



UNSW

# Model Driven Adapter Development for Web Service Interactions

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## Outline

- Motivation
- Background
- Issues of Adapter Development for WS
- State of the Art
- Current Progress
- Ongoing and Future Work

## Motivation

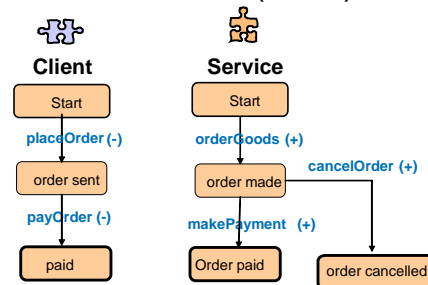
- Application Integration
  - The typical approach is based on use of adapters
- Web services (WS) simplify integration via standardization
- Adapters for WS?
  - Heterogeneity at the higher levels of WS interoperability stack
  - High number and diversity of WS partners

## WS Interoperability Layers

- Messaging (SOAP)
- Basic Coordination (WS-Transaction)
- Business level Interfaces and Protocols
  - Interfaces (WSDL)
  - Business protocols (BPEL abstract process, WSCI)
  - Other protocols (trust negotiation, ...)
- Policies and non-functional aspects

## Business Protocols (BPs)

- Business Protocols
  - Specify message ordering constraints (observable behavior)
- We use finite state machines (FSM) to model BPs [BCT'05]



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## Adapter Development for WS

- Adapter
  - A service which sits between two interacting services and compensate for their differences
- Types of adaptation
  - For compatibility
  - For replaceability
- Main issues
  - Interface level
  - Protocol level

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## State of the Art (Related Work)

- Interface Level
  - Schema Matching [RB'01]
  - Software Signature Matching (e.g., [ZW'97])
  - Semantic Web services (e.g., [POSV0'4, Metal'04])
  - Woogle [Detal'04], and other recent advances in WS
- Protocol level
  - Software Component Protocol Matching and Adaptation (e.g., [YS'97, Cetal'01])
  - Service Protocol Matching Approaches (e.g., [Wetal'04, Betal'04])
  - Semantic Web services protocol adaptation (e.g. [WKetal'05])

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## Our proposal

An extensible Framework for Model-Driven Adapter Development

- Goal:
  - automated assistance to developers in generating adapters code starting from protocol specifications
- Approach
  - Developing a framework and methodology that allows for
    - Specifying and managing recurring mismatches between services
    - Leveraging existing approaches for (semi-) automated mismatch identification
    - Generating adapter code from mismatch specifications

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## Current Progress

Capturing Mismatches as Mismatch patterns

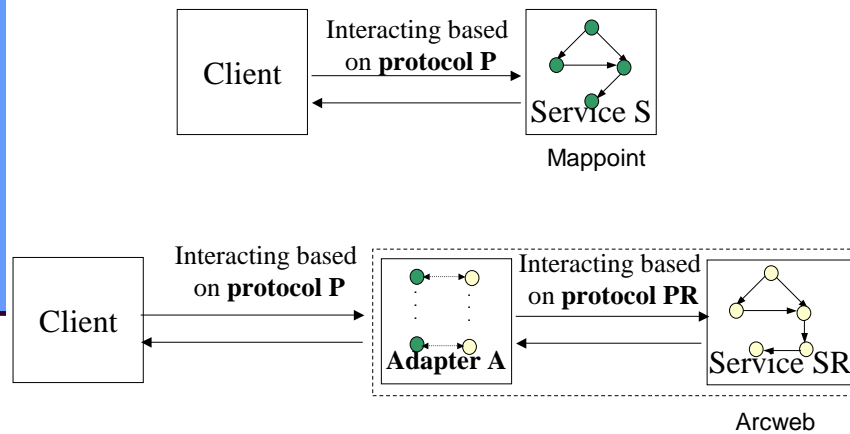
- Interface level mismatches
  - Signature Mismatch Pattern (SMP)
  - Parameter Constraint mismatch Pattern (PCP)
- Protocol level mismatches
  - Ordering Constraint mismatch Pattern (OCP)
  - Missing Message mismatch Pattern (MMP)
  - Extra Message mismatch Pattern (EMP)
  - Many to One mismatch Pattern (MOP)
  - One to Many mismatch Pattern (OMP)

## Structure of a Mismatch Pattern

Name	Name of the pattern
Mismatch Type	A description of the type of difference captured by the pattern
Template parameters	Information that needs to be provided by the user to derive the adapter code
Adapter template	Pseudo-code that describes the implementation of an adapter that can resolve the difference
Sample usage	examples on how to instantiate the template

## Mismatch Pattern Example

(Adaptation for Replaceability)



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## Mismatch Pattern Example

(Interface-level mismatch)

- Mappoint ([www.microsoft.com/mappoint/](http://www.microsoft.com/mappoint/))
  - Operation : CalculateRoute
    - Parameter : Specification (type = SegmentSpecification)
- Arcweb ([www.esri.com/software/arcwebservices/](http://www.esri.com/software/arcwebservices/))
  - Operation : findRoute
    - Parameters : routeStops (type = routeStops) and routeFinderOptions (routeFinderOptions)

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## Example: SMP (Signatures Mismatch Pattern)

Template Parameters	Signatures of operations O and OR, XQuery functions
Adapter Template	<b>Receive</b> the input message OI of operation O from client <b>Transform</b> OI -> ORI (XQuery) <b>Invoke</b> operation OR <b>Transform</b> output message ORO -> OO <b>Send</b> reply of operation O to client

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## XQuery Transformation Function

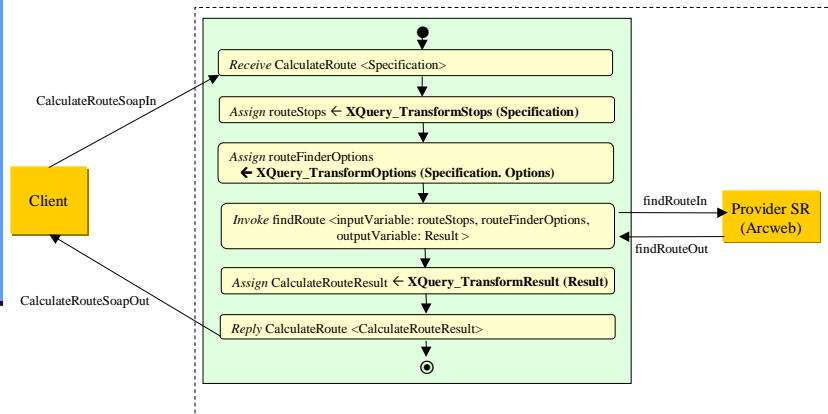
```
declare function smp: XQuery_ TransformOptions
($Options as tns:SegmentOptions) as
ns13:RouteFinderOptions {

let $PrefInt = fn:compare($Options/Preference,
"Quickest")
if ($PrefInt = 0) then let $Pref := "Quickest" else
let $Pref := "Shortest"
return
<RouteFinderOptions>
  <RouteOptions>
    <routeType>"{$Pref}"</routeType>
    < hwyPref>0</hwyPref>
    ...
  <RouteOptions>
    ...
</RouteFinderOptions>}
```

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# SMP Adapter Template



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# Ongoing and Future Work

- Context
  - ServiceMosaic Project
- Ongoing
  - Developing a formal semantic for adapters
  - Devising composition methods for multiple mismatch instantiation
  - Implementation of a tool for adapter code generation (Eclipse plug-in)
- Future (problems)
  - (semi-) automated mismatch identification
  - A methodology and extensible framework for adapter development

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Q&A

Thank You!

Comments/Questions?