Middleware and Web Services

Lecture 6: Integration Patterns

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Enterprise Service Bus

- ESB is a central intermediary in SOA
 - Types of services: shared and infrastructure
 - Types of processes: Technical and Business
- ESB Application
 - Application running on an application server
 - Exposes functionality via Web service interface
 - Allows to communicate with various messaging protocols
- Integration Patterns
 - Technical-level interoperability message broker
 - Location transparency
 - Dynamic routing
 - Data transformations mediator
 - Resequencing of messages
 - Session pooling
 - Service orchestrations BPMN, BPEL
 - Message enrichment

Major Vendors

- Oracle
 - Oracle Service Bus (OSB)
 - Oracle SOA Suite
 - Oracle Enterprise Gateway (OEG)
- IBM
 - IBM WebSphere
- SAP
 - SAP NetWeaver
- Microsoft
 - .NET Framework
 - BizTalk server
- Opensource
 - -JBoss
 - Apache ServiceMix
 - WSMX Semantic Web Service Execution Environment

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Integration Patterns

- Applied in implementation of business services and processes
 - Usually a combination of more patterns
- Technical patterns
 - Deals with technical aspects of service communication
 - Message broker technical-level interoperability
 - Location transparency
 - Session pooling
- Business patterns
 - Deals with business aspects (message content) of service communication
 - Dynamic routing
 - − Data transformations − mediator
 - Service orchestrations BPMN, BPEL
 - Message enrichment
 - Resequencing of messages

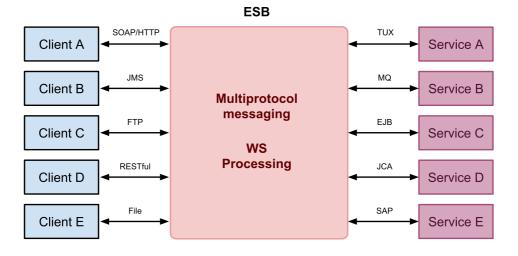
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Message Broker

• Message broker

- ESB can mix and match transports both standard and proprietary

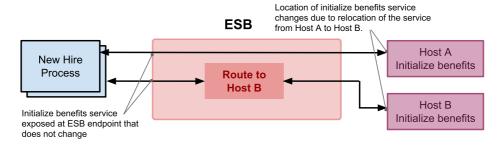


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Location Transparency

- Location transparency
 - ESB can hide changes in location of services
 - Such changes will not affect clients
 - Can also be used for load balancing for multiple service instances



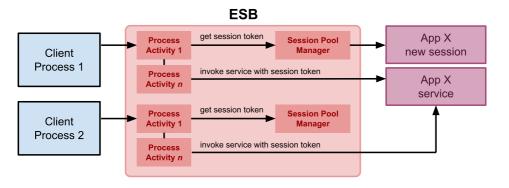
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Session Pooling

• Session Pooling

- ESB can maintain a pool of connections (session tokens) to a back-end app when creating a new connection is expensive
- A single session token can be reused by multiple instances of business processes



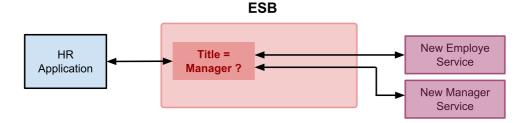
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Dynamic Routing

• Dynamic routing

- ESB exposes a service that routes to various back-end services based on message contents.



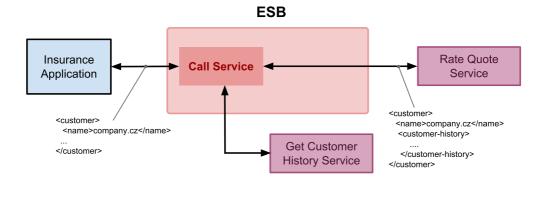
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Message Enrichment

• Message enrichmenet

- Enriches a message before invoking back-end application service.



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Data Transformation

- Data transformation phases:
 - Definition of mapping and execution of mappings
- Definition of mappings (design-time)
 - A mapping associates one data structure to another data structure and defines a conversion between them.
 - Mapping languages
 - \rightarrow graphical for design that translates to XSLT, XQuery
 - \rightarrow Sometimes implemented in 3rd gen. languages (e.g., Java)
- Execution of mappings (runtime)
 - application of mappings to instance data
- CDM terminology
 - Application Business Message back-end app format
 - Enterprise Business Message CDM format

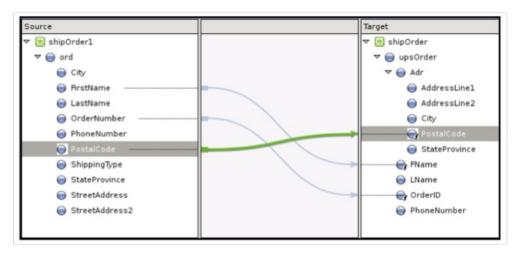
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Definitions of Data Mapping Example

Source and target schemas

- Source: Order flat data structure
- Target: UPS order with address as a sub-entity
- Differences in names of entities
- Conversion function applied to postal code



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Service Orchestration

Orchestration of multiple business services

- Includes transformation, message enrichmenet, service callouts, etc.
- A step in orchestration is an activity

Patterns

- Sequential processing of activities
- Parallel processing of activities with synchronization points
- Decision branches, iterations

Technologies

- Graphical languages
- Standard representations: BPEL, BPMN
- Proprietary, for example OSB uses graphical language that translates to XQuery

Good design

- Orchestration faciliates communication in CDM
- Orchestration handles key-mapping

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Key Mapping

• What is key mapping

- -Key = identifier of en entity in a back-end application
- Key Mapping = a mapping of an ID of an entity in one system to an ID of the same entity in another system.
- Key mapping is realized using universal IDs (UID)

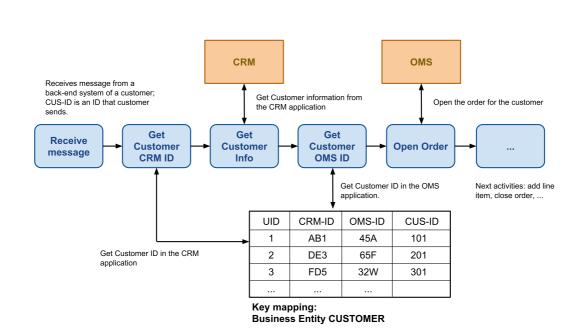
• Example

- A customer MOON exists in CRM and OMS systems
- In CRM system, MOON has an CRM-ID=AB1
- In OMS system, MOON has an CRM-ID=45A
- Key mappig allows to map the CRM-ID AB1 to the OMS-ID 45A
- Key mapping is a table
 CRM-ID → UID → OMS-ID

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Key Mapping Example

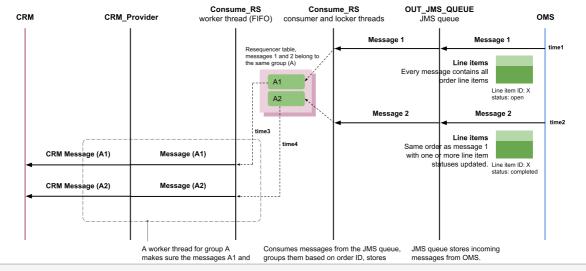


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Message Sequencing

- Resequencer in update sales order
 - Every order line item needs to update its status several times (e.g. open, completed)
 - Resequencer makes sure that the update status messages arrive to CRM in the same order as they were created in OMS system (FIFO resequencer)



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