

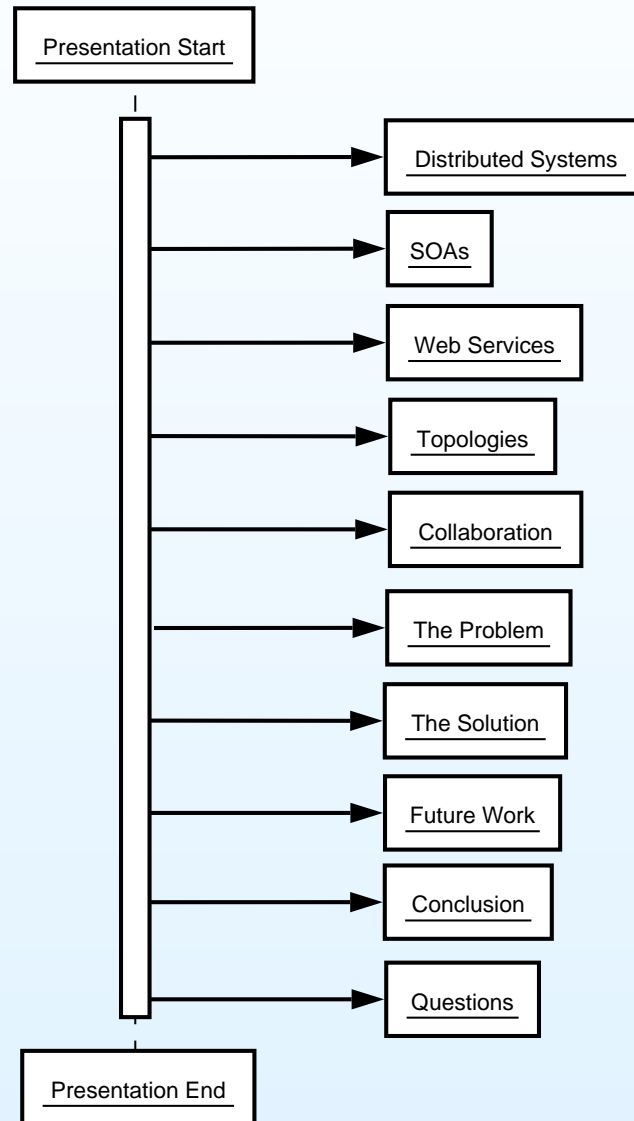
Topology Configuration and Coordination for Service Oriented Architectures

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Supervised by: Dr Claus Pahl

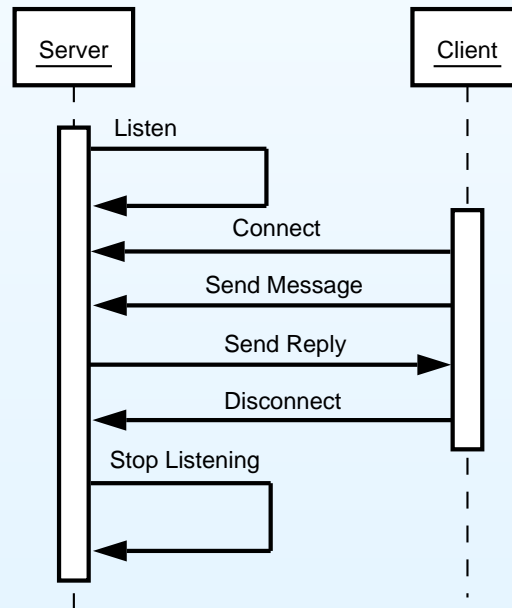
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Agenda



What is a Distributed System?

“A distributed system is a system in which computations are performed by separate programmes, normally running on separate pieces of hardware, that cooperate to perform the same task as a whole.” *



*Lethbridge & Laganière

What is a Service Oriented Architecture?

“An SOA is a design model with a deeply rooted concept of encapsulating application logic within services that interact via a common communications protocol.” *

- Resources on demand
- Each service is independent
- Access achieved in a standard way
- Promotes loose coupling
- New logical layer within distributed computing
 - Service integration layer
 - No ad-hoc integration issues (in theory!)

*Thomas Erl

What are Web Services?

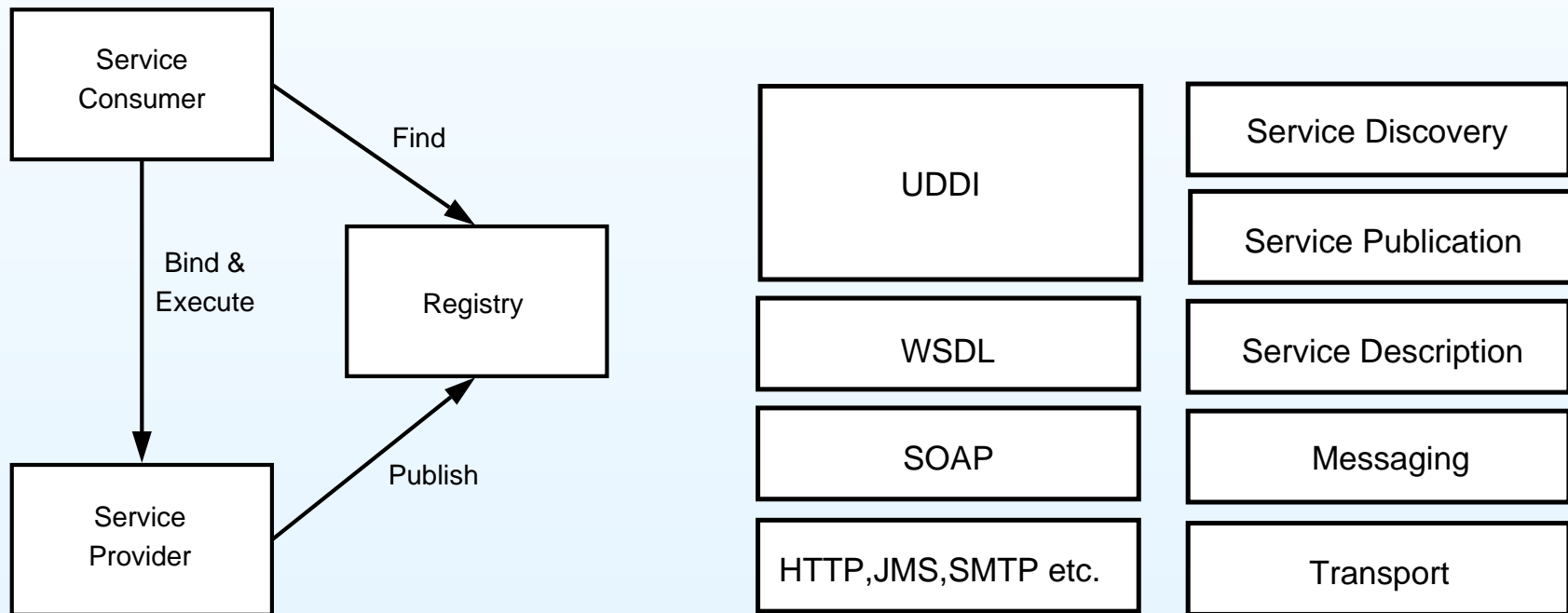
“A Web service is a software application identified by a URI, whose interfaces and binding are capable of being defined, described and discovered by XML artifacts and supports direct interactions with other software applications using XML based messages via Internet-based protocols” *

- Specific form of SOA
- Identified by URI
 - e.g. <http://www.mysevice.org/calc>
- W3C standardised

*W3C

1st Generation Web Services

- Web Service Paradigm
 - Find, Bind & Execute
 - Standardised Stack



2nd Generation Web Service Technologies

- WS-
 - WS-Coordination
 - WS-Transaction
 - WS-CDL
 - WSCI
 - BPEL4WS
 - WS-Security
 - WS-ReliableMessaging
 - Many more.....
- Why do we need these?

What is a Topology?

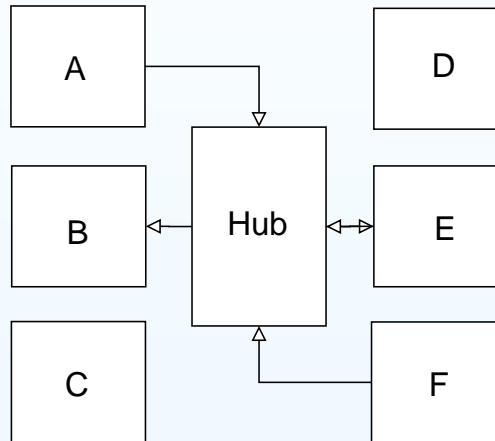
“A topology is the layout of the nodes within a distributed system and how they collaborate and coordinate.”

- Some possible topologies
 - Binary or Point-to-Point
 - Hub & Spoke or Centralised
 - Peer-to-Peer
- Varying performance based on a number of metrics *

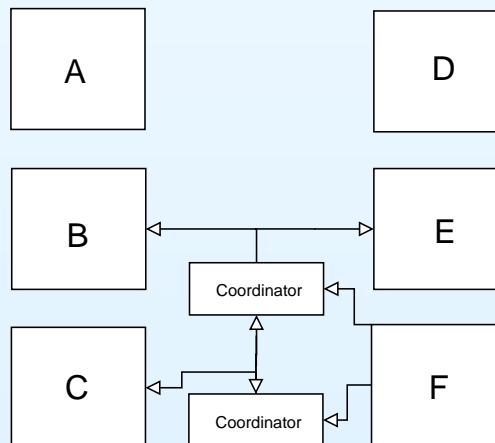
*Chafle, Chandra & Mann

Some Possible Topologies

- Hub & Spoke or Centralised Topology



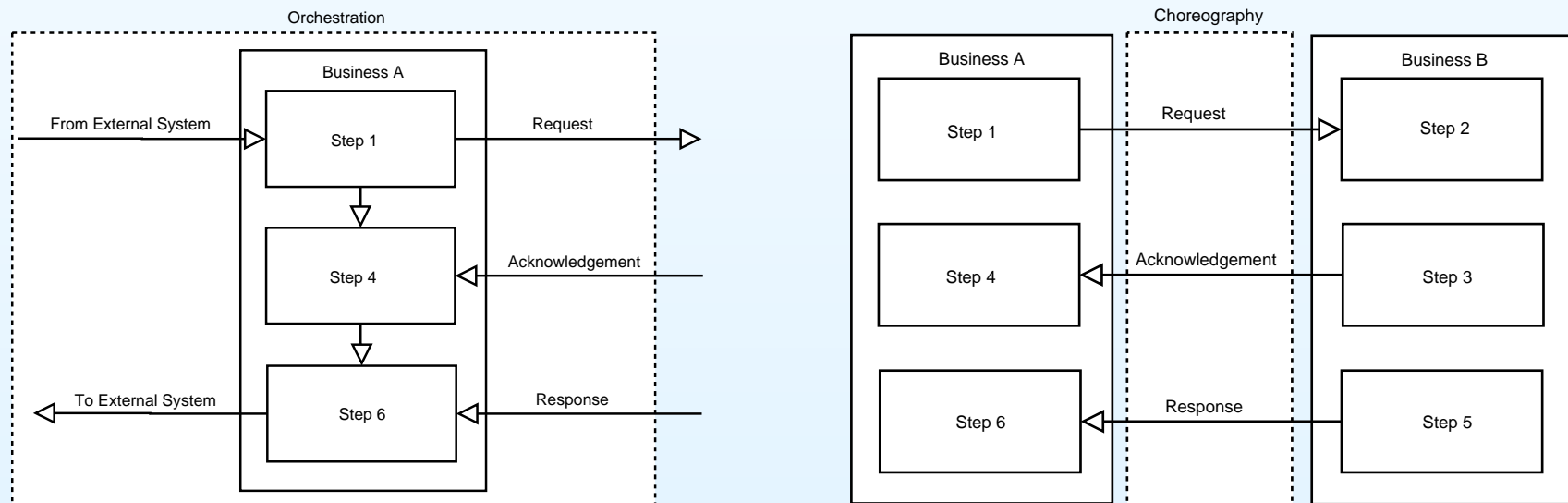
- Peer-to-Peer Topology



Collaboration

“A collaboration is the high level cooperation of components to achieve some compound novel task. For example a number of Web Services working together to achieve a goal different to their discrete goals may be considered a collaboration.”

- 2 distinct forms



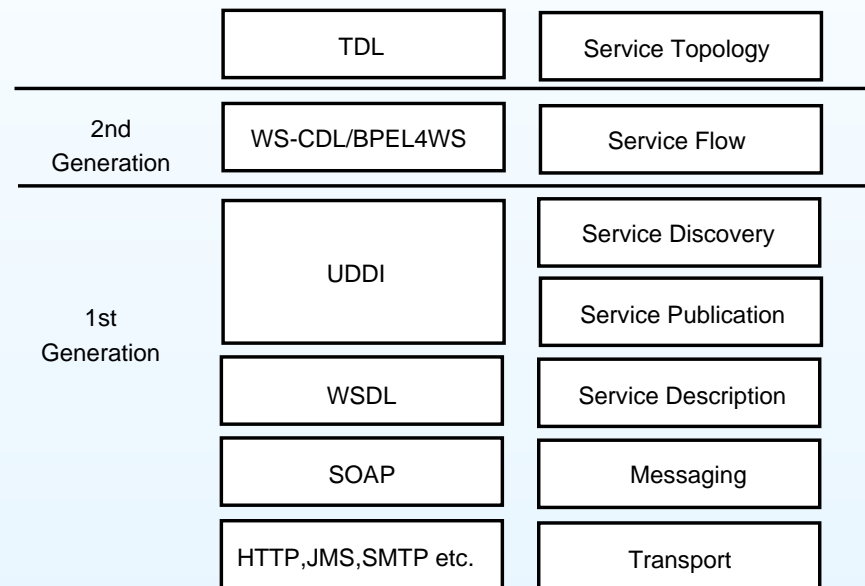
The Problem

“Given a system utilising distributed components, can its topology configuration be separated from the underlying distributed system or collaboration description to provide for reliable re-configuration and assembly?”

- Define the problem
 - System with distributed components
 - Topology embedded in system
- Define the question
 - Can the topology be separated out?
- The solution?
 - WS-Topology

The Solution: WS-Topology

- Abstract the topology configuration from the system
- Define a specification to describe topology configurations



- Create tools to support specification
- Create tools to build service flow automatically
- Create a reusable coordinator to ensure reliable collaboration

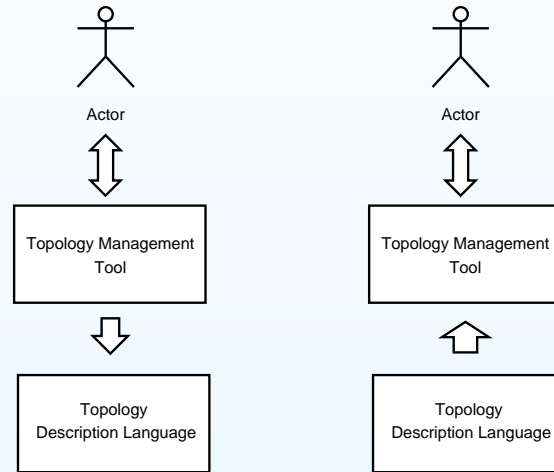
WS-Topology: Specification

- Topology Description Language (TDL)
- XML based syntax restricted by XML Schema

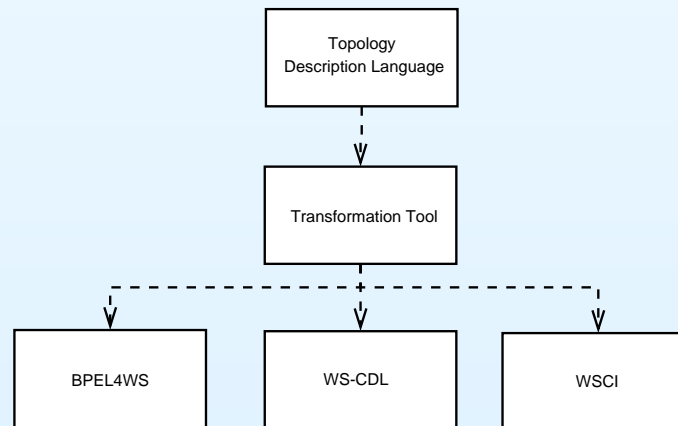
```
<?xml version="1.0" encoding="ISO-8859-1"?>
<tdl:topology xmlns:tdl="http://www.ws-topology.ws/tdl" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.ws-topology.ws/tdl.xsd">
  <tdl:collaboration-language>BPEL4WS</tdl:collaboration-language>
  <tdl:coordination-language>WS-Coordination</tdl:coordination-language>
  <tdl:configuration>Hub_And_Spoke</tdl:configuration>
  <tdl:nodes>
    <tdl:node name="A" uri="http://www.ws-topology.ws/A.wsdl" role="spoke"/>
    <tdl:node name="B" uri="http://www.ws-topology.ws/B.wsdl" role="spoke"/>
    <tdl:node name="C" uri="http://www.ws-topology.ws/C.wsdl" role="spoke"/>
    <tdl:node name="D" uri="http://www.ws-topology.ws/D.wsdl" role="spoke"/>
    <tdl:node name="E" uri="http://www.ws-topology.ws/E.wsdl" role="spoke"/>
    <tdl:node name="F" uri="http://www.ws-topology.ws/F.wsdl" role="spoke"/>
    <tdl:node name="G" uri="http://www.ws-topology.ws/G.wsdl" role="hub"/>
  </tdl:nodes>
</tdl:topology>
```

WS-Topology: Tools

- Topology Management Tool

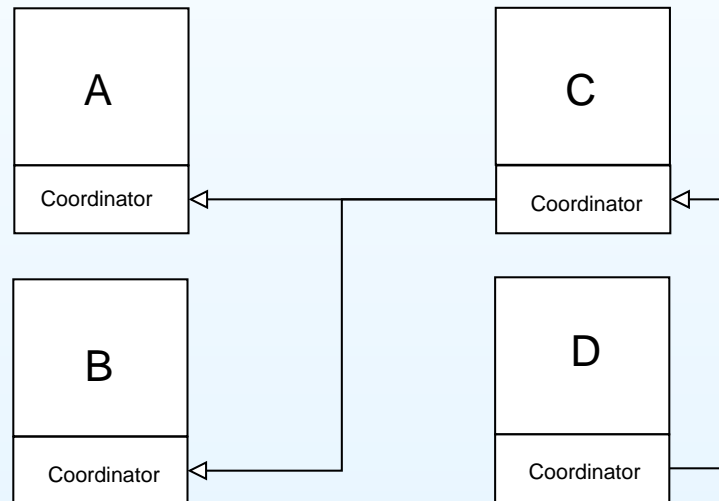


- Transformation Tool



WS-Topology: Coordination

- Contributor towards reliable collaboration *
- Format of coordination messages determined by TDL
- Generic coordinator using Aspect Oriented Programming †



- No alteration to existing service codebase

* Ahuja

† Capizzi et al.

WS-Topology: Use Case Scenario

- Take some existing elementary services
- Select a suitable architectural topology (based on spec)
- Write (or use the tool) a TDL document
- Transform the TDL document (using the tools)
- Deploy coordination service at each elementary web service
- Deploy collaboration engine at each elementary web service

Issues

- Web Service stack is in constant flux
- Competing specifications
- New specifications require tool updates
- Lack of collaboration engine implementations
- TDL will need to be richer
- HTTP does not support asynchronous messaging

Future Work

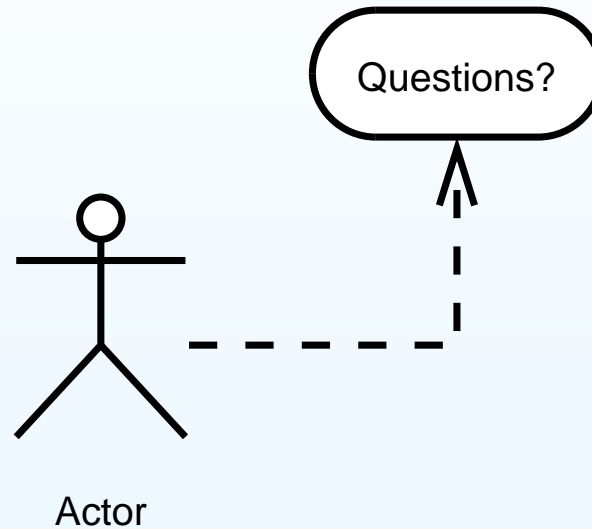
- Define Topology Description Language (TDL) fully
- Build tools
- Perform case study - Teaching & Learning Environment
- Evaluate usefulness of solution
 - Domains applicable to?
 - Identify topologies
 - Grade topologies
 - Expected acceptance

Conclusion

- Address the lack of flexibility of topology configurations
- What are the benefits?
 - Think from architect's point of view
 - Negate need to know unstable 2nd generation languages
 - Improved maintainability and extensibility
 - Non-invasively allow Web Services to collaborate to solve business problems
 - Cleaner code
 - Support multiple stack specifications
 - Avoid vendor dependence

Questions

Thanks for listening!



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



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