IPv6 overview

Florent Parent
Florent.Parent@viagenie.qc.ca

http://www.viagenie.qc.ca

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Viagénie

- Consulting firm specialized in:
  - Network security and PKI
  - Advanced IP networks (IPv6)
  - Voice/Video/Telephony over IP
  - Internationalisation
- Runs the CA*net3 IPv6 backbone with Dalhousie Univ.
- Runs the 6tap exchange with ESnet.
- Designed and runs the freenet6 tunnel server (http://www.freenet6.net)
- Port quake to IPv6 and runs a quake IPv6 server
- Helping ISP and organisations to deploy IPv6

Plan

- IPv6 Features
  - Address space
  - Packet format
  - Autoconfiguration
- Mobile IPv6
- Applications
- Deployment
- What to choose ?

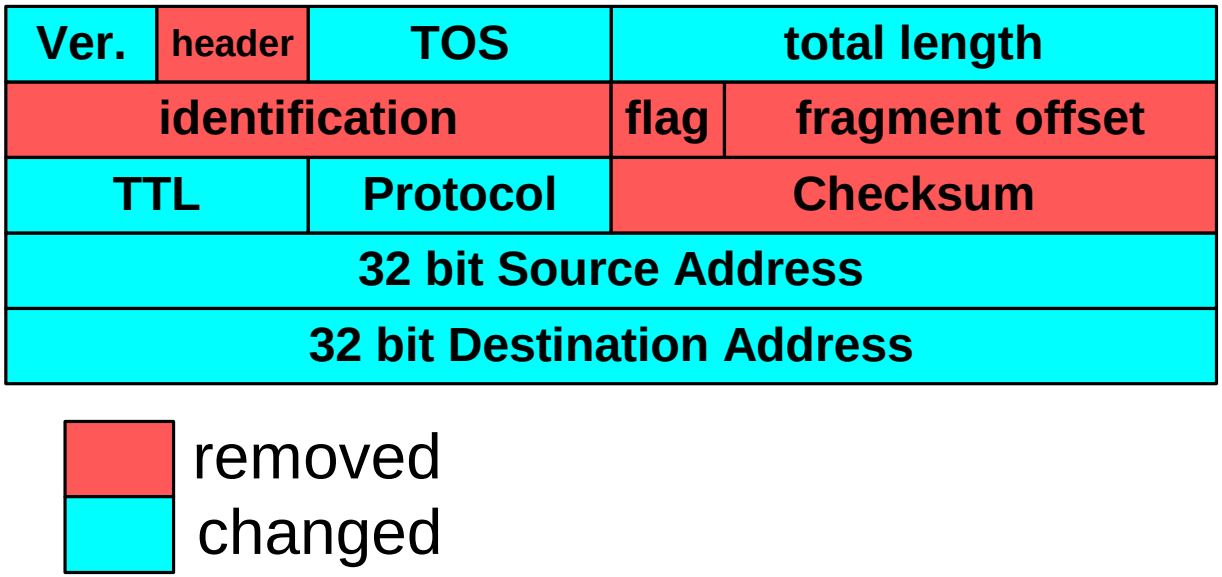
IPv6 Features

- Larger Address Space
- Aggregation-based address hierarchy
  - Efficient backbone routing
- Efficient and Extensible IP datagram
- Autoconfiguration
- Security (IPsec mandatory)
- Mobility
- IP Renumbering

Larger Address Space

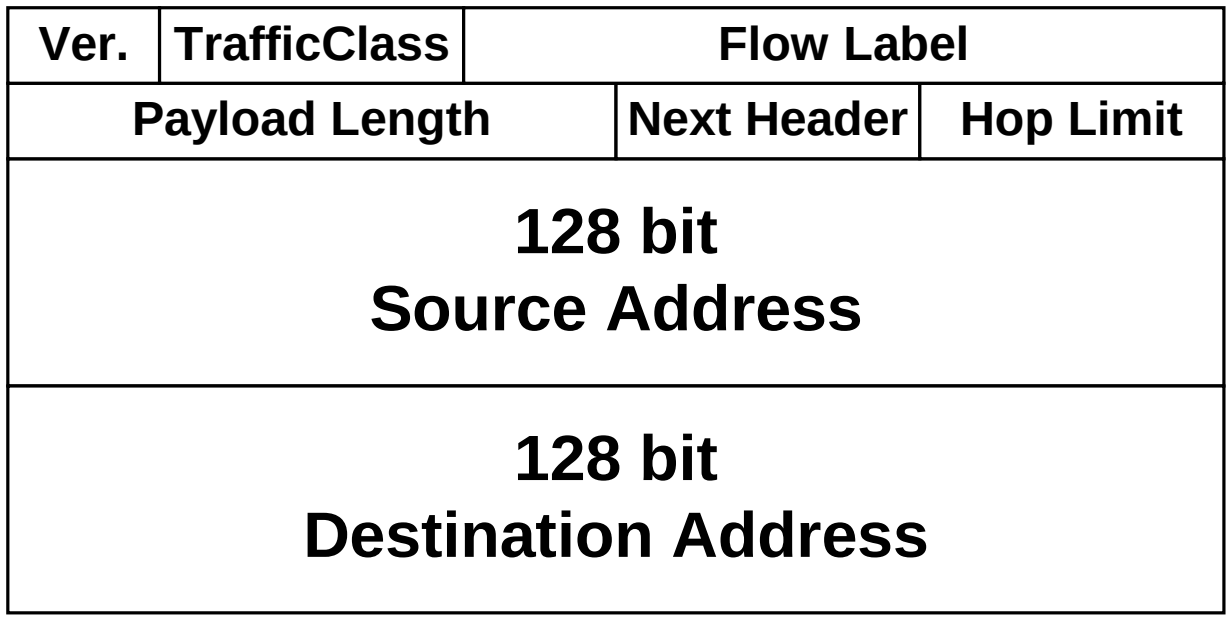
- IP addresses are 128 bits
- IP addresses are scoped
  - Link-local scope (trafic limited to local link)
  - Site-local scope (trafic limited to site)
  - Global scope
- Address types
  - unicast (one to one)
  - multicast (one to many)
  - anycast (one to nearest)
  - NO broadcast

IPv4 packet format



- IPv4 packet length: 20 bytes + options

IPv6 packet format



- IPv6 packet length: 40 bytes (= 2x IPv4)

Efficient and Extensible IP datagram

- IPv6 basic packet is of fixed length
  - Simple header, 64 bits field alignement
  - No options, no checksums
  - No fragmentation by routers
  - >> **Efficient routing**
- IPv6 packet length is twice as big as an IPv4 packet without options
  - BUT: the size of the average compressed IPv6 header will be smaller than the corresponding IPv4 header

Efficient and Extensible IP datagram

- Extensions to the header can be added
  - Most do not require router intervention

IPv6 Header next = TCP	TCP Header + data

IPv6 Header next = routing header	Routing Header next = TCP	TCP Header + data

IPv6 Header next = security hdr	Security hdr next = Destination hdr	Destination hdr next = TCP	TCP Header + data

Autoconfiguration

- Stateless Address Autoconfiguration
  - Plug and Play
  - No manual configuration required on end nodes
  - Nodes uses router advertisements on the link to automatically configure its IPv6 address, default route, MTU

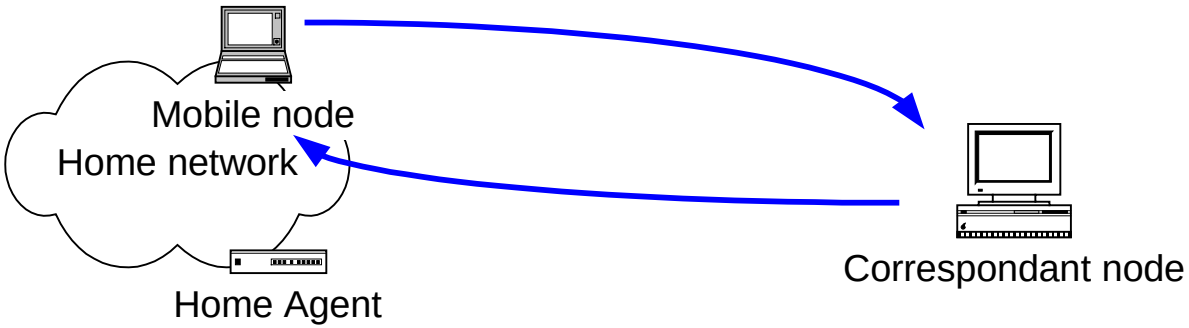
Mobile IPv6

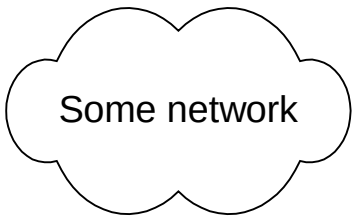
- Mobile IP allows node to always be identified by its home address, regardless of its current point of attachment to the Internet
- Benefits of IPv6
  - Mobile IP is now fully integrated into IPv6
  - Mobile IPv6 uses the destination header options in IPv6
  - Provides many improvements over Mobile IPv4.

Mobile IPv6

- Route optimization is built in IPv6
  - eliminates the « triangle routing » problem in mobile IPv4
- No need for foreign agents
  - Neighgor discovery and autoconfiguration provides the required mechanisms for the mobile node
- IPsec is used as the security mechanism
  - available in all IPv6 implementations

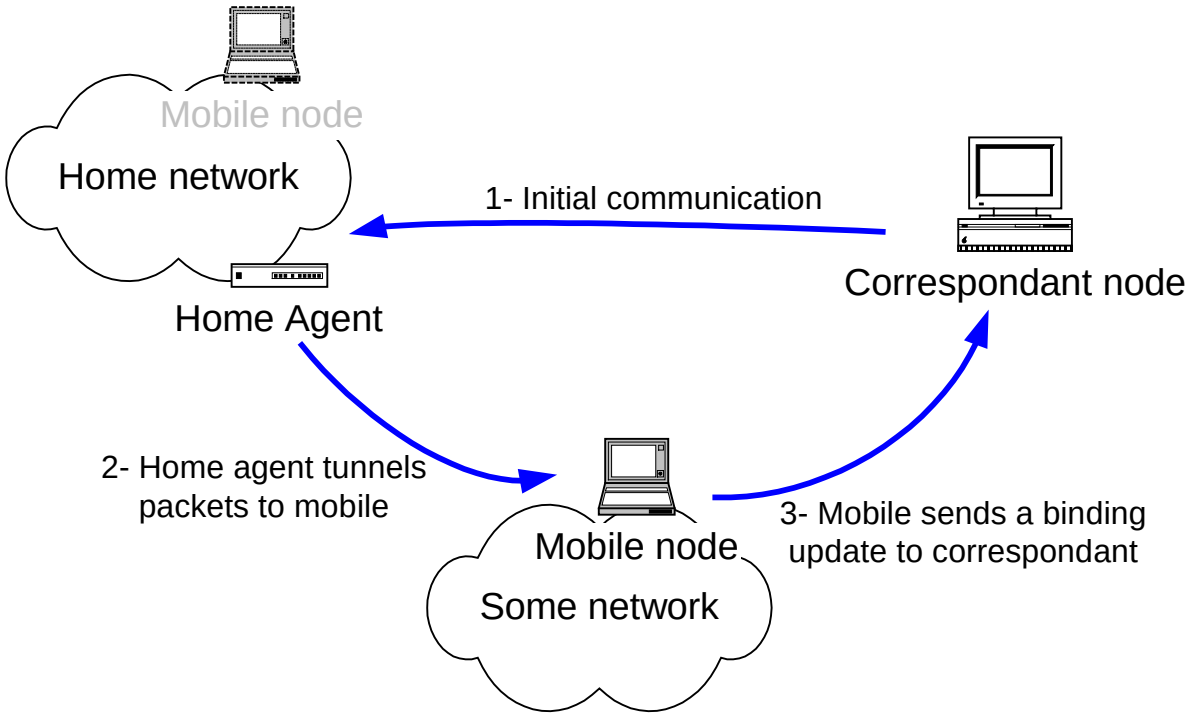
Mobile IPv6





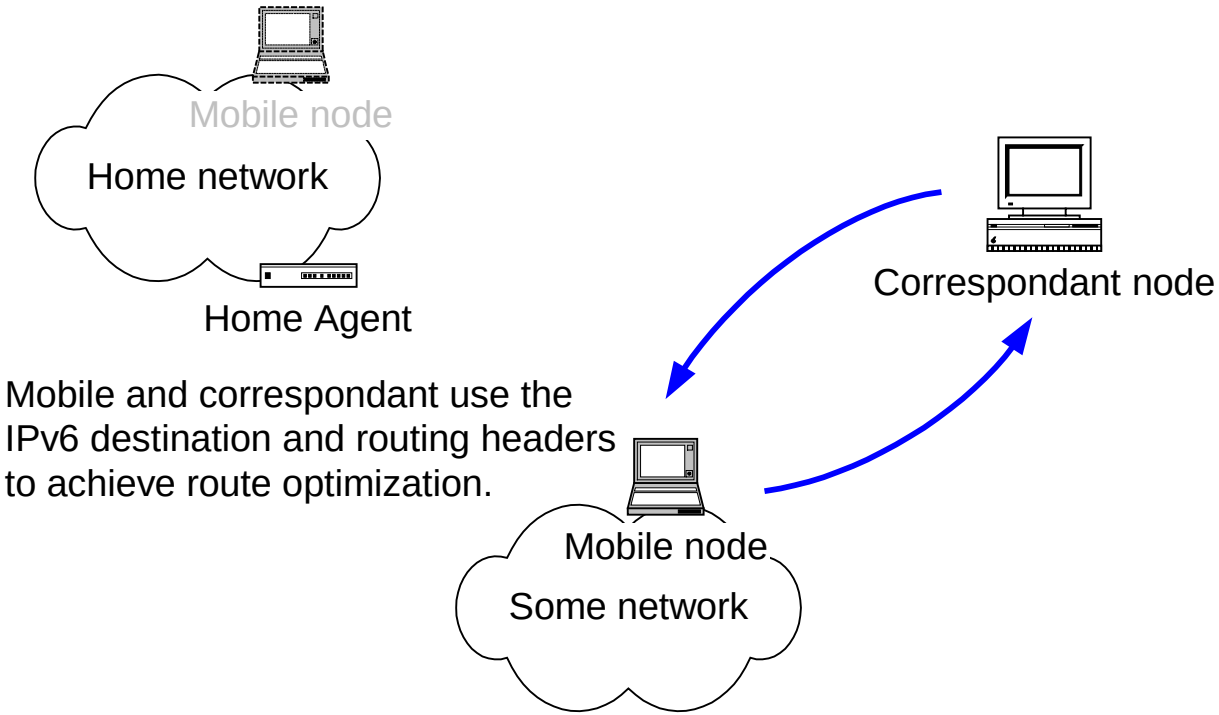
- Mobile node in home network

Mobile IPv6



- Mobile node registers its new address with home agent
- Home agent will redirect traffic to mobile node

Mobile IPv6



- Correspondant still refers to mobile node by its home address
- Mobility is now fully integrated into IP

Applications

- More and more applications are being ported to IPv6
- The IPv6 API is well documented and standardized
  - Source and binary compatible with existing code and applications
  - Existing binairies (IPv4) will continue to run
  - Minimum changes in API
  - Porting applications to IPv6 should be easy
  - Seamless IPv6/IPv4 interoperability

Applications

- Test case: Quake
  - Only 200 lines of code needed to be changed of a total of 146500 lines. (Including comments and blank lines)
  - Compiled under *BSD/KAME, Linux, Solaris8, WindowsNT/2000 using the **same standard API**

IPv6 deployment

- New infrastructures can build on IPv6 from start
  - Deploy IPv6 nodes and applications
  - New applications deployed within IPv6 networks do not require proxies or NAT boxes.
    - **Simpler and less expensive to deploy new applications**
  - IPv6 clients can access any IPv6 applications, services, content …

IPv6 deployment

- Not all applications are IPv6 ready (as of today, the Internet is still mostly IPv4)
- IPv6 was designed from the beginning with transition mechanisms in mind (many tools are available)
- For example, application gateways can provide access to the IPv4 network services
  - Typically, a dual stack (IPv4/IPv6) node running application proxies (mail, web …)
  - These gateways are used only when an IPv6 client is requesting a service from an IPv4 only server.

What to choose ?

- IPv4 is well knowed
- IPv4 is a « comfortable » technology

- ***BUT***
- IPv4 doesn’t offer the address space required for the new technologies
- IPv4 requires NAT for any large scale deployment
  - New services will be harder and more expensive to deploy
  - End-to-end model broken. Hard to implement security
- IPv4 requires « add-ins » for new services (Mobile IP, IPsec)

What to choose ?

- IPv4 may look as an easy path now, but new deployments using IPv4 will be stuck with the current limits.

What to choose ?

- IPv6 is stable
- Has industry support
- Provides new features
- Integrates Mobile IP and IPsec
- And may be adapted for new technologies

Conclusion

- IPv6 is NEW …
  - built on the experiences learned from IPv4
  - new features
    - large address space
    - new efficient header
    - autoconfiguration
    - IPsec, mobility
- … and OLD
  - still IP
  - build on a solid base
  - started in 1995, a lot of implementations and tests done

Some links on IPv6

- IPng wg: http://playground.sun.com/pub/ipng/html/
- NGtrans: http://www.6bone.net/ngtrans
- IPv6 users site: http://www.ipv6.org
- IPv6 Forum: http://www.ipv6forum.com
- Normos (Internet standards): http://www.normos.org