

# IPv6 at UCLouvain

## IPv6 usage and IPv6-only Wi-Fi

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## 1 IPv6 deployment status

- IPv6 enabled networks
- IPv6 statistics
- IPv6: what's next at UCLouvain

## 2 IPv6-only Wi-Fi

- IPv6-only network creation
- Giving access to IPv4 world
- Some results

Some numbers:

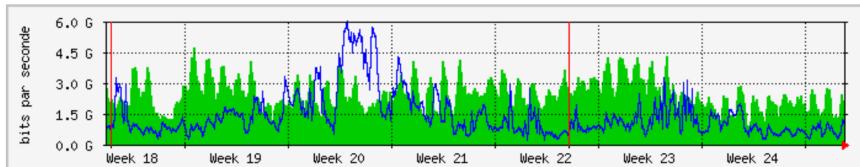
- 7 core routers
- $\sim 600$  network switches
- $\sim 30.000$  network sockets
- $> 1.000$  wireless access points
- point-to-multipoint connectivity between several campuses (LLN, Woluwe, Saint-Gilles, Tournai, ...)
- Up to 60.000 connected devices (15.000 through wireless)

Internet connectivity: 2 BGP peerings with Belnet at 10Gbit/s.

- Around 9% of the networks are IPv6 enabled (dual stack)
- This includes 93% of our wireless networks
  - All students and all computer scientists have access to IPv6
- CEPH storage backend is IPv6 only
- Some networks generate a lot of IPv6 traffic  
(e.g. transfers between our Centre for Cosmology, Particle Physics and Phenomenology and the CERN)
- Few web services available in IPv6 (`uclouvain.be` not IPv6 ready)

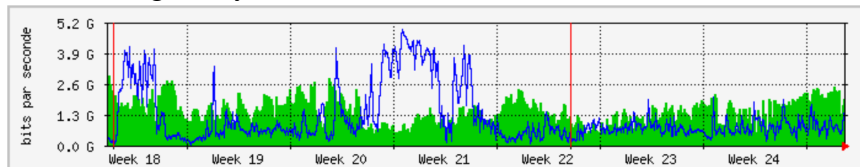
# IPv6 statistics

## IPv4 internet gateway:



	Max	Moyenne	Actuel
Entrée	4686.0 Mb/s (46.9%)	2378.3 Mb/s (23.8%)	1953.6 Mb/s (19.5%)
Sortie	5947.9 Mb/s (59.5%)	1378.2 Mb/s (13.8%)	1054.1 Mb/s (10.5%)

## IPv6 internet gateway:



	Max	Moyenne	Actuel
Entrée	2945.7 Mb/s (29.5%)	1420.2 Mb/s (14.2%)	1941.9 Mb/s (19.4%)
Sortie	4867.3 Mb/s (48.7%)	1142.6 Mb/s (11.4%)	766.8 Mb/s (7.7%)

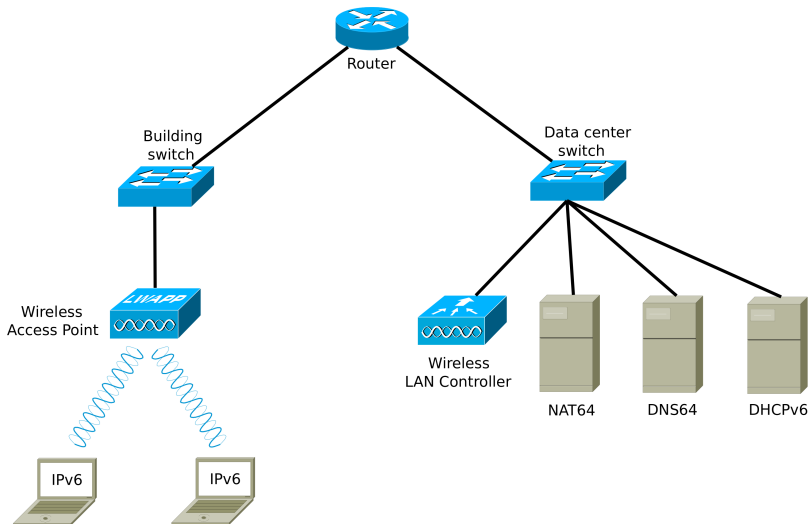
# IPv6: what's next at UCLouvain

Coming soon at UCLouvain:

- IPv6-only Wi-Fi
- IPv6 inside user VPN
- more internal networks and services supporting IPv6

# IPv6-only Wi-Fi: Architecture

Network components:



# IPv6-only Wi-Fi: Router and WLC

Create the IPv6-only network:

- Router: new network for wireless clients
  - Only IPv6 addresses and gateway
  - Stateless Address Autoconfiguration
  - DNS advertised both by RA and stateless DHCPv6



```
interface Vlan42
description WIFI-IPV6-ONLY
no ip address
ipv6 address FE80::80 link-local
ipv6 address AAAA::1/64
ipv6 enable
ipv6 nd other-config-flag
ipv6 nd ra dns server BBBB::1
ipv6 dhcp relay destination CCCC::1
```

Minimal configuration example on Cisco router

- Wireless LAN Controller: connect to this IPv6 network



# IPv6-only Wi-Fi: DNS64

Giving access to the old IPv4 world:

- DNS64: Resolves all domains into IPv6, even if only IPv4 exists
  - Forwards all requests to a "normal" DNS server
  - If AAAA asked but no IPv6 returned, create a new IPv6:  
64:ff9b::/96 + append IPv4/32 (RFC6052)  
Example: uclouvain.be: 130.104.6.136 → 64:ff9b::8268:688



```
options {  
    listen-on-v6 { any; };  
    allow-query { ACL_Allowed_Clients; };  
    dns64 64:ff9b::/96 {  
        clients { ACL_Allowed_Clients; };  
    };  
    recursion yes;  
    forwarders {  
        Your DNS1 IP;  
        Your DNS2 IP;  
    };  
    forward only;  
};
```

Additional configuration inside bind9 options file

# IPv6-only Wi-Fi: NAT64

Giving access to the old IPv4 world:

- NAT64: Translates IPv6 into IPv4
    - Packets going to 64:ff9b::/96 routed on this device
    - Other packets going to existing IPv6 address not intercepted
    - Stateful natting: Several IPv6 share a single IPv4
    - IPv4 destination extracted from last 32 bits of IPv6 destination
- Example: (uclouvain.be) 64:ff9b::8268:688 → 130.104.6.136



```
/sbin/modprobe jool
jool instance add UCL --iptables --pool6 64:ff9b::/96
jool -i UCL pool4 add --[protocol] [pool network] [pool ports]
jool -i UCL global update logging-bib true

iptables -t mangle -A PREROUTING --destination 64:ff9b::/96 -j JOOL --instance UCL
iptables -t mangle -A PREROUTING --destination [pool network] -p [protocol] --dport [pool ports] -j JOOL --instance UCL
```

Configuration example for Jool NAT64

# IPv6-only Wi-Fi: Results

- Works on many operating systems and devices



- Keeps compatibility with IPv4 world
- But some drawbacks:
  - Some badly coded applications won't work (e.g.: hardcoded IPv4)
  - Some applications not yet designed to support IPv6-only (e.g.: natting inside Virtualbox)
  - Longer connection times observed
- Tests to be continued...

# Questions ?



# Backup slide: IPv6-only Wi-Fi example

