IST FP6 MUSE Integrated Project

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IPv6 Cluster meeting
June 9th, 2004

Note: presented proposals on IPv6 are ideas from individual partners and do not yet represent a MUSE consensus.
Introduction to consortium

Integrated project on BB access

Phase I: 2004-2005
Phase II: 2006-2007
34 partners
110 PY/year

System vendors
ALCATEL
ERICSSON
Lucent Technologies Bell Labs Innovations
SIEMENS
THOMSON

Operators
BT
Telefónica
france telecom R&D
TELECOM ITALIA

Research Inst. & Universities
IMEC
Inria
Budapest University (BUTE)
ICCS/NTUA
HHI
Lund Institute of Technology (LTH)
TU Eindhoven
ACREO
Univ. Carlos III de Madrid
University of Essex

Component vendors

SME

IPv6 Cluster meeting 09.06.2004 — 2
Project objective

Low cost, full service access and edge network for ubiquitous delivery of broadband services to all European users

IPv6 Cluster meeting 09.06.2004 — 3
Study of future access and edge **architecture** aiming at **consensus** by almost all major players

Open **service enabling** access platform multi-service and multi-hosting capable

Cost effective migration to **high BW** (optical - DSL) (ready for 100 Mbit/s per user by 2010)

Definition of global set of **standards** allowing for interop between access network elements and CPE across the different network layers

**Business case** evaluation of low cost target for the end-user (< ca. 50 Euro/month) and benefits for every player in the value chain

**Proof-of-concept** in end-to-end lab trials
Highly efficient delivery of BB services for “50 Euro /user /month”

> Typical monthly fee for ADSL/Cable today: 25-75 Euro
  • Users will not spend more, but will desire more for the same fee
  • Flat fee model for connectivity: margins eroding due to competition
> Ability to deliver value added services is essential
> How to achieve ubiquitous BB service delivery?
  • Get the business case profitable for every player in the value chain
“Open”
- Access provider allows to interface with various service and application providers
- Interface with different consumer appliances in the home network

“Service enabling”
- Provide necessary network behaviours to support multiple services
- Allows access provider to provide added value and to tap on the revenue stream

“Access platform”
- Combination network elements that allow delivery of BB services
- Provide generic “application developer toolkit”
Integrated trial (in 2nd phase)
Project planning

- 2004:
  - Network architecture

- 2005:
  - Enhanced network view
  - Network elements 1st feature group

- 2006:
  - Network elements 2nd feature group

- 2007:
  - Integrated lab trials 1st feature group
  - Integrated lab trials 2nd feature group
AGGREGATABLE ADDRESING
IPv6 Global Unicast Address

FP: Format Prefix
• Must be 001b for Global Unicast Addresses.
• 2000::/3 is the global unicast address range.

Global Unicast Address Prefix (/16):

<table>
<thead>
<tr>
<th>IPV6 PREFIX</th>
<th>FP</th>
<th>TLA (HEX)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000::/16</td>
<td>001</td>
<td>0x0000</td>
<td>Reserved</td>
</tr>
<tr>
<td>2001::/16</td>
<td>001</td>
<td>0x0001</td>
<td>Sub-TLA-Assignments</td>
</tr>
<tr>
<td>2002::/16</td>
<td>001</td>
<td>0x0002</td>
<td>“6to4”</td>
</tr>
<tr>
<td>3FFE::/16</td>
<td>001</td>
<td>0x1FFE</td>
<td>6bone Testing</td>
</tr>
<tr>
<td>3FFF::/16</td>
<td>001</td>
<td>0x1FFF</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

The ones not listed are reserved.
### IPv6 Global Unicast Address (II)

> Global Unicast Address Prefix (/23):

<table>
<thead>
<tr>
<th>IPv6 Prefix</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001:0000::/23</td>
<td>IANA</td>
</tr>
<tr>
<td>2001:0200::/23</td>
<td>APNIC (Asia/Pacific)</td>
</tr>
<tr>
<td>2001:0400::/23</td>
<td>ARIN (America)</td>
</tr>
<tr>
<td>2001:0600::/23</td>
<td>RIPE NCC (Europe, Middle East, Central Asia, Africa)</td>
</tr>
<tr>
<td>2001:0800::/23</td>
<td>RIPE NCC</td>
</tr>
<tr>
<td>2001:0A00::/23</td>
<td>RIPE NCC</td>
</tr>
<tr>
<td>2001:0C00::/23</td>
<td>APNIC</td>
</tr>
<tr>
<td>2001:0E00::/23</td>
<td>APNIC</td>
</tr>
<tr>
<td>2001:1000::/23</td>
<td>Future Assignment</td>
</tr>
<tr>
<td>2001:1200::/23</td>
<td>LACNIC (Latino America, Caribe)</td>
</tr>
<tr>
<td>2001:1400::/23</td>
<td>RIPE NCC</td>
</tr>
<tr>
<td>2001:1600::/23</td>
<td>RIPE NCC</td>
</tr>
<tr>
<td>2001:1800::/23</td>
<td>ARIN</td>
</tr>
<tr>
<td>2001:1A00::/23</td>
<td>RIPE NCC</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>2001:FE00::/23</td>
<td>Future Assignment</td>
</tr>
</tbody>
</table>
> Subnet ID
  • Identifies subnet.
  • Used by individual organizations to create their own local addressing hierarchy.
  • One subnet prefix <-> One Link.

> Interface ID:
  • Identifies a unique interface on a link.
  • In many cases, based on the link-layer address (MAC) of an interface.
  • Could contain the IMEI number of a mobile phone (Nokia proposal)
  • Constructed in the EUI-64 format (based on 48-bit MAC address).
## Assignment Address Space Size

> **LIRs (ISP) Assignment:**
> - /32 for ISPs that plan to connect more than 200 end-sites in two years.

<table>
<thead>
<tr>
<th>Assigned ISP Prefix (32 bits)</th>
<th>IAF(32)</th>
<th>Interface ID</th>
</tr>
</thead>
</table>

> **End Sites Assignment:**
> - /48 in general case

<table>
<thead>
<tr>
<th>Assigned End-Site Prefix (48 bits)</th>
<th>Sub-Net ID (16)</th>
<th>Interface ID (64 bits)</th>
</tr>
</thead>
</table>

- /64 when it is known that only ONE SUBNET is needed by design.

<table>
<thead>
<tr>
<th>Assigned End-Site Prefix (64 bits)</th>
<th>Interface ID (64 bits)</th>
</tr>
</thead>
</table>

- /128 when it is known that only ONE DEVICE is connecting.

| Assigned End-Site Prefix (128 bits) | |
|-------------------------------------| |
The address assignment reflects the network topology.

Two Options:

- Each ISP assigns the address prefix (IAF) to a site hierarchically.
  - Used for subnetting
- “Hybrid” assignment of the IAF by both ISP and NAP
  - 32 bit IAF field:
    - Edge Routers (ERs) of NAP can be identified (e.g. 8 bits)
    - IP DSLAMs of NAP can be identified (e.g. 12 bits)
  - First 16 bits of Interface ID for identification of subnets within organization.
    - This would require an adaptation of the IETF Standard!!!!
  - 48 bit: interface ID ~ MAC (e.g. MAC+time)

Neither ISP nor NAP is involved in the address prefix. Instead it is controlled by national authorities and reflects the topological location, related to infrastructure (reflecting population density). See Geographical proposal.
Advantages & Disadvantages of Hierarchy

> Advantages:
  - Reduces the required address information at every switch.
  - Allows simple and efficient routing.
  - Scalable to an internet of any conceivable size.
  - Automatic assignment of IPv6 address to all subscribers.

> Disadvantages:
  - Host and Routers addresses need to be changed when:
    - Network topology changes > yes, but changes are regional only, for example there is no change outside a town if there is a new quarter constructed in this town
    - Changing from one ISP to another one > not for infrastructure related addressing!
  - Requires renumbering technology (which however can be simple and low cost).
  - Does not solve the problem of Load Balancing
    - it does load balancing if local routing is possible in each node (for example in a town much traffic is expected to remain in the town)
CEOGRAPHICAL ADDRESING
### IPv6 Global Unicast Address

**FP: Format Prefix**
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**Global Unicast Address Prefix (/16):**

<table>
<thead>
<tr>
<th>IPv6 Prefix</th>
<th>FP</th>
<th>ASCII code</th>
<th>Global Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>22B1::/16</td>
<td>001</td>
<td>0xB</td>
<td>0001</td>
<td>North America</td>
</tr>
<tr>
<td>22B3::/16</td>
<td>001</td>
<td>0xB</td>
<td>0011</td>
<td>Europe</td>
</tr>
<tr>
<td>22B7::/16</td>
<td>001</td>
<td>0xB</td>
<td>0111</td>
<td>Asia</td>
</tr>
<tr>
<td>22BF::/16</td>
<td>001</td>
<td>0xB</td>
<td>1111</td>
<td>Latin America</td>
</tr>
</tbody>
</table>
> Proposed Global assignment of the Fixed Value
  
  - 1 bit: always a “0”
  
  - 8 bit: Code Assigned by the IETF
    - For example “+” (Ascii 0x2B) to indicate relationship with telephone numbering
  
  - 4 bit: Global Area Code by the IANA
    - 0001 = North America (ARIN)
    - 0010 = Middle East, Central Asia, Africa (RIPE)
    - 0011 = Europe (RIPE)
    - 0101 = Latin America, Caribe (LAPNIC)
    - 0110 = Asia/Pacific (APNIC)
    - For example 2exp48 addresses for Europe = 28.000 billions prefixes
> Proposed assignment of the Geographical Address

- **12 bits**: Country code,
  - i.e. 001 = US; 049 = Germany; 034 = Spain; 358 = Finland; 972 = Israel)

- **12 bits**: Area code
  - In relation to the current assignment per country

- **24 bits**: Access code
  - In telephone numbering it was related to the PABX the user got service from. > this principle should be maintained. The DSLAM should have contiguous prefix blocks
  - For data networks it can be use to identify the “Access Network” that provides connectivity to the end-user.

Possible conflict: Israel belongs to middle east

Area codes are different in each country:
in D: 2 digits for large towns, 4 digits for rural areas
in B: 1-digit code?
in F: '1' for region parisienne, '4' for Rhone-Alpes etc.
MUSE is focusing on "Access architecture aiming for synergies between different first mile solutions" with the purpose of "enhancing impact of EU in standardisation".

MUSE will influence in end-to-end scenarios by clustering with "home network and core network" R&D projects.

MUSE will dedicate great effort in setting the basis for IPv6 optimised access networks. A common vision with all IPv6 actors is essential!

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Questions?