# WS-Topology: Topology Configuration for Service Oriented Architectures

Author: Ronan Barrett - rbarrett@computing.dcu.ie

Supervisor: Dr Claus Pahl

School of Computing, Dublin City University, Dublin, Ireland

## Question?

Given a distributed Web Service based system, described using some modelling language or notation, can it's architectural configuration (topology) be extrapolated and subsequently can this topology be used to guide the collaboration of the discrete components of the distributed system?

## What we do?

The architectural configuration of a distributed system directly impacts many of its characteristics. However this configuration is often lost within the underlying distributed system or architectural model making a topology difficult to implement initially and even more difficult to alter subsequently. Current solutions do not isolate the architectural configuration from the rest of the distributed system, instead the distributed components refer directly to each other, resulting in the hard coding of the topology. We investigate the abstraction of the architectural configuration from the distributed system and/or the extrapolation of the architectural configuration from an architectural model.

## Why do this?

Topology configurations exhibit varying performance for a number of metrics based on the chosen configuration. This implies that having the ability to vary the configuration should provide for improved system evolution and varying levels of scalability, availability and performance.

## Objectives

Our objective is to ascertain whether the architectural configuration of a Web Service collaboration can be separated from the underlying distributed system and/or extrapolated from an architectural model to provide for improved maintainability/mutability and flexibility with regard to performance, scalability and availability of SOAs.

## What is a Collaboration?

We consider a collaboration to be a number of Web Services working together to achieve a goal different to their discrete goals. A collaboration is the coming together of a number of elementary Web Services to form a complex Web Service. Collaborations come in two flavours, Orchestrations and Choreographies.

## How will we achieve our objectives?

We intend to achieve our goals by separating the topology configuration from the underlying SOA by introducing a new layer of abstraction, the Topology Description Layer (TDL). This layer can be generated by inputting one of three different models.

- System is modelling using UML/Model Driven Architecture techniques.
- System is modelling using Pi-Calculus.
- System is modelling using an Architectural Description Language.

This TDL can then be refined and used in combination with a number of Web Service artifacts such as existing WSDL documents as inputs to a generator which produces the Web Service wrapper interfaces and collaboration artifacts necessary to realise a topology.

## Model of Proposed Solution

As can be seen below the system model will describe the component interactions using some form of modeling language or notation. Using this model we can extrapolate a topology of how the components connect to each other. Once we have a topology and some existing Web Service interfaces we can generate the Web Service wrappers/Flow Documents to realise the topology.

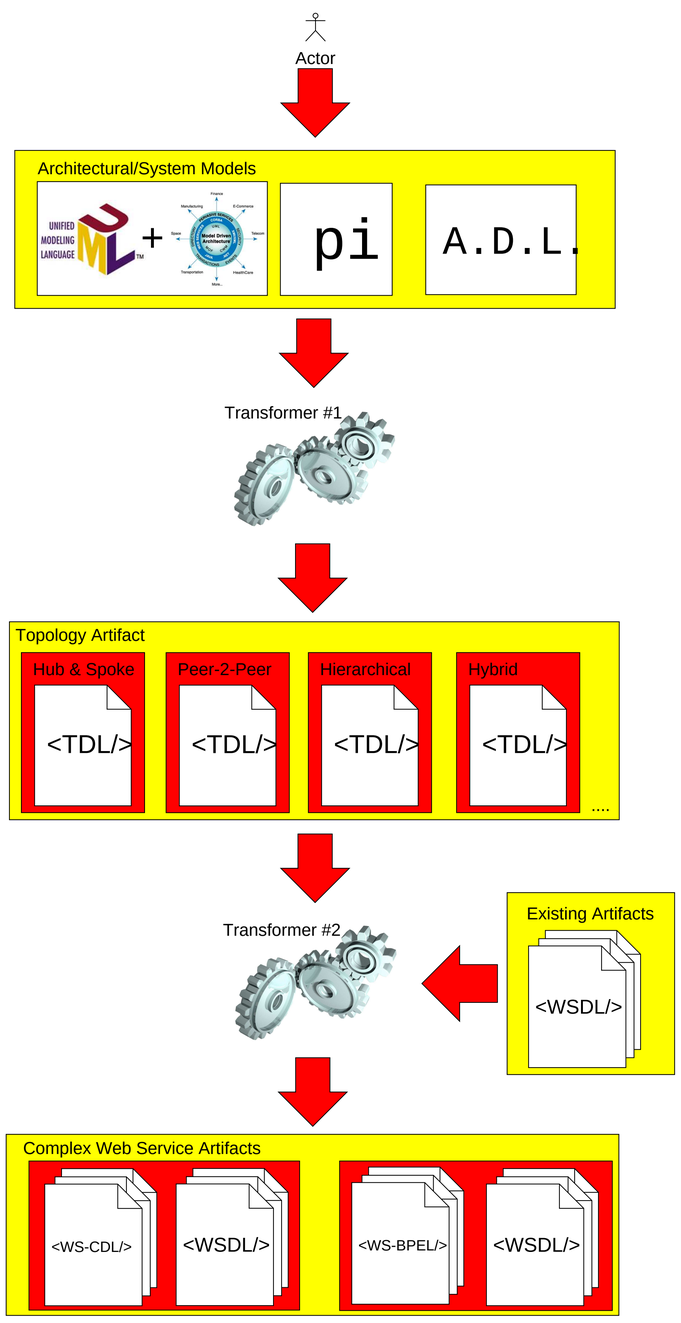


FIGURE 1: Proposed solution overview.

## Some Possible Topologies

Any of the following (and more) topology configurations can be applied to a distributed system using our tools and specifications.

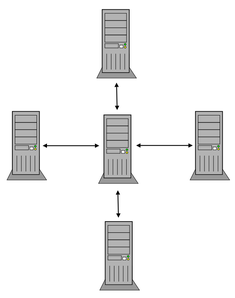

FIGURE 2: Star or Hub and Spoke topology.

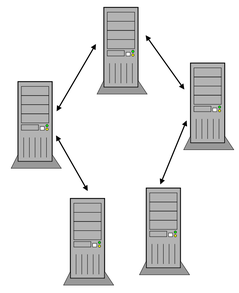

FIGURE 3: Peer-to-Peer toplogy.

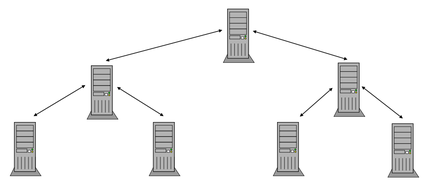

FIGURE 4: Hierarchical topology.

## Applications?

We intent to implement a case study to verify our work. This case study will be an enterprise banking environment which utilises discrete Web Services.

## Results

- Identified SOA specific characteristics.
- Identified that SOAs are excellent candidates for topology configuration.
- Researched appropriate topology modelling languages and identified UML, Pi Calculus and ADL as being appropriate.
- Identified composition engine activeBPEL which will be used to realise our topology configurations. Other engines were also evaluated.
- Defined and tested a TDL specification to describe the architectural configuration of a distributed system.
- Built transformation engine which takes a TDL and a number of WSDL artifacts as inputs and generates complex Web Service artifacts such WSDL wrappers and collaboration documents.

## Future Work

- Consolidate our research hypothesis by obtaining further proof of concept.
- Build transformation engine to convert topology modelling languages to TDL artifacts.
- Build case study to prove usefulness of solution.

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