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

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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

1) IPv6 in IPv6 Tunnel in own network
2) IPv6 over IPv4 over internet/6Bone
• Other similar tunnels could be setup in other links if needed
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

L3 Internet Exchange

Standard IX customers

Next Generation IX customers
IX Model C

- L2 infrastructure (fully redundant) where the IX services are placed
- Routers infrastructure (long-haul providers and customers)
- Layer 3 mediation function router (L3MF) is the real new element of this model
RFC2374 Benefits

• This model is based on the RFC 2374 to verify that:
  – a customer could change its service provider without changing its addressing space
  – the renumbering functionality could be realized more easily (no renumbering in the better case)
  – the multihoming functionality could be realized more easily
• IX plays an intermediation role between the ISP and the customers (Layer 3 mediation function router)
• Routing:
  – iBGP+IGP: inside the Long Haul Provider
  – Euro6IX is the collection of the routers inside the IX emulating the LHP (single AS)
  – eBGP4+: between the customers and the IX
  – eBGP4+: between the IX and the LHPs
Address Assignment

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

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

Other long-haul ISPs

Euro6IX

IPv6 IX services

L2 standard

L3 mediation

Standard IX customer

Next Generation IX customers

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

Euro6IX
Backbone
Autonomous
System

Other
IXs

IPv6 Exchange

IS-IS
OSPFv6
RIPng
iBGP4+

IGP

eBGP4+

Standard IX
customer

Next Generation
IX customer

Euro6IX
Sites

eBGP4+

Next Generation
IX customer

Euro6IX
IPv6 Exchange

eBGP4+

Standard IX
customer

Euro6IX
Backbone
Autonomous
System
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 and Dynamic 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

https://pki.ipv6.um.es
UMU – PKIv6 Advanced Services

- SCEP Server (for requesting certificates from an IPsec device)
- Certification Authority
- OCSP Server (for on-line revocation support)
- Time Stamping Authority
- Time Stamp Server (associated with a NTP server)
- OCSP Authority
- TSP Client
- SCEP Client
- OCSP Client
- IPsec device
- TSP Message
- OCSP Message
UMU – PKIv6 RA Snapshot

Requesting a certificate

Validating a certificate
UMU – PKIv6 CA Snapshot

CA Internal Management Process
Other Applications

• Messaging Systems:
  – Peer-to-peer

• Audio and video-conferencing:
  – Include multi-conference and collaboration

• Web mail tools

• VNC over IPv6

• Network Management, Analysis, test & diag:
  – IPv6 Network Management Tool (Magalia)
  – Intrusion Detection System
  – Route Server
IX Based Services

- IX becomes a place where new services are offered to the users.
- IX is an aggregation point, so it can provide those services who can benefit by this “user aggregation” (e.g. in a based multicast network, the RP could be located inside the IX, because a lot of users connect to it).
  - Network Services
    - Multicast, AAA, QoS, DNSSec
    - Transition Mechanisms: NAT-PT, Tunnel Broker, 6to4
    - Route Server mechanism
  - Application Services
    - HTTP, FTP, SMTP
    - VideoConference/e-learning services
    - P2P applications
  - Monitoring Services
    - Routing/Traffic/Reachability Monitoring (Magalia, AS-Path tree, Looking Glass)
The UK6x (LON6IX)

- Layer 2 & 3 IPv6 Internet exchange
- First in the UK
- Uses commercial IPv6 addresses
- Located at the heart of the UK Internet – Telehouse
- Open to all
- Primary aims are:
  - to stimulate the IPv6 environment in the UK, Europe and the World
  - to further the understanding of IPv6
UK6x Core Architecture

- Ethernet switch for Layer 2 peering
- ATM switch for additional customer access mechanisms
- Router for Layer 3 functionality
- 2001:618::/32 used for address allocation
- 2001:7F8:2::/48 used for infrastructure
- Maintenance via Looking Glass, ASpath-tree etc.
DNSsec Services

• UPM is completing the DNS emulation environment
• Developing a complete set of DNSSEC example configurations using the emulation environment
• DNSSEC pilot work on setting-up and maintaining experiment between UMU, Consulintel and UPM
• Publishing certificates using DNSsec
  – Models analyzed to publish certificates:
    • TSIG Model: symmetric keys.
    • SIG Model: asymmetric keys.
  – Support in PKlv6:
    • PKlv6 supports TSIG Model
      – BIND 9.2.0 or newer for TSIG
    • PKlv6 will support SIG Model
      – BIND 9.3.0 (snapshot) for SIG(0)
IX service PKIv6 to publish certificates using DNSSEC

• Scenario 1:
  – Root CA and Name Server are together in the IX
IX service PKIv6 to publish certificates using DNSSEC

- **Scenario 2:**
  - Root CA is out

![Diagram showing IX service PKIv6 to publish certificates using DNSSEC](image-url)
Security Framework

- General VPN Policy Definition. Tools VPNEtool
- Tested with UCL in 6NET-Euro6IX collaboration
- 6WIND VPN Enforcement element working, and being tested by 6WIND
- CISCO: Waiting CISCO IOS version that could be accessible with support for IPsec for IPv6. Actually working with IPv4
Instant Messaging v1

• Jabber based
• Developed using Java
• Up to now, we have
  – Deployed and debug the Jabber IM server
  – Developed the GUI based IM client
  – Debugged the interaction of IM client and IM server
  – Migrated to IPv6 Internet
• IM Services include:
  – User management:
    • register/unregister; login/out;
  – Roster management:
    • add/delete friends
  – Messaging
  – Presence management
  – Group management:
    • join/leave group
  – Group chat
Instant Messaging v2

- Client relayed multicast messaging
  - based on the Jabber address scheme
  - some clients can be configured to relay the chat messages
  - balance the store-forward load on the IM server
  - easily integrated to IM version 1
  - prototype implemented
VOCAL

• Porting was undertaken within the Euro6IX project (www.euro6ix.org)
  – But also in conjunction with 6NET (www.6net.org)
  – Work done by a researcher between degree and PhD
  – Being used in 6NET, 6WINIT and Euro6IX
  – Quality of VoIP depends largely on latencies in hardware
• Now moving to VOCAL+ENUM integration
  – A lot of issues to be sorted out
Certification Publish and Request with DNSsec
Scenario

- Complete DNSSEC hierarchy under .e6 with IPv6 and IPv4 support and a master/slave relation secured using TSIG
XEDL: Session Management Tool

Isabel event
WEB server

INTERNET

WEB server

Manager at
master site

Isabel event

VPN
creation

INTERNET

Web
browser

Linked to Policy
Based System
User Auth. DSL, PPP connections based on IPv6

- First scenario:
  - Unique domain
  - End-user is authenticated
  - End-user obtains a prefix (IPv6CP)

- Second scenario:
  - several domains
  - Security between Radius servers is a concern => VPN
User authentication

• **Future**: PANA Protocol for carrying Authentication for Network Access (PANA) and DIAMETER Protocol that allows clients to authenticate themselves to the access network using IP protocols

• **Collaboration with PANA-developers for integration with DIAMETER pure scenario.**
Extended TB architecture

- Integrate new functionality over TB RFC
- Supports entities authentication (Integration with PKIv6)
- UMTP Universal Tunnel Management Protocol
  - used between all devices
  - messages can be “secured” using signs
  - supports several tunnel types (IPv6 in IPv4, IPv6 over UDP, IPSECv6 tunnels)
Multihoming demonstration

Linux web server with an adapted version of Looking Glass

VNUml based scenario

IPv6 enabled web browser

Euro6IX network
Thanks!

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- Madrid 2005 IPv6 Summit, soon more info at: http://www.ipv6-es.com

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