

Trust Models in Grid Computing

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Trust and Reputation

- **Trust** is the firm belief in the **competence** of an **entity** to **behave** as **expected** such that this firm belief is a dynamic **value** associated with the entity and it is also **subject** to the **entity's behavior** and applies only within a specific context at a given time.
- The **Reputation** of an entity is an **expectation** of its **behavior** based on its **identity** and other **entities' observations** or **information** about the **entity's past behavior** within a specific context at a given time.



Trust Classification

- Trust can be classified into different categories according to different standards.
- ✧ **According to attributes:** identity trust and behavior trust
- ✧ **According to obtaining way:** direct trust and recommended trust
- ✧ **According to role:** code trust, third party trust and execution trust, etc.
- ✧ **According to based theory:** subjective trust and objective trust.



Trust Categories

- Identity trust and Behavior trust.
- **Identity trust** is concerned with **verifying** the **authenticity** of an entity and determining the **authorizations** that the entity is entitled to and is based on **cryptographic techniques** such as encryption and digital signatures.
- **Behavior trust** deals with a wider notion of an entity's “**trustworthiness**” and focuses more on the **behavior** of that entity.
- For example, a **digitally signed certificate** does not indicate whether the issuer is an **industrial spy** and a piece of **digitally signed code** does not show whether the code will perform some **malicious actions** or not.



Trust Models

- PKI Based Trust Model
- Network Topology Based Trust Model
- Basic Behavior Based Trust Model
- Domain Based Trust Model
- Subjective Trust Model
- Dynamic Trust Model



PKI Based Trust Model

- This trust model depends on a few leader nodes to secure the whole system.
- The leaders' validity certifications are signed by CA.
- GSI Security Infrastructure of Globus the most famous Grid toolkit is also based on PKI technology.
- **Drawback:** PKI model may cause uneven load or a single point of failure since it rely on leader nodes too much



Network Topology Based Trust Model

- This trust model is constructed on the basis of network topology.
- Each entity's trust is evaluated according to its location in system topology and it usually uses tree or graph traversal algorithm
- **Drawback:** due to the extremely complexity of network environment, trust values are often inaccurate which may cause system security risks



Basic Behavior Based Trust Model

- This model uses history trade records to compute trust.
- One entity's trust is gained by considering both former trade experiences and other nodes' recommendation.
- Trust value is relatively complete and reliable in this model
- **Drawback:** large-scale computation.



Domain Based Trust Model

- This trust model is mostly used in Grid computing.
- It divides Grid environment into several trust domains and distinguishes two kinds of trust.
- One is **in-domain trust relationship** and the other is **inter-domain trust relationship**.
- low computational complexity because
 - in-domain trust's computation only depends on the number of nodes in a domain and
 - inter-domain trust only depends on the number of domains.
- **Drawback:** network bottleneck and a single point of failure



Subjective Trust Model

- Subject logic based trust model divides trust into several subclass:
 - execution trust,
 - code trust,
 - authority trust,
 - direct trust and
 - recommendation trust
- Subjective trust is a subjective decision about specific level of entity's particular characters or behaviors
- Entity A trusts entity B means A believes that B will perform certain action in some specific situation
- **Drawback:** it cannot realize the integration of identity and behavior certification.



Dynamic Trust Model

Dynamic trust mechanism is a new and hot topic of security research for distributed applications.

- * To decide **trust degree** space. Always it is defined by fuzzy logics.
- * To design mechanism of acquirement of **trust value**. There are two kinds of methods: direct or indirect.
- * To design mechanism of **trust value evaluation** or **evolution**.



Reputation based Trust Models

- Study highlighted points in the paper titled
“Resource Selection In Grid Environment Based On
Trust Evaluation Using Feedback And
Performance”

File Name: LectureI_ReputationTrustModels



Reputation based Trust Models

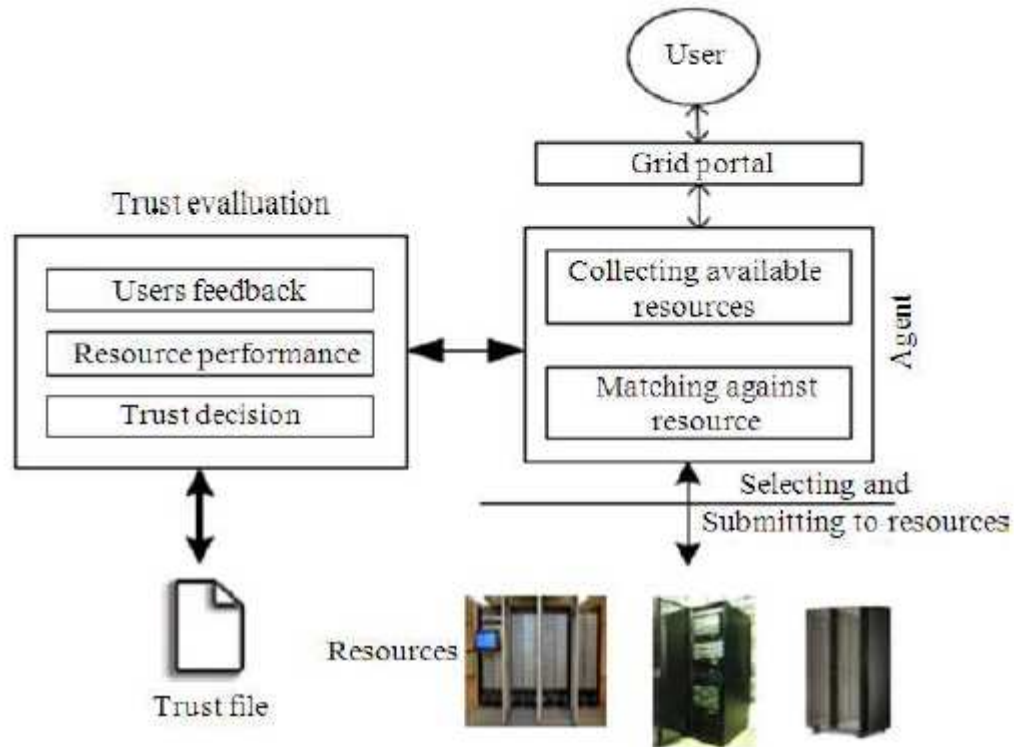


Fig. 1. Trust resource selection model



References

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- Mohan, Prakash, and Ravichandran Thangavel. "RESOURCE SELECTION IN GRID ENVIRONMENT BASED ON TRUST EVALUATION USING FEEDBACK AND PERFORMANCE." *American Journal of Applied Sciences* 10, no. 8 (2013): 924.

