Web services og SOA – hvordan ser vi for oss bruk i fremtiden?

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Outline

- Hvilke adopsjonsrater og trender ser man i bruk av WS/SOA?
- Hvilke relaterte arkitekturer og teknologier vil introduseres i kjølvannet av WS/SOA?
  - Interoperabilitet og systemintegrasjon
  - SOA referansemodell
  - Web services
  - Teknologiplattformer for SOA
  - Forskning og utvikling på SOA
Interoperabilitet og systemintegrasjon
Rationale for interoperability

- Interoperability is the key to increase competitiveness of enterprises.
- “Enterprise systems and applications need to be interoperable to achieve seamless operational and business interaction, and create networked organizations” – European Group for Research on Interoperability, 2002

Application integration license revenue

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(Source: the Yankee Group 2001)

System implementation budget

- Integration 40%
- Imp. Services 20%
- Software 10%
- Hardware 10%
- Misc. 20%

The cost of non-interoperability are estimated to 40% of enterprises IT budget.
Holistic approach to interoperability

To achieve meaningful interoperability between enterprises, interoperability must be achieved on all layers:

- **Business layer**: business environment and business processes
- **Knowledge layer**: organisational roles, skills and competencies of employees and knowledge assets
- **ICT layer**: applications, data and communication components
- **Semantics**: support mutual understanding on all layers

Interoperability (def.) is “the ability of two or more systems or components to exchange information and to use the information that has been exchanged” – IEEE Standard Computer Dictionary
Motivation

Enterprise
- Challenges
  - Business agility
  - Flexibility and adaptability
- Enterprise architecture frameworks
  + Holistic approach
  + Different views of an enterprise as related (visual) knowledge models
  - Current enterprise architectures are only blueprints

ICT
- Challenges
  - Inflexible and difficult to adapt
  - Enterprise application integration (EAI)
- Service-oriented architecture (SOA)
  + Architectural style
  + Loosely coupled systems
  + Horizontal integration between different business domains
  + Use case oriented service composition
  +/- Web services (enabling technology)

Requirements
- Enterprises require operational enterprise architectures
- ICT solutions must be designed to be inherently interoperable
SOA and integration

- Fundamental change for integration: X <-> Y
  - Pre-SOA: outside, after development
  - Post-SOA: inside, integral part of development / computational model

- Consequences
  - How should integration be done?
  - Innovation and experience
  - Competition, expansion, consolidation

- Not understood:
  - IDC Directions 2006 (3/2/06): SOA important but not understood or deployed as claimed
  - Gartner (2/15/06): “Globally, organizations placing minor emphasis on understanding the role of data integration in SOA and creation of data services at the foundation of their architectures”
**History of integration**

- **1950 – 2006**: Integration = develop then integrate
  - 1950s-1970s: Simple, manual integration
  - 1970s-1980s: Distributed Computing
    - Applications (interoperation)
    - Databases (integrate)
- **1990s**: Business Driven Integration – concepts, technologies, and tools – increased automation, internet-based computing
  - Concepts: Workflows, Processes, Web,
  - Integration solutions blossom (diverge): ETL, EAI, BPM, …
- **2000**: SOA Emerges
  - 2000: Web services
  - 2003: Integration solution evolution accelerates, vendor chaos ensues
  - 2005: Growth in all integration categories
Integration in SOA

- 2006 – 2012: Integration = dominant programming model
  - 2001-2010: Wrapping
  - 2005-2010: Re-Engineering
  - 2006-2008: Consolidation
  - 2006-2008: Research on Semantic SOA
  - 2007-2012: Emergence of SOA Platforms and Solutions
  - 2006-2012: Problem Solving Era: IT/integration relegated to low level function
SOA referansemodell
Service-oriented model

- **Service provider**
  - Provides software applications for specific needs as services.

- **Service requester**
  - A requester could be a human user/application program/another service accessing the service through a desktop or a wireless browser; it could be an application program.

- **Service broker:**
  - A service broker provides a searchable repository of service descriptions.
  - Examples of service brokers are UDDI (Universal Description, Discovery, and Integration).
Extended service-oriented architecture

Role actions
- performs
- publishes
- uses
- becomes

Papazoglou and Georgakopoulos
CACM, Oct. 2003
OASIS SOA Reference Model (RM)
Web services
Web service definition

- **Web service**
  - “Applications identified by a URI, whose interfaces and bindings are capable of being defined, described and discovered as XML artefacts. A Web service supports direct interactions with other software agents using XML-based messages exchanged via Internet-based protocols.” (W3C)
  - [http://www.w3.org/](http://www.w3.org/)

- **SOA ~ architectural style**
- **Web services stack ~ technology/protocol standards**
- **SOA =/= Web services**
The Waves of Client/Server Technology

First Wave
- File Servers
- Groupware
- TP Monitors

Second Wave
- Database Servers

Third Wave
- Distributed Objects
- OMG CORBA
- COM/OLE
- Web/Internet
- Java

Fourth Wave
- Server-side components
- J2EE/EJB
- COM+
- Corba
- MDA, Web Services, .Net
- Service-oriented Architecture
- SOAP, XML
- WSDL/WSFL

Fifth Wave
- Agents, P2P
- FIPA
- Grid

Base Source: Client/Server Survival Guide, 1994
Robert Orfali, Dan Harkey
OS/2 Edition, VNR Computer library + AJB update 2004
 CORBA ORB with IDL

Corba Messaging Service

Event & Notification service

Naming service

Trading service

Security service

Interaction/Presence services

User services (application/process)

Shared Business Services

Data services & Legacy systems

Persistence service

XML, IIOP mapping

Workflow service

Corba Components (CCM)

Concurrency service

Transaction service

Security service

+ real-time/min. CORBA
+ Firewall + QoS + ...

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Web services architecture

- Web services can be used to implement service-oriented solutions.
- They adhere to the set of roles and operations specified by the service oriented model.
- They have also managed to establish a standardized protocol stack.
Web services og port 80

Interessen for Web-tjenester har mye av sitt utgangspunkt i problemet for CORBA, MS DCOM og Java RMI med å slippe igjennom for kommunikasjon med ukjente klienter, på grunn av sperrer i brannmurer.

Det ble raskt oppdaget at port 80 (for http Web-browser) kommunikasjon var åpen i de fleste brannmurer, og man begynte å pakke inn informasjon (tunneling) i meldinger som ble sendt gjennom port 80, først innpakket i HTML, deretter i XML.

Dette gav både en teknologi- og markedsom mulighet som først Microsoft, deretter IBM var tidlig ute med å utnytte og promotere.
WS-* stack to-be

- Simplified version of the to-be WS-* stack
  - Families of related specs not expanded
  - Competing spec families not shown
  - “Historical” or abandoned specs not shown
WS-* stack as-is

- Complete version of the as-is WS-* stack
  - The 3 widely-accepted specs today are the same as 5 years ago
  - BPEL and WS-Security is gaining momentum
  - Orchestration, discovery and brokering do not exist in today’s world
  - In terms of development process, nothing has changed since CORBA
Teknologiplattformer for SOA
SOA Framework: Process + Applications + Data

Enterprise / Information Workplace

Business process and workflow definitions

User Interaction module

User Interaction module

User Interaction module

Business Unit Services

Business service

Business service

Business service

Business service

ESB

Composite Applications

Enterprise Services

Business service

Business service

Business service

Business service

Utility services

Information Fabric

Databases

Files

Devices

Databases

Vertical App

Legacy App

ERP

Custom App

CRM
Enterprise Service Bus (ESB) Core

- New technology: SOA generation EAI + MOM + ...
- Core SOA infrastructure for service-to-service communication, mediation and other SOA / Web service functions
- All integration types including infrastructure
- Vendors: 20 and growing
SOA platform consolidation

- Data and information integration ➔ Information Fabric
  - EII: Enterprise information integration
  - ETL: Extract, transform and load

- Application integration ➔ Integration Suite
  - EAI: Enterprise application integration
  - B2Bg: Business-to-business gateway
  - ESB: Enterprise service bus

- Applications and Processes ➔ Business Process Management Suite
  - BPM: Business process management
  - B2Bi: Business-to-business integration

- Enterprise workplace ➔ Interaction Platform
IBM Websphere
Goal: Composite applications
- Extensions: Adapter, collaboration, analysis, reporting, development, monitoring, contracts, SOA standards, ...
Business process management suite & interaction services

- **Goal:** Continuous process improvement
- **Components:** BPM
  - Human-centric: people-intensive processes
  - Integration-centric: system-intensive processes
Information fabric services

- Goal: Holistic view of data (information virtualisation)
- Components: DBMS, EII + ETL + replication
- Extensions: Distributed meta-data repository, distributed data access, integrated data management
Den ”gode” tjenesten

- Må defineres i et samarbeid mellom forretningsssiden og IT-siden
- Hvordan relatere forretning i forhold til IT – samarbeid på forretningsssidens premisser
Trends

- Consolidation ↔ comprehensive platforms
- Merging of Human Workflow and System Orchestration/Process services
- Integration of Business Rules Engines
- Support for Event Notification services (publish and subscribe)
- Integration of Model-generated workplaces and role/task-oriented user interfaces, user interaction services, portals, and multi-device interfaces
- Explicit use of models (Enterprise and System)
- Enterprise architecture + SOA
Forskning og utvikling på SOA
Pågående prosjekter

- ATHENA (Advanced Technology, Interoperability, Heterogenous Enterprises)
  - Holistisk og tverrfaglig tilnærming til interoperabilitet
    - Virksomhetsmodellering
    - Semantiske teknologier
    - Tjenesteorienterte arkitekturer

- SODIUM (Service-Oriented Development In a Unified framework)
  - Web services og tjenestekomponering

- SWING (Semantic Web-Service Interoperability for Geospatial Decision Making)
  - Semantisk teknologier
ATHENA Interoperability Framework

- **Provided**
  - Enterprise / Business
  - Processes
  - Services
  - Information / Data

- **Required**
  - Enterprise / Business
  - Processes
  - Services
  - Information / Data

- **Model-Driven Interoperability**
  - Collaborative Enterprise Modelling
  - Cross-Organisational Business Processes
  - Flexible Execution and Composition of Services
  - Information Interoperability

- **Semantics**
"Adaptive" service-oriented architecture (ASOA)

ASOA: "Adaptive" service-oriented architecture
SOA: Service-oriented architecture
ASA: Adaptive software architecture
MDD: Model-driven development
PIM: Platform-independent model
PSM: Platform-specific model
PIM4SOA – 4 system aspects

Metamodel for (software) services

Metamodel for (automated software) processes

Metamodel for information

Metamodel for quality of service (QoS)
ATHENA project PIM4SOA architecture & transformations overview

CBP: Collaborative Business Process
PIM: Platform Independent Model
SOA: Service-Oriented Architecture
XSD: XML Schema Definition

BRMF: Business Resource Management Framework
WSDL: Web Service Description Language
BPEL: Business Process Execution Language
SODIUM project
-on heterogeneous service composition
SODIUM solution

Composition Suite

VSCL Editor

VSCL 2 USCL Translator

USCL Engine

Runtime Environment

USQL Engine

Service search (USQL) & model import

USQL

Invoke

SODIUM Repository

Query

P2P/WSDL/OWL-S

P2P Networks

UDDI Registry

LDAP Registry

ebXML Registry

Services

P2P, Web, Grid

SINTEF
VSCL Editor – prototype screenshot

- Composition Studio menu
- Palette with available model element types
- Visual editor with the composition
- Tree view of the composition
- Eclipse project view
- Property view of the currently selected model element
- Local dictionary with imported services, service operations, and data types
- on semantic services

WP1 Geospatial dec.-making use cases

WP2 Service Execution Engine

WP3 Ontologies

UOM (Westfälische Wilhelms-Universität Münster)

WP4 Service Annotation Engine

JSI (Institut Jozef Stefan)

WP6 Development environment

SINTEF

BRGM

IONICSOFT

WP7 Dissemination and Exploitation

NUIG (National University of Ireland Galway)

LFUI (Leopold-Franzens-Universität Innsbruck)
8 SOA challenges

1. **Service identification.** What is a service? What is the business functionality to be provided by a given service? What is the optimal granularity of the service?

2. **Service location.** Where should a service be located within the enterprise?

3. **Service domain definition.** How should services be grouped together into logical domains?

4. **Service packaging.** How is existing functionality within legacy mainframe systems to be re-engineered or wrapped into reusable services?

5. **Service orchestration.** How are composite services to be orchestrated?

6. **Service routing.** How are requests from service consumers to be routed to the appropriate service and/or service domain?

7. **Service governance.** How will the enterprise exercise governance processes to administer and maintain services?

8. **Service messaging standards adoption.** How will the enterprise adopt a given standard consistently?
Teknologiområder for videre forskning på SOA i EUs 7. rammeverk

- Networked European Software & Services Iniative (NESSI)
  - Business Process Management
  - Semantic Technologies
  - Service Engineering
  - Service Oriented Infrastructure
  - Services Sciences
  - Software Engineering
  - Trust, Security and Dependability
  - User Services Interactions
Referanser
Referanser

- Den norske dataforening (DnD)
  - Faggruppen for applikasjonsintegrasjon – metoder og arkitektur
    - Semantisk web (interessegruppe)
  - http://www.dnd.no/
- OASIS SOA Reference Model
  - http://www.oasis-open.org/
- ATHENA
  - http://www.athena-ip.org/
- SODIUM
  - http://www.atc.gr/sodium/
- SWING
  - http://www.swing-project.org/
- Networked European Software & Services Iniative (NESSI)
  - http://www.nessi-europe.eu/Nessi/