Dynamic Selection of Redundant Web Services

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Introduction

• Web Services evolve from the Service-Oriented Architecture paradigm;

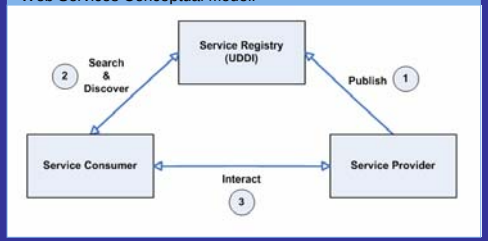
• Web Services are loosely-coupled, distributed components;

• Web Services are platform- and programming language independent;

• Web Services are described by Web Service Definition Language (WSDL) in XML format;

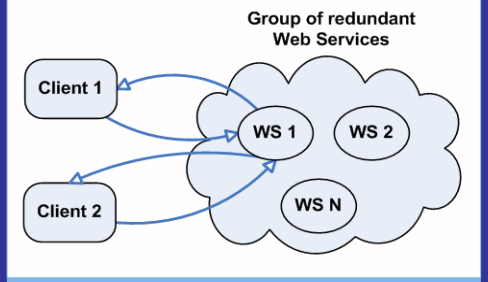
• Web Services message exchange is based on Simple Object Access Protocol (SOAP).

• Web Services Conceptual Model:



Problem Definition

• By nature, the domain of Web Services consists of redundant services:



• How to manage redundant Web Services on the server side in order to achieve:
  • Transparent selection;
  • Dynamic selection.
• What selection techniques should be applied?

Related Work

• Issues:

➢ Do the other researchers focus on dynamic service selection? – Yes.

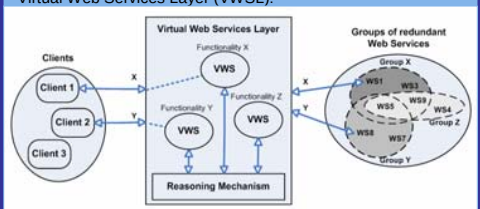
➢ Is the service selection transparent to the clients? – No. Usually, the clients are involved in the service selection.

➢ How is the service selection realized? – QoS computation and ranking; Expert systems and service evaluation functions; Agents/Mobile agents; Virtualization of services and monitoring.

•What is missing? – A flexible architecture that provides transparent and dynamic selection of redundant Web Services.

Proposed Approach

• Virtual Web Services Layer (VWSL):



• Characteristics of the Virtual Web Services Layer:

➢ Dynamic service selection and invocation;

➢ Transparent service selection and invocation;

➢ Flexibility:

▪ New functionality can be added to the system at run-time;

▪ Different selection strategies can be applied.

Evaluation

• Phase 1: VWSL prototype – feasibility check for managing redundant Web Services in a dynamic and transparent manner;

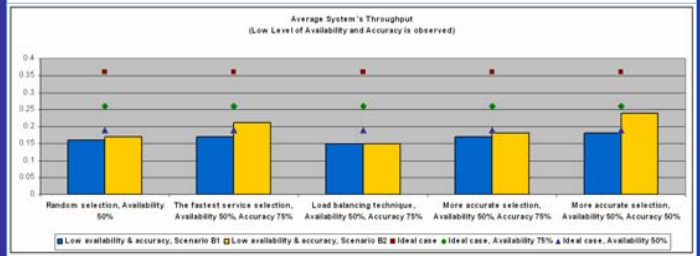
• Phase 2: Observing response times of Web Services in different environments – the results are used in phase 3;

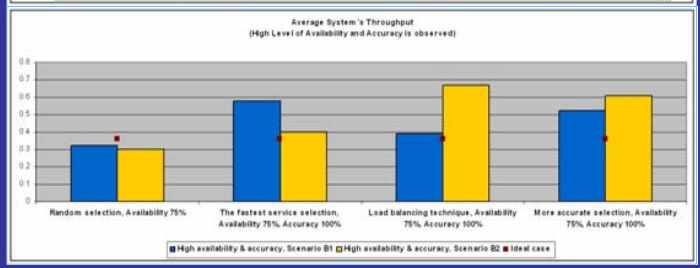
• Phase 3: VWSL simulation – observing which selection techniques should be applied depending on the information available to the system regarding the QoS of the Web Services.

Experiments Results

Information about the system		High level of dependability	Minimum overloading	Minimum execution time
None	–	Virtual Web Services Layer is not needed		
Web Services availability & Web Services models accuracy	Low	1 (X) 2 (~) 3 (~) 4 (~)	1 (~) 2 (√) 3 (~) 4 (~)	1 (~) 2 (√) 3 (~) 4 (~)
	High	1 (X) 2 (~) 3 (~) 4 (~)	1 (X) 2 (~) 3 (~, √) 4 (√)	1 (X) 2 (~) 3 (√) 4 (~)

1 – Random selection; 2 – The fastest selection; 3 – Load balancing; 4 – More accurate selection
√ – The best choice; X – The worst choice; ~ – Similar; N/A – Not applicable
Low Web Services availability – 50% or less Low Web Services models accuracy – 75% or less
High Web Services availability – 75% or high High Web Services models accuracy – 100%





Conclusions

• The accuracy of the QoS of the Web Services is crucial for the Virtual Web Services Layer;

• When the accuracy is low, selection techniques which take into account less QoS criteria should be applied;

• When the accuracy is high:

➢ The load balancing technique and the more accurate selection assure minimum overloading;

➢ The load balancing technique assures the lowest system's execution time;

➢ All selection techniques which consider QoS criteria, assure a high level of dependability.