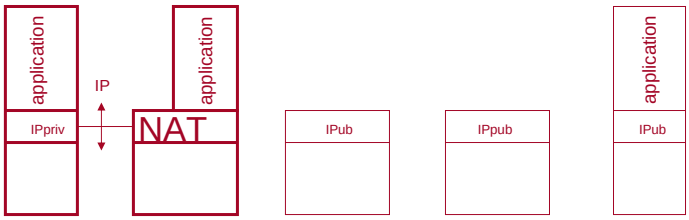
IPv6 and home networking

Laurent Toutain
Laurent.Toutain@enst-bretagne.fr

Triple play architecture



- **Provider services have a public address**
  - They can be managed directly
- **User is behind a NAT so:**
  - He cannot be joined directly
  - He does not know the public address
  - Security feeling
- **Is NAT the provider way to impose its own value added services and block the others ?**

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NAT : Fortified castle ?

- **UP&P allows applications to modify NAT context to publish port numbers**
  - Big security issue
- **NAT traversal exists:**
  - Skype uses it :
    - Locate a relay with a public address
    - Use this relay to communicate with private equipments
  - Microsoft TEREDO generalized this approach
    - An IPv6 address is constructed based of public IPv4 address
    - Even behind a NAT an application will have an IPv6 public address.
- **Routing is inefficient, but who cares if its works**

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Model evolution

- **Going back to end-to-end principle**
  - I know my identity on the network
  - I can be joined directly
- **Introduce security and trust to services**
  - I cannot be joined directly if I have not registered my service
- **Introduce more flexibility**
  - In terms of architecture
  - In terms of services deployment
- **Very smooth evolution from existing architecture to the new one**
- **Adapted to large audience without any network knowledge**

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IPv6

- **IPv4 prefixes are more and more difficult to obtain**
  - End forecasted in 2008-2010
- **IPv6 offers almost unlimited addressing space**
  - But every equipment (host, router) and application have to be modified
  - Most of content is only accessible in v4
  - Dual Stack approach (private IPv4 and public IPv6)
- **If IPv6 packet format is different, administrative process and network architecture remain the same**
  - IPv4 : one address is allocated to site
  - IPv6 : one prefix (part of the address) is allocated to site

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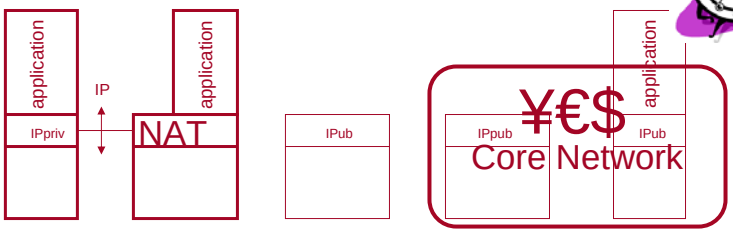
Adding IPv6



- **IPv4 and IPv6 prefixes are managed the same way**
- **Adapt equipment to IPv6 (routing protocol and forwarding plan)**
  - If not possible with core network elements : use MPLS or 6PE
- **We already have some IPv6 core networks**

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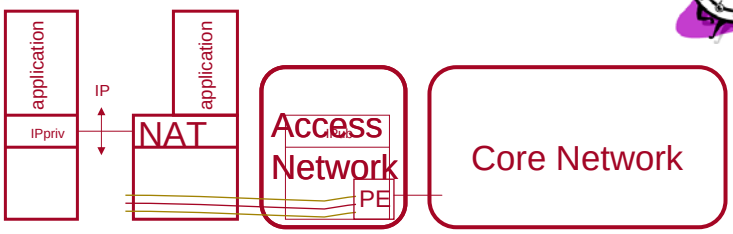
Adding IPv6



- **V6fication can be a question of investment**
- **But last mile syndrome… may stay IPv4 until new IPv6 based services are developed in home network.**
- **Transition is possible**
  - IETF's Softwires working group

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Softwires' tunnels

- **During first phase : L2TP**
  - L2TP uses UDP => NAT Traversal
  - PPP is encapsulated in L2TP :
    - User authentication
    - Keep alive messages to maintain NAT contexts
    - Link Local addresses configuration
- **Study prefix delegation**
  - Interaction with DHCPv6 PD
  - Interaction with AAA

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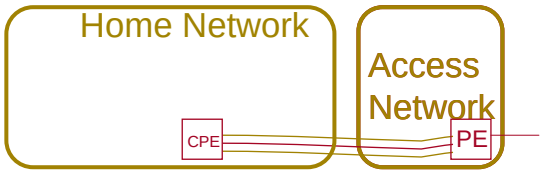
Softwires' tunnels



- **Three possibilities in Home Network :**
  - CPE on hosts: One IPv6 address per hosts
  - CPE on special devices :
    - Prefiguration of IPv6 service : always-on, not computer centric
    - Point6box experimentation
  - CPE on Home Gateway
    - Last step before dual stack Access Network
- **Challenge :**
  - Low cost CPE
  - PE architecture

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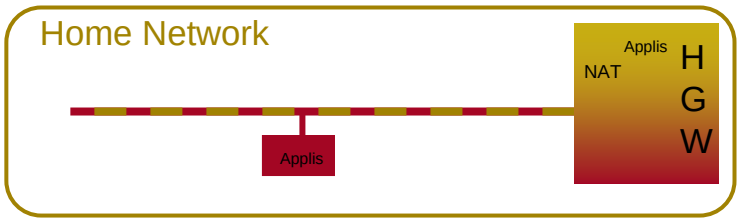
Home Network Architecture



- **Have some dedicated applications outside of the gateway**
  - Managed by the provider ?
  - Security is a key element

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Home Network Security

- **In IPv4 : NAT gives a security feeling**
- **In IPv6 : Firewall can do the same**
  - Address scanning is more difficult
  - In-gress connection filtering can be done
- **Benefits : Application knows their addresses**
- **But we need to go forward to accept some incoming sessions:**
  - With extensions : protocol stack is complex and order is important
  - Addresses may change from time to time (privacy issues)
- **Need for a formal language to specify rules**
- **Need dialog between applications and routers**
  - Based on a service discovery protocol

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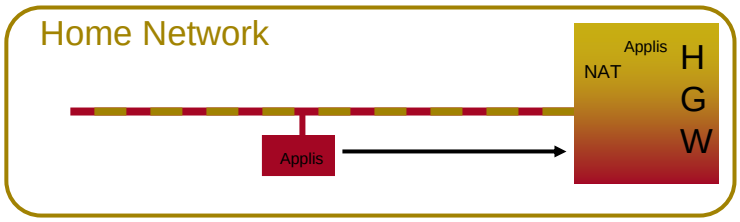
Home Network Architecture



- **Better security than UPnP NAT context setting**
- **Authentication is a way to maintain links between providers HGW and applications**
  - Standard protocols or pre registered keys ?

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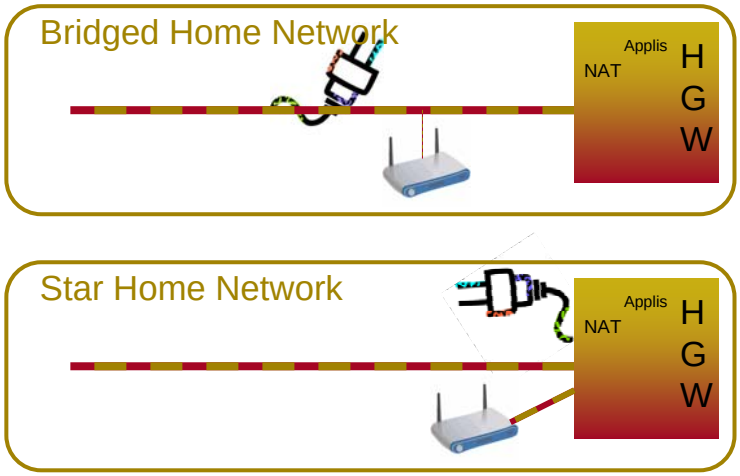
Home Network Architecture



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Home Network Architecture

- **User can build complex architecture**
  - If Bridging is used : loops must be detected
  - Spanning Tree is not efficient for Traffic Engineering
  - Traffic will converge on some links
- **Routing will allow more control:**
  - Routers have to be configured

GP = provider	SID = ?	I-ID = autoconf

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DHCPv6 Prefix Delegation

- **Main idea: The edge router**
  - become the DHCPv6 server for prefixes (/64) for the home network.
  - Get a global prefix for the provider.
  - Create a pool of GP:SID to reach the /64 boundary
  - Allocate these prefixes to routers
- **When a router starts :**
  - Periodically broadcast requests until receiving an answer from a DHCPv6 server
  - When configured act as a DHCPv6 relay.
- **More studies on multi-homing and network stability are needed**

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No Administration Protocol

- **`draft-chelius-router-autoconf-00.txt`**
- **Main idea:**
  - IPv6 address is divided in 3 parts
    - GP is given by the ISP (DHCPv6,…)
    - IID is obtained through auto-configuration
    - SID is currently configured manually in routers
  - To allow a full auto-configuration, SID must be assigned automatically.
- **Solution :**
  - Use extension to OSPF to obtain a consensus on SID value in a domain.
- **Next Step :**
  - Better integration with routing protocols

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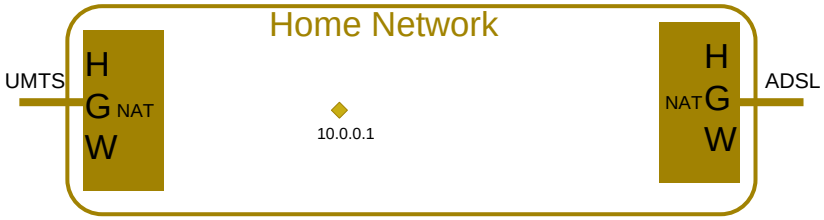
IPv4 Multi-homing



- **Private addresses for hosts**
- **Packets are routed to the closest exit router**
- **Exit router will change the source address to the provider's address**
- **Applications are not multi-home aware**

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IPv6 Multi-homing

- **Host will have one per providers**
  - Rules to select source address are very simple
- **Routing is based mainly on default route**
  - Packet may led to the wrong provider and discarded
- **Modify IGP to handle source address in default routing ?**

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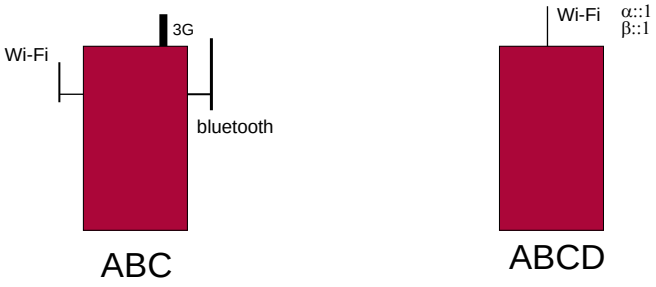
ABC Extension

2010

- **Improve IGP to handle source address properly**
- **When an equipment selects a provider by selecting the source address**



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ABCD

2010

- **Edge routers using service discovery protocol gives information concerning providers network (cost, bandwidth, error rate, prefix…)**
- **Application selects source address regarding edge router information**
- **If one access fails, application decides the appropriate behavior**
  - Wait until network recover
  - Change addresses (source or destination)
- **Compatible with shim6 multi-homing approach**

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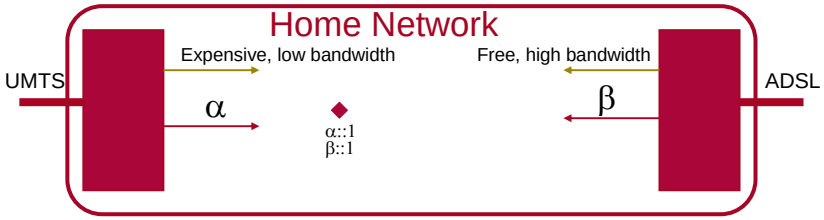
ABCD example



- **Peer to peer application:**
  - Use β prefix - If β fail, wait
- **VoIP application:**
  - Use β prefix - if β fail use α (a multi-homing mechanism will mange address change)
- **Monitoring application:**
  - Use β prefix - if β fail use α and reduce quality

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Routing strategy

- **Current IGP:**
  - scalable
  - Traffic converge to high speed links
- **Home network:**
  - Relatively low bandwidth
  - No scalability problems
  - Spread as much as possible traffic to use available bandwidth

Laurent Toutain

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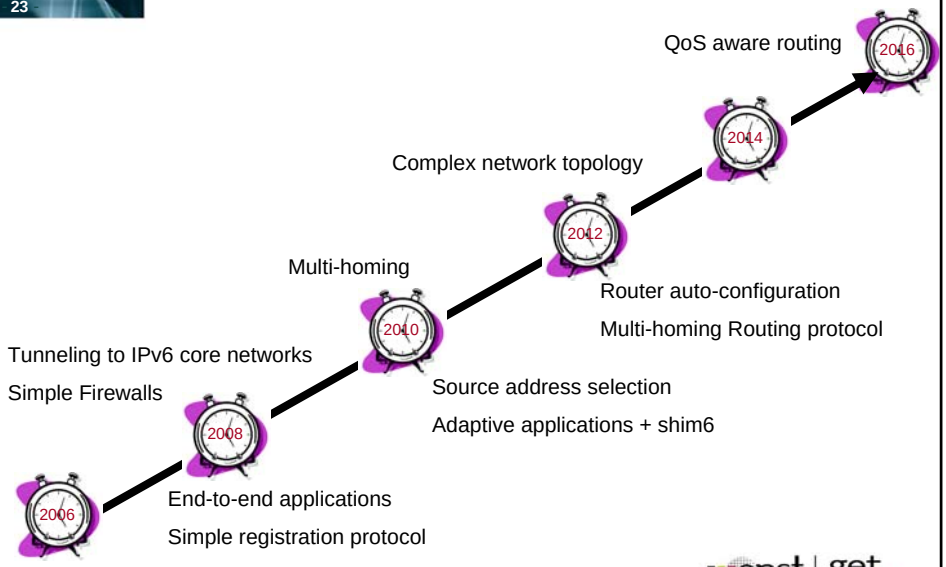
Conclusions: Time line



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Conclusions

- **To go from interface to interconnection:**
  - Guaranty security
    - Trust in providers, in equipments
  - Guaranty simplicity
    - For users: plug and play
    - For providers: not all services in one box
    - Keep IPv6 simple to allow interconnection
  - Guaranty quality
    - For user : “intuitive” cabling
  - Guaranty incomes
    - Based on service discovery and security