

## Everything is negotiable, even quality of Web services!

### 1. Objective

- To develop an automated negotiation model which uses negotiation as the main technique for Web service selection in an abstract composite service / business process
- To develop an active coordination model in order to orchestrate the complex one-to-many negotiation processes, related to each atomic service in the business process
- To evaluate the proposed model through experiment by developing a prototype system

The automated negotiation system will negotiate on behalf of the composite service requester, with different service providers over different atomic services' quality attributes to choose the providers whose offers match the requirements most.

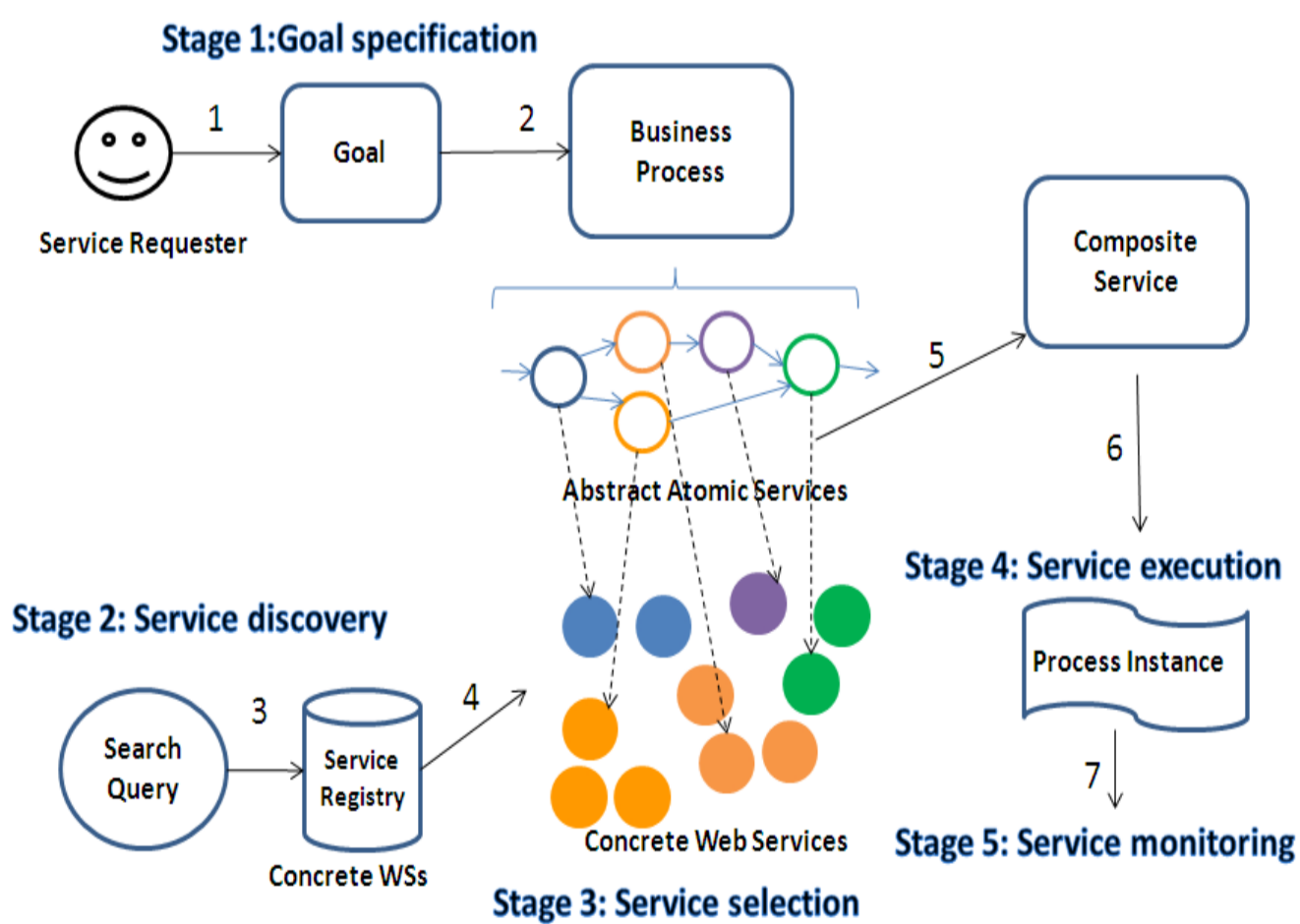
### 2. Introduction

Web service composition (WSC) offers a range of solutions for rapid creation of complex applications in service-oriented systems by facilitating the composition of already existing concrete web services. One of the critical challenges is the dynamic selection of concrete services to be bound to the abstract composite service.

In our research, we identify and elaborate on the challenges involved in developing an automated negotiation solution for service selection. We propose an active negotiation model in order to more effectively benefit from the dynamic environment created by negotiation, through an active coordinator.

### 3. Web Service Composition (WSC)

- Main goal in WSC: compose existing web services together to achieve a new value-added service.



#### Web Service Composition Lifecycle

- Service Discovery & Selection (Stage 2&3): The process of finding concrete web services that match atomic services in the Business Process.
- The assumption in current approaches for service selection: Services are offered with a **fixed set of attributes**; one price, one availability ratio, one response time, for all the requesters!
- This is an **unrealistic assumption** which has made the research in this area **unpractical**; very hard to follow and use for industry!

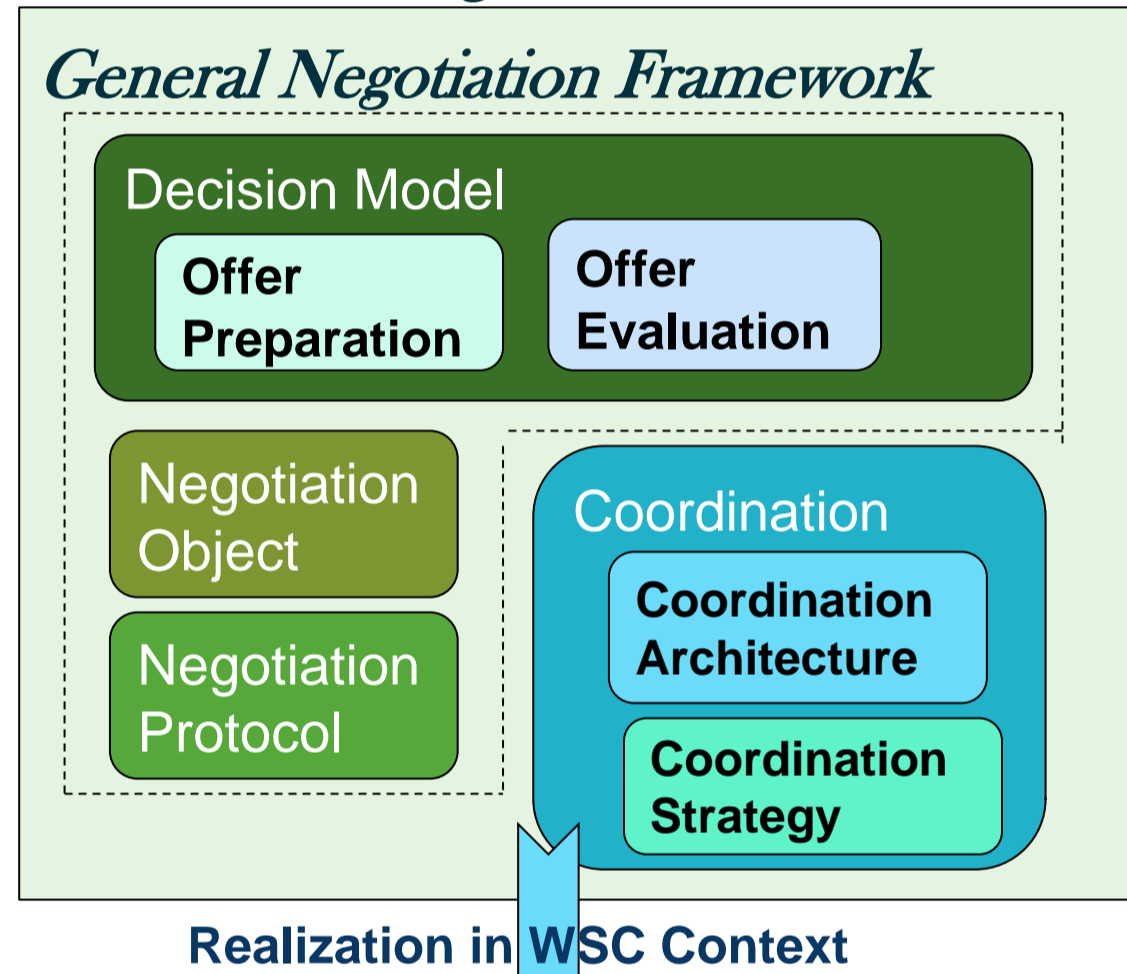
### 4. Automated Negotiation

- Negotiation: The process of searching a space of potential agreements to find a solution that satisfies all the negotiating parties' requirements.
- In computer science, automated negotiation has been used for different purposes:
  - Grid Computing : Resource Allocation ,
  - Multi-agent Systems: As agents' interaction mechanism when cooperating or competing over a common goal,
  - Web Services : Creating Service Level Agreement (SLA)
- Service Level Agreement is the agreement between service consumer and provider over terms such as price, Quality of Service, penalty, etc

### 5. Negotiation Framework

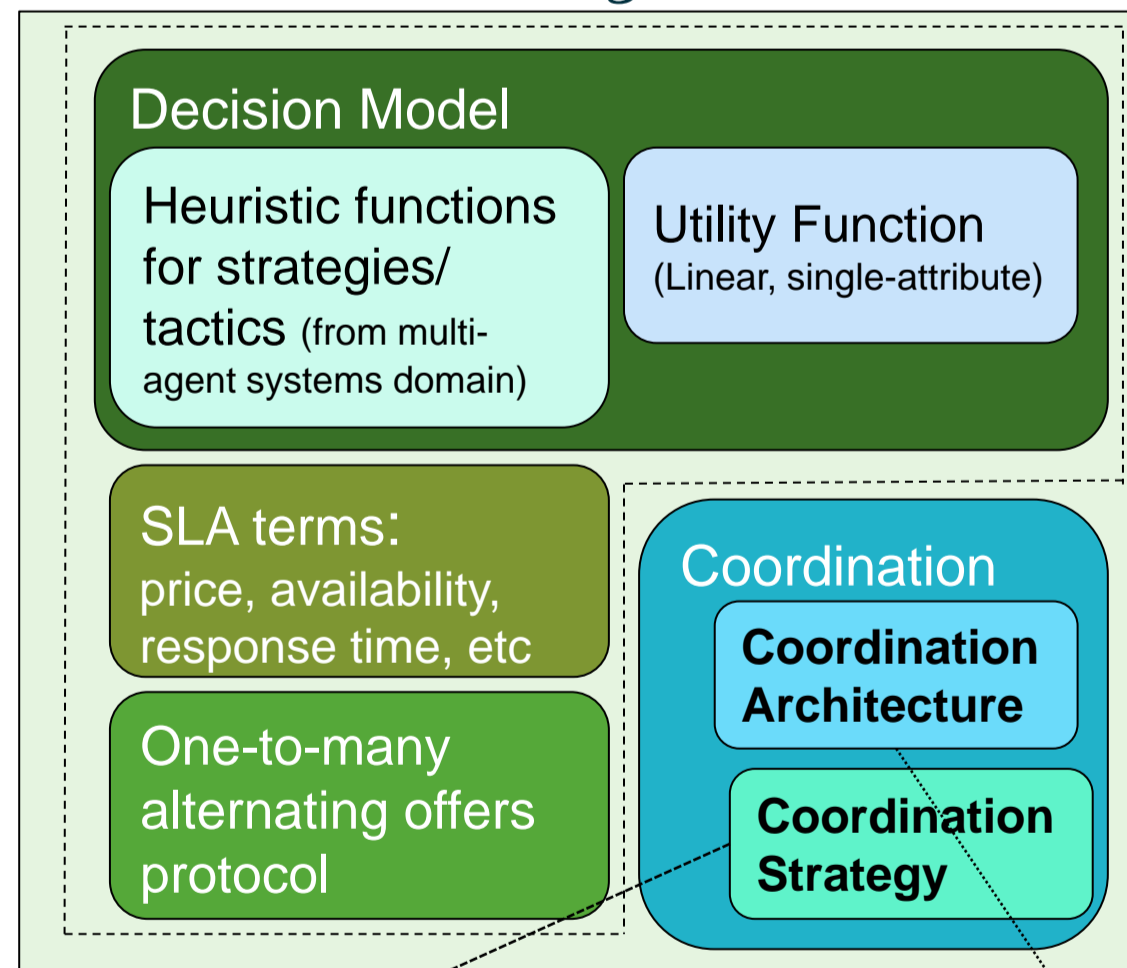
This includes the essential components in any automated negotiation solution :

#### Abstract WSC Negotiation Framework



Realization in WSC Context

#### Realisation of WSC Negotiation Framework



#### Time to initiate negotiation

- When to initiate the negotiation for each atomic service? (All parallel? Sequential? What priority?)
- Information to collect**  
What information to collect from ongoing negotiation processes and/or finished negotiations?
- Actions to take**  
Based on the information received, what reactions are possible to improve the overall negotiation result?

#### Our Interesting Research Questions!

- Negotiating Components**  
( an agent or WS?, any mediator for speeding up the negotiation?)
- Coordinating Layers**  
(configuration / number)

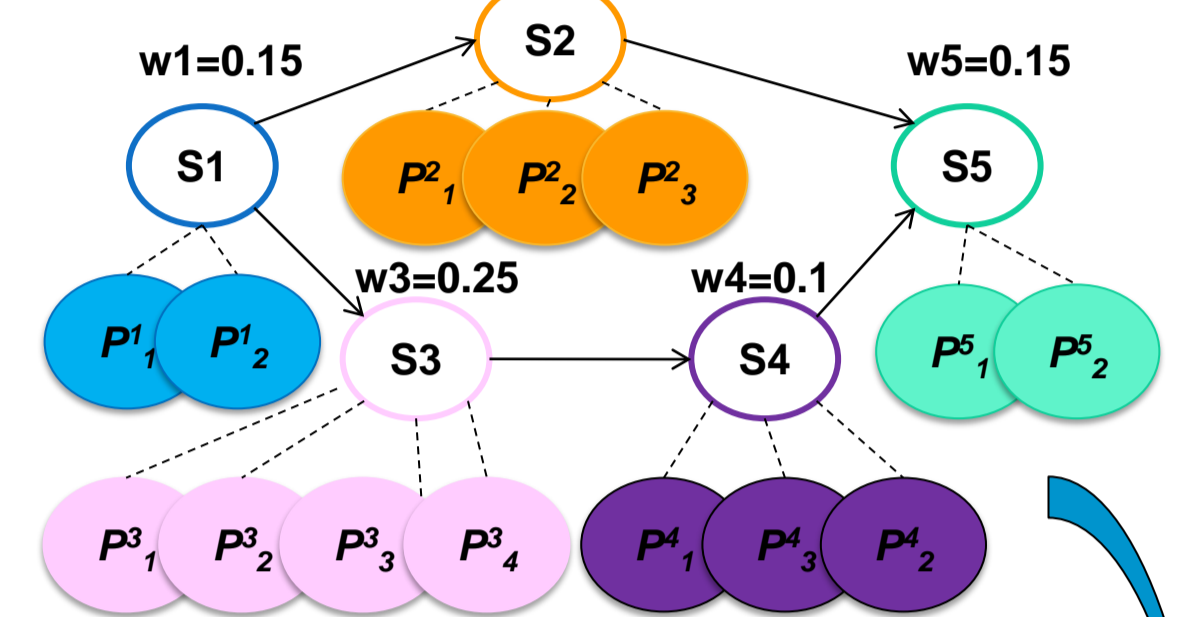
### 5. Research Method

- Developing the conceptual model and the evaluation metrics
- Building a prototype system to evaluate the proposed model
- Experimenting through the prototype system and real (or simulated) data

### 6. Proposed Active Negotiation Model

#### Current Assumptions:

- All negotiation processes start concurrently
- Only collect the information from the finished negotiations, not the ongoing ones
- Only one reaction upon receiving the information: distributing surplus  $w_2=0.35$



BP with Atomic Services and their Available Providers

#### Proposed Active Negotiation Model:

- Calibrates the risk of failure in negotiation for each atomic service in the BP
- Risk calibration based on two factors:
  - Number of available providers
  - Atomic service importance

importance category	normalized weight	Atomic service	# available providers	available provider category
L	0.15	S1	2	L
H	0.35	S2	3	M
M	0.25	S3	4	H
L	0.10	S4	3	M
L	0.15	S5	2	L

Risk Calibration Table

- The priority of the atomic service's negotiation initiation is determined based on the calibrated risk, using a decision table:

Available providers category	Low	Medium	High
Importance category			
Low	MR	LR	LR
Medium	HR	MR	LR
High	HR	HR	MR

Decision Table

- Initiation of neg. based on ascending order of risk

Atomic service	S1	S2	S3	S4	S5
Risk Class	MR	HR	LR	LR	MR

Determining the Priority of Negotiation Initiation

### 7. Future Work

- Ongoing development of a prototype system, in Java, with these main components: Active Coordinator, Business Process, Atomic Service, Dynamic QoS Profile, Tactic/Utility functions
- Extending the active model with more analysis of the negotiation information and potential reactions

### 8. References

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