



*Architectural Transformation and Re-Engineering
for Web Service-Based Systems*

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Agenda

- Introduction
- SOA and Web Services
- Our Solution
- Case Study
- Conclusions
- Future Work

Introduction

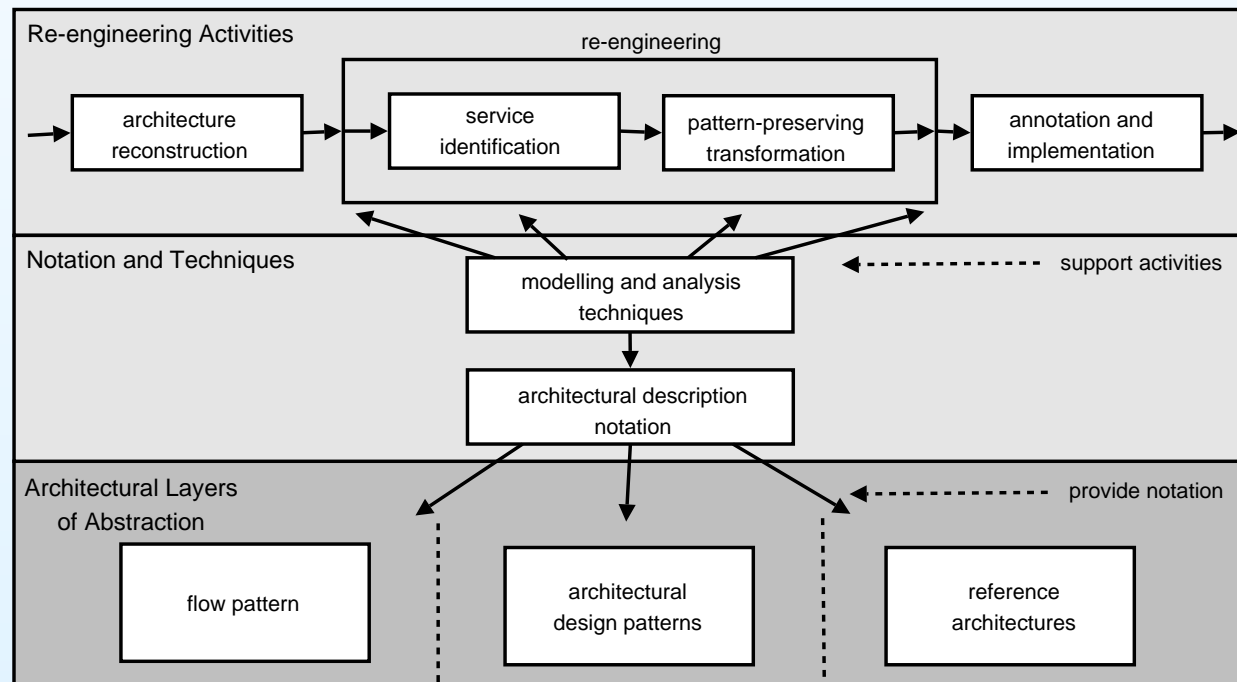
- Service Oriented Architectures (SOA)
 - Web Service Framework (WSF)
- Benefits of SOA
 - Interoperability/Integration
 - Software Reuse
 - New revenue model
 - Ubiquity of web infrastructure
- Migration to SOA
 - Procedural Oriented Programming -> OOP (past)
 - OO -> SOA (now)
- Case Study
 - Teaching & learning system
 - Interactive Database Learning Environment (IDLE)

Architectures and Web Services

- Software Architecture
 - Separates communication from computation
 - Connectors (Dynamic) and Components (Structural)
 - Interfaces provide access to components anywhere
- What is a Service?
 - Set of coherent operations at a location
 - Has abstract service interface
 - Both simple and complex services

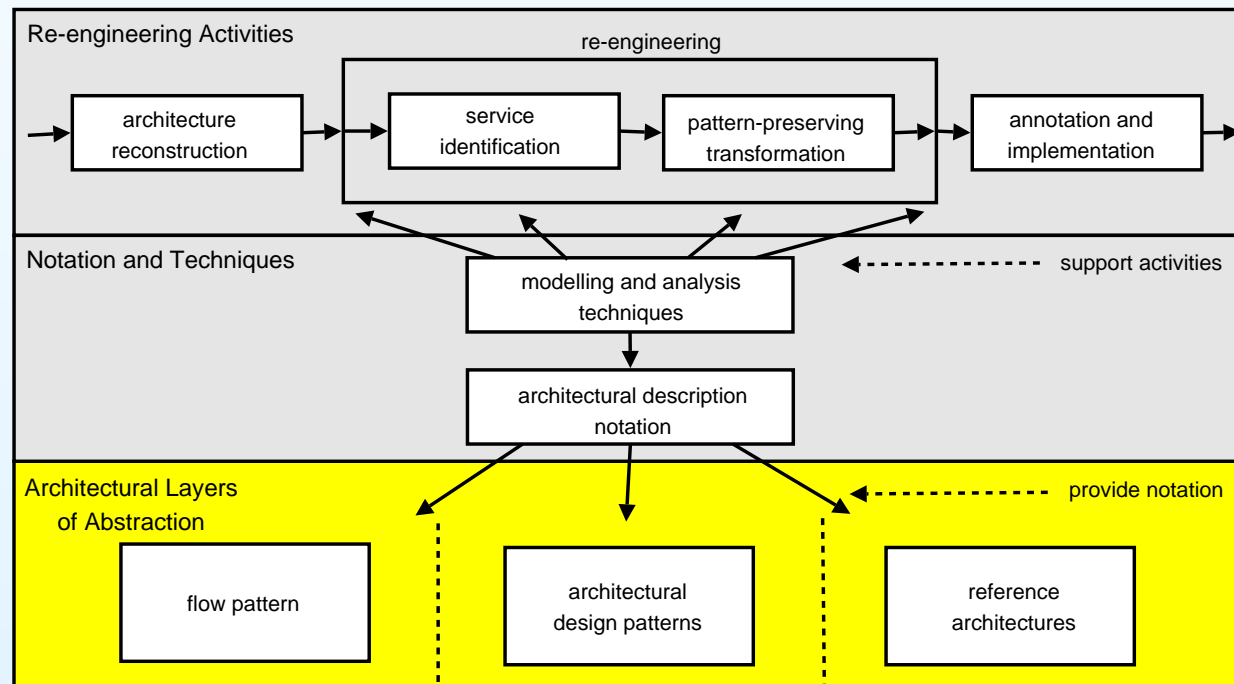
Problems & Solution

- Problem - Legacy Systems
 - Middleware platforms e.g CORBA
 - No clear separation of user and provider
 - Might not have clearly designed architecture
- Solution - 3 Step Re-engineering Framework



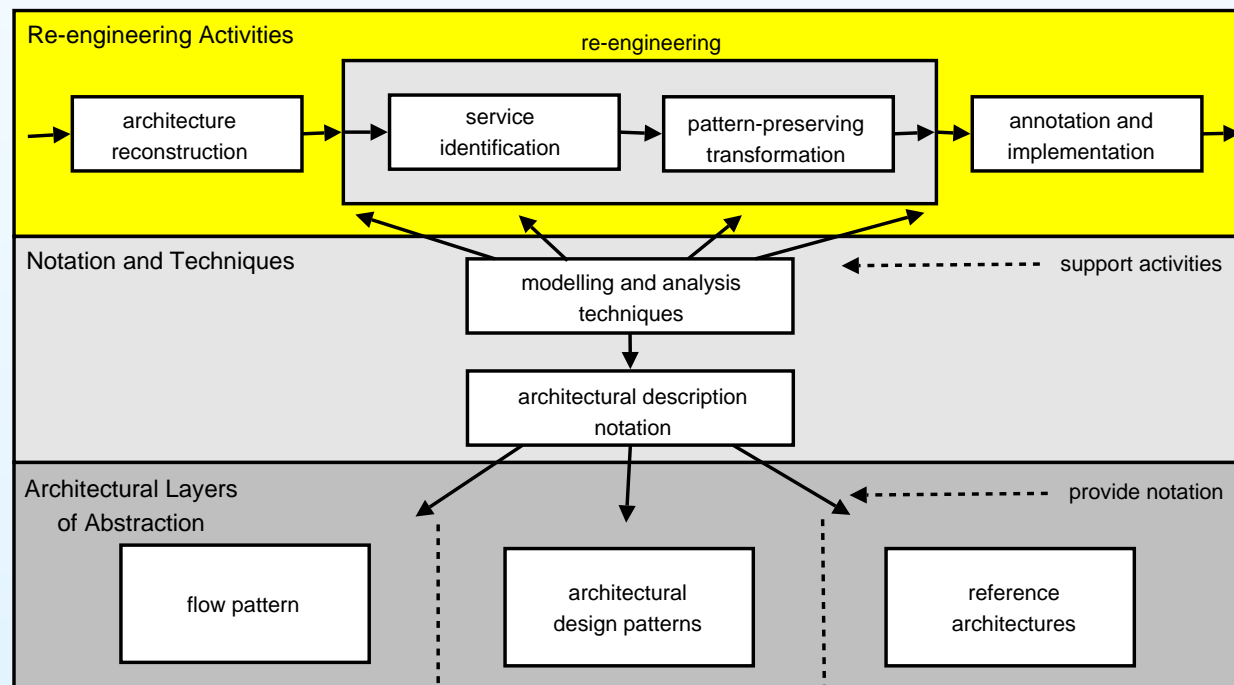
Our Solution - Layered Architectural Model

- Layered Architectural Model
 - Flow patterns
 - Architectural design patterns
 - Reference architectures



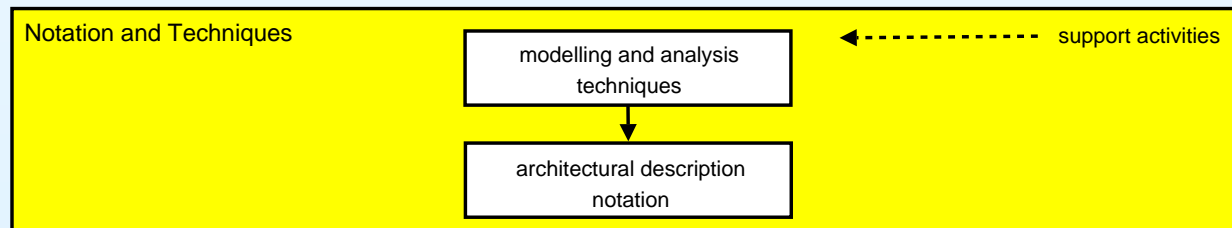
Our Solution - Re-engineering Activities

- Architectural Description
 - Service identification
 - Architectural/Workflow patterns preserved
 - Service annotation/implementation



Our Solution - Description & Techniques

- Architectural Description
 - Calculus notation
 - Expresses workflow/patterns using π calculus
- Modelling Techniques
 - Simulation
 - Property preserving transformation
 - Interactions remain the same
 - Structural patterns preserved
 - Pattern repository
 - Workflow patterns (connector types)
 - Architectural patterns (structural/behavioural)

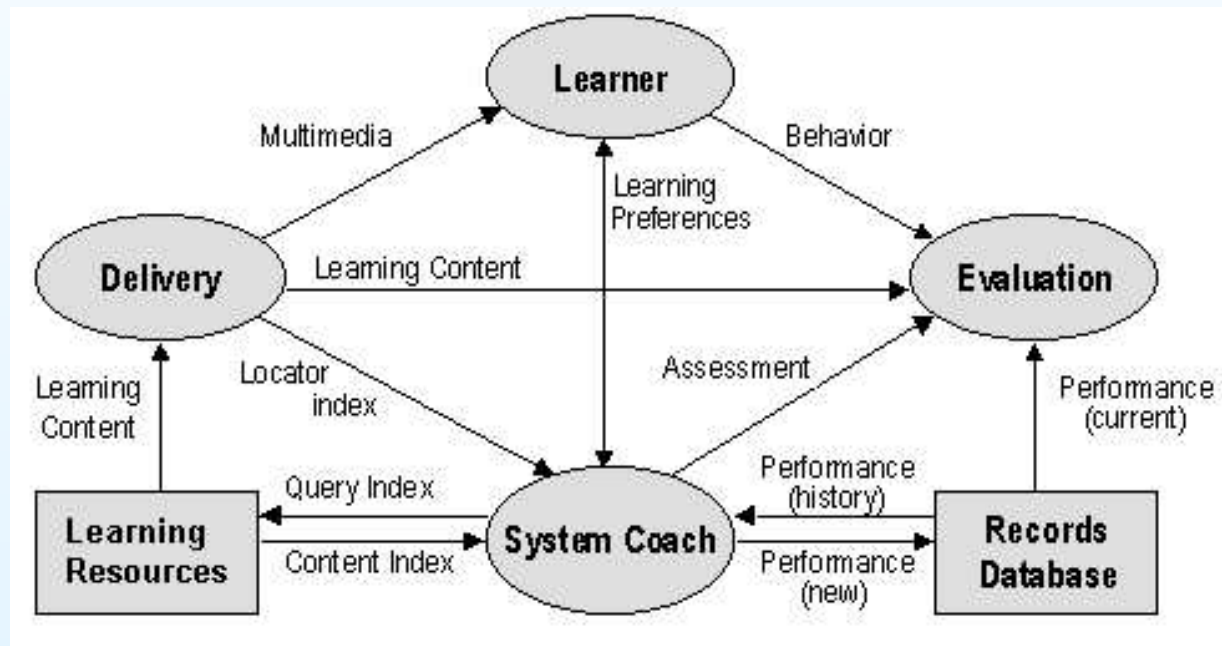


Case Study

- Teaching & Learning System - IDLE
 - Multimedia system
 - HTML
 - RealAudio
 - Flash
 - Java based
 - OO with web based interface
 - Real system used by students
 - 8+ years in use
 - Architecture undocumented due to growth
- Re-engineering objective
 - SOA
 - WSF based on LTSA

Case Study - Reconstruction I

- Identify Reference Architecture
 - Define accepted structures/processes
 - Encourage Maintainable/Interoperable systems
 - LTSA exhibits SOA characteristics



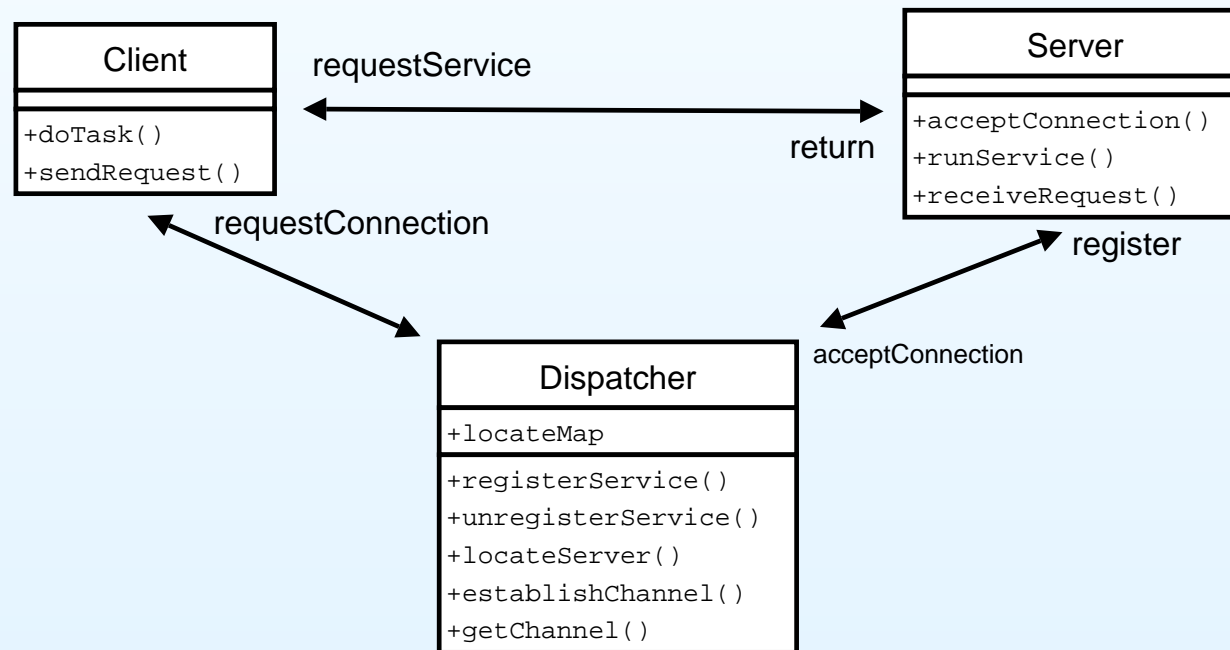
Case Study - Reconstruction II

- Identify Workflow patterns
 - Describe small compositions
 - Describe IDLE's basic activities
 - Use LTSA as basis for modelling IDLE

```
LearnerEntity=prefInfo=invgetPref();invsetPref(alter(prefInfo));learRes=invmultimedia()
Coach=repeat(choice(rcvgetPref();repgetPref(prefInfo),
    rcvsetPref(prefInfo),uri=invlocator(resource)))
Delivery=rcvlocator(uri);learnRes=invretrvRes(uri);repmultimedia(learnRes)
LearningResources=rcvretrvRes(uri);repretrvRes(retrieve(uri))
```

Case Study - Reconstruction III

- Identify Architectural/Design patterns
 - Client-dispatcher-server (Architectural) pattern
 - LTSA exhibits this pattern
 - Learner->Coach->Delivery->Learner



Case Study - Reconstruction IV

- Service Identification
 - Some components are already services e.g SQL tutor
 - Convert appropriate Java objects to services e.g LTSA Evaluation component
- Transformation
 - Design patterns are preserved
 - Workflow patterns preserved

Conclusion

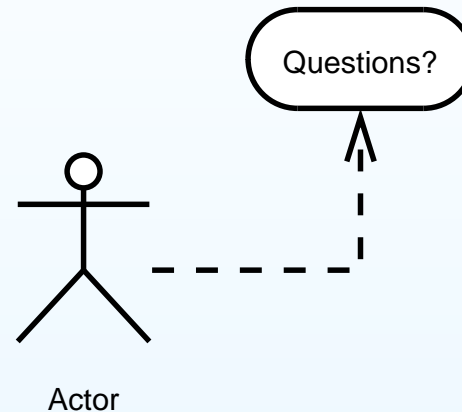
- Migration is often desirable
 - Success of Web
 - Take advantage of web properties
- What we have done
 - Moved from OO to SOA
- What we have provided
 - Layered architectural model
 - A calculus
 - Process Model of Re-Engineering Activities
 - Reuse of Services

Future Work

- Message Sequence Charts (MSC)
- Automatic re-engineering tool
- π calculus -> WS-BPEL auto-generator tool

Questions

Thanks for listening!



Open Source tools used to make this presentation.....



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