# Autonomic Networking Architecture ANA

LANCASTER UNIVERSITY

## About The Project

The ANA Project aims at exploring novel ways of organizing and using networks beyond legacy Internet technology.

The ultimate goal is to design and develop a novel autonomic network architecture that enables flexible, dynamic, and fully autonomous formation of network nodes as well as whole networks. Universities and research institutes from Europe and Northern America are participating in this project.

The resulting autonomic network architecture will allow dynamic adaptation and re-organisation of the network according to the working, economical and social needs of the users.

**Period:1/1/2006 – 12/31/2009**
Funding Agency: European Union (EU)
Program: Information Societies Technology—Future Emerging Technologies (IST-FET)

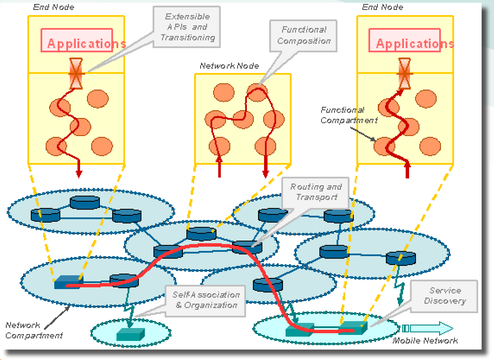

**Lancaster University, Computing Dept representation**
Principal Investigator: Prof. David Hutchison
Co-investigators: Dr. Andreas Mauthe, Dr. Andrew Scott, Prof. James P.G. Sterbenz
Researchers: Mr. Manolis Sifalakis, Dr. Marcus Schöller


## Scientific Objective

To identify fundamental autonomic networking principles that enable networks to scale not only in size but also in functionality. The main premise of our work is that a functionally scaling network is a synonym for an evolving network which includes the various self-x attributes essential to autonomic communication such as self-management, self-optimization, self-monitoring, self-repair, and self-protection.

The hypothesis is that, due to these self-x attributes, such functional scaling will naturally lead to networks that are not only richer in functionality but which also scale in size. Scientific research in ANA will explore the "Internet de-construction" trends of functional atomization, diffusion and sedimentation that will replace the current static layering approach.

A new Autonomic Network Architecture will emerge as a result of this research. This architecture will provide the framework for network function re-composition. The goal is to produce an architectural design that enables flexible, dynamic and fully autonomic formation of large-scale networks in which the functionalities of each constituent network node are also composed in an autonomic fashion.




## Technological Objective

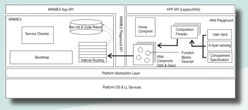
The second premise in ANA is that the only way to make new ideas and concepts succeed is to put them into practice. Therefore, ANA takes on the challenge of not only producing original scientific research results and a novel architectural design, but also showing that they work in real situations, and using the experience gained experimentally as feedback to refine the architectural models and other research results.

The technological objective of ANA is therefore to build an experimental autonomic network architecture, and to demonstrate the feasibility of autonomic networking within the coming 4 years. Prototypes of research results will be implemented in the testbed at an early stage, such that preliminary experimental results can be used as a feedback to steer and refine the architectural design and to obtain more accurate and realistic research results. (Figure 1 ANA)

## Lancaster University Leadership:

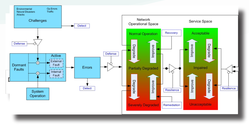
1. Functional Composition and Cross-layering Optimisations:

Analysis, design and development of modern, flexible, adaptive and evolvable network subsystems (to replace legacy network stacks).



2. Resilience and Survivability:

Architecture, mechanisms, and protocols for providing resilience, security, and survivability of nodes, compartments, and the network.

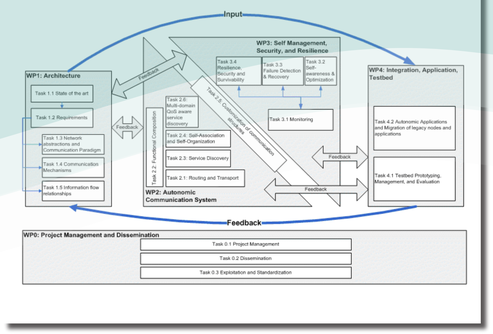


3. Testbed Prototyping, Management, and Evaluation

## Examples

Step 1: A network based on the predominant infrastructure of Ethernet switches and wireless access points will be built. The goal is to demonstrate self-organization of individual nodes into a network. The design of such network should potentially scale to large network meshes in the range of $10^5$ active (routing) elements. In order to show scalability, three approaches are envisaged: a) overlay for interconnecting the participating sites, b) simulations, and c) a distributed open collaborative approach similar to successful initiatives such as "SETI@ Home", "Folding@Home", to include external experimentators and to disseminate ANA results.

Step 2: Using insights from the first effort, will loosen the constraints and permit wired and multihop wireless heterogeneous devices to be integrated in an autonomic way. Here the focus is on the self-organization of networks into a global network.




## Project Partners:

- ETH Zurich , Communication Systems Group Autonomic Networking
- University of Basel Computer Networks Group (UBasel)
- NEC Europe Ltd. Network Laboratories (NEC)
- University of Lancaster (ULanc)
- Fraunhofer Gesellschaft zur Förderung der angewandten Forschung (FOKUS)
- Université de Liége (ULg)
- Université Paris VI Pierre et Marie Curie (UPMC)
- National and Kapodistrian University of Athens (NKUA)
- Universitetet I Oslo (UiO)
- Telekom Austria
- University of Waterloo

**External Collaborators**
Simula Lab, Network and Distributed systems (Norway)
Kansas University, Information and Telecommunication Technology Center (U.S.A.)
University of Sydney, School of Information Technologies (Australia)

**Inter-project Technology Exchange:**
ResiliNets: Multilevel Resilient and Survivable Networking Initiative
- ANA - Autonomic Network Archiecture (EU FET-IST)
- Postmodern Internetwork Architecture (NFS NeTS-Find)

SAC: Integrated Projects in the area Situated and Autonomic Communications
- BIONETS - BIOlogically-inspired autonomic NETworks and Services
- ANA - Autonomic Network Architectures
- HAGGLE - An innovative Paradigm for Autonomic Opportunistic Communication
- CASCADAS - Componentware for Autonomic, Situation-aware Communications and Dynamically Adaptable

InfoLab21


INVESTING IN englandsnorthwest
Northwest REGIONAL DEVELOPMENT AGENCY
Project Part-Financed by the European Regional Development Fund
NW Objective 2 Programme 2000-06 NW Knowledge-Based Action Plan www.nwua.ac.uk