

# The Broadband for All Cluster in FP6

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**Abstract.** This paper describes the Broadband For All Cluster, which resides within the IST (Information Society Technologies) Thematic Area of the EU's 6<sup>th</sup> Framework Programme. By explaining the topics being addressed by the projects in the Cluster, it gives a summary of the current trends in broadband provision in the access and core networks, from the perspective of the major industrial and network operations organisations throughout Europe. Since there will be further Calls for projects in this Strategic Objective, it can be a useful guide towards assessing where important topics have been overlooked.

## 1 Introduction

Proposals for IST-oriented projects in the EU's 6<sup>th</sup> Framework Programme (2002 - 2006) were invited to address the following so-called "Strategic Objectives":

- Broadband For All
  - To develop the network technologies and architectures allowing a generalised availability of broadband access to European users, including those in less developed regions. This is a key enabler to the wider deployment of the information and knowledge-based society and economy.
- Mobile and Wireless systems beyond 3G
  - To realise the vision of "optimally connected anywhere, anytime". Early preparatory work has characterized Systems Beyond 3G as a horizontal communication model, where different terrestrial access levels and technologies are combined to complement each other in an optimum way for different service requirements and radio environments. They may include the personal level (personal/body area/ad hoc network) the local/home level (W-LAN, UWB) the cellular level (GPRS, UMTS) the wider area level (DxB-T, BWA). The resulting access landscape is complemented by a satellite overlay network, providing notably a global multicast layer (eg. S-DMB).
- Networked Audiovisual Systems and Home Platforms

- To develop end-to-end networked audio-visual systems and applications, and open trusted and interoperable multimedia user platforms and devices, notably for broadcasting and in-home platforms with full interactivity capacity.

Whilst these 3 areas are becoming increasingly closely inter-related, this categorisation has led to groups (“Clusters”) of manageable size (approx. 20 projects), in which dissemination and discussion takes place that is always of common interest for most of the participants.

This paper focuses on the projects and activities in the *Broadband for All* Cluster.

## 2 Technology trends

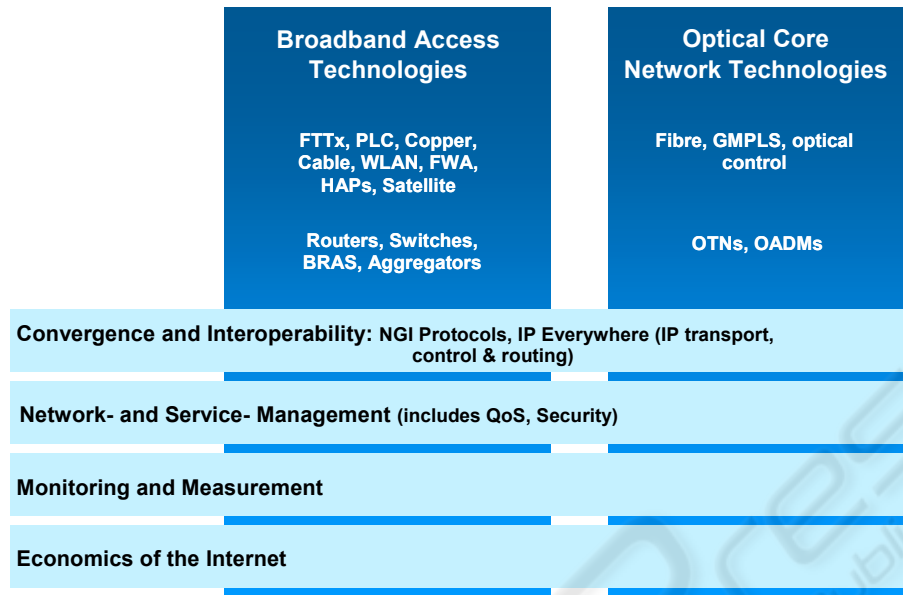
The Broadband For All Cluster is especially relevant for this workshop in so far as nowadays there can be no information society without broadband infrastructure. The demand for broadband is being driven by increasingly sophisticated content and services (e-business, e-learning, e-health, gaming, ...) running on high-speed LANs connecting a widening variety of office- and entertainment- terminals.

Capacity is generally available in the core networks of developed countries, since this is being upgraded cost-effectively in-line with demand, thanks to the foresighted deployment of fibre and DWDM technologies over the last 10 years. The spotlight for providing users with broadband is therefore directed more onto the access network, where DSL, CATV, WLAN hot-spots, BFWA, Powerline and fibre access networks are competing to bring higher bitrates to the end users. As expected, many of the projects in the Broadband For All Cluster therefore address the access network.

The complexity of service interoperability has also been recognised as a potential roadblock to the ubiquitous availability of information to the general public. Whilst the Networked Audiovisual Systems and Home Platforms Cluster examines the networking - and interworking - of domestic equipment with the telecommunications network, the Broadband For All Cluster includes projects that are working to ensure that multiple services can be supported independent of the underlying networks. “Ambient” networks and services are also being defined, whereby - through automated procedures - the complexity of network operations (and handovers) can be hidden from the user, thereby enabling the development of attractive and exciting new value-added services. If successful, this will further drive the demand for bandwidth in the access and core networks, and generate new sources of revenue.

An overview of the projects in the Broadband For All Cluster serves to highlight the trends in access and core network technologies for enabling the delivery of end-to-end services and applications with appropriate QoS, security, etc., ambient networks and services.

Fig. 1 below shows the technologies that are addressed, and also the issues covered within the Cluster that have to be supported by - or impact upon - the networks, but which are technology-independent:



**Fig. 1.** Technologies addressed (vertical), and issues (horizontal) that have to be supported by - or impact upon - the networks

### 3 The projects

**Table 1.** Projects from the 1<sup>st</sup> Call<sup>1</sup> that participate in the Broadband For All Cluster

Short Name	Type of Project <sup>2</sup>	Aspects Addressed
ACE	NoE	Sophisticated antennas are a strategic multi-application technology for emerging communications, navigation and sensing services for the Information Society, for aeronautics and space, transport, security, tele-medicine, etc. Involving thousand of specialists, European antenna engineering is currently scattered over 150 entities, with some €200M of R&D expenditure yearly. ACE will restructure this fragmented European R&D, reducing duplications and boosting excellence and competitiveness in key areas. 40 leading institutions take part in the project.

<sup>1</sup> The 1<sup>st</sup> Call for Proposals was issued on 17<sup>th</sup> December 2002. The deadline for submitting proposals was 24<sup>th</sup> April 2003. The EC budget was €60M. Most of the projects started on 1<sup>st</sup> January 2004.

<sup>2</sup> IP = Integrated Project (new instrument in FP6)  
 NoE = Network of Excellence (new instrument in FP6)  
 STREP = Specific Targeted Research Project (similar to FP5 RTD projects)  
 SSA = Specific Support Action (similar to FP5 Accompanying Measures)  
 CA = Co-ordination Action (replaces the Concerted Actions and Thematic Networks of FP5)

ATHENA	STREP	<p>ATHENA develops an approach for the digital switchover that comprises the use of the DVB stream for interconnecting NGN nodes. The solution uses regenerative configurations to enable the realisation of a virtual common Ethernet backbone that can be exploited by 3G/UMTS and Beyond 3G Systems operators and broadcasters, as well as enabling broadband access for all. Such a configuration enables multi-service capability, as the regenerative DVB-T creates a single access network physical infrastructure, shared by multiple services (ie. TV programmes, interactive multimedia services, Internet applications, etc.).</p> <p>Validation will be made through a trial in a medium-sized city, including the implementation, testing and validation of a spectrum efficient real time dynamic management of the available bandwidth, for supporting the variety of heterogeneous bit rate services, and a traffic policy mechanism, for UMTS users on the move, for the seamless reception of IP data when transitioning from one UHF channel (DVB-T stream) to another.</p>
BREAD	CA	<p>BREAD considers a multi-disciplinary approach regarding the realisation of the 'broadband for all' concept within Europe. Societal, economic, regulatory and technological issues will be addressed, sharing views and knowledge, developing new strategies and good practices.</p> <p>The study will include regional "success stories" of actual deployments and the influence of government stimulus for accelerating the early rollout of broadband services. The societal aspects of introducing broadband access and sustainable economic business models for this will be taken into account.</p> <p>One "Broadband Summit" conference and exhibition will be organised per year.</p>
BROADWAN	STREP	<p>BROADWAN looks at all the (hybrid) solutions for broadband access networks for fixed and nomadic users within a global coverage architecture. New adaptive equipment and automatic network planning and management software is included.</p>
CAPANINA	STREP	<p>CAPANINA examines the broadband capability that can be achieved from aerial platforms for the delivery of cost effective, viable alternatives to cable and satellite, with the potential to reach rural, urban and travelling users.</p> <p>Examples of High Altitude Platforms include airships and solar powered aeroplanes operating at altitudes of around 20km. Data rates of up to 120Mbps will be delivered to fixed and moving users within a 60km area.</p> <p>Free-space optic and mm-wave technologies will be used for backbone and interplatform links providing seamless integration with existing infrastructure.</p>
COCOMBINE	SSA	<p>COCOMBINE focuses on collecting the knowledge and developing the tools to understand the related markets for long distance transit, public peering and broadband access. It also focuses on the interplay between infrastructure and contents, which defines the broadband diffusion modalities across Europe. Partners will monitor the evolution of the Internet architecture using data from online transit markets and from Internet Exchange Points.</p>

DIADEM FIREWALL	STREP	<p>DIADEM FIREWALL develops a novel and comprehensive security solution for secure broadband services, by combining high-speed packet processing, algorithms for intrusion detection, and policy-based techniques for automated configuration and decision-handling. Elements include:</p> <ul style="list-style-type: none"> <li>- provider-controlled edge devices, representing a new generation of distributed high-speed broadband firewalls with policy-based control</li> <li>- enhanced techniques capable of detecting a wide range of security violations, in particular DDOS</li> <li>- techniques for responding intelligently to security violations.</li> </ul>
DAIDALOS	STREP	<p>DAIDALOS concerns the creation of a user-centred and manageable communication infrastructure for the future (with the focus on an integrated mobile environment). DAIDALOS will:</p> <ul style="list-style-type: none"> <li>- design, prototype and validate infrastructure and components for the efficient distribution of services over diverse network technologies beyond 3G</li> <li>- integrate complementary network technologies to provide pervasive and user-centred access to services</li> <li>- develop an optimized signalling system for communication and management support</li> <li>- demonstrate the results of the work through a strong focus on user-centered and scenario-based development of technology.</li> </ul>
E-PHOTON/One	NoE	<p>This Network of Excellence will integrate and focus the know-how available in Europe on optical communications. The main technical focus of the project is to show which are the potential advantages of optical technologies in telecommunication networks with respect to electronic technologies.</p>
EUQOS	IP	<p>EUQOS will experiment with, and deploy, a solution for the outstanding issues presently associated with the delivery of end-to-end QoS service across heterogeneous networks. These issues are related to the heterogeneity of the underlying network technologies, and the resource management equipment deployed (even for common types of network technology).</p> <p>The EUQOS system is based on a model that accepts the varied and proprietary nature of resource management mechanisms deployed by network operators and ISPs; necessitating only a common interface for the communication with end-users and peer domains. It exploits the growing popularity of SIP (or SIP-like) schemes.</p>
Euro NGI	NoE	<p>EuroNGI focuses on Next Generation Internet design and engineering. The Next Generation Internet will offer multi-service/multimedia, mobility, convergence (services and fixed-mobile), QoS and variable connectivity as the norm. Future high-speed wireline and wireless access technologies will provide instant high bandwidth connectivity, which makes it difficult to forecast traffic and thus to apply existing traffic engineering methods. The telecommunications environment will remain one deploying multiple technologies, and therefore new design, planning, dimensioning and management principles are needed.</p>

FLEXINET	STREP	<p>FLEXINET develops a value-added complementary network and gateways architecture for enhanced access network services and applications. It will offer cross-connect switching/routing and advanced services and data management functions at network access points. The focus is on UMTS and WLAN infrastructures. The goal is to:</p> <ul style="list-style-type: none"> <li>- relieve core networks from data handling and signalling overhead</li> <li>- accelerate the introduction of new services</li> <li>- broaden the current business models for service provisioning.</li> </ul>
GANDALF	STREP	<p>GANDALF will demonstrate the simultaneous provision of Gbps data rates to wireline and wireless access nodes, by employing a novel optical feeder concept. The proposed optical feeder employs a dual-drive Mach-Zehnder modulator at the central station, operated in such a way that is possible to recover simultaneously the transmitted broadband data directly at base-band or intermediate frequency (BB/IF) and modulated onto an RF carrier. This architecture allows therefore to remotely feed heterogeneous (wireline and wireless) access nodes with very interesting features when compared to previous approaches based in fibre-radio techniques. Cost savings are anticipated.</p>
LASAGNE	STREP	<p>All-optical label swapping is a type of optical packet switching that is intended to solve the potential mismatch between fibre capacity and router packet forwarding capacity. To date packet label processing has been carried out at the electrical domain, but in order to achieve full transparency at the optical node, it is necessary to perform this functionality at the optical domain. Likewise, the node optical layer needs to implement the required "intelligence" to look up the routing table and forward the packets.</p>
MESCAL	RTD (FP5)	<p>MESCAL proposes and validates scalable, incremental solutions that enable the flexible deployment and delivery of inter-domain QoS across the multi-provider commercial Internet for uni- and multicast services, based on IPv4 and IPv6 infrastructures. This involves advancing the state-of-the-art in service management, traffic engineering and routing by developing templates, protocols and algorithms for establishing SLSs between ISPs and their customers and peers; and a scalable solution for inter-domain traffic engineering based on enhancements to the existing inter-domain routing protocol and associated route selection logic. Architectures, algorithms and protocols will be validated through simulations and testbed experiments.</p>
MOME	CA	<p>MOME is a Cluster providing support for knowledge and tool exchange and for the co-ordination of activities in the field of IP monitoring and measurement between IST projects and other European initiatives. Collected data will be made accessible for the whole community over the Internet. Monitoring and measurement related contributions to standardisation bodies (eg. IETF) from the participating projects will be co-ordinated by MOME. The activities will be supported by the organisation of public workshops and conferences.</p>

MUSE	IP	<p>MUSE will develop a low cost, full service access and edge network, which enables the ubiquitous delivery of broadband services to every European citizen. It integrates studies in:</p> <ul style="list-style-type: none"> <li>- access and edge network architectures and platforms</li> <li>- first mile solutions (DSL, optical access, fixed wireless access)</li> <li>- interworking of the access network with home gateway and local networks</li> <li>- techno-economics.</li> </ul>
NOBEL	IP	<p>NOBEL focuses on developing an appropriate optical core/metro network infrastructure to aggregate end-user traffic and ensure an end-to-end transport with the desired level of quality. It will carry out analyses, feasibility studies and experimental validations of innovative network solutions and technologies for intelligent and flexible optical networks. It includes strategies for the end-to-end management and control of intra/inter-domain connections in multi-layers networks (eg. IP over Optics).</p>
OBAN	STREP	<p>OBAN (Open Broadband Access Networks) plans to establish a high performance broadband mobile network, based upon inexpensive WLAN technology and unused capacity in the fixed access networks. Issues addressed are:</p> <ul style="list-style-type: none"> <li>- mobility, security and QoS as a group of related issues in heterogeneous networks, where seamless and fast handover, scalable services, personalisation, ... are all important</li> <li>- antenna technologies (MIMO, beamforming, ...)</li> <li>- network coverage and capacity analyses and estimation</li> <li>- commercial and regulatory aspects (opening for new services and business opportunities).</li> </ul>
OPERA	IP	<p>OPERA (Open PLC European Research Alliance) has the strategic objective to offer low-cost broadband access service to ALL European citizens using the most ubiquitous infrastructure: the electricity network. Efforts will be focused on obtaining:</p> <ul style="list-style-type: none"> <li>- an improved performance in transmission speed</li> <li>- ready- to-sell and low-cost products</li> <li>- a complete system specification</li> <li>- a unique international regulation</li> <li>- interoperability with current back-haul and in-house technologies</li> <li>- a higher market share.</li> </ul>
SATLIFE	STREP	<p>SATLIFE (Satellite Access Technologies: Leading Improvements For Europe) will be the first R&amp;D satellite project in the world with a multimedia on-board processor, the (ESA) AMERHIS system, based on the satellite standards DVB-RCS and DVB-S. SATLIFE responds to the imperative need of facilitating the development of broadband for all by means of significantly enhancing the state-of-the-art of DVB-RCS satellite standard solutions, with the focus on the integration with other terrestrial alternatives in the implementation of the Information Society.</p>

SEINIT	STREP	A secure information infrastructure is, after widespread availability of broadband access, the second enabler of a broader access to Information Technology. SEINIT defines security models and policies to address the new issues of the pervasive computing world. SEINIT develops a trusted and dependable security framework, working across multiple devices and, heterogeneous networks, being organisation-independent and centred around the end-user. SEINIT delivers guidelines and best practices manuals that facilitate the spreading of the technology-oriented results and the acceptance of the new approach.
U-BROAD	STREP	The goal of U-BROAD is to transmit Ethernet at 100Mbps over local loop copper pairs for broadband multiservice access. This "Ultra High Speed DSL" will be used for connecting legacy, video and next generation services to existing and future infrastructure. The project will develop new communications algorithms and signal processing techniques. The main benefits are reducing expenditures and achieving a fast ROI, by: leveraging the existing access infrastructure <ul style="list-style-type: none"> <li>- supporting future, ultra high-speed technologies</li> <li>- providing a variety of services, such as data, voice and video on the same access lines.</li> </ul>

The complementary coverage of these projects can be seen in the following figure:

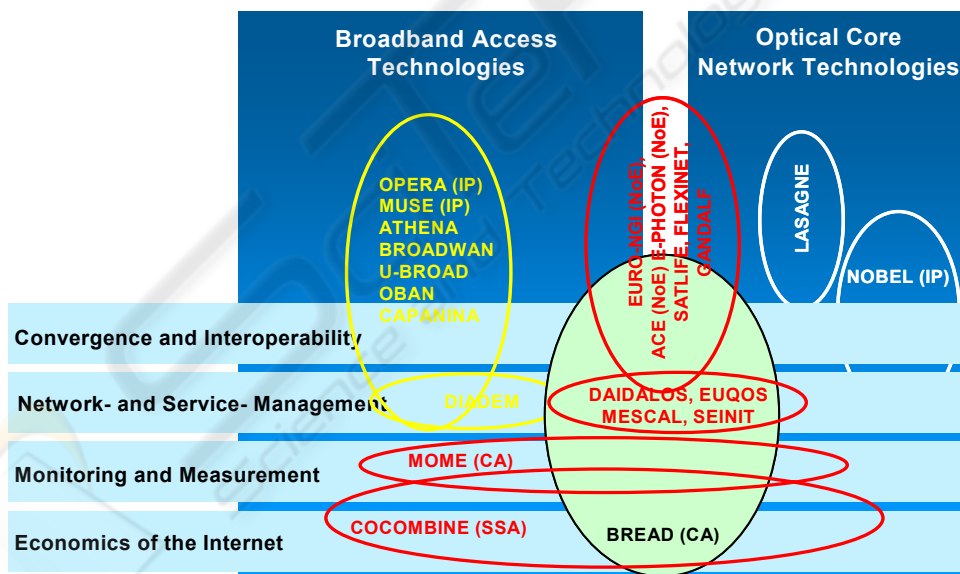


Fig. 2. The mapping of Broadband For All projects to the key issues for broadband deployment



Issues addressed in the Broadband for All Cluster are:

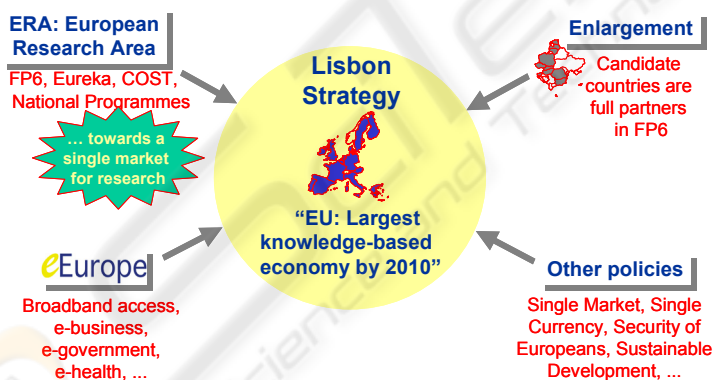
*Technology and Applications:*

- Technology trends:
  - overview of leading technologies for Home Networks, Access Networks and Core Networks
- Convergence and interoperability:
  - Physical Layer
  - Network Layer
- Open Issues:
  - relationship with Next Generation Network activities in ETSI, ITU-T, where the separation of the roles of network providers, service providers and service creators is encouraged
  - security
  - new IP protocols
  - end-to-end QoS

*Business and Economic:*

- Technological considerations:
  - infrastructure costs
  - price of mobility
- cost benefits of scale (convergence) vs niche solutions
- cost of bandwidth vs processing vs memory
- reducing the “digital divide”
- new business models

*Regulatory and legal:*



**Fig. 3.** Political aspects that are closely-related to the work of the Broadband for All Cluster

*Social and Cultural:*

- an Information Society for all:
- educating governments and society in general (developed and developing nations)
- promoting broadband content, *eGovernment*, *eHealth*, *eLearning*, *eBusiness*
- collectively encouraging the availability of broadband access at affordable prices (“digital inclusion”)

- informing on current broadband status, developments both regional & worldwide and the expected evolution ("Roadmap")
- raising awareness on information security and privacy
- fostering links to (eg.) Russia, Brazil, Japan

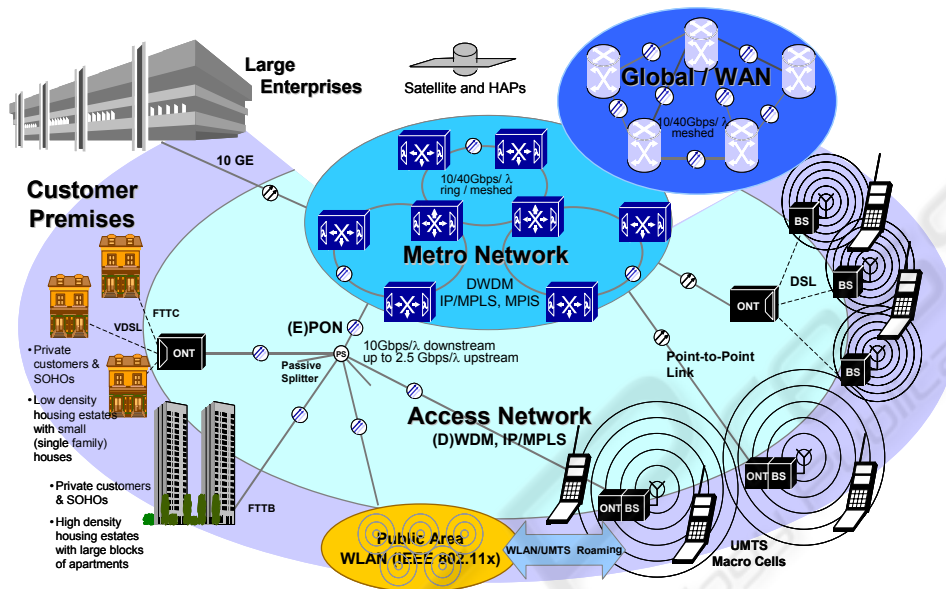


Fig. 4. The scope of networking environments covered by the Broadband For All projects

### 3 Conclusions

This paper has described the Broadband For All Cluster, which resides within the IST (Information Society Technologies) Thematic Area of the EU's 6<sup>th</sup> Framework Programme.

By explaining the topics being addressed by the projects in the Cluster, it has given a summary of the current trends in broadband provision in the access and core networks, from the perspective of the major manufacturers and network operators throughout Europe.

Since there will be further Calls for projects in this Strategic Objective, it can also be a useful guide towards assessing where important topics have been overlooked.

The added-value of having such a Cluster of related projects is to reach a consensus on broadband evolution that has sufficient critical mass of support to guarantee its standardization and deployment. This avoids spending effort on technologies and trends that are likely to be unsuccessful in the mass market. Other benefits include the sharing of information on topics such as: standards, events, press releases, national initiatives, world news, ... , the opportunity to share testbeds and make joint experiments, organize joint workshops and conferences, etc., and increasing the visibility of this part of the FP6 Programme.