mWSF05 - The 2005 miniWorkshop on Security Frameworks
"Security Assurance"

Trust Models for Flat Environments

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Introduction

- Flat environments
- Unreliability information problems in flat environments
- Hint at social network
- Trust definitions
- Mathematical Properties of trust
- Trust Model Definition
- Example of trust models applied to MANET
- Question time

Flat environments

- Cooperative scheme
- Authority that regulates the environments does not exists
- E2E (Entity to Entity) communication

Information Unreliability

- Information corruption
- Non collaborative behavior (selfishing)
- Eavesdropping

Social Network

- A **social network** is a map of the relationships between individuals, indicating the ways in which they are connected through various social familiarities ranging from casual acquaintance to close familial bonds. The **analysis of social networks** (sometimes called *network theory*) has emerged as a key technique in modern sociology, anthropology and organizational studies, as well as a popular topic of speculation and study

What is trust?

- All kinds of transactions, interactions, and communications in human life are based on one fundamental aspect: trust.

Trust in Psychology

1. If an individual is confronted with an ambiguous path, a path that can lead to an event perceived to be beneficial(Va+) or to an event perceived to be harmful(Va-);

Trust in Psychology

2. He perceives that the occurrence of Va+ or Va- is contingent on the behavior of another person;

3. He perceives that strength of Va- to be greater than that strength of Va+. If he chooses to take an ambiguous path with such properties, I shall say he makes a trusting choice; if he chooses not to take the path, he makes a distrustful choice.

Trust in Sociology

1. Expectation of the persistence and fulfillment of the natural and moral social orders;
2. Expectation of “techinically competent role performance” from those we interact with in social relationships and systems;
3. Expectation that partners in interaction will “carry out their fiduciary obligations and responsibilities, that is, their duties in certain situations to place others’ interests before their own”

Trust in terms of Mathematics

- Trust (or, symmetrically, distrust) is a particular level of the subjective probability with which an agent assesses that another agent or group of agents will perform a particular action, both before he can monitor such action(or independently or his capacity ever to be able to monitor it) and in a context in which it affects his own action

Trust in terms of Mathematics

- When we say we trust someone or that someone is trustworthy, we implicitly mean that the probability that he will perform an action that is beneficial or at least not detrimental to us is high enough for us to consider engaging in some form of cooperation with him
- Correspondingly when we say that someone is untrustworthy, we impy that that probability is low enough for us to refrain from doing so

Properties of trust relationships

$$E_1 \xrightarrow{T} E_2$$

- **Relative**
- **Asymmetric**
- **(Should) not transitive**
- **Measurability**

Trust Model Definition

- A trust model consists in the definition and the application of the concept of trust in order to stimulate the cooperation among the entities of a flat environment

Real Example of Trust Model

- For each transaction, the buyer and seller are allowed to rate each other by leaving feedback

Punteggio di feedback:	**88**
Feedback positivi:	**97,8%**
Utenti che hanno lasciato un feedback positivo:	90
Utenti che hanno lasciato un feedback negativo:	2
Tutti feedback positivi:	113

Ulteriori informazioni sui seguenti numeri.

Punteggi recenti:

	Mese scorso	Ultimi 6 mesi	Ultimi 12 mesi
positivo	20	113	113
neutro	0	0	0
negativo	1	2	2

Ritiro delle offerte (ultimi 6 mesi): 0

Real Example of Trust Model

- The feedback score represents the number of eBay members that are satisfied doing business with a particular member. It is usually the difference between the number of members who left a positive rating and the number of members who left a negative rating.

$$score = \frac{good\_feedback - bad\_feedback}{total\_feedback}$$

Real Example of Trust Model

Google

- Semi-automatically techniques separate reputable, good pages from spam
- Determing if a page is spam is subjective and requires human evaluation

$$O(page) = \begin{cases} 0 & if \quad page \quad is \quad bad \\ 1 & if \quad page \quad is \quad good \end{cases}$$

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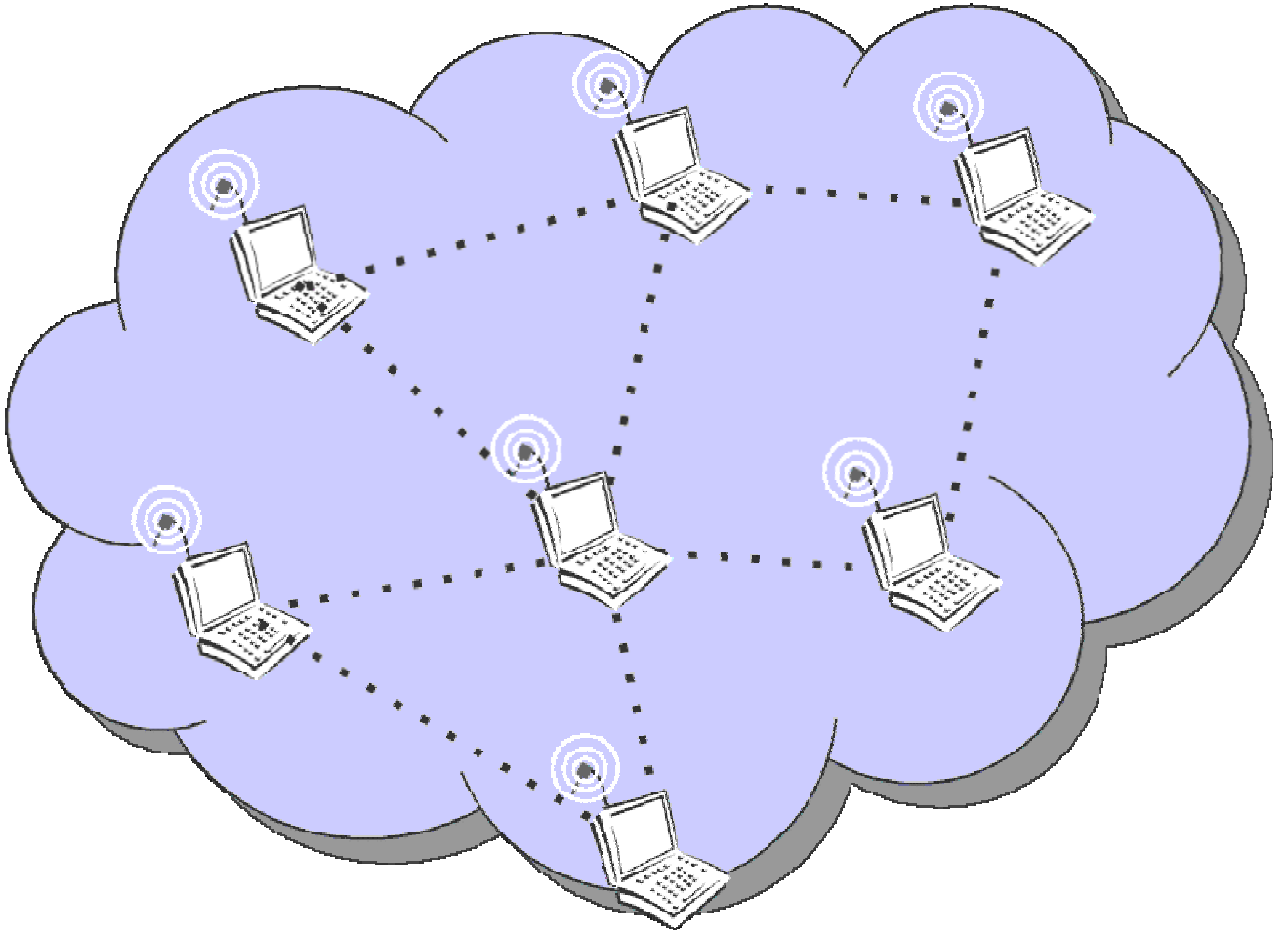
Mobile Ad hoc NETwork



Selfish Attack

Collaborative Reputation mEchanism

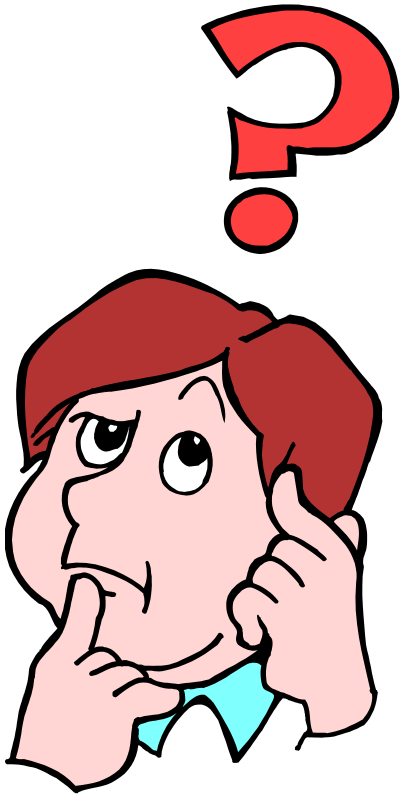
- Direct Reputation

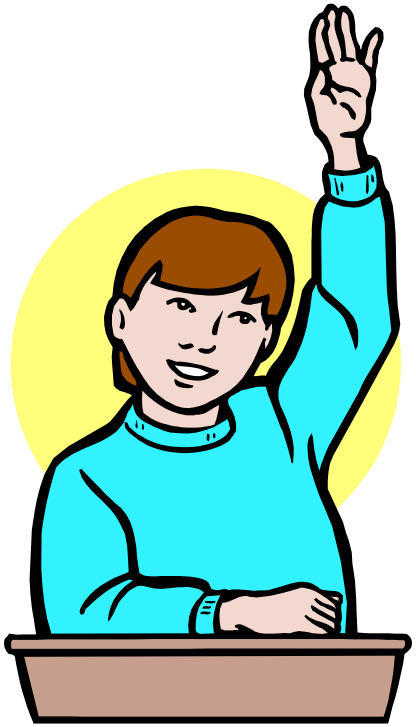
$$r_{s_j}^{t}(s_j \mid f) = \sum \rho(t, t_k) \cdot \sigma_k$$

- Indirect Reputation
  - Distribuita tra i nodi della rete
- Functional Reputation
  - Reputazione soggettiva e indiretta su una certa funzione *f*
- Global Reputation

$$r_{s_i}^{t}(s_j) = \sum w_k \cdot \{r_{s_i}^{t}(s_j \mid f_k) + ir_{s_i}^{t}(s_j \mid f_k)\}$$

Question Time





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