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| Title        | Challenges Toward a Dependable Infrastructure for a Trustworthy e-Society   |
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| Citation     |   |
| Issue Date   | 2005-03-11  |
| Type         | Presentation  |
| Text version | publisher   |
| URL          | <a href="http://hdl.handle.net/10119/8278">http://hdl.handle.net/10119/8278</a>   |
| Rights       |   |
| Description  | JAIST 21世紀COEシンポジウム2005「検証進化可能電子社会」 = JAIST 21st Century COE Symposium 2005 “Verifiable and Evolvable e-Society”, 開催 : 2005年3月10日～11日, 開催場所 : 石川ハイテク交流センター, Technical session 5 <Dependable Infrastructure> |



# Some Challenges Toward a Dependable Infrastructure for a Trustworthy e-Society

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## Motivation



## Dependable Infrastructure for a Trustworthy e-Society

## Context: e-Society

### Characteristics

- very heterogeneous
- very large scale
- very dynamic

### Requirements

- correctness, accountability
- availability, reliability, robustness
- adaptability, evolvability



## Goal

## Dependable Infrastructure for a Trustworthy e-Society

### Dependable Infrastructure

- Mechanisms, methodologies for dependable infrastructures

### Trustworthy e-Society

- Face new challenges

## Outline

### Background

- Dependability
- Agreement

### Challenges with e-Society

- multi-levels guarantees
- heterogeneity
- scalability

### Conclusion

## Dependable Systems

### Dependability

- errors & faults can occur anywhere at any time
- they should have little or no consequence

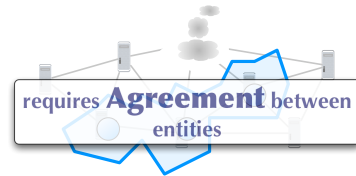
### Means

- prevention (specification, verification, testing)
- masking (redundancy, resilience)
- recovery (checkpointing, reparation)

## Dependable e-Society

- **e-Society is a System**
- **Correctness**
  - Behavior corresponds to specification
  - Specification corresponds to expectations
- **Dependability**
  - **Reliability:** e-Society does not fail.
  - **Availability:** e-Society responds when I needed it.
  - **Accountability:** e-Society can report on actions/decisions.
  - **Privacy:** e-Society protects private sphere.
  - **Fairness:** e-Society maintains fairness / transparency.

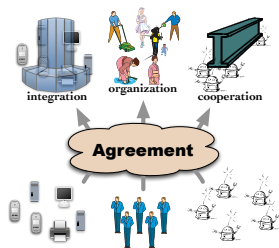
## Dependability in Distributed Systems



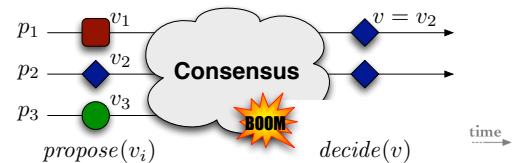
- **Distributed Systems**
  - Entities/services, communication
  - Interactions

## Agreement as Foundation

- **Agreement**
  - Interact to reach common decisions
  - E.g., elections, ...
  - Also between sub-systems
- **Applications**
  - Consensus,
  - Atomic multicast,
  - Atomic commit,
  - Service replication, ...



## Agreement Protocol (e.g., Consensus)

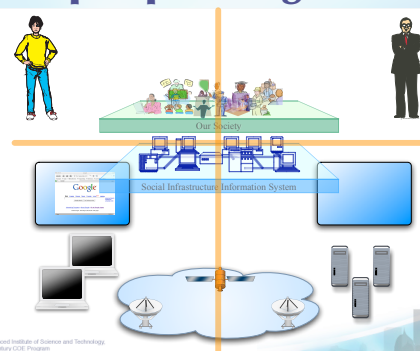


- **Definition**
  - Participants propose value
  - Agreement on decision value

## Challenge 1: multi-perspective guarantees

- **Traditional systems**
  - computer service: client / server
  - guarantees for servers
  - guarantees for clients
- **e-Society infrastructure**
  - system perception includes other "clients"
  - people also part of the system.
- **Difficulty**
  - Manage interactions between machines and people
  - Provide guarantees from different viewpoints

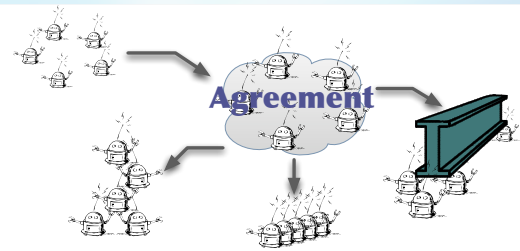
## Challenge 1: multi-perspective guarantees



## Challenge 2: heterogeneity

- **Active components**
  - computers, servers
  - electronic appliances
  - vehicles, transportation systems
  - robots
  - people
- **Mobility**
  - mobility as “input”
  - mobility as “output”

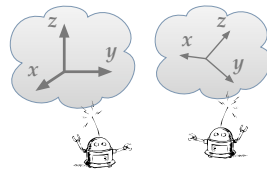
## Mobility & Agreement



- **Agreement**
  - Group behaves as **single** entity
  - Many kinds of agreement

## Mobility & Agreement

- **Agreement on coordinate system (“x-y-z”)**
  - **with GPS**
    - problem is **trivial**
    - ... modulo errors
  - **with landmarks**
    - problem is **easy**
  - **no GPS, no landmarks**
    - problem is **very hard**
    - or even **impossible**



## Challenge 3: scalability

- **“Big numbers”**
  - many **participants**
  - high **activity**
  - large amounts of **data & computation**
  - large **distances**
- **Effect**
  - complex **interactions**
  - efficiency/performance issues
- **Actions**
  - combination / integration of **techniques**
  - good **abstractions**, scalable **protocols**

## Conclusion

- **Trustworthy e-Society**
  - More and more **reliance** on e-Society
  - **Dependability** essential for **deserving trust**
  - **People** are big part of the game
- **Research**
  - Builds upon **state-of-the-art**
  - Many **new challenges**
  - Highly **interdisciplinary**