



- University of Patras, Coordinator
- Research Academic Computer Technology Institute
- University of Ioannina
- University of Athens



- Radiolabs
- Università degli Studi di Salerno
- Università degli Studi di Roma "Tor Vergata"
- Università degli Studi di Padova
- Università degli Studi di Roma "La Sapienza"



- Centre National de la Recherche Scientifique
- Institut National de Recherche en Informatique et en Automatique



- Universität Paderborn
- Max-Planck Institut für Informatik
- Christian-Albrechts-Universität zu Kiel



- Université de Genève
- Eidgenössische Technische Hochschule Zürich



- Universitat Politècnica de Catalunya



- Katholieke Universiteit Leuven



- DIMATIA, Univerzita Karlova v Praze



- University of Cyprus



- Cybernetica



AEOLUS

Algorithmic Principles for
Building
Efficient Overlay Computers



Integrated Project AEOLUS (IP-FP6-015964)
Funded by the European Union
September 2005 - August 2009

<http://aeolus.ceid.upatras.gr>



Sixth Framework Programme
FET Proactive Initiative on Global Computing
Information Society Technologies

Project goals

The recent explosive growth of the Internet gives rise to the possibility of a global computer of grand-scale consisting of Internet-connected computing entities (possibly mobile, with varying computational capabilities, connected among them with different communication media), globally available and 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. Achieving this efficiently and transparently is a major challenge that can be overcome by introducing an intermediate layer, the *overlay computer*.

The goal of AEOLUS is to investigate the principles and develop the algorithmic methods for building such an overlay computer that enables this efficient and transparent access to the resources of an Internet-based global computer.

In particular, the main objectives of AEOLUS are:

- To identify and study the important fundamental problems and investigate the corresponding algorithmic principles related to overlay computers running on global computers.
- To identify the important functionalities such an overlay computer should provide as tools to the programmer, and to develop, rigorously analyze, and experimentally validate algorithmic methods that can make these functionalities efficient, scalable, fault-tolerant, and transparent to heterogeneity.
- 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 overlay computers.
- To implement a set of functionalities, integrate them under a common software platform in order to provide the basic primitives of an overlay computer, as well as build sample services on this overlay computer, thus providing a proof-of-concept for the theoretical results.

Workplan

The work within AEOLUS is logically divided into six components which define corresponding subprojects SP1-SP6.

SP1 Paradigms and principles aims to develop the theoretical framework to cope with new algorithmic problems that arise in Global Computing. It studies structural properties of global/overlay computers, fundamental techniques for coping with selfishness and for achieving stability and fault tolerance, and tackles the challenge of computing with partial knowledge by blending theories from economics, game theory, algorithmics and combinatorics.

SP2 Resource management focuses on specific aspects related to the management of critical resources, resource discovery, as well as on the design of mechanisms for accessing resources owned by selfish entities. Resources can either be of a low-level (i.e., infrastructure-dependent) or application-level.

SP3 Sharing information and computation considers algorithmic problems related to the management of resources focusing on computational and information resources. It addresses issues like distributed data management, load management and scheduling while studying in depth the resource usage and management issues posed by the Global Computing Proactive Initiative.

SP4 Security and trust management explores problems related to trust management, authentication mechanisms, privacy, anonymity, and secure distributed computation. Fundamental issues crucial to a transparent security layer are addressed. In achieving this goal, the work within SP4 adapts concepts from cryptography and economics that have recently shown to be very successful in modeling adversarial but rational behavior.

SP5 Extending global computing to wireless users investigates how to transparently include wireless nodes in an Internet-based overlay computer. It focuses on issues like resource management and quality of service in wireless sub-networks, network design and topology control under dynamic scenarios, mobility and fault tolerance. SP5 aims to provide efficient and practical algorithmic solutions for high-quality, reliable, stable end-user services on heterogeneous wireless networks. Due to the specific limitations of wireless devices, particular attention is placed to the efficient usage of critical resource like energy and spectrum.

SP6 Design and implementation of components and applications for programmable overlay computers aims to implement and integrate functionalities produced covering all the above areas of research into a common software platform (the *Overlay Computing Platform*) that will provide the programmable interface of the overlay computer. Special attention is devoted to the efficiency of the implementations. An application implemented on top of this overlay computer will serve (together with the platform and the integrated functionalities) as a proof-of-concept.

Designing and implementing components and applications for programmable overlay computers has impact on the research conducted in all research areas addressed within AEOLUS which reversely supply the proof-of-concept with functionalities as well as corresponding algorithms to be included in the Overlay Computing Platform. The selection of the overlay computer also identifies key areas on which theoretical and experimental research focuses.