A coalition formation based model for Web service composition

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1. Introduction(1/3)

Context and Motivation

- Service Oriented Computing (SOC)→ Development of rapid, low-cost and easy composition of distributed applications even in heterogeneous environments
- Web Service (WS)→ Concretization of SOC
- Web Service Composition (WSC)→ Aggregation of several WSs to answer to needs that a single WS can not provide
- New WSC process based on the combination of WSs and software agents in order to have a better interoperability [Souilah and al., 11]

1. Introduction (2/3)

Problem

The service providers don't have enough autonomy to choose their partners during the WSC process!!

- Very close to the coalition formation in the Multi Agent Systems where software agents can allow such autonomy

1. Introduction (3/3)
Objective

- Proposition of a negotiation model where the service providers can participate in the WSC process

- Considering criteria permitting the construction of a composed WS that answers at best to the service consumer needs

Outlines

1. Introduction
2. Some research works comparison
3. Proposed model
4. Does it work?
5. Conclusions
6. References

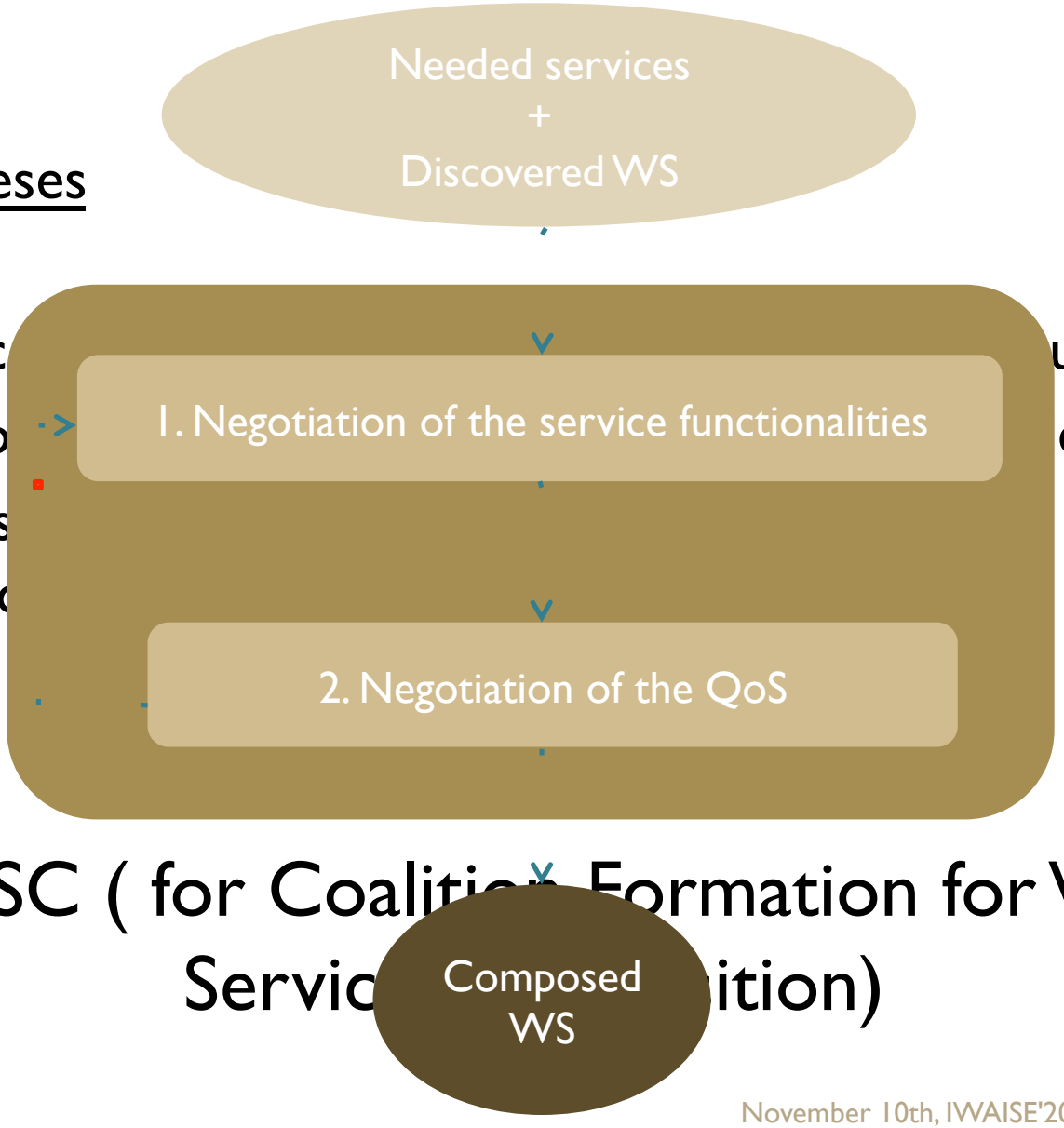
2. Comparison of some research works

Research Works	Objective	Technology used in WSC	Provider-Provider negotiation	QoS negotiation
[Ermolayev and al. , 03]	Composition	Coalition formation	No	No
[Maamar and al., 05]	Composition	Agent and context	No	No
[Wang and al.,12]	Composition	Cooperative reasoning based agent	No	No
[Zarour and al. , 06]	Cooperation	/	Yes	No
Our work	Interoperability	Coalition formation	Yes	Yes

3. Proposed model (1/8)

Hypotheses

- The c… umer
- The p… e
- s…
- sc…



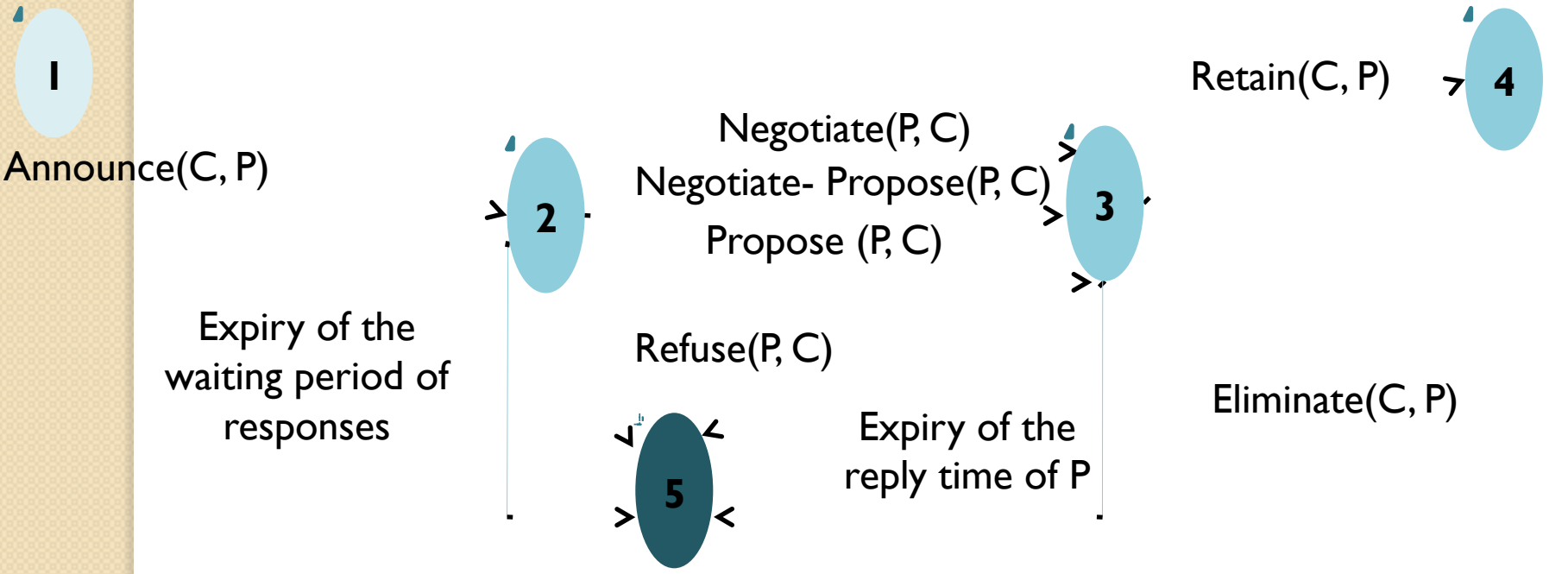
CFWSC (for Coaliti… Formation for Web Servic… …ition)

Announce message=
The needed services+
The service to negotiate on +
The current coalition members +
The waiting period

Message=
The QoS values +
The maximum reply time value +
(ev. the services wanting to negotiate on)

IA CTIONALITIES

1. ***Formulation and sending of the announcements by the consumer agent C***
2. ***Formulation and sending of the offers by the discovered provider agents P***
3. ***Evaluation of the discovered provider agents and selection of 3 retained agents R***



3. Proposed model (3/8)

What are the criteria that are used to evaluate the discovered provider agents?

- Criteria that are related to the partners [Cherni,04]:
  - Previous relations with the partner
  - Experience in the cooperation

- The criteria will be aggregated by the coalition members in order to have a global estimation for each discovered provider agent that will be then classified [Zarour and al., 06]

3. Proposed model (4/8)

a. Accept one of the proposed offers,

b. Propose three counter-offers Re-

b.1.2 V

the

THE QOS

b.1 Accept the counter-offer Accept

b.2 Reject the counter-offer

b.3 Generate a new offer then propose it Re-propose (RP, C)

Algorithm: Agents negotiation
Inputs: Retained agent offers O_R.
Outputs: A provider agent member of the coalition.

Begin
1. $t \leftarrow 0$
2. $O^t_R \leftarrow O_R$
3. Repeat
4. $t \leftarrow t+1$
5. The consumer agent offer computation at round t(O^t_C)
6. $O_R{}^t \leftarrow O_R{}^{t-1}$
7. Offers evaluation
8. Offers comparison
9. Generation and sending of responses
10. Until($t \geq temp$) or ($temp_1=0$ and $temp_2=0$ and $temp_3=0$) or ($O^t_R=\Phi$)

End

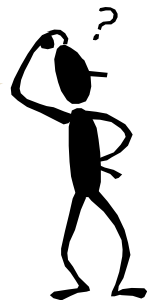
3. Proposed model (5/8)

What are the QoS criteria that are considered in the negotiation?

- We consider the set C including the following QoS criteria:
  - Response time
  - Price — Criteria qualified quantitatively
  - Availability
  - Robustness → Criterion qualified qualitatively

3. Proposed model (6/8)

How about the offers evaluation?



QoS Criteria	Response time	Price	Availability	Robustness
Domain	[4,		0.2, 0.7]	{weak, little-robust, robust}
Weigh	0		0.20	0.10

[Pantakar, 08]

$$AggregationFunction:$$

$$U^a = \sum_{c \in C} w_c \times V_c$$

$$\left(\frac{\max - \min}{} \right.$$

Let be:

$$U^C : forC$$

$$U^1, U^2, U^3 : forRP$$

3. Proposed model (7/8)

- O
- O 1)If it finds that there is an offer that has values that are the same or better than its own, then it accepts it
  2) else, it regenerate a counter-offer in which it makes a concession

$$1.(U^1 < U^C) and (U^2 < U^C) and (U^3 < U^C)$$

$$2.(U^1 \geq U^C) \oplus (U^2 \geq U^C) \oplus (U^3 \geq U^C)$$

3. Proposed model (8/8)

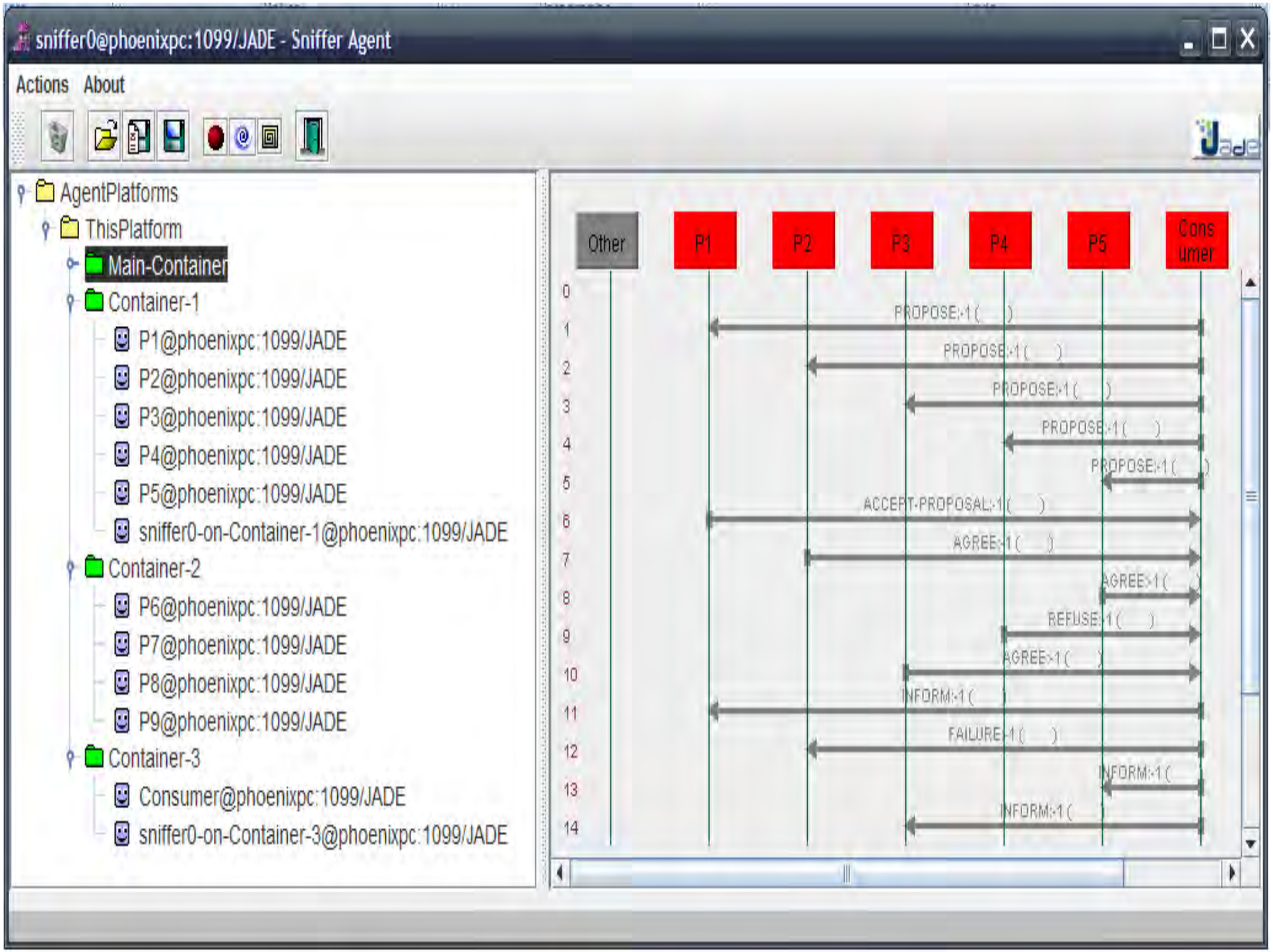
When does a negotiation process end?

- When all the discovered services will be allowed to providers that are now coalition members (coalition formation)

4. Does it work?(1/2)

Example:A service negotiation in a project of the construction

Needed services	**(Discovered Web Service, Provider agent)**
Interior decoration service	$(WS_1, P_1), (WS_2, P_2), (WS_3, P_3), (WS_4, P_4), (WS_5, P_5)$
Exterior decoration service	$(WS_6, P_6), (WS_7, P_5), (WS_8, P_8), (WS_9, P_1), (WS_{10}, P_{10}), (WS_{11}, P_{11})$


sniffer0@phoenixpc:1099/JADE - Sniffer Agent
Actions
About
AgentPlatforms
ThisPlatform
Main-Container
Container-1
P1@phoenixpc:1099/JADE
P2@phoenixpc:1099/JADE
P3@phoenixpc:1099/JADE
P4@phoenixpc:1099/JADE
P5@phoenixpc:1099/JADE
sniffer0-on-Container-1@phoenixpc:1099/JADE
Container-2
P6@phoenixpc:1099/JADE
P7@phoenixpc:1099/JADE
P8@phoenixpc:1099/JADE
P9@phoenixpc:1099/JADE
Container-3
Consumer@phoenixpc:1099/JADE
sniffer0-on-Container-3@phoenixpc:1099/JADE
Other
P1
P2
P3
P4
P5
Consumer
PROPOSE:-1 ( )
ACCEPT-PROPOSAL:-1 ( )
AGREE:-1 ( )
REFUSE:-1 ( )
FAILURE:-1 ( )
INFORM:-1 ( )

5. Conclusions

- We have:
  - ✓ Used a negotiation as a mechanism of interoperation.
  - ✓ Materialized the agent negotiation by the CFWSC
  - ✓ Studied a real case of interoperability domain
  - ✓ Realized its simulation in jade platform

- Now, we are :
  - ❑ Working on the second phase of the CFWSC (extension by other QoS criteria like security)

- As next step, we'll:
  - ➢ Formulize the CFWSC so that it'll verify some properties such as the lack of blocking

7. References

[Cherni,04] M. Cherni, "Les critères déterminants de sélection de partenaires dans les coopérations d'innovation,", Toulouse, France, 2004.

[Ermolayev and al.,03] V. Ermolayev, N. Keberle, and S. Plaksin, "Towards Agent-Based Rational Service Composition _ RACING Approach," in the Inter Conf Web Services Europe, Springer Verlag, Germany, 2003, pp. 67–182.

[Jaeger and al.,05] M.C. Jaeger, G. Muhl, and S. Golze, "QoS-aware Composition of Web Services: A Look at Selection Algorithm," in Proc. 2005 IEEE International Conference on Web Services , *ICWS'05*, 2005.

[Maamar and al.,05] Z. Maamar, S. Kouadri Mostéfaoui, and H. Yahyaoui, *"Toward an Agent-Based and Context-Oriented Approach for Web Services Composition – Appendices,"* Knowledge and Data engineering, IEEE, vol. 17, issue: 5, Zayed university, Dubai, 2005, pp. 686–697.

[Menasce and al., 07a] D.A. Menasc´e, H. Ruan, and H. Gomma, "*QoS Management in Service Oriented Architectures,*" Performance Evaluation Journal, North-Holland, Elsevier Science, Vo l. 64, 2007, pp. 646–663.

[Menasce and al.,07b] D.A. Menasce, and V. Dubey "Utility-based QoS Brokering in Service Oriented Architectures," in *Proc. ICWS'07,* Salt Lake City, Utah, 2007.

[Souilah and al.,11] M. Souilah Benabdelhafid, and M. Boufaida, "A Web services and agents-based approach for a better interoperability of enterprises," in the 11th Inter Symposium on Programming and Systems, IEEE, Algiers, Algeria, 2011, pp. 53–60.

[Pantakar,08] V. Patankar "Analytical approach to semi-automated tradeoffs and negotiation in software development," A thesis in computer science, Texas Teck university, 2008.

[Wang and al.,12] X. Wang, W. Niu, G. Li, X. Yang, and Z. Shi, *"Mining Frequent Agent Action Patterns for Effective Multi-agent-Based Web Service Composition,"* Agent and data mining interaction, vol. 7103, 2012, pp. 211–227

[Zarour and al.,06] N. Zarour, and S. Bouzidi, *"Coalition Formation for Cooperative Information Agent-Based Systems,"* J. Computers, Communications & Control vol. I, n° 3, 2006, pp. 85–92.

Thanks for your attention, Questions?