface
- Operating System Services
- Network Services
- Communications Infrastructure Interface
- Security
- Transactions Processing
- Location & Directory
- User Interface
- Data Interchange
- International Operations
- Data Management
- Graphics & Image
- Qualities
Why and When: Historical Development of AF’s.

MODAF
Meta-Model (M3) expressed using UML Notation

C4ISR Architecture Framework
v1.0

DoDAF
v1.0

NAF
v1.0

DoDAF
v1.5

MODAF
v1.1

DNDAF
v1.7

MODAF
v1.2

2005

2007

2008

2009

DoDAF
v2.0

DNDAF
v1.7

C4ISR Architecture Framework
v1.0

MACCIS
Norway

1996

1997

2003

2005

2007

2008

2009

Scope of UPDM 1.0
Approved Sept 2008

TOGAF 1 - ...

TOGAF 9

Scope of UPDM 2.0
Started Sept 2009

DODAF 2.0 - viewpoints

Capability Viewpoint
Articulate the capability requirements, delivery timing and deployed capabilities

Operational Viewpoint
Articulate operational scenarios, processes, activities and required services

Services Viewpoint
Articulate the services, activities, processes and their inter-connections and capability requirements and the services delivered to meet these requirements

Systems Viewpoint
Articulate the legacy systems or independent systems, their composition, interconnectivity and content providing for or supporting, this function

All Viewpoint
Articulate the individual viewpoints, interdependencies and relationships

Data and Information Viewpoint
Articulate the data and information handled by the system and the system that operates on this data

Capability Viewpoint
Articulate the capability requirements, delivery timing and deployed capabilities

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Articulate the data and information handled by the system and the system that operates on this data
### EAEA – European Air Traffic Management Enterprise Architecture

<table>
<thead>
<tr>
<th>Strategic View</th>
<th>Operational View</th>
<th>Service-Oriented View</th>
<th>System View</th>
<th>Technical View / Physical Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Problem</td>
<td>Organisation</td>
<td>System</td>
<td>Software</td>
</tr>
<tr>
<td></td>
<td>Opportunity</td>
<td>Human Actor</td>
<td>Interface</td>
<td>Network</td>
</tr>
<tr>
<td>e.g. Performance</td>
<td>e.g. Organisational Structure</td>
<td>Operational Service</td>
<td>Information</td>
<td>Hardware</td>
</tr>
<tr>
<td>Targets Business</td>
<td>e.g. Organisational Structure</td>
<td>Process Model</td>
<td>Information</td>
<td></td>
</tr>
<tr>
<td>Strategies</td>
<td>e.g. Conceptual Information Model</td>
<td>Conceptual Information Model</td>
<td>Information</td>
<td></td>
</tr>
</tbody>
</table>

- e.g. Logical Architecture: AICM, FOIPS
- e.g. Technical Architecture: AIXM, ICIG ICDs
- e.g. Implementation Standards: ATM Infrastructure

<table>
<thead>
<tr>
<th>Programme View</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process / Activities</td>
</tr>
<tr>
<td>Timing</td>
</tr>
<tr>
<td>e.g. Gantt Chart</td>
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</tbody>
</table>

### OMG Model-Driven Architecture (MDA)

See: [www.omg.org/MDA](http://www.omg.org/MDA)
IEEE 1471, ISO 42010

Use of OMG metamodels

- BPMN (BPMN 2.0)
- BMM
- UML 2.0
- SoaML
- OSM
- VDM
- Case Management
- SBVR
- ODM
UPDM coverage

Model Based Systems Engineering and Interoperability

Business Architecture
(SysML Context + BPMN 2.0/BMM)

Enterprise Architecture (EA) for Systems of Systems (UPDM)

System & IT Service oriented Architecture (UML&SysML/SoaML)
What is UPDM? - Summary

- UPDM 1.0 is a standardized way of expressing DoDAF 1.5 and MODAF 1.2 artefacts using UML and SysML
  - UPDM is **NOT** a new Architectural Framework
  - UPDM is not a methodology or a process
  - UPDM 2.0 is scheduled to address DoDAF 2.0, MODAF 1.2, NAF 3.x, and DNDAF 1.7
- UPDM 1.0 was developed by members of the OMG with help from industry and government domain experts.
- UPDM 1.0 has been implemented by multiple tool vendors.
  - Tools supporting UPDM 1.0 are available now.

UPDM: UML Profile for DoDAF and MODAF

- **Context**
  - Stakeholders
    - US DoD
    - UK MOD
    - NATO
    - Canada/Australia
    - OMG, INCOSE
  - OMG
    - XMI, UML, SysML
    - BPMN
    - UPMS, BMM
  - End Users
    - Aerospace
    - Commercial
  - Tool Vendors
    - Software
    - Systems
    - Enterprise

- **Products -- Reports -- Simulations**

NAF Meta Model  DoDAF 1.5 Concepts  CADM 1.5
MODAF Meta Model  DoDAF 2.0 Ontology

UPDM Domain Meta Model
UPDM Profile Meta Model

UPDM Profile & Library

External Reference
Products -- Reports -- Simulations

Transformations

BMM
SoaML
SoaML Extensions
SysML Extensions
SysML
UML4SysML
<<import/merge>>

UJTL
CDD
CONOPS
SF List
LUTL
UPDM - Unified Model for DODAF and MODAF

Acquisition Viewpoint

Technical Viewpoint

Services Viewpoint

Operational Viewpoint

UPDM

Custom Viewpoint

All Views

Systems Viewpoint

Strategic Viewpoint
UPDM – Unified Model for DODAF and MODAF

UPDM RFC - Domain Meta Model Summary
Package structure organizes stereotypes by viewpoint
Multiple viewpoints manage model complexity
Service innovation is inherently multidisciplinary

Knowledge sources driving service innovations...

SSME = Service Sciences, Management, and Engineering

Economic evolution of services

What was occurring during these time periods that may have influenced shifts in economies and changes in business?
What is a service?
Per Wikipedia (2006):

In economics and marketing, a service is the non-material equivalent of a good.

It is claimed to be a process that creates benefits by facilitating either a change in customers, a change in their physical possessions, or a change in their intangible assets.

By supplying some level of skill, ingenuity, and experience, providers of a service participate in an economy without the restrictions of carrying stock (inventory) or the need to concern themselves with bulky raw materials. On the other hand, their investment in expertise does require marketing and upgrading in the face of competition which has equally few physical restrictions.

Service dominant view

- Three primary notions
  1. Co-creation of value
  2. Relationships
  3. Service provisioning
Service Architecture

ESA – Enterprise Service Architecture with BPMN and SoaML
Enterprise SOA

Context for Enterprise SOA

MDA Terms

Business Concerns

- Business Model
- Enterprise Services (e-SOA)
- Roles, Collaborations & Interactions
- Process, Information & Rules

Logical System Model

- Technology Services (t-SOA)
- Components, BPM
- Interfaces, Messages & Data

Technology Specification

- JMS, JEE, Web Services, .NET
- WS*, BPEL, XML Schema

Platform Specific Model

SoaML

- Core
- Service Variability

PIMs for different Architectural Styles

WSDL, WSMO, OWL*, JACK, JADE, JXTA, OGSA, J2EE, CORBA

PSM Implementation Models

J2EE, NetWeave .Net, ...

CIM – PIM - PSM

BPMN  BPDM  BMM  EPC  ...

SoaML-SHA

PIM

System Models

PIMs for different Architectural Styles

Realization Technologies

J2EE, NetWeave .Net, ...
# CIM – PIM – PSM methods

<table>
<thead>
<tr>
<th>Information</th>
<th>Service</th>
<th>Process</th>
<th>Rules</th>
<th>Events</th>
<th>Organization</th>
<th>Goals</th>
<th>NFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2P2M</td>
<td>Total:  1 Sources: COMET-S</td>
<td>Total:  1 Sources: COMET-S</td>
<td>Total:  1 Sources: COMET-S</td>
<td>Total:  1 Sources: OASIS</td>
<td>Total:  1 Sources: SMART, ISE</td>
<td>Total:  1 Sources: SMART, ISE</td>
<td>Total:  1 Sources: SMART, ISE</td>
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<tr>
<td>P2M2PS</td>
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<td>Total:  3 Sources: OSLA, COMET-S</td>
<td>Total:  3 Sources: COMET-S</td>
<td>Total:  5 Sources: ESIM, SCM, SM, SOAD, SOA, ISE, ESOA, COMET-S</td>
<td>Total:  4 Sources: SAE, SM, SOAD</td>
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<td>Total:  1 Sources: SAE, SM, SOAD</td>
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<td>PIM</td>
<td>Total:  10 Sources: ESIM, SCM, SM, SMART, ISE, SAE</td>
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<td>Total:  21 Sources: ESIM, SCM, SMART, SOAD, SOA, ISE, ESOA, OSLA</td>
<td>Total:  7 Sources: SMART, ISE, ESOA</td>
<td>Total:  6 Sources: SMART, ISE</td>
<td>Total:  1 Sources: SMART, ISE</td>
<td>Total:  1 Sources: SMART, ISE</td>
</tr>
<tr>
<td>PIMPS</td>
<td>Total:  1 Sources: SMART, ISE, ESOA, COMET-S</td>
<td>Total:  3 Sources: SMART</td>
<td>Total:  3 Sources: SMART</td>
<td>Total:  1 Sources: SMART, ISE, ESOA, COMET-S</td>
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## CIM – PIM – PSM methods in this INF5120 course

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<th>Information</th>
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<th>Process</th>
<th>Rules</th>
<th>Organization</th>
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<th>NFA</th>
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<tbody>
<tr>
<td>PIM</td>
<td>UML: Class diagram</td>
<td>UML: Activity diagram, sequence diagram, BPMN</td>
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</tr>
<tr>
<td>PIMPS</td>
<td>Objecteering &amp; MOFScript</td>
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</tr>
<tr>
<td>PSM</td>
<td>Java and Web services (XML)</td>
<td>Java and Web services (WSDL)</td>
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CIM – PIM – PSM methods

CIM – PIM – PSM methods in this INF5120 course
Core concept for BMM

BMM Core Concepts
SHAPE project and SoaML

Flexible Business Models
Web Services
Grid
SINTEF

UPMS
SoaML
Agents
P2P
Semantic Web Services
Heterogeneous Platforms

CIM to PIM to PSM

Goals
Business rules
Business processes
Business services
E-contracts

Executable business processes
Service interfaces
Service contracts
Service enactment
Business rules
SLAs
Parameterized services

Executable artefacts:
XSD, WSDL, BPEL
Teams and plans
Resource management
Semantic Web Services

What service-oriented aspects to capture in models

Which metamodels and languages to use

Flexible Business Models
Business metamodels

Transformer (engine)
Transformation rules

Transformation engine
Unified and standardised metamodel for SOA & SHA

Uniform and standardised metamodel for SOA & SHA

Transformer (engine)
Transformation rules

Semantically-enabled heterogeneous SOA platform models

Semantically-enabled heterogeneous SOA platform models
CIM-PIM-PSM Reference Matrix

SoaML Historikk  
(Service oriented architecture modeling language)

- OMG RFP – September 2006
- 3 initial submissions – June 2007
- Merge process in 2008 and 2009
- SoaML 1.0 ferdigstilt desember 2009
- SoaML 1.0 adopteres av OMG i mars 2010
- FTF chairs: Arne J. Berre, SINTEF og Jim Amsden, IBM

http://www.soaml.org
VDM Metamodel

Value Network - Notations
VDM Metamodell

INF5120
"Modellbasert Systemutvikling"
"Modelbased System development"

Lecture 6: 28.02.2011
EPF, SPEM – Software Engineering Metamodels (Brian Elvesæter)

Lecture 7: 07.03.2011
BPMN 2.0

Arne-Jørgen Berre