

Title	Challenges Toward a Dependable Infrastructure for a Trustworthy e-Society
Author(s)	DEFAGO, Xavier
Citation	
Issue Date	2005-03-11
Type	Presentation
Text version	publisher
URL	http://hdl.handle.net/10119/8278
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

Xavier DÉFAGO

School of Information Science,
Japan Adv. Inst. of Science & Tech. (JAIST)
PRESTO, Japan Science & Tech. Agency (JST)

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

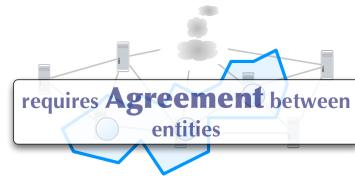
Means

- 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.

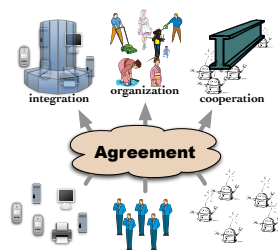
Dependability in Distributed Systems



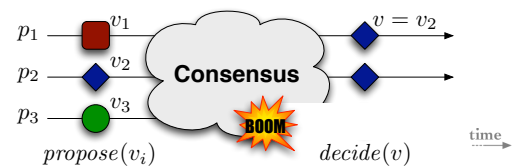
- **Distributed Systems**
 - Entities/services, communication
 - Interactions

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)

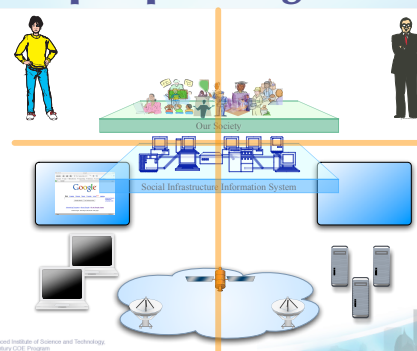


- **Definition**
 - Participants propose value
 - Agreement on decision value

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

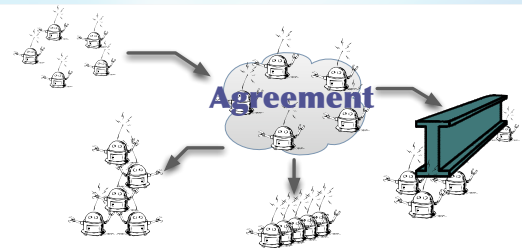
Challenge 1: multi-perspective guarantees



Challenge 2: heterogeneity

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

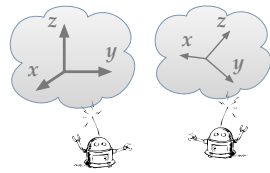
Mobility & Agreement



- **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**