



Trust concepts and methodology

Trust Based on Evidence (TuBE)

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Outline

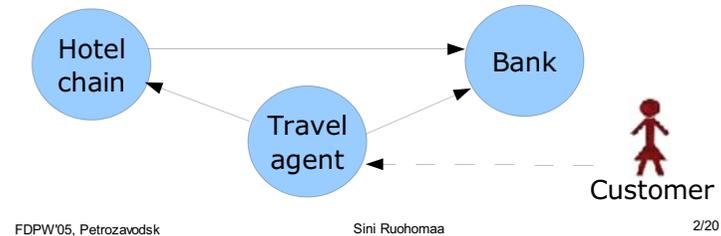
- Trust relations
- Concepts: what is agent trust?
 - Defining trust
 - Trust vs. reputation
 - Lifecycle of trust
- Trust models: how should agents trust?
 - Initialization
 - Using trust in decisions
 - Evolving trust
- Future directions
 - Problems needing more work



The need for trust



- Autonomous agents in cooperation networks
 - Eg. providing composed services
 - Problem: others may be malicious
- Uncertainty → risks
 - Cannot control others
- When is risk acceptable, when not?
- Trust helps making the decision



Trust relations



Example: Alice accesses an online banking service through her personal computer

What kind of trust relations are involved?



Trust relations



Example: Alice accesses an online banking service through her personal computer

Trustee:
requesting access
to a service



Alice

Action: accessing a service

Trusted:
providing
a service



Bank

Trust relations



Example: Alice accesses an online banking service through her personal computer

(Risks)
(Alice's trustworthiness)
(Other incentives)

Trust decision: do we trust Alice enough to allow this action?



Alice



Bank

Trust relations



Example: Alice accesses an online banking service through her personal computer

Getting a bit more complicated...



Alice

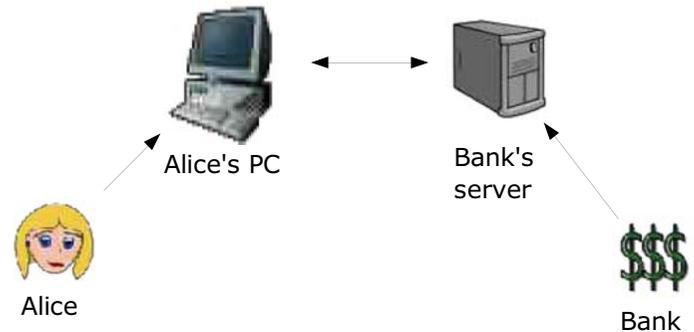


Bank

Trust relations



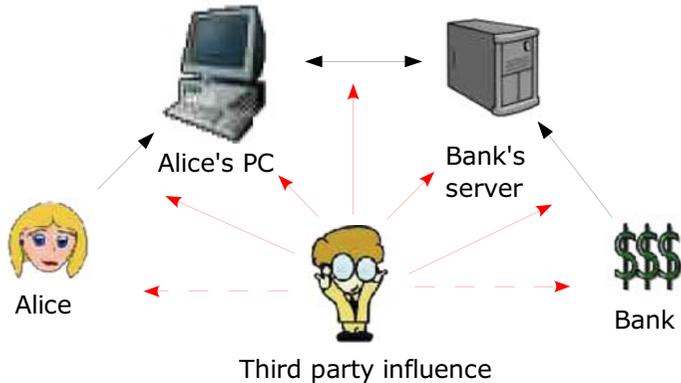
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Trust relations



Example: Alice accesses an online banking service through her personal computer



Defining trust



- Trust can be viewed as
 - A belief about some property of another agent
 - A *willingness* to take the risk of cooperating with another agent
 - Behaviour expressing the willingness
- Trust ranges from general to specific
 - Belief: agents in general vs. one agent, one context
 - Willingness: general strategy vs. *situational decision*



Trust vs. reputation



- Reputation: a perception a trustee creates through past actions about its intentions and norms
 - A part of a trust decision, action-specific
- Trust not generally transitive – a local decision
 - But: one trustor's perception can affect another's
 - Communicate via recommendations



"Alice seems OK"
"Janet is suspicious"

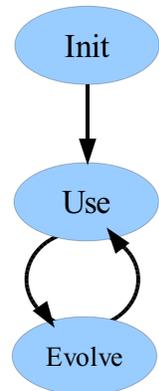


Is Bank a reliable source?

Trust lifecycle



- Init: Identification, building initial trust
- Using trust: evaluating for a specific situation
 - Trust decisions for authorization
 - Adjusting service: resource allocation, looser observation etc.
- Evolving trust: update with new experience
 - Observation, recommendations



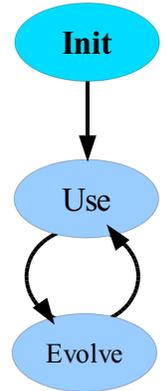
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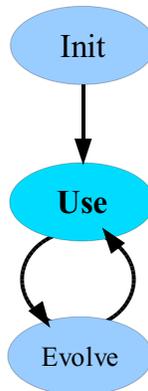
Identifying and initializing

- The actors: trustor, trustee
 - Humans, organizations, *automated agents*
 - Agent platform can set limits to trust model
- Identifying the trustee
 - Rely on *identity*, pseudonyms (or anonymity)
 - Persistency needed for experience
 - Shared names for recommendations
- Determining initial trust
 - Exchange credentials
 - Ask others for recommendations
 - Use a default value



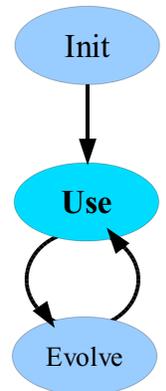
Using trust information

- Trust decision-making
 - Fully or *partially automated*
 - Supporting information for human decisions
- The location of a trust decision
 - Centralized (eg. part of a service)
 - *Distributed* (each makes local decisions)
 - How willingly do users delegate decisions?
- Consequences: trustee's "goal"
 - *Authorization, choosing partners*
 - sharing or believing information (eg. credentials, recommendations)
 - *service personalization, etc.*



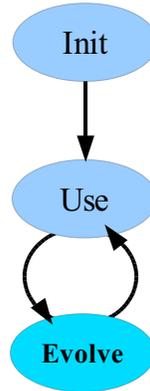
Factors of a trust decision

- Factors in a trust decision
 - *Risk, trustee reputation* or experience, her competence, trustor confidence, *importance/value* of trusting
 - Representation and use also interesting
- Input for a trust decision
 - *Trustor, trustee, time / situation-specificness, action / consequence (with parameters?), context*



Evolving/updating trust

- Sources of experience
 - *Local* (personal observations)
 - *External* (recommendations)
- Gathering local experience
 - Manual input vs. *automated observation*
- Or: Nonexistent/"outsourced" evolution
 - Trust fully fixed once determined
 - Base trust on credentials from outside sources who update them for you



Future challenges 1/2

- Gathering experience locally
 - Automated observation on application level not trivial
 - Application-level Intrusion Detection Systems a developing research area
- Sharing experience through reputation systems
 - Interoperable views of reputation & identity?
 - Data structured to support automation? (eg. eBay)
 - Privacy issues



Future challenges 2/2

- Heavy to configure
 - Risk analysis, importance values
 - Trust decision policy
 - Turning experience to reputation
- Large organizations manage
 - But simplifying needed for end-users



Decision Policy:
 $\frac{\text{risk}^3 - \text{reputation}}{\text{importance}}$

Reputation formula:
 $\int \log x / yx dx$



Set risk of "buy book"



Thank you for your attention!

Questions, comments?

Example models: SECURE



- Identifying and initializing
 - Automated agents on mobile, roaming devices, pseudonym-based identification
 - New user: can ask for recommendations / delegate
- Using trust information
 - Partially automated, distributed decisions leading to authorization
- Trust decision factors
 - Risk and business value (cost-benefit estimate reputation/experience, confidence)
- Evolving / updating trust
 - Local and external information used

Example model: eBay reputation system



- Identifying and initializing
 - Humans, identification bound to pseudonyms
- Using trust information
 - Human-made decisions based on centralized information, leading to a choice of partner
- Trust decision factors
 - Experience statistics and other users' comments on the trustee provided as decision support
- Evolving / updating trust
 - Information used is local to eBay, users provide experience and trust eBay to reproduce it reliably

The eBay experience view



Member Profile: Seller X (296 ☆)

Feedback Score: 296
Positive Feedback: 99.0%

Members who left a positive: 293
Members who left a negative: 3
All positive feedback received: 304

[Learn about](#) what these numbers mean.

Recent Ratings:

	Past Month	Past 6 Months	Past 12 Months
positive	1	10	53
neutral	0	0	1
negative	0	1	3

Bid Retractions (Past 6 months): 0