

Trust and Reputation Mechanisms

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Social Computing and Participative Web 2009

Agenda

- Trust
 - Definition
 - Characteristics
 - Categorization
- Reputation
 - Centralized and Decentralized Reputation Systems
 - Some Example Systems
- Trust-based Social Network for Promoting Honesty in E-Marketplaces
- Trust-based Community in Peer-to-Peer File Sharing Systems

Why Trust?

- Common characteristics of online systems (networks)
 - E-commerce (electronic marketplaces), peer-to-peer networks, grid networks, semantic web, web services and mobile networks
 - Open, distributed, dynamic
 - Composed of autonomous entities like individual persons, enterprises or agents that behave on behalf of their users
 - They may be self-interested (maximize their own utility) and deceptive
- Trust plays an important role
 - Allows to model the capability, reliability and honesty of others
 - Entities gather and spread information to develop trust and reputation
 - Various trust and reputation mechanisms have been proposed to separate good and bad entities

Definition of Trust

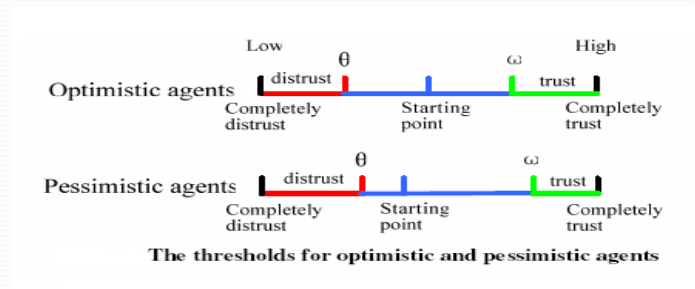
- Trust can be defined in different ways
 - In literature, trust has been described as attitudes, beliefs, probabilities, expectations, and honesty

“Trust (or, symmetrically, distrust) is a particular level of the subjective probability with which an agent will perform a particular action, both before [we] can monitor such action (or independently of his capacity of ever to be able to monitor it) and in a context in which it affects [our] own action”

“Trust itself consists of beliefs. Trust is a mental attitude of an agent x towards another agent y about the behavior/action relevant for the result (goal)”

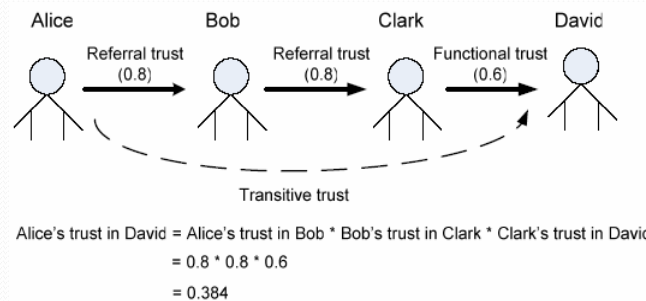
Characteristics of Trust

- In computer mediated environments, the interaction between human beings or agents present characteristics
 - subjectivity, transitivity, context-dependence, dynamics
- Subjectivity of trust
 - It is influenced by the persons disposition and experience



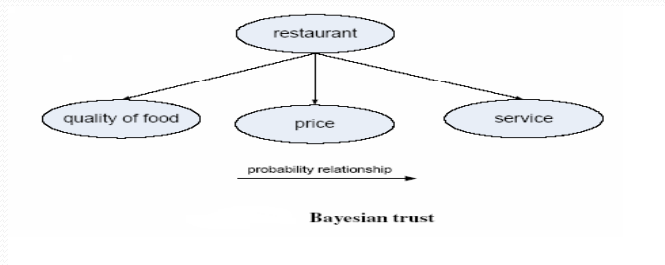
Characteristics of Trust

- Transitivity of Trust
 - The transitivity of trust is when an entity asks other entities about something that it does not know well, which could be a recommendation for something or a particular product/person/agent
 - As the length of the path increases the strength of trust is gradually decreased



Characteristics of Trust

- Trust is based on prior knowledge and experience (own or others')
- Trust is dynamic, increase or decrease over time
- Context dependent and multi-faceted
 - An entity's trust on another entity can be different in different contexts
 - Based on different aspects



Classification of Trust

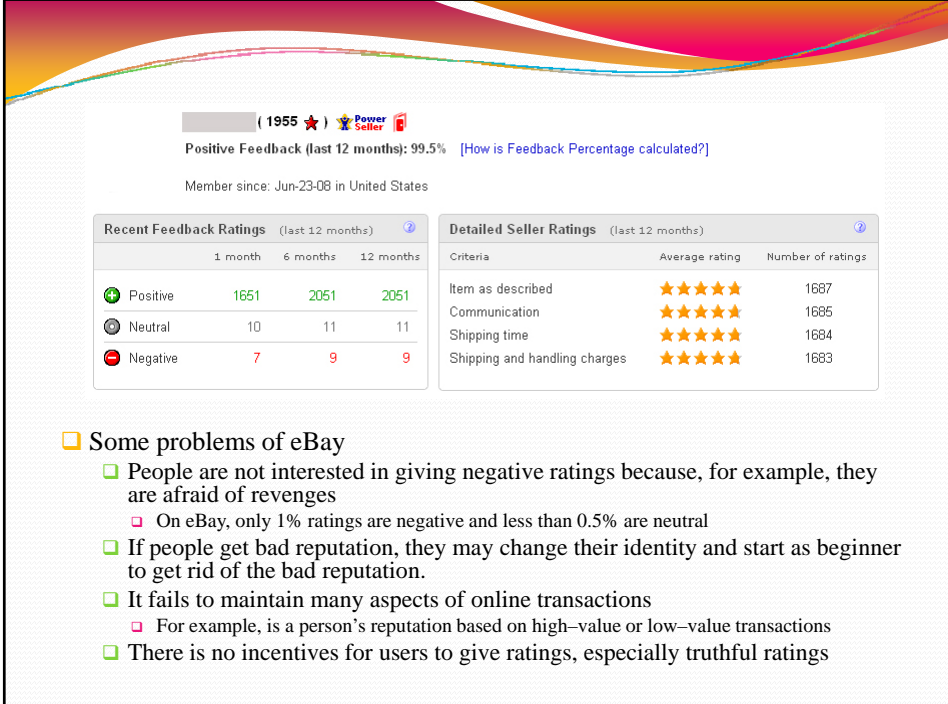
- Trust is classified as individual-level and system-level
 - Individual-level trust established by a single entity
 - Trust between user and his/her agents
 - Trust in providers (provision trust)
 - Trust in consumers
 - Trust in references
 - Trust in groups
 - System-level trust is inherent and guaranteed by the system
- Trust Acquisition
 - Trust can be gained through Personal experiences such as
 - Direct interactions
 - Observations
 - Presumptions
 - Trust can also be acquired from others
 - Word of mouth (Reputation)
 - Institutions

Reputation

- Reputation is the general public's opinion about a person/agent/item's character or standing
 - Communication between the people became easy with the popularity of the Internet. It is easy to gather, spread information and build up one's reputation
 - From an individual's point of view: reputation helps people/agents identify good resources or trustworthy partners to interact with
 - From a collective system view: reputation encourages good behavior of people/agents: good people/agents are rewarded by better chances to gain interactions
- Typology of reputation systems
 - Centralized reputation systems
 - Person/agent vs. Resource
 - Decentralized reputation systems
 - Person/agent vs. Resource

Reputation Systems

- Centralized person/agent reputation systems
 - Relatively simple
 - A centralized node acts as a system manager responsible for collecting feedback from transactions on both sides
 - Reputation information is public and global, built by the system
 - A person/agent can only communicate with centralized node to find out the person/agents reputations
 - Less communication is required to get reputation information
- eBay
 - The largest and most popular auction sites
 - After each transaction, buyer and seller give a rating to each other, whether they are satisfied with the transaction
 - Ratings are positive, negative or neutral (1, -1, or 0)
 - Users can also comment, specially when they give negative ratings to indicate the reasons for comments
 - A new user starts with 0 reputation



(1955 ★) **Power Seller**

Positive Feedback (last 12 months): 99.5% [\[How is Feedback Percentage calculated?\]](#)

Member since: Jun-23-08 in United States

Recent Feedback Ratings (last 12 months)			
	1 month	6 months	12 months
Positive	1651	2051	2051
Neutral	10	11	11
Negative	7	9	9

Detailed Seller Ratings (last 12 months)		
Criteria	Average rating	Number of ratings
Item as described	★★★★★	1687
Communication	★★★★★	1685
Shipping time	★★★★★	1684
Shipping and handling charges	★★★★★	1683

- Some problems of eBay
 - People are not interested in giving negative ratings because, for example, they are afraid of revenges
 - On eBay, only 1% ratings are negative and less than 0.5% are neutral
 - If people get bad reputation, they may change their identity and start as beginner to get rid of the bad reputation.
 - It fails to maintain many aspects of online transactions
 - For example, is a person's reputation based on high-value or low-value transactions
 - There is no incentives for users to give ratings, especially truthful ratings

Centralized Person/Agent Reputation Systems

- SPORAS: similar to eBay but overcomes some problems of eBay
 - The reputation of a person will not fall below the reputation of the beginner
 - People will not switch back to change their identities
 - People can rate each other only once even if they interact more than once
 - Only their latest rating will be considered.
 - The rater's rating will be weighed to calculate the reputation of their partner
 - The rating from persons with higher reputation will be weighed more than the ratings from beginners
- Social network topology analysis for reputation
 - A social network is a network consisting of a group of people who are connected through various social relationships, such as acquaintances, friendship, cooperation, familial bonds or similarity of interests.
 - It is a directed graph where each node represents a member and each edge represents a relationship weighted by the strength of the relationship between the two connected nodes
 - Use node ranking algorithm (**EigenTrust**) to calculate authority of each node
 - Similar to Google's **PageRank** algorithm to deduct the reputation of web pages

Centralized Resource Reputation Systems

- ❑ Centralized resource reputation system is used to build reputation of resources
- ❑ Reputation is derived as an overall rating from different users.
- ❑ Guideline for users to select resources
- ❑ Epinions:
 - ❑ Users can rate and review various items such as books, cars, computers
 - ❑ Items are organized as categories
 - ❑ Users are classified into 5 levels
 - ❑ Category leaders, top reviewers, advisors, most popular reviewers, ordinary members
- ❑ Collaborative filtering based systems
 - ❑ It is centralized where a centralized node is used in collecting ratings with rows and columns for user names and items.
 - ❑ The similarity of the ratings is calculated as the ratings done by them earlier
 - ❑ The predicted rating which the user has not rated is calculated as ratings from the raters who has done it.
 - ❑ The items with highest ratings are recommended to the user

The screenshot shows the Epinions.com interface for a Canon PowerShot S5 IS Digital Camera. At the top, there are navigation tabs for various categories like CARS, BOOKS, MOVIES, MUSIC, COMPUTERS & SOFTWARE, ELECTRONICS, GIFTS, HOME & GARDEN, KIDS & FAMILY, OFFICE SUPPLY, SPORTS, TRAVEL, and MORE. A search bar is present with 'Digital Cameras' selected. The breadcrumb trail reads 'Home > Electronics > Digital Cameras > Canon PowerShot S5 IS Digital Camera'. The product title is 'Canon PowerShot® S5 IS Digital Camera'. The overall rating is 5 stars. Below this, there are performance metrics: Ease of Use, Durability, Battery Life, Photo Quality, and Shutter Lag, each with a green progress bar. To the right, a 'Compare Prices' section shows the price range from \$290 to \$450, with specific offers from Circuit City (\$319.99), Dell (\$299.99), and OneCall (\$349.99). A 'Read Reviews (73)' button is visible. Below the product details, there are sorting options for 'Product Rating' and 'Review Date'. A review by 'Howard_Creach' is displayed, titled 'The Canon Powershot S5 IS The Mega-Zoom wars heat up', dated Jun 19 '07. The review text includes 'Pros: Fast, hot shoe, 2.5 inch vari-angle LCD, 12X USM IS zoom, full manual controls.' and 'Cons: No RAW/TIFF mode'. The review concludes with 'Photography has been my obsession for more than thirty years, so I'm a very lucky guy - I get to test lots of nifty new digital cameras. The only problem is that I have to send the cameras back when my tests are finished. Usually that's not too'. A sidebar advertisement for Energizer Lithium batteries is also visible.

Decentralized Reputation Systems

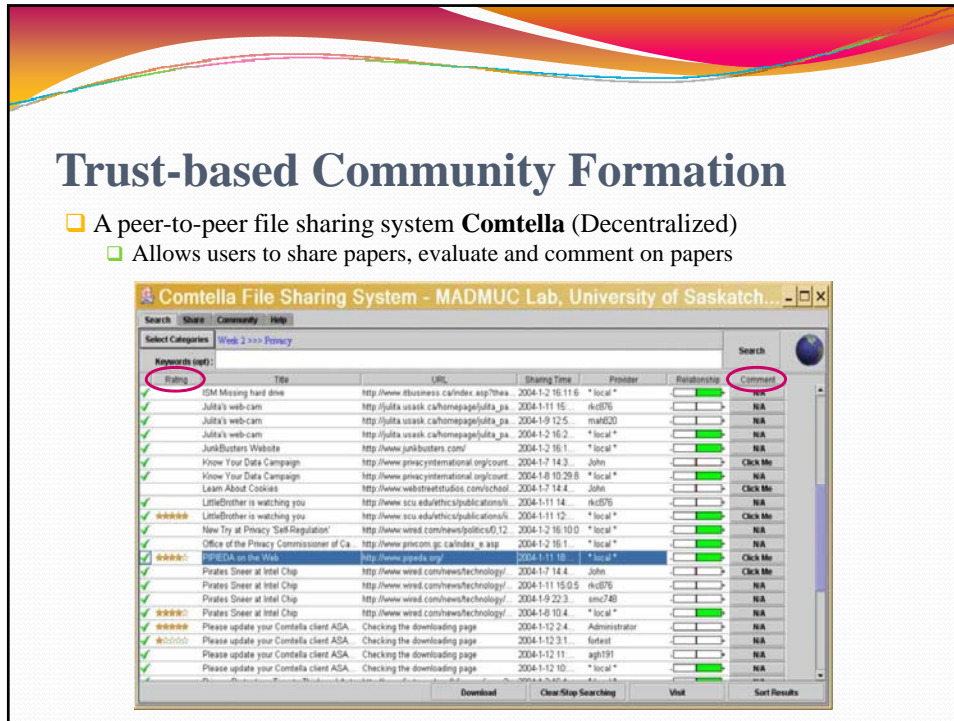
- Difference from centralized reputation systems
 - No centralized system manager to keep track of trust and reputation
 - No global or public reputation exists
 - Entities build their own trust on others
 - A lot of communication may be required among entities to exchange information about others
- Decentralized person/agent reputation system
 - Each agent has to develop the reputation on other agents based on direct interactions.
 - They follow six steps in giving reputation
 - Send queries, ask for recommendations, select Provider, interaction, update Trust, update neighbors
- Decentralized person/agent resource reputation system
 - Agents in decentralized systems, care about good resources. Agents get a long list of resources matching their requirements if they search for some resource. Some of them may be bad or even be dangerous. They use reputations of the resources to avoid this

A Trust-based Social Network

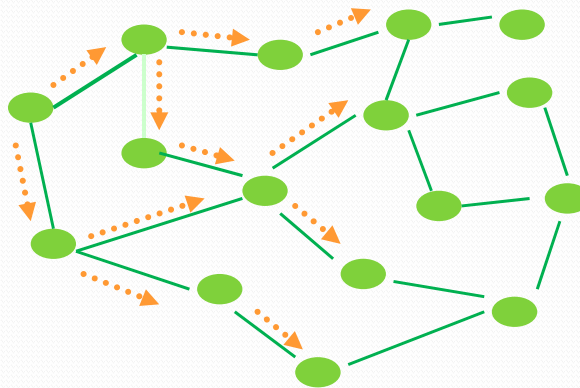
- Electronic marketplace – buyer and sellers
 - Deceptive sellers may not deliver products
 - Deceptive buyers may untruthfully rate sellers
- A trust-based social network to promote honesty (Centralized)
 - Social network of buyers
 - Buyers model each other and choose the most trustworthy ones as neighbors
 - Honest buyers will become neighbors of many other buyers (reputable)
 - Users reporting honestly provide benefit to others, be preferred as allies, attract audience to witness their feedback
 - Sellers offer better rewards to satisfy reputable buyers
 - Be known as trustworthy sellers by many other buyers
 - Buyers encouraged to be truthful
 - A user's altruism in one context signals "quality" of the user that will benefit from increased opportunities in other wider contexts
 - Sellers encouraged to be truthful
 - Modeled by buyers and their (truthful) neighbors

Trust-based Community Formation

- A peer-to-peer file sharing system **Comtella** (Decentralized)
- Allows users to share papers, evaluate and comment on papers



Search in Comtella



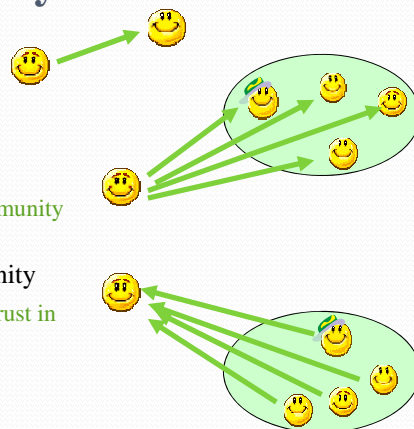
● Peer — Connection

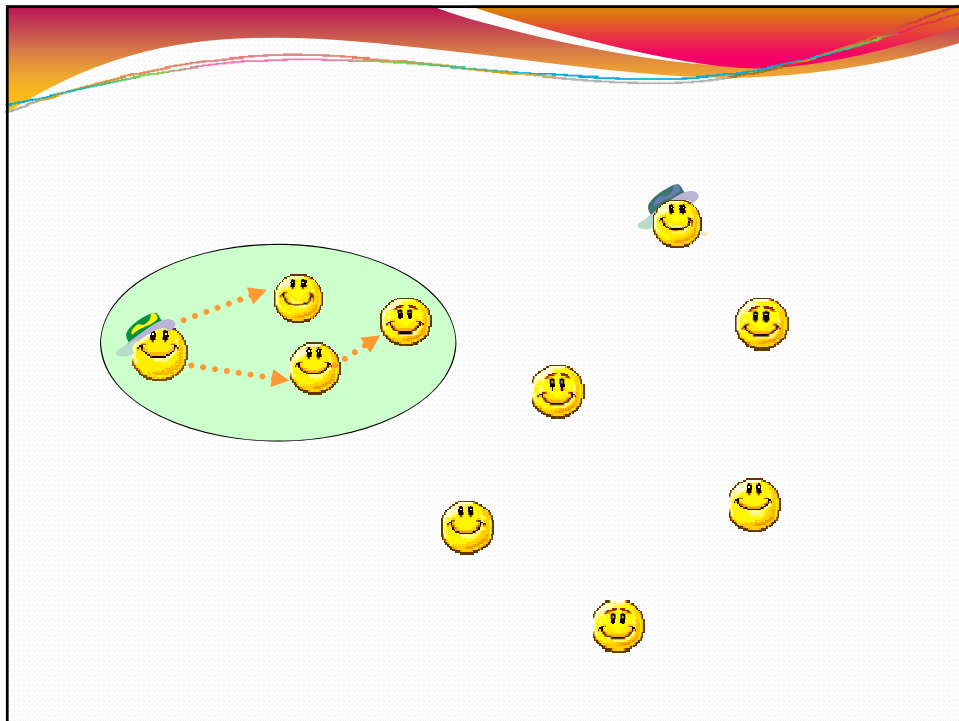
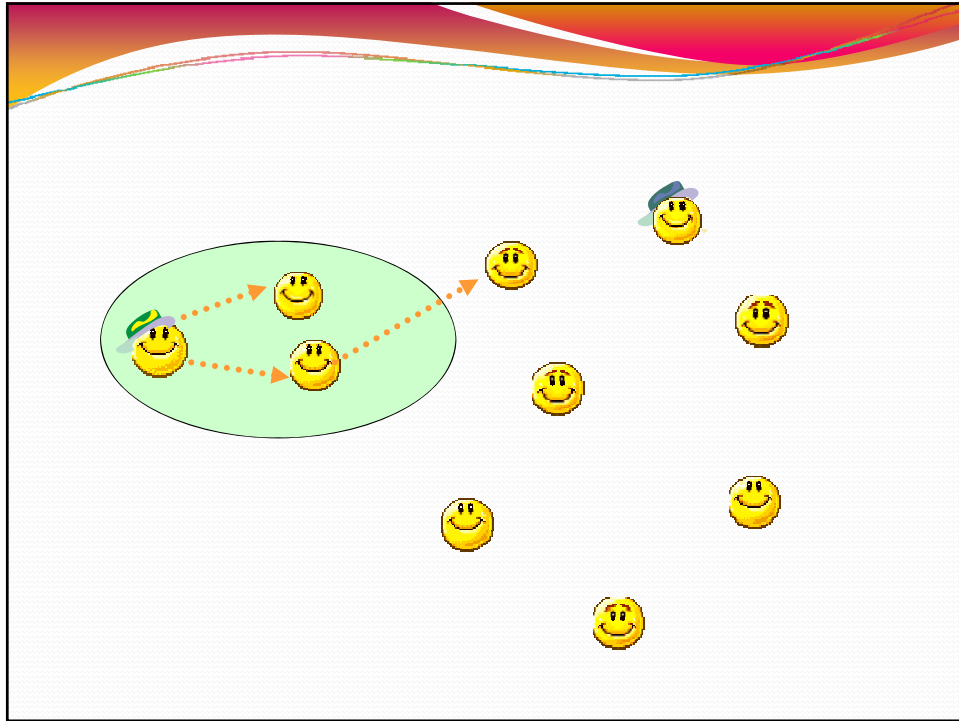
Trust-based Community Formation

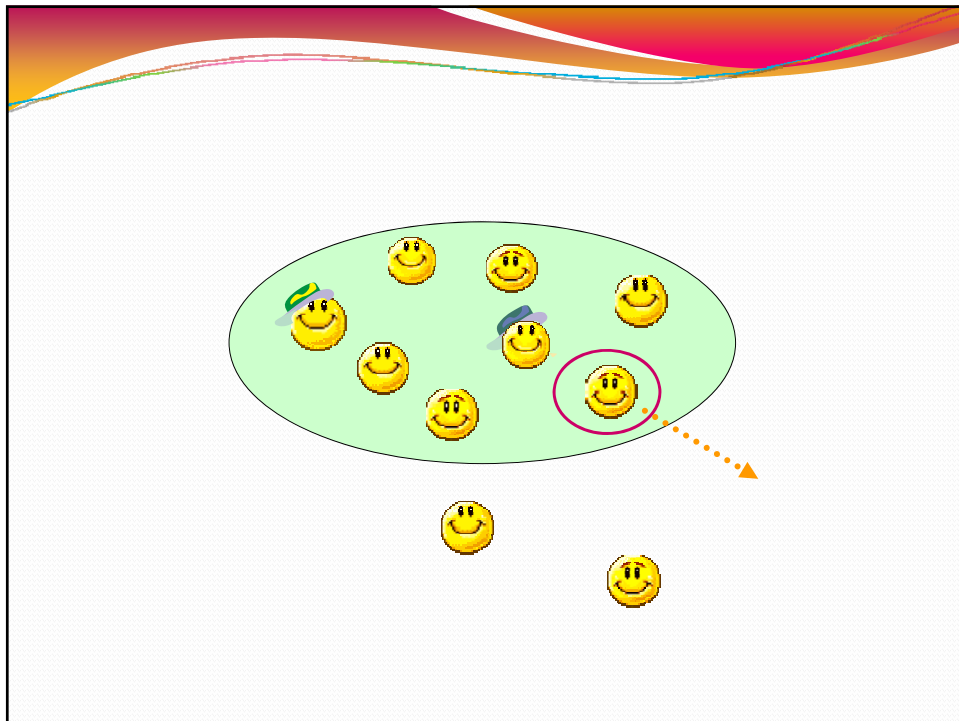
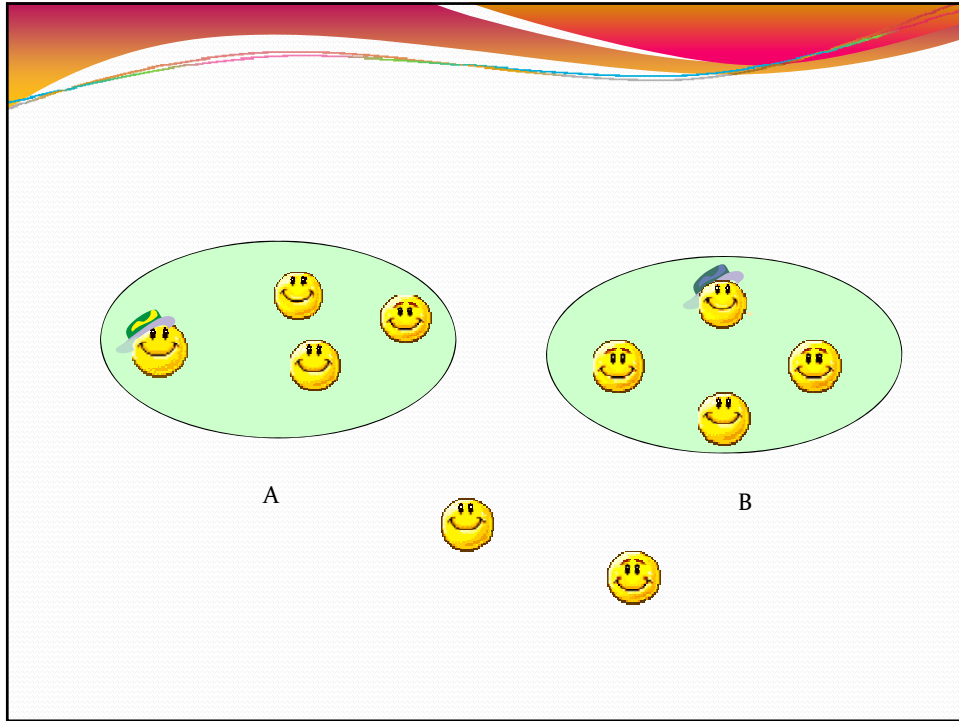
- Community
 - An organization that facilitates a group of agents that share common interests and preferences to share their knowledge, learn and benefit from one another.
- The role of community
 - Recommend good papers
 - Recommend good peers
- Critical Questions
 - Who creates a community?
 - Who are the members in a community?
 - How is a community created?

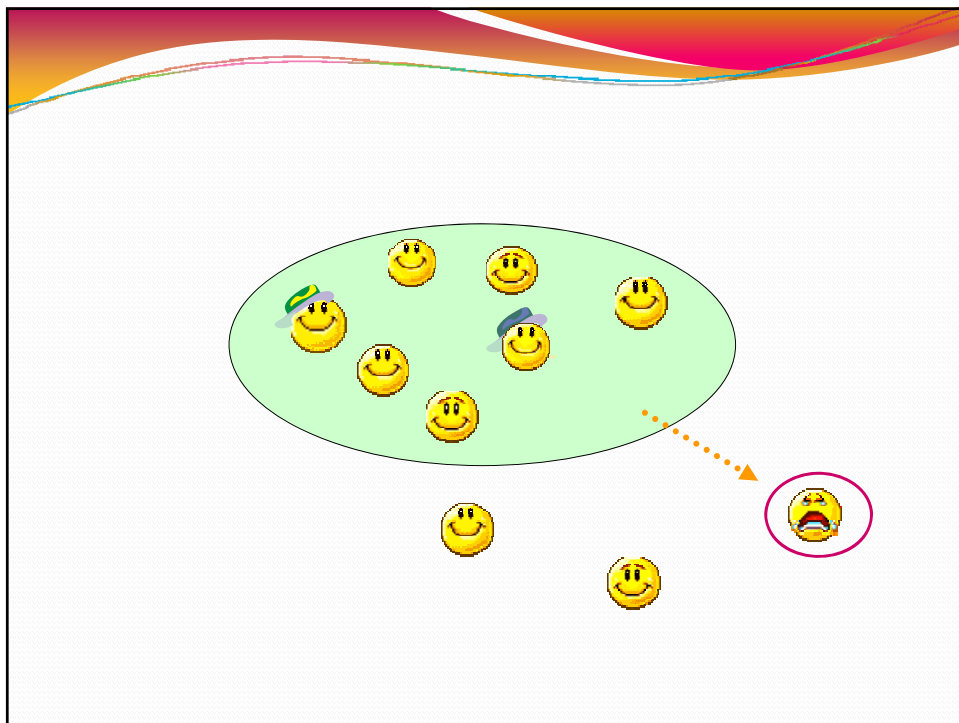
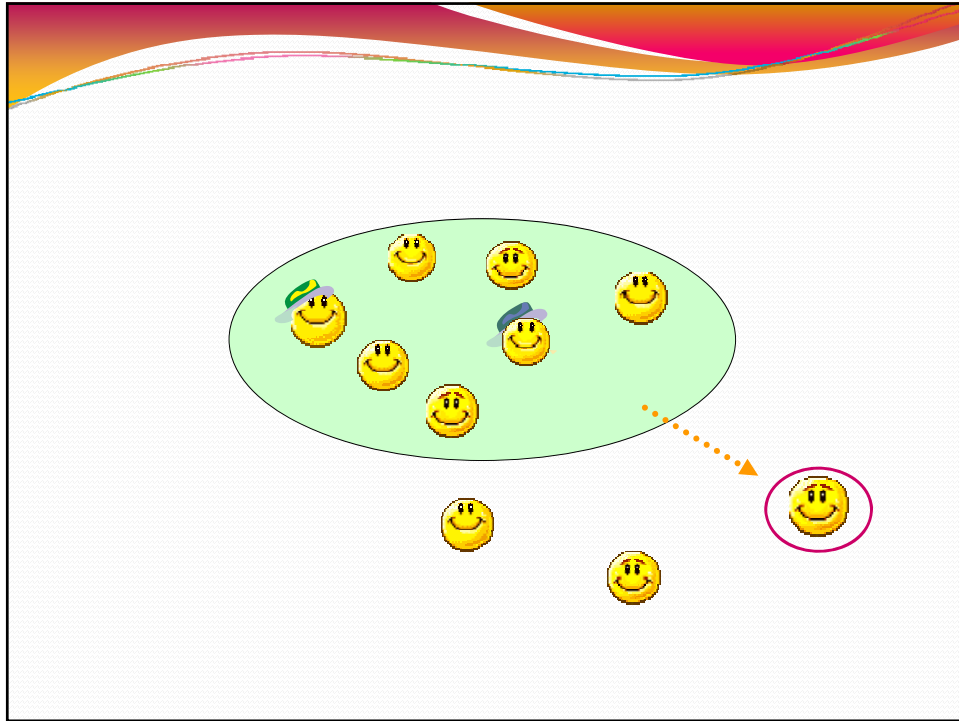
Trust-based Community Formation

- An agent's trust in another agent
- Collective trust measure
 - An agent's trust in a community
 - Based on the agent's trust in each community member
 - An agent's reputation in a community
 - Based on each community member's trust in the agent
- Collective ratings to papers





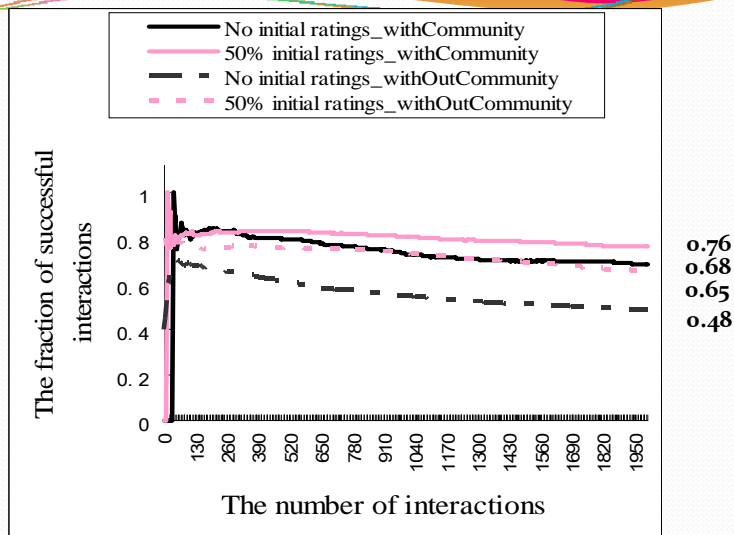




Trust-based Community Formation

- Procedures of community formation
 - Community update
 - Update the members periodically
 - Update the information about the papers periodically

- Motivation for the users of creators
 - Cannot be expelled from communities
 - Social recognition
 - Great benefit to the users' research



Interactions with Communities vs. Interactions without Communities

Concluding Remarks

- Trust plays an important role in open and dynamic environment
 - Trust has many definitions
 - Some characteristics: subjectivity, dynamics, context dependent, multi-faceted
 - Categorization of trust, reputation
- Reputation systems
 - Categorization and some example systems, i.e. eBay, Epinions
- A trust-based social network electronic marketplaces
 - Centralized system, makes use of social network analysis
 - Promotes buyer and seller honesty
- Trust-based community formation, Comtella
 - Decentralized system
 - A trust-based mechanism for creating communities is feasible

Discussions

- To what extent do you think that the reputation managed by online communities in which users rate products and reputation of the real world products provided by brand names influence users decisions?

Discussions

- On eBay, do trust and reputation play a role on prices of products?

References

- Wang Y., Vassileva J. (2007) "[Toward Trust and Reputation Based Web Service Selection: A Survey](#)", International Transactions on Systems Science and Applications, 3 (2), 118-132
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- Zhang J., Cohen R. (2007), "[Design of a Mechanism for Promoting Honesty in E-Marketplaces](#)", In Proceedings of the Twenty-Second Conference on Artificial Intelligence (AAAI-07)