AOT LAB

Agent and **O**bject **T**echnology **L**ab
Dipartimento di Ingegneria dell'Informazione
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A Multi-Agent implementation of Social Networks

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Outline

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- Research goals
- Related Work
- Design
- Future work
- Conclusion

Social Networks

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- A Social Network (SN) is a connected graph of public and/or semi-public profiles
- A Social Network System (SNS) is a software system that supports the persistent storage of SNs and that provides means to update, to add and to query information
- We also expect a SNS to suggest proactively possible acquaintanceships among users, using the information in user profiles

Features of Existing SNSs

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- Lots of different social network systems exist
- They are centralized systems
  - Relatively easy to suggest contacts
  - Privacy concerns with user data
  - Funded through ads (*stronger privacy concerns*)
- The goal is to build a Distributed SNS (DSNS) using Agents

Small World Phenomenon

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- Milgram original experiment with snail mail, 1967 [1]:
  - 6 degrees of separation
  - “Searchability” of social networks
- Confirmed by more recent experiments
- Social networks are “small-world” networks (Strogatz and Watts [2])
  - Neural network, the power grid and the collaboration graph of film actors
- Searchable small-world networks have “power-distribution” for the “random” short paths [3]

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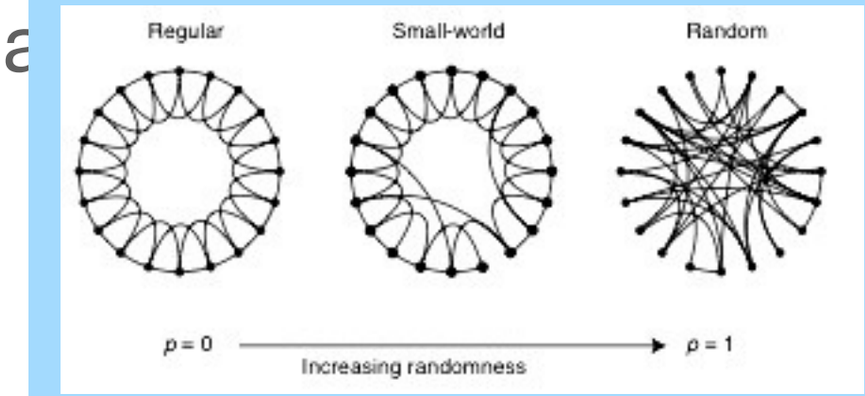

ReferralWeb

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- Kautz, Selman & Shah, 1997 [4]
- Multi-agent platform to “search” for experts in a user’s social network
- Exploits “searchability” of social networks
- Completely different from modern Social Networking Systems

Yenta

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- Foner, 1997 [5]
- “Matchmaker” system to bring together people with similar interests but *mainly* intended to “find experts”
- Different from “modern” SNSs where users want to connect to friends

Flink

- Mika, 2005 [6]
- Extraction, aggregation and visualization of online social networks
- Semantic technology for reasoning with personal information extracted from a number of electronic information sources
- Used for social network analysis and for generating a web-based presentation

Polyphonet

- Matsuo et. all, 2007 [7]
- Several advanced techniques to extract relations of persons, to detect groups of persons, and to obtain keywords for a person
- Uses multiple sources for the data (among them, FOAF profiles)

DSNS Architecture

- Each user is represented by a software agent
  - The agent mediates connections to user data
  - The agent proactively searches new contacts
- Each agent has a unique identifier (user nick, email, ...)
- Identifiers should be resolved to agents
- Software agents communicate through messages
- Public/private keys are used to sign and encrypt communication

DSNS Tasks

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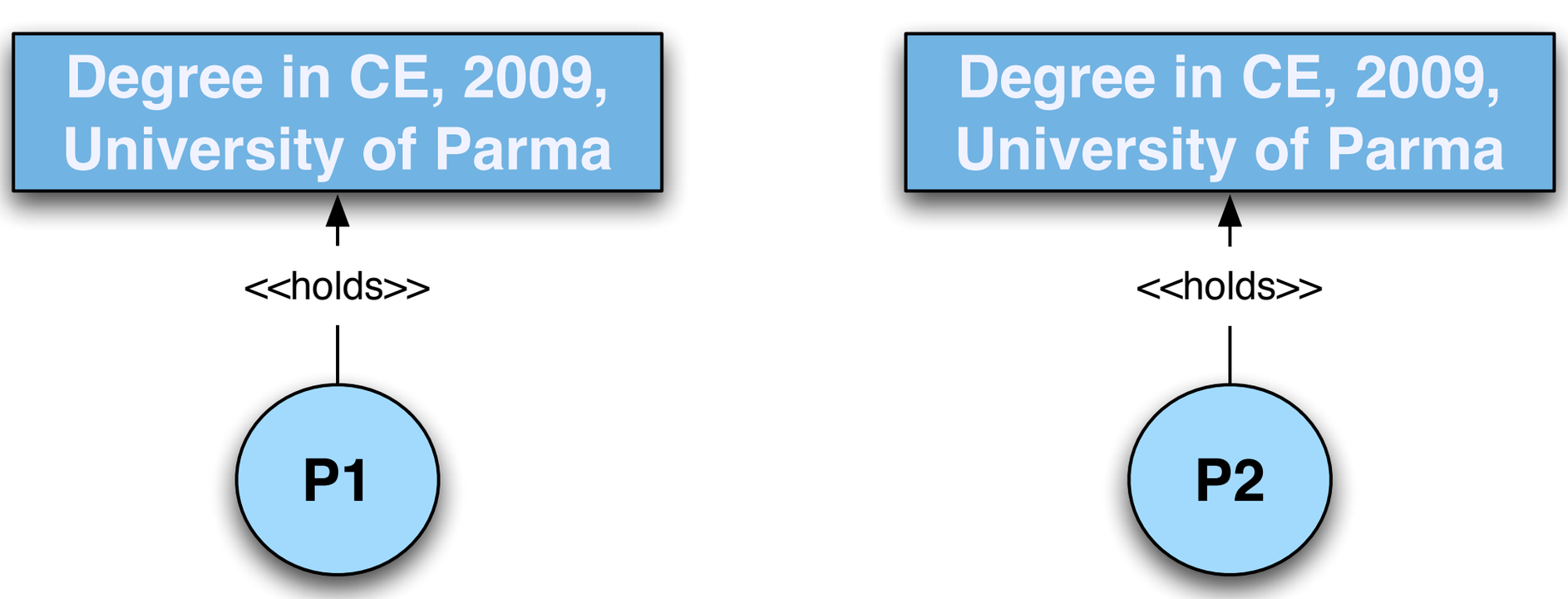
- Agents should build their user's social network
- Agents shall only disclose the minimum amount of information
- Agents can communicate only with other agents they "know", i.e., they are connected with

User profiles

- Data come from different sources (posts, queries, tags, profiles)
- *Non restrictive assumption*: all the relevant information is in a RDF profile (FOAF)
  - the owner is put in relation with other entities
  - we “extract” these relationships and derive possible acquaintances



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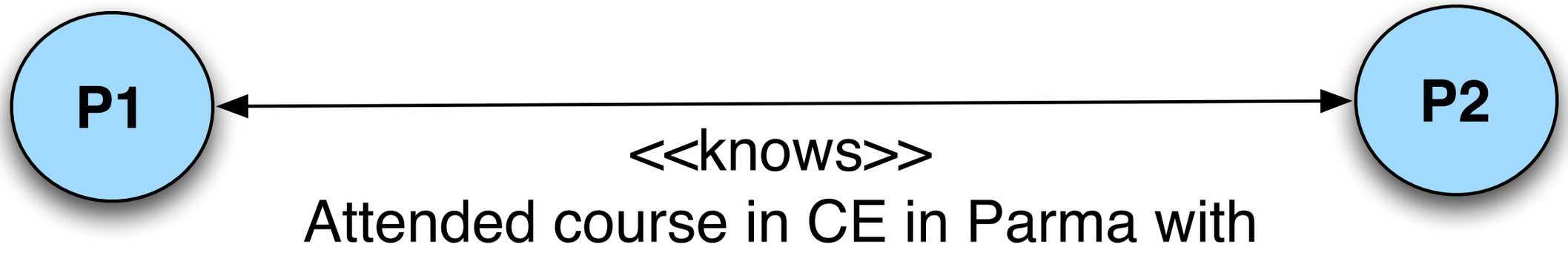

Example

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</doac:title></doac:organization>
University of Parma
<doac:organization>
</doac:Degree>
</doac:education>
</foaf:Person>

<doac:Degree>
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<doac:organization>University
of Parma
</doac:org...></doac:Degree>

<foaf:Person>
<foaf:name>**P2**</foaf:name>
<doac:education>
<doac:Degree>
<doac:title>Computer Engineer
</doac:title></doac:organization>
University of Parma
<doac:organization>
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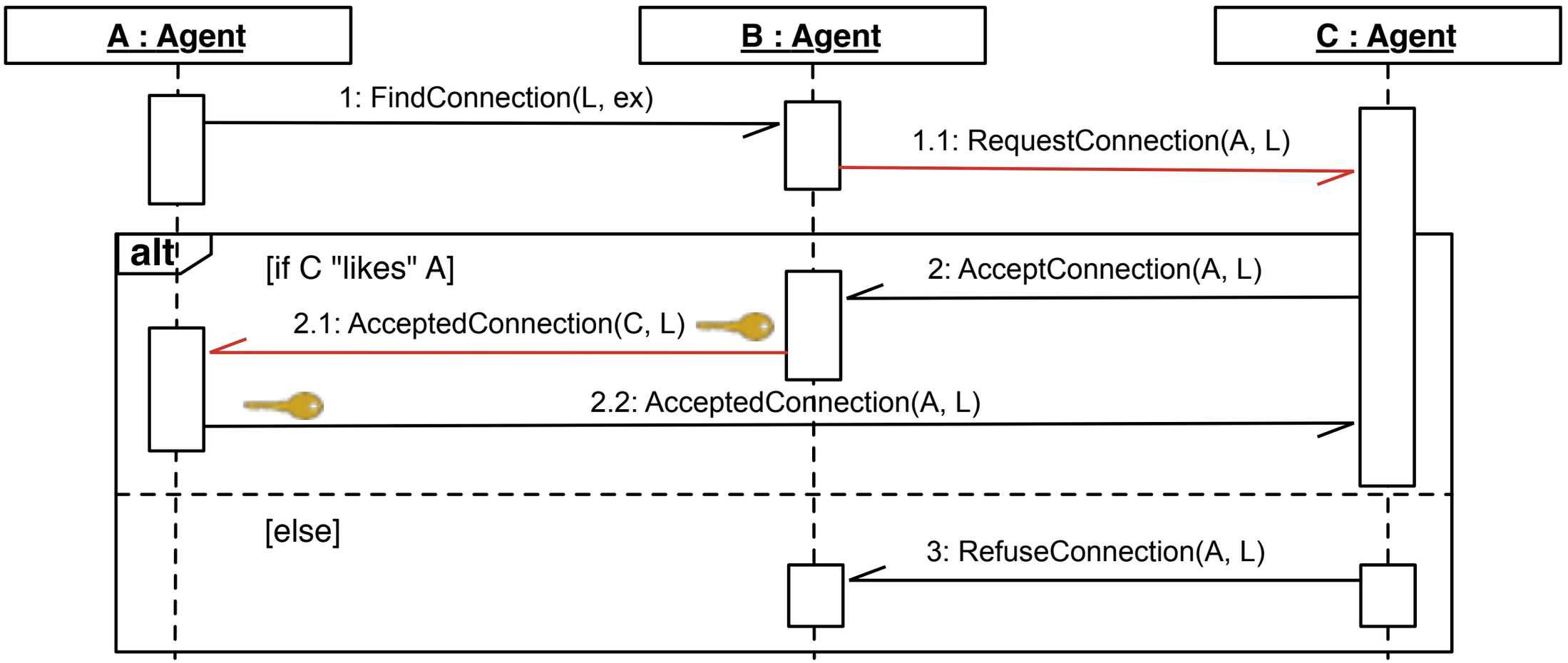
</doac:education>
</foaf:Person>

Connection Discovery Algorithm



red arrows if information transmission occurs

Implementation details

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- Use HDS as the basis
- Reasons:
  - Algorithms are easily conceivable as typed messages exchange
  - Performance may be important
  - Agents may reside on heterogeneous nodes

Implementation with HDS

- 1 Agent ↔ 4 Processes [2 Actors, 2 Servers]

Process	Type	Role
Proc1	Agent	Searches new connections according to available data
Proc2	Agent	Brokers connections with possible mutual friends
Proc3	Server	Accepts/refuses connections proposed by Proc1 and Proc2
Proc4	Server	Mediates access to data

Future work

- Experimental study on the algorithm
- Devise mathematical models based on first item
- Develop distributed variants of algorithms trying to “match” FOAF profiles
- Add new data sources (posts, image tags)
- Explore engineering issues (e.g., what happens when the user turns off the machine)

Thanks for your kind attention!

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References

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