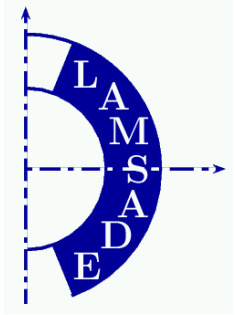

Formation de coalitions pour une composition de services Web fondée sur la confiance dans les réseaux sociaux

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Journées Francophones sur les Systèmes Multi-Agents (JFSMA)

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Outline

1. Motivation
2. Background
3. Trust model
4. Coalition formation process description
5. Experimental Results
6. Conclusion and Perspectives

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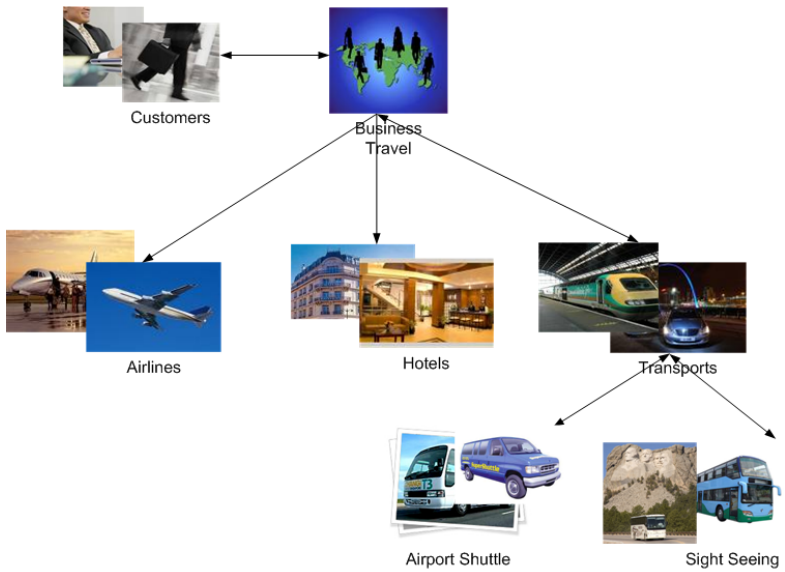
Motivation

Service Composition

- Satisfies a complex user needs which cannot be achieved by an atomic service
- Allows the definition of value added applications, which have the potential to reduce effort and time of development [Ponn 02]



The model : a multi-agent model

- Able to perform complex and distributed tasks
- Support different forms of interaction including negotiation and coordination
- Capable to extract and interpret information

Existing multi-agent approaches

- Planning (graph, state, actions) [Paik 06, Ponn 02, Siri 04, Tong 11, Xu 11]
- Coordination (reasoning, roles, negotiation) [Charif 13, Siala 11, Wang 06, Maam 05]
- Cooperation (organization, preferences, sociability) [Grif 03, Ermo 03, Mull 06, Hong 09, Bour 09]

Proposition : a coalition formation process

Challenges

- How to integrate social dimension in the coalition process
  $\Rightarrow$ Social trust model
- How to ensure providers autonomy to decide with whom to cooperate
  $\Rightarrow$ Endow agents with the ability to participate in the coalition process according to their preferences
- How to enable agents to leave coalition when they are not satisfied
  $\Rightarrow$ Definition of an incremental, dynamic and overlapping protocol for member selection

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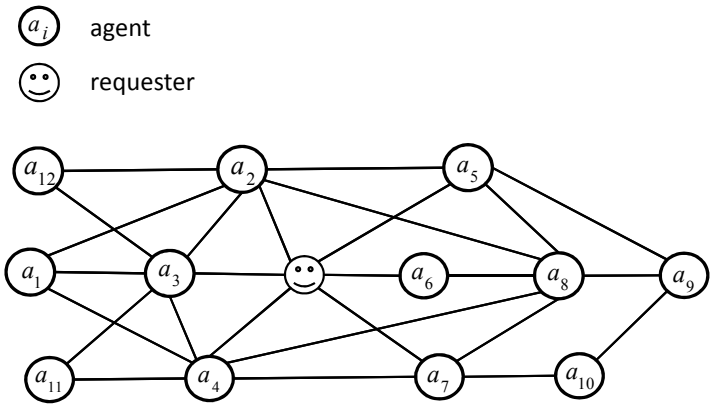
Concepts Definitions

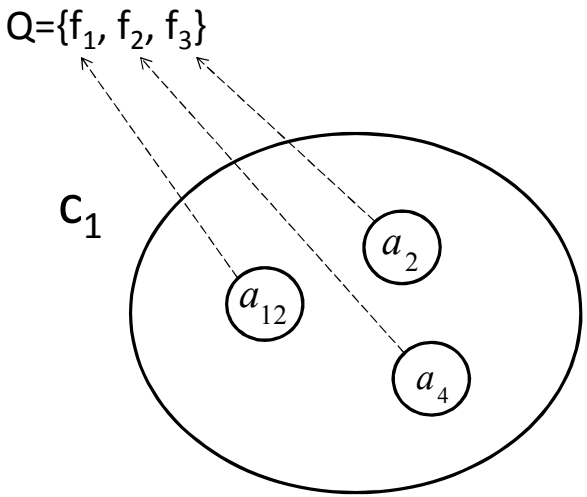
- Social network : Given a set $A = \{a_1, a_2, ..., a_l\}$ of agents and a set $E \subseteq A \times A$ of edges, a social network is a connected graph $G =< A, E >$ where an edge $(a_k, a_j) \in E$ represents an asymmetric trust relationship between a_k and a_j
- Agent : An agent $a_k \in A$ is an autonomous entity such that $a_k =< S_k, Trust, ET, CT, \lambda \text{Inf}_k, \lambda \text{Sup}_k, \beta_k, Blist_k >$
- Service : A service s is a tuple such as $s = (in, out, f, q^1, q^2, q^3)$

Louati, A., El Haddad, J., Pinson, S.
A Multilevel Agent-based Approach for Trustworthy Service Selection in Social Networks in IAT 2014



Concepts Definitions

- User query : Let F be the definition domain of available functionalities. A user query $Q = \{f_1, f_2, \ldots, f_n \,|\, \forall 1 \leq i \leq n, f_i \in F\}$ is a finite set of functionalities
- Coalition : Let Q be a user query. A coalition $c = \{(f_1, x_1), \ldots, (f_i, x_i), \ldots, (f_n, x_n) \,|\, \forall i \in [1, n], \exists k \in [1, s]$ such as $x_i = a_k$ et $a_k \in A_i\}$ is a set of agents that satisfy Q.



Multi-agent model

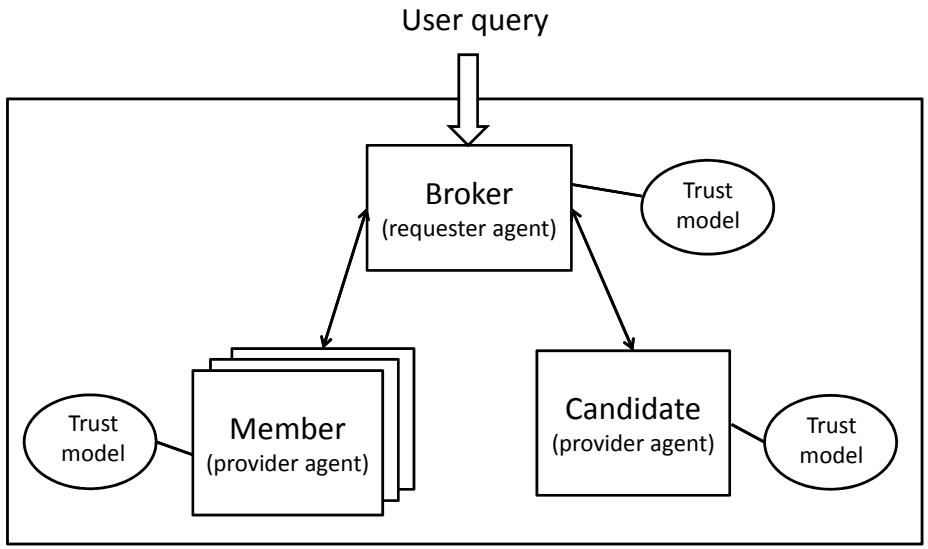


FIGURE – A broker-based multi-agent model for dynamic service composition

Agents cooperate to satisfy complex user's needs based on decentralized decision making guided by trust in cooperation

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Trust

Trust in cooperation

$$CT(a_k, a_j) = \begin{cases} 1 & \text{if} \quad NbSoll_k[j] = 0 \\ \frac{NbMem_k[j]}{NbSoll_k[j]} & \text{otherwise} \end{cases}$$

Level of reliability of a candidate a_j according to a member a_k based on their history of cooperation

Trust in coalition

$$evalC(a_k, c_z) = \frac{\sum_{a_t \in c_z} CT(a_k, a_t)}{|c_z|}$$

Degree of satisfaction of a candidate a_k to join a coalition c_z

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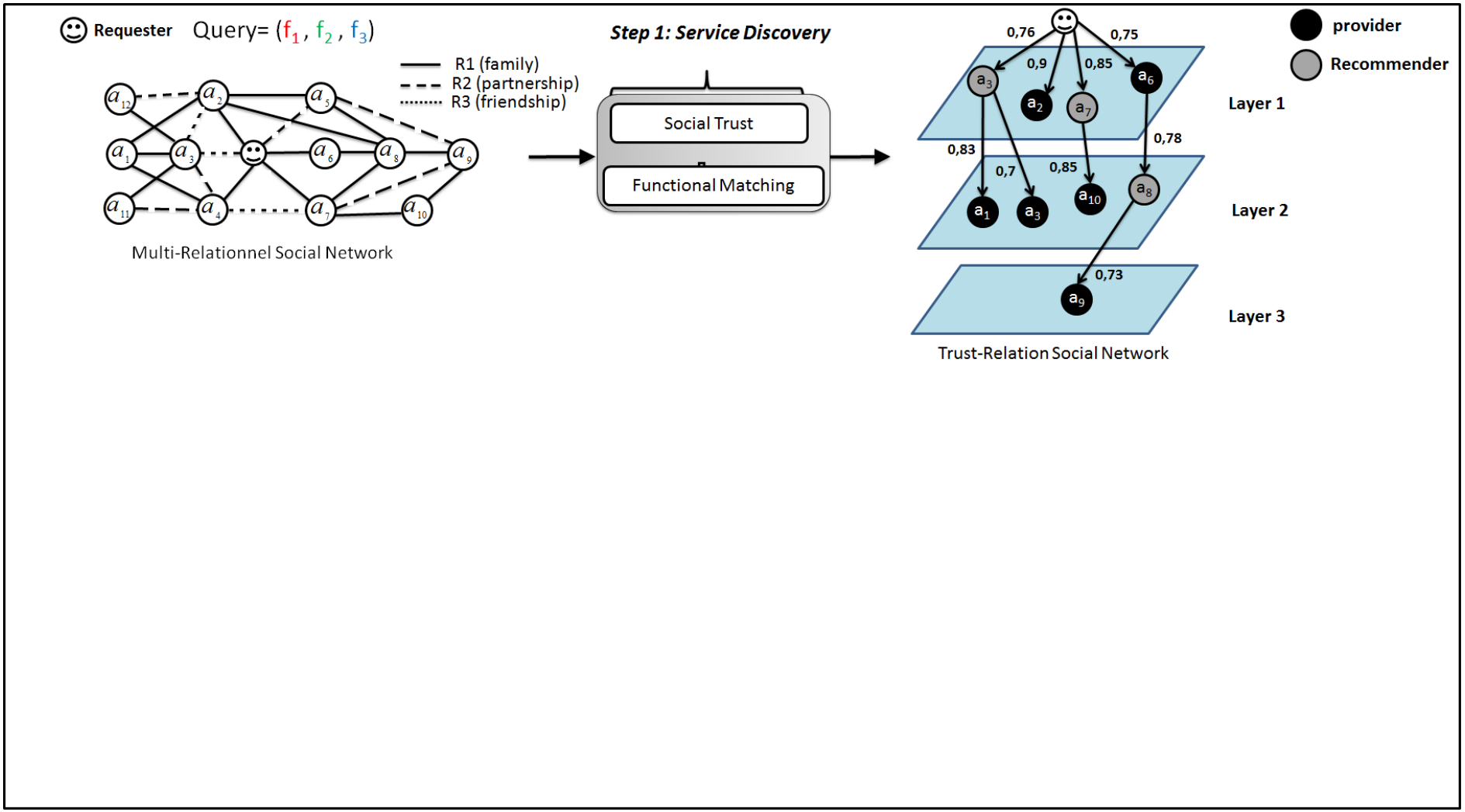
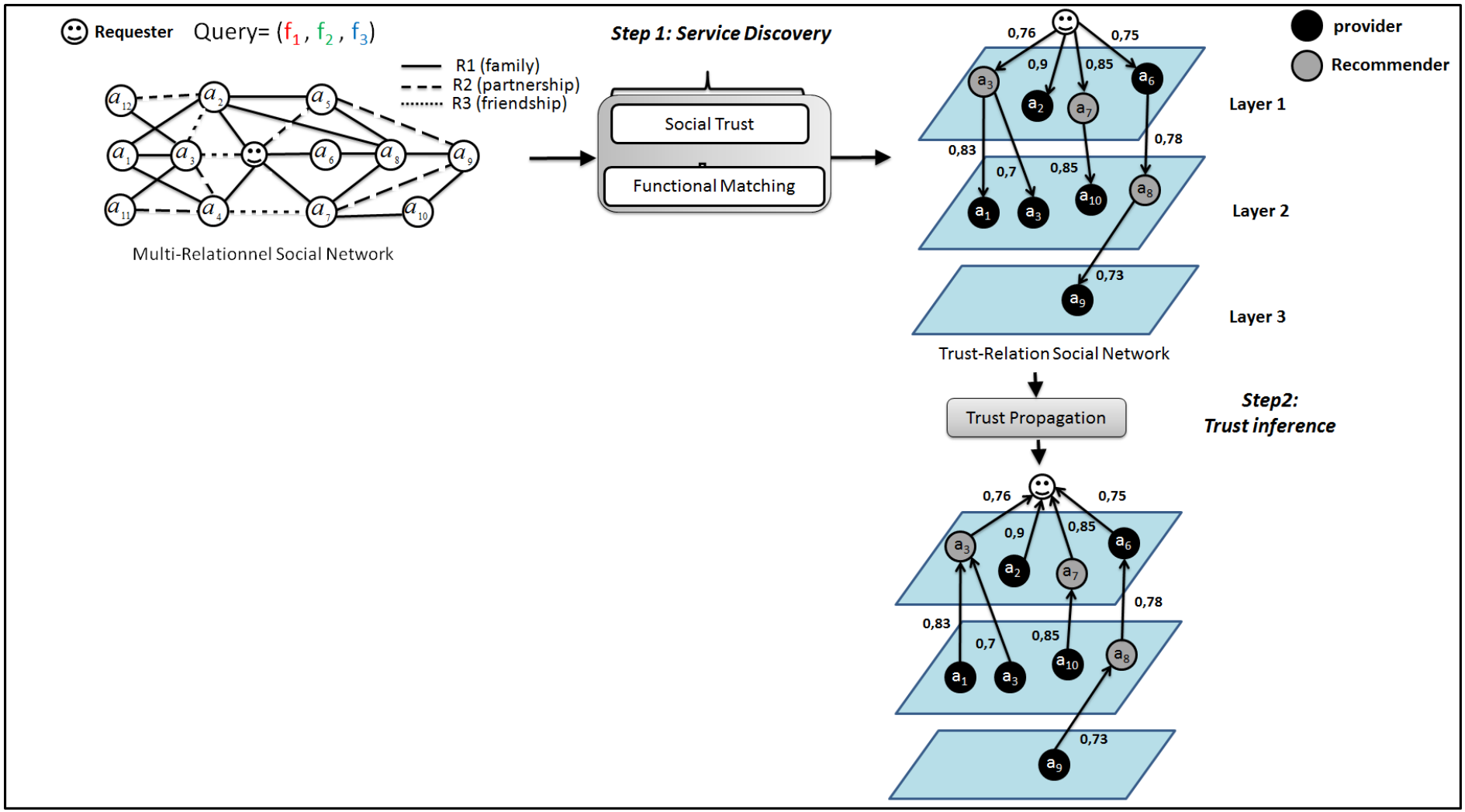
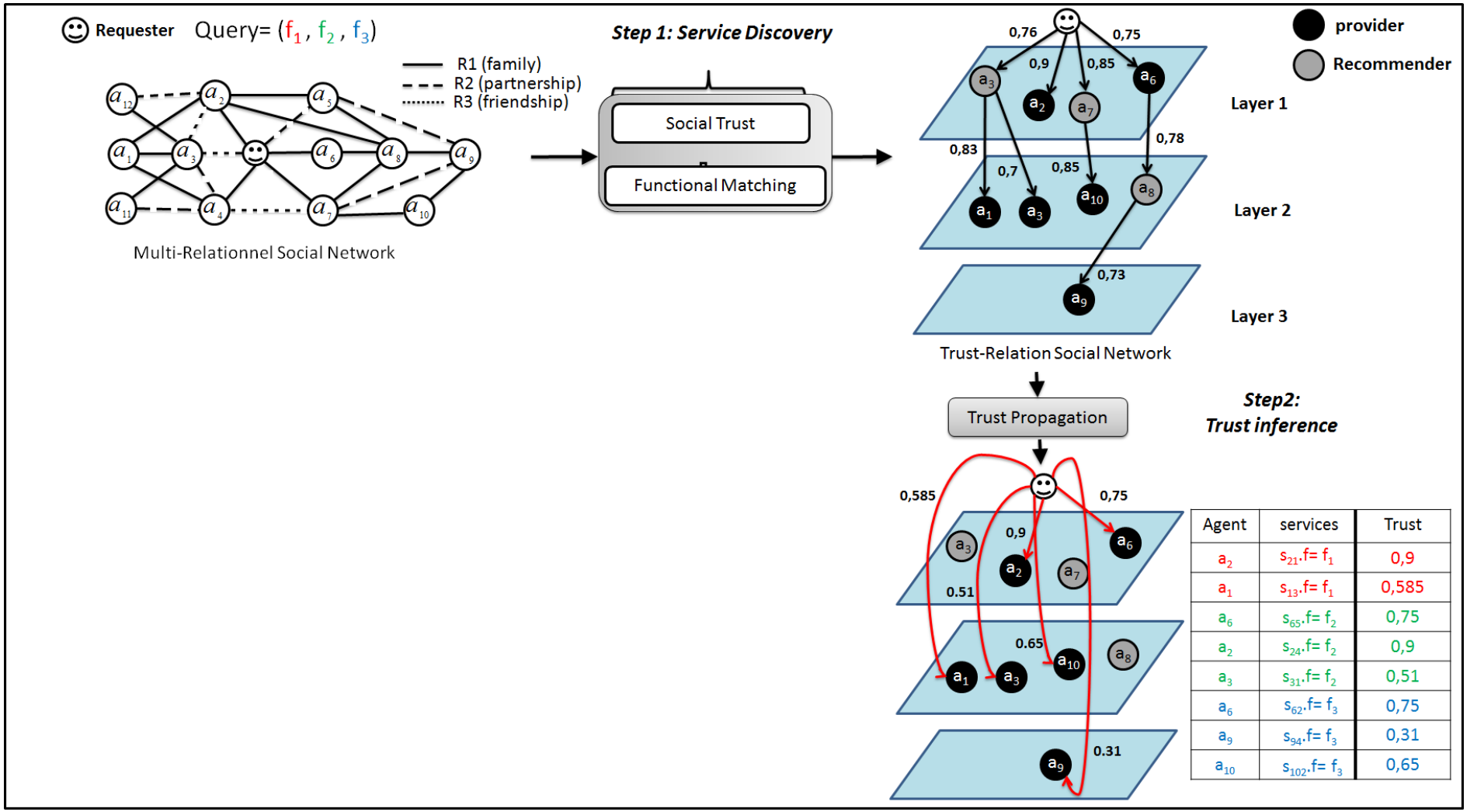
Service discovery and selection process



Service discovery and selection process

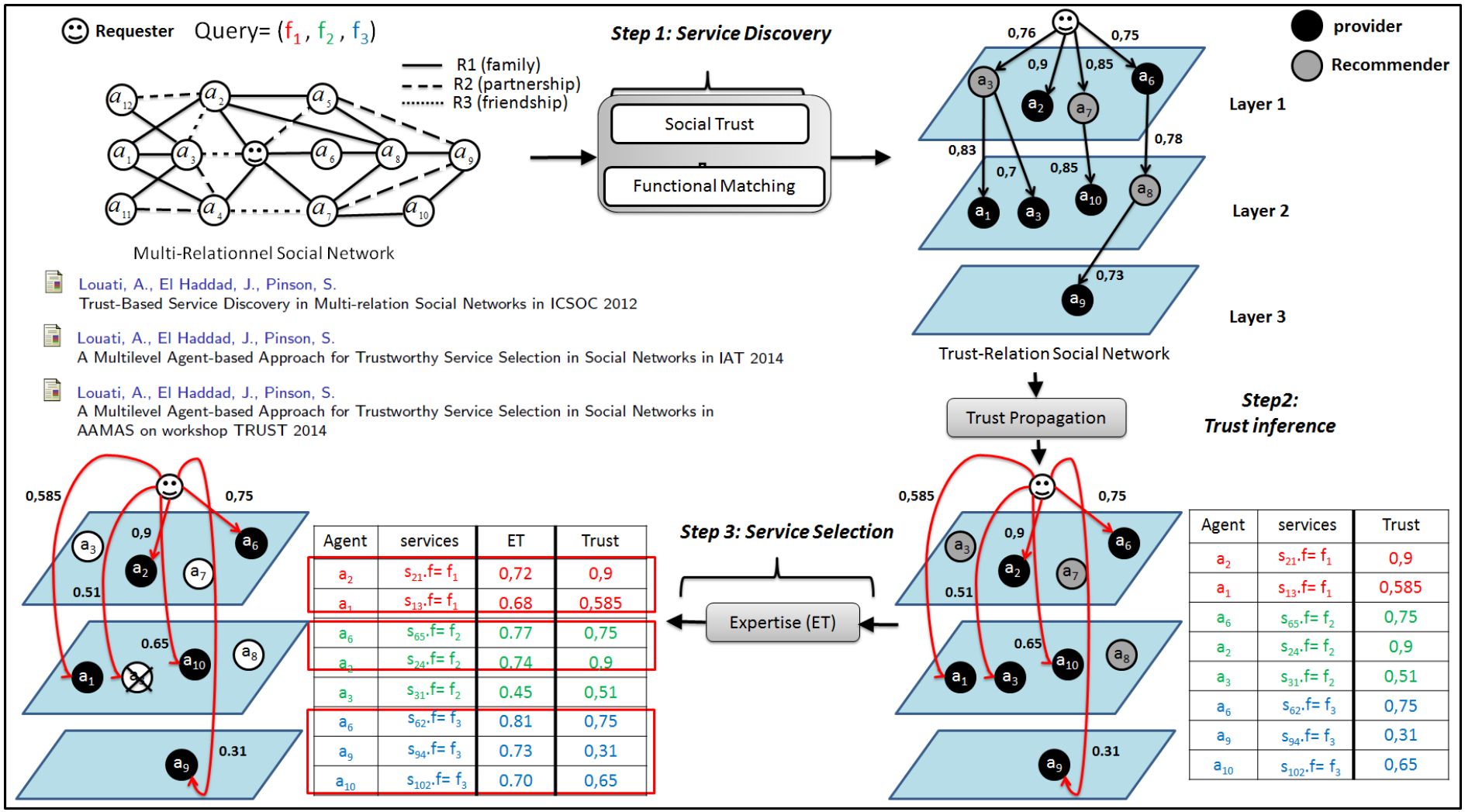


Service discovery and selection process



Agent	services	Trust
a_2	$s_{21}.f = f_1$	0,9
a_1	$s_{13}.f = f_1$	0,585
a_6	$s_{65}.f = f_2$	0,75
a_2	$s_{24}.f = f_2$	0,9
a_3	$s_{31}.f = f_2$	0,51
a_6	$s_{62}.f = f_3$	0,75
a_9	$s_{94}.f = f_3$	0,31
a_{10}	$s_{102}.f = f_3$	0,65

Service discovery and selection process



Agent	services	ET	Trust
a_2	$s_{21}.f = f_1$	0,72	0,9
a_1	$s_{13}.f = f_1$	0.68	0,585
a_6	$s_{65}.f = f_2$	0.77	0,75
a_2	$s_{24}.f = f_2$	0.74	0,9
a_3	$s_{31}.f = f_2$	0.45	0,51
a_6	$s_{62}.f = f_3$	0.81	0,75
a_9	$s_{94}.f = f_3$	0.73	0,31
a_{10}	$s_{102}.f = f_3$	0.70	0,65

Agent	services	Trust
a_2	$s_{21}.f = f_1$	0,9
a_1	$s_{13}.f = f_1$	0,585
a_6	$s_{65}.f = f_2$	0,75
a_2	$s_{24}.f = f_2$	0,9
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a_{10}	$s_{102}.f = f_3$	0,65

Coalition formation process description

Sequential process composed of three phases :

1. Initial Coalitions Generation (e.g. $\mathcal{C} = \{c_1 = \{a_2\}, c_2 = \{a_6\}\}$)

Coalition formation process description

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1. Initial Coalitions Generation (e.g. $\mathcal{C} = \{c_1 = \{a_2\}, c_2 = \{a_6\}\}$)
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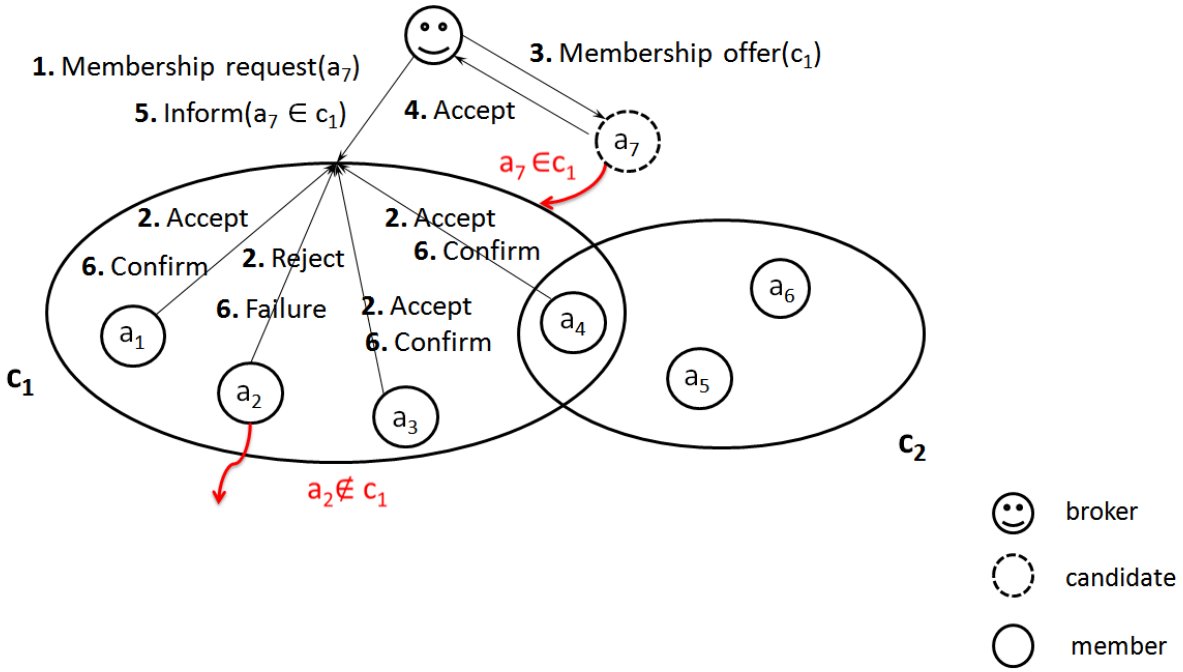
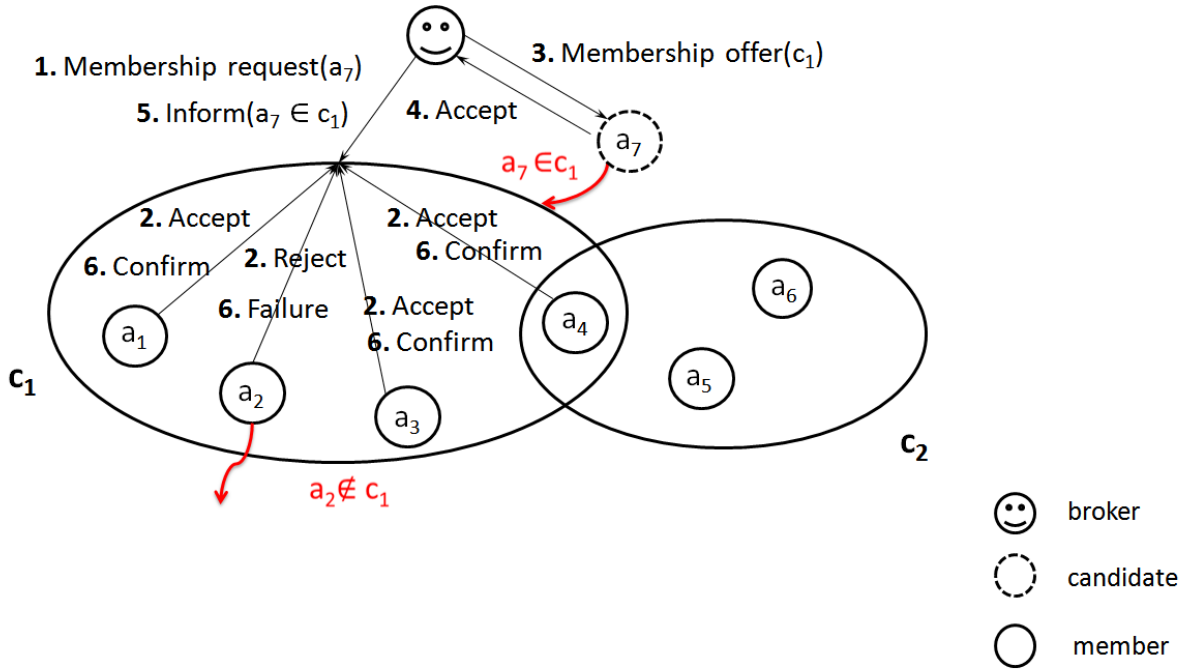


Coalition formation process description

Sequential process composed of three phases :

1. Initial Coalitions Generation (e.g. $\mathcal{C} = \{c_1 = \{a_2\}, c_2 = \{a_6\}\}$)
2. Member Selection
3. Best coalition choice $c \leftarrow Argmax_{1 \leq z \leq |\mathcal{C}|} \frac{\sum_{a_t \in c_z} ET(a_t)}{|c_z|}$



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Experimental methodology

Configuration \ Scenario	A	B	C	D	E
User query	2	3	4	5	6
services	5	5	5	5	5
timeout (ms)	3000	3000	3000	3000	3000

TABLE – Definition of test scenarios

Performance of the coalition process

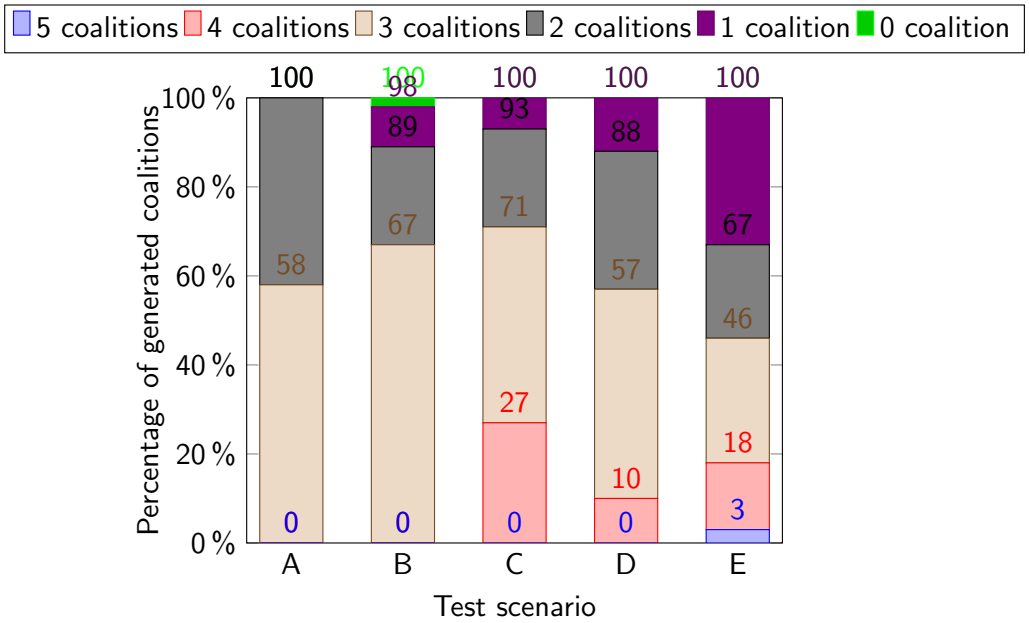

FIGURE – Percentage of generated coalitions per test scenario

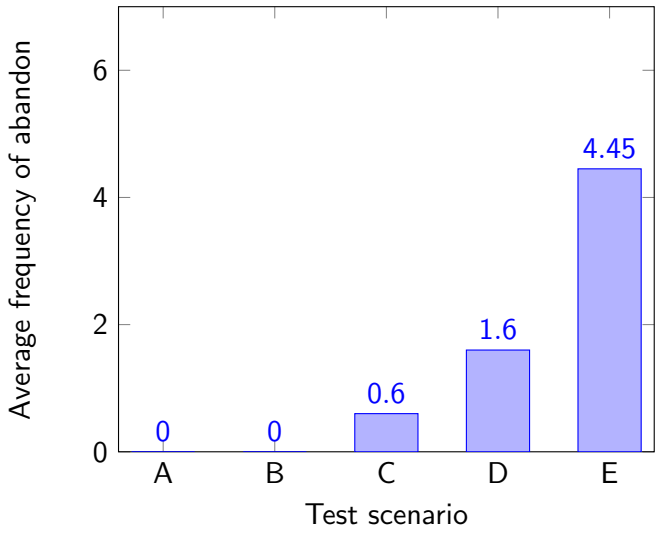

FIGURE – The average frequency of abandon per test scenario

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Conclusion

Trust-based dynamic coalition formation process for service composition in social networks

- Incremental, dynamic and overlapping selection protocol
- Agent cooperate based on a decentralized decision-making process guided by trust in cooperation
- Members are able to leave any coalition if they are no longer satisfied

Perspectives

- More experimentation
- Investigate the correlation between the quality of the chosen composite service and the trustworthiness of its members
- Analyze the impact of the variation of the maximum layer value on the coalition formation process
- Integrate negotiation in the coalition formation process : persuasions strategies
- Examine the coalition stability : parallel coalition generation and define the utility of a service composition

Thank you !
Questions ... ?