
Global Communications Newsletter

September 2002

E-NET: Emerging Networking Technologies

By Arturo Azcorra, Spain and David Hutchison, United Kingdom

E-NET (Emerging Networking Technologies) is a European Network of Excellence funded under the last call of the Framework V Information Society Technologies (IST) Program.

Networks of Excellence (NoEs) have been used as a method of conducting joint research in the European Framework Programs for many years, with an emphasis on university and industry laboratories doing longer-term research and coordinating their activities by means of workshops, short-term visits and exchanges, training and development of Ph.D. students, and exploitation and integration of the research results coming from the individual laboratories. One such NoE is Cabernet, specializing in distributed and dependable computing technologies. European Commission (EC) funding for an NoE has been focused on the coordination activities of the various laboratories involved. Another sort of coordination activity, funded from a different budget, has been in place in Europe for much longer: the COST Program started more than 25 years ago, and COST Actions bring together a number of research laboratories in a loosely coupled activity where the emphasis is on workshops and short-term exchanges. The budget of a typical COST Action is much smaller than that of an NoE. The lifetime of an NoE and a COST Action is typically three to four years. In Framework VI, it seems likely that NoEs will become more significant instruments (ways of doing research) and be more generously funded than at present, while COST Actions will continue much as before.

The concept driving the E-NET NoE is stronger coordination of independent research initiatives within each state into European-scale initiatives, to work in a more coherent way toward international scientific collaboration. This collaboration is being applied to the particular research field of networking technologies to allow the integration of computers and networks into the everyday environment, allowing access for every ordinary citizen, enabling the use of a multitude of services and applications through self-configured and easy-to-use interfaces. We emphasise that the terms *computers* and *networks* mean not only existing sorts of PCs and current ways

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of accessing the Internet, but are used in their widest possible interpretation as any electronic device and any type of personal, local, or wide area network, either wired or wireless.

The grid, consisting of networking and middleware layers supporting distributed applications, is seen as a fundamental infrastructure for the global information society, supporting all manner of electronic activities (e-science, e-business, e-health, e-leisure, etc.). E-NET's research activities will also contribute

to advances in building the network layer of the Grid, including engineering better quality of service (QoS) into the network. Thus, E-NET's networking activities form a natural complement to the middleware work of the Cabernet NoE mentioned earlier.

In addition, the E-NET partners form a network of excellence in current and emerging Internet technologies, and can act as a source of appropriate expertise for Europe; this includes the training of badly needed new people, through Ph.D. programs and advanced projects, with skills in networking and the Internet.

E-NET is therefore structured as a distributed research center, composed primarily of research groups belonging to leading universities in Europe. E-NET collaborates with industry leaders to perform technology transfer when a given research result is in a mature enough state for appropriate exploitation. Collaboration agreements with leading universities and research centers outside Europe will be established to begin or reinforce wider international activities.

The coordination of work within E-NET is achieved by a combination of three work lines:

- Harmonization of members' research activities to strengthen their complementarity. This will be reached by setting common research objectives, aligning separate efforts into mainstream objectives.
- The use of a distributed Virtual Laboratory infrastructure to allow virtual and interactive work methods. The Virtual Laboratory will include a distributed seminar/meeting

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COST272: Packet-Oriented Service Delivery via Satellite: Part 1

By Erina Ferro, Italy; Gérard Maral, France; and Laurent Franck, France

This article presents the activities performed in the European-funded COST272 Action. COST272 brings together European researchers involved in satellite communications. The contribution starts with a presentation of the COST framework; then the COST272 motivation and activities are covered.

The COST Framework

Founded in 1971, COST is an initiative by the European Commission (EC). The objective of COST is to coordinate nationally funded research at a European level¹ in order to ensure that Europe holds a strong position in the fields of scientific and technical research. As such, COST stands for Cooperation in the Field of Science and Technology. Actions implemented in the COST framework are further categorized in domains, among these the telecommunications domain, to which COST272 is naturally related.

There are about 180 COST Actions currently running,

among these 26 in the telecommunications domain (Table 1). Actions have an average duration of three to four years and are finalized through the delivery of a final report. Yearly reports also enable monitoring of the Actions.

COST is specific about in no way funding the conducting of research. Rather, funding is allocated in order to make it possible for researchers to convene and exchange views on a given theme (satellite communications in the case of COST272). The scope of each Action is described in a memorandum of understanding (MoU) submitted to and approved by the EC. In order to submit a candidate MoU, at least five countries (among the participating countries) must sign an MoU, committing themselves to Action participation.

A COST Action is driven by a Management Committee comprising up to two delegates from each signatory country. The Management Committee meets at least three times a year. For the sake of efficiency, an Action is often organized in working groups. Depending on the Action size and allocated budget, meetings dedicated to working group activities may also be held. Apart from meetings, the Action budget (60,000 Euros a year on average) also gives provision for the organization of short-term scientific missions (STSMs). These missions make it possible for researchers to organize short stays in other institutions participating in the Action. STSMs act as a catalyst for starting up more permanent collaborations among institutions. Additionally, COST Actions are natural preludes to consortia formed as the result of EC issued calls for proposals.

In this respect, the EC unveiled in mid-2002 some aspects related to the 6th Framework Programme (FP6). Two new tools are introduced in order to support the FP6: Networks of Excellence (NoEs) and Integrated Projects (IPs). It is interesting to note that NoEs are large-scale COST Actions, in line with the concept of providing means to support research coordination while not funding the actual research efforts. This way of proceeding credits a widespread feeling among the research community that theme-driven research activities are preferable to goal-driven research, at least when noncompetitive research is addressed.

The COST272 Action

COST272 started in June 2001. Most of its participants came from two previous Actions: COST252 (Evolution of Satellite Personal Communications from 2nd to Future Generation Systems) and COST253 (Service Efficient Network Interconnection via Satellites), ended in 2000. Table 2 summarizes the Action data.

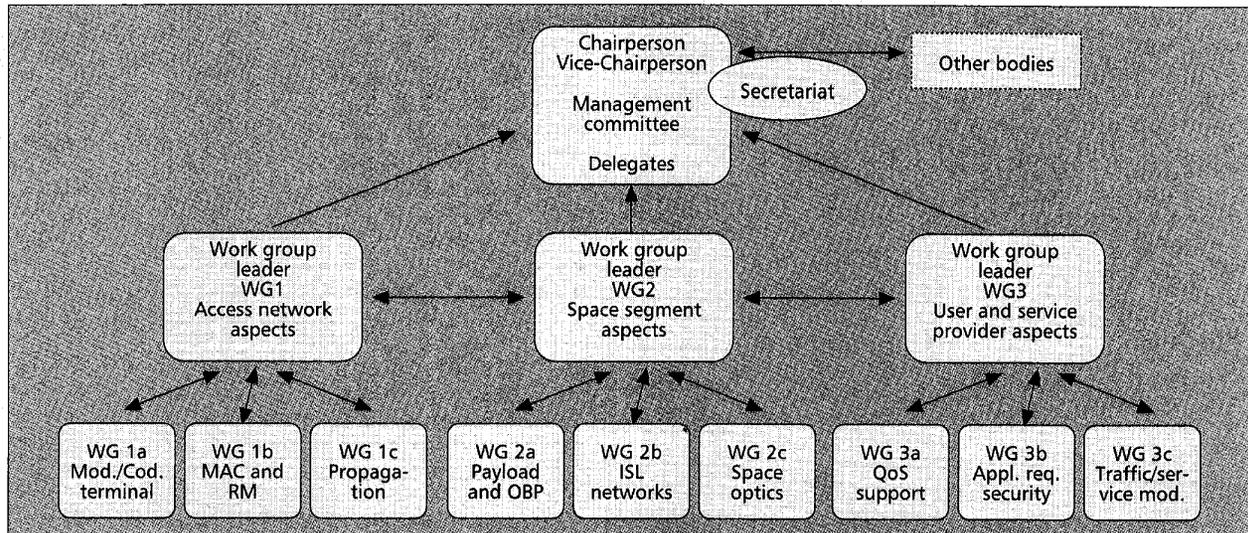
The main objectives of the Action are to contribute to the identification of key requirements, analysis, performance comparison,

Action	Title
COST 256	Modelling and Simulation Environment for Satellite/Terrestrial Networks
COST 258	The Naturalness of Synthetic Speech
COST 261	Electromagnetic Compatibility in Distributed and Complex Systems
COST 262	Spread Spectrum Systems and Techniques in Wireless and Wired Communications
COST 263	Quality of Future Internet Services (QofIS)
COST 264	Enabling Networked Multimedia Group Communication
COST211quat	Redundancy Reduction Techniques and Content Analysis for Multimedia Services
COST265	Measurement Techniques for Active and Passive Fibres to support Future Telecommunications
COST266	Advanced Infrastructure for Photonic Networks
COST267	Semiconductor Devices for Optical Signal Processing
COST268	Wavelength Scale Photonic Components for Telecommunication
COST269	User Aspects of ICTs
COST270	Reliability of Optical Components and Devices in Communications Networks and Systems
COST271	Effects of the Upper Atmosphere on Terrestrial and Earth-Space Communications
COST272	Packet-Oriented Service Delivery via Satellites
COST273	Towards Mobile Broadband Multimedia Networks
COST274	Relational Structures as Knowledge Instruments
COST275	Biometrics-Based Recognition of People over the Internet
COST276	Information and Knowledge Management for Integrated Media Communication Systems
COST277	Non-linear Speech Processing
COST278	Spoken Language Interaction in Telecommunication
COST279	Analysis and Design of Advanced Multiservice Networks Supporting Mobility, Multimedia and Internetworking
COST280	Potential Health Implications from Mobile Communication Systems
COST282	Knowledge Exploration in Science and Technology
COST283	Computational and Information Infrastructure in the Astronomical DataGrid
COST284	Innovative Antennas for Emerging Terrestrial and Space-Based Applications

■ Table 1. Actions currently running in the telecommunications domain.

¹ 33 states are now members of COST, widening the European scope of the framework.

COST272: Packet-Oriented Service Delivery via Satellite (cont'd)



■ Figure 1. Action activities organizational breakdown.

architectural design, and protocol specification of future packet-oriented satellite communication systems, with a clear focus on Internet-type system concepts, applications, and protocols/techniques on the various layers.

Satellite communications are currently not keeping pace with the development witnessed in terrestrial networks; however, in an all-IP environment they could easily facilitate early deployment of the service to many users currently out of reach of communication services. Deployment of such an all-IP environment in the satellite segment, however, requires the examination/study of suitability of the existing protocols and algorithms, and the implementation of the required modifications/ adaptations, or even the development of more efficient algorithms that take into account the peculiarities of the satellite systems. Additionally, satellite communications are expected to play an important role in such competitive environment, driven by some recent technological advances that have enabled:

- The implementation of efficient intersatellite links for traffic interconnection in the satellite segment
- Onboard processing capabilities, aiming to improve dynamic resource utilisation and flexibility
- Multiple spotbeam coverage to optimize bandwidth efficiency

Based on these advances, broadband satellite networks will represent an attractive solution to provide two-way connectivity direct to the end user and to furnish new services such as high-speed Internet access and private network solutions. Furthermore, satellite networks are best suited to satisfy the increasing demand for the broadcast and multicast type of services with the additional advantage of providing global accessibility.

These reasons are the strongest motivation for the Action participants. In order to cope with the wide scope of the problem, the Action is subdivided in three working groups, as shown in Fig. 1.

After one year of activity, the Action has produced about 40 documents, covering subjects ranging from coding to security for multicast communications. The Action participants also promoted an Expression of Interest (called OSMOSIS-NET) as a reaction to an EC request in the scope of the FP6 preparation.

Action title	Packet-Oriented Service Delivery via Satellites	
Started in	June 2001	
Ending in	June 2005	
Chairman	Prof. Gérard Maral	
Participants	Belgium	Brussels University
	Croatia	University of Zagreb
	France	French Space Agency (CNES), Telecommunications for Space and Aeronautics (TeSA), Telecom Paris (ENST)
	Germany	German Aerospace Centre (DLR)
	Greece	Aristotle University of Thessaloniki
	Italy	National Inter-University Consortium for Telecommunications (CNIT), National Research Council (CNR), Telecom Italia Lab
	Norway	Telenor
	Slovakia	To be defined
	Slovenia	Jozef Stefan Institute
	Spain	University Carlos III of Madrid, University of Vigo
	United Kingdom	University of Bradford, University of Surrey
Number of meetings as of late June 2002	Three management committee meetings	
Web site	http://www.tesa.prd.fr/cost272	

■ Table 2. COST272 Action data.

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room, a set of information servers, and remote use of complex testbeds and research infrastructures.

- Short-, medium-, and long-term exchange of personnel. This is accomplished by exchange of Ph.D. students, postdoctoral staff, and visiting professors. Common use of the English language for teaching and research, as well as multilingual frameworks, will facilitate these exchanges

E-NET arose from combining two existing COST actions in networking: COST 263, "Quality of Future Internet Services," and COST 264, "Enabling Networked Multimedia Group Communication," and its current list of core research groups is based on the following institutions: Universidad Carlos III de Madrid (Spain), Universidad Politecnica de Catalunya (Spain), Lancaster University (United Kingdom), University of Cambridge (United Kingdom), Université Pierre and Marie Curie (Paris 6) (France), University of Liège (Belgium), University of Coimbra (Portugal), Delft University of Technology (The Netherlands), University of Athens (Greece), Kungliga Tekniska Hogskolan (Sweden), ETH-Zurich (Switzerland), University of Krakow (Poland), Universita di Napoli Federico II (Italy), Fraunhofer Fokus (Germany), and Technical University Darmstadt (Germany).

It is expected that several more institutions will soon join E-NET, including the University of Oslo (Norway), Helsinki University of Technology (Finland), Vienna University of Technology (Austria), Technical University Denmark (Denmark), and Laboratory for Analysis and Architecture of Systems (France). Networking research groups from up to another 25 universities and research laboratories have applied to become associate members of E-NET.

Research is carried out jointly by defining technical work-

ing groups on topics that have enough critical mass and shared interest. A technical working group chair is appointed to coordinate the group, and to coordinate with other groups. Groups will change focus throughout the network's life, to reflect the natural evolution of the advanced technical fields being addressed in E-NET.

Some of the technical working groups planned at this stage are:

- AAE: Authentication, authorization, and encryption
- GCM: Group communications management
- AHNW: Ad hoc networks for wireless devices in the personal area
- ASON: Autonomous self-organized survivable networks
- BIP: Network protocol beyond IPv6
- QoS: QoS engineering
- WCM: Wireless capacity management in the personal, local, and wide areas
- ANRL: Addressing, naming, and resource location
- SCALE: Very large scalability for number of terminals, routing tables, and microflows
- FDPN: Fast service deployment and programmable networks
- DISP: Dynamic IP service creation and auto-configuration
- CDI: Content distribution infrastructure

The COST 263 and COST 264 Actions have initiated a successful series of international workshops (QoFIS and NGC), and it is intended that E-NET members will consolidate their leading involvement in these key workshops as well as pushing ahead with ideas for new international endeavours.

We expect E-NET to be reinforced through the European Framework VI Research Program, increasing its funding, incorporating other key institutions, and broadening its integration and joint research activities.

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Conclusions

The COST272 Action provides the opportunity for European researchers in the field of satellite communications to meet and coordinate their activities.

Current COST272 activities are distributed over two axes:

- The integration within an Europe-wide interactive network of satellite and terrestrial components, with the aim of validating user-friendly applications and demonstrating new services, thus enhancing the communication capabilities within the group at low expenses
- Regular research activities around the Action themes
Expected research outcomes are:
- Identification of technologies supporting IP over satellites and enabling new services and QoS guarantees;
- Suitability to implement IP switching in the sky
- Adaptation of protocols and algorithms initially developed for the mixed mobile and fixed terrestrial networks, to make them suitable for the satellite segment;
- Development of new algorithms, designed ad-hoc for the satellite segment;
- Suitability of using various optical technologies in the satellite space.

COST272 is also a core network for setting up industrial and academic consortia in view of elaborating proposals in response to calls for participation initiated by the EC.