GLOBAL IPv6 SERVICE
LAUNCH EVENT

# IPv6 Demos

*everything connected everywhere*

# GLOBAL IPv6 SERVICE LAUNCH EVENT

IPv6 is an upgrade to the networking protocol, which is central to the working of 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 internetworking of billions of new devices (PDAs, cellular phones, appliances, etc.) and new users. IPv6 is particularly relevant for countries, such as China and India, with a rapidly increasing Internet user community. Another key driver for the demand of IPv6 are the new, 'always-on' technologies (xDSL, cable, Ethernet-to-the-home, fibre-to-the-home, PLC, etc.).

While the existing protocol, IPv4, has a 32-bit address space that provides for a theoretical $2^{32}$ (approximately 4 billion) unique globally addressable hosts, in practice, the number of global IPv4 addresses that can be used is far less, due to inefficiencies in address allocation and use. IPv4 has inherently a limited addressing capacity to provide for Internet scaling and potential to enable billions of devices to be globally connected where appropriate. Network Address Translation (NAT) has extended IPv4's life in conjunction with private IPv4 addresses. However, NAT adds complexity to the deployment of new end to end models inhibiting Internet growth and innovation including 'always-on' and 'peer-to-peer' services that require secure and constant access to devices for instance in home networks. IPv6 is here to ease out these two issues by providing a virtually unlimited address capacity that can uniquely address $2^{128}$ (about 340 undecillion[1]) hosts.

The IPv6 Showcases outlined in this brochure highlight the importance and impact of IPv6 in new and advanced user-oriented services and applications. Focus is placed on new opportunities enabled by IPv6 deployment in following fields of interest:

- ★ Home automation and surveillance
- ★ Mobility
- ★ Multimedia, high definition TV, Digital Video, video streaming, DVB-S/MPEG-2
- ★ New ways for collaborative environments
- ★ Quality of Service and multicast over broadband
- ★ Remote instrumentation
- ★ Security

These showcases are the results of international cooperation between researchers from around the world. IPv6 is indeed the single biggest worldwide new Internet effort achieved over the past decade attracting leading technologists, vendors, academia and standard bodies to embrace it with a single mission: IPv6 is a global opportunity for the good of all.

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

# IPv6 Demo

6 in Space

IPv6 HDTV streaming with guaranteed Quality of Service

IPv6 multicast / M6Bone

IPv6 applications and services over PLC

Internet on the move

Isabel collaborative environment

Digital v6TV: EuroNews

IPv6 Digital Home

IPv6 Global Networks Monitoring: Magalia

IPv6@Home

Remote Instrumentation – Digital Video over IPv6

IPv6 Broadband Resources

Mobile IPv6 Car: GPRS - WiFi Roaming

## IPv6 Demos

# 6 in Space

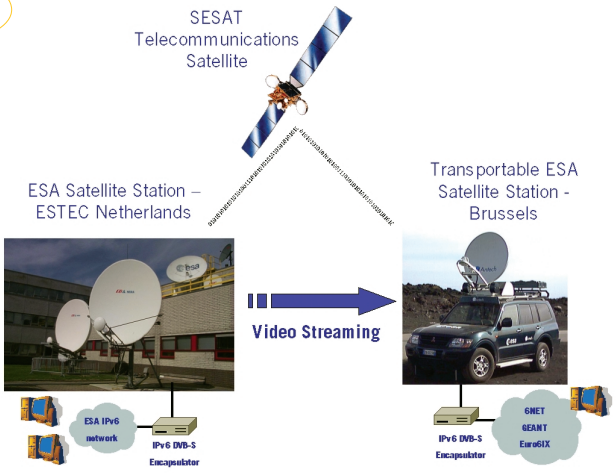


Figure 1: Video Streaming via IPv6 over DVB-S/MPEG-2, using an intended IETF Proposed Standard

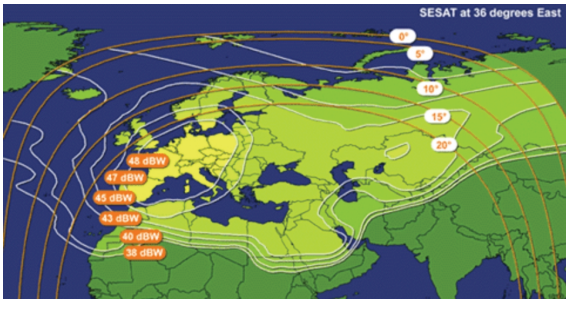


Figure 2: SESAT Satellite Coverage

## Native IPv6 over Satellite using DVB-S/MPEG-2

Satellite communications will continue to play an important role in Internet trunking and direct Internet access. Worldwide 640 satellite transponders were dedicated to Internet trunking in 2003, which is the equivalent of 22 Gbps.

ESA (European Space Agency) has initiated a number of projects that will support the role of satellite communications in emerging IPv6 networks.

### Demonstration

The demonstration uses prototype equipment from ESA projects that implement an Internet Draft proposing a method to transport IPv6 and other protocols more efficiently over satellite links. In this demonstration Ultra Light Encapsulation (ULE) is used, as defined in the emerging IETF ip over MPEG-2/DVB (ipdvb) Working Group.

Streaming video over IPv6 is uplinked from ESTEC (European Space Research and Technology Centre) in Noordwijk and received at the Global IPv6 Services Launch Event. Using commercially available DVB-S receivers with modified drivers, native IPv6 can be received in the whole of the footprint of the satellite.

### Applications

The efficient support of IPv6 will allow seamless integration of satellite communication into a range of applications including: IPv6 multicast overlay networks, mobile networks, integration with Set Top Boxes and Home networks, IPv6 Internet trunking and direct Internet access via satellite.

### Future Plans

ESA is committed to support initiatives for further developments which are required to have satellite communications integrated in IPv6 networks.

IPv6 Demos

# IPv6 HDTV streaming with guaranteed Quality of Service

## The demonstration shows inter-domain IPv6 HDTV streaming in a DiffServ Network

In this demonstration, we show an inter-domain IPv6 HDTV streaming service with guaranteed Quality of Service and IPv6 live video streaming service over TEIN (TransEurasia Information Network). See Figure 1.

**IPv6 HDTV Streaming Service with guaranteed QoS.** The HDTV streaming will be delivered over SURFnet and 6NET backbone, guaranteeing the streaming bandwidth for preserved HDTV stream in advance using Diffserv mechanism (Figure 2).

**IPv6 Live Video Streaming Service over TEIN.** The live video streaming will cover the two different sites to include between the 6NET booth in venue, Belgium and ETRI-v6Lab, Korea over TEIN IPv6 network during the Global IPv6 Service Launch Event (Figure 3).

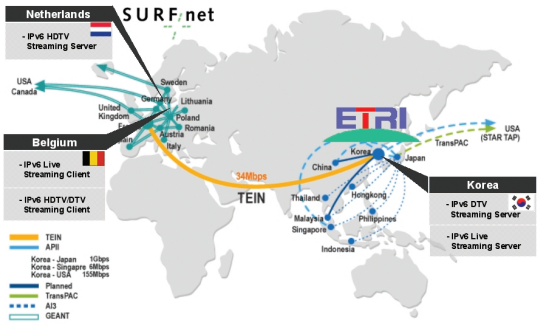


Figure 1: Global IPv6 Streaming Service over TEIN

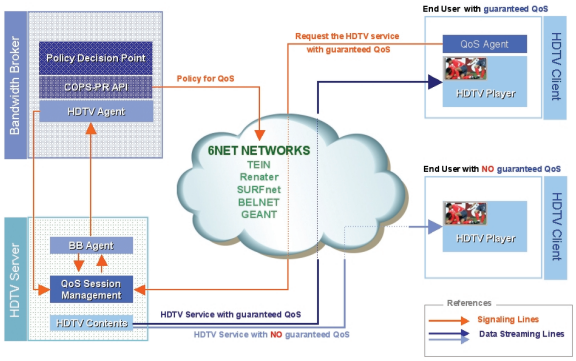


Figure 2: HDTV Streaming Service with guaranteed QoS over 6NET

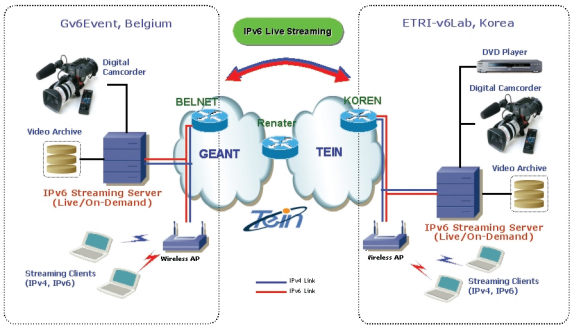


Figure 3: IPv6 Live Streaming Service over TEIN

IPv6 Demos

# IPv6 multicast / M6Bone

## The demonstration shows IPv6 multicast deployment and inherent applications

The M6Bone interconnects today 24 networks and 45 end-sites worldwide. Tests done in the M6Bone make it possible to validate the protocols and make recommendations for future standardization.

**Deployment in 6NET.** National research and education networks in Europe involved in M6Bone are interconnected via the 6NET core network. IPv6 multicast transport is not native end to end. Sites are often connected to their national network with IPv6 multicast in IPv6 (or IPv4) unicast tunnels.

**IPv6 multicast services.** TV and radio broadcast, multi-user videoconferencing can be easily done over IPv6 multicast. Tools like vic, rat, sdr, Isabel, freeamp, windows media player support IPv6 multicast now. A gateway developed in the 6NET project assures interoperability with the IPv4 multicast world without the need of pre-defined configuration.


Figure 1: Global IPv6 Streaming Service over TEIN

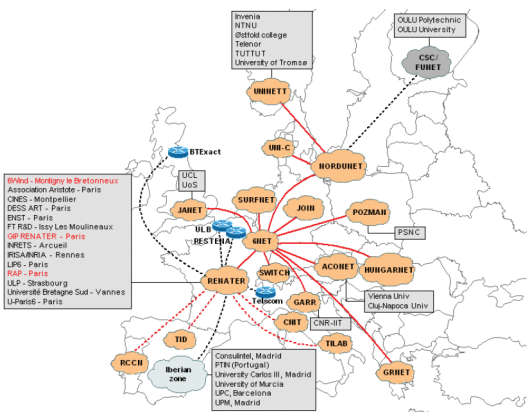


Figure 2: European map of the M6Bone

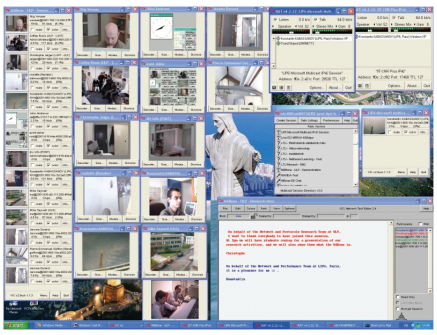

Figure 3: Multi-user videoconferencing on M6Bone

IPv6 Demos

# IPv6 applications and services over PLC

Figure 1: Video-on-Demand over PLC

## Advanced IPv6 services over broadband Power Line Communications (PLC)

This demonstration shows some applications for the Next Generation Internet, making use of normal power wires as a broadband transmission medium. The IPv6 protocol allows high quality end-to-end services to be deployed over PLC, like the ones showed in this demo.

**High quality video and audio services.** Bandwidth in PLC allows to take full advantage of Quality of Service techniques in IPv6, making it possible to archive high quality VoD (Video-on-Demand) applications (Figure 1), and real-time adaptive video conferencing (Figure 2).

**Security services.** The usage of a PKIv6 to offer a wide range of services, like Windows access control and web authentication based on smart cards, is also shown (Figure 3).

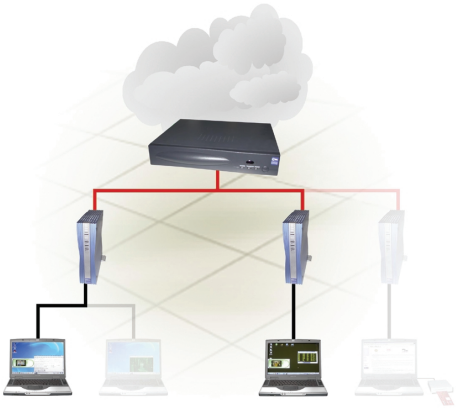

Figure 2: Real-time Videoconference

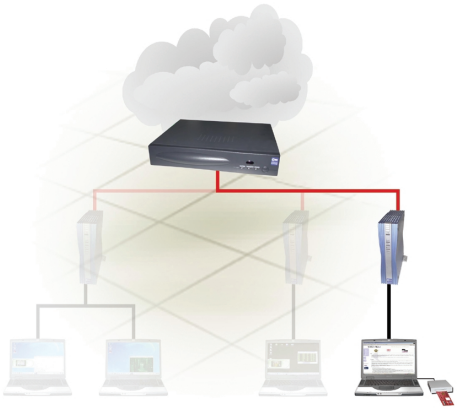

Figure 3: Smartcard based security

IPv6 Demos

# Internet on the move

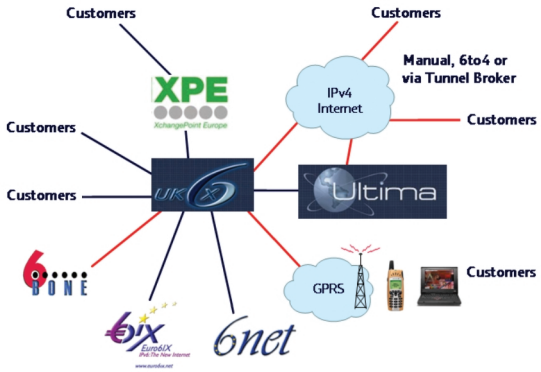


Figure 1: LON6IX Customer Connectivity

## Mobile video services and IPv6 over GPRS

Using the video-on-demand and streaming media services of the LON6IX, in combination with our Mobile IPv6 infrastructure we demonstrate the power of IPv6 to provide mobile video services over both fixed and wireless network infrastructures.

**Mobile Video Services.** Streaming video is delivered from the LON6IX IPv6 Internet Exchange point to mobile nodes at the Global IPv6 Service Launch Event.

**IPv6 over GPRS.** Using the IPv6-capable GPRS bearer of the LON6IX we demonstrate the use of IPv6 technology over a 2.5G network including the use of International GPRS roaming.

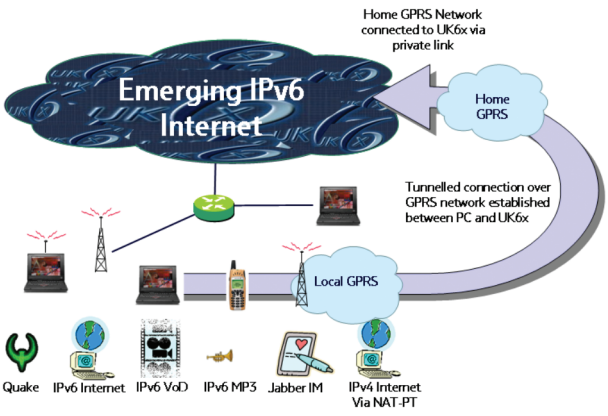


Figure 2: LON6IX Services and connectivity

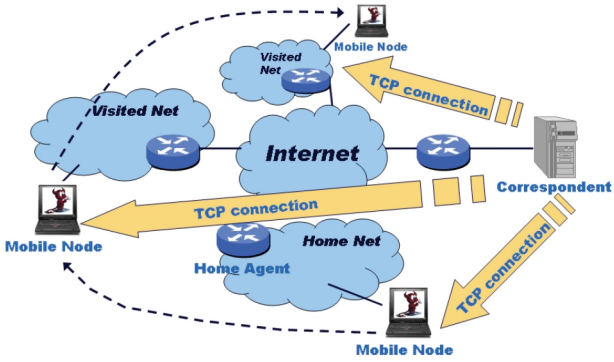


Figure 3: Mobile IPv6 provides seamless connectivity

IPv6 Demos

# Isabel collaborative environment

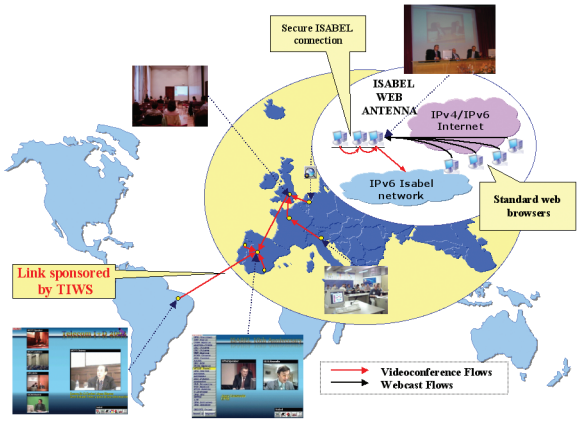


Figure 1: Isabel platform

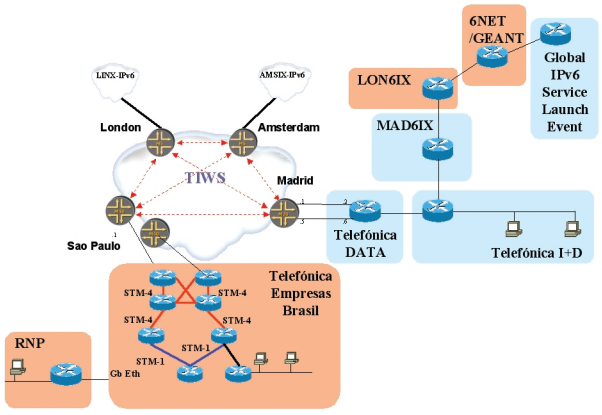


Figure 2: Network deployment

## An advanced IPv6 capable videoconferencing for large multi-points over Next Generation Internet

Isabel collaboration services integrate a shared media space:

- Supports large number of audience groups interconnection.
- Over transition Internet scenarios (unicast and multicast).
- Floor control schemes and policies.
- Reconfigurable services and quality.
- Generic language for defining services.
- New service concept: easy management of multipoint.
- Includes a variety of shared media: Video, Audio, Slides, Pointer, Shared Display, Notepad, White Board, etc.

### Isabel collaborative environment:

- 'ISABEL Web Antenna' allows to follow ISABEL sessions from standard java enabled web browsers (http://antenna.dit.upm.es).
- 'ISABEL/SIP Gateway' allows to access ISABEL sessions from standard SIP clients.

### Advanced services deployment integration:

- 'Secure ISABEL' (over IPSec based VPNs)
- VPN connections and ISABEL platform are described in a common language, called XEDL (Xml sEssion Description Language).
- ISABEL deploys automatically VPNs at startup.

In this demo, videoconference flows are secured using IPsec tunnels.

IPv6 Demos

# Digital v6TV: EuroNews

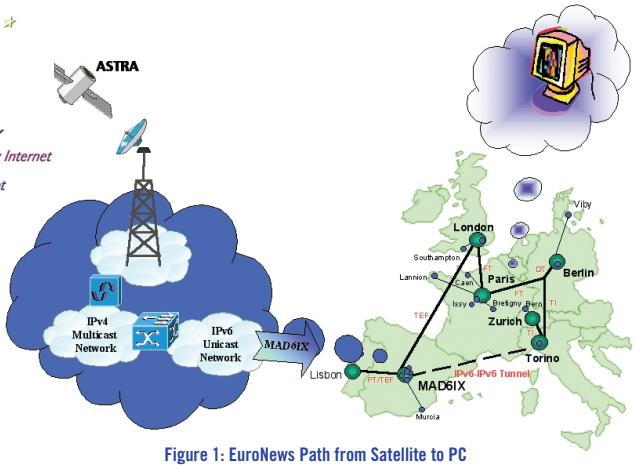


Figure 1: EuroNews Path from Satellite to PC

## Digital TV on your computer using IPv6

This demo shows EuroNews channel using digital TV over IPv6 using Euro6IX network infrastructure.

### EuroNews Path.

EuroNews signal arrives through satellite to a Digital TV operator system that serves several channels. The digital TV server offers a DVB over UDP multicast over IPv4. After the digital server there is a burst-smoother, relay_m2t, that selects a channel of the offered by the server, changes bursts in stable traffic and changes UDP multicast over IPv4 to UDP unicast over IPv6, other option is to change to UDP multicast over IPv6. This flow goes through Euro6IX network to the premises of the Global IPv6 Service.

A TV client available in Internet over IPv6 is VLC either for Windows XP or Linux.

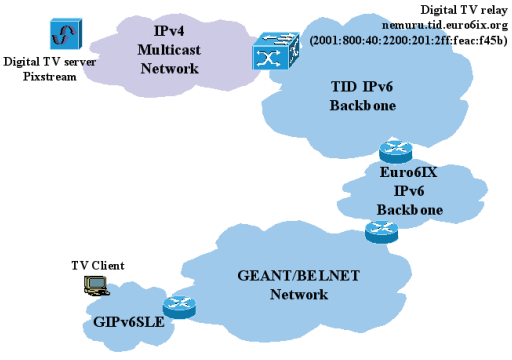


Figure 2: Digital TV network

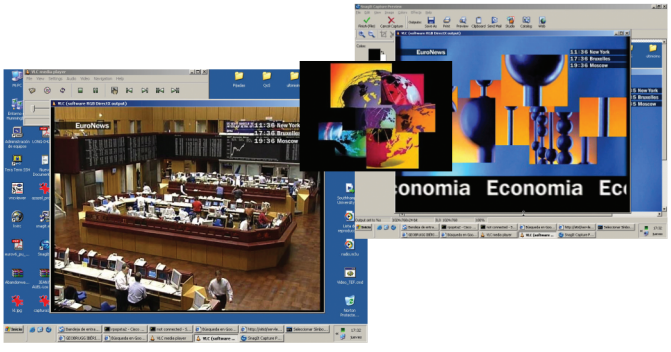


Figure 3: EuroNews over IPv6

IPv6 Demos

# IPv6 Digital Home

Figure 1: Digital Home at Telefónica I+D (Madrid)

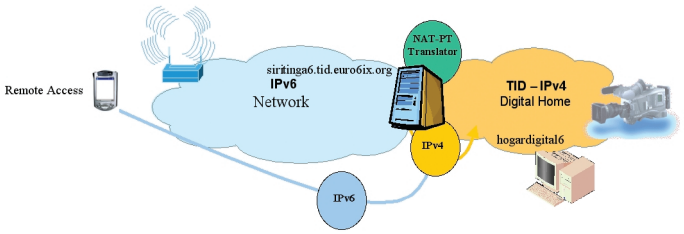


Figure 2: IPv6 access to Digital Home

## Digital Home

Some of last generation services are also available in IPv6. There are cases where it is possible to have a fast access from IPv6 to IPv4. This is the case of the Digital Home.

### Fast access to IPv6

The Remote Control of a digital home has been made available in a fast way by using a translator from IPv6 to IPv4.

### Digital Home Demonstration

The Remote Control allows the user to control the lights switches, the blinds, etc using sensors and cameras to supervise and control the house.

Figure 3: Digital Home View

IPv6 Demos

# IPv6 Global Networks Monitoring: Magalia

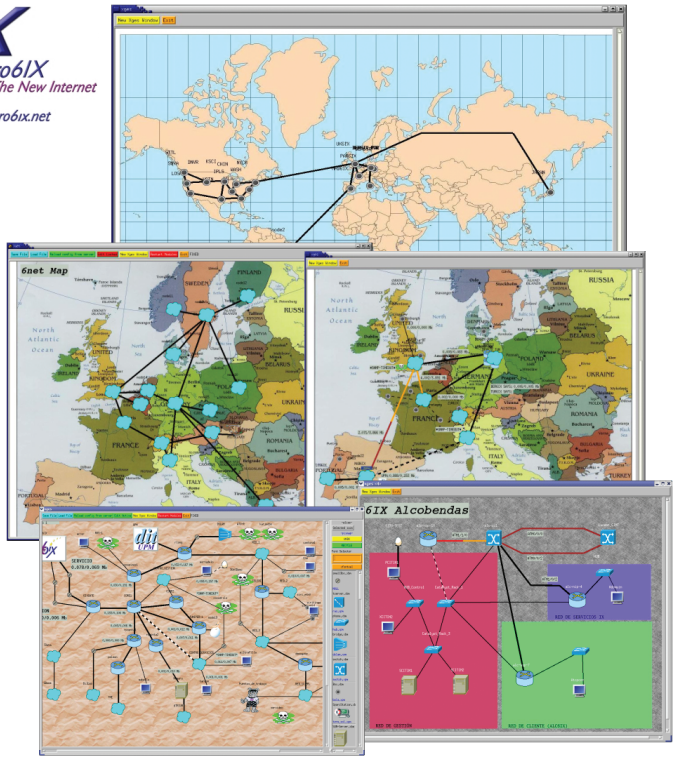


Figure 1: Magalia Maps (World, 6net, Euro6IX, MAD6IX and TID networks)

## IPv6 Network Monitoring: Magalia

This demo shows a network monitoring tool that allows to know the network status at any moment. It is a distributed tool that interacts and monitors different networks according to different permissions.

### Magalia structure

Magalia is a distributed and multi-partner tool and consists of a kernel and different modules. The kernel allows the communication between all the modules. Each module has its own task, for instance one of the most important modules is the graphical interface, others are MSIP (allows communication between different Magalia entities), SNMP, etc.

### Magalia at the Global IPv6 Service Launch Event

Magalia monitors the status of some of the IPv6 networks involved. There are several levels: showing locations, networks, sub-networks, etc.

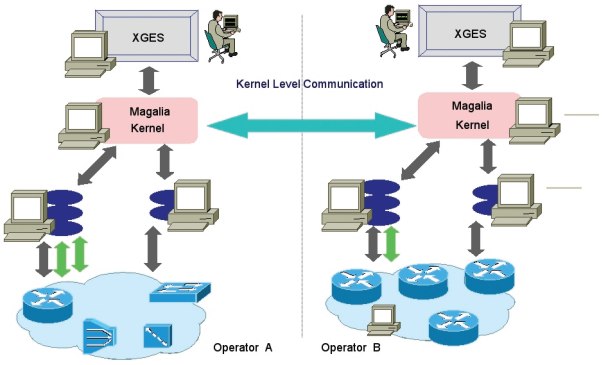


Figure 2: Magalia structure

IPv6 Demos

# IPv6@Home

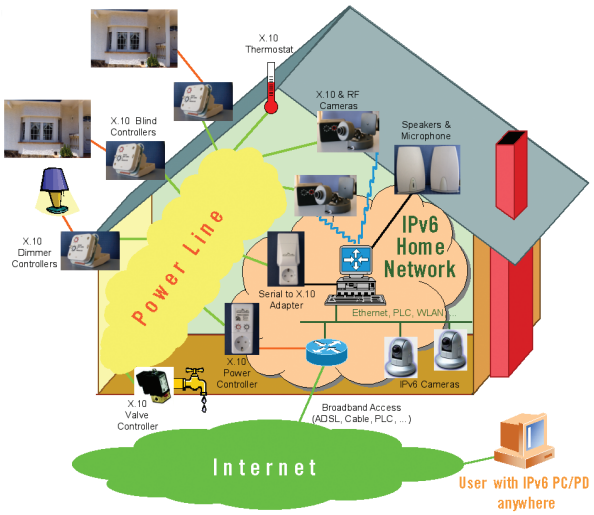


Figure 1: Network Diagram


Figure 2: Application Snapshot

## The demonstration shows an IPv6 based home automation and surveillance system

**Home automation systems take advantage of IPv6.**

By supporting end-to-end communication, and unlimited number of devices (addresses), IPv6 is a good basis for allowing home automation systems, surveillance and pet care,among other facilities, to be deployed at user's homes. IPv6 works even if barriers like NAT or Firewalls are present in home networks.

The demonstration consists of a set of elements like blinds, lights, heaters/air-conditioning and other appliances, installed in a real home. Those devices can be controlled by means of X10 devices, but there is a mix of other technologies, like PLC, Ethernet, IPv6 cameras, alarm via a serial-to-IPv6 tunnel, wireless devices and so on.

Such devices can be directly controlled (thanks to IPv6) or via a central IPv6 web based platform. Consequently, remote users can easily activate or deactivate whatever elements, even while they are away from home.

Communication with the home is easily performed by means of a browser in a PC, PDA or Java-enabled phone.

Along with a list of X10 elements, images from X10 cameras are also integrated in order to continuously monitor the house. Images from IPv6 native cameras can also be visualized, and the camera itself can be controlled (zoom, focus, pan, tilt, ...).

Conclusion: IPv6 enables users to stay connected and to take control of their home at anytime, from anywhere.

IPv6 Demos

# Remote Instrumentation – Digital Video over IPv6

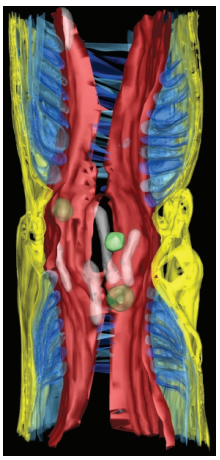

Figure 1: An example of the Tomographic reconstructed Node of Ranvier

Figure 2: A pool of scientific instruments

## This demonstration shows two applications streaming live data from an intermediate-voltage electron microscope (EM) and a high speed laser scanning multi-photon light microscope (LM).

High resolution digital video is streamed from the national Center for Microscopy and Imaging Research (NCMIR) at the University of California, San Diego (UCSD) enabling viewers to monitor and/or control the instruments in real time. The two live data streams depict biological samples at two different scales of magnification. The first shows a sample at the scale of light microscopy (sub-micron) and the second at the scale of electron microscopy (angstrom).

This demo illustrates the work of researchers at the NCMIR, who are developing the Telescience Project (https://telescience.ucsd.edu). The project merges technologies for remote instrumentation, Grid computing and federated digital libraries of cell-level structural data to create a cyber-infrastructure for collaborative biomedical imaging.

This demonstration shows a system that is fully compliant with IPv6 and features the effective use of Digital Video over this protocol. The streaming video over native IPv6 networks is delivered to the conference over the Internet2, GÉANT, and BELNET research networks in collaboration with UCSD.

The use of IPv6 in applications of this nature facilitates the remote access of key scientific instruments. Mobile IP, using IPv6, will extend the usage model for remote microscopy.

IPv6 Demos

# IPv6 Broadband Resources

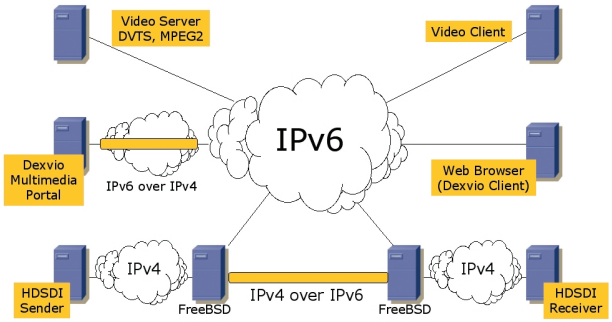


Figure 1: i2CAT configuration for the demonstration

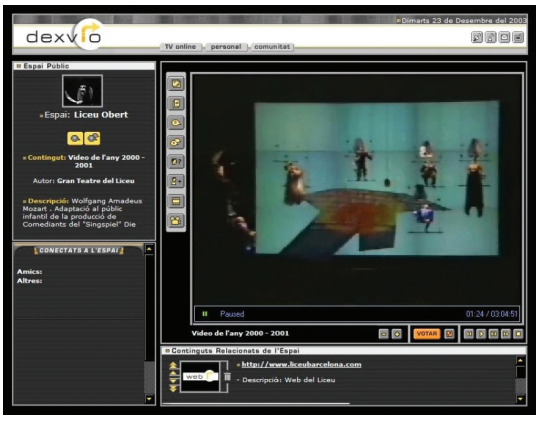


Figure 2: Dexvio is the broadband web site of i2CAT

## Digital Media flows over IPv6

**High Definition Video transmission over IPv6.** In collaboration with ResearchChannel, we deliver HD contents from Barcelona to Brussels (HDSDI over SDTI@270Mbps). Last year, the first transoceanic HDSDI transmission over IP was delivered from Amsterdam to Seattle within the iGRID 2002.

**DVTS over IP.** Live and recorded Digital Video at 25 Mbps over IPv6 are transmitted using the DVTS software developed by WIDE project in Japan.

**MPEGx over IPv6.** Compressed video with different qualities and formats are shown using IPv6-capable video servers; i.e. Videolan, Windows Media, ...

Most of the delivered contents have been produced by Catalonian content providers, not only standard definition but also high definition videos.

**Dexvio.** Audiovisual portal for residential users. Internet TV + virtual community tools.

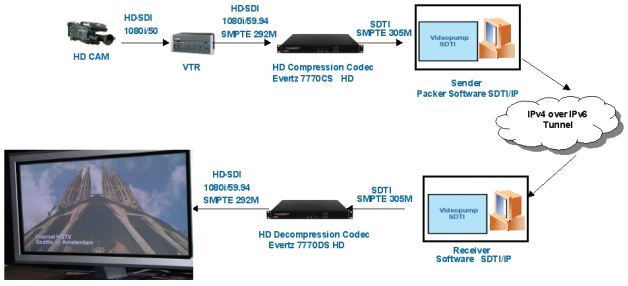


Figure 3: HDSDI Transmission Diagram

IPv6 Demos

# Mobile IPv6 Car: GPRS - WiFi Roaming

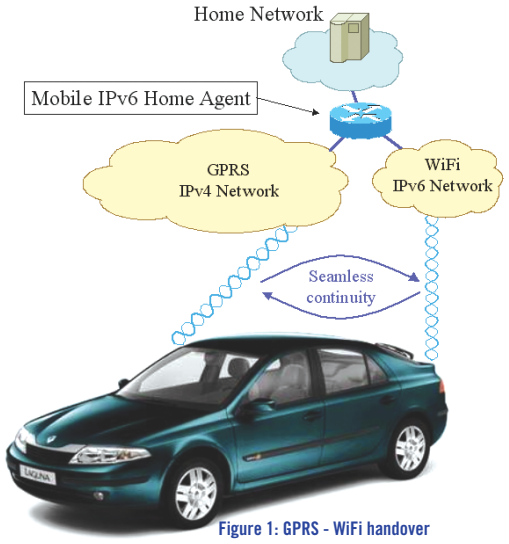


Figure 1: GPRS - WiFi handover

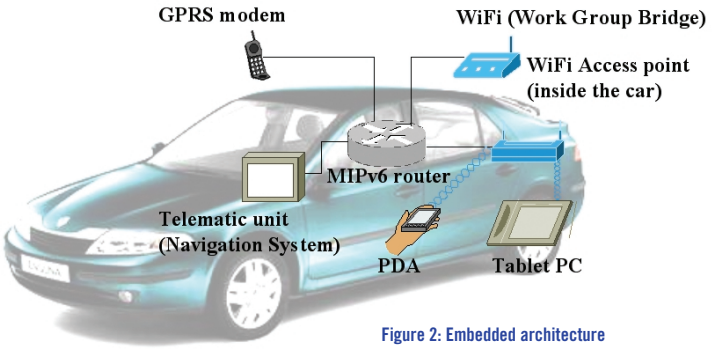


Figure 2: Embedded architecture

## The demonstration shows a Car using Mobile IPv6 to support WiFi to GPRS handover

The car is equipped with an embedded micro router providing both IPv4 and IPv6 connectivity inside the car (Bluetooth and WiFi), and enabling connection to IPv4 or IPv6 infrastructure.

**Mobile IPv6:** A Mobile IPv6 "home agent" router located on the internet provide a seamless continuity between several access networks.
The handover is ensured between GPRS and WiFi thanks to the embedded micro router, supporting physical interfaces switching.

**Mobile Network:** The embedded micro-router enables "mobile networking". Several equipments inside the car benefit from the IPv6 mobility:
The whole network in the car is mobile. The main telematic control unit (providing navigation system), a tablet PC and a PDA are "IP connected" inside the car.

**Ready for Transition:**
The car can be connected to IPv4 and IPv6 networks.

IPv4 and IPv6 applications are supported inside the car.

Using the best of IPv6 on top of IPv4 existing infrastructure, this IPv6 car is ready for the new generation Internet.

European Commission

Information Society
Technologies

6net

Euro6IX
IPv6:The New Internet
www.euro6ix.net

IPv6 Cluster

Euro v6

GEANT

European Union
IPv6 Task Force

www.global-ipv6.net