

Trust Protocol integrating Services' Semantics

Cédric LÉVY-BENCHETON
Frédéric LE MOUËL

CITI - INRIA/ARES

Ubiq NW, Tokyo, Japan, November 25, 2007

Summary

- Introduction
- Related Works
 - Trust
 - Services
 - Linking Trust and Services
- Trust Protocol integrating Services' Semantics
 - Service Model
 - Service Description
 - Protocol Steps
- Implementation
 - Scenarios
- Conclusion and Future Work

Context

- Research – INRIA – ARES Team
 - National Institute of Computer Science and Automatic
- Teaching – INSA Lyon – Telecom Dprt
- Work supported by
 - KAA French Ministry Project – Ambient Authentication
 - PRIAM INRIA Project – Privacy Issues in Ambient

Introduction

- Services are...
 - Provided or not
 - Configurable or not
 - Decisions based on identities

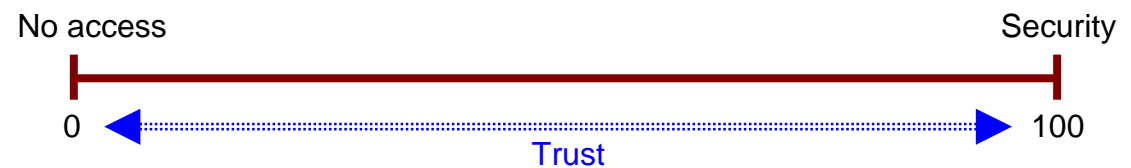
- How to...
 - Use a service when no identity verification is possible ?
 - Provide a service depending the user ?
 - Grant a partial access ?
 - Allow a trusted user to access more services ?

- Proposed solution
 - Develop a trust protocoll using the services' description
 - Adapt a service with the trust level

Related Works

Trust

- A social concept
 - Expectation of a future action
 - Depends on the context
 - Defined properties (asymmetric, transitivity, ...)
- In computer science
 - 100% = Security
 - 0% = No access
 - Inbetween = Trust



Trust Implementations

- Trust properties are defined by
 - Context [AbdulHailes00], [ToivoDenker04]
 - Previous exchanges [MundiBoudec05], [WangVassi03]
 - Relationship [ChangHussain05], [Choi et al. 06], [FOAF]
- Association of
 - Context + Previous Exchanges [BriggsMarsh06], [Capra04]
 - Previous Exchanges + Relationship [Sierra05]
 - Context + Relationship [Zheng et al. 06]

Trust Implementations

- Trust is based on identity
 - Person identity
 - X.509 certificates [X.509], PGP Web of Trust [PGP], PolicyMaker [Blaze et al. 96]
 - Computer identity
 - Trusted Computing Group with the Trusted Platform Module [TPM], Peer-to-Peer [AbererDespo01]
 - Software identity
 - Trusted Extended Dynamic [Zhang et al. 06], SARAH in Grid Computing [SongHwang04]
- Decisions are taken by trust
 - Restrict access
 - Peertrust [Nejdl et al. 04], TrustBuilder+GAA [Ryutov et al. 05]
 - Provide new services
 - SSRD and SSRD+ [Sharmin et al. 06]

Services

- Realize a goal, an action
- Have a Description with Properties
 - Semantics

- In computer science
 - Platform independent
 - Communicate with other services
 - Regroup to create a bigger service
 - Service Composition

Services Implementations

- Service description
 - Define how to access it [WSDL]
 - Specifies their functionalities [OWL-S], [WSMO]
- Service discovery based on their description
 - Using Third-party [Jini], [UDDI], [MNM]
 - Directly [UPnP], [Yang01]
- Negotiation of a wanted service
 - Description-based [Preist04], [Tsveti03]
 - Contract-based [Parkin et al. 06], [Lock06]
 - Service granted or refused [Cao et al. 05]

Existing Approaches

- Identity-based
 - Trust should depend on the services properties

- Not Dynamic
 - Trust should allow new properties of a services to be disclosed
 - Negotiation doesn't depend on credentials

- Rely on a third party
 - Trust should occur directly between two services

No Service-to-Service trust model

Linking Trust and Services

- Description of trust and service
 - Expected behaviour of a service
 - Based on its properties
- Propagation and Discovery
 - Enhance the discovery of new services
 - Discover services based on the trust level
- Policies and Negotiation
 - Adapt services to the trust level
 - Disclose or hide properties

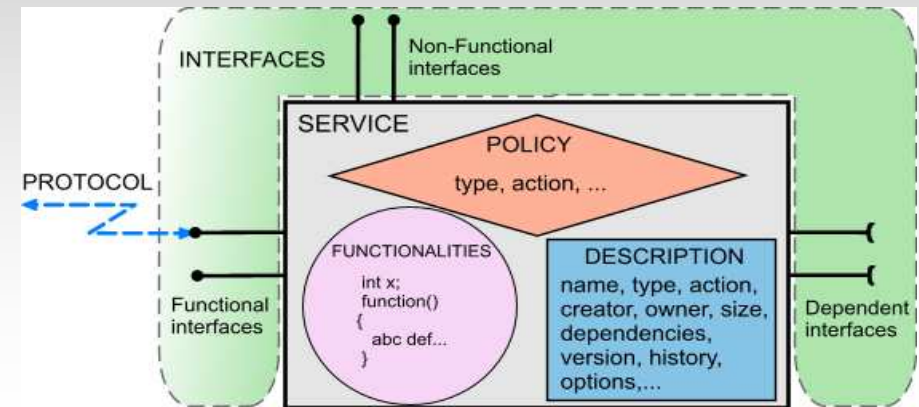
A Trust Protocol implementing Services' Semantics

Service-to-Service Trust Protocol

- Trust and services have similar properties
 - Services' semantics define the service behaviour
 - Adapt the service to the trust level
- Description-based
 - Trust evaluation based on the semantics
 - Disclose new properties according to the trust level
 - Transitions based on policies
- Different steps based on the service life-cycle
 - Initiation, Discovery, Choice
 - Negotiation, Agreement
 - Propagation
- A Contract
 - Description of the two services
 - Signed at the agreement
 - Rating = a rated contract, used in propagation

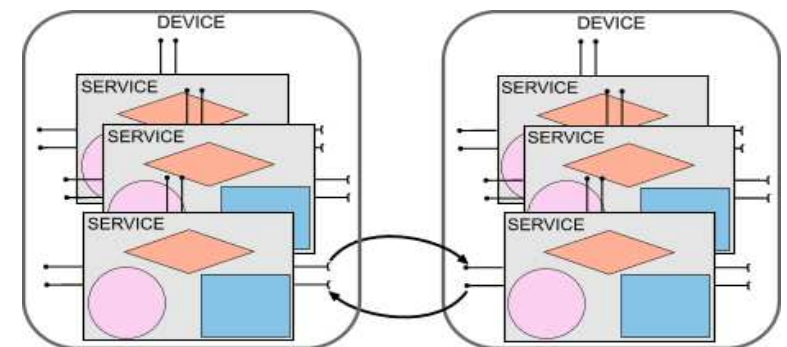
Service Model

- Runs on a device
- Four building blocks
 - Interface, protocol, policy, description



Service Model

- Requester
 - Requests a service
 - Contacts a provider
- Provider
 - Answers a requester
 - Is a requester in composed services



Two services communicate

Service Description

- Enhanced with trust
 - Properties have values
 - Values have a trust level
- Disclose a property for a defined trust level
 - Properties allowed to be used

Trust is added
to the service
description

Service X

Property	Value			Trust
name	vlc			80%
type	mediaplayer			40%
creator	videolan			70%
protocol	rtsp			80%
interface	url://service_x			10%
history	r1	r2	...	60%
	80%	60%	...	
...%

A Trust-Enriched Service Description

Policies

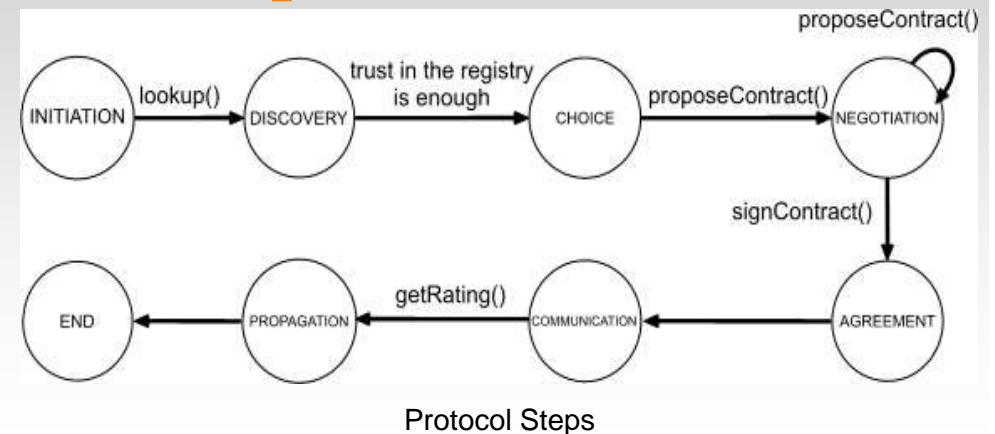
- Defined at the service level
- Make a decision
 - Evaluate Trust - `Service.trust(Description D)`
 - A Service evaluates trust of the Description D and returns a trust level. Used to get a Description.
 - Defines the trust level in the *null* Description: trust in an unknown service.
 - Filter Description - `Service.filter(Description Ds, Trust T)`
 - A service filters the description Ds for the trust level T. Returns a filtered Description with no trust. Used to get a Description.
 - Minimum trust level and Trust Acceptation Level
 - Minimum Trust Level: Defined by a service. Below this level, the communication stops. Used at Discovery and Choice.
 - Trust Acceptation Level: Defined by a service. Trust level to accept a contract. Used at Negotiation.

Policies

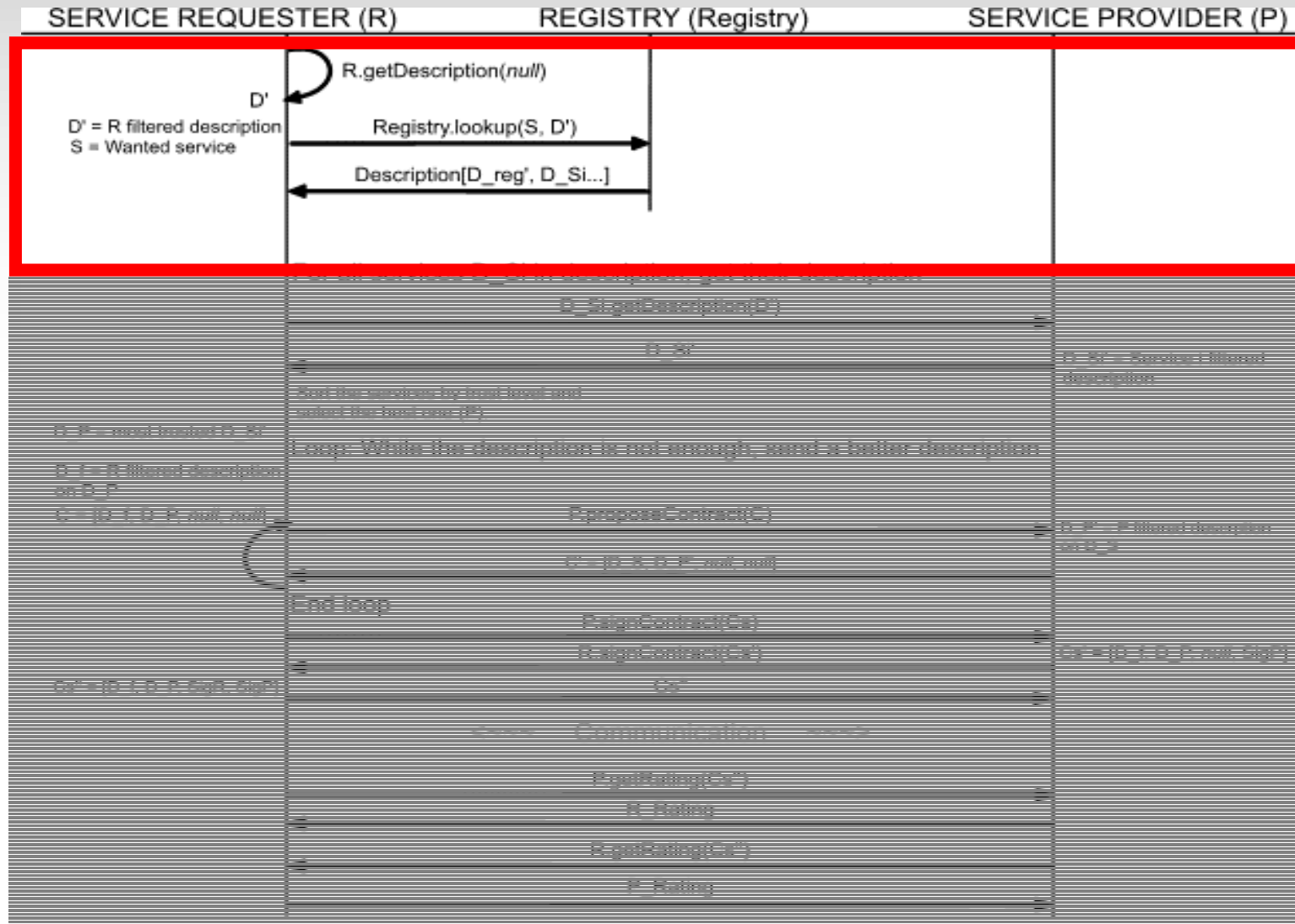
- Defined at the service level
- Make a decision
 - Temporary trust increase
 - Specifies the temporary value the trust level should be increased, to get a better description. Used at Negotiation.
 - Maximum number of trust increase
 - Specifies the maximum number of time the trust can be temporary increased when the other side hasn't changed its description. Used at Negotiation.
 - Same Contract
 - Checks if the contract is the same as previously sent/agreed. Used at Agreement and Propagation.

Protocol Steps

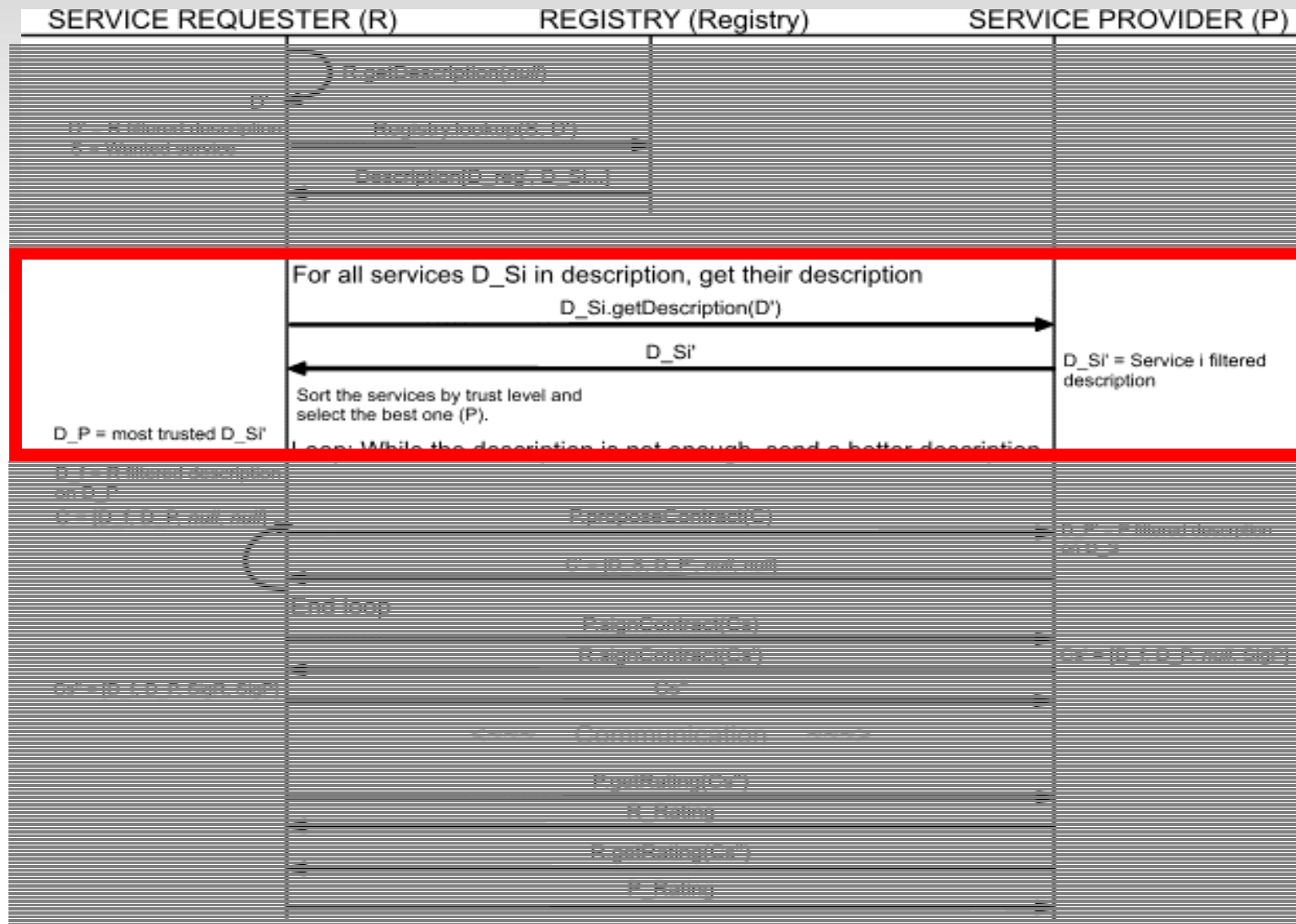
- **Initiation**
 - The requester creates a wanted service
- **Discovery**
 - A registry looks up for a service
 - The requester gets a list of services
- **Choice**
 - The requester evaluates trust in every service and selects a provider
- **Negotiation**
 - Creation of a contract, using the description of both services.
 - The requester and provider disclose more properties of their description, based on trust.
- **Agreement**
 - The trust level is enough: a contract is signed.
- **Propagation**
 - Both sides rate the communication, using the trust level in the other side



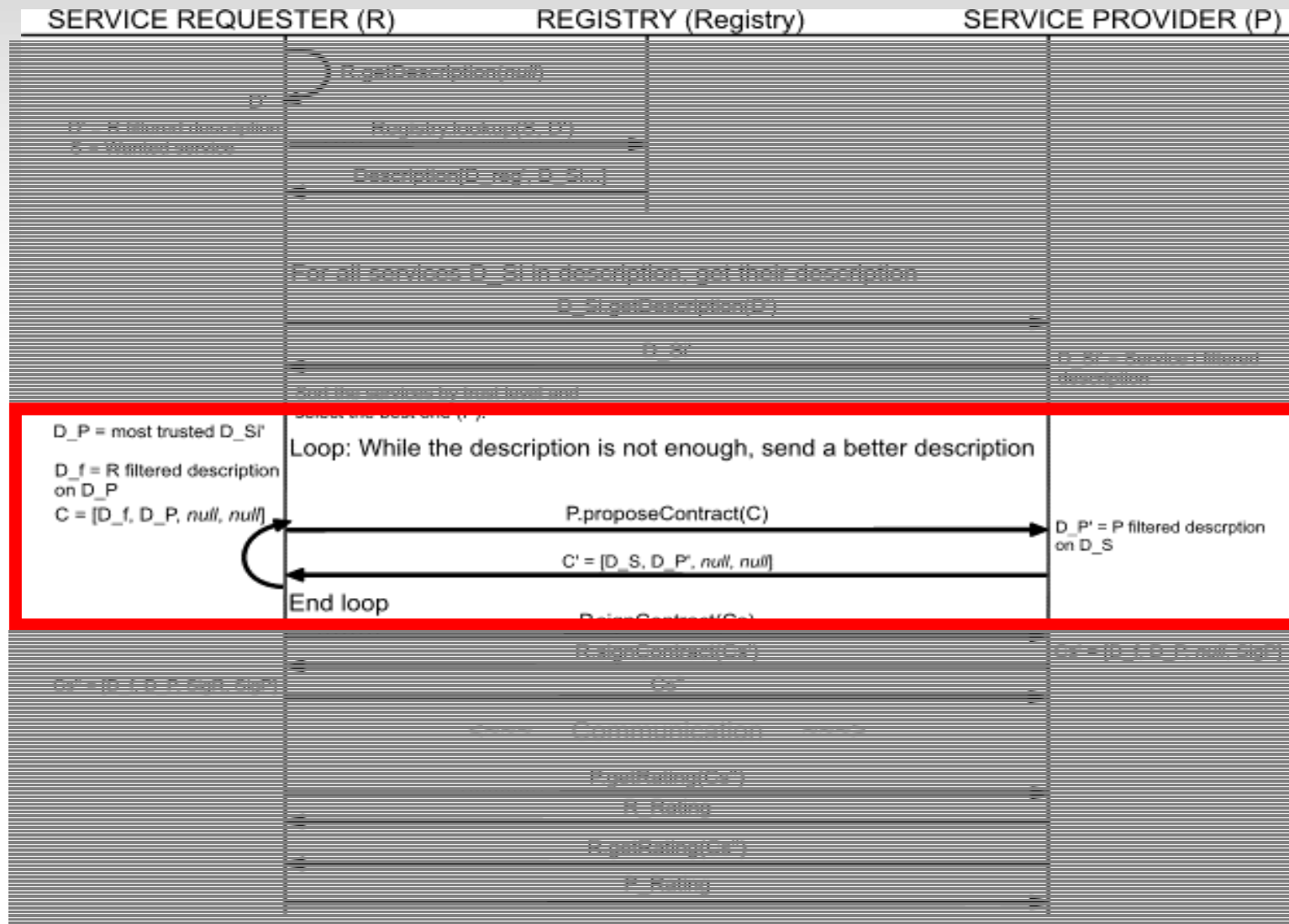
Protocol - Initiation



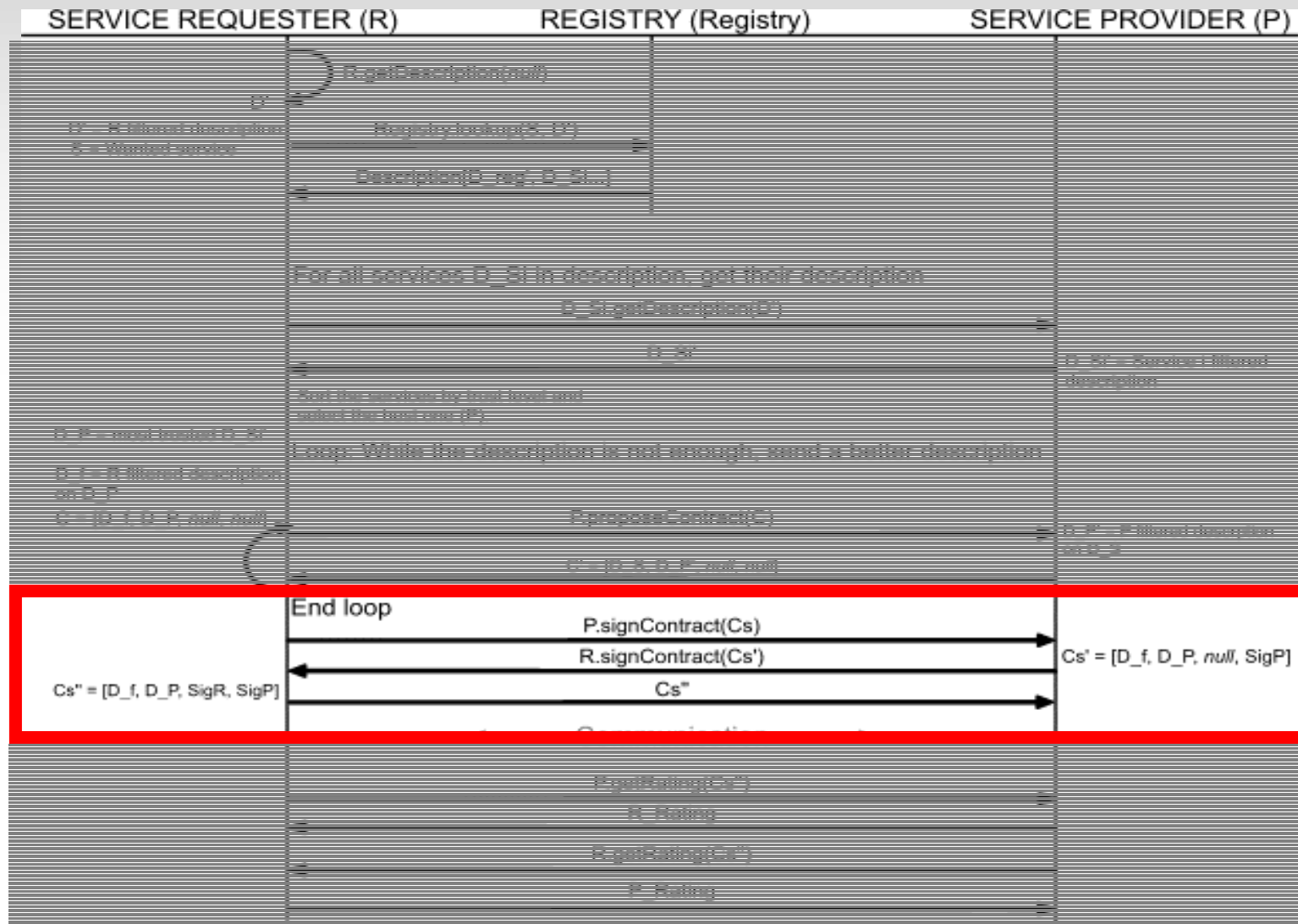
Protocol - Choice



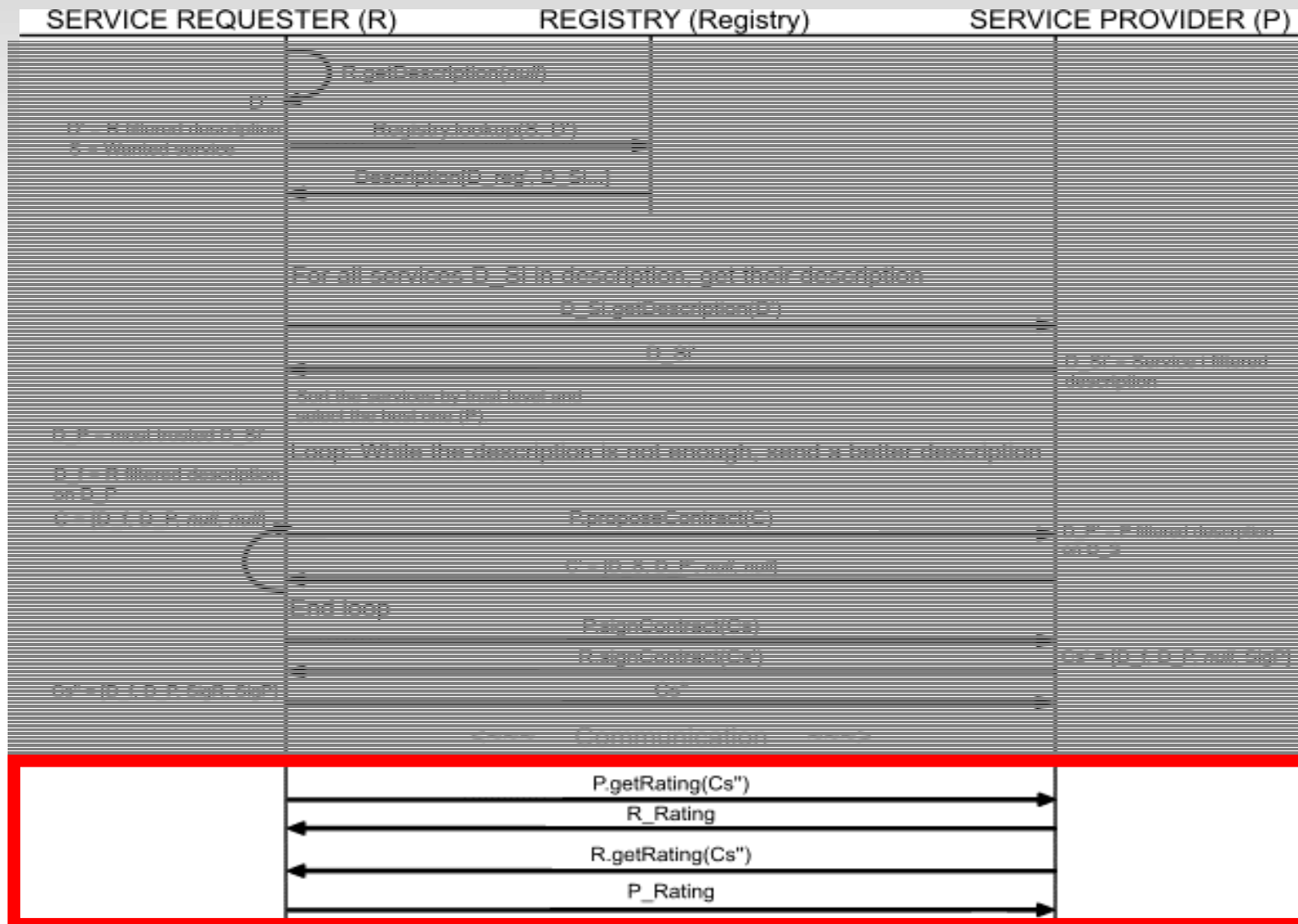
Protocol - Negotiation



Protocol - Agreement



Protocol - Rating



Implementation

Prototype

- Developed in JAVA
 - Test the protocol using different scenarios
- Different Classes
 - Property, Description, ServiceTrusted, ...
 - Registry
- Four services
 - Requester, Registry, two providers
 - A Wanted Service = a description created by the requester
 - Every service has its own description

Scenarios

- Three scenarios
 - The requester decides the Trust Acceptation Level
 - Negotiation with different Trust Acceptation Levels
 - Direct acceptance, acceptance after negotiation, rejection after negotiation

- Scenario 1 – Direct acceptance
 - A requester (mediaplayer) wants to use a wanted service (mediaserver)
 - A registry is contacted to find a matching service
 - The requester gets a list of different services, and contacts them to choose a provider
 - A negotiation ensues and a contract is set
 - To conclude, a rating is done based on the contract

Initiation, Discovery

■ Initiation

- The requester builds the description of a wanted service
- The requester filters its own description using the *null* description

■ Discovery

- The requester queries a registry, with a lookup message containing its description and the wanted service
- The registry filters providers descriptions based on the requester's trust and the wanted service

Name	Value	Trust
type	mediaplayer	40
name	vlc	60
version	1.2	76
creator	videolan	65
interface	requester	10

(A) REQUESTER

Name	Value	Trust
name	servideo	55
type	mediaserver	40
version	1.3	70
creator	videolan	62
interface	1	10

(C) PROVIDER1

Name	Value	Trust
type	registry	40
name	searchor	60
interface	registry	10

(B) REGISTRY

Name	Value	Trust
name	winmedia	80
type	mediaserver	30
interface	2	10

(D) PROVIDER2

The different services

Name	Value
name	machin
type	mediaserver

(A) WANTED SERVICE

Name	Value
interface	1

(C) PROVIDER1 FILTERED DESCRIPTION

Name	Value
type	mediaplayer
interface	requester

(B) REQUESTER FILTERED DESCRIPTION ON A NULL DESCRIPTION

Name	Value
type	mediaserver
interface	2

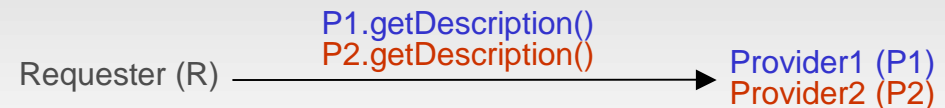
(D) PROVIDER2 FILTERED DESCRIPTION

Choice

Name	Value
type	mediaplayer
interface	requester

REQUESTER FILTERED DESCRIPTION
ON A NULL DESCRIPTION

- The requester contacts all providers to get their description, using its filtered description
- The providers evaluate trust in the requester, using the appropriate policy, and send their filtered description
- The provider evaluates trust and selects the most trusted provider
- A new description is filtered using the new trust level



P1 Trust evaluation in R
Basic trust = 50%
type mediaplayer => +10%
Total = 60%

P2 Trust evaluation in R
Basic trust = 50%
type mediaplayer => +10%
Total = 60%

Disclose "type mediaserver" (40%)
Disclose "name servideo" (55%)

Disclose "type mediaserver" (30%)

R Trust evaluation in P1
Basic trust = 50%
type mediaplayer => +15%
name servideo => +5%
Total = 70%

R Trust evaluation in P2
Basic trust = 50%
type mediaplayer => +10%
Total = 60%

Provider1 is selected as Provider.
Requester's Trust in Provider = 70%

Disclose "name vlc" (55%)
Disclose "creator videolan" (65%)

Name	Value
name	vlc
type	mediaplayer
creator	videolan
interface	requester

REQUESTER DESCRIPTION
WITH TRUST = 70%
New filtered description

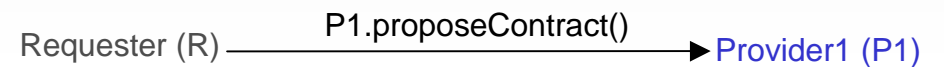
Negotiation, Agreement, Rating

- Negotiation: A contrat is proposed using both sides description
 - If the trust is enough, the contract is accepted
 - New properties are disclosed until the trust in the contract is enough
 - If the same description is sent 3 times in a contract, the communication is stopped

- Agreement: The contract is signed by both sides

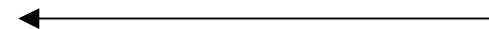
- Rating: The signed contract is rated
 - The providers rates the contract with its trust level in the requester, and sends it to the requester, and vice-versa
 - The service receives the rating and stores it in "history"

First Contract		Requester		Provider	
Descriptions	Name	Value	Name	Value	
	name	vlc	name	servideo	
	type	mediaplayer	type	mediaserver	
	creator	videolan	interface	1	
	interface	requester	PROVIDER1 DESCRIPTION WITH TRUST = 60%		
REQUESTER DESCRIPTION WITH TRUST = 70%					
Signatures	null		null		



P1 Trust evaluation in R
 Basic trust = 50%
 name vlc => +10%
 type mediaplayer => +10%
 Total = 70%

Disclose "creator videolan" (62%)



R Trust evaluation in P1
 Basic trust = 50%
 type mediaplayer => +15%
 name servideo => +5%
 creator videolan => no change
 Total = 70%

Scenario 1: contract accepted

Conclusion

- Adapt a service using trust
 - Link description with trust
 - Discover trusted services
 - Trust-based negotiation

- A Service-to-Service trust protocol
 - Based on enhanced service description
 - Based on policies
 - Defined at the service level

Future Work

- Calibration tools
 - Decide trust values to use
 - Create automatic trusted description
 - Create adapted policies
 - Trust metrics, matching...
- Implement propagation
 - Implement the negotiation inside the discovery
 - Use history and ratings as credentials
- Study Privacy and Security issues

Bibliography – Trust 1/2

- **[AbdulHailes00]** A. Abdul-Rahman and S. Hailes, "Supporting trust in virtual communities" in *HICSS 2000*, vol. Track 6: Internet and the Digital Economy. IEEE Computer Society, January 2000.
- **[AbererDespo01]** K. Aberer and Z. Despotovic, "Managing trust in a peer-2-peer information system" in *CIKM 2001*, November 2001.
- **[Blaze et al. 96]** M. Blaze, J. Feigenbaum, and J. Lacy, "Decentralized trust management" in *1996 IEEE Symposium on Security and Privacy*. IEEE Computer Society, May 1996.
- **[BriggsMarsh06]** P. Briggs and S. Marsh, "An exploration of trust, forgiveness and regret" in *Pervasive 2006*, T. Strang, V. Cahill, and A. Quigley, Eds., May 2006.
- **[Capra04]** L. Capra, "Towards a human trust model for mobile ad-hoc networks" in *UK-UbiNet 2004*, May 2004.
- **[ChangHussain05]** E. J. Chang, F. K. Hussain, and T. S. Dillon, "Fuzzy nature of trust and dynamic trust modeling in service oriented environments" in *SWS 2005*, November 2005.
- **[Choi et al. 06]** H.-C. Choi, S. R. Kruk, S. Grzonkowski, K. Stankiewicz, B. Davis, and J. G. Breslin, "Trust models for community-aware identity management" in *WWW 2006*. ACM, May 2006.
- **[FOAF]** The Friend Of A Friend Project, "FOAF Vocabulary Specification" Available at: <http://xmlns.com/foaf/0.1/>, FOAF, July 2005.
- **[MundiBoudec05]** J. Munding and J.-Y. L. Boudec, "Analysis of a reputation system for mobile ad-hoc networks with liars" in *WiOpt 2005*. IEEE Computer Society, April 2005.
- **[Nejdl et al. 04]** W. Nejdl, D. Olmedilla, and M. Winslett, "Peertrust: Automated trust negotiation for peers on the semantic web" in *SDM 2004*, ser. Lecture Notes in Computer Science, vol. 3178. Springer, August 2004.

Bibliography – Trust 2/2

- **[PGP]** P. Zimmermann, "Pretty good privacy: public key encryption for the masses" pp. 93–107, 1995.
- **[Ryutov et al. 05]** T. Ryutov, L. Zhou, B. C. Neuman, T. Leithead, and K. E. Seamons, "Adaptive trust negotiation and access control" in *SACMAT 2005*, June 2005.
- **[Sharmin et al. 06]** M. Sharmin, S. Ahmed, and S. I. Ahamed, "An adaptive lightweight trust reliant secure resource discovery for pervasive computing environments" in *PERCOM 2006*. IEEE Computer Society, March 2006.
- **[Sierra05]** C. Sierra and J. Debenham, "An information-based model for trust" in *AAMAS 2005*. ACM, July 2005.
- **[SongHwang04]** S. Song and K. Hwang, "Trusted grid computing with security assurance and resource optimization" in *ISCA PDCS 2004*. ISCA, September 2004.
- **[ToivoDenker04]** S. Toivonen and G. Denker, "The impact of context on the trustworthiness of communication: An ontological approach" in *ISWC 2004*, November 2004.
- **[TPM]** Trusted Computing Group, "Trusted Platform Module" Available at: <https://www.trustedcomputinggroup.org/groups/tpm/>, January 2005.
- **[WangVassi03]** Y. Wang and J. Vassileva, "Trust and reputation model in peer-to-peer networks" in *P2P 2003*. IEEE Computer Society, September 2003.
- **[X.509]** C. Adams and S. Farrell, "Internet x.509 public key infrastructure certificate management protocols", United States, 1999.
- **[Zhang et al. 06]** X. Zhang, F. Xu, Y. Liu, X. Zhang, and C. Shen, "Trust extended dynamic security model and its application in network" in *MSN 2006*, ser. Lecture Notes in Computer Science, vol. 4325. Springer, December 2006.
- **[Zheng et al. 06]** X. Zheng, Z. Wu, H. Chen, and Y. Mao, "Developing a composite trust model for multi-agent systems" in *AAMAS 06*. ACM Press, May 2006.

Bibliography – Services 1/2

- **[Cao et al. 05]** J. Cao, J. Wang, S. sheng Zhang, and M. Li, "A multi-agent negotiation based service composition method for on-demand service" in *SCC 2005*. IEEE Computer Society, July 2005.
- **[Jini]** Sun microsystems, "Jini version 2.01" Available at: <http://java.sun.com/products/jini/>, October 2005.
- **[Lock06]** R. Lock, "Automated negotiation for service contracts" in *COMPSAC 2006*. IEEE Computer Society, September 2006.
- **[MNM]** M. Garschhammer, R. Hauck, B. Kempter, I. Radisic, H. Roelle, and H. Schmidt, "The MNM Service Model – Refined Views on Generic Service Management" *Journal of Communications and Networks*, vol. 3, no. 4, pp. 297–306, December 2001.
- **[OWL-S]** D. Martin, M. Burstein, J. Hobbs, O. Lassila, D. McDermott, S. McIlraith, S. Narayanan, M. Paolucci, B. Parsia, T. Payne, E. Sirin, N. Srinivasan, and K. Sycara, "Owl-s: Semantic markup for web services" Available at: <http://www.w3.org/Submission/OWL-S/>, W3C, November 2004.
- **[Parkin et al. 06]** M. Parkin, D. Kuo, and J. Brooke, "A framework & negotiation protocol for service contracts" in *SCC 2006*. IEEE Computer Society, September 2006.
- **[Preist04]** C. Preist, "A conceptual architecture for semantic web services" in *ISWC 2004*, ser. Lecture Notes in Computer Science, vol. 3298, November 2004.

Bibliography – Services 2/2

- **[Tsveti03]** P. E. Tsvetinov, "Pre-negotiations over services - a framework for evaluation" in *AI 2003*, ser. Lecture Notes in Computer Science, vol. 2671. Springer, June 2003.
- **[UDDI]** K.-P. Eckert, "The fundamentals of web services" in *The Industrial Information Technology Handbook*, R. Zurawski, Ed. CRC Press, 2005, pp. 1–15.
- **[UPnP]** UPnP Forum, "UPnP Standards" Available at: <http://www.upnp.org/standardizeddcps/default.asp>, May 2006.
- **[WSDL]** Erik Christensen - Microsoft, Francisco Curbera - IBM Research, Greg Meredith - Microsoft, and Sanjiva Weerawarana - IBM Research, "Web Services Description Language (WSDL) 1.1" Available at: <http://www.w3.org/TR/wsdl>, W3C, March 2001.
- **[WSMO]** D. Roman, U. Keller, H. Lausen, R. L. Jos de Bruijn, M. Stollberg, A. Polleres, C. Feier, C. Bussler, and D. Fensel, "Web service modeling ontology" *Applied Ontology*, vol. 1, no. 1, pp. 77–106, 2005.
- **[Yang01]** X. Yang, "A framework for semantic service discovery" Tech. Rep., June 2001.

Trust Protocol integrating Services' Semantics

Cédric LÉVY-BENCHETON
Frédéric LE MOUËL

CITI - INRIA/ARES

CITI Laboratory: <http://citi.insa-lyon.fr>

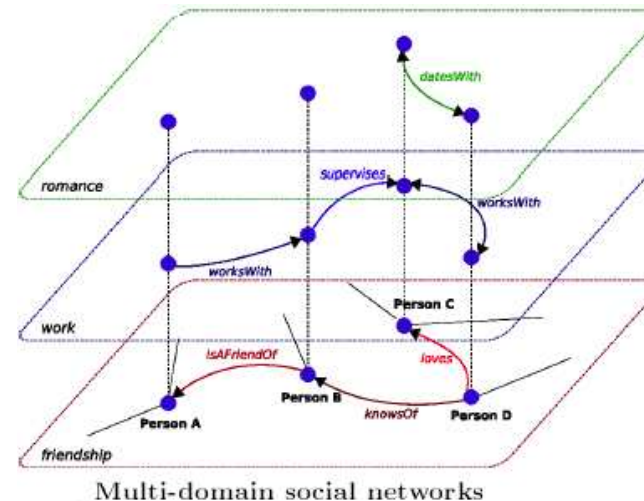
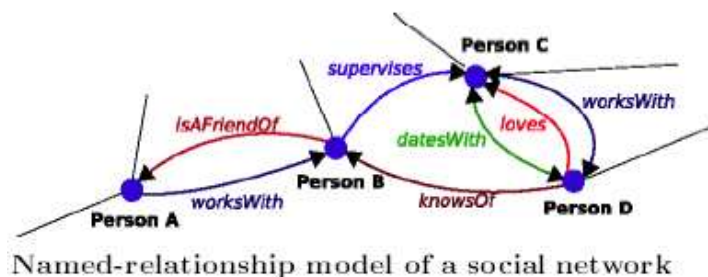
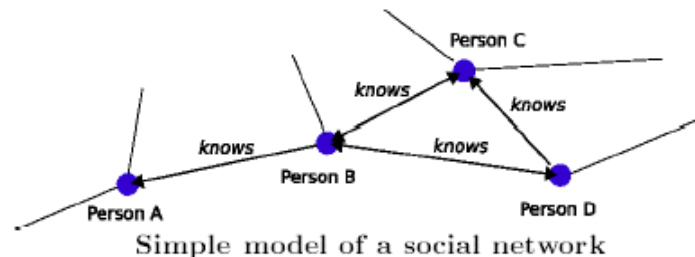
KAA Project: <http://kaa.citi.insa-lyon.fr>

PRIAM Project: <http://priam.citi.insa-lyon.fr>

Appendices

Trust models in bibliography

- Trust models represent trust relations
- Domain of trust using named relations
 - Different trust possible
- A metric is needed to evaluate trust



Images from H.-C. Choi, S. R. Kruk, S. Grzonkowski, K. Stankiewicz, B. Davis, and J. G. Breslin, "Trust models for community-aware identity management," in *WWW 2006*. ACM, May 2006.

Evaluating Trust

- Metrics to evaluate trust
 - Numeric (between 0 and 1, -1 and 1, ...)
 - Leveled (untrusted/low/high/very high)
 - Fuzzy (assign values to named relationships)
 - Weighted (one property weights more than the others)
- Using recommendation/reputation
 - Transitivity of trust
 - Trust in the recommender
 - Global reputation vs local reputation

Services Definitions

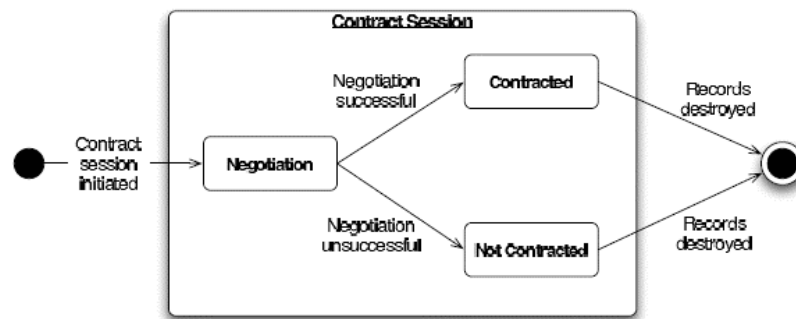
- *"a service is something general which has properties. A service's intention is to undertake certain functions to provide value to the business; its specification isn't just the direct service it provides but also the environment in which it undertakes those functions. A service therefore is a discreet domain of control that contains a collection of tasks to achieve related goals". [Jones05]*
- "activities [...] of a more or less intangible nature that normally [...] take place in interactions between the customer and service employees and/or physical resources or goods and/or systems of the service provider, which are provided as solutions to customer problems". [Grönroos]
- "any act or performance that one party can offer to another that is essentially intangible" [Kotle]
- *"services are deeds, processes and performances". [Zeithaml]*

[JONES05] - S. Jones, "Toward an acceptable definition of service." *IEEE Software*, vol. 22, no. 3, pp. 87-93, 2005.

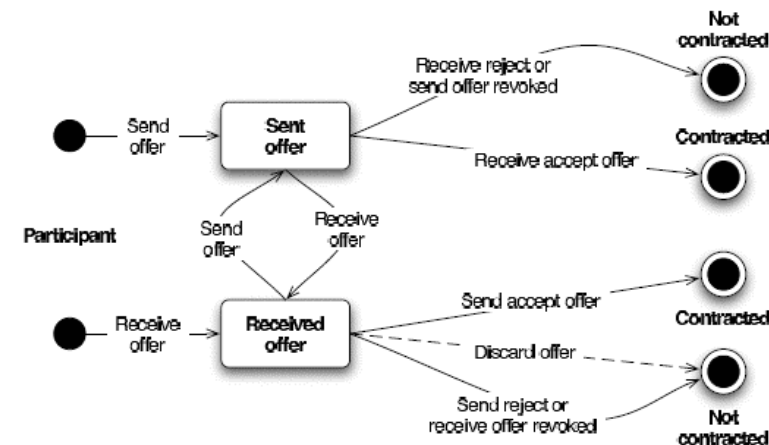
[Grönroos], [Kotle], [Zeithaml] - Found in Z. Baida, H. Akkermans, and J. Gordijn, "Serviguration: towards online configurability of real-world services," in *ICEC 2003*, September-October 2003, pp. 111-118.

Service Negotiation

- Discuss the properties of a wanted service
- Based on the contracts
 - Accept or reject



Negotiation based on contracts



Agreement through negotiation

Images from M. Parkin, D. Kuo, and J. Brooke, "A framework & negotiation protocol for service contracts." in SCC 2006. IEEE Computer Society, September 2006.

Scenario 2

Name	Value
name	vlc
type	mediaplayer
creator	videolan
interface	requester

REQUESTER DESCRIPTION
WITH TRUST = 70%

Requester (R) → Provider1 (P1)

- The requester temporary increases the trust level to 75%
- The provider's trust in the requester does not increase trust, the contract is unchanged
- The requester temporary increases the trust level to 76% and discloses a new property
- The provider has more trust and discloses a new property
- The requester's trust level in the provider is evaluated 75%
- Agreement

R evaluation in P1

SAME CONTRACT (first time)
Trust = 70%

TEMPORARY increase
trust : +1*5% => 75%

Name	Value
name	vlc
type	mediaplayer
creator	videolan
interface	requester

REQUESTER DESCRIPTION
WITH TRUST = 70%

P1 Trust evaluation in R
Total = 70%

R evaluation in P1

SAME CONTRACT (second time)
Trust = 70%

TEMPORARY increase
trust : +2*5% => 80%
Disclose "version 1.2" (76%)

Name	Value
name	vlc
type	mediaplayer
version	1.2
creator	videolan
interface	requester

REQUESTER DESCRIPTION
WITH TRUST = 76% AND MORE

P1 Trust evaluation in R
Current trust = 70%
version 1.2 => +2%
Total = 72%

Disclose "version 1.3" (70%)

R Trust evaluation in P1

Basic trust = 50%
type mediaplayer => +15%
name servideo => +5%
version 1.3 => +5%
Total = 75%

Name	Value
name	vlc
type	mediaplayer
version	1.3
creator	videolan
interface	requester

PROVIDER1 DESCRIPTION
WITH TRUST = 72% AND MORE

Scenario 2: contract accepted

Scenario 3

- Same as scenario 2, but no agreement...
- The trust isn't enough, but a new description was disclosed by the provider
- The requester temporary increases the trust level by 5%, to 80%
- No new description is received, same process is repeated
 - Same description received 3 times, the connection is closed

Name	Value
name	vlc
type	mediaplayer
version	1.2
creator	videolan
interface	requester

REQUESTER DESCRIPTION
WITH TRUST = 76% AND MORE

Requester (R) → Provider1 (P1)

R evaluation in P1

New Contract received
Trust = 75%

But a description with 76% has been disclosed already.

Name	Value
name	vlc
type	mediaplayer
version	1.3
creator	videolan
interface	requester

PROVIDER1 DESCRIPTION
WITH TRUST = 72% AND MORE

P1 Trust evaluation in R
SAME CONTRACT
Total = 72%

R evaluation in P1 ←

SAME CONTRACT (first time)
Trust = 75%

TEMPORARY increase trust : +1*5% => 80%

P1 Trust evaluation in R
SAME CONTRACT
Total = 72%

R evaluation in P1 ←

SAME CONTRACT (second time)
Trust = 75%

TEMPORARY increase trust : +2*5% => 85%

P1 Trust evaluation in R
SAME CONTRACT
Total = 72%

R evaluation in P1 ←

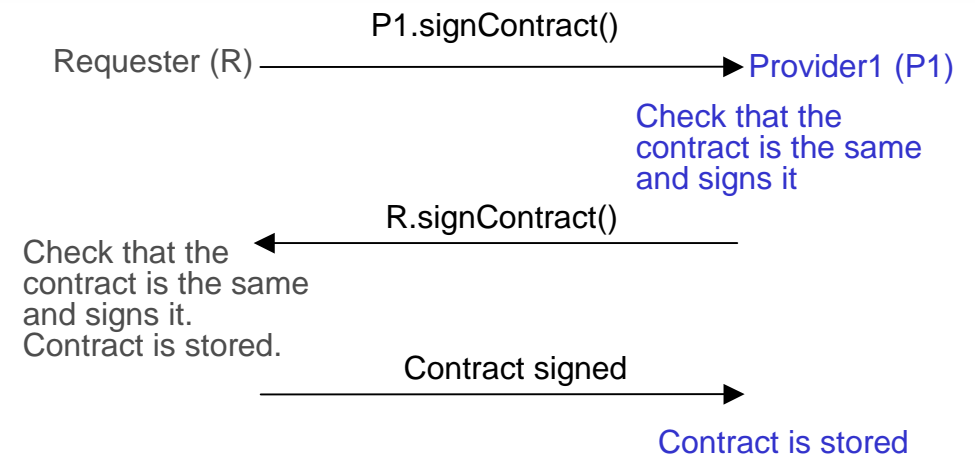
SAME CONTRACT (third time)
Trust = 75%

Scenario 3: contract rejected

Agreement

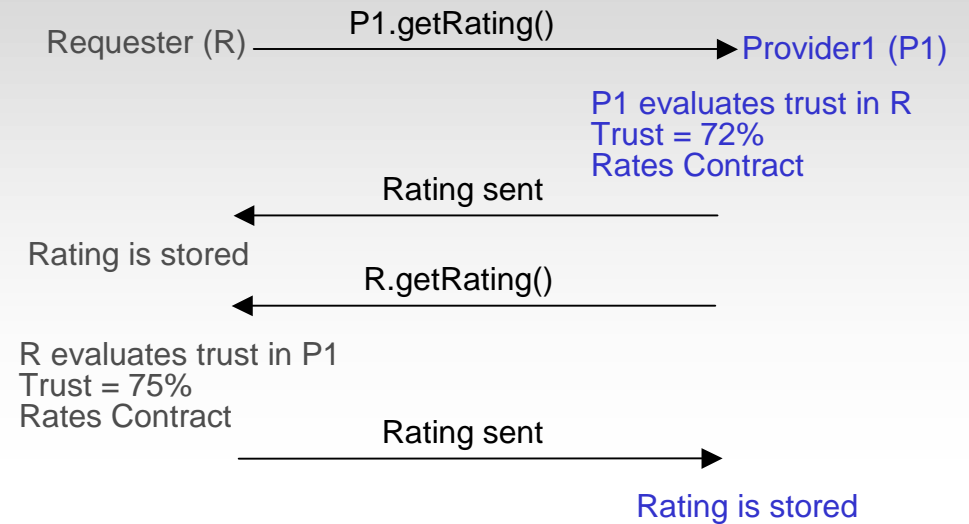
- The requester asks the provider to sign the Contract
- The provider checks that the contract is the same as previously, and signs it
- The requester receives the contract signed by the provider, checks that it is the same, and signs it too
- The contract is stored for future use

Agreement	Requester	Provider																						
Descriptions	<table border="1"> <thead> <tr> <th>Name</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>name</td> <td>vlc</td> </tr> <tr> <td>type</td> <td>mediaplayer</td> </tr> <tr> <td>version</td> <td>1.3</td> </tr> <tr> <td>creator</td> <td>videolan</td> </tr> <tr> <td>interface</td> <td>requester</td> </tr> </tbody> </table> <p>PROVIDER1 DESCRIPTION WITH TRUST = 72% AND MORE</p>	Name	Value	name	vlc	type	mediaplayer	version	1.3	creator	videolan	interface	requester	<table border="1"> <thead> <tr> <th>Name</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>name</td> <td>servideo</td> </tr> <tr> <td>type</td> <td>mediaserver</td> </tr> <tr> <td>creator</td> <td>videolan</td> </tr> <tr> <td>interface</td> <td>1</td> </tr> </tbody> </table> <p>PROVIDER1 DESCRIPTION WITH TRUST = 70%</p>	Name	Value	name	servideo	type	mediaserver	creator	videolan	interface	1
Name	Value																							
name	vlc																							
type	mediaplayer																							
version	1.3																							
creator	videolan																							
interface	requester																							
Name	Value																							
name	servideo																							
type	mediaserver																							
creator	videolan																							
interface	1																							
Signatures	Sig_Requester	Sig_Provider																						



Rating

- The requester asks the provider to rate the contract
- The provider checks that the contract is the same as agreed and rates the contract with the trust level in the requester
- The requester stores the contract in its property "history", with the trust level in the other side to disclose it (here 75%)
- And vice-versa



Provider's rating	Requester	Provider																						
Descriptions	<table border="1"> <thead> <tr> <th>Name</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>name</td> <td>vlc</td> </tr> <tr> <td>type</td> <td>mediaplayer</td> </tr> <tr> <td>version</td> <td>1.3</td> </tr> <tr> <td>creator</td> <td>videolan</td> </tr> <tr> <td>interface</td> <td>requester</td> </tr> </tbody> </table> <p>PROVIDER1 DESCRIPTION WITH TRUST = 72% AND MORE</p>	Name	Value	name	vlc	type	mediaplayer	version	1.3	creator	videolan	interface	requester	<table border="1"> <thead> <tr> <th>Name</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>name</td> <td>servideo</td> </tr> <tr> <td>type</td> <td>mediaserver</td> </tr> <tr> <td>creator</td> <td>videolan</td> </tr> <tr> <td>interface</td> <td>1</td> </tr> </tbody> </table> <p>PROVIDER1 DESCRIPTION WITH TRUST = 70%</p>	Name	Value	name	servideo	type	mediaserver	creator	videolan	interface	1
Name	Value																							
name	vlc																							
type	mediaplayer																							
version	1.3																							
creator	videolan																							
interface	requester																							
Name	Value																							
name	servideo																							
type	mediaserver																							
creator	videolan																							
interface	1																							
Signatures	<i>Sig_Requester</i>	<i>Sig_Provider</i>																						
Provider's Trust in the Requester = 72%																								

Requester's Rating	Requester	Provider																						
Descriptions	<table border="1"> <thead> <tr> <th>Name</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>name</td> <td>vlc</td> </tr> <tr> <td>type</td> <td>mediaplayer</td> </tr> <tr> <td>version</td> <td>1.3</td> </tr> <tr> <td>creator</td> <td>videolan</td> </tr> <tr> <td>interface</td> <td>requester</td> </tr> </tbody> </table> <p>PROVIDER1 DESCRIPTION WITH TRUST = 72% AND MORE</p>	Name	Value	name	vlc	type	mediaplayer	version	1.3	creator	videolan	interface	requester	<table border="1"> <thead> <tr> <th>Name</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>name</td> <td>servideo</td> </tr> <tr> <td>type</td> <td>mediaserver</td> </tr> <tr> <td>creator</td> <td>videolan</td> </tr> <tr> <td>interface</td> <td>1</td> </tr> </tbody> </table> <p>PROVIDER1 DESCRIPTION WITH TRUST = 70%</p>	Name	Value	name	servideo	type	mediaserver	creator	videolan	interface	1
Name	Value																							
name	vlc																							
type	mediaplayer																							
version	1.3																							
creator	videolan																							
interface	requester																							
Name	Value																							
name	servideo																							
type	mediaserver																							
creator	videolan																							
interface	1																							
Signatures	<i>Sig_Requester</i>	<i>Sig_Provider</i>																						
Requester's Trust in the Provider = 75%																								

Ratings for Scenario 2