



Algorithmic Principles for Building Efficient Overlay Computers

AEOLUS



AEOLUS Approach

- Global computer
 - of grand-scale
 - consisting of Internet-connected computing entities
 - globally available
 - able to provide to its users a rich menu of high-level integrated services that make use of its aggregated computational power, storage space, and information resources.
- Overlay computer
 - Intermediate layer between the global computer and the services
 - Major issues: efficiency, scalability, fault-tolerance, transparency to heterogeneity



AEOLUS Objectives

- To identify and study the important fundamental problems and investigate the related algorithmic principles
- To identify the important functionalities such an overlay computer should provide as tools to the programmer
- To develop, rigorously analyze and experimentally validate algorithmic methods that make these functionalities efficient, scalable, fault-tolerant, and transparent to heterogeneity



AEOLUS Objectives (contd.)

- To provide improved methods for communication and computing among wireless and possibly mobile nodes so that they can transparently become part of larger Internet-based global computers
- To implement a set of functionalities and integrate them under a common software platform to provide the basic primitives of an overlay computer
- To build sample services on this overlay computer (proof-of-concept of the theoretical results)



The partners

- University of Patras (EL) -
Coordinator
- Telecom Italia Learning Services (I)
- CNRS (F)
- University of Paderborn (D)
- Research Academic Computer
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- Universita di Salerno (I)
- University of Ioannina (EL)
- Centre Universitaire d' Informatique
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- Christian-Albrechts Universitaet zu
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- Universita di Roma "Tor Vergata"
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- University of Athens (EL)
- Universita di Padova (I)
- ETH Zurich (CH)
- Universitat Politecnica de
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- Katholieke Universiteit Leuven (B)
- INRIA (F)
- DIMATIA, Charles University (CZ)
- University of Cyprus (CY)
- Cybernetica (EE)



Challenges

- Resource usage and management
 - CPU, disk space, bandwidth, information/application-level resources
- Security
 - Trust management, authentication, privacy, anonymity, secure distributed computation
- Support of wireless devices
 - Special characteristics: mobility, heterogeneity, limited computational power, limited availability



Innovation in AEOLUS

- Efficiency and scalability are fundamental requirements in order to guarantee the success of global systems
- Algorithmic approach to global computing
- New issues because of:
 - Scale, heterogeneity, high dynamicity, diversity in ownership of resources, selfishness, untrustworthiness, limited knowledge
- New computational paradigms are required
- Examples of innovative research:
 - Secure data mining, distributed trust management, coping with selfishness/maliciousness, fairness vs efficiency, coping with imperfect/partial/uncertain knowledge



Expected results

- Formulation of algorithmic principles for overlay computers
 - understanding of models
 - design and analysis of provably efficient algorithms
 - statements of trade-offs, impossibility results and lower bounds
- Implementation of functionalities
- Integration of functionalities into a common platform to serve as the General-Purpose Programmable Overlay Computer
- Proof-of concept application