The Pan-European IPv6 IX Backbone
Towards deployment of IPv6 in Telcos / ISPs

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CEO/CTO - Consulintel

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Euro6IX: The Concept

- How to pronounce it: forget IX and read 6 ("SIX")

- Build a large, scalable and native IPv6 Backbone of Traffic Exchanges, with connectivity across Europe and other IPv4/v6 Exchangers

- In order to promote and allow other players to trial v6 and port/develop key applications and services

- In order to break the chicken and egg issue !

- Gain REAL IPv6 experience, in a real world with not just research users, involving Telcos/ISPs/ASPs, among others: Allow new players into our trials

- Bring IPv6 into a production transit service

Euro6IX Goal

- Support the fast introduction of IPv6 in Europe.
- Main Steps:
  - Network design & deployment
  - Research on network advanced services
  - Development of applications validated by user groups & international trials
  - Active dissemination:
    - participation in events/conferences/papers
    - contributions to standards
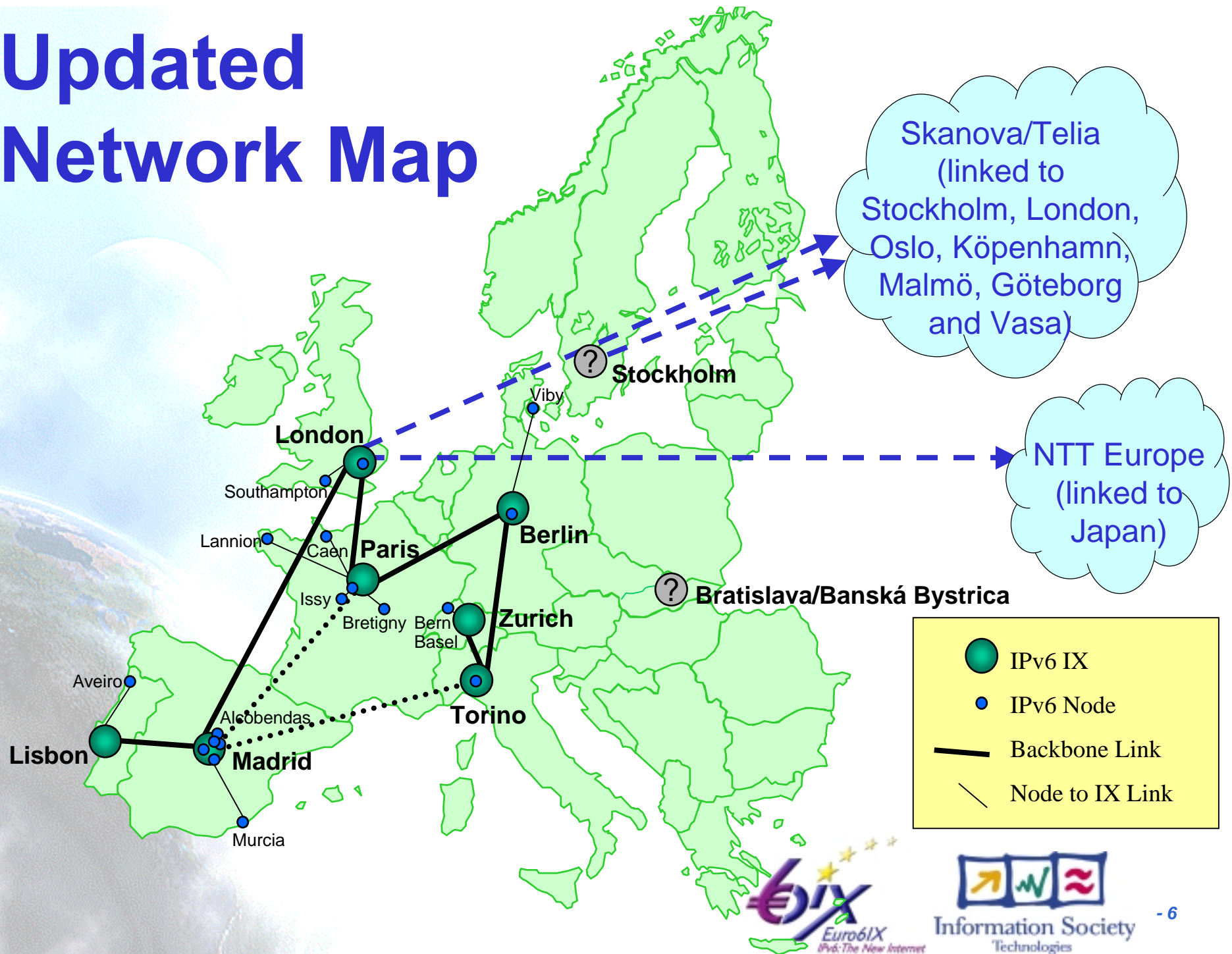   - project web site

Objectives

1. Research an appropriate architecture, to design and deploy the first Pan-European non-commercial IPv6 Internet Exchange Network.

2. Use this infrastructure to research, test and validate IPv6-based applications & services.

3. Open the network to specific User Groups for its validation in trials.

4. Dissemination, liaison and coordination with clusters, fora, standards organizations (e.g. IETF, RIPE) and third parties.

Consortium Members (17)

- ## Telcos/ISPs (7):
  - Telecom Italia LAB (WP2 leader), Telefónica I+D (WP3 leader and project coordinator), Airtel-Vodafone, British Telecom Exact, T-Nova (Deutsche Telecom), France Telecom RD, Portugal Telecom Inovação

- ## Industrial (2):
  - 6Wind, Ericsson Telebit

- ## Universities (3):
  - Technical University of Madrid (WP4 leader), University of Southampton, University of Murcia

- ## Research, System Integrators and Consultancy (3):
  - Consulintel (WP1 leader and project coordinator), Telscom (WP5 leader), novaGnet systems

- ## Others (2):
  - Écija & Asociados Abogados, Eurocontrol

Updated Network Map

Skanova/Telia (linked to Stockholm, London, Oslo, Köpenhamn, Malmö, Göteborg and Vasa)

NTT Europe (linked to Japan)

Stockholm

Viby

London

Southampton

Lannion

Caen

Paris

Issy

Bretigny

Berlin

Bern
Basel

Zurich

Bratislava/Banská Bystrica

Aveiro

Alcobendas

Lisbon

Madrid

Torino

Murcia

🟢	IPv6 IX
🔵	IPv6 Node
▬	Backbone Link
╲	Node to IX Link

6IX
Euro6IX
IPv6:The New Internet

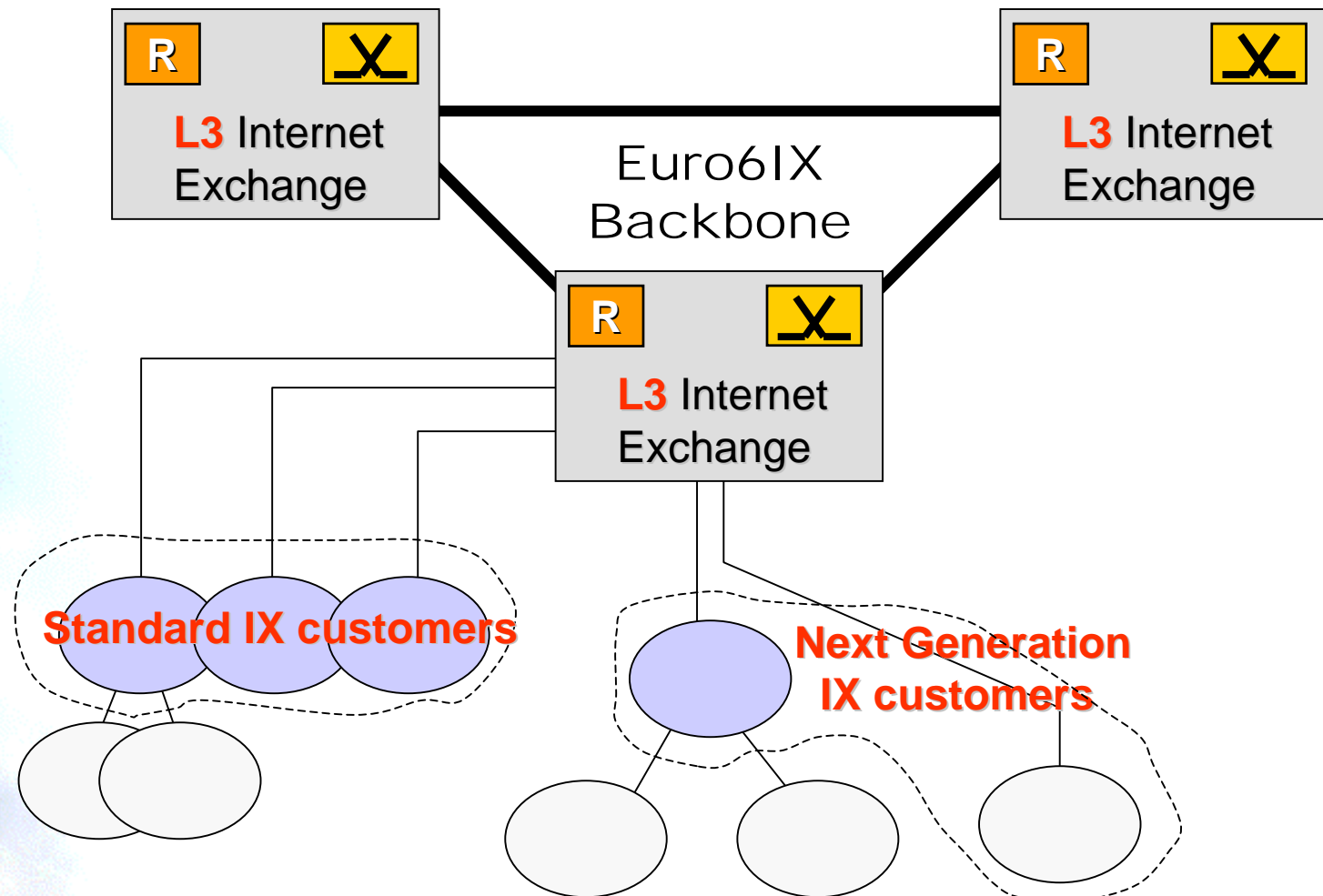Information Society
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Layer 3 IX

- Infrastructure providing both layer 2 and layer 3 interconnection service.

- Several IXs can make direct peering offering also Wide Area Layer 3 transport as an Internet Service Provider. Every IXs will use an assigned xTLA prefix (x=p or s) to assign NLA prefixes to ISPs or customers connecting to the IX.

- Project partners will use their xTLA prefix to assign NAL to customers and regional ISP connecting to IX.

Layer 3 IXs Network Architecture

Euro6IX Backbone

R **X**
L3 Internet Exchange

R **X**
L3 Internet Exchange

R **X**
L3 Internet Exchange

Standard IX customers

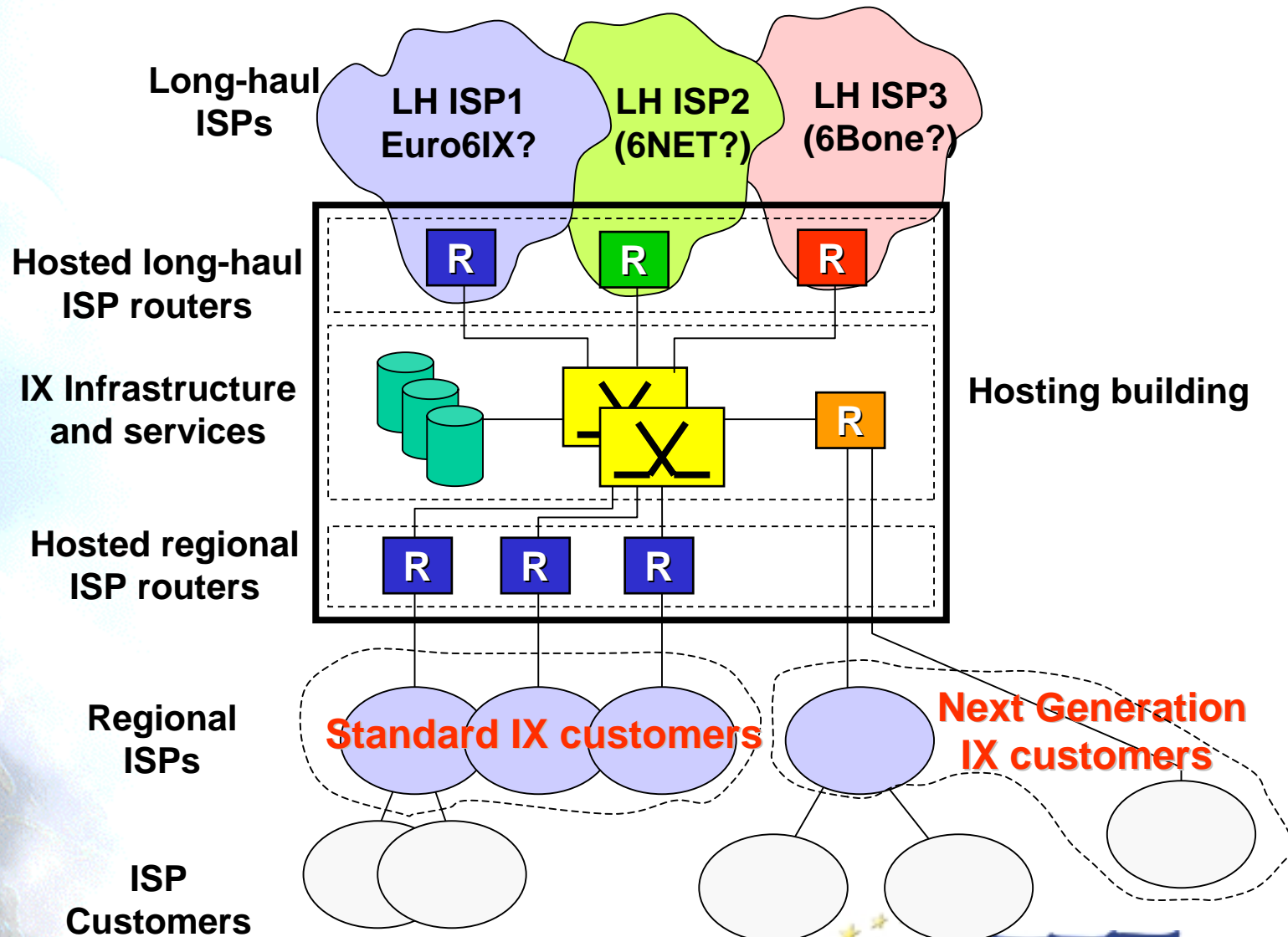**Next Generation IX customers**

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Next generation IX services

- Assignment of provider independent IPv6 addresses to the IX customers (i.e. regional ISPs or companies)

- Provision of a L3 "mediation function":
  - the customer uses the addresses assigned by the IX and establishes a BGP4+ peering with the IX
  - the customer buys the long-haul service from one (or more) of the long-haul providers connected to the IX
  - the IX forwards the traffic generated by the customer only to the long-haul ISPs it subscribed with
  - the return path is unpredictable (it is important?)
  - proven (but to be better understood) advantages are
    - the possibility to change long-haul ISP without changing addresses
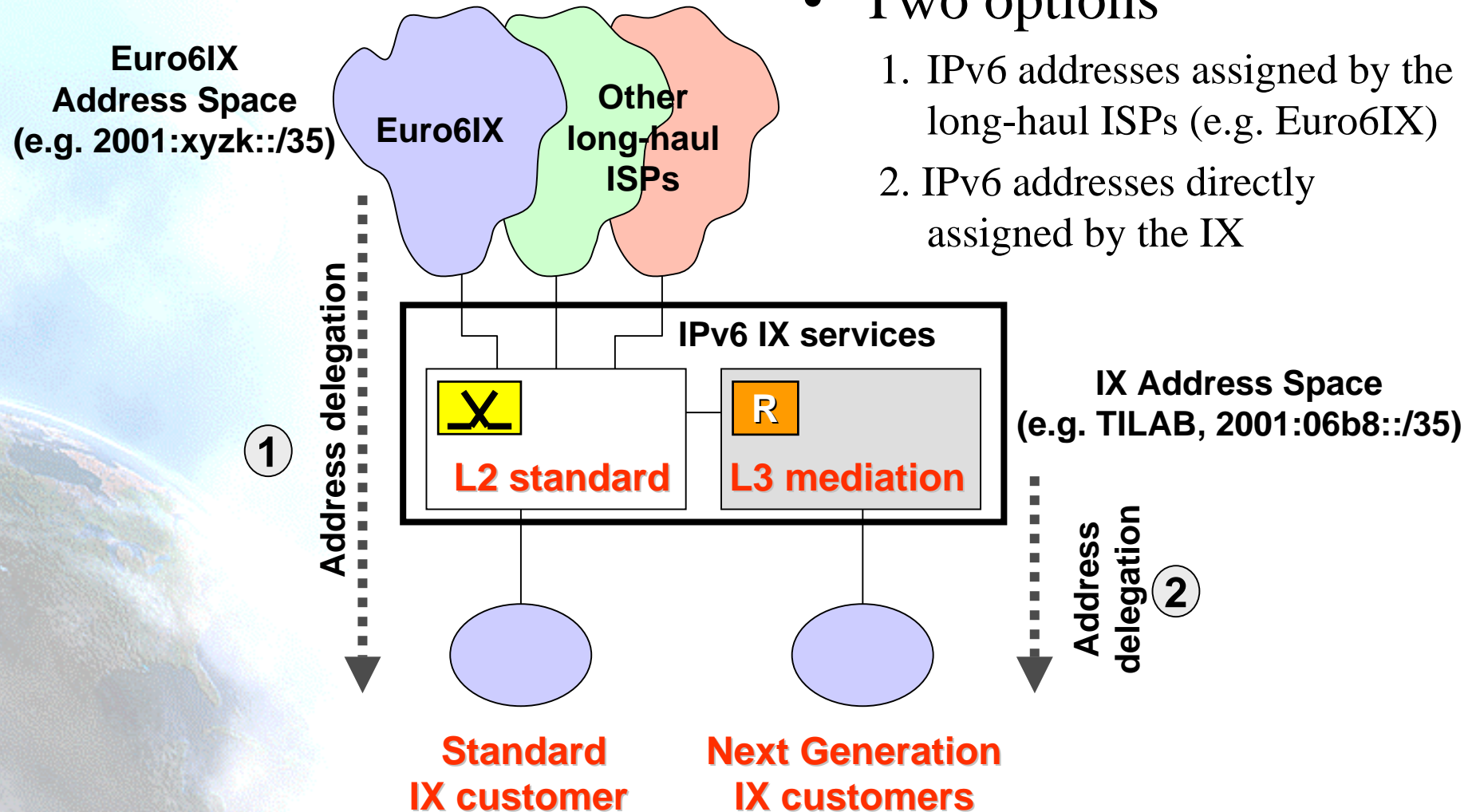   - easier support for multihoming

Internet Exchange Architecture

Long-haul ISPs — LH ISP1 Euro6IX?, LH ISP2 (6NET?), LH ISP3 (6Bone?)

Hosted long-haul ISP routers — R R R

IX Infrastructure and services — Hosting building

Hosted regional ISP routers — R R R

Regional ISPs — Standard IX customers, Next Generation IX customers

ISP Customers

Address Assignment

Euro6IX Address Space (e.g. 2001:xyzk::/35)

Euro6IX

Other long-haul ISPs

Address delegation ①

IPv6 IX services

X
L2 standard

R
L3 mediation

IX Address Space (e.g. TILAB, 2001:06b8::/35)

Address delegation ②

Standard IX customer

Next Generation IX customers
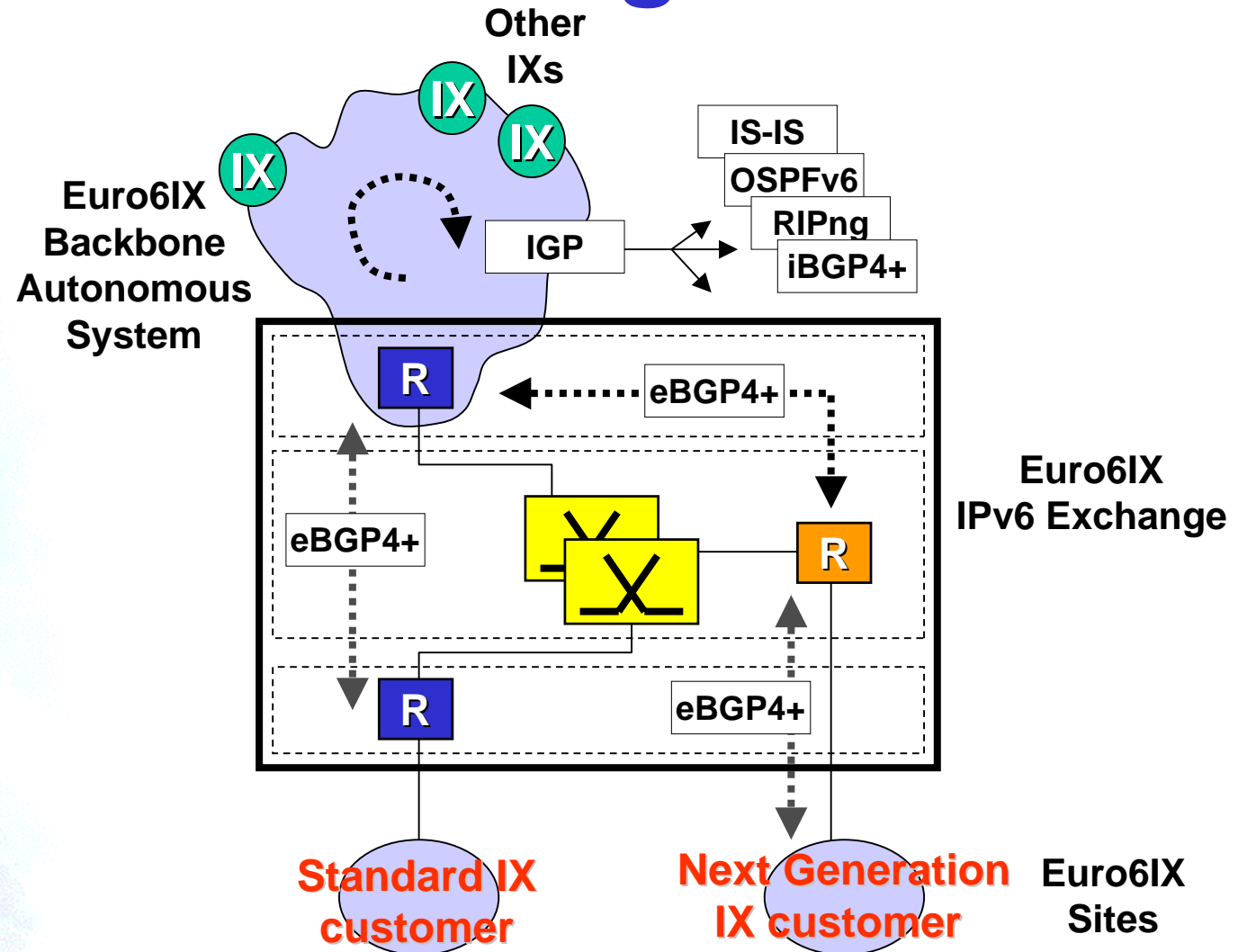
- Two options
  1. IPv6 addresses assigned by the long-haul ISPs (e.g. Euro6IX)
  2. IPv6 addresses directly assigned by the IX

Routing

Other IXs

IS-IS
OSPFv6
RIPng
iBGP4+

IGP

Euro6IX Backbone Autonomous System

IX IX IX

R

eBGP4+

Euro6IX IPv6 Exchange

eBGP4+

R

R

eBGP4+

Standard IX customer

Next Generation IX customer

Euro6IX Sites

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Mobility

- Definition of mobility scenarios for IPv6

- Identification of macro-mobility technologies to be used in the test-beds

- First Identification and evaluation of available implementations for macro-mobility for a common platform

- Selection of access technologies to be used in the test-beds

- Every participant will design their own access network based on the available implementations identified before.
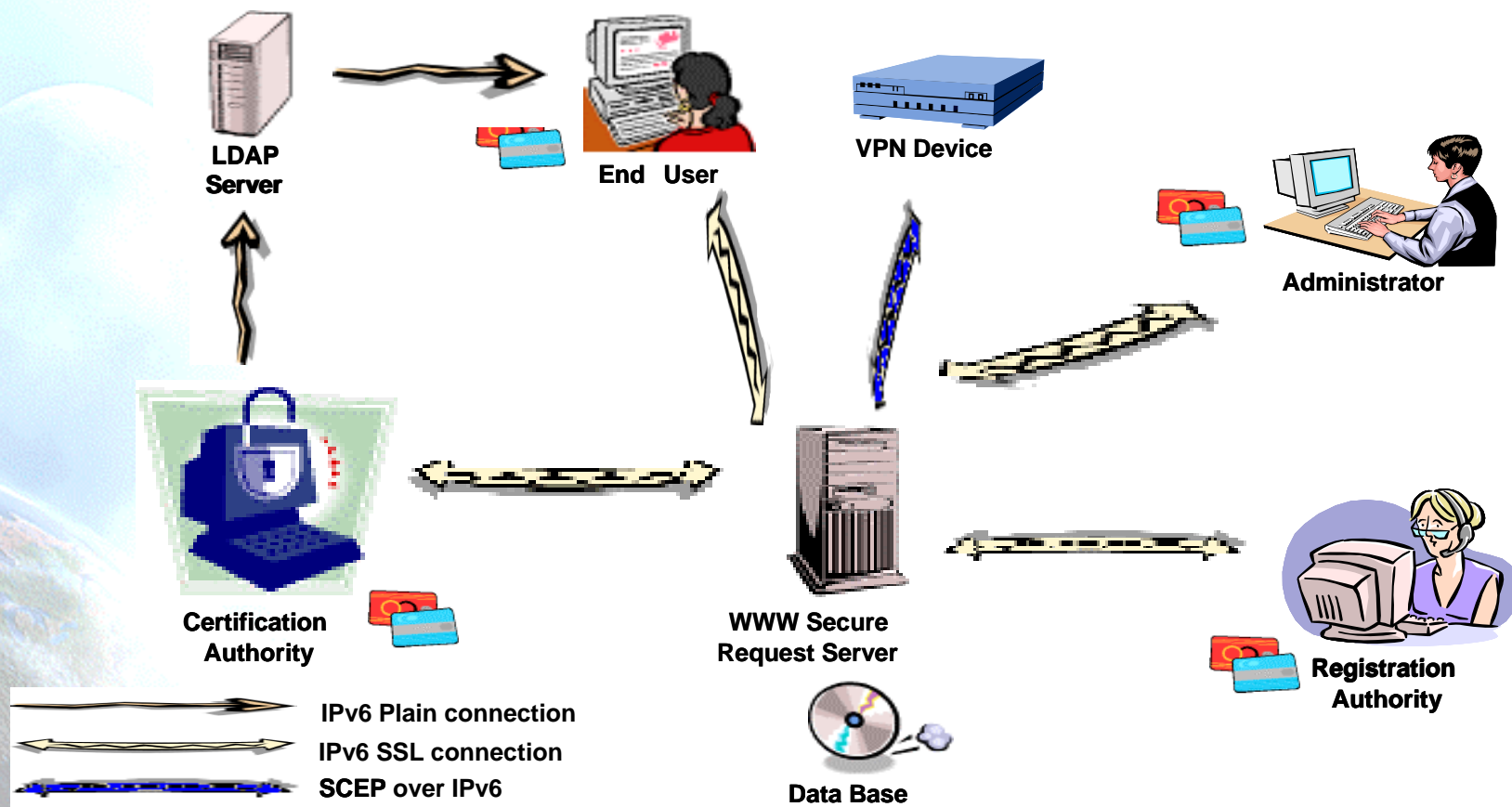
Static VPNs with IPv6

- To evaluate the current status of the main open source IPsec/IKE implementations and some commercial IPsec/IKE solutions

- To deploy of a static VPN service in the Euro6IX test-bed

- Configuration and installations guides for IPsec/IKE

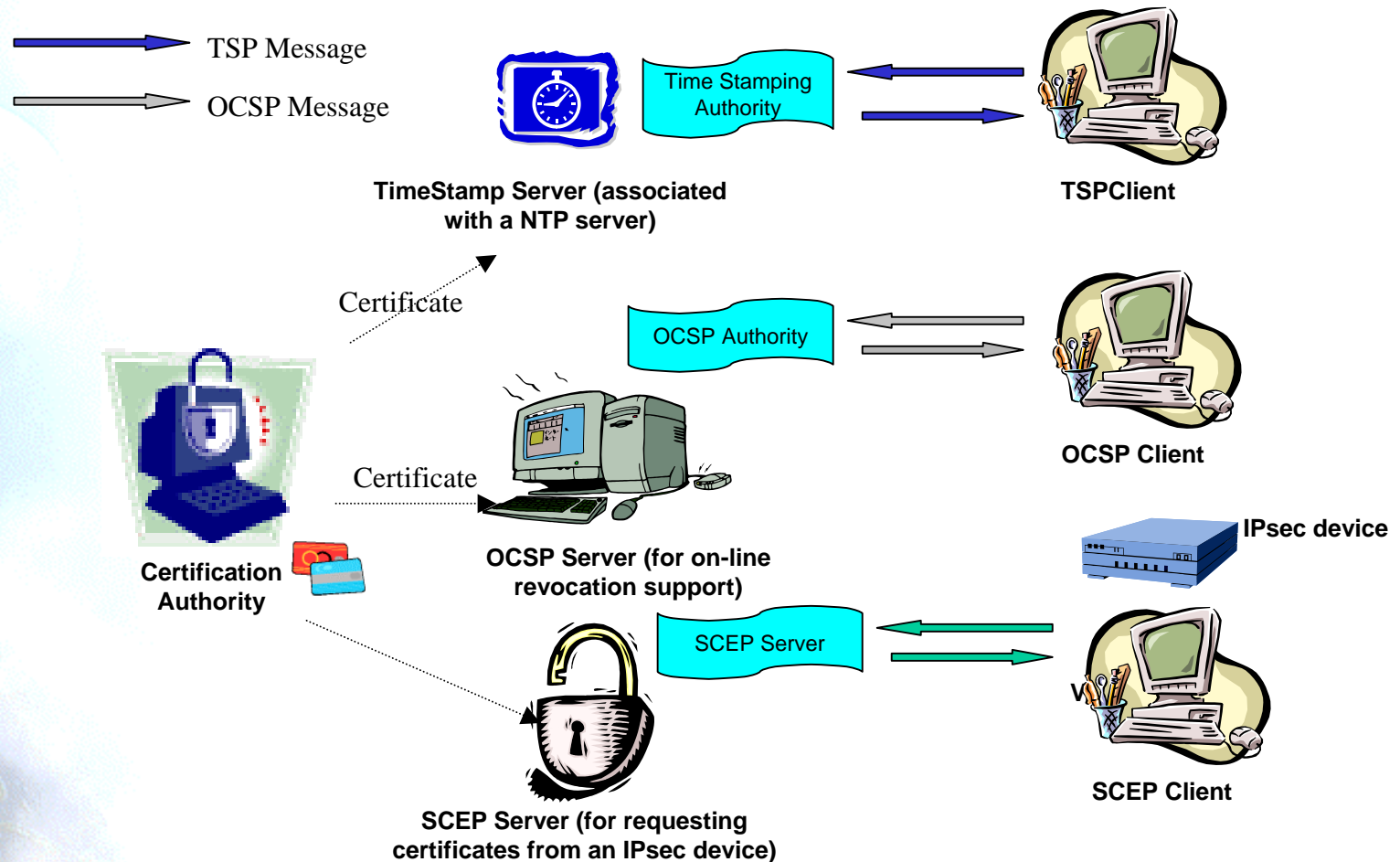- Test reports of interoperability and conformance

UMU – PKIv6 Description

- Main Objective: Establish a high security infrastructure for distributed systems

- Main Features:
  - PKI supporting IPv6
  - Developed in Java ➔ Multiplatform
  - Issue, renew and revoke certificates
  - Final users can use either RAS or Web
  - LDAPv6 directory support
  - Use of smart cards (file system, RSA or Java Cards) ... allowing user mobility and increasing security
  - PKI Certification Policy support
  - VPN devices certification support (using the SCEP protocol)
  - Support for the OCSP protocol and Time Stamp
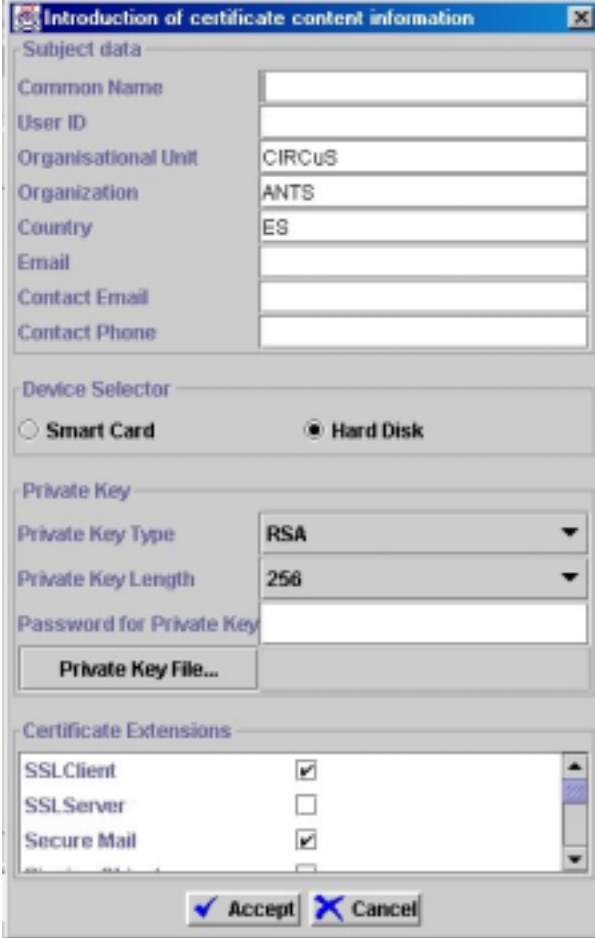 - Web administration

UMU – PKIv6 Architecture

LDAP Server

End User

VPN Device

Administrator

Certification Authority

WWW Secure Request Server

Registration Authority

IPv6 Plain connection
IPv6 SSL connection
SCEP over IPv6

Data Base

https://pki.ipv6.um.es

UMU – PKIv6 Advanced Services

TSP Message

OCSP Message

Time Stamping Authority

TimeStamp Server (associated with a NTP server)

TSPClient

Certificate

OCSP Authority

OCSP Client

Certificate

OCSP Server (for on-line revocation support)

Certification Authority

IPsec device

SCEP Server

SCEP Client

SCEP Server (for requesting certificates from an IPsec device)

UMU – PKIv6 RA Snapshot
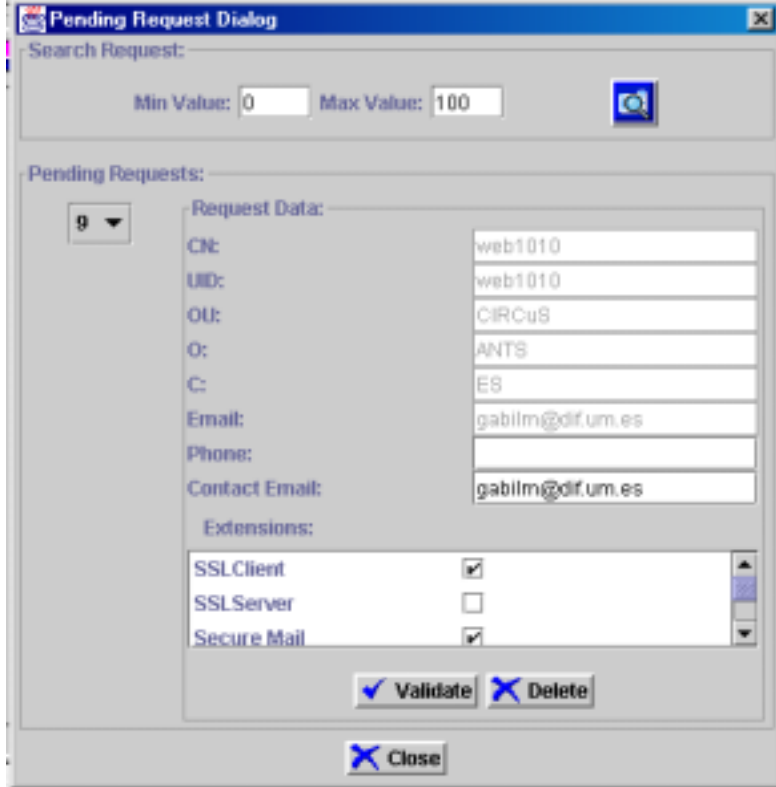
Requesting a certificate

Validating a certificate

UMU – PKIv6 CA Snapshot
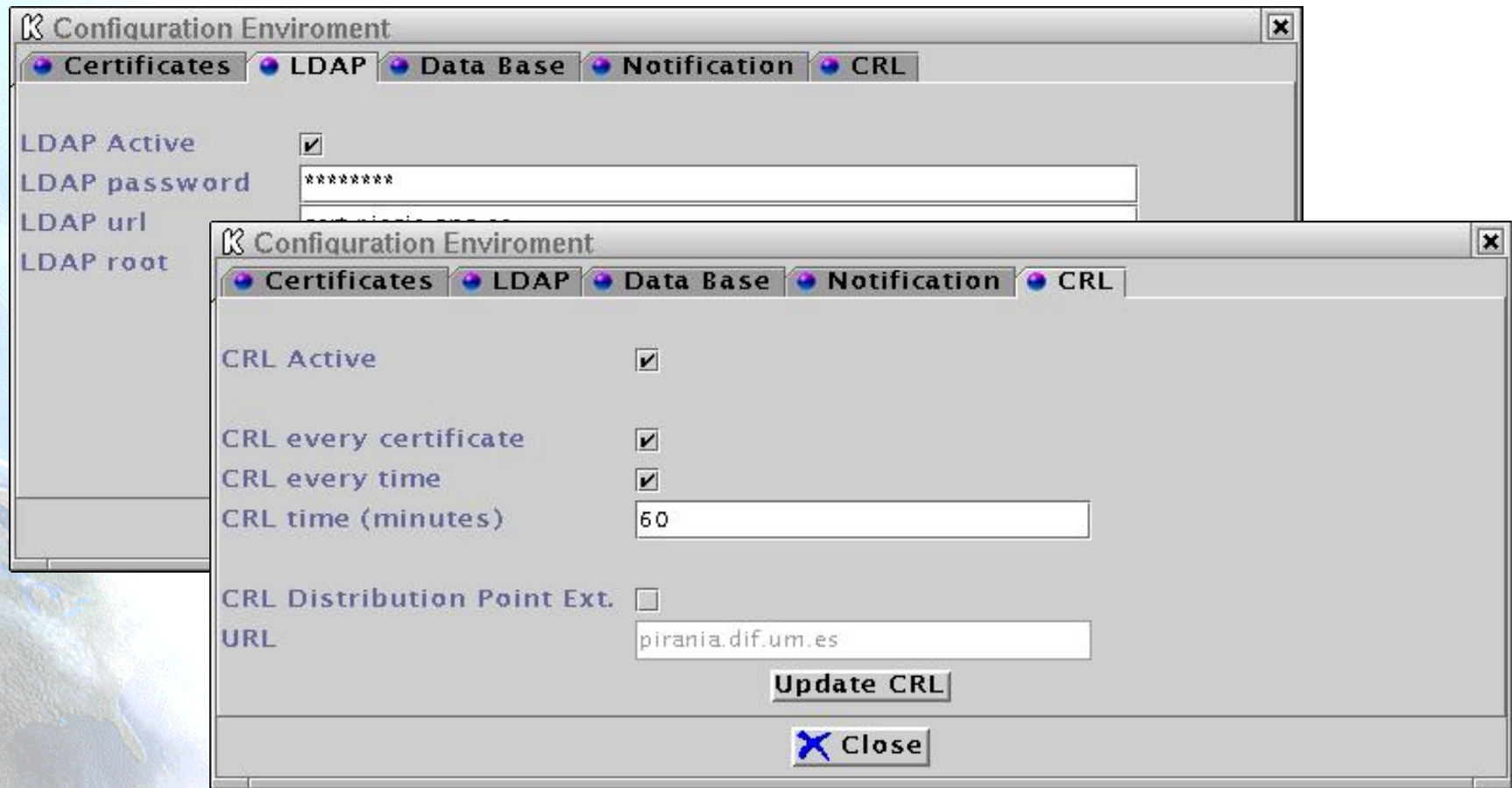
CA Internal Management Process

Network Management

- IPv6 Network Management Tool (Magalia)
- Intrusion Detection System
- Route Server

6POWER:
IPv6, QoS & Power Line Integration
www.6power.org

How IP can reach …
… all the Planet

6POWER: Objectives

- Research native IPv6/IPv4 and related protocols or advanced network services (QoS, security, multicast, mobility, …) support over broadband Power Line, in several platforms/devices, including the necessary standardization activities.

- Adaptation of next generation applications and services, including VoIP, multi-conferencing and audio/video streaming.

- Field Trial and Evaluation, network prototypes, interconnected with other IPv6 trials.

6POWER: Sub-Objectives

- Large-scale deployment of very high speed broadband PLC over 45 Mbps !
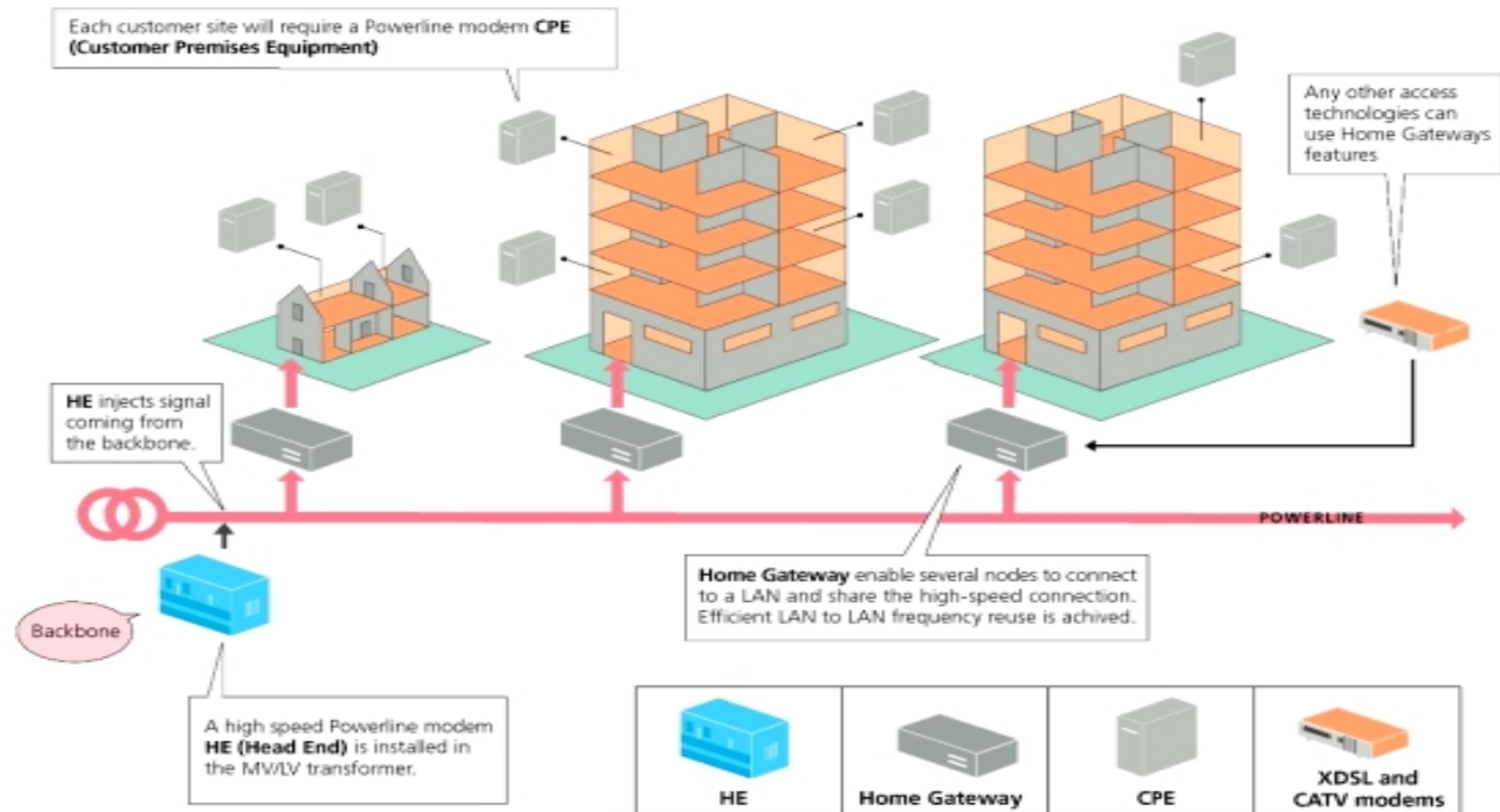
- Early deployment of IPv6-capable devices in residential and SOHO environments, first supporting QoS features

- Support for emerging technologies: VoIPv6, advanced "next generation" digital set-top-boxes, next generation services (high-speed interactive TV, secure e-commerce, virtual shopping, infotainment and related applications)

- Dissemination activities

Why 6POWER ?

- Power Line will need v6 for end-2-end model services

- Research other protocols and aspects related to IPv6 and Power Line Technologies

- Research and Identify different models for Power Line application into real life

- Deploy trial networks

- Standardize

Typical PLC Network Topology

Each customer site will require a Powerline modem **CPE** (Customer Premises Equipment)

Any other access technologies can use Home Gateways features

HE injects signal coming from the backbone.

Backbone

A high speed Powerline modem **HE (Head End)** is installed in the MV/LV transformer.

Home Gateway enable several nodes to connect to a LAN and share the high-speed connection. Efficient LAN to LAN frequency reuse is achived.

POWERLINE

| HE | Home Gateway | CPE | XDSL and CATV modems |

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PLC for Broadband Access

- Key advantage:
  - Power wires are already installed in any location where information could be delivered (access).
    - Traffic lights
    - Information panels
    - Metering systems
    - Vending machines

- PLC offer speeds up to 3x45 Mbps. today
  - In the future up to 200 Mbps.

- Home and industrial automation ("in-home")

- Some technologies offer both, access and in-home

- Some technologies not compatible with European Standards

Broadband PLC and Business

- New service providers
  - "Uti-telcos" ;-)
  - ISPs over PLC

- Reaching everywhere
  - 3G+ base stations!
  - WLAN Access Points!
  - Security, surveillance
  - "New" Vending machines
  - Only the imagination say where is the limit …

For the user …

- Higher competition
- Better services, better prices
- True QoS
- True Interactive TV
- Intelligent environments
- Example: Door-opening system (voice or voice&video)
  - Can be easily "upgraded"
  - Can be installed at every place in the home
  - Connectivity with Internet (remote opening/control)
  - Several people using it simultaneously
  - Same device as the computer, PDA, cellular, VoIP phone, etc.
  - Can be used to communicate between neighbors
  - …

Enough Bandwidth?

- Next generation applications are hungry of Mbps.
  - User and applications ask for more and more …
    - Most probably will never stop !
  - Streaming (audio/video, multiconferencing, gaming, …)
- Mechanisms for optimizing bandwidth
  - Multicast
  - QoS/CoS (TE?)
  - IPv6 for intelligent networks
- With IPv6 we "enable" intelligent devices
  - Today p2p means human intervention
  - With IPv6 is end-to-end, restoring Internet paradigms

IPv6 & PLC, good "room-mates"

- IPv6 Compelling reason: More Addresses
  - Billions of devices, users, "always-on" technologies
- Main IPv6 Benefits:
  - Expanded addressing capabilities
  - Server-less autoconfiguration ("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
  - Improved support for options / extensions

6POWER: Consortium Members

- Power Line experts (DS2)
- Network suppliers (power the networks !) (Endesa)
- IPv6 experts (Consulintel)
- Device manufacturers:
  - Routers (6WIND)
  - Set-top-box (PACE)
- Next Generation Applications and services experts (Agora, MCL)
- Universities, scientific collaboration & evaluation (UMU)
- Sponsors: Willing to participate in test-beds and trials

Work Package Description

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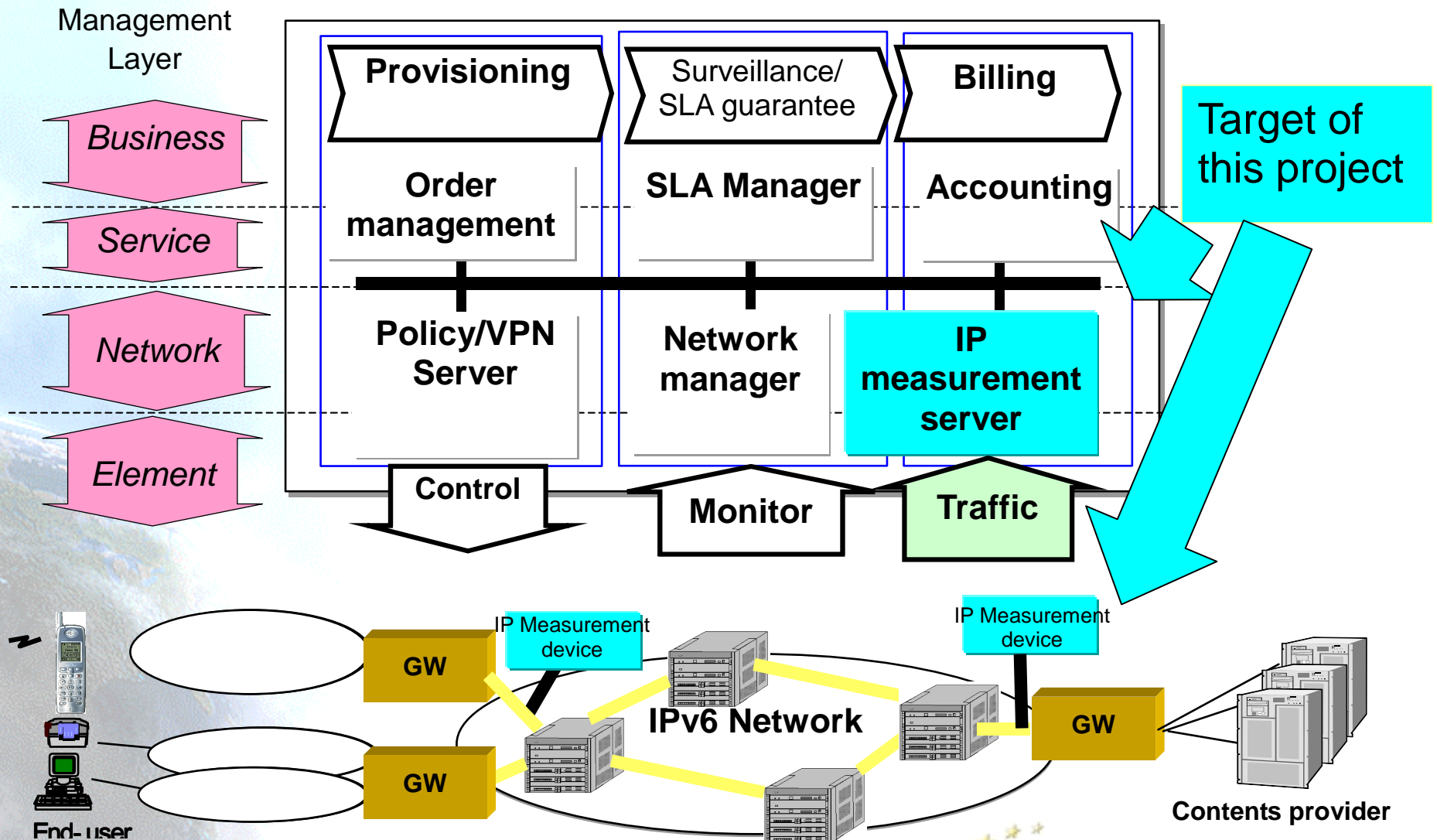 - Trials and Evaluation

6QM

IPv6 Quality of Service Measurement

IPv6 Quality of Service Measurement

www.6qm.org

6QM: Objectives

- Development of a measurement device for IPv6. The measurement device inserts precise timestamp information when it captures the IPv6 packet. Each device has time synchronization functionality, by GPS, or any other equivalent mechanism.

- Development of a measurement server. Collects the captured IPv6 packet. Then it provides usage and also QoS metrics (delay, loss, jitter and so on).

- Integration and local test of the developed components, for the further trial and evaluation of the developed system.

- Dissemination and Linkage with other related Foras and Projects, in order to publicize the project results.

6QM: Structure of IP OSS

Management Layer

Business

Service

Network

Element

Provisioning	Surveillance/ SLA guarantee	Billing
Order management	**SLA Manager**	**Accounting**
Policy/VPN Server	**Network manager**	**IP measurement server**

Target of this project

Control

Monitor

Traffic

End-user

GW

GW

IP Measurement device

IPv6 Network

IP Measurement device

GW

Contents provider

6IX Euro6IX IPv6:The New Internet

Information Society Technologies

6QM: Consortium Members

- Hitachi Europe (France)
- Hitachi Ltd (Japan)
- France Telecom (France)
- Consulintel (Spain)
- Fokus (Germany)

Eurov6:
The European IPv6 Showcase

www.eurov6.org

Eurov6: Objectives

- Bring together the vendors as sponsors to test their devices and systems.

- Show various users applications, permanently at a few centers in Europe, and to develop a mobile or "nomadic" version of this showcase.

- Be able to show the usage of IPv6 and its impact to anyone at anytime and keep the progress rolling.

- Take this (packaged) Showcase to different significant events (INTEROP among others) and provide a public view of the IPv6 features to bring the awareness to wider society audiences, by showing an Internet living environment which only IPv6 can bring.

Eurov6: Partners

- ULB (Belgium)
- Ericsson AB (Sweden)
- Consulintel (Spain)
- Telscom (Switzerland)

EC IPv6 Task Force

European Commission
IPv6 Task Force

http://www.ipv6tf.org

What we did …

- The lobby of the IPv6 Forum and the industry in Europe has achieved the goal of the EC to embrace IPv6.

- Now is officially recommended and key target of the EU strategy, together with broadband and mobility, among other priorities.

- IPv6 is a key technology for the next IST FP6 activities.

The Global Effort

- Now the Task Force is not just Europe !
- Is a "global" issue, with strong cooperation with the rest of the world
  - Global R&D
  - Global policy
  - Global deployment
  - Global business
- Global deployment already started
  - See Japan !

IPv6 TF-SC

**IPv6 Task Force
Steering Committee**

IPv6 TF-SC: Objectives

- To perform all required actions aiming at the enhanced coordination and continuation of the work performed within the IPv6 Task Force with an enlarged participation and renewed mandate as the IPv6 Task Force 2nd phase.

- To provide a regularly updated review and plan action on the development and future perspectives of IPv6 in order to coordinate European efforts on IPv6.

IPv6 TF-SC: Partners

- T-Systems Nova (Germany)
- BT (UK)
- Consulintel (Spain)
- Ericsson LM (Sweden)
- Philips (Netherlands)
- Siemens (Germany)
- UoS (UK)
- Uoulu (Finland)

IPv6 Project Cluster

IPv6 Cluster

www.ist-ipv6.org

6LINK
IPv6 Projects United

www.6link.org

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6LINK: Objectives

- Consensus building
  - IPv6 development
  - IPv6 deployment
- Dissemination
- Exploitation of consensus
  - Common trials
  - Coordinated input to standards development

IST IPv6 Cluster

- www.ist-ipv6.org
- Register and get:
  - Newsletter (every 2 months)
  - Standards report (every 4 months)
  - Applications Database
  - Publications
  - Contact with IPv6 EU Researchers

Thanks !

Contact:

- **Jordi Palet (Consulintel): jordi.palet@consulintel.es**

- **Madrid 2003 IPv6 Summit, register at:**
  http://www.ipv6-es.com

- **Euro6IX Project Coordinators (coordinators@euro6ix.org):**
  - **Jordi Palet Martínez (Consulintel):**   jordi.palet@consulintel.es
  - **Carlos Ralli Ucendo (Telefónica I+D):**   ralli@tid.es