Exchanging tokens in Grid

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Agenda

- Motivation
- Token based Accounting System
- Extended model: Token Exchange System
- First simulation approach
- Conclusion and outlook
Motivation

- LHC particle collider at CERN
- 4 Petabytes/s at CERN in an experiment before hardware and software filtration
- Storage of 10 Petabytes/year

Resources (CPU & Storage) regulated by MoU

Bilateral agreement on resource sharing

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Research question

Problem statement:
- High communication cost for and inflexibility due to bilateral agreement
- Excessive consumption of resources
- No temporal shifting of resources guaranteed

Research question:
- How can a fair exchange of resources be realized?
- How do the right incentives and enforcements have to be set up to prevent selfish and malicious behavior?
Token based Accounting System (TbAS)

- Implemented system to exchange resources by paying with tokens
- Personalized tokens
- Quorum of peers as trusted peers

- No economical aspects considered (exchange rate of tokens)
- Reputation as an extra option besides token payment
The goal of the Token Exchange System

Reputation as an assessment factor for user behavior

Payment instrument as an assessment factor for commodity valuation

Goal of the Token Exchange System:

Impact of the reputation on the budget of a user

[Resnick et al. 2000]  [Keynes 1947]
Extension of TbAS

Token exchange process

Trustee Group (A)

Verification of tokens

1

User A

User B

2

User C

3

Budget of User A

- Impact of B’s and C’s reputation on A’s budget
- Diversification of possessing tokens

Token value?

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Calculation of the token value

- **Axioms:**
  1. Limited number of distributed tokens
  2. Incentives for distributing some tokens
  3. Obtain a credit with “some kind of interest”

- **Value of a token from person X:**

  \[ v_x(m_x, r_x) = \max\{0, r_x - j \cdot (e^{m_x/l} \cdot m_x - k)^2\} \]

  Reputation \( r = \{0..1000\} \)  
  Number of distributed tokens \( m_x \)  
  Value of one token \( v_x(m_x, r_x) \)  
  Parameter \( j \)  

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Example

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Model assumptions – a first approach

• 50 agents: 38 Pastors, 12 Mavericks
  – Pastor: likelihood of obedient behavior 80%
  – Maverick: likelihood of selfish behavior 80%

• Token value:
  – Parameter: j = 0.05, k = 70, l = 110
  – No overdraft of distributed tokens

• Strategies:
  – No transaction between a Pastor and a Maverick after falling below a certain reputation limit
  – No strategy changes implemented (learning effect)
  – No utility function considered

• Reputation mechanism
  – Truthful feedback
  – Initial value = 1000
  – selfish behavior: decrease of reputation value by 10
  – obedient behavior: increase of reputation value by 2

\[ v_x(m_x, r_x) = \max\{0, r_x - j \cdot (e^{m_x/l} - k)^2\} \]
Preliminary test run

Scenario 1: all Maverick tokens are distributed at the beginning

Payment + Reputation:

TES:
Preliminary test run

Scenario 2: Mavericks consider their reputation

Payment + Reputation:

TES:
Conclusion and Outlook

- Emission of own tokens
- Determination of a calculation function for the token value
- Simulation: Impact of reputation on the budget of the user
- Fair exchange depending on reputation mechanism

- Extension of the first draft simulation model
- Appropriate reputation mechanism for TES
- Formalization of the model
Thank you for your attention!

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