European Commission

IPv6 Cluster

Information Society Technologies

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IPv6 Research and Development in Europe

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Edited by the IPv6 Cluster with the support of 6LINK.

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If you have any questions or comments or you would like to receive another copy of this book, please visit http://www.ist-ipv6.org. On-line PDF version also available.

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Participant	Projects
6WIND	6POWER,6WINIT, ANDROID, Euro6IX, GCAP, NGNi
ACOnet	6NET, GÉANT
AGH Univ. Tech.	Moby Dick
Agora	6POWER, MIND
Airbus	WirelessCabin
Airtel	Euro6IX
Algonet S.A.	MESCAL
AMREJ	SEEREN
AQL	6HOP, SATIP6
ARNES	GÉANT
ASPI	GCAP, SATIP6
BBC	DRiVE
BELNET	GÉANT
BEN	xMOTION
Bertelsmann	DRiVE
BIBA	xMOTION
BIHARNET	SEEREN
Bosch	DRiVE
BT	6INIT, 6LINK, 6WINIT, ANDROID, Euro6IX, IPv6 TF-SC, MIND
CEFRIEL	FUTURE HOME
Celtius	xMOTION
CESNET	GÉANT
CiaoLab	FUTURE HOME
CINI-ITME	INTERMON
Cisco	6NET, NGN-LAB
Consulintel	6LINK, 6POWER, 6QM, Euro6IX, Eurov6, IPv6 TF-SC
Corning	HARMONICS
CRM	6LINK
CTI	6NET
CTU	GCAP
CWC	Moby Dick
CYNET	GÉANT
Daimler Chrysler	DriVE, OverDRiVE
DANTE	6LINK, 6NET, GÉANT, SEEREN
DFN	6NET, GÉANT
Dimension D.	NGN-LAB
DLR	WirelessCabin
DS2	6POWER
DTT-BUTE	INTERMON
DTU	6NET
E&A Abogados	Euro6IX
EENET	GÉANT
EML	CRUMPET
Emorphia	CRUMPET
Endesa	6POWER
ENSICA	GCAP
Ericsson	6WINIT, DRiVE, Eurov6, OverDRiVE, WirelessCabin
Ericsson D	OverDRiVE
Ericsson I	OverDRiVE
Ericsson M.	DRiVE
Ericsson Radio Sys.	MIND
Ericsson-Pol	6WINIT
ESYS	WirelessCabin
ETH Zürich	Moby Dick
ETRI	6WINIT
EURECOM	Moby Dick
Eurocontrol	Euro6IX
FCCN	GÉANT
Flextel	TORRENT
Fokus	6NET, 6QM, CRUMPET, FUTURE HOME, GCAP, INTERMON
Fraunhofer G.	Moby Dick
Fresenius	xMOTION
FT	6QM, @HOM, Euro6IX, MESCAL, MIND, OverDRiVE, SATIP6,
FTW	Moby Dick
FUnet	6NET
GARR	6NET
Genuity	TORRENT
GRNET	6NET, GÉANT, SEEREN
HEAnet	GÉANT
HEL	6QM
HHI	DRiVE
HIT	6QM
HUNGARNET	GÉANT, SEEREN
IABG	6WINIT
IB	6INIT
IBM	6NET
ICTDA	SEEREN
IKOM	xMOTION
IMCS LU	GÉANT
IMEC	HARMONICS
Infineon technologies	MIND
INFN	GÉANT
INFP	6INIT
INIMA	SEEREN
Inmarsat	WirelessCabin
INRIA	6NET
Intracom	6HOP, 6INIT, HARMONICS, TORRENT
Invenia	6NET
IUCC	GÉANT
KID Systeme	WirelessCabin
King's College London	MIND
KPN Rch.	HARMONICS
KTU	GÉANT
LAAS/CNRS	GCAP, SATIP6
Land Bremen	xMOTION
LIP6	GCAP
LM Ericsson	IPv6 TF-SC
Lucent	HARMONICS
MARNET	SEEREN
Martel GmbH	NGNi
Mason	HARMONICS
MCLab	6POWER, NGN-LAB, TORRENT
MCYT	GÉANT
MediaSec	ANDROID
Microsoft	xMOTION
Motorola	@HOM, Moby Dick, OverDRiVE
Motorola TCI	@HOM
NEC	INTERMON, Moby Dick, NGN-LAB
Netcelo	ANDROID
Nokia	DRiVE, FUTURE HOME
Nokia Corporation	MIND
NORDUnet	6NET, GÉANT
Nortel	CRUMPET, LONG
novaGnet	Euro6IX
NTT	6WINIT
NTT DoCoMo	MIND
NTT-Com	6NET
NTUA	ANDROID
OHB Teledata	xMOTION
Opensugar	@HOM
OTEC	TORRENT
Oulu Poly	6NET
Oy Media	6INIT
Pace	6POWER
Philips	6HOP, IPv6 TF-SC
PSNC	GÉANT
PTIN	CRUMPET, Euro6IX, HARMONICS, LONG, Moby Dick, TORRENT
QMUL	CRUMPET, TORRENT
RAI	OverDRiVE
RENATER	6NET, GÉANT
ResCom	NGN-LAB
RESTENA	GÉANT
RoEduNet	GÉANT, SEEREN
Rosenbauer	xMOTION
RUS	6WINIT
RWTH	DriVE, OverDRiVE
SANET	GÉANT
Siemens	INTERMON, IPv6 TF-SC, MIND, NGNi, WirelessCabin, xMOTION
SINTEF	SATIP6
Sonera	CRUMPET
Sony	6NET, @HOM, MIND
SR-ANC	INTERMON
Steria	DRiVE
SURFnet	6NET, GÉANT
SWITCH	6NET, GÉANT
TED	6INIT, 6WINIT, Euro6IX, GCAP, NGNi
Telekom Austria	GCAP
Telematic Solutions	xMOTION
Telenor	TORRENT
Telia	6INIT
TELIN	6NET
Telscom	6INIT, 6LINK, Euro6IX, Eurov6, NGNi, NGN-LAB
Teracom	DRiVE
TERENA	6LINK, 6NET, SEEREN
Tesion	TORRENT
Thales	MESCAL
Thomson	6INIT
Thomson M.	FUTURE HOME
TID	Euro6IX, INTERMON, LONG
TILAB	@HOM, Euro6IX, INTERMON, SATIP6
T-Mobile	xMOTION
T-Nova	6INIT, 6LINK, 6WINIT, Euro6IX, HARMONICS, INTERMON, IPv6 TF-SC, MIND, Moby Dick, xMOTION
Tomorrow Focus	FUTURE HOME
TriaGnoSys	WirelessCabin
TZI	6WINIT
U. Cantabria	6HOP
U. Karslruhe	GCAP
U. Limerick	HARMONICS
U. of Bradford	WirelessCabin
U. of Stuttgart	Moby Dick
U. Oulu	6HOP, 6NET, IPv6 TF-SC
U. Soton	6INIT, 6LINK, 6NET, 6WINIT, Euro6IX, IPv6 TF-SC
U. Twente	xMOTION
UC3M	6LINK, GCAP, LONG, Moby Dick
UCL	6LINK, 6NET, 6WINIT, ANDROID, MESCAL
UEV	LONG
Uhe	CRUMPET
UKERNA	6NET, GÉANT
UKT	6WINIT
ULANC	6NET, GCAP
ULB	6NET, Eurov6, NGN-LAB
ULP	6NET
UMM	6WINIT
UMU	6POWER, Euro6IX
Uni Bern	INTERMON
UNI Bonn	DriVE, OverDRiVE
Uni Do	INTERMON
UNINETT	6NET
UniS	DriVE, MESCAL, OverDRiVE
UoM	GÉANT
UoR	SATIP6
UPC	LONG
UPM	6LINK, ANDROID, Euro6IX, LONG, MIND
UST	TORRENT
VCON	DRiVE
Versaware	TORRENT
Vodafone	DRiVE
VTT	6WINIT, FUTURE HOME
VUB	NGN-LAB
WIT	INTERMON, TORRENT
WRAP	FUTURE HOME
WWU	6NET

Country Codes

Country Code	Country
A	Austria
AL	Albania
B	Belgium
BA	Bosnia and Herzegovina
BG	Bulgaria
CH	Switzerland
CY	Cyprus
CZ	Czech Republic
D	Germany
DK	Denmark
E	Spain
EE	Estonia
EL	Greece
F	France
FIN	Finland
YU	Yugoslavia
MD	Macedonia
HU	Hungary
I	Italy
IL	Israel
IRL	Ireland
JP	Japan
KR	South Korea
LT	Latvia
LU	Luxemburg
MT	Malta
NL	Netherlands
NO	Norway
P	Portugal
PL	Poland
RO	Romania
S	Sweden
SG	Singapore
SI	Slovenia
SK	Slovakia
UK	United Kingdom
US	United States of America

Project Types

AM	Accompanying Measures
RTD	Research and Technology Development
TN	Thematic Network
TU	Take-Up

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IPv6 Cluster

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IPv6 Research and Development in Europe

IPv6 Research and Development in Europe

1. About this booklet

This booklet was first published in November 2002 during the IST2002 conference in Copenhagen, Denmark. It is one of the activities that the IST IPv6 Cluster is supporting, which will include joint project demonstrations in the conference exhibition hall, and several workshops addressing both political and technical issues.

2. What is IPv6?

IPv6 is an upgrade to the data networking protocols that power the Internet. The Internet Engineering Task Force (IETF) developed the basic specifications during the 1990s after a competitive design phase used to select the best overall solution. The primary motivation for the design and deployment of IPv6 is to expand the available "address space" of the Internet, thereby enabling billions of new devices (PDAs, cellular phones, appliances, etc.), new users (countries like China, India, etc.), and new, "always-on" technologies (xDSL, cable, ethernet-to-the-home, fiber-to-the-home, PLC, etc.).

While the existing protocol, IPv4, has a 32-bit address space that provides for a possible 232 (approximately 4 billion) hosts, IPv6 has a 128-bit address space that can uniquely address 2^{128} (around 340 undecillions[1]) hosts.

During the design of IPv6, the IETF took the opportunity to make further improvements above and beyond providing extra addressing space, making IPv6 extensible and highly adaptable to future requirements.

In short, technically speaking, the main advantages of IPv6 are:

- Expanded addressing capabilities;
- Server-less auto-configuration ("plug-n-play") and reconfiguration;
- More efficient and robust mobility mechanisms;
- Built-in, strong IP-layer encryption and authentication;
- Streamlined header format and flow identification, and;
- Improved support for options/extensions.

[1] Actually: 340,282,366,920,938,463,463,374,607,431,768,211,456.

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Some interesting features to mention are the removal of the checksum field from the IPv6 header (checksumming is now performed by upper layers), and the removal of fragmentation-related fields (fragmentation is performed end-to-end). In fact, most IPv6 "options" (now called "extension headers", with no limit to their size or number), are also processed end-to-end, obviating the need for routers to perform tasks other than simple packet forwarding.

Taken together, these features provide the means for restoring the end-to-end Internet paradigm, facilitating peer-to-peer applications, end-to-end security, and avoiding network address translators.

3. IPv6 in the 5th Framework Programme

The European Commission Information Society Technologies Programme is funding a number of projects with a very important focus on IPv6 research and development activities. These projects represent a huge investment on behalf of the EC (over €90M) and the project partners.

These projects can be divided into 2 groups: The projects of the first group, that can be called IPv6 Projects, have a particular emphasis on IPv6, with the main goal being the research and development related to the protocol itself. Projects of the second group, than can be called IPv6 Related Projects, are employing IPv6 as part of their broader goals.

The projects are addressing several complementary areas. Two large very scale experimentation platforms are investigating the real deployment of IPv6. Some other projects are devoted to the promotion of IPv6. The political dimension is also addressed an a large set of projects ae addressing diferent technical aspects related to IPv6 (e.g. IPv4 to IPv6 transition, Quality of Service, etc.).

The IPv6 projects as well as the IPv6 related projects have been collaborating in the frame of the IPv6 Cluster since June 2001. A specific project, 6LINK, is supporting the activity of the IPv6 Cluster.

To aid the reader in understanding the scope of IPv6-related research being undertaken as part of the IST 5th Framework Programme, the following sections will identify projects with a specific focus on IPv6 and those where IPv6 is incidental to their objectives, summarizing what has been done during FP5.

4. Projects where IPv6 is the main focus

These projects cover a broad number of research and development aspects.

Starting in January 2000, **6INIT** was one of the first attempts to validate the introduction of IPv6 technology in Europe.

GCAP studied multicast and QoS based on IPv6 and DiffServ in relation to active networks technology.

The goal of the **WINE** project was to build fully IPv6-based globally optimized wireless Internet environments with QoS awareness.

In December 2000, **LONG** was initiated with the aims to foresee and solve problems related to the design, configuration and deployment of IPv6, especially when new services and applications are involved.

6WINIT continues the work done in **6INIT**, but with an emphasis on wireless access and IP mobility, combining IPv6, GPRS, and 3GPP/UMTS.

6NET and **Euro6IX,** started in January 2002, as major projects for the broad deployment of IPv6 in Europe, building dedicated, native, IPv6 networks, involving National Research and Education Networks, telcos and ISPs, in a complementary approach, and considering other aspects like applications and Internet Exchanges.

In March 2002, the **SATIP6** project started to examine the technical issues facing satellite broadband access in the coming years, including adaptation of DVB-RCS for IP and IPv6 introduction.

OverDRiVE is aimed at UMTS enhancements and the coordination of existing radio networks into a hybrid network to ensure spectrum efficient provision of mobile multimedia services, based on the IPv6 architecture.

6POWER started in July 2002 with the main goal of contributing to ensure affordable broadband access and the deployment of IPv6 in Europe, using Power Line Technology, and advanced network services such as QoS and multicast.

6QM will develop a comprehensive approach towards IPv6 QoS measurement.

6HOP studies how multi-hop heterogeneous wireless IPv6 networks can support mobility of users, packet routing and adaptation to varying link conditions.

In addition, three special projects were started in March, July and October 2002, respectively, as accompanying measures to the research and development projects:

- **6LINK** was designed in order to support the IPv6 Cluster activities, via consensus building, dissemination on consensus agreements and exploitation of the consensus;
- **Eurov6** principal objective is to show the usage of IPv6 products and services and their impact to anyone, at anytime, by the means of fixed and nomadic showrooms, and;
- **IPv6 TF-SC's** main goals are to discover and fill gaps, provide strategic guidance with the assistance of a number of industry and academic players, to quickly propose measures to the appropriate bodies, to involve the European Commission and to verify sustained activities and implementation of proposed measures, towards the global deployment of IPv6.

Both Eurov6 and the IPv6 TF-SC include special liaison with similar international initiatives, in order to raise political and industrial awareness related to IPv6 on a global scale.

5. The European IPv6 Task Force

The European Commission initiated an IPv6 Task Force driven by major and key European and worldwide players, to develop a comprehensive action plan by the end of 2001 aiming at ensuring the timely availability of IPv6.

The conclusions and recommendations of the Task Force were successfully submitted to the European Council Spring Meeting of 2002, under the Spanish presidency (Barcelona), and in the context of this document, a series of recommendations pertaining to the implementation of IPv6 by all relevant ICT sectors were proposed by the Commission.

As a result, the Heads of State resolution was to prioritise the widespread availability and use of broadband networks throughout the Union by 2005 and the deployment of the new Internet protocol, IPv6, as part of the e-Europe 2005 initiative.

One of the main achievements was a Communication from the Commission to the Council and the European Parliament called, "Next Generation Internet - priorities for action in migrating to the new Internet protocol IPv6".

As a complementary action, the European Commission called for the renewal of the mandate of the IPv6 Task Force as a platform for debate on critical issues concerning the deployment of IPv6.

As a consequence, the nature of the IPv6 TF-SC project is to be the main strategic instrument fostering the deployment of IPv6 technology in Europe. In addition, the project will collaborate with other regional groups and initiatives deploying IPv6.

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6. IPv6-Related Projects

As indicated earlier, the following projects aren't specially focused on IPv6, but have some related activities, rely on IPv6 networks or will run with IPv6, sooner or later.

In April 2000, **DRiVE** started, aiming at enabling spectrum-efficient high-quality wireless IP in a heterogeneous multi-radio environment to deliver in-vehicle multimedia services, including the design of an IPv6-based mobile infrastructure that ensures the inter-working of different radio systems.

HARMONICS proposes a common dynamically reconfigurable fibre infrastructure, deploying flexible wavelength routing integrated with flexible time slot allocation in a new Medium Access Control protocol.

ANDROID is an Active Networks project, started in June 2000, whose aim is to design a means of managing active services through the use of policies. Several IPv6 application layer software modules are being developed.

The overall aim of the **CRUMPET** project is to implement, validate, and trial tourism-related value-added services for nomadic users (across mobile and fixed networks).

GÉANT was started on November 2000, in order to provide pan-European IPv4 interconnection between National Research and Education Networks (NRENs) in Europe at gigabit speeds, based on direct access to optical connectivity, migrating finally to IPv6.

NGNi's prime mission is to establish an appropriate infrastructure to operate the first European open environment for research organizations and industry to investigate a broad range of topics and issues covering NGN evolution, and create opportunities for strategic discussions on a global scale.

NGN-LAB establishes a platform for the development of advanced Internet technologies, by provisioning the required system infrastructure and interactive applications, to realise Next Generation Network related experiments.

Moby Dick, started on January 2001, develops, implements, and evaluates an IPv6-based mobility-enabled network architecture with Authentication, Authorisation, Accounting and Charging (AAAC) services and support for Quality of Service (QoS), in order to continue the evolution of the 3rd generation mobile and wireless infrastructures towards the Internet.

TORRENT is building a test-bed for multi-service residential access networks that will allow the project to demonstrate the benefit of intelligent control, both for the customer and for the network operators and service providers, with applications based on IPv6.

MIND takes as starting point the concept of an IP core, accessed by a variety of technologies. Research is conducted in the areas of services and applications, the access network architecture and the air interface. The project investigates new business models for "systems beyond 3G", mapping the value chain into the functional entities.

@HOM, started on September 2001, is dedicated to the promotion of broadband home networks and the proof of concept of an open, end-to-end and seamless network architecture, with the objective to provide citizens with the emerging IP-based broadband services. Will include an IPv6 testbed demonstrator.

The **FUTURE HOME** project will create a solid, secure, user friendly home networking concept with open, wireless networking specifications and will introduce usage of IPv6 and Mobile IP protocols in the wireless home network

In April 2002, **INTERMON** was started, in order to enhance the inter-domain QoS analysis in large-scale, multi-domain Internet (IPv4, IPv6) infrastructures.

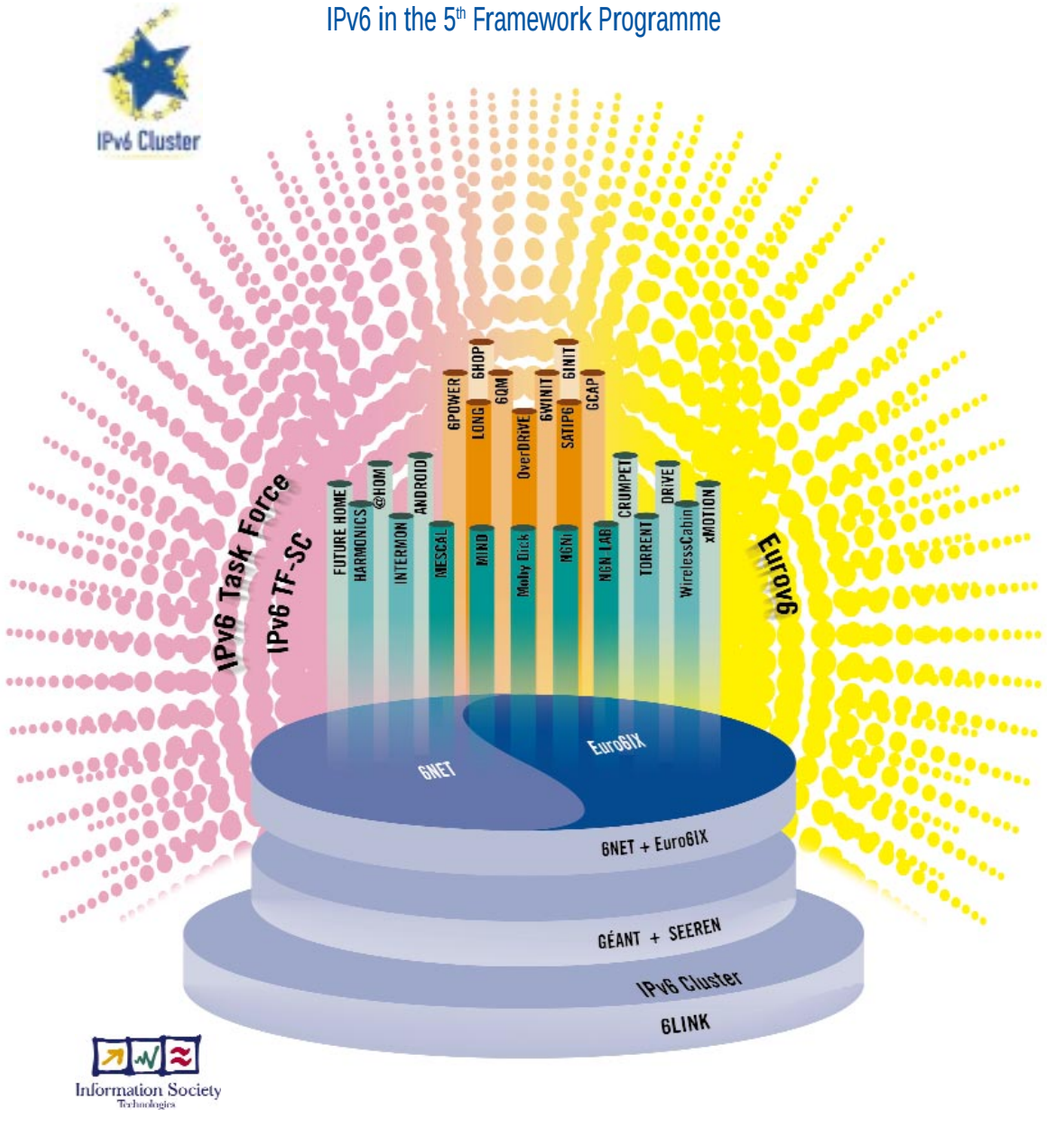
WirelessCabin project is developing wireless access technologies for aircraft cabins.

xMOTION will specify and test requirements emerging from the nature of safety and security providing organisations operating in varying degrees of emergency (in particular communication and information needs).

SEEREN, started in October 2002, is aiming at easing the 'digital divide' that still separates most of the South Eastern European countries from the developed world, expanding GÉANT reach.

MESCAL will start in November 2002, and aims to propose and validate scalable, incremental solutions that enable the flexible deployment and delivery of inter-domain Quality of Service (QoS) across the Internet, applicable for both, IPv4 and IPv6.

IPv6 in the 5th Framework Programme



7. All-IPv6-World Working Group

Supporting the e-Europe 2005 plan, this group has considered several research and development areas or topics related to IPv6 aspects, including broadband, 3G+, optical, communications and networking, new access technologies, network management, traffic engineering, new broadcasting technologies, DVB, Digital and Interactive TV, security, wireless technologies, GRIDs, Service Creation, Home and Industrial Automation, Intelligent Systems, amongst others, in addition to some considerations at political and marketing levels.

7.1 Objectives

The targets of the current projects include different aspects like wireless, large scale deployment, Quality of Service and so on. It became necessary to identify clearly what are the different building blocks needed for the deployment of IPv6. With such a picture in mind, this group tried to map the expected results to some of the requested building blocks and therefore understand better what remains to be done.

The main goal has been to identify, as clearly as possible, what IPv6 research and development still remains to be done, what are the missing pieces in the puzzle of IPv6 deployment?

Some of the questions that the WG tried to answer are:

1

What is needed to get IPv6 deployed in the near future?

2

What activities that we already do using IPv4 are still incomplete with IPv6?

3

What new we can do with IPv6?

4

What can we enhance thanks to IPv6?

5

What problems still exist that aren't resolved sufficiently or that you feel have better approaches?

7.2 Participants

Over 80 entities, mainly from the EC, but including also a few from Japan, China, Korea, India, Taiwan, Russia, Switzerland, Turkey, Israel, US and Canada, have participated actively.

In order to participate in this working group it was necessary to contribute in advance of the meetings. There are several reasons for this, including ensuring the relevance and quality of the work, and having it distributed to the rest of the participants before the meeting, in order to guarantee that the meeting time is not spent in presenting these documents, and instead good technical debate is achieved.

No.	Topic
1.	Ad-hoc networks (incl. PANs) for small (and embedded) devices
2.	Applications for the transport business (that can't be satisfied with IPv4): Air-transport Ground-transport Sea-transport
3.	Other application areas: Telemedicine e-commerce Virtual presence GRIDs Multimedia, CDNs (e.g. for education/e-learning), incl. QoS Astrophysics (including synchronisation)
4.	Service security (requires inputs from the specific application areas)
5.	End to end security (global architecture, VPN)
6.	Service and application roaming, VHE, charging
7.	Reconfigurable and adaptable applications
8.	Services for handicapped people
9.	Scalable new services (multicast-related) inc. voice, video, QoS and automatic deployment of the services (including programability)
10.	Micro/Macro mobility in campus environments (including location awareness/location based services, e-learning)
11.	P2P (including large-scale management)
12.	Generalised mobility (including 4G, header compression)
13.	Mobility and emergency services (Tetra)
14.	Solutions for deployment scenarios according to entities (ISPs, global corporates, SMEs), services, multihoming, renumbering, mirrored IPv6 data centres, multi-tenant buildings and transition
15.	Toolkit for creating/developing IPv6 services and applications (improving middleware framework)
16.	European IPv6 stack
17.	Conformance Testing & Interoperability (plug and play, performance)
18.	Home networks (e.g. global vs local addresses, usability, terminal portability, plug and play security, MM home protocol, etc.)
19.	Marketing (unique selling points: addresses, QoS, mobility, etc.), education, training, awareness creation, and standards
20.	Long-term research objectives: id/location separation

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7.3 Meetings and Results

Most of the participants met in Brussels on the 14th of June and a second time on the 1st of October.

At the moment, as a result of these meetings, a top-down approach (i.e. starting with the identification of application areas and user requirements) has been decided upon.

Several topic groups were formed, according to the table in the previous page, and one or two people were nominated to write a brief description about the theme.

In summary, it appears that research and development activities related to IPv6 should focus on services and applications built over and using IPv6.

In FP6, as a result of the IPv6 Task Force efforts, and as recommended in the last Communication to the Council and the e-Europe 2005 plan, a number of new IPv6 focused projects are expected.

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PROJECTS

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Protocols for Heterogeneous Multi-Hop Wireless IPv6 Networks

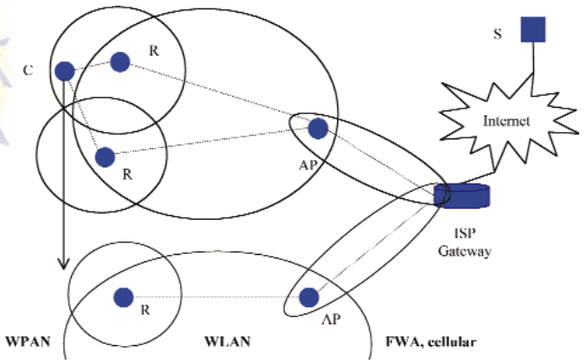
Abstract

6HOP studies how multi-hop heterogeneous wireless IPv6 networks can support mobility of users, packet routing and adaptation to varying link conditions. 6HOP aims to research and demonstrate a heterogeneous wireless IPv6 network consisting of several different wireless technologies. End-to-end optimization for IPv6 based services over multi-hop heterogeneous wireless network with respect to throughput, power consumption and implementation complexity will be provided. The results from previous IST project WINE using a platform independent wireless adaptation layer will be exploited, streamlined and extended.

Objectives

- To specify, design and demonstrate a heterogeneous multihop wireless IPv6 network consisting of a combination of WPAN and WLAN technologies in the 2.4 GHz and 5 GHz ISM bands and possible connection to public cellular networks. The project focuses on solving practical use cases involving "semi ad-hoc networking" in MHWN based on IPv6.
- To optimise our solution in respect of throughput, power consumption and implementation complexity. A platform independent wireless adaptation layer from a previous IST project will be exploited.
- To extend the wireless adaptation framework to implement intelligent routing schemes on top of existing wireless network architectures.

Figure: One possible 6HOP scenario



Technical Approach

In the 6HOP project, the issues related to fully IPv6-based wireless networks that involve different standards and usage scenarios will be investigated. These include support for end users' mobility, packet routing and compensation for link quality variations. Although 6HOP approach is native IPv6 based, it will be providing transition and interoperability mechanisms for IPv4 legacy networks. 6HOP intends to study WAL and PEP performance on multi-hop heterogeneous environment, where we are studying the end-to-end transparency and performance. The innovative aspect in the 6HOP project is also that we are going to use also IPv6. Moreover, we are interested in to study, if the WAL/PEP type concept could be used to provide "home" for transition mechanisms from IPv4 to IPv6, that is could we implement e.g. NAT-PT, brokering and tunnelling methods as WAL/PEP modules.

The goal of the project is trying to study and implement PEP concepts to be used in future heterogeneous 4G networking environment. We do this by taking into account not only theoretical protocol boosting and booster issues but also considering a real practical implementation problems (and requirements of terminals) as boundary conditions.

Innovation

One of the key objectives and innovations in the 6HOP project is to study further recently published generic protocol booster environment called Wireless Adaptation Layer (WAL). This WAL mechanism is a generalized Protocol Booster and Protocol Enhancement Proxy (PEP) mechanism that can be transparently used either as an heavy duty PEP-type proxy/booster in the access points and base stations, but also as a light-weight "virtual" layer in terminal equipment. 6HOP intends to use, evaluate and further develop WAL so that it can be used for heterogeneous IP networking, and can be leveraged to provide support for multihop wireless networking (but in the limited context of "small number" (circa 6) of hops).

The objective is to provide and study the overall WAL architecture, to produce and enhance WAL code family (including proxies and more light-weight implementations) and a suitable number of protocol booster modules (that is booster modules such as Snoop, ROHC, and FEC that are used through WAL). The above is done in order to evaluate PEP concept in the heterogeneous multihop environment. The consortium leverages the industrial partners access to actual hardware and software of the different access point and terminal technologies. The WAL concept will be developed up to point where it can be introduced (backed with actual trials, measurements and experimentation) to standardization bodies and academic community, but most importantly we aim at to provide initial reference code that could be used in future to enhance actual products.

Project name: 6HOP
Protocols for Heterogeneous
Multi-Hop Wireless IPv6 Networks

Contract no.: IST-2001-37385

Project type: RTD

Start date: 01/09/2002

Duration: 20 months

Total budget: 1.862.833 €

Funding from the EC: 1.195.803 €

Total effort in person-month:
209

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02. Philips	I
03. Intracom	EL
04. AQL	F
05. U. Cantabria	E

Key words:
Heterogeneous
IPv6
Multi-hop
Wireless

IPv6 INternet IniTiative

Abstract

The objective of the 6INIT project is to prove the business case for Euro-IPv6 by defining implementation and set-up procedures for European IP Networks to offer production IPv6-based Internet services.

The primary areas addressed within this project will be to:

- Define operational procedures for IPv6 networks and for IPv4 to IPv6 network and application migration –interconnection of IPv6 native applications and IPv6/IPv4 networks.
- Set up telephony and videophony services and access to video-n-demand services.
- Implement IPv6 applications (Stock Exchange, Remote Newspaper printing).
- Initiate the implementation of IPv6 Internet Service Provider.

Objectives

The objective of the 6INIT project is to validate the introduction of the NEW INTERNET in Europe based on the new Internet Protocol version 6 (IPv6), which offers a solution for current problems in space address limitation, quality of service, mobility and security.

The 6INIT project will lead to the set-up of a first European operational platform providing customers with native IPv6 access points and native IPv6 services. 6INIT is a coordinated initiative of the major European Telecom companies, equipment manufacturers, solutions/software providers and research labs that will lead to provide production IPv6 transit service to facilitate high quality, high performance, and operationally robust and secure IPv6 networks in view of wider deployment of European E-commerce and convergence.

Figure: 6INIT Test-bed

Information Society Technologies

Technical Approach

The primary works of the 6INIT project will be to:

- Deploy an operational Trans-European IPv6 packet delivery service.
- Provide a set of multimedia services including IP telephony and videophony, multimedia web services.
- Develop operational procedures for IPv6 networks and for IPv4 to IPv6 network and application migration.
- Promote early IPv6-ready application testing and deployment.
- Develop Access Devices which allow seamless IPv4-v6 transition, differentiated services and VPN services.

Key Issues

The key issues addressed in this project are:

- Definition of fixed network architecture for next generation networks to provision seamless IP services with security and QoS.
- Integration of IPv6 protocol suites to next generation networks.
- Assess the technology that allows the rapid deployment of services and protocols for chosen architecture and application.
- Implement a test-bed with available and prototype products to demonstrate the technologies with selected applications and validate the exploitability of new technologies.
- Bring awareness of these new technologies and applications, and their possible impact on the user community.

Expected Impact

The expected result should be the validation of the New Internet based on IPv6, demonstrating the crucial benefits of the IPv6 features including quality of service (QoS) and Security.

Project name: 6INIT
IPv6 INternet IniTiative

Contract no.: IST-1999-12383

Project type: RTD

Start date: 01/01/2000

Duration: 18 months

Total budget: 4.244.000 €

Funding from the EC: 1.800.000 €

Total effort in person-month: 297

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11. U. Soton	UK

Key words:
IPv6
QoS
Security

IPv6 Projects Linkage Cluster

Abstract

The 6LINK project aims to unite IPv6 projects across the IST programme and beyond. It seeks to identify IST projects that have an interest in IPv6, including projects that may not mention IPv6 specifically in their definitions, and to bring representatives from identified projects together in a series of workshops. These workshops will serve to foster a common view of the status of IPv6 development and deployment in Europe and elsewhere, and will permit the identification of the most important issues for IPv6 deployment in Europe. The project seeks to identify common issues and promote shared understanding amongst all participants, and to disseminate this work to as wide an audience as possible. Dissemination vehicles will include an annual publication of reports compiled by members of the 6LINK consortium. In addition, the 6LINK project will establish an IPv6 resource center which will serve as a repository for the outputs of 6LINK as well as providing an important source of up-to-date and detailed information about IPv6-enabled applications and IPv6 standards.

Objectives

The 6LINK project has three objectives. These are consensus-building, dissemination and exploitation. The European Commission is actively sponsoring a number of IPv6-related IST projects, and there are other bodies, for example Eurescom, that fund IPv6-related collaborative work. It is the objective of 6LINK to bring representatives of these projects together to identify common experiences and to share knowledge and understanding of the state-of-the-art with regards to IPv6 development and deployment in Europe. The second objective, dissemination, builds upon the consensus and understanding generated by the first objective and seeks to promulgate the agreements and analyses arrived at by the partners to as wide an audience as possible. The third objective is concerned with capitalising on the synergies developed through achievement of the first objective, by providing support to participants developing inputs to standards bodies, and by presenting 6LINK participants' submissions at standards meetings. The intention is to bring focus and clarity to the development and deployment of IPv6 in Europe, and beyond, in the hope that this will hasten its widespread adoption as the internetworking protocol of choice, and thereby give European industry and society an important advantage in the global information society.

Figure: 6LINK

Information Society Technologies

Technical Approach

In order to achieve the objectives set out above, the 6LINK project will adopt a work-plan with elements to address the key areas of consensus-building, dissemination and exploitation. The core of the consensus-building work will be a series of workshops, held every four months throughout the project, at which partners will present and discuss the latest developments, both within the represented projects, and from the global IPv6 community. A global perspective will be achieved by including standards development reports as regular inputs to these workshops. As well as identifying commonalities of interest and important issues for IPv6 development and deployment in Europe, the workshops will agree specific subjects for written reports. These reports will be reviewed and agreed at subsequent workshops and will serve to bring focus and clarity to the subject of IPv6 development and deployment in Europe.

In tandem with the workshops, the project will establish an online resource centre, which will provide public access to 6LINK reports, IPv6-related IST news and developments, and will host a database of IPv6-enabled applications. This online resource centre will partly meet the objective of disseminating the work of 6LINK to as wide an audience as possible. To further the achievement of this objective, the project will publish books of these reports on an annual basis. The form of this publication is to be decided, but may take the form of the Lecture Notes in Computing Science.

In order to best achieve the third objective, exploitation, the 6LINK project will seek to identify opportunities for common trials across projects, to draw further benefit from the work being done in IST projects, and to build on contacts and partnerships forged at 6LINK workshops. 6LINK will monitor standards development activities being undertaken as part of represented projects and will provide services to these projects in the form of presentations at standards meetings, document review and editorial support. The 6LINK project will serve to coordinate inputs to standards bodies from all of the represented projects and will take an active role in promoting the standards development work of 6LINK participants at standards meetings, provided that there is no contravention of the rules governing participation in the standards body in question by so doing.

Expected Achievements and Results

It is expected that 6LINK will foster an improved understanding throughout the IST community of the most important issues for IPv6 development and deployment. 6LINK will publish 3 books on the subjects deemed most important by the participants in 6LINK workshops. 6LINK will also serve to heighten awareness of the status of IPv6-related standards development, and will help to promote the standards work of participant organisations within the relevant standards bodies

Innovation

The 6LINK project provides the first, and only, forum for IPv6-related IST projects to come together and discuss important issues. Prior to the 6LINK project, collaboration and discussion between projects took place informally. 6LINK provides a formal, funded framework for such collaboration, and sets clear objectives for the participants in terms of deliverables. 6LINK will serve to identify and document the important issues for IPv6 development and deployment in Europe. 6LINK provides the first forum for dissemination of developments in the commercial, academic and standards arenas that is focused exclusively on IPv6 technologies.

Project name: 6LINK
IPv6 Projects Linkage Cluster

Contract no.: IST-2001-34056

Project type: AM

Start date: 01/03/2002

Duration: 36 months

Total budget: 1.017.805 €

Funding from the EC: 805.000 €

Total effort in person-month: 67,3

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Key words:
Cluster
IPv6

Collaboration with other EC funded projects:
6NET
6WINIT
ANDROID
Euro6IX
GCAP
GÉANT
LONG
MIND
MobyDick
NGNLab

Large-scale International IPv6 Pilot Network

Abstract

6NET is Europe's largest Internet research project, and aims to deploy and test IPv6 under realistic conditions. The 31 project partners represent a rich combination of research and industrial organizations. The consortium will provide a native IPv6 network on an international scale, throughout Europe, and to North America and the Asia-Pacific region, for test and demonstration purposes.

The 6NET infrastructure will connect more countries at a higher capacity than any other native IPv6 network deployed to date; initially spanning nine European countries, with links of up to 2.5 Gbit/s.

Objectives

The main goals of the project are to:

- Build and operate a dedicated international IPv6 network, and use this network to validate that the demands for the continuous growth of the global Internet can be met with the new IPv6 technology.
- Help European research and industry to play a leading role in defining the next generation of networking and application technologies that go beyond the current state of the art.

Sub-objectives are to:

- Provide and operate a combined fixed/mobile IPv6 pilot network, in order to gain a better understanding of IPv6 deployment issues, including physical infrastructure, address allocation, registries, routing and DNS operation.
- Operate an international pilot service such that geographically dispersed groups can interwork using native IPv6 facilities.
- Study, implement and validate IPv6/v4 coexistence, migration techniques and transition tools.
- Test state of the art IPv6 applications and access to legacy IPv4 applications and content.
- Exploit the synergy between work being performed on IPv6 by manufacturers such as Cisco, IBM and Sony, DANTE, European NRENs and Universities.

Figure: The 6NET Network Map

Technical Approach

First a stable European infrastructure will rapidly be put in place, and supporting network features will be developed in order that sophisticated applications -that take advantage of IPv6 capabilities- can be validated and demonstrated. Once the pan-European network is operational, the 6NET pilot network will be extended to link also North America and the Asia-Pacific region. In parallel with all these activities, management tools will be selected/developed in the project and integrated into the network operation procedures.

The work therefore follows an approach that allows for the incremental integration of new connectivity, network services, applications and management tools into the test-bed. The main items of technical work are focused in these 3 broad areas: infrastructure, network services, and application trials. Work in each of these areas follows a cycle of increasing functionality:

The IPv6 infrastructure will initially be based on a central core of European cities and be gradually extended within Europe and to North America and the Asia Pacific region. The extension within Europe entails not only the linking of new core locations, but also the pervasion of IPv6 within the NREN networks, and into many University campus environments. Each phase of this growth will be associated with new network operation and management features, and tests of interoperability.

Similarly, new network services (IPv6 DNS tree, IPv6 multicast, IPv6 mobility, IPv6-only wireless LAN access, VPN, etc.) and transition strategies/tools will be integrated and tested as they are developed. In parallel with all these activities, management tools will be selected/developed in the project and integrated into the network operation procedures.

Finally, the experimentation with applications will begin with IPv6 applications in common use (mail, web, vic, vat, etc.) and lead up to advanced experiments with state of the art IPv6 applications.

Expected Achievements

The main expected result is the provision and operation of a large-scale (intercontinental) combined fixed/mobile IPv6 pilot network, with the associated management functionality. This will bring a better understanding of IPv6 deployment issues, such as the physical infrastructure, and network service issues such as address allocation, registries, routing and DNS operation.

Further achievements will include a study, implementation and validation of IPv6/v4 coexistence, migration techniques and transition tools.

State of the art IPv6 applications and access to legacy IPv4 applications and content will be tested.

The practical experience gained in deploying emerging technologies in realistic settings will help European research and industry to play a leading role in defining the next generation of networking and application technologies.

Innovation

The innovation of this project extends from the many service support development activities, through to the building and operation (including management) of the network, so that it can be used for the application trials. For example:

- Auto-configuration, and the relationship between auto-configuration and User/Terminal management, multihoming, multicast, performance, and roaming.
- Support for class-of-service (in the form of a "Traffic Class" field compliant with the IETF DiffServ model).
- IPSec.
- The development and testing of network services such as DNS, multicast routing, etc.
- The design, implementation and test of both intra-domain and inter-domain IPv6 multicast. Interoperability with IPv4 multicast will be examined too.
- Interoperability between IPv6 network services and IPv4 network services.
- Mobility (wireless-only LANs in an end-site environment, ranging from 802.11b, Bluetooth and 802.11a, through to the convergence of mobile and fixed network technologies.
- New applications that will stress the network and be used to evaluate the benefits end-users that IPv6 can bring, through the expanded IP addresses, integrated auto-configuration, quality-of-service (QoS), mobility and security.

Project name: 6NET
Large-scale International IPv6 Pilot Network

Contract no.: IST-2001-32603

Project type: RTD

Start date: 01/01/2002

Duration: 36 months

Total budget: 16.941.983 €

Funding from the EC: 9.474.697 €

Total effort in person-month: 1.093,5

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06. DFN	D	22. RENATER	F
07. SWITCH	CH	23. NORDUnet	DK
08. GRNET	EL	24. SURFnet	NL
09. UCL	UK	25. ACOnet	A
10. ULANC	UK	26. GARR	I
11. UNINETT	NO	27. U. Soton	UK
12. Oulu Poly	FS	28. TELIN	NL
13. U. Oulu	FIN	29. FUnet	FIN
14. Invenia	NO	30. WWU	D
15. Fokus	D	31. INRIA	F
16. CTI	EL		

Key words:
International pilot network
IPv6
Network services Applications

Collaboration with other EC funded projects:
6LINK
6WINIT
Euro6IX
GÉANT
NGN-I
NGN-LAB

IPv6, QoS & Power Line Integration

Abstract

The main goal of the project is to contribute to ensuring affordable broadband access and the deployment of IPv6 in Europe, as stated in the conclusion of the Presidency from the Barcelona European Summit.

In order to achieve this goal, the project will research the native support and deployment of IPv6, QoS and other advanced services over Power Line Communication networks.

Objectives

- Research native IPv6/IPv4 and related protocols or advanced network services (QoS, security, multicast, mobility and so on) support over broadband Power Line, in several platforms/devices, including the necessary standardization activities mainly on the IETF, but not limited to.
- Adaptation of several next generation applications and services required for a correct evaluation of this technology and the actual support of the advanced network services, including VoIP, multi-conferencing and audio/video streaming.
- Field Trial and Evaluation of several devices, services and network prototypes, interconnected with other major IPv6 network trials, like Euro6IX and 6NET.

Other key features of this project with respect to other projects that may be related in any way to PLC, IPv6 or QoS (among other advanced services) are:

- For the first time, a large-scale deployment of very high speed broadband PLC will be performed in Europe. Currently deployed technologies in Germany and other European countries only provide data rates up to 2 Mbps and do not have QoS support. The PLC technology deployed in this project will provide up to 45 Mbps and will support QoS features to the upper layers (IPv6) through well-defined and standardized interfaces.
- The project will provide the support for emerging technologies and will make possible their actual evaluation and assessment. These technologies, like VoIPv6, and advanced "next generation" digital set-top-boxes, will have the right scenario to benchmark the next generation services as high-speed interactive TV, secure e-commerce, virtual shopping, infotainment and related applications.
- The project will be active in dissemination and linkage activities, with other related Foras and Projects, including IPv6 Forum, 6Link, IPv6 Cluster, and other events related to IPv6, PLC, and related technologies, in order to publicize the project results.

Technical Approach

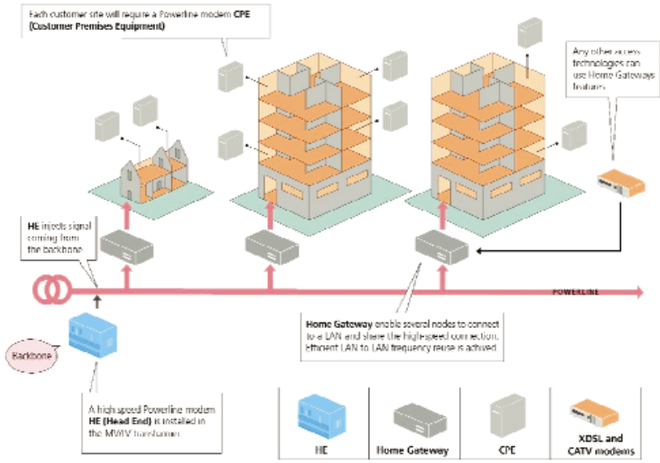
In order to meet the objectives of the project, the following work packages have been defined:

- WP1: Coordination, Interconnection & Dissemination.
- WP2: Integration of IPv6 Advanced Services over PL.
- WP3: Network Architecture Design and Implementation.
- WP4: PLC Devices.
- WP5: Next Generation Applications.
- WP6: Trials and Evaluation.

WP1 offers to the rest of Work Packages both, administrative and technical management skills. This WP is also responsible for the dissemination and exploitation of the results, and the coordination/liaison with other related networks and projects.

WP2 and WP4 are closely related because WP4 is going to use very directly the PLC functionalities provided by WP2 low layers research.

Figure: Typical PLC Network Topology



In addition, WP3 and WP4 need also to be closely coupled as long as WP3 will design and implement a network using the equipment provided by WP3.

- WP3 will provide the network that will be used by the rest of the WP.
- WP4 includes the development of the different pieces of equipment to deploy an end-to-end IP over PLC architecture. These developments include the Head End, the Home Gateway, a Set-Top Box and some adaptations for end devices. Also will link the "home appliances" to offer home automation.
- WP5 will heavily exercise the network running Next Generation Applications and even VoIPv6 over PLC.

WP6 will offer feedback to the different WP about the results of the trials. In order to be effective, WP6 will receive support for performing the trials from the other WPs, creating a bi-directional communications channel, finalizing with the evaluation process.

Key Issues

The success of the 6Power project will be measured against the achievement level of:

- Good management of project activities to meet the milestones according to agreed plans, on top of the rest of the activities, including the dissemination and awareness of the project results (WP1).
- Integration of IPv6 protocols and advanced services over Power Line Communications Technologies, and the related standardization activities (WP2).
- Design, Procurement and Deployment of 6POWER networks and the interconnection with major IPv6 test beds, based on other technologies, according to defined specifications (WP3).
- Development of the software and hardware for the devices to be integrated with IPv6 and PLC (WP4).
- Adaptation and/or integration of several next generation applications, mainly related to audio and video, to be used over the PLC/IPv6 implemented network (WP5).
- Trial and evaluation activities, involving users, in order to use the network, advanced services and applications (WP6).

Expected Impact

The expected impact of the project is to ensure affordable broadband access with PLC, offering QoS and the deployment of IPv6 in Europe.

Project name: 6POWER
IPv6, QoS & Power Line Integration

Contract no.: IST-2001-37613

Project type: RTD

Start date: 01/07/2002

Duration: 24 months

Total budget: 4.817.599 €

Funding from the EC: 2.133.974 €

Total effort in person-month: 475

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Key words:
IPv6
Multicast
PLC
QoS

Collaboration with other EC funded projects:
6QM
Euro6IX
Eurov6

IPv6 QoS Measurement

Abstract

The project goal is the research, development and integration of the different pieces needed for the correct measurement of the Quality of Service in IPv6 networks.

In order to achieve this goal, a measurement device will be developed. This device will insert precise timestamp information when IPv6 packets are captured. A measurement server will be also developed. This server will collect the packets that had been time-stamped by the measurement device and provide usage data and QoS metrics (delay, loss, jitter and so on). All the developed components will be integrated, locally tested.

Given the fact that the time frame of 6QM project, and the coincidence with two pan-European native IPv6 networks (Euro6IX and 6NET), they will be used as major test-beds to validate the 6QM project, in a pragmatic way.

The liaison and the cooperation between 6QM and these projects will lead to study the impact of the characteristics of these networks on the design of measurement tools (probes) and on the specification of the measures (metrics, collection techniques, processing methods…).

As part of the expected result from 6QM project, a knowledge base and a set of guidelines will be created, that could be exploited by operators and ISPs to meet the client demand in IPv6 advanced services with guaranteed and differentiated QoS.

Extensive dissemination and Linkage with other related Foras and Projects will be carried out, and will permit to progress in the standardization, in order to solve some remaining R&D issues and publicize of the project results.

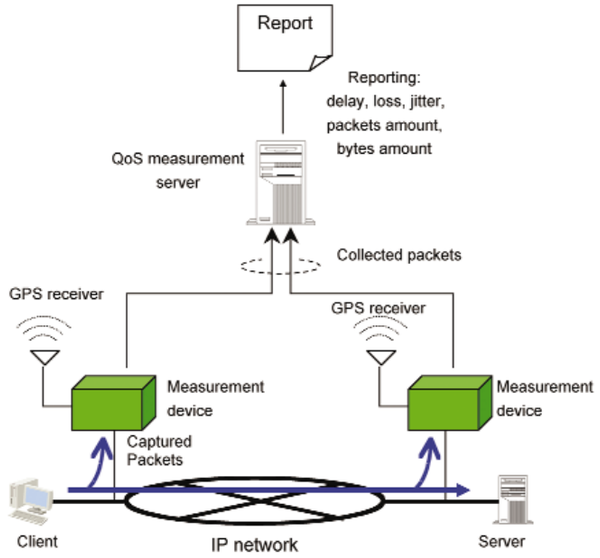
These operational results could be also helpful to give an answer to the market expectations concerning the development of the New Generation Internet based on IPv6 technology with a strong constraint on QoS.

Objectives

The project will develop a comprehensive approach towards IPv6 QoS measurement. In order to achieve this goal, the project has defined the following objectives:

- Development of a measurement device for IPv6. The measurement device inserts precise (micro second order) timestamp information when it captures the IPv6 packet. Each device has time synchronization functionality, by GPS, or any other equivalent mechanism, if widely available.
- Development of a measurement server. The measurement server collects the captured IPv6 packet. Then it provides not only usage data but also QoS metrics (delay, loss, jitter and so on) for IPv6 traffic by analyzing the collected information through the measurement device.
- Integration and local test of the developed components, for the further trial and evaluation of the developed system, at least in European IPv6 infrastructures.
- Generation of a set of guidelines for the possible application and further research of the IPv6 QoS Measurement in different scenarios.
- Dissemination and Linkage with other related Foras and Projects, in order to publicize the project results.

Figure: Structure of IP Measurement System



Technical Approach

The project Work Plan has been structured in the following set of Work Packages:

- WP1 (Management and Coordination).
- WP2 (Requirement Study for IPv6 QoS Measurement) as a pre-requisite for achieving the project objectives in real large-scale scenarios, and outputs for guidelines.
- WP3 (Development of IPv6 Measurement Technology) to address the development of the measurement device and server, and generation of final guidelines.
- WP4 (System Integration, Testing and Evaluation).
- WP5 (Dissemination, Liaison and Interconnection).

Innovation

The number of experimental projects for IPv6 networks is radically increasing with worldwide scale. These projects have been proving the effectiveness of the IPv6 protocol. Moreover, several kinds of applications using IPv6 network have been proposed, and major applications using IPv6 network are video conferencing and game-on-the-net using real-time and peer-to-peer communication. These applications require high throughput, low delay and less data loss. Therefore, the guarantee of QoS will be quite important issue for IPv6 Operations Support System (OSS).

By relating the measured data and network configuration, the network manager can identify the specific network device that should be intensively monitored to avoid network problems. By relating the data from configuration system with the data from IP measurement server, the basic information for identifying the rest of network capacity can be expected. Based on this information, the configuration system can find the best route for establishing new end-to-end path. Moreover, based on this data, the network operator can forecast the time when the network capacity should be increased. The major applications of IPv6 networks will require the QoS to each end-to-end path.

Therefore, to complete technologies for QoS guaranteeing network operation and management, not only the QoS control technique but also the measurement technologies for IPv6 should be developed.

Project name: 6QM
IPv6 QoS Measurement

Contract no.: IST-2001-37611

Project type: RTD

Start date: 01/09/2002

Duration: 24 months

Total budget: 2.322.696 €

Funding from the EC: 964.860 €

Total effort in person-month: 143

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Key words:
IPv6
Measurement
QoS

Collaboration with other EC funded projects:
6NET
6POWER
Euro6IX
Eurov6

IPv6 Wireless Internet IniTiative

Abstract

The 6WINIT project is intended to validate the introduction of the NEW MOBILE WIRELESS INTERNET in Europe –based on a combination of new Internet Protocol version 6 (IPv6) and wireless protocols (GPRS and UMTS/3GPP).

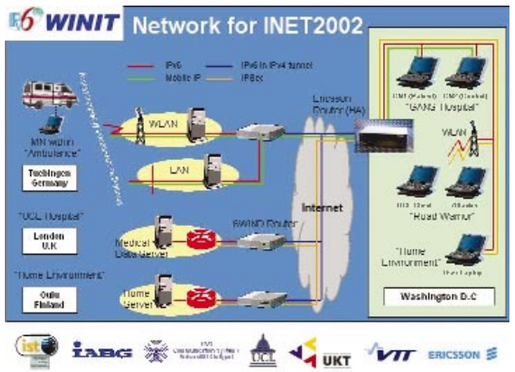
This offering will solve current problems of the scarcity in the IP and wireless world of the following: IP addresses, quality of service and security from the IP side and lack of spectrum and bandwidth from the wireless side. The project is setting up and validating one of the first operational IPv6-3G Mobile Internet initiatives, with customers having native IPv6 access points and native IPv6 services in a 3G environment.

The project concentrates on mobile and wireless aspects of the system. It links into existing IPv6 wired infrastructures, using mainly existing applications for the validation, with emphasis on the clinical, multimedia and home control applications. In most cases the applications themselves are not being developed inside the project.

Objectives

- Validate the introduction of the NEW MOBILE WIRELESS INTERNET in Europe –based on a combination of the new Internet Protocol version 6 (IPv6) and the new wireless protocols (GPRS and UMTS/3GPP).
- Validate the integration of the protocol suites in (1) into real applications by running complete application test-beds.
- Ensure that the implementations of (1) are generic, and not specific to a particular supplier or operator.
- Ensure that the validation applications of (2) are not too tied to specific choice of applications.
- Ensure that the international perspective is maintained.

Figure: 6WINIT Demonstration at INET 2002



Technical Approach

The technical approach is to take applications from other activities, where they have been used in tethered applications in an IPv6 environment –but which are expected to gain by being exercised in a mobile IPv6 one. These applications are ported to work over IPv6, and we ensure that all the requisite technology is available to allow them to work in a wireless-enabled IPv6 environment.

Amongst the activities that must be pursued are the following:

- An Architecture that is viable allowing also for transition from IPv4 to IPv6 (WP3).
- Non-clinical applications that largely existed outside the project, but must be ported to work in an IPv6 environment (WP4).
- Clinical applications which were designed to work in a conventional, wired, local IPv4 environment –but which have to be completely re-examined for the mobile IPv6 environment. Because these are major applications with live patients, it is not feasible to completely re-engineer them. Instead it is necessary to adopt front-end and agent techniques to mitigate the need for change in the applications themselves (WP5).
- Ensuring that the relevant relays, routers and gateways can operate in the mobile IPv6 environment (WP6).
- Providing any additional components needed to deploy the applications from WP4 and WP5. This includes providing host support, security infrastructure, mobile infrastructure and enabling tools like IPv6-enabled Java (WP7).
- Ensuring the availability of the requisite IPv6-enabled network wireless and wired resources to be available in the partner and demonstration network (WP8).
- Providing the appropriate enhancements of the clinical applications of WP5 to ensure that they can be demonstrated over the wireless IPv6 environment (WP9).
- An evaluation both of what has been demonstrated, what should be extended in the future, and what can be expected to occur in the near future (WP9).

Technology, Components and Test-bed

The infrastructure of 6WINIT consists of IPv6-enabled communications facilities include Wireless LANs, GPRS and a UMTS test-bed attached to an IPv6 wired infrastructure derived from 6NET and NREN pilots.

To make use of this test-bed, considerable work is being done on:

- Routers: Here dual-stack routers, with support for Mobile IPv6, Road Warrior functionality (via IPsec/IKE) and multicast.
- Relays: Both to provide media adaptation via active network technology and SIP-H.323 transformation at the network edge.
- Hand-helds: Here we are ensuring IPv6 and mobile support both in standard terminals like laptops, servers and really portable devices such as IPAQs.
- Technologies: Here we ensure that the requisite components are available under IPv6 such as RTP, IPsec, Location information, Mobile IP and Java.
- Transition: Here we ensure that we are able to work in a world where only some of the components have migrated to IPv6, with others still IPv4.

Applications

6WINIT offers advanced network services, and a repository of IPv6 enabled applications, which have been ported, adapted or enhanced, and made available for trials both within 6WINIT and to third parties. While some of the applications were developed inside the project, most were provided from other projects –but adapted to the Mobile IPv6 environment.

Amongst the non-clinical applications are media conferencing, media streaming and home appliance control.

Amongst the clinical applications are counselling and vital statistics in accident and emergency, access to clinical data from patients' homes and on-line education.

Innovation

The project is intended to provide an insight into the problems in deploying real applications in the emerging IPv6-enabled wireless internet. The innovation is in carrying through complete systems pilots, and identifying what components are inadequate in the applications, network facilities, major components and middleware. This work is indispensable for ensuring the success of the Mobile Internet.

Project name: 6WINIT
IPv6 Wireless Internet IniTiative

Contract no.: IST-2000-25153

Project type: RTD

Start date: 01/01/2001

Duration: 25 months

Total budget: 6.018.800 €

Funding from the EC: 3.492.000 €

Total effort in person-month: 568

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05. Ericsson	S
06. Ericsson-Pol	PL
07. T-NOVA	D
08. TZI	D
09. IABG	D
10. RUS	D
11. UKT	D
12. 6WIND	F
13. VTT	FIN
14. UMM	PL
15. ETRI	KR
16. NTT	JP

Key words:
Clinical Applications
GPRS
IPv6
Mobility
Non-Clinical Applications
UMTS

Collaboration with other EC funded projects:
6NET
ANDROID
GÉANT
LONG
NGN-LAB

European IPv6 Internet Exchanges Backbone

Abstract

The goal of the Euro6IX project is to support the rapid introduction of IPv6 in Europe. Towards this target, the project has defined a work plan. This describes the network design, network deployment, research on advanced network services, development of applications (that will be validated through the involvement of user groups and international trials), and active dissemination activities, including events and conferences, contributions to standards (IETF among others), publication of papers and active promotion of all the publicly available project results through the project web site.

The project will research, design and deploy a native pan-European IPv6 network, called the Euro6IX test bed. It will include the most advanced services obtainable from present technology and will follow the architecture of the current Internet (based on IPv4). It will consider all the levels needed for the worldwide deployment of the next generation Internet.

Objectives

- Research an appropriate architecture to design and deploy the first pan-European non-commercial IPv6 Internet Exchange (IX) Network. It will connect several regional neutral IPv6 Internet Exchange points across Europe, and achieve the same level of robustness and service quality as currently offered by IPv4 Internet Exchange Networks.
- Use the deployed IPv6 IX infrastructure to research, test and validate IPv6-based applications and services.
- Open the Euro6IX network to specific user groups (existing and to be created), who will be connecting to the Euro6IX network by means of a variety of access technologies –mobile, xDSL, cable– and internetworking with legacy IPv4 networks and services, to test the performance of future IPv6 networks, and non-commercial native IPv6 advanced services and applications.
- Disseminate, liaise and coordinate with clusters, fora, standards organizations (e.g. the IETF and RIPE) and third parties, with particular consideration for interworking and coordination with peer projects.

Figure: Initial Euro6IX Network

Information Society Technologies

Technical Approach

The success of the Euro6IX project will be measured against the achievement level of:

- Good management of project activities to meet the milestones according to agreed plans, on top of the rest of the activities (WP1).
- Procurement of IXs according to defined specifications, deployment and provision of efficient interconnectivity for the IPv6 European level Internet (designed by WP2, and deployed by WP3).
- Involvement of research entities and non-commercial trial users in order to use this network, advanced services and applications (developed by WP4).
- Promotion of the IPv6 interests by ISPs and users through test and trials (WP5 and carried out by WP4).
- Creation of awareness with Euro6IX activities at events of IST, IETF, fora, summits and national events with targeted participants (WP5).

Test-bed

The infrastructure of Euro6IX will consist of the following different network levels:

- IX-level: Regional native IPv6 exchanges.
- Backbone-level: Pan-European core network that interconnects the regional exchanges and creates the highest level in the network hierarchy.
- Node-level: Service providers, ISPs and other providers accessing the core network to provide IPv6 services and end user access. The users will be connected by means of a variety of access technologies, including legacy IPv4 networks and services whenever no IPv6 native links are available or feasible. This level includes a set of academic, research and non-commercial trial users who will use native IPv6 services and generate IPv6 native traffic.

Applications

Euro6IX will offer advanced network services, and a repository of IPv6 enabled applications, which have been ported, adapted or enhanced, and made available for trials both within Euro6IX and to third parties.

Emphasis will be put on tools that use the advanced features of IPv6 such as:

- Code porting (include Java).
- Address Delegation WEB Tools.
- Instant Messaging.
- WEB Mail Tools.
- Multimedia.
- Shareware Repository.
- Test Suites.
- On-Line Education Tools.
- Billing Tools Prototypes.

Innovation

In order to allow for the continuous growth of the Internet, it is necessary to provide a neutral IPv6 based test exchange facility for researchers and ISPs to connect to and test the network, performance, its reliability and scalability, to determine if large scale networks can be established, solving interoperability and QoS issues. This is the key purpose of the Euro6IX project. Euro6IX will:

- Provide efficient interconnectivity for the IPv6 European networks.
- Involve the research community and non-commercial trial users on the network, with advanced services and applications.
- Promote the interests of ISPs and users for IPv6 development.
- Create awareness through dissemination of project results among the targeted recipients (IETF, RIPE, fixed and mobile operators, Summits, etc.).

Project name: Euro6IX European IPv6 Internet Exchanges Backbone

Contract no.: IST-2001-32161

Project type: RTD

Start date: 01/01/2002

Duration: 36 months

Total budget: 15.527.711 €

Funding from the EC: 7.697.308 €

Total effort in person-month: 1.299

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07. 6WIND	F
08. Airtel	E
09. T-Nova	D
10. BT	UK
11. E&A Abogados	E
12. TED	DK
13. Eurocontrol	B
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16. PTIN	P
17. UMU	E

Key words:
Backbone
IPv6
IX
Mobility
Native

Collaboration with other EC funded projects:
6NET
6WINIT
GÉANT
LONG
MIND
NGNLAB

The European IPv6 Showcase

Abstract

The Eurov6 project is in line with the current policy of the European Commission, which has recognized the growing importance of IPv6 and has made it a policy to adopt IPv6 for next generation networks.

Eurov6 will build an IPv6 applications and services showcase by bringing together devices and systems vendors as sponsors.

The Eurov6 will act as a catalyst; it will let different interests converge, from users, vendors, operators, ISPs, researchers, universities, IST networks and applications projects.

Objectives

The principal objective of the Eurov6 project is to show the usage of IPv6 products and services and their impact to anyone at anytime.

For this purpose, the following actions have to be performed:

- Bringing together vendors as sponsors to test and demonstrate their devices and systems.
- Showing various users applications based on IPv6 products and services, permanently at a few locations in Europe ("fixed showcase"), which can be visited physically or accessed remotely through telematic means.
- Organizing temporary demonstrations at different locations and/or significant events like INTEROP (concept of "nomadic Showcase").

The Eurov6 Showcase will obtain sponsoring of organisations who have the commercial and beta prototype network components, devices and applications for building a Showcase, in order to show the users all functionalities, features and benefits, in such a way that entrepreneurs identifiy major investment potentialities to reap the benefits and also to contribute towards developing a healthy information society.

The Eurov6 project, with its permanent test-bed/demonstration centers in Basel, Brussels and Madrid interconnected to other IPv6 initiatives and experiments through 6NET, Euro6IX, GÉANT and other national networks will allow the user community to experiment and trial their new applications, network and protocol features to all interested parties and in particular to policy makers, political leaders and industrial strategists, to promote IPv6 technology with its rich features.

The Eurov6 Showcase will also be presented as a portable packaged unit, so that the project can move the IPv6 technology package to as many events as possible (INTEROP, others) to show the European competence to the public at large.

Technical Approach

According to the project objectives, and in order to develop the permanent and nomadic versions of the showcase, the following steps have been identified and will be followed:

- Develop a concept of IPv6 Showcase with a range of devices, network subsystems, applications and connectivity to different user premises or demo centers.
- Identify the vendors and their products for availability and their usability in the scenario so developed.
- Establish contacts to key marketing people through the IPv6 Task Force (European and others), IPv6 Forum, IPv6 Cluster, different IST project partners (6LINK, NGN-LAB, 6WINIT, GÉANT, 6NET and Euro6IX, among others), the Commission services, and any other available options that we can consider during the project life.
- Plan a stable network and applications scenarios from the users point of view (simplicity and straightforwardness) so that the features are visible and not the complex networking issues.
- Identify the locations of a few permanent showrooms, where the demonstrations are generally available round the year and special demos targeted to particular types of visitors that can be arranged at short notice. Obvious candidates are Brussels and Basel, which constitute the NGN-LAB infrastructure as well as Madrid because of the involvement of CONSULINTEL in Euro6IX.
- Get the sponsoring of connectivity, devices, systems and services, applications from the vendors and ISPs for integrating the system.
- Build a prototype demo system and maintain it, including packaging and documentation.
- Build a plan to illustrate different aspects of IPv6 remotely from some networked centers around Europe and help the local personnel of different centers to develop their own user manuals.
- Plan to take the demo Showcase to different events (including INTEROP) and other international exhibits.
- Provide a living IPv6 Internet environment in such events with active participation in these events.
- Define appropriate information dissemination and public relations policy, as well as relations with the press and the media, and conduct the corresponding activities.
- Establish a project web site, which will describe the package and its availability, list the forthcoming information dissemination events and report about the previous ones.
- Include the sponsors in the web site, in order to reward their contribution and increase their participation.

Key Issues

In summary Eurov6 will contribute to the IST Program Objectives in many ways:

- Providing a technology showcase that illustrates the actual and rapid deployment of the IPv6-based services and applications; allowing assessing, validating and improving architectures and protocols.
- Showing IPv6 integrated products and demonstrating the technologies with selected applications to validate their exploitability, for commercial success.
- Providing incentives for increasing the user demand for the services, and the supplier ability to meet the demands.

Expected Impact

The main result expected from the Eurov6 project is the stimulation and promotion of the dissemination of IST research activities and innovations, helping the maximization of the exploitation of results and their socio-economic and policy implications.

And from a policy perspective, the results of Eurov6 include:

- Supporting technological developments, in areas such as: data security across heterogeneous networks spanning across terrestrial and mobile networks.
- Reinforcing the links to industrial consensus development to ensure coherence in EU-wide technology deployment and in creation of new open framework for fair competition and fast innovation.
- Anticipating market needs and nurturing emerging technologies where the project can make a substantial impact by aggregating critical mass ahead of market maturity.
- Strengthening competitiveness of European industry in areas where Europe has a demonstrated leadership and/or in areas of strategic importance.

Project name: Eurov6
The European IPv6 Showcase

Contract no.: IST-2001-38200

Project type: RTD

Start date: 01/07/2002

Duration: 24 months

Total budget: 645.165 €

Funding from the EC: 442.691 €

Total effort in person-month: 48

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Key words:
Demo
IPv6
Showcase
Showroom

Collaboration with other EC funded projects:
6NET
6POWER
Euro6IX
NGN-LAB

Global Communication Architecture & Protocols for new QoS services over IPv6 networks

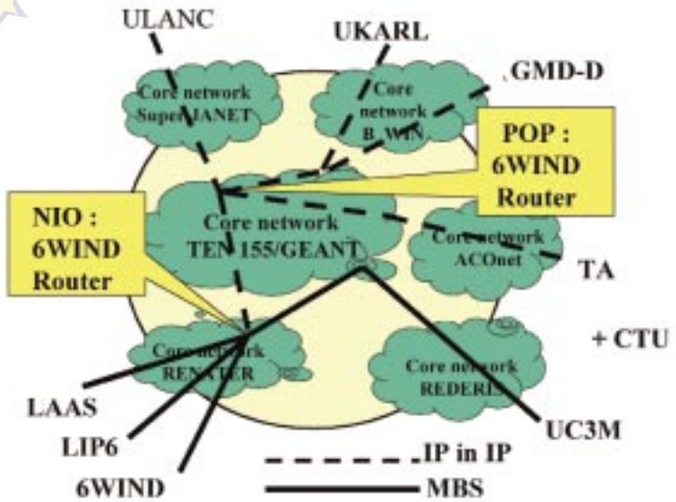
Abstract

High performance networking with guaranteed Quality of Service is one of the major challenges of the next decade. It mandates very important efforts to provide multimedia and multicast communications to wide area advanced users, because the limited mechanisms of UDP and TCP cannot adequately support innovative distributed applications. Furthermore, future architectures will involve heterogeneous networks, as new satellite and terrestrial networks having sophisticated services. As a consequence, GCAP aims at developing for the future Internet two new end-to-end multicast and multimedia transport protocols, embedded in a new global architecture to provide a guaranteed QoS to advanced Multimedia Multipeer Multinetwork applications. In order to rapidly experiment the proposed solutions, an efficient deployment of the communication software will be developed over an industrial IPv6 layer by using a programmable active network based technology.

Objectives

- Define and evaluate a new end-to-end multicast transport protocol and a new end-to-end multimedia multicast transport protocol for supporting dedicated or specialised applications having guaranteed QoS requirements.
- Define and evaluate a new integrated global multinetwork end-to-end architecture for supporting multimedia and cooperative applications needing guaranteed Quality of Service.
- Propose a design approach to rapidly deploy and use such new protocols, that will be developed on top of the new QoS architecture based on IPv6, by means of an active network based technology.
- Illustrate the feasibility and evaluate the potential of the advocated approach by conducting two experiments using the national research networks and their European interconnection.

Figure: GCAP Test-bed Network



Information Society Technologies

Technical Approach

GCAP project has defined the following Workpackages to achieve the targeted objectives:

- Qos and Layering (WP1).
- Definition and Specification of the Protocols (WP2) and deployed by.
- Protocol Implementation & Deployment (WP3).
- Application Experiments (WP4).
- Management, Dissemination and Assessment (WP5).

GCAP Architecture

To design and implement a new Transport layer for the Internet next generation, the work conducted in GCAP addresses the following items:

- Specify and implement two protocols, designed as two building blocks, a multimedia protocol and a multicast protocol.
- The multicast protocol allows the management of groups of users, and provides the mechanisms needed to guarantee the selected QoS parameters to receivers.
- The multimedia multicast protocol allows the application user to select the mono-media reliability and multimedia synchronisation to be enforced by the layer.
- Select an active network approach to be able to run the two previous protocols written in Java in IPv6 environments. The aim is to produce a software environment that will be able to support the automatic remote loading and the automatic remote execution of these two protocols for deployment
- Integrate these results into a new advanced end-to-end multinetwork transport layer.
- Evaluate and analyse the results obtained: the protocols themselves and their mechanisms, the active support environment including code design and execution, and the large scale deployment and behaviour.

Applications

The last technical workpackage devoted to the demonstration and to the evaluation of the approach consists of four Tasks.

- The first one will define the global experimental hardware and software environment. In particular, it will make precise the hardware and software involved, the different IPv6 supports, both in edge-devices and in network-devices, the precise platform in the different sites, and the measurement software to be used.
- The two following tasks will be related to the specification and to the design of the two illustrative experiments:
  - One will be devoted to multicast through the design of a distributed service, seen as a building block, providing a multicast dynamic group communication.
  - The other will be devoted to the implementation of a N users multimedia server across a multimedia multiQoS transport layer. These two experiments will be implemented to integrate the application software, the transport layer, the active network environment and the IPv6 network support.
- The last Task of the WP will have as a purpose, during the last three months, to analyse the demonstrations and capture the main lessons to be gained from GCAP.

Innovation

GCAP is a research project needed for designing the new generation Internet; its quite advanced objectives consider together and integrate a new architecture, two new protocols with QoS guarantee, over the most advanced deployment architecture. Its purpose is to give to the users/providers as much flexibility as possible. The goal of GCAP being to integrate the design of advanced QoS protocols together with the design of their deployment on top of active network, it appears that, to our knowledge, no other project is tackling this advanced problem.

Project name: GCAP
Global Communication Architecture & Protocols for new QoS services over IPv6 networks

Contract no.: IST-1999-10504

Project type: RTD

Start date: 01/01/2000

Duration: 24 months

Total budget: 3.428.009 €

Funding from the EC: 1.905.414 €

Total effort in person-month: 332

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06. ULANC	UK
07. UC3M	E
08. ASPI	F
01. Telekom Austria	A
09. U. Karslruhe	D
10. ENSICA	F
11. CTU	CZ

Key words:
Active Networks
Internet Protocols
IPv6
Quality of Service

Collaboration with other EC funded projects:
GÉANT

IPv6 Task Force Steering Committee

Abstract

The European Commission initiated an IPv6 Task Force driven by major and key European and worldwide players, to develop a comprehensive action plan by the end of 2001 aiming to ensure the timely availability of IPv6.

The conclusions and recommendations of the Task Force were successfully submitted to the European Council Barcelona Spring meeting of 2002, under the Spanish Presidency, and in the context of this document, a series of recommendations pertaining to the implementation of IPv6 by all relevant ICT sectors were proposed by the Commission.

As a result, the Heads of State resolution was to prioritize the widespread availability and use of broadband networks throughout the Union by 2005 and the deployment of the New Internet Protocol IPv6.

One of the main achievements was a Communication from the Commission to the Council and the European Parliament called "Next Generation Internet-priorities for action in migrating to the new Internet protocol IPv6".

As a complementary action, the European Commission calls for the renewal of the mandate of the "IPv6 Task Force" as a platform for debate on critical issues concerning the deployment of IPv6.

Objectives

In order to exchange views with all economic and industrial sectors likely to be impacted by IPv6, including, consumer organizations, research institutions, and independent data protection authorities as well as representatives of national or regional IPv6 Councils and appropriate representatives from candidate countries the renewed mandate of the Task Force will encompass:

- Ensure a working liaison with standards and Internet governance bodies such as ISOC, IETF, ICANN, RIPE NCC, 3GPP, ETSI, IPv6 Forum, Eurescom, ETNO, UMTS Forum and GSM Europe.
- Provide a regularly updated review and plan action ("the European IPv6 Roadmap") on the development and future perspectives of IPv6 in order to coordinate European efforts on IPv6.
- Establish collaboration arrangements and working relationships with similar initiatives being launched in other world regions.

One of the main goals is to discover and fill gaps, provide strategic guidance with the assistance of a number of industry and academic players, to quickly propose measures to the appropriate bodies, to involve the European Commission and to verify sustained activities and implementation of proposed measures.

As a consequence, the nature of this project (IPv6 TF-SC) is to be the strategic instrument and create ground for discussion and monitor how the recommendations are transformed. Besides, it will collaborate with other regional groups and initiatives deploying IPv6.

To assure the success of IPv6 deployment, IPv6 TF-SC project, in its role as the facilitator of the Task Force, which is invited to create strategic Roadmaps, will continuously monitor the academic, market and industrial activities, and provide guidance where appropriate to avoid duplication of work.

To this extend, the project will facilitate, support and coordinate the continuation of the work of the IPv6 Task Force, with the renewed mandate of a 2nd phase, with the means of a Steering Committee, consisting of IPv6 experienced Experts. This will facilitate the successful introduction of IPv6 in Europe and consequently, the rest of the world.

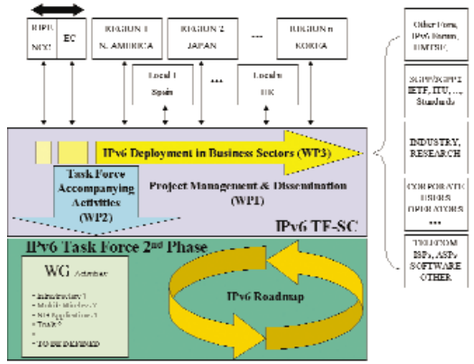

Figure: WP Interrelation and Liaison/Support to the Task Force

Technical Approach

In order to achieve the project objective, the following goals had been defined:

- To perform all required actions aiming at the enhanced coordination and continuation of the work performed within the IPv6 Task Force 2nd phase. The IPv6 TF-SC will set the Agenda and with the assistance of the Commission invite participation of representatives of not yet represented economic and industrial sectors likely to be impacted by IPv6, including representatives of national or regional IPv6 Councils and appropriate representatives from candidate countries.
- The IPv6 Task Force provide a regularly updated review and plan action on the development and future perspectives of IPv6 in order to coordinate European efforts on IPv6. The IPv6 Task Force Steering Committee will monitor how the recommendations are implemented and remind those that need to take action where appropriate.
- Create the proper working and liaison environment to ensure that a working collaboration with standards and Internet governance/policy bodies takes place.
- Establish collaboration arrangements and working relationships with similar initiatives being launched in other world regions, industry and research.
- Organize regular IPv6 Task Force meetings (Plenary and/or Working Groups) with the assistance of the Commission.
- Foster dissemination and awareness activities, regarding the IPv6 Task Force work, and other related efforts and initiatives, including the operation of the IPv6 Task Force and the project web sites.

Key Issues

From the perspective of this project, and considering the previous recommendations submitted to the EC, taking into account that these are subject to change as a matter of decision of the IPv6 Task Force 2nd Phase, the main goals of the IPv6 Task Force will be:

- Educate the Industry and disseminate the Information.
- Work out a Roadmap for deployment of IPv6 in different Industry sectors with the help of applicable scenarios where appropriate.
- Promote the rollout of IPv6 products.
- Encourage national governments and institutions in Europe to accelerate the rollout of broadband, "always on" networking with IPv6.
- Encourage vendors to incorporate IPv6 support into their products.
- Encourage European car manufacturers to deploy and test IPv6.
- In view of the increasing deployment of VoIP, encourage the feasibility of dual stack SIP phones development.
- Encourage active contributions towards the acceleration and alignment of on-going IPv6 work within standards and specifications bodies.
- Help to develop key guidelines permitting the efficient integration of IPv6.
- Where appropriate work out proposals for IPv6 work activities.
- Identify major Integrated Projects in view of FP6, to extend and complement, if necessary, the goals of this project.

Project name: IPv6 TF-SC
IPv6 Task Force Steering Committee

Contract no.: IST-2001-37583

Project type: AM

Start date: 01/10/2002

Duration: 18 months

Total budget: 249.961 €

Funding from the EC: 249.961 €

Total effort in person-month: 17,6

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Key words:
IPv6
Roadmap
Task Force

Collaboration with other EC funded projects:
All related to IPv6

Laboratories over Next Generation Networks

Abstract

LONG aims to foresee and solve problems related to the design and deployment of Next Generation Networks and Advanced user applications.

LONG is focused in IPv6, since this protocol is expected to become part of NGN networks. LONG experiments cover Network Access Systems (ADSL, CATV, ISDN) and Transport Technologies (ATM, POS, GbE) as well as IPv6 nodes (hosts, routers).

To achieve a complete study, LONG also includes studies and tests related to advanced network services (Mobility, Multicast...), end-user IPv6 applications (CSCW, Videoconference) and IPv4-IPv6 Transition Mechanisms.

Objectives

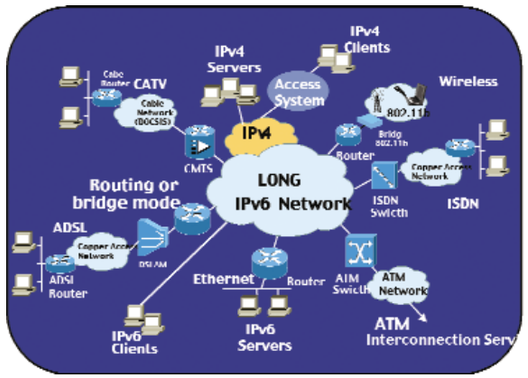
The first LONG's objective is to deploy a Next Generation Test-bed where IPv6 protocol can be studied and tested over different access and transport technologies.

Advanced Network services are studied and tested in order to validate the integration of them together with the IPv6 protocol.

IPv4-IPv6 transition mechanisms are studied and tested to incorporate transition scenarios and solutions in the LONG test-bed.

Finally a relevant end-user application or a set of them are to be migrated during the project, producing a set of guidelines about porting applications to IPv6 and mixed IPv4-IPv6 scenarios.

Figure: LONG Distributed IPv6 Test-Bed Platform



Technical Approach and Test-Bed

In order to achieve all LONG objectives, the following items are to be studied and tested: IPv6 study and equipment selection, Access and Transport systems, Transition Mechanisms, Advanced Network Services, End-user services, CSCW apps. porting.

All partners work alone at the beginning for each item, generating documentation with a detailed description, standardization status and basic installation and configuration of the selected implementation. Then, these technologies are installed in some partners premises including them in the LONG test-bed to perform trials and experiments.

The first relevant milestone has been connecting all IPv6 partner's networks obtaining a first release of the LONG test-bed. Next step has been setting up some basic network services: DNS, routing protocols (BGP) and develop and install network monitoring tools.

The following step is to include in the network end-user services: WEB server, FTP server, Mail and News services connected to current Internet mail system, LDAP server including LONG participants information, IRC service, etc.

The connectivity of these IPv6 servers with IPv6 & IPv4 clients, and even other IPv4 servers, will naturally demand the installation of the Transition Mechanisms studied and tested first by each partner (stand-alone tests).

In parallel with all this work, ISABEL CSCW (collaborative work) IPv4 application is used from the beginning of the project to perform most of LONG meetings using an IPv4 temporally broadband infrastructure (needs 2 Mbps for multi-videoconference).

One main task of LONG project is to port ISABEL software to IPv6 and generate application porting and migration guidelines. Once ISABELv6 is tested enough, the objective is to re-design the IPv6 LONG Test-bed (using GÉANT or other broadband services/projects) to perform LONG meetings using ISABELv6 over the permanent project IPv6 infrastructure.

The stable IPv6 project Test-Bed is showed in the figure in the previous page. In that figure the different access systems, user service's servers and client hosts appear to be connected to a single "IPv6 LONG Network". This is really a global vision of the distributed platform. The actual infrastructure corresponds to it in the following manner:

- Central LONG IPv6 network: Is a network of IPv6 subnets, each subnet is placed in each partner's premises.
- Array of IPv6 servers/clients: They are distributed among all partners premises.
- IPv4 Network and IPv4 servers/Clients: Composed by all IPv4 test networks where each partners install IPv4 clients/server to test transition scenarios.

Trials and Experiments are performed over this stable platform.

Applications

LONG will provide guidelines and conclusions related to the integration and end-user orientation of all items explained before.

The main application of the project will be derived from the results and conclusions obtained in the trials and experiments to be done once the stable IPv6 platform is ready.

Innovation

The most innovative characteristics of LONG project are:

- Integration: IPv6, different access & transport systems, transition scenarios, advanced services and applications are tested to integrate all them in a single platform.
- Practical orientation: Not all combinations of T.M. and transition scenarios are studied. The transition mechanisms are only introduced in the stable platform when needed by the network/user services (IPv4/IPv6 clients/host interaction).
- End-user orientation: All elements in the stable test-bed are introduced to provide benefits for user/network services.

Project name: LONG
Laboratories over Next Generation Networks

Contract no.: IST-1999-20393

Project type: RTD

Start date: 01/12/1999

Duration: 24 months

Total budget: 2.082.928 €

Funding from the EC: 1.073.085 €

Total effort in person-month: 233,3

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07. Nortel	E

Key words:
CSCW-Applications
IPv6
Network-Services
Transition-Mechanisms

Collaboration with other EC funded projects:
6NET
Euro6IX
Moby Dick
Sequin

Spectrum Efficient Uni- and Multicast Services Over Dynamic Multi-Radio Networks in Vehicular Environments

Abstract

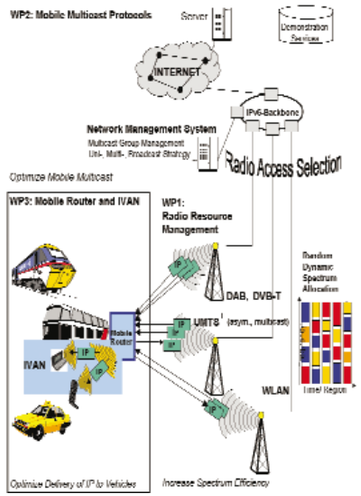
The European research project OverDRiVE (Spectrum Efficient Uni- and Multicast Over Dynamic Radio Networks in Vehicular Environments) aims at UMTS enhancements and coordination of existing radio networks into a hybrid network to ensure spectrum efficient provision of mobile multimedia services. An IPv6 based architecture enables interworking of cellular and broadcast networks in a common frequency range with dynamic spectrum allocation (DSA).

Objectives

The project objective is to enable and demonstrate the delivery of spectrum efficient multi- and unicast services to vehicles. OverDRiVE addresses resource efficiency by sharing network and spectrum resources. OverDRiVE will:

- Develop a vehicular router, providing multi-radio access to a moving intra-vehicular area network (IVAN). The concepts rely on Mobile IPv6 extensions for mobile networks.
- Develop and demonstrate efficient IPv6 mobile multicast techniques (MMC).
- Provide mechanisms for spectrum sharing between systems using Dynamic Spectrum Allocation (DSA) according to the actual load. OverDRiVE will investigate system coexistence in one frequency band.
- Active participation in the Internet Engineering Task Force IPv6, Mobile IP Working Groups as well as in the Mobile Networks (NEMO) Birds-of-a-Feather and subsequent Working Group. Monitoring and participation in 3GPP, ITU and Digital Video Broadcasting Project.

Figure: Conceptual Overview



IPv6 Activities within OverDRiVE

- Mobility in hybrid networks.
  - Vertical handover of a multicast group (WLAN, UMTS, DVB-T).
- Multicast: Optimize Multicast transmission by.
  - Sub-Group Management and Multicast Mobility Management.
- Moving Intra-Vehicular Area Networks (IVAN).
  - Mobile router: Support for Multi-access and IVAN Mobility.
  - Roaming into IVAN: Authorization and Authentication (AAAv6).
- IPv6 Prototyping and Demonstration.
  - Multicast Mobility, Group Management and Mobile Router.

Technical Approach

The project is divided into four work packages, which are hierarchically subdivided into several tasks: WP1 (Spectrum Efficient Radio Resource Management) investigates new and advanced methods for dynamic spectrum coordination in old and new frequency bands and the coexistence (with regard to interference and sensitivity) of different radio services such as UMTS and DVB-T in one frequency band. It develops enhancements for UTRAN to provide spectrum efficient multicast and asymmetric services. WP2 (Mobile Multicast Protocols) enables mobile multicasting for transport IP level protocols in a multi-radio environment. A mobile multicast and group management functionality will coordinate the traffic distribution to different access systems. WP2 develops a multicast prototype. WP3 (Mobile Router and IVAN) specifies a in-vehicular router, that provides wireless access from the IVAN (Intra- Vehicular Area Network) to multi-radio services. WP3 demonstrates the key concepts of OverDRiVE. WP4 (Project Management and Dissemination) establishes the project management organisation, coordinates the inter-WP work, develops a business model.

Test-bed

The OverDRiVE project has the ambitious aim to demonstrate key issues of work package 2 (Mobile Multicast) and work package 3 (Mobile Router and IVAN). The test-bed consists of an entirely IPv6-based core network that supports dynamic IPv6 routing as well as link, inter- and intra-domain multicast routing protocols such as MLD, M-BGP and PIM-SM. Due to certain legacy aspects of DVB-IP protocols, IPv6-to-IPv4 transition mechanisms will also be deployed. Network mobility at IP level will be demonstrated on mobile routers and attached hosts. Several applications are currently being considered, most based on multicast delivery of video-streaming sessions. Hybrid access systems: WLAN, DVB-T and various forms of UTRAN emulation.

Innovation

The functionality of a mobile router of an IVAN is far beyond the normal forwarding of IP packets. In a multi-radio network infrastructure the mobile router must on one hand support seamless handover between various radio systems to ensure network connectivity, and on the other hand support multiple user devices that are brought into and out of the IVAN. The management of the mobility of sub-networks and the IP overlay network will be investigated. A mobile multicast mobility and group management functionality will coordinate the traffic distribution to different access systems in a hierarchical multi-layer cell architecture. It will select the access system, which provides the multicast transport service in the most efficient way. The multicast group management will group according to available bandwidth, region, and capabilities. Today's radio networks operate with fixed long-term spectrum allocations even if the actually required spectrum varies both over time and region. By introducing dynamic spectrum allocation (DSA) and regional system coexistence for the radio access systems, spectrum could be shared between different systems to optimise the overall usage in an area. Project will develop methods for random dynamic spectrum management, requiring new methods for automatic spectrum selection and investigations to assure the coexistence and evaluation of the performance of different radio technologies in one fragmented spectrum band.

Project name: OverDRiVE Spectrum Efficient Uni- and Multicast Services Over Dynamic Multiradio Networks in Vehicular Environments

Contract no.: IST-2001-35125

Project type: RTD

Start date: 01/04/2002

Duration: 24 months

Total budget: 6.404.787 €

Funding from the EC: 3.956.374 €

Total effort in person-month: 581

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Key words:
Car Area Networks
DVB-T
Dynamic Spectrum Allocation
IPv6
Mobile IPv6
Mobile Multicast Protocol
Mobile Routers
Networks
UMTS

Collaboration with other EC funded projects:
DRiVE

Satellite Broadband Multimedia System for IPv6 Access

Abstract

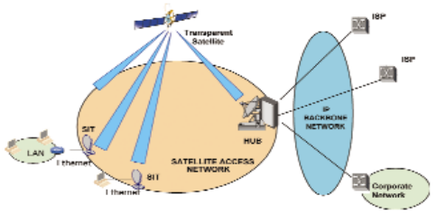
SATIP6 will examine the most immediate technical issues facing satellite broadband access in the coming years, namely the functions to be implemented in the protocol layer between physical medium access and the IP layer (i.e. typically layer 2).The introduction of IPv6 (compared to today's IPv4) requires modification of user applications and network infrastructure, which will be a gradual process and will be implemented differently in different parts of the global network. The satellite system and notably the satellite transport protocols as well as the interfacing and the inter-working with the core network at the gateway stations will need to be adapted to provide cost-effective services compatible with terrestrial network IPv6 services.

Objectives

The objectives of the project are to evaluate and demonstrate key issues of integration of the satellite-based access networks into the Internet in order to offer multimedia services over wide areas. IP will serve as the common denominator to allow inter-operability for services and transport technology within integrated networks. The project will define solutions for two stages:

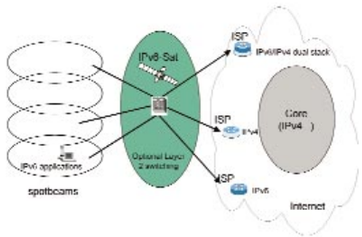
- For the short-to-medium term focussing on better adaptation of DVB-RCS access for IP services with current satellites. The objective is to make access to the satellite appear transparent to the IP layer, by improving transmission performance over DVB-RCS and by allowing common IP-based equipment and terminals to be used (i.e. similar to ADSL, cable modem terminals).

Fig.1: Short/Medium term case



- For long term case, the shorter term solutions defined for IP/DVB-RCS will be extended and adapted for more advanced satellite systems supplemented with mesh connectivity (directly between users) via transparent or regenerative payload. In addition satellite integration into Next Generation Networks (NGN) based on IPv6 associated with a range of advanced features in terms of mobility and security,for example, will be targeted.

Fig.2: Long term case



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Technical Approach

The emphasis of the project will therefore be on:

- IP service support within the satellite access network, and the integration of the satellite access network into the Internet by defining scenarios and issues related to migration to the IPv6-based Internet.
- Adaptation and optimization of the DVB-RCS access standard in order to support layer 2 models from terrestrial networks, such as the ADSL or MPLS.
- Definition of new label-based access techniques (i.e. "IP-dedicated") for further efficiency improvement of satellite access, and compatibility enhancement between satellite-based networks and the next generation (i.e. IPv6-based) terrestrial Internet.
- Advanced IP inter-working: mobility,QoS, Security and Multicast.
- Development of a demonstrator for broadband multimedia services transported over IP and DVB-S/RCS to validate results achieved in the course of the project.

Test-bed

The aim of the test-bed development is to validate innovative Satellite/IPv6 integration aspects focusing on two satellite architectures:

- Network interconnection through MPLS-aware satellite stacks.
- Network interconnection through IPv6-aware satellite stacks.

Provisions are made for live experiments using a connection to Renater, the French experimental IPv6 network connected to the 6bone.

Based on the satellite access network definition for the long term case, the test-bed will de defined to implement key Satellite-IPv6 features. It will be based upon:

- Complete DVB-RCS MAC Stack, DAMA included (i.e. with resource management protocols and algorithms).
- Hub/Satellite/BSAT stations based on Linux.
- IPv6 transport mechanisms.
- QoS mechanism enhancement (based on e2e Diffserv and RSVP).
- Specific IPv6 applications: secure transactions, QoS-aware applications.
- IPv6 Linux applications: Web (Streaming video), Chat, White board (Multicast).

Standardization Activities

The project will contribute to the following standards groups:

- ETSI BSM (Broadband Satellite Multimedia) group, by building upon work started in the BRAHMS project.
- IETF: production of Internet Draft on "IPv6 over Satellite" and participation at selected meetings.
- IPv6 Forum contribution and participation.

Innovation

In the long term case, a new label-based satellite transfer scheme (such as "IP-dedicated", introduced in BRAHMS) over DVB-RCS needs to be considered to show how IPv6 and future NGN services can be most efficiently transported over DVB-RCS.

DVB-RCS is being enhanced with more layer 2 functions to provide flexible and mesh connectivity. This is seen as a good opportunity to show how "IP-dedicated" can make use of these new functions, and show the potential gain of its connectionless transfer mode.

At the IETF, the idea of better encapsulation of IP over MPEG is also gaining momentum. "IP-dedicated" therefore needs to be considered as a potential replacement for the current MPE (Multi-Protocol Encapsulation).

SATIP6 is an essential step for an European answer. It prepares the industrial choice for advanced Broadband Multimedia System. It deals with innovative solutions that have not yet been commercially proposed and will place the European Space Industry in a strong position to compete and succeed in the global market.

Project name: SATIP6
Satellite Broadband Multimedia System for IPv6 Access

Contract no.: IST-2001-34344

Project type: RTD

Start date: 01/03/2002

Duration: 24 months

Total budget: 4.992.020 €

Funding from the EC: 2.496.007 €

Total effort in person-month: 362

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06. LAAS/CNRS	F
07. AQL	F

Key words:
Backbone
IPv6
Mobility
Multimedia
Satellite

Collaboration with other EC funded projects:
6NET
6WINIT
Euro6IX
GEOCAST
MIND
NGN-LAB

Network @ppliances and services for the Home environment

Abstract

The project is dedicated to the promotion of broadband home network and the proof of concept of an open, end to end and seamless network architecture, with the objectives to provide citizens with the emerging IP-based broadband services. The overall network architecture is based on an open service platform which allow technical management of the residential gateway clusters, billing, remote access to home portal and services delivery. The project involves development of an open service platform and its implementation. The overall architecture is based on the OSGi specifications (Open Service Gateway Initiative). IPv6 and its impact on the home network and its architecture is also investigated in @HOM.

Objectives

- To facilitate the introduction of existing or emerging IP-based broadband applications and services.
- To facilitate new opportunities for operators, services providers, content providers to offer high speed value added home services.
- To facilitate for the operator the home network management, from network, services and information system point of view.
- The project will provide:
  - A seamless open architecture, based on OSGI specifications.
  - A web manager for broadcasting, managing and billing services.
  - A remote multi-terminal user access to services.
  - A broadband home network enabling services distribution to the home terminals.
  - A demonstration over ADSL, VDSL and Giga Ethernet Access network.
  - A study and demonstration of end to end IPv6 network.
- Disseminate, liaise and coordinate with clusters, fora, standards organizations (OSGI, ETSI NGN@HOME) and third parties, with particular consideration for interworking and coordination with peer projects.

Figure: General architecture concept

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Technical Approach

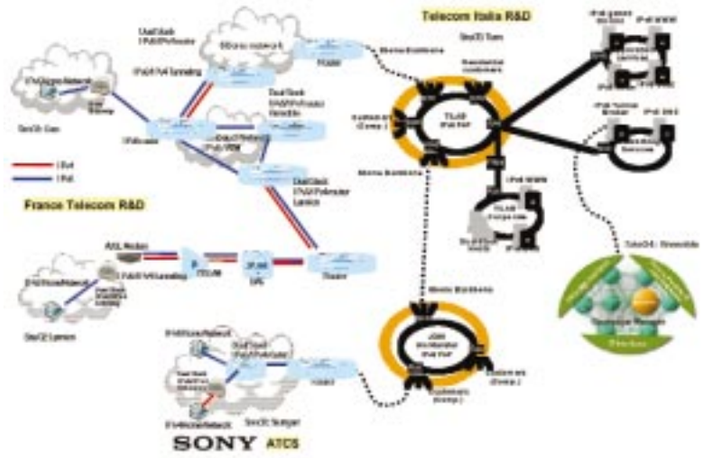
The demonstrator components are:

- The home network.
- The gateway and the OSGI service gateway.
- The OSGI gateway manager located in Grenoble France.
- Services for demonstrations illustration.
- ADSL, VDSL, Giga ethernet access network.

All these components are integrated together in order to provide a demonstration between FT R&D site in France, Tilab site in Turin, Sony site in Stuttgart.

Test-bed

The IPv6 infrastructure is not the primary goal of the project, but nevertheless it is under investigation and will lead to a demonstration. The objective is to understand the benefit of IPv6 in the home network. Tilab site, FT R&D site are connected directly to the 6bone. Some other tunnels are connecting Sony Stuttgart and Opensugar in France. Tilab provides a tunnel brocker in order to provide this interconnection service. The demonstration illustrates end to end services over IPv6 to the home terminal. IPv6 end to end services have been simulated between home networks from two different location in France.



IPv6 Services

Today, IPv6 core protocols are now available, but it is still difficult to applications and services based on IPv6 stacks. Services tested in @HOM IPv6 on line game service (Quake) and IPv6 PM3 streaming, instant messaging services. A collaboration with project developing application over IPv6 will benefit to the domain and could open new perspectives for the 6PCRD call.

Project name: @HOM
Network @ppliances and services for the Home environment

Contract no.: IST-2000-28186

Project type: RTD

Start date: 01/09/2001

Duration: 20 months

Total budget: 3.280.438 €

Funding from the EC: 1.640.218 €

Total effort in person-month: 223

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03. TILAB	I
04. Motorola	F
05. Motorola TCI	I
06. Opensugar	F

Key words:
Broadband services
Gateway
Home Network
IPv6
OSGI

Active Networks Distributed Open Infrastructure Development

Abstract

ANDROID is an Active Networks project whose aim is to design a means of managing active services through the use of policies. In accomplishing this goal, several active Java-based software modules (which we term proxylets) have been developed with an ability to be managed by policies. Policies, together with events that can activate them, are specified in the form of XML messages. Proxylets are dynamically loaded onto active routers or active servers and operate transparently to existing applications to compliment end-to-end flows that transit the network. Examples of proxylets include those that support inter-site multicast reflection, dynamic and incremental VPNs, access control of watermarked flows, and distributed multi-media recording.

The management system and accompanying proxylets have been developed as IPv6 software. Testing has been accomplished over the 6bone between the ANDROID project partners residing in various locations around Europe including the UK, Germany, France, and Greece.

Objectives

- Research in the design of an extensible management system for active services. The system is to be controlled via XML-defined policies that articulate conditions and actions to be taken by proxylets.
- Use and leverage related efforts in policy based management and distributed active edge services that are being advanced in the IETF. Where possible, introduce state-of-the-art approaches from ANDROID into the IETF standards process.
- Disseminate, liaise, and coordinate efforts with related projects and other institutions interested in IPv6 applications and policy based managed active services.

Technical Approach

The success of the ANDROID project is measured against the achievement level of:

- Designing and developing active platforms that can be managed and support the control of active services in the form of proxylets.
- A secure transport service supporting dynamic and incremental VPN(s) that are data-driven and established in an on-demand manner.
- Policy based IPv6 Proxylets that can augment the services of end-to-end flows.
- Simulation of active components to determine their scaling properties.
- Integration and testing of the ANDROID IPv6 software and management architecture over the wide area using IPv6 networks using test beds like the 6bone for inter-site connectivity.
- Managing the project, coordination and complimenting where possible, other related project efforts such as 6WINIT, Alpine and Radioactive.

Innovation

In order for the community to more confidently accept the use of active services, a secure management architecture must exist. The ANDROID project has produced a policy based design that offers management of active services for both routers and servers.

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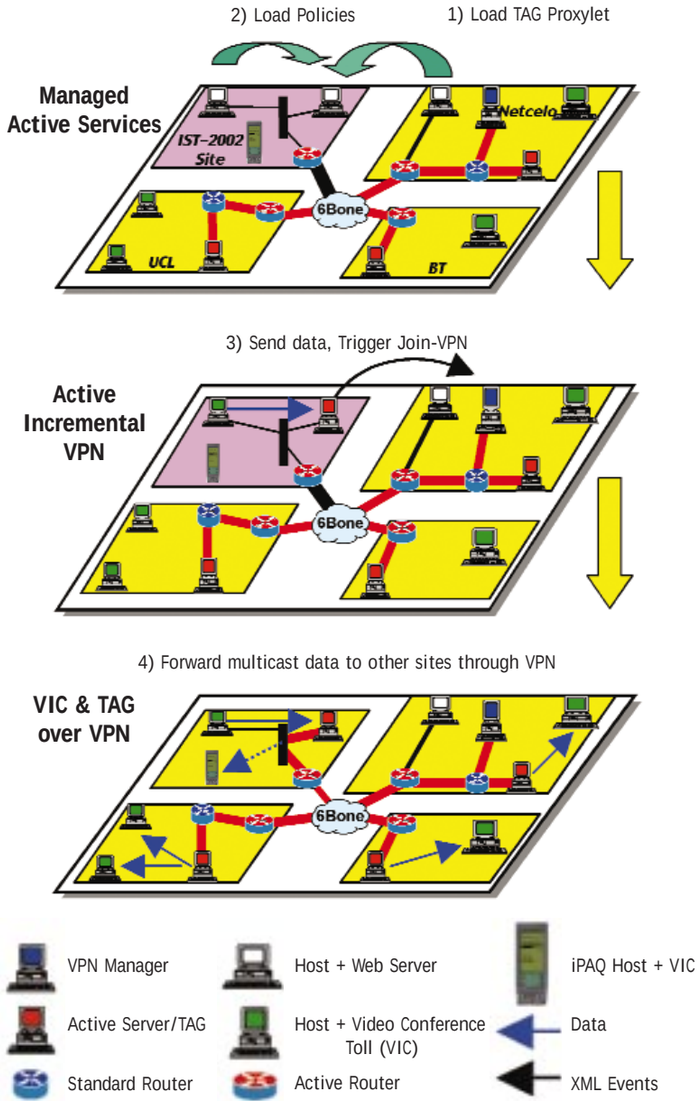
Applications

ANDROID has developed several IPv6 application layer software modules that realize its objective of managed active services. We divide these modules into two categories: management and active services. In the former case, we have developed or employed the following: Management Information Distribution (MID) server, Resource Manager, Security Manager, Resource Discovery, and FunnelWeb. Regarding active services, we have developed: Transcoding Active Gateway, Watermark Reader/Policer, and Multi-Media Conference Recorder (MMCR). Below we show an abstract operation of ANDROID in its construction of a dynamic VPN.



Project name: ANDROID
Active Networks Distributed Open Infrastructure Development

Contract no.: IST-1999-10299

Project type: RTD

Start date: 01/06/2000

Duration: 29.5 months

Total budget: 7.071.295 €

Funding from the EC: 4.197.906 €

Total effort in person-month: 654

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Key words:
Active
IPv6
Mobility
Policy
VPN

Collaboration with other EC funded projects:
6NET
6WINIT
FAIN
TEQUILA

Creation of User Friendly Mobile Services Personalised for Tourism

Abstract

The overall aim of the CRUMPET project is to implement, validate, and trial tourism-related value-added services for nomadic users (across mobile and fixed networks). In particular the use of agent technology will be evaluated (in terms of user-acceptability, performance and best-practice) as a suitable approach for the fast creation of robust, scalable, seamlessly accessible nomadic services. The implementation is based on FIPA-OS; a standards-compliant open source agent framework, extended to support nomadic applications, devices and networks.

Objectives

The main goals of the project are to:

- Develop a service-oriented architecture to establish and deploy flexible tourism services and applications.
- Adapt tourism services to the various QoS levels offered by different bearer services, to changes in physical location, and to other contextual factors such as the characteristics of the terminal in use.
- Develop a generic seamless execution environment across different types of networks and access devices for a range of value-added services within the tourism domain.
- Explore an evolutionary approach to the integration of emerging technologies in this application area, such as the provision of services over mobile cellular networks such as GSM/GPRS/UMTS, wireless data networks such as Wireless LAN and Bluetooth, and including wired data standards such as IPv6.
- Explore the use of contextual information such as presence, location (e.g. GPS), and user-preferences (e.g. service-specific preferences and preferences associated with different contexts), in order to intelligently adapt service delivery.
- Explore the applicability of advanced software techniques, specifically Intelligent Agent technology, for service creation, deployment, distribution, personalisation, and interaction for nomadic users.
- Provide an architecture that supports the distribution and re-distribution of intelligence between smart terminals and smart network elements –this will involve consideration of active network research.
- Evaluate how the system meets the business needs of multiple service providers and network operators (in a competitive environment) and the relationship between them.

Figure: The CRUMPET device

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Technical Approach

The technical approach towards achieving the objectives was to:

- Select and modify services that will be trialled and evaluated by multiple mobile service providers.
- Select and modify service content that is tourism-related, and supports intelligent, anytime, anywhere communication.
- Adapt nomadic services to enable them to respond to underlying dynamic characteristics, such as network QoS and physical location.
- Implement a service architecture that is standards-based and that will be made available at the end of the project as (mostly) publicly available open source code.
- Implement a service that is suitable for networks that will be typical of those that a tourist user might be exposed to now and in the near future (including IP networks, Wireless LAN, and mobile networks supporting WAP technology: GSM, GPRS, and UMTS).
- Implement a service that is suitable for a wide range of terminal types, including next generation mobile phones/PDAs/PCs, and hybrid terminals.

The implementation is being developed using best practice, including an "open source for open standards" platform. The implementation is based on generic re-usable components on an open distributed architecture. During the trial phase of the project, an assessment is being made of the scalability, robustness, and time-to-market advantages of the approach.

Expected Achievements

The main expected achievement is a seamless realisation for tourists of the Mobile Internet that can evolve from GSM, through GPRS, to UMTS, in addition, to WLANs. It represents an evolution of the Internet Portal concept.

Furthermore, the design includes information such as the personalised data recorded about users in a Instant Message Server (IETF IMPP Working Group) relating to the current context that the user is in (such as in the office, in the car, etc.) and the types and associated constraints of the terminals to which they have access.

The system will enable the easy, user-friendly and intelligent handling and use of geographic information for intelligent applications that profit from this information in many ways (specifically tourism in CRUMPET, although the technology developed should be applicable for other domains) over wired and wireless networks.

Innovation

The innovation of this project extends from the many service support development activities, through to the building and operation (including management) of the CRUMPET system, so that it can be used for application trials in 4 countries. For example:

- Developing a service environment that will generically integrate the traditional Internet and wireless services.
- Determining how such a system infers where a user is and what his/her requirements and intentions are according to context information such as location and preferences.
- Enhancing mobile communications technology to allow the delivery of services anytime, anyplace; developing "Smartware" as the distributed intelligent software "glue" that encapsulates the user service needs and adapts and delivers it across the changing transport networks.
- Taking the use of geo-information technology beyond the current thinking of OpenGIS and other research groups, by developing an integrated spatially-enriched information architecture through the intensive use of distributed intelligent agent technology.
- Being the first research group world-wide to use FIPA-style agent communication within a GIS application.

Project name: CRUMPET
Creation of User Friendly Mobile Services Personalised for Tourism

Contract no.: IST-1999-20147

Project type: RTD

Start date: 01/10/2000

Duration: 26 months

Total budget: 3.461.940 €

Funding from the EC: 1.896.574 €

Total effort in person-month: 315,9

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Key words:
Applications
Context-aware services
eTourism
Location-based services

Collaboration with other EC funded projects:
Agentlink
FETISH
Ontoweb
SHUFFLE

Dynamic Radio for IP-Services in Vehicular Environments

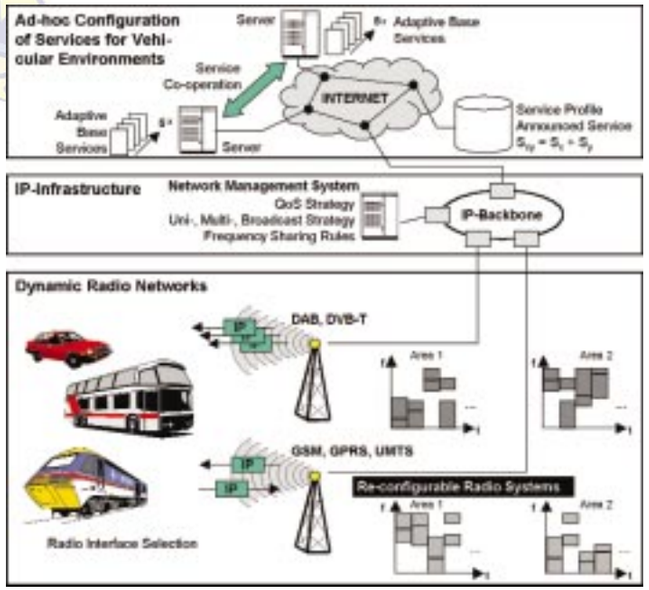
Abstract

The European research project DRiVE (Dynamic Radio for IP Services in Vehicular Environments) aims at enabling spectrum-efficient high-quality wireless IP in a heterogeneous multi-radio environment to deliver in-vehicle multimedia services. DRiVE addresses this objective on three system levels: (1) The project investigates methods for the coexistence of different radio systems in a common frequency range with dynamic spectrum allocation. (2) DRiVE develops an IPv6-based mobile infrastructure that ensures the optimised inter-working of different radio systems (GSM, GPRS, UMTS, DAB, DVB-T) utilising new dynamic spectrum allocation schemes and new traffic control mechanisms. (3) Furthermore, the project designs location dependent services that adapt to the varying conditions of the underlying multi-radio environment.

Objectives

- Design an IPv6-based mobile infrastructure that ensures the Inter-working of different radio systems (GSM, GPRS, UMTS, DAB, DVB-T). The IPv6-infrastructure will provide support for asymmetric communication and for continuous service in case of hand-over.
- Develop methods for dynamic frequency allocation and for coexistence of different radio technologies (GSM, GPRS, UMTS, DAB, DVB-T) in one frequency band to increase the total spectrum efficiency.
- Deliver IP multi-media services to the vehicle. DRiVE develops adaptive services for a multi-radio vehicular environment.
- Demonstrate the key concepts and liaise and coordinate with clusters, fora, standards organizations for dissemination of the results.

Figure: Conceptual view of DRiVE system showing the three areas of investigation: spectrum, network, and application/service aspects.



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Technical Approach

DRiVE is divided in four work packages:

- WP1 (dynamic radio aspects): develops methods for dynamic frequency allocation and for coexistence of different radio technologies (GSM, GPRS, UMTS, DAB, DVB-T) in one frequency band to increase the total spectrum efficiency and reach.
- WP2 (IP-infrastructure): realises an IPv6-based mobile infrastructure that ensures the optimised inter-working of cellular and broadcast networks. The IP-infrastructure will provide support for asymmetric communication, for uni-, multi-, and broadcast, for quality of service and for continuous service in case of hand-over.
- WP3 (services, implementation, and trials): develops adaptive services for a multi-radio vehicular environment, integrates the key concepts of DRiVE developed in WP1&2 to demonstrate them and validate the benefits by user trials and field test.
- WP4 (project management and dissemination): manages the project and coordinates the dissemination of the results, e.g. contribution to standardisation activities.

Innovation

The DRiVE project addresses the convergence of cellular and broadcast networks. It aims at laying the foundation for broadband in-vehicle multimedia services. This is facilitated by an architecture that enables spectrum-efficient high quality wireless IP. The key innovation of DRiVE is the distribution of IP packet streams over the best suitable radio link in a heterogeneous multi-radio environment. In such an environment different radio technologies cooperate in a common dynamically shared frequency range. This will allow a faster penetration of new radio technologies and a more market oriented usage of the available spectrum.

Results

The DRiVE project specified an IPv6 based multi-radio overlay architecture (D04-the deliverable is available from http://www.ist-drive.org/). It ensures full cooperation of cellular and broadcast networks, including AAA functionality, HMIPv6 mobility and continuity of service (D15) and QoS management (D11). The cooperation of multiple access systems requires a common coordination channel (CCC) that announces the available access systems and allows for negotiation between them to distribute the traffic and share the spectrum. The project defined the CCC protocols (D14). DRiVE has developed a mechanism, called “host-controlled flow-based forwarding” to distribute IP packet streams over the best suitable radio link. This concept has resulted in an Internet Draft (draft-soliman-mobileip-flow-move-01.txt) extending HMIPv6.

The DRiVE project developed algorithms for dynamic spectrum allocation and traffic control (D12). Based on the proposal for Dynamic Spectrum Allocation the simulations resulted in an estimation for the increase of spectrum efficiency, both for temporal and regional DSA (D09). The coexistence of DVB-T and UMTS in one frequency band was verified by simulations and measurements (D10). The telecom and broadcast partners produced a first draft of fair sharing rules (D13) to prepare discussion with regulatory bodies (D21).

The project implemented three new location dependent value-added services (D17): city guide, travel companion, and mobile office. In addition two technology demonstrators were built: a “Traffic Information” service demonstrating MPEG 4 video streaming and a “video conferencing” service demonstrating adaptive bandwidth adjustment. DRiVE’s concept of re-usable base services (D06) proved to accelerate the introduction of new mobile services. The demonstration of the DRiVE services and the mobile multimedia car at the IFA2001 fair and IST Mobile Summit 2002 was well received from visitors and press (D05, D16, D18).

The project has been presented at industry fora, such as UMTS forum, DVB project, and Wireless World Research Forum (WWRF), and has thereby triggered new concepts for the convergence of cellular and broadcast systems.

Project name: DRiVE
Dynamic Radio for IP-Services in Vehicular Environments

Contract no.: IST-1999-12515

Project type: RTD

Start date: 01/04/2000

Duration: 24 months

Total budget: 8.718.309 €

Funding from the EC: 4.604.899 €

Total effort in person-month: 728,5

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13. VCON	IL
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Key words:
DSA (Dynamic Spectrum Allocation)
Hybrid networks
IPv6
Multi-access
Multimedia Services

Collaboration with other EC funded projects:
MCP
OverDRiVE

Future Home

Abstract

The Future home project will create a solid, secure, user friendly home networking concept with open, wireless networking specification and will introduce usage of IPv6 and Mobile IP protocols in the wireless home network. The project will specify and implement prototypes of wireless home network elements and service points, develop new services that use capabilities of the network and verify feasibility of the concept in user trial. The networking concept will define wireless home networking platform with network protocols and network elements. It will define the wireless technologies and network management methods for supporting user friendliness and easy installation procedures as well as management of the wireless resources. Ensuring privacy and security in wireless networking is an integral part of concept.

Figure: Flora of home centric applications and services

Scope

The scope of the Future Home project is to define a solid intelligent wireless home network solution that would offer desired services and privacy for consumers. This home network system will allow both the high-speed media transportation and low speed control and automated information flow. The intelligent auto-configurable connections between devices and terminals in the home as well as the interoperability with the external world are essential features of the home network.

Objectives

The objective of the project is to introduce the intelligent communication platform that promotes the concepts of “ubiquity” into the home. The people at home will be able to move, control, communicate and enjoy the entertainment without noticing the underlying technologies or networks. The homes can then be designed with a goal of supporting an efficient lifestyle while offering extreme comfort for all citizens. The fruits of communication technology and information technology for homes will significantly improve our quality of life by enabling a richer and more active residential existence, maintaining the mental and physical health, guaranteeing safety at home and ensuring the necessary privacy of family life.

Information Society Technologies

The vision of the advances of intelligent home network and its services, have existed for several decades, but those have not been able to become reality yet, although most of technologies have been available for a while. One of the reasons for the situation is fragmentation of home technology field and missing overall concept for home networks. On the other hand many possible network technologies have been designed for other purposes and are not suitable, as such, for home networking. When the pieces have not been working together and when some pieces are still missing, the launch of home network markets has not been able to take off. To make this happen, serious concerns should be taken, to create a solid home network concept.

The main objectives of the project are to:

- Define business models and the market and end user requirements on home networks as well as the technical requirements.
- Define a solid wireless intelligent home networking architecture based on IPv6 and other proposed wireless communication and network solutions that fulfils the requirements.
- Define a open and scalable home network base station concept that allow intelligent automated control and management of the home network.
- Define generic device interfaces that enable home appliances, devices and terminals to be automatically connected in an intelligent way to the wireless network.
- Validate the proposed solution by building a prototype of the wireless intelligent home network and testing it with selected user groups.

By introducing the usage of IPv6 in residential environments it is possible to solve important issues –such the ease of installation of the network to a level of complete transparency for the user; the QoS of control, voice and video contents; the security and privacy of communication and interoperability with external communication world. Connection of Media terminals and PCs.

The definition of generic device interfaces will make it easy and cost effective to insert intelligence and communication capabilities in home appliances and will accelerate the appearance of these on the market. The state of art wireless home network concept, that will be created by Future Home project, will gain the launching of markets for home networks and intelligent appliances and will lower the threshold of adoption by final users.

Project name: Future Home

Contract no.: IST-2000-28133

Project type: RTD

Start date: 01/10/2001

Duration: 30 months

Total budget: 7.000.000 €

Funding from the EC: 3.500.000 €

Total effort in person-month: 652

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Key words:
IPv6
Mobility
Wireless

The pan-European Gigabit research network

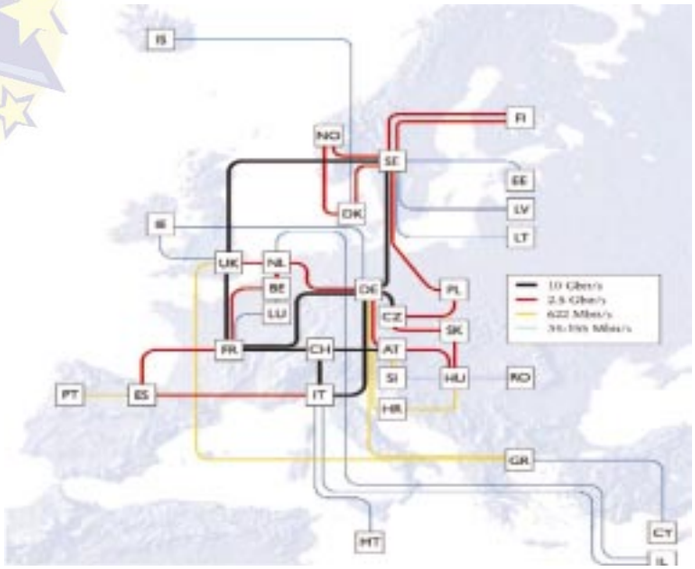
Abstract

GÉANT will provide pan-European interconnection between National Research and Education Networks (NRENs) in Europe at Gigabit speeds, based on direct access to optical connectivity where this is available in the market. Core connectivity procured will be 2.5 Gbps, enhanced to tens of Gbps, as soon as possible. The network will be extended from the current geography of TEN-155 to include connectivity to Cyprus, Israel and Poland and to extend it to Bulgaria, Estonia, Latvia, Lithuania, Romania and Slovakia. Services will include a standard IP service, a premium IP service, a Guaranteed Capacity Service and Virtual Private Networks. Multicast and, later, new value-added services arising from networking developments will also be offered. A European Distributed Access will provide connectivity between European researchers and their counterparts in other world regions.

Objectives

The key objective of GÉANT is to provide a very high performance, advanced, pan-European network service interconnecting the services provided by Europe's National Research and Education Networks (NRENs). It will support the development activities of the European research and education community, including the development of new advanced applications and the exploitation of new networking capabilities. GÉANT will create a ubiquitous infrastructure interconnecting the participating NRENs based on shared core connectivity operating at 2.5 Gbit/s initially and in the range of tens of Gbit/s within four years. It will maintain and develop a stable and dependable set of services on which a large and diverse end user community can rely. GÉANT will initiate a set of service developments that are needed to provide predictable Quality of Service. Consistent operational procedures will be set up to manage QoS mechanisms across multiple management domains.

Figure: GÉANT Network



Technical Approach

A competitive tender was organised for the provision of circuits with capacity in the range 2.5 to tens of Gbit/s and other appropriate capacity where Gbit/s was not offered competitively; telehousing; and network management services. Following the completion of this major milestone, implementation plans were refined based on a knowledge of the response to the ITT. A core transmission network with capacities of 2.5 and 10 Gbit/s initially, with possible future upgrades to tens or hundreds of Gbit/s later has been implemented, involving in addition the procurement of new equipment, installation of new PoPs, integration of existing TEN-155 connectivity and the design of a mixed technology network which supports IP services over optical transmission between core locations together with IP over SDH elsewhere and the support of guaranteed capacity and VPN capability at all network nodes. Connections have been made to all partners which were not already connected to TEN-155. GÉANT PoPs have been established in all of these and in existing TEN-155 countries. A cost sharing model has been defined. Research networks from other world regions may establish interconnections with GÉANT via a European Distributed Access in order to allow academic and research collaborations between Europe and other continents to be given high performance network support. Ways are being devised of providing the capability for guaranteed QoS at the IP level. Systems for the management of interworking with equivalent NREN services are currently under development. A specification of a premium IP service which matches the requirements of the NRENs and their end users and an implementation plan (including management and accounting systems) will be produced. Traffic measurement facilities have been installed at all nodes. Some activities are continuous: operation of the GÉANT services, operation by the NRENs of their access to GÉANT, promotion of use of the network. Comprehensive reports on usage are produced monthly; annual reports will each include a review of the whole activity.

IPv6 Support

It is expected that demand for the use of IPv6 will increase and that better software implementations to support it will become available over time. It is likely that a migration to the general use of IPv6 will take place during the four year contract period in. In parallel with the GÉANT network deployment, a subset of NRENs is participating in another EC funded RTD project, dedicated to the deployment of broadband IP services on a dedicated infrastructure closely connected to the GÉANT network. This project, called 6NET, will allow, during its lifetime, the support of a smooth implementation of IPv6, as a second protocol, which will then become available to all GÉANT users by the end of the GN1 contract.

Project name: GÉANT
The pan-European Gigabit research network

Contract no.: IST-2000-26417

Project type: RTD

Start date: 01/11/2000

Duration: 48 months

Total budget: 200.000.000 €

Funding from the EC: 80.000.000 €

Total effort in person-month: 587

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15. IUCC	IL
16. KTU	LT
17. NORDUnet	DK
18. MCYT	E
19. PSNC	PL
20. RENATER	F
21. RESTENA	LU
22. RoEduNet	RO
23. SANET	SK
24. SWITCH	CH
25. UKERNA	UK
26. SURFnet	NL
27. UoM	MT

Key words:
Gigabit
Network
Research

Collaboration with other EC funded projects:
6LINK
6NET

Hybrid Access Reconfigurable Multi-wavelength Optical Networks for IP-based Communication Services

Abstract

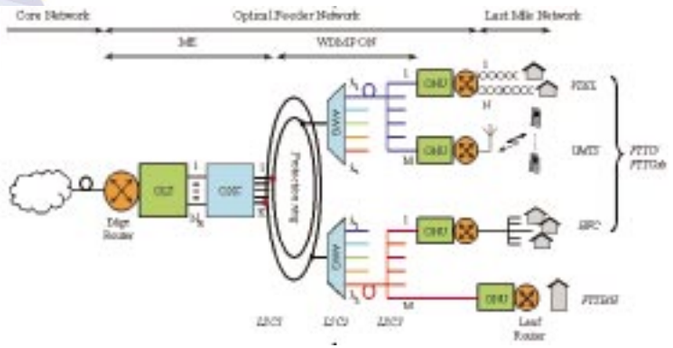
A common dynamically reconfigurable fibre infrastructure is proposed, deploying flexible wavelength routing integrated with flexible time slot allocation in a new Medium Access Control protocol. This infrastructure feeds various last-mile access networks, and provides capacity on demand while accounting for Quality of Service requirements of user traffic. An adaptive resource manager supports the MAC protocol, and aligns traffic flows with core and last-mile network capabilities. Both a wireless HIPERLAN2 and a twisted-pair VDSL user access network enabling QoS-differentiated IP traffic will be set up. Novel optical modules will be developed, such as a fast flexible wavelength router. The results of architecture studies and techno-economic analyses will e fed into consensus building activities and standardisation bodies. After being validated in laboratory trials, the system will be operated in a field trial with real users and IP-based QoS-sensitive services.

Objectives

The main objective is to stimulate the convergence of access networks; supported by:

- A dynamically reconfigurable fibre-based feeder network infrastructure, supporting a wide variety of last-mile customer access networks.
- A packet-based WDMA/TDMA MAC protocol, offering capacity-on-demand.
- Control plane protocols for a range of QoS classes for IP-based services.
- The techno-economical aspects of the system concept and alternatives.
- Evolution strategies leading to convergence of hybrid access networks.
- Novel optical system modules supporting the WDMA/TDMA system concept.
- To evaluate the key functionalities of the system in a laboratory test-bed.
- To demonstrate the viability of the system in a field trial involving real-life IP-based services and real users, and to evaluate the users' experiences.

Figure: Harmonics Architecture



Technical Approach

System and Network Architecture

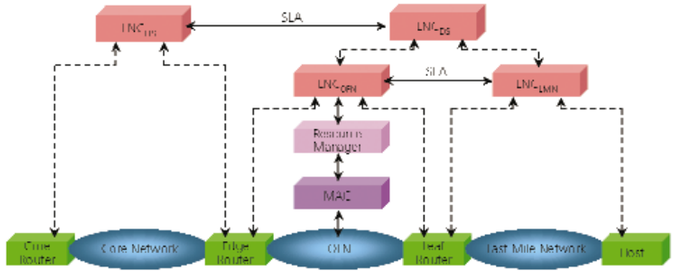
Various access network architectures are analysed based on a shared-fibre infrastructure (e.g. PON) feeding a range of last-mile customer access networks (deploying twisted pair, coaxial cable, wireless drops). It is studied how flexible wavelength routing supports provisioning of IP-based services with different QoS classes and how it accommodates strongly varying traffic. Gradual migration scenarios from today's access networks towards these DWDM reference networks are analysed, regarding techno-economical feasibility.

Network Management and Resource Control

The Control Plane for managing the adaptive allocation of the network's resources is designed, and a new medium access control protocol which deploys both the wavelength and time dimension to obtain a fast and efficient medium access.

IP quality of service is ensured by a developed management architecture, consisting of diffServ Layer Network Coordinators (LNC) for each administrative domain, and technology depend LNCs for each underlying network segment. These components translate IP flow requests into lower level configurations.

Figure: IP Management Architecture



Novel Optical System Modules

The following modules are developed:

- Optical cross-connect (including fast-switchable gate arrays).
- Multi-wavelength bi-directional optical fibre amplifier.
- Protection switches for ring network protection.
- Low-cost ONU (with spectral slicing, or reflective modulation of remotely generated light).
- Multi-wavelength Optical Line Terminal (OLT).

Last-Mile Access Networks

A variety of customer access networks is studied, focussing on IP-based services with various QoS classes. A HIPERLAN2 wireless interactive broadband in-door access system, and a VDSL system, are adapted to interface with the flexible DWDM fibre feeder network.

System Integration and Experiments

The system modules are tested in a laboratory set-up. Based on the results, the modules are refined, and subsequently evaluated. The modules are installed in a field trial, where experiments are run with real users and IP-based services.

Project name: HARMONICS Hybrid Access Reconfigurable Multi-wavelength Optical Networks for IP-based Communication Services

Contract no.: IST-1999-11719

Project type: RTD

Start date: 02/04/2000

Duration: 36 months

Total budget: 8.868.083 €

Funding from the EC: 4.556.610 €

Total effort in person-month: 725

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Key words: Hybrid Access IPv6 QoS WDM PON

Collaboration with other EC funded projects: OPTIMIST

Advanced architecture for INTER-domain quality of service

Abstract

In order to enhance the inter-domain QoS analysis in large-scale, multi-domain Internet (IPv4, IPv6) infrastructures, the project INTERMON will develop and demonstrate a scalable inter-domain QoS architecture with integrated monitoring, topological and geographical structure mapping, modelling, simulation, optimization and visual data mining components using common distributed QoS data base with intelligent agents for management of component's interworking and automated processing of different kind of inter-domain QoS information (inter-domain QoS, traffic, resource, events).

The focus is to offer to Internet service providers (ISP), QoS enabled end system developers and application users, an integrated inter-domain QoS analysis architecture for the purpose of operative control, planning and optimization.

Objectives

The aim is a novel scalable inter-domain QOS analysis architecture for large interconnected Internet domains (DiffServ, IntServ, MPLS) based on integration of monitoring, modelling, structure mapping, simulation, optimization and visual data mining components using a common distributed database with intelligent agents for management of toolkit interworking and automated processing of different kind of inter-domain information (e.g. monitoring and modelling information for long term trends and short experiments on inter-domain QOS and traffic behaviour of application classes, visualization models for inter-domain QoS, inter-domain QoS optimization models, inter-domain network performance, resource and event information, etc).

Figure: INTERMON objectives

Project Description

1. Definition of inter-domain QoS analysis framework for test and verification of inter-domain QoS of application classes (e.g. Internet telephony, content and videoconferencing, etc) in large interconnected QoS based domain infrastructures.
2. Design of scalable inter-domain QoS analysis architecture with integrated monitoring, topological and geographical QoS structure mapping, modelling, simulation, optimization and visual data mining components using common distributed QoS database.
3. Implementation of a prototype of integrated inter-domain QoS analysis architecture:
   - Distributed inter-domain database with intelligent agents for management of tool interworking and automated information processing.
   - Integrated inter-domain QoS monitoring toolkit including passive monitoring, active probing tools and event detection tools.
   - Modelling toolkit including algorithms and tools (long term trend and short term experiments) for prediction of inter-domain QoS for application classes, network performance models, event patterns, traffic profiles.
   - Automated mapping of Internet topological and geographical structures including options for mapping of inter-domain QoS, traffic, resource, events and network performance issues to autonomous systems (BGP routing), countries, equipment (multiple IP addresses map to the same router), and geographic location information (latitude/longitude coordinates).
   - Simulation environment for inter-connected QoS based domain (MPLS, DiffServ, IntServ) infrastructures and QoS enabled application classes combined with optimization toolkit.
   - Visual data mining environment (models, tools and advanced multidimensional techniques) for specific kind of inter-domain QoS and traffic analysis.

Innovation

The project INTERMON is addressing one of the most important and complex problem facing the telecommunications community today, namely inter-domain QoS management and network tomography by integration of measurement and modelling techniques for large scale QoS and traffic analysis in inter-connected domain infrastructures. The approach taken by the project is to provide a comprehensive solution in form of an innovative advanced architecture for inter-domain QoS monitoring, modelling and visualization by bringing together expertise in measurement and monitoring technologies, mathematical and statistical modelling, simulation, visual data mining and data base operation. The INTERMON architecture is aimed at integrated QoS (Quality of Service) monitoring, analysis and modelling of application traffic in inter-domain environment using data base and visual data mining facilities.

INTERMON features address the automated measurement and modelling of QoS and border router traffic for different time scales as well as visual data mining relating statistics and models describing end-to-end and inter-domain QoS as well as border router traffic. Concepts like "spatial composition" of inter-domain QoS and "policy-based" performance measurement and traffic collection are considered.

The key innovation points of INTERMON architecture are focussed on:

- Integration of tools for automated Internet structure analysis, monitoring, modelling and visual data mining using common data base for the purpose of QoS monitoring and verification in an inter-domain environment.
- Data base design and data mining to support requirements for spatial composition of inter-domain QoS and automated producing of monitoring, modelling and analysis reports considering different aggregation interval.
- Novel architecture concept with flexible import/export interfaces for measurement and modelling data (QoS, traffic).

Applications

- Inter-domain traffic and QoS measurement, modelling and analysis.
- Visual data mining for inter-domain traffic and QoS behaviour.
- Inter-domain traffic engineering and capacity planning.
- QoS and SLA monitoring and modelling in inter-connected domains.
- Inter-domain QoS and traffic simulation.

Project name: INTERMON
Advanced architecture for INTER-domain quality of service

Contract no.: IST-2001-34123

Project type: RTD

Start date: 01/04/2002

Duration: 24 months

Total budget: 5.093.335 €

Funding from the EC: 2.800.000 €

Total effort in person-month: 443,1

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12. CINI-ITME	I

Key words:
Inter-domain QoS
Simulation
Spatial composition
Traffic Analysis
QoS Modelling
Visual data mining

Collaboration with other EC funded projects:
Aquila
Cadenus
NGNi

Management of End-to-end Quality of Service Across the Internet at Large

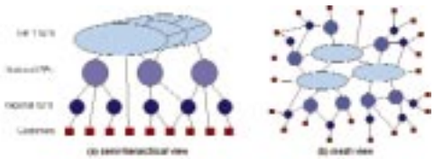
Abstract

MESCAL aims to propose and validate scalable, incremental solutions that enable the flexible deployment and delivery of inter-domain Quality of Service (QoS) across the Internet. This involves developing: templates, protocols and algorithms for establishing Service Level Specifications (SLS) between Internet Service Providers (ISP) and their customers, including their peers; scalable solutions for inter-domain Traffic Engineering (TE) based on enhancements to the existing Border Gateway Protocol (BGP) routing protocol and associated route selection logic. MESCAL will consider both unicast –and multicast-based services and ensure that the proposed solutions are applicable to both IPv4 and IPv6.

Project Rationale

In today's Internet, there are numerous relationships between a multitude of stakeholders who are each responsible for part of the provision of end-to-end connectivity and value-added services. Service and content providers rely on connectivity services provided by what could be termed a loose federation of organisations, which together provide end-to-end connectivity across the global Internet. No single organisation is responsible for vertical integration, in terms of applications over service providers over network connectivity, or horizontal integration, in terms of global geographical coverage.

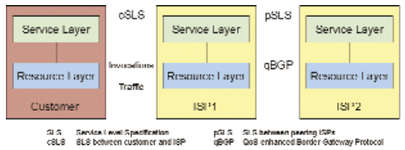
Figure 1: Many autonomous systems are involved in end-to-end service provision



A major limitation of the Internet is its lack of service level guarantees due to its basic design for best-effort packet delivery. The introduction of the IP Differentiated Services framework and subsequent research and standardisation efforts, represent significant progress on solving the problem of QoS delivery in a single domain for unicast traffic. However, inter-domain communication and information access is the rule rather than the exception, and extensive deployment of QoS-based services will not take place unless they can be offered across domains. The provision of end-to-end QoS is a wide-open research issue whose solution will transform the Internet to the global multi-service network of the future.

MESCAL views two major aspects as essential to the deployment and delivery of inter-domain QoS-based IP services: the definition of QoS-based connectivity services to be provided by stakeholders; and second, the means to engineer network resources to meet agreed performance and capacity targets for the contracted services. Together, these two dimensions aim at providing the means for a dynamically configurable Internet, with service requirements driving traffic engineering to meet end-to-end service demands.

Figure 2: Inter-domain interactions at service and resource layers



Information Society Technologies

Objectives

MESCAL's key objective is: to propose and validate scalable, incremental solutions, enabling flexible deployment and delivery of inter-domain QoS across the Internet at large, with the following sub-objectives:

- To develop business models, based on current commercial practice and emerging business scenarios, describing the roles of and relationships between the stakeholders involved in providing QoS-based services across domains.
- To specify a generic, multi-domain, multi-service functional architecture for the flexible deployment and delivery of inter-domain QoS-based services.
- To develop templates, protocols and algorithms for the specification, negotiation, subscription and invocation of QoS-based IP services between customers and ISPs and between peer ISPs.
- To enhance existing inter-domain routing protocols and algorithms and to investigate new approaches to convey QoS information to enable scalable inter-domain traffic engineering solutions.
- To examine the impact of:
  - IPv6 on inter-domain traffic engineering and to ensure that the TE solutions proposed by the project are applicable to both IPv4 and IPv6 infrastructures.
  - Both unicast- and multicast-based services on inter-domain TE.
  - Inter-domain aspects of SLS management and TE on corresponding intra-domain aspects, and vice versa, and to investigate the cooperation required between them.
- To adopt a policy-based approach to service provisioning and network operation and investigate policies for SLS negotiation, admission, and inter-domain TE.
- To evaluate and validate the devised algorithms and protocols through simulation and test-bed prototypes.
- To contribute to international standardisation efforts, especially the IETF, and to participate in other consensus-forming activities in the IST programme.

Project Organisation

The project is structured around four Work Packages:

- WP0, Project Management and Coordination of External Liaison, is concerned with the administrative and technical management of the project, including liaison with other projects and coordination of dissemination and standardisation.
- WP1, Specification of Functional Architecture, Algorithms and Protocols, is responsible for defining a business model and a generic, multi-domain, multi-service IP QoS functional architecture for inter-domain QoS delivery. The main output will be the specification of algorithms and protocols for negotiation and establishment of inter-domain SLSs, inter-domain TE and routing, including the required interactions with intra-domain TE and route computation capabilities to achieve inter-domain QoS delivery.
- WP2, System Design and Implementation, will enhance experimental routers and simulators to support the inter-domain QoS requirements of the project. Based on the specifications from WP1, WP2 will design and implement the specified algorithms and protocols, as both test-bed prototypes and simulation tools/models. WP2 will deliver prototypes and simulators to WP3 in an incremental way to allow experimentation activities to take place.
- WP3, Integration, Validation and Experimentation, is responsible for setting-up the required experimentation infrastructure and for performing validation and performance evaluation activities on the prototypes and simulators developed by WP2. The test-bed experiments are focussed on proof-of-concept validation, while the simulation experiments aim at assessing the performance and scalability of the project's inter-domain solutions.

Project name: MESCAL
Management of End-to-end Quality of Service Across the Internet at Large

Contract no.: IST-2001-37961

Project type: RTD

Start date: 01/11/02

Duration: 30 months

Total budget: 3.330.071 €

Funding from the EC: 2.096.009 €

Total effort in person-months: 305

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Keywords:
Inter-domain
Internet
QoS
SLS
Traffic Engineering

Collaboration with other EC funded projects:
To be determined once the project has started

Mobile IP based Network Developments

Abstract

MIND takes as a starting point the concept of an IP core, accessed by a variety of technologies. Research is conducted in the areas of services and applications, the access network architecture and the air interface.

The project investigates new business models for "systems beyond 3G" mapping the value chain into the functional entities. Suitable mechanisms for authentication, security and accounting over novel network topologies are considered. These new topologies include ad hoc and self-organizing networks connected to a fixed full IP-based radio access network. The work done within the predecessor project BRAIN to provide micro-mobility and QoS in the radio access network is extended and completed to support these new topologies in MIND.

MIND is intended to complement other access systems (e.g., UMTS). To this avail, vertical handover (handover between different access technologies) is studied and multi-homing terminal concepts are analyzed.

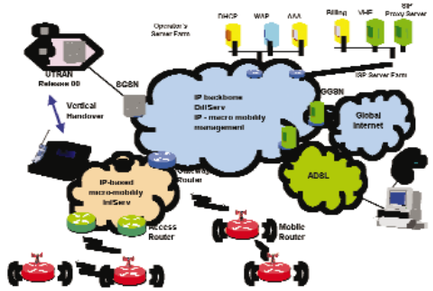
The MIND access network allows the connection of a generic radio interface to an IP core network. A layer 2-3 interface has been defined to hide the radio technology specific elements to the higher layers and yet provide them with the necessary information for an efficient management of mobility and QoS. The project centers its air interface investigations on WLAN technologies for providing coverage to hot spot areas. Solutions for dynamic frequency and resource allocation mechanisms for supporting ad hoc and self-configuring networks are dealt with. A service specific convergence layer for IP for HIPERLAN/2 has already been specified. Proposals for extending range and supported velocities from WLANs are studied as well.

Besides the conceptual work detailed above, the project is conducting trials on key concepts studied in the predecessor project BRAIN.

Objectives

- To facilitate the rapid creation of broadband multimedia services and applications that are fully supported and customised when accessed by future mobile users from a wide range of wireless access technologies.
- To extend the concepts of IP mobile networks. This includes: new network topologies –ad-hoc, self-organising and meshed networks; enhanced support for QoS, ad-hoc networks and self organisation at all layers of WLANs; QoS support in IP-based mobile networks; investigation of the spectrum requirements for systems beyond 3G.
- The project researches the use of WLAN and an IP-based access network as a complement to UMTS for high bandwidth provision in hot spot areas.
- To contribute actively to standards bodies and industry forums.

Figure: The MIND Achitecture



Technical Approach

The key issues studied in MIND include:

- To investigate new business models beyond 3G –mapping the value-chain into the functional entities required for rapid and flexible multimedia service creation and support.
- To provide support –QoS, mobility management and security– for ad-hoc and self provisioned sub-networks attached to a fixed IP network.
- To investigate the generic support required at the layer2/3 interface for vertical handover and multi-homing.
- To investigate how the range and performance of WLANs can be increased to make it suitable for a wider range of scenarios including ad-hoc networks and supporting a full range of user QoS.
- To integrate a trial environment including systems such as WLAN (e.g. HIPERLAN/2), UTRA and IPv6 based core network test-beds.

Test-bed

MIND will trial key concepts defined during the predecessor project BRAIN:

- Service concepts: the MIND trial experiments with different applications and implements a computer-supported collaborative work application able to handle adaptation to the network, as well as QoS and mobility support.
- Network concepts: with the aim of providing a full mobility management solution, the BRAIN Candidate Mobility Protocol (BCMP) is implemented. This protocol fulfils the requirements for Handover, Paging and Scalability and Resilience in a Wireless LAN environment, and it improves on existing gateway-centric protocols for Path Updates. This protocol can be run on top of both IPv6 and IPv4 WLAN networks. The base-line architecture for QoS trialed provides a scalable complete solution for QoS. The solution clearly separates the network (layer 3) QoS providing mechanism from the (layer 4) end-to-end signalling. A set of extensions to the QoS base-line architecture directed at achieving seamless handover is experimented.
- Radio interface concepts: A test bed is used to verify the basic link layer performance of OFDM based WLANs and proposed enhancements. The inter-working between BRAIN access networks and UMTS is addressed by testing vertical handovers at IP layer between the IP access network and UMTS networks.

Innovation

MIND develops further the concepts elaborated by the IST project BRAIN and, thus, shows a path towards beyond 3G systems. It designs an access system which is optimised across application, network, and air interface layer with regard to QoS and mobility management taking into account the requirements of future mobile users. The resulting MIND trials will allow the validation of key concepts and protocols, including mobile applications exploiting high data rates, QoS negotiation between terminals and the access network, IP handovers, and integration with IP core networks over well defined interfaces. The main conceptual work of MIND includes investigations of the performance limitations of the current WLAN standards in terms of range and mobility, to reduce the gulf between it and the UTRA air interfaces and investigations of the way in which ad-hoc and self organising networks can be supported, including the meshed (multi-hop) case and integration with wired networks.

The results of the MIND work are disseminated through conferences, workshops, journals, and through the Internet.

Project name: MIND
Mobile IP based Network Developments

Contract no.: IST-2000-28584

Project type: RTD

Start date: 01/06/2001

Duration: 18 months

Total budget: 8.685.714 €

Funding from the EC: 4.423.000 €

Total effort in person-month: 664

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05. FT	F
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07. Nokia Corporation	FIN
08. NTT DoCoMo	JP
09. Sony	D
10. T-Nova	D
11. UPM	E
12. Infineon	D

Key words:
IP RAN
Systems beyond 3G
WLAN

Collaboration with other EC funded projects:
I-METRA
SHAMAN
TONIC
WSI

Mobility and Differentiated Services in a Future IP Network

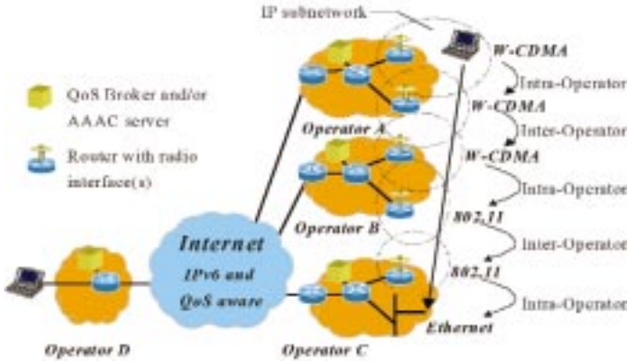
Abstract

In order to continue the evolution of the 3rd generation mobile and wireless infrastructures towards the Internet and targeting the Key Action IV "Terrestrial Wireless System and Networks" of the IST Programme, the Moby Dick project develops, implements, and evaluates an IPv6-based mobility-enabled network architecture with Authentication, Authorisation, Accounting and Charging (AAAC) services and support for Quality of Service (QoS). The framework network architecture integrates separate IETF models for support of Mobile IPv6, QoS, and AAAC. A representative set of interactive and distributed multimedia applications is used to derive the system requirements for verification, validation, and demonstration of the integrated architecture in a test-bed comprising different access technologies: W_CDMA, 802.11 Wireless LAN and Ethernet. Where the existing applications or the IETF models do not provide what is required, the necessary extensions and modifications are provided.

Objectives

- Definition of a common architecture integrating QoS, IPv6 mobility, and AAAC out of the separate architectural approaches proposed by IETF, with special focus on wireless problems.
- Implementation and evaluation of an IPv6-based network to fulfil the requirements of present and future mobile communication services.
- Implementation and evaluation of the QoS model based on Differentiated Services in a heterogeneous network topology and dynamic environment, in contrast to current QoS models, typically restricted to relatively static environments.
- Definition of a suitable charging concept which would enable mobile IP based services on a large scale to complement the areas currently out of scope of IETF.
- Trans-European trial to test the implementations by SOCRATES-ERASMUS exchange students and learn their perception of the system.
- Active participation in Internet Research Task Force (IRTF), Authentication, Authorisation, and Accounting Architecture working group (AAAArch), and monitoring standardisation bodies, including European Telecommunications Standards Institute (ETSI), 3rd Generation Partnership Project (3GPP), Mobile Wireless Internet Forum (MWIF), The Institute of Electrical and Electronics Engineers (IEEE) –in particular 802.11 group. Follow and actively influence ongoing relevant IETF standardisation activities, especially in the working groups.

Figure: The Moby Dick Network



Information Society Technologies

Technical Approach

The Moby Dick consortium brings together companies and research institutes with a strong background in telecommunication technologies, Internet technologies, and network operation. This expertise is used to define a converged network architecture for future data and voice telecommunication, a solution that goes beyond UMTS Release 99/2000. Moby Dick aims to present and discuss the emerging architecture in public, and to promote it in the research community and standardisation groups. The Moby Dick develops a prototype environment for tests and evaluation. The evaluation will be carried with real services and real users.

Test-bed

Moby Dick will perform international trials in two different sites: Madrid in Spain and Stuttgart in Germany. SOCRATES-ERASMUS students (http://www.esn.org) will use the infrastructure for ubiquitous access to network resources and for voice communication.

The trials will test different scenarios based on synchronous (VoIP and telelearning) and asynchronous (access to administrative information, digital libraries, etc.) applications. Moby Dick will perform tests in three phases in order to learn feedback from the experiments and to master the network capabilities. First tests will be focussed on local tests of the Moby Dick prototype network. The second set of tests will include unicast applications based on VoIP, tele-education, and database access between the two trial sites with expert users only. The final tests will include unicast and multicast applications and SOCRATES-ERASMUS students in a real life scenarios.

The main objectives of the trials are as follows:

- To propose and demonstrate a converged and coherent All-IP(v6) network infrastructure able to federate heterogeneous wireless access networks.
- To evaluate in a test-bed and with representative applications the different access network technologies.
- To integrate and validate the proposed integrated network architecture in various real life scenario.

Innovation

With the transmission capabilities vastly upgraded thanks to photonisation, it is time to bring the benefits of new Internet services closer to the mobile user. This is addressed by first providing a wireless network platform and a service architecture and applications for supporting mobility.

The definition, implementation, and evaluation of an IPv6-based mobility-enabled end-to-end QoS architecture starting from the IETF's QoS models, Mobile-IPv6, and AAAC framework, carried out by Moby Dick, will provide a major contribution to a Terrestrial Wireless System and Networks technology discipline, which has the profound impact on the socio-economic situation of the general public including both institutional and individual users.

Some of the main Moby Dick innovative aspects:

- Definition of a common architecture integrating QoS, IPv6 mobility and AAAC (out of the separate architectural approaches for each component currently provided by the IETF).
- Implementation and evaluation of an IPv6-based technological approach to fulfil the requirements of present and future mobile communication services.
- Implementation and evaluation of QoS models in highly dynamic network topologies (understanding of QoS models is normally restricted to relatively static environments).
- Definition of a suitable charging concept which would enable permanent mobile IP based services on a large scale.

Project name: Moby Dick
Mobility and Differentiated Services in a Future IP Network

Contract no.: IST-2000-25394

Project type: RTD

Start date: 01/01/2001

Duration: 36 months

Total budget: 8.950.000 €

Funding from the EC: 4.720.000 €

Total effort in person-month: 818

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03. UC3M	E
04. ETH Zürich	CH
05. U. of Stuttgart	D
06. Fraunhofer G.	D
07. PTIN	P
08. Motorola	F
09. EURECOM	F
10. AGH Univ. Tech.	PL
11. FTW	A
12. CWC	SG

Key words:
AAAC
Mobile IPv6
Mobility
QoS

Collaboration with other EC funded projects:
6WINIT
GÉANT
LONG
MIND

Next Generation Network Initiative

Abstract

The projects prime mission is to establish an appropriate infrastructure to operate the first European open environment for research organisations and industry to investigate a broad range of topics and issues covering NGN evolution, and create opportunities for strategic discussions on a global scale. The project is open for all organizations to share their opinion and discuss the issues in an open framework. The project has invited interested institutions to enroll as members in order to contribute to the objectives of this initiative by producing technology benchmarking, road maps and establishing a close liaison with the global forums.

Objectives

The NGN Initiative's mission is to establish the infrastructure to operate the first open environment in Europe, where research on the whole range of Next Generation Networks (NGN) topics can be discussed, consensus achieved and collective outputs disseminated to the appropriate international standards bodies, fora, and other organisations. It seeks to build momentum on top of as many R&D actions as exist in the broad domain of NGN. Being of worldwide interest, it is inevitable that some of the Internet-related topics addressed here will also be covered in the US Next Generation Internet (NGI) programme. This creates an opportunity for strategic discussions to take place on this subject on a global scale.

The project will bring additional value to the IST Programme by solving complex multi-disciplinary problems through the involvement of a variety of projects acting in a complementary manner. It will also encourage and support the production and submission of collective contributions to standards; a key process for deriving European advantage.

A further objective of creating this environment is to give IST NGN projects –and the European research community in general– a strong collective voice and a structure, through which industry and user awareness of NGN work and achievements in Europe will be dramatically improved.

The project will therefore encourage the creation of high quality and secure Next Generation Networks, allowing equitable access to knowledge and technology.

Sub-objectives that collectively combine to achieve the objectives identified above are to:

- Establish a European-driven (but open, internationally) initiative of NGN expertise that will be a catalyst function for clustering activities associated with IST projects, especially from the Units E1, E4 and Research Networks (RN).
- Benchmark the results from NGN projects in IST against activities and developments in the rest of the world.
- Disseminate the collective achievements from the IST Programme. I.e:
  - Produce and submit collective contributions to standards; a key process for deriving European advantage, and an activity strongly supported by the large industrial partners in the project.
  - Produce roadmaps describing trends and forecasts relating to NGN issues, taking into account the several coinfluencing aspects of NGNs.
  - Identify convergence opportunities offered by new developments.
  - Identify innovative solutions as a result of having an overview of many technologies.

Technical Approach

The technical approach to achieve these objectives has 3 key components:

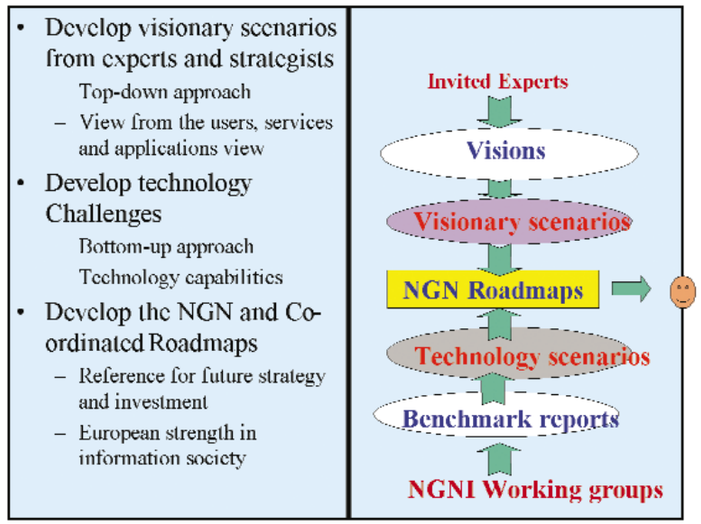
- The creation and maintenance of the infrastructure needed to support the project activities, and strategic liaison.
- The performing of technical activities related with the production of standards, benchmark reports and evolutionary roadmaps.
- The building of a critical mass of member organisations from whom experts can be found to lead the technical activities, contribute their ideas and experience, identify opportunities for novel products, collectively build consensus, and provide a representative endorsement of the results.

The NGNi secretariat has been established to supervise the infrastructure to support the project activities. All public information will be hosted on the project web site and the list of members with their links is also provided with the links to contact person of each organization. Member organizations are spread across the world and the experts from these organizations are active as contributing members in the thematic working groups established to achieve benchmark reports, roadmaps and standards liaison.

Thematic working groups have been set up to address different aspect of NGN such as Access networks, photonic metro and core networks, QoS and Multimedia services, Network management including network performance monitoring, IPv6 deployment issues, Seamless mobility, Interoperability and VoIP technologies with experts spread across multiple organizations across Europe. The deliverables from these working groups are made available to the members for exploitation.

The core team of NGNI will compile the results of thematic working groups and produce the useful documents and resources that will be used for dissemination in major events such as NGN summits, concertation meetings, IST conferences, etc.

The process involved in achieving the success of the NGN roadmaps development is shown in the figure below:



Project name: NGNi
Next Generation Network Initiative

Contract no.: IST-2000-26418

Project type: TN

Start date: 01/01/2000

Duration: 27 months

Total budget: 2.269.563 €

Funding from the EC: 1.628.582 €

Total effort in person-month: 181

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Key words:
Access Networks
Content Management
Interoperability
IPv6
Mobile Communications
Optical networks
QoS
Services

Collaboration with other EC funded projects:
Several IST-projects contribute to the success of NGNi

Next Generation Networks Laboratories

Abstract

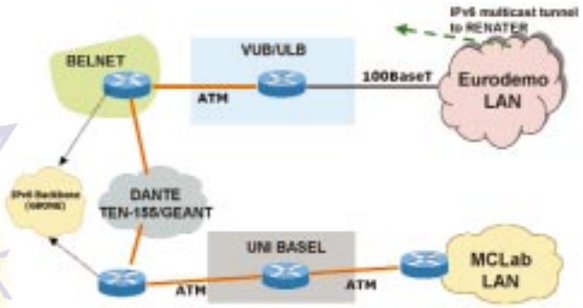
The project establishes a platform for the development of advanced Internet technologies, by provisioning the required system infrastructure and interactive applications, to realise Next Generation Network related experiments.

Objectives

Provision of a test platform for Next Generation Networks:

- Main topics addressed are: IPv6 and QoS.
- Additonal topics: security, mobility, access networks, interworking & interoperability, multimedia.
- Support of IST and national research projects for testing their systems:
- Applications and test equipment provision.
- Link to TEN-155/GÉANT to test across 2 test-beds in Basel (CH) and Brussels (BE).

Figure: IPv6 Connection between Brussels (EuroDemo) and Basel (MCLab)



Technical Approach

NGN-LAB is making advanced networking infrastructure available in two interconnected test-beds, to support IST projects to test new technologies such as IP telephony, IP over xDSL, IP over ATM, IP over WDM, etc.

Test-bed

Two test-beds in NGN-LAB:

- Basel, MCLab: Multiple applications, terminals, LANs and WLANs, and connectivity to GÉANT:
  - Multiple access technologies.
  - IPv6 implemented and tested.
  - DiffServ environment available.
- Brussels, EuroDemo environment:
  - ADSL and ISDN access network.
  - Connectivity to GÉANT.
  - Multiple IPv6 applications.

In both test-beds, IPv6 applications are installed on:

- Windows 2000.
- Linux (Suse, RedHat, Debian).
- FreeBSD 4.4.

Applications

Ping, traceroute, vic, rat, quake, DNS, DiffServ, traffic generators...

Innovation

NGN-LAB is liasing with other national and international test-beds and Forums, to promote the Next Generation Networks infrastructure for provisioning end-to-end services.

NGN-LAB

Project name: NGN-LAB
Next Generation Networks Laboratories

Contract no.: IST-2000-26041

Project type: RTD

Start date: 01/01/2001

Duration: 36 months

Total budget: 1.772.167 €

Funding from the EC: 818.633 €

Total effort in person-month: 132

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Project participants:

01. ULB	B
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03. Cisco	B
04. Dimension D.	B
05. MCLab	S
06. Telscom	S
07. NEC	D
08. ResCom	IRL

Key words:
Interoperability
Interworking
IPv6
Next Generation Networks
QoS

Collaboration with other EC funded projects:
6NET
6WINIT
AQUILA
CADENUS
GÉANT
MOEBIUS
SEQUIN
TEQUILA
TORRENT

South Eastern European Research and Education Networking

Abstract

The SEEREN project aims at easing the "digital divide" that still separates most of the South Eastern European countries from the developed world, by helping to establish a research and educational networking environment in the region. To that end, the National Research and Education Networks (NRENs) of Albania, Bosnia-Herzegovina, Bulgaria, Former Yugoslav Republic of Macedonia (FYROM), Federal Republic of Yugoslavia –Serbia and Montenegro (FRY), Greece, Hungary and Romania (called regional NRENs) will be linked via 2-34 Mbps interconnections amongst them and to the major GÉANT Points of Presence (PoPs) in this area. This initiative will greatly benefit from the partnership with the TERENA and DANTE. This regional initiative is fully supported by the GÉANT community and will benefit from additional funds aiming at the stability and peace in the region by helping the development of the ICT research and education infrastructures.

Objectives

Establish the South-East European infrastructure interconnecting the National Research and Education Networks (NRENs) of Albania, Bosnia-Herzegovina, Bulgaria, Former Yugoslav Republic of Macedonia (FYROM), Federal Republic of Yugoslavia –Serbia and Montenegro (FRY), Greece, Hungary and Romania. The NRENs will be linked via 2-34 Mbps international connectivity.

Interconnect the regional NRENs to the major GÉANT Points of Presence (PoPs) in this area and thus to the pan-European research network. The major GÉANT PoPs in the region are located in Budapest, Athens, Lubljana and Vienna.

Serve as a guide for future upgrades, so that all regional NRENs will be able to participate in "GÉANT+" and be part of the European "e-Science" distributed platform.

Ease the "digital divide" that still separates most of the SEE countries from the developed world. Build awareness of IST in SE Europe non-EU countries and serve as a paradigm for bridging the digital divide in other areas. Provide a platform for cooperation of scientific and educational communities of EU Member States with Newly Associated States (NAS) and 3rd Countries.

Investigate additional sources of funding from the EC, from EU States national funds and international organizations that are actively involved in the SEE region, such as UNESCO and NATO.

Information Society Technologies

Technical Approach

The SEEREN initiative, aims at expanding the European research network in the region by providing GÉANT connectivity to non-GÉANT countries and will act as enabler of joint research and educational activities, as a first step towards integrated eScience applications.

SEEREN is expected to be an essential vehicle for the creation and exploitation of a range of new services and best current practices to support research and education as well as offering facilities for collaboration and experimentation carried out as part of the IST and other international programmes including the deployment of native IPv6 to the desktop.

Based on the SE Europe NRENs interconnectivity requirements, market conditions, supplier capabilities and technical, operational and commercial requirements, all possible implementation approaches and topology options of GÉANT–SEEREN interconnection will be assessed.

A tender will be prepared following EU legislature. After the evaluation of offers technically and financially, selection of suppliers and final negotiations, the final interconnectivity topology will be designed. Acceptance tests for connection lines and equipment will be defined, ensuring the quality-performance required by the SEE NRENs, configuring the network elements and ensuring the stable operation of the interconnections by day-to-day supervision.

The partners who are directly involved in the SEEREN project have a vast experience on developing and using world-class networking infrastructures. The involvement of TERENA, DANTE, GRNET, HUNGARNET and RoEduNet will be vital to ensure the success of the project and the wide applicability of its results to the research & education communities involved and indirectly to other important socio-economic development aspects of the region (health care, industry, culture, tourism, trade and public administration).

Expected Results

The SEEREN project will promote regional relations in SE Europe by facilitating the cooperation amongst the participating countries and the integration of the region into the pan-European Research and Education community. The importance of the proposed initiative is emphasized by the fact that SE Europe was up to recently a source of political, social and economic instability.

The SEEREN project will smoothly introduce the aforementioned countries into the IST community and will stimulate the launching of joint RTD projects, widening the scope of existing IST actions. Hence, this project can act as a vehicle for the participating countries to become more technology competent. The know-how transfer concerning project management and implementation will be achieved by means of direct or electronic interaction in the region, complemented by relevant workshops and task force participation.

The proposed project will promote the integration of the SE Europe region to the rest of the continent, via connections to GÉANT, and through it to research activities throughout the world (Internet2, CANARIE, etc). In addition, the European research, academic and industrial community will benefit from having easier access to highly qualified ICT researchers and professionals, who will eventually be the user-base of SEEREN.

The project will have a positive effect in the area of "brain-drain" prevention making the right information and knowledge resources accessible to the scholars both locally and globally.

Project name: SEEREN
South Eastern European Research and Education Networking

Contract no.: IST-2001-38830

Project type: AM

Start date: 01/10/2002

Duration: 18 months

Total budget: 1.297.481 €

Funding from the EC: 1.297.481 €

Total effort in person-months: 41

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04. DANTE	UK
05. TERENA	NL
06. AMREJ	YU
07. INIMA	AL
08. ICTDA	BG
09. MARNET	MD
10. BIHARNET	BA

Key words:
International pilot network
IPv6 Native/Backbone
South-East Europe

Collaboration with other EC funded projects:
6NET
COM-REN
EUMEDCONNECT
GÉANT

Technology for a Realistic End User Access Network Test-bed

Abstract

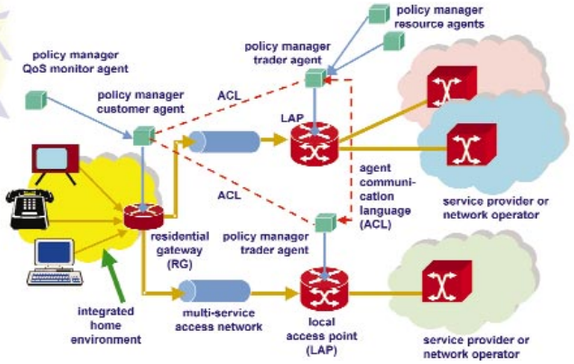
TORRENT is building a test-bed for multi-service residential access networks that will allow the project to demonstrate the benefit of intelligent control, both for the customer and for the network operators and service providers. The test-bed will support the definition of architectures that allow a home user's quality of service expectations to be met by employing –in a way that is transparent to the user– the most appropriate core transport network, be it connectionless or connection-oriented. Systems will be prototyped to segregate traffic according to its optimum mode of transportation and to manage routing and charging. TORRENT encompasses systems integration activities, new developments, and close liaison with emerging standards and specifications. TORRENT is basing its applications on the use of IPv6.

Objectives

The main objectives of TORRENT are to create:

- A test-bed to develop architectural frameworks for mapping service characteristics to network performance parameters.
- Functionality, using Agent Technologies, to negotiate with the available core networks on the user's behalf, on issues such as bandwidth, quality of service and pricing.
- Capabilities incorporated into a "Residential Gateway", to enable communication between user terminals and the network, on policy matters relating to authorisation, authentication and accounting.
- "Local Access Point" able to route services over the most appropriate available network standards for home networks.

Figure: Overview of the TORRENT Test-bed



Technical Approach

- TORRENT is developing an architectural framework in which service requirements can be mapped to network capabilities. These requirements include service management functionalities for authorisation, authentication and accounting.
- TORRENT is designing, developing and integrating functionality, using Agent Technologies that are able to negotiate, on the user's behalf, with the core networks regarding issues such as bandwidth, quality of service and pricing.
- TORRENT is developing a Residential Gateway, incorporating suitable service management functionalities and taking into account the need to handle various types of home network and local access networks carrying multiple types of services.
- TORRENT is developing a Local Access Point that is capable of recognising services coming from home users via a common access network, and routing these services over the most appropriate available core network.
- TORRENT is combining these features into the TORRENT test-bed and is basing applications on the use of IPv6.

Test-bed

The TORRENT test bed –as detailed above and in the figure– consists of Local Access Points and Residential Gateways together with agent-based software. This software provides the TORRENT system with intelligence for key tasks such as service negotiation on the user's behalf.

Applications

- TORRENT will show that its test-bed approach provides a sound generic platform for the definition, development and selection of new services. TORRENT will show that new applications and services can be developed by using standard plug-in-software components based on flexible intelligent agent technology.
- TORRENT will identify an integrated network which could provide a global capability for a full portfolio of applications and services. TORRENT will validate the key functionalities of the different layers of the network, as well as those of the gateways between the layers in the test-beds. TORRENT will identify the enabling technologies required to connect different test-beds in a pan-European context.
- TORRENT will determine the physical performance of the TORRENT test-bed. The test-bed must be able to respond rapidly to a multitude of demanding emerging customer requirements including QoS issues and related Service Level Agreements. In addition, the test-bed must be able to provide bandwidths sufficiently large to accommodate these demanding customer requirements.
- TORRENT will make the results of its basic research available for scientific and technological development as wel as to the international standards organisations.

Innovation

TORRENT provides innovation in 3 key areas: intelligence, inter-working and multi-service access. The approach based on this combination is technically challenging and has not been attempted before.

- TORRENT introduces intelligence into elements associated with the management of access networks, in order to allow a user's QoS expectations to be met on a session-by-session basis, by selecting the most appropriate transport network at the time, in a way that is transparent, flexible, robust and efficient for the user.
- Interworking between different access network technologies is an integral part of this solution, which also provides improvements in response times from the network, and can reduce backbone traffic for applications such as video on demand. Interworking is summarised in a concept that we call EoNEP (Edge of Network Processing).
- The multiservice access nature of the developed test-bed integrates several technologies that operators use to provide broadband capacities in the access network including DSL and CATV. The integration of several access technologies that traditionally have been seen as isolated, reduces considerably the uncertainty faced from country to country and from network to network.

Project name: TORRENT
Technology for a Realistic End User Access Network Test-bed

Contract no.: IST-2000-25187

Project type: RTD

Start date: 01/05/2001

Duration: 30 months

Total budget: 5.167.706 €

Funding from the EC: 2.567.490 €

Total effort in person-month: 523,4

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Key words:
Access Networks
Home Networks
IPv6
Service Policy

Collaboration with other EC funded projects:
Next Generation Networks Initiative (NGNi)

Information Society Technologies

Development and Demonstrator of Wireless Access for Multimedia Services in Aircraft Cabins

Abstract

The WirelessCabin project is developing wireless access technologies for a aircraft cabins. Several access technologies in the cabin are envisaged for passengers: UMTS for personal telephony and packet data, Bluetooth and WLAN for IP access. The Bluetooth interface will also be used for transport of UMTS services.

The project will define a system architecture for wireless access (UMTS, WLAN and Bluetooth™) in an aircraft cabin. The passenger will have the possibility to use its own personal equipment (mobile phone, laptop). For this, the project will develop a service integrator that maps the cabin services on a satellite bearer to be connected to the terrestrial infrastructure.

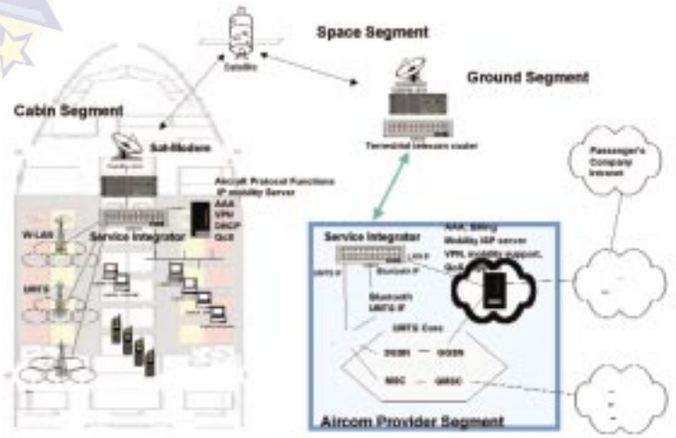
The concept of the wireless cabin access will be demonstrated in flight via satellite using an Airbus long-haul aircraft. The cabin services will provide mobility, VPNs and AAA functions which need to be developed for the mobile users.

Objectives

The demand for making air travel more pleasant, secure and productive for passengers is one of the winning factors both for airlines and the aircraft industry. While security and passenger safety have always been of prime concern, recent acts of international terrorism have clearly demonstrated the need for major improvements and new initiatives in these areas. Such developments can be brought about by the use of the latest in communications technologies. Besides, a wireless network might also support the airline personnel (cabin crew, maintenance crew) during their daily work (e.g. for mobile data access).

The goal of the WirelessCabin project is to develop technologies that enable the use of personal wireless communication devices inside an aircraft cabin.

Figure: WirelessCabin Network Architecture



Information Society Technologies

Technical Approach

The concept of having several mobile users with different access standards is called Collectively Mobile Heterogeneous Network (CMHN). The aircraft cabin represents such a CMHN supporting several radio access networks. The communication infrastructure to support such an network is depicted in the previous Figure.

The architecture consists of (i) several wireless access segments in the aircraft cabin, (ii) a satellite segment for interconnection of the cabin with the terrestrial telecom networks, and (iii) an aircom service provider segment supporting the integrated cabin services.

The CMHN concept will be elaborated and the required protocols will be analysed and designed. A concept for providing different quality of service with variable bandwidth for each of the access standards will be developed and a handover strategy among several available satellite segments with eventual asymmetric bandwidth in up –and down– link will be defined.

For the wireless access, the propagation channel in the aircraft will be determined by a channel measurement campaign, and channel statistics and a model will be derived. This will yield to an interference analysis to determine the cell topology, but also the impact on avionics equipment in flight deck and bay.

On the protocol side the project will investigate the effect of the propagation delay on UMTS protocols and an encapsulation of UMTS services over Bluetooth™ will be developed.

Furthermore, a market survey will perform passenger and airline interviews, and a business relation model between service providers, airlines, and satellite providers will be established.

Innovation

The WirelessCabin project is a highly innovative concept that promises a quick, easy, and feasible technological solution for the personal and multimedia communications in an aircraft cabin. The wireless access solution is a new service compatible with other kinds of in-flight entertainment (IFE), such as live TV on board or provision of Internet access via special installed hardware in the cabin seats. Hence, it should not be seen as an alternative to wired architecture in an aircraft, but as a complementary service to the passengers. For instance, access to VPN or the possibility of keeping the user's telephone number while flying, will become real with the network architecture described in this proposal. Wireless access provides not only these benefits, but also the following ones:

- Ease of connection.
- Allows mobility.
- Avoids additional cabling to all seats for connecting personal equipment and its consequent update for having always the latest technology WEB Mail Tools.
- Users can enjoy the services with their own personal profile.

This new service contributes to the development of the Information Society, extending it to limits that today have not yet been crossed.

The WirelessCabin project will improve bearer satellite services for aeronautical communications, by supporting wireless access technologies inside the cabin.

Project name: WirelessCabin Development and Demonstrator of Wireless Access for Multimedia Services in Aircraft Cabins

Contract no.: IST-2001-37466

Project type: RTD

Start date: 01/07/2002

Duration: 30 months

Total budget: 6.008.221 €

Funding from the EC: 3.200.609 €

Total effort in person-month: 459

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Key words: Aeronautical Communications, Mobile Networks, Satellite, Service demonstration, Wireless access

Collaboration with other EC funded projects: FIFTH, SUITED

eMobile Test-bed for Interoperability of Networks in eLogistics

Abstract

Requirements emerging from the nature of safety and security providing organisations operating in varying degrees of emergency (in particular communication and information needs) will be specified and used in the scenario service tests.

The services in the tests will be enabled by three main technologies: mobile middleware, location-based services, and video-streaming.

Mobile wireless middleware has to provide access to 2.5 - 3G telephony technology. This technology shall be optimised concerning bandwidth and package transportation. Mobile Middleware that guarantees a maximum of performance will be used. The applications that will be designed or adapted have to be attached to mobile middleware. Besides IPv4 technology, the new IPv6 has to be evaluated as transport protocol.

Technologies for location-based services have to be tried and compared.

Provision of a proven 2.5G mobile network and set-up of en experimental 3G network to make it for 3 trial scenarios possible to perform a field test on the basis of a realistic network. Measurement equipment will be used to record the load of the Network.

Compression video streaming technologies (mpeg 4) will be tested as data exchange from/to database and mobile client. These video streaming technologies have to be optimised in conjunction with the used mobile middleware. Furthermore, connection and data traffic between 2.5G and 3G has to be tested.

Existing components have to be adapted and augmented to provide test cases for the application scenarios Tele Ambulance, Emergency Management, and Transport Surveillance.

Empirical data have to be collected on the performance and real-world suitability of the selected application scenarios.

Relevant applications, including location-based services and video streaming, will be tested on mobile devices e.g. PocketPCs (PDAs), Notebooks, and WAP –wireless telephones. Platforms and protocols are based on 2.5 - 3G Technology with focus on interoperability between both generations.

Objectives

The eMOTION project is a trial action aiming at the adaptation and introduction of not yet fully established leading edge technology in mobile applications and its joint evaluation.

The overall objective of eMOTION is to enhance citizen safety & security by demonstration of the interoperability of diverse wireless technologies (2.5-3G) and their mutual support for a better response to emergency cases.

Three trial set-ups will be used for tests: Teleambulance, Emergency Management, and Transport Surveillance. Although the scenarios are thematically different, they are similar in structure and in their technical requirements. They need e.g. interoperability between networks, high bandwidth during peak phases, location accuracy, and short response times. In all scenarios, empirical data will be gathered on the performance and real-world adequacy of the wireless technologies to be established in the near future. The data from the three scenarios shall contribute to an integrated view on the suitability of mobile technology in safety and security related areas.

Within the trials Location Based Services and Mobile Middleware will be used. The adoption of this innovative service the trial applications of Teleambulance, Emergency Management and Transport Surveillance show the usability and benefit to the end-users involved in eMOTION.

The scenarios in Teleambulance, Emergency Management and Transport Surveillance will be set-up in an experimental 3G environment to make a contribution of the awareness for the need of this communication technology.

Technical Approach

The application scenarios in Teleambulance, Emergency Management and Transport Surveillance are all related Mobile Applications and intends to evaluate 2.5G and 3G network features and performance against it and gather insights on general suitability of 2.5G and 3G networks for such complex communication tasks and hints for workarounds and future technological development of 2.5G and 3G networks.

One main objective of eMOTION is to develop facilities that will allow for the exploitation oft the heterogeneous wireless world –instead of disregarding it– with a focus on emergency management as well as transport and surveillance services.

Interoperability: Suppliers are providers of the network infrastructure. Users are the persons that are actively involved in controlling the emergency at hand. While the suppliers have a more passive role, the users actively demand network resources according to the distress level of the emergency.

Within the application scenarios interoperability in the context of wireless services is investigated as providing:

- Scalable services to be principally operational with 2.5G or 3G technology. Thus providing graceful system degradation (but still usable system functionality) in places where 2.5G technology is available but 3G technology is not available.
- Harmonious collaboration of 2.5G and 3G technologies, where a combination of these technologies is used to implement one or more services.

Roaming: Cross border including cross network operator border performance is particularly important in Europe where apart from political borders network operator borders may (on first sight) limit the market acceptance, market penetration and cross border applicability of mobile applications in general.

Through the inclusion of two network operators into the project, eMOTION aims at providing and demonstrating technological solutions in order to provide cross operator/cross border operation of the selected application scenarios, e.g. regarding transport surveillance across different network operator borders.

Location Based Services: The provision of location information as a network service to mobile application is a new key feature of 2.5 and 3G networks. Emergency management is an inherently location information dependent application field.

Innovation

The goal of creating a truly mobile tactical response system for e-logistics management cannot be achieved with today's communications technologies: The once heralded second generation mobile communications (2G) are limited even in their extended form. What was sufficient for high-quality service with digital voice communication and some Internet functions via the mobile phone, is not sufficient for video telephony in real time, multimedia messaging and access to Internet pages with complex graphics and layouts.

This is the starting point for 2.5G and 3G in the context of tactical response that aim to provide a greater security for the public and more services than were previously possible.

Instead of using a single tactical response test case, a generic model is proposed. Test cases for each of the three domains Tele-Ambulance, Emergency Management, and Transport Surveillance are then generated from the model. In this way, the results become comparable and more widely applicable, even to tactical domains not covered by the test cases.

Tactical response measures are triggered by an alert (e.g. a distress call or an overdue report) and typically include assignment of workers, processes, vehicles, communication channels and other resources. Hence, eMOTION aims to provide innovations in the field of mobile e-logistics induced through mobile applications to 2.5G and 3G mobile telecommunication technology and in the field of tactical management out of which the three application cases with different background have been selected. The application of 2.5G and 3G technologies to the inherent and apparent complex task of tactical management is an innovation that will be applicable to mobile business processes in general.

Project name: xMotion
eMobile Test-bed for Interoperability of Networks in eLogistics

Contract no.: IST-2001-36059

Project type: TU

Start date: 01/07/2002

Duration: 18 months

Total budget: 6.384.813 €

Funding from the EC: 3.651.595 €

Total effort in person-month: 516

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10. Rosenbauer	A
11. Microsoft	D
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eLogistics
Mobile Applications
Mobile Middleware

Collaboration with other EC funded projects:
MobiHealth
NOMAD

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