IISM
Institute of Information Systems and Management

Exchanging tokens in Grid

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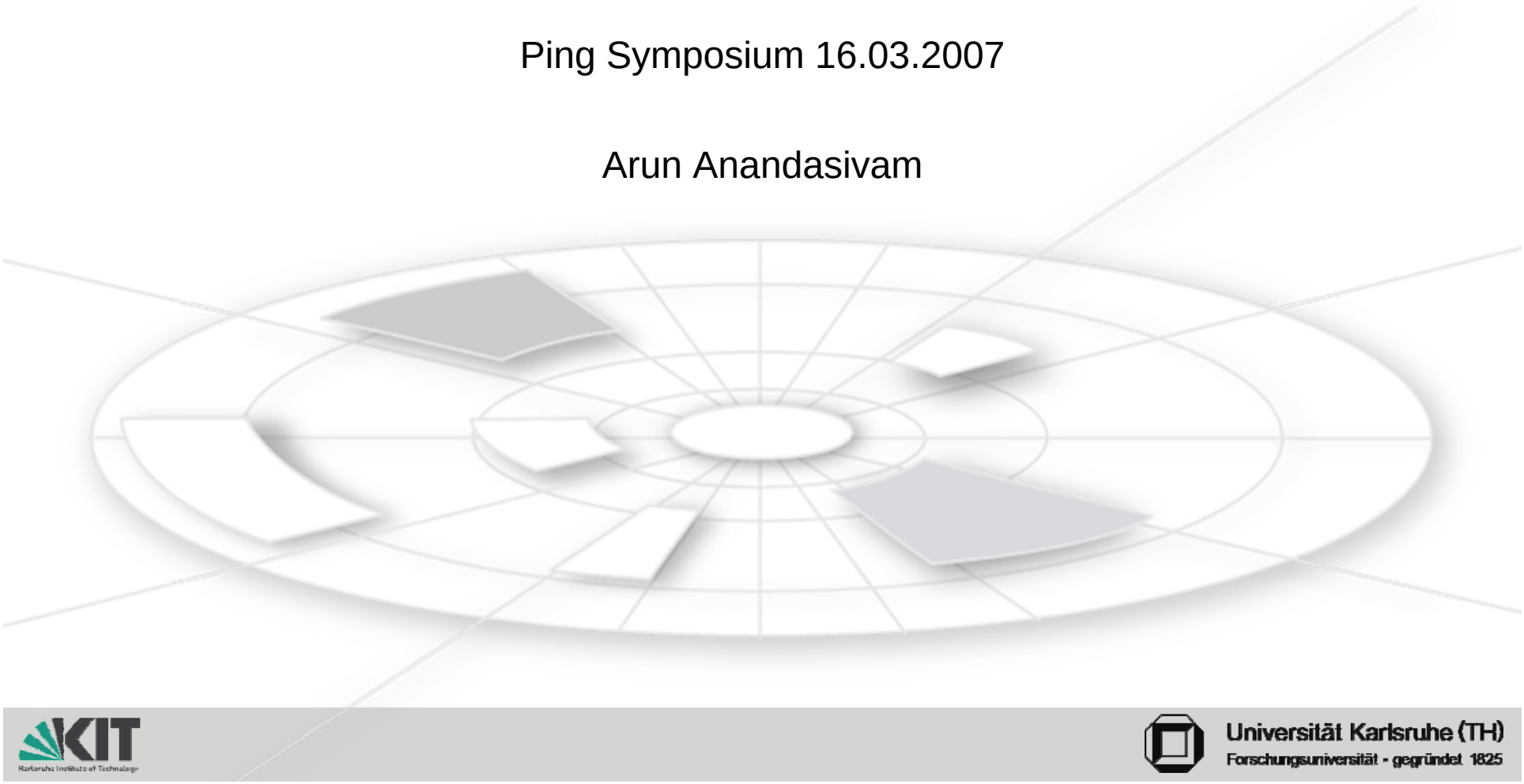


Agenda

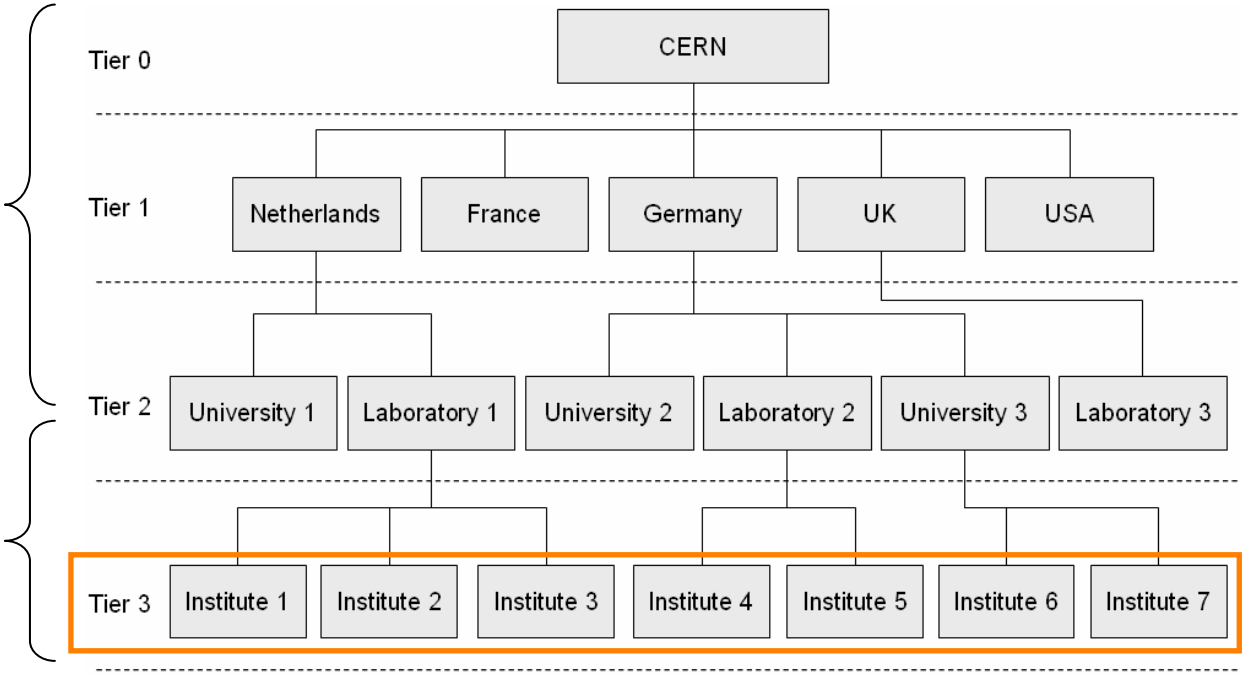
- Motivation
- Token based Accounting System
- Extended model: Token Exchange System
- First simulation approach
- Conclusion and outlook

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

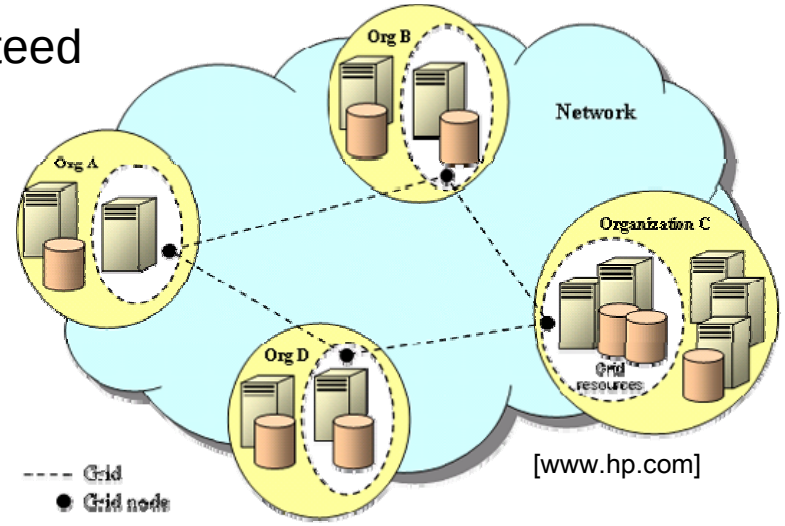
Bilateral agreement on resource sharing



Research question

Problem statement:

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



[www.hp.com]

Research question:

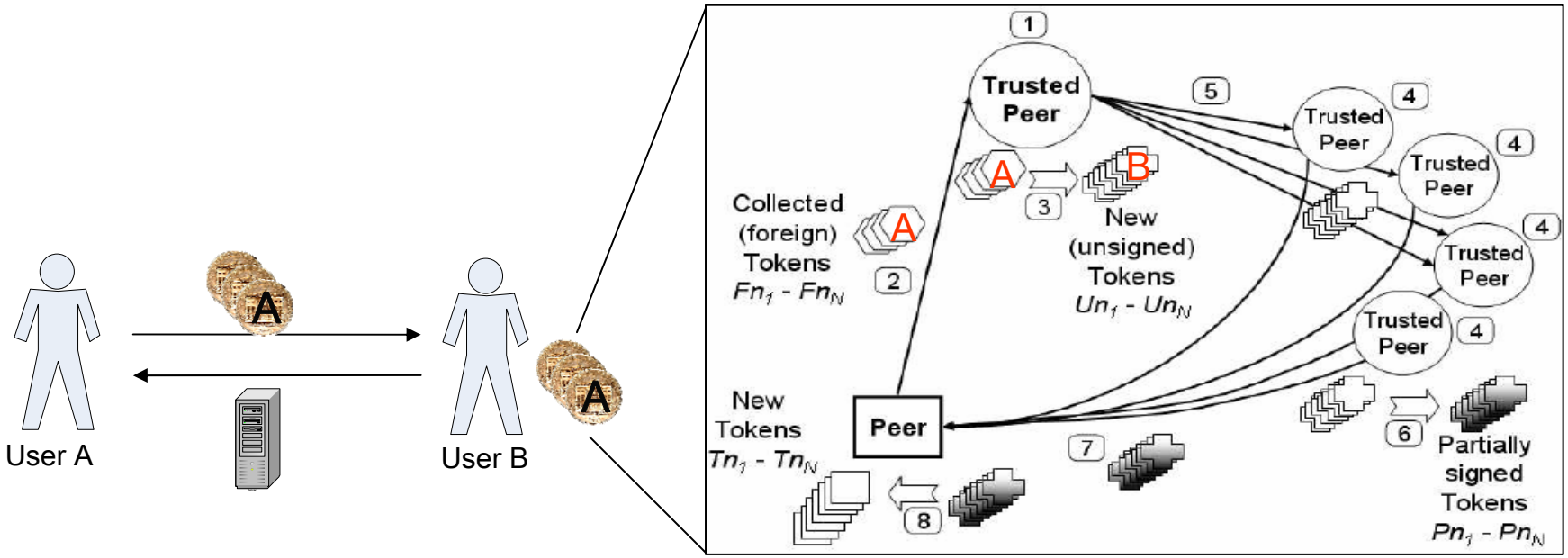
- How can a fair exchange of resources be realized?
- How do the right incentives and enforcements have to be set up to prevent selfish and malicious behavior?

Token based Accounting System (TbAS)

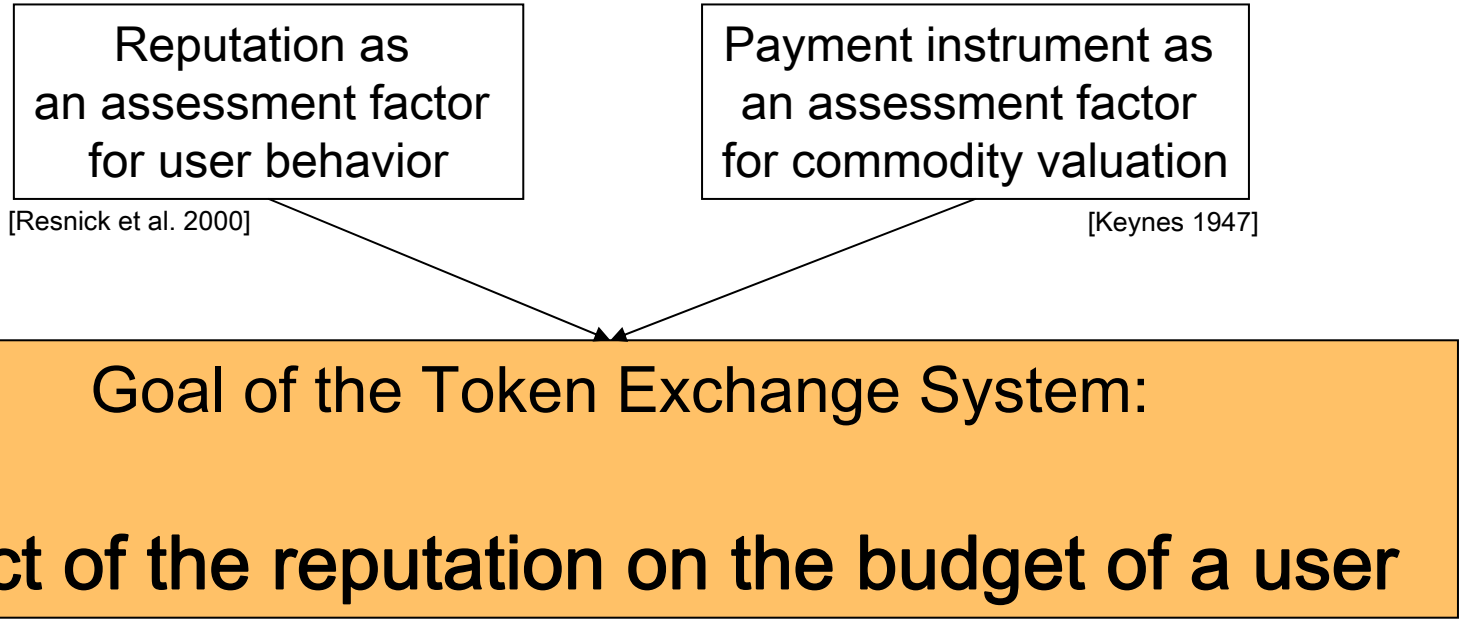
[Liebau et al. 2005]

- 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

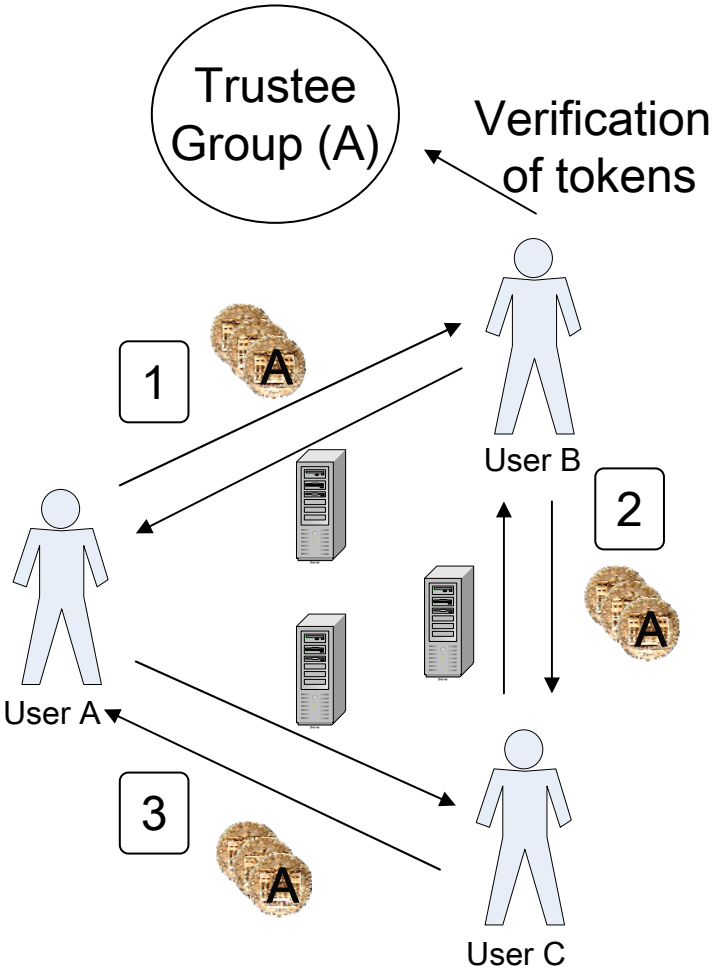


The goal of the Token Exchange System

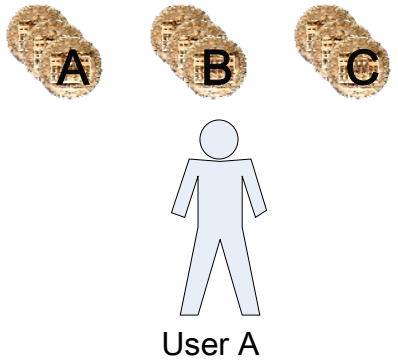


Extension of TbAS

Token exchange process



Budget of User A

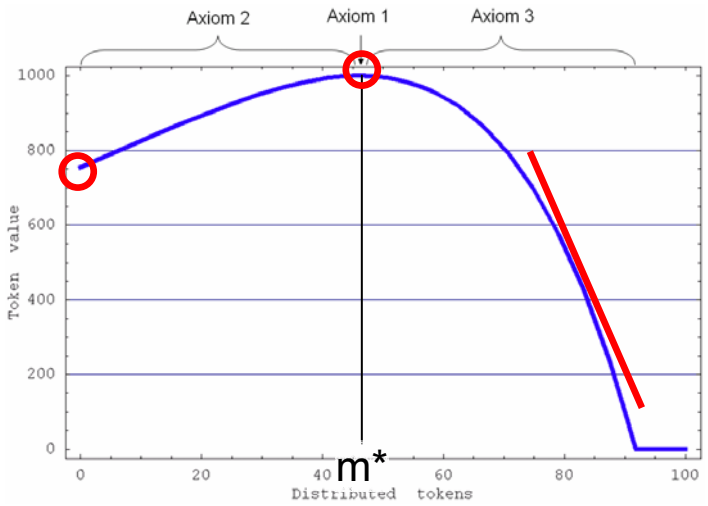


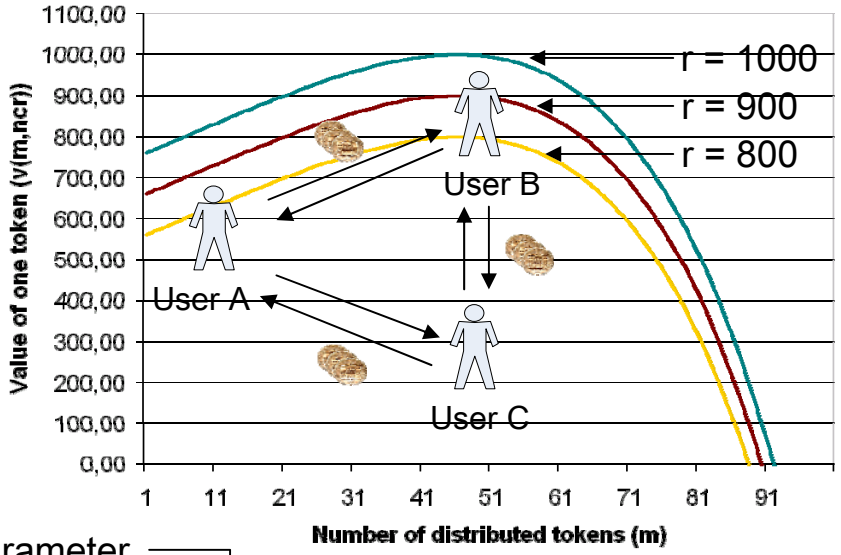
- Impact of B's and C's reputation on A's budget
- Diversification of possessing tokens

Token value?

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:

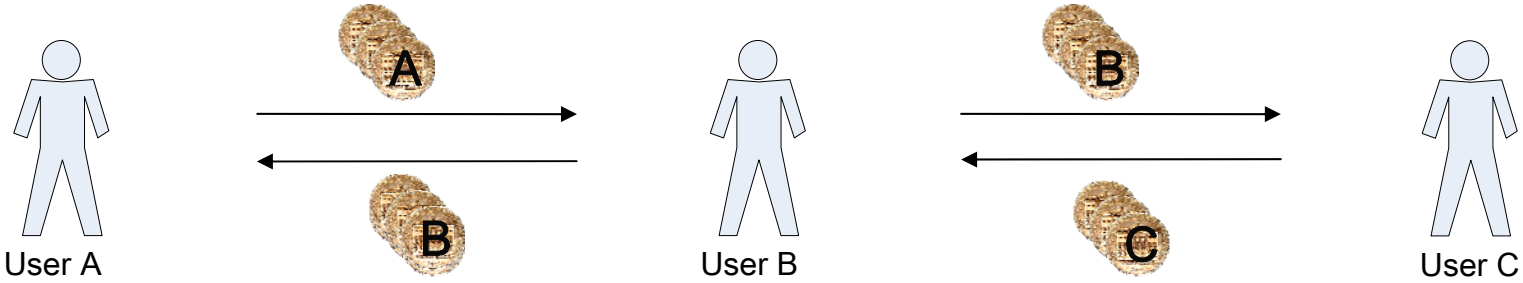
$$v_x(m_x, r_x) = max\{0,\ r_x - j \cdot (e^{m_x / l} \cdot m_x - k)^2\}$$

Parameter

Reputation r = {0..1000}

Number of distributed tokens

Example



Owner	Amount
A	*35*
B	10
C	10

Owner	Amount
B	*20*
A	10
C	15

Owner	Amount
C	*25*
B	20
A	5

Rep (all): 1000

v_A: 832
v_B: 932
v_C: 902

Budget A: 47460
Budget B: 40490
Budget C: 45350

Rep B: 850

v_A: 832
v_B: 783
v_C: 902

Budget A: 45970
Budget B: 37510
Budget C: 42370

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

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

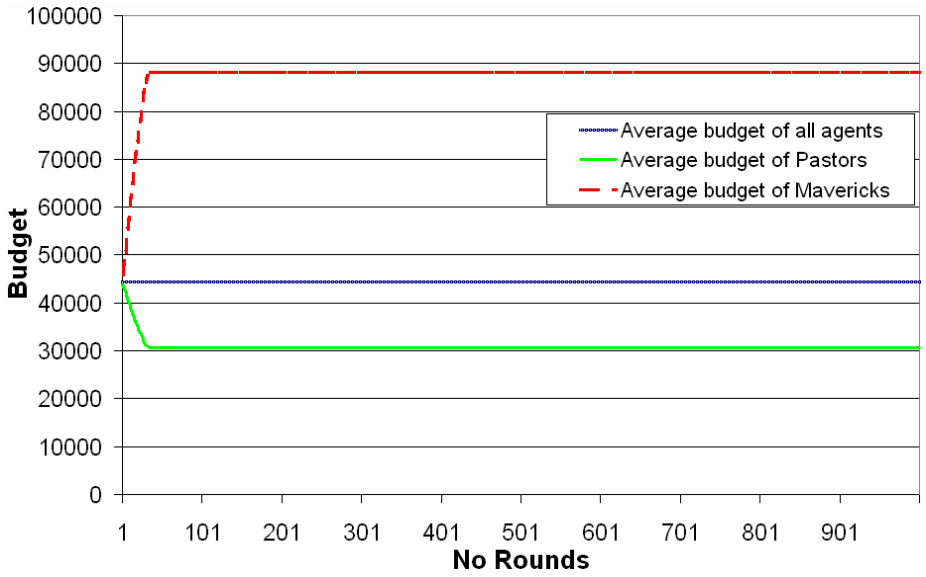
- Strategies:
  - No transaction between a Pastor and a Maverick after falling below a certain reputation limit
  - No strategy changes implemented (learning effect)
  - No utility function considered

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

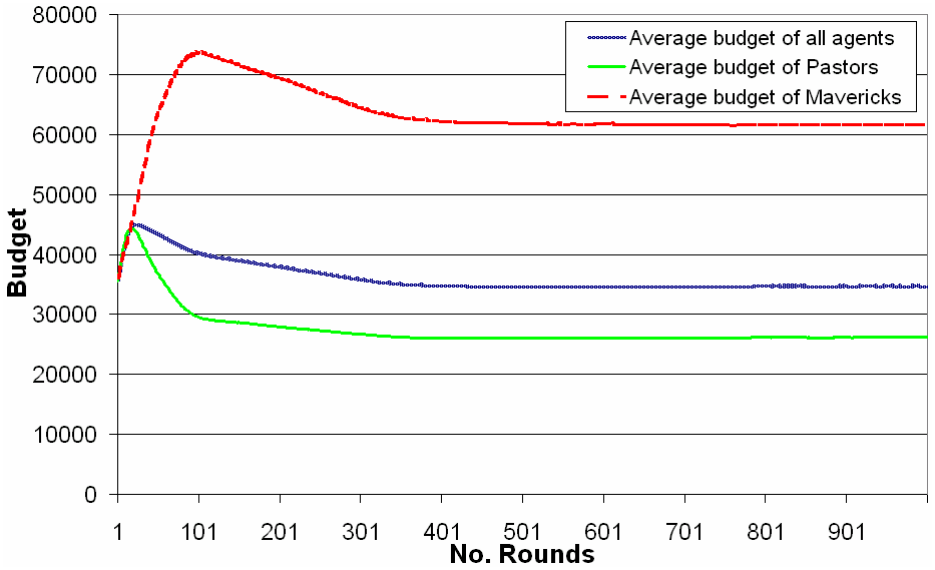
Preliminary test run

Scenario 1: all Maverick tokens are distributed at the beginning

Payment + Reputation:



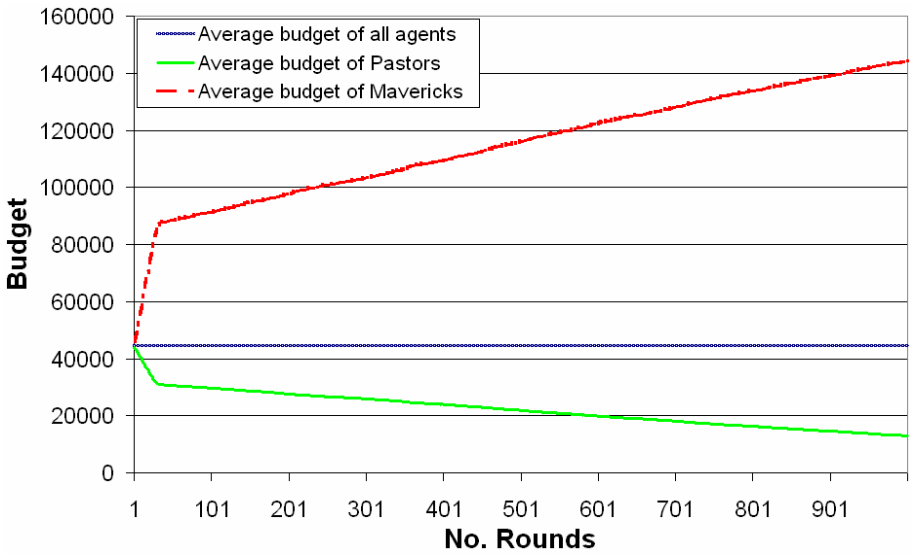
TES:



Preliminary test run

Scenario 2: Mavericks consider their reputation

Payment + Reputation:



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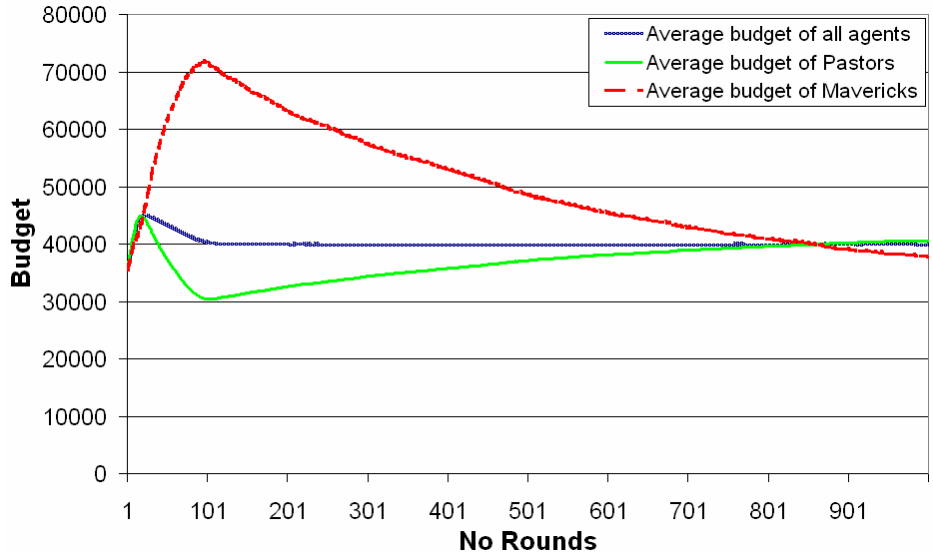

Conclusion and Outlook

- 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!