Deploying IPv6 at University College Dublin

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About UCD

- Ireland's largest University
- Active in data networking since before Internet
- IPv4 since 1990
- Hosted HEAnet NOC for several years
- Cisco shop

Motivation

- TERENA Networking Conference 2014
- Hosted by HEAnet on UCD's main campus
- IPv6 access required for attendees

Earlier achievements (2007)

- IPv6 addressing plan
- BGP with upstream
- OSPFv3
- Public authoritative DNS dual-stacked
- Client equipment on dedicated test LAN

Known Problems

- Tunnelled — not native
- RA not reaching client — no SLAAC
- Server configuration brittle — abandoned
- No wireless
- Separate administration

Strategic Goal

- Position organization for further IPv6 deployment
  - Standard, replicatable configuration
  - Knowledge transfer into Net Ops Team
- Achieved!

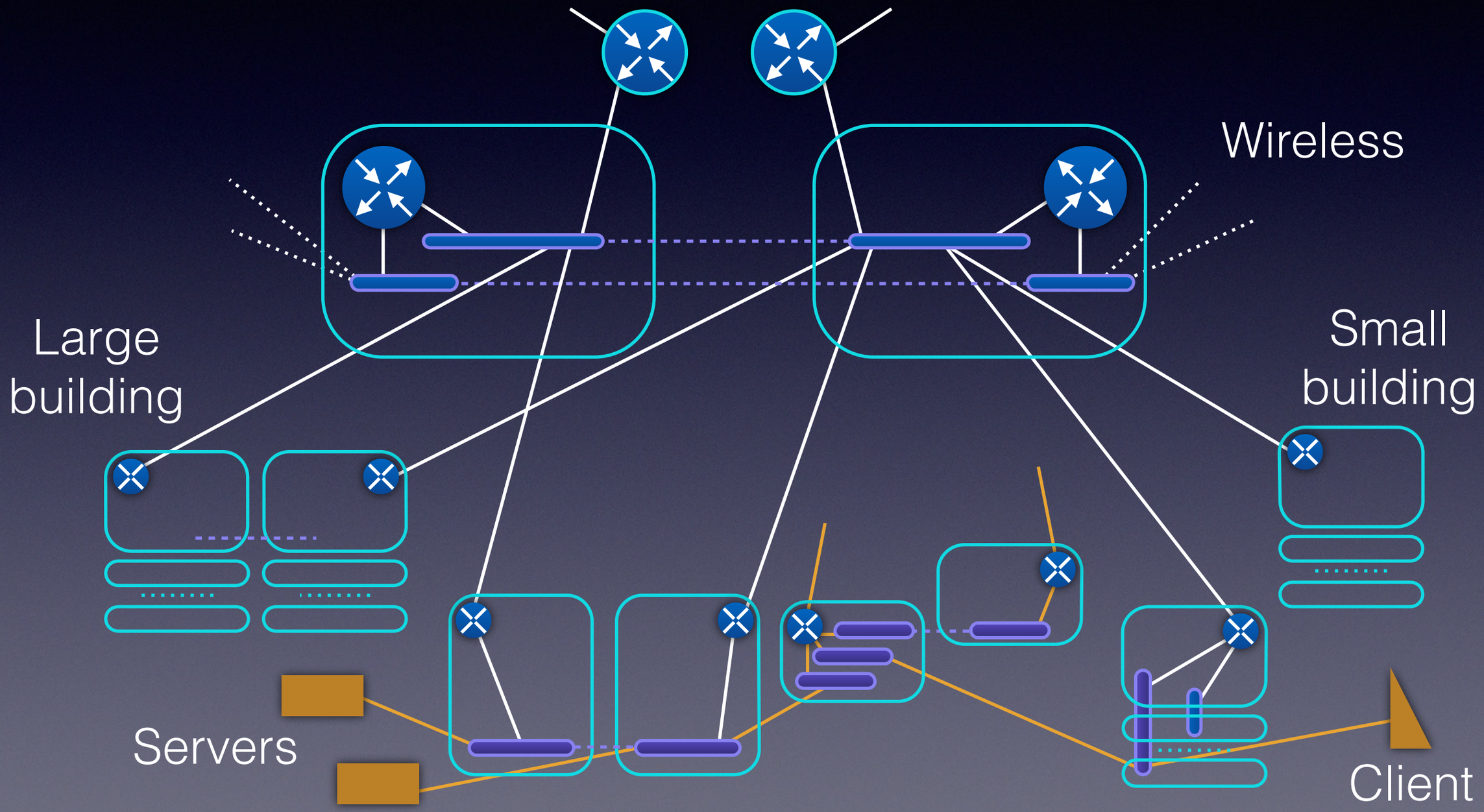
Operational Goals

- OSPFv3 on backbone LAN
- Native IPv6 and BGP on upstream links
- Wireless and cabled
- BCP 38
- Replace by-pass routers with dual stack
- Missing-RA problem
- L2/L3 address binding and logging
- Retire test LAN

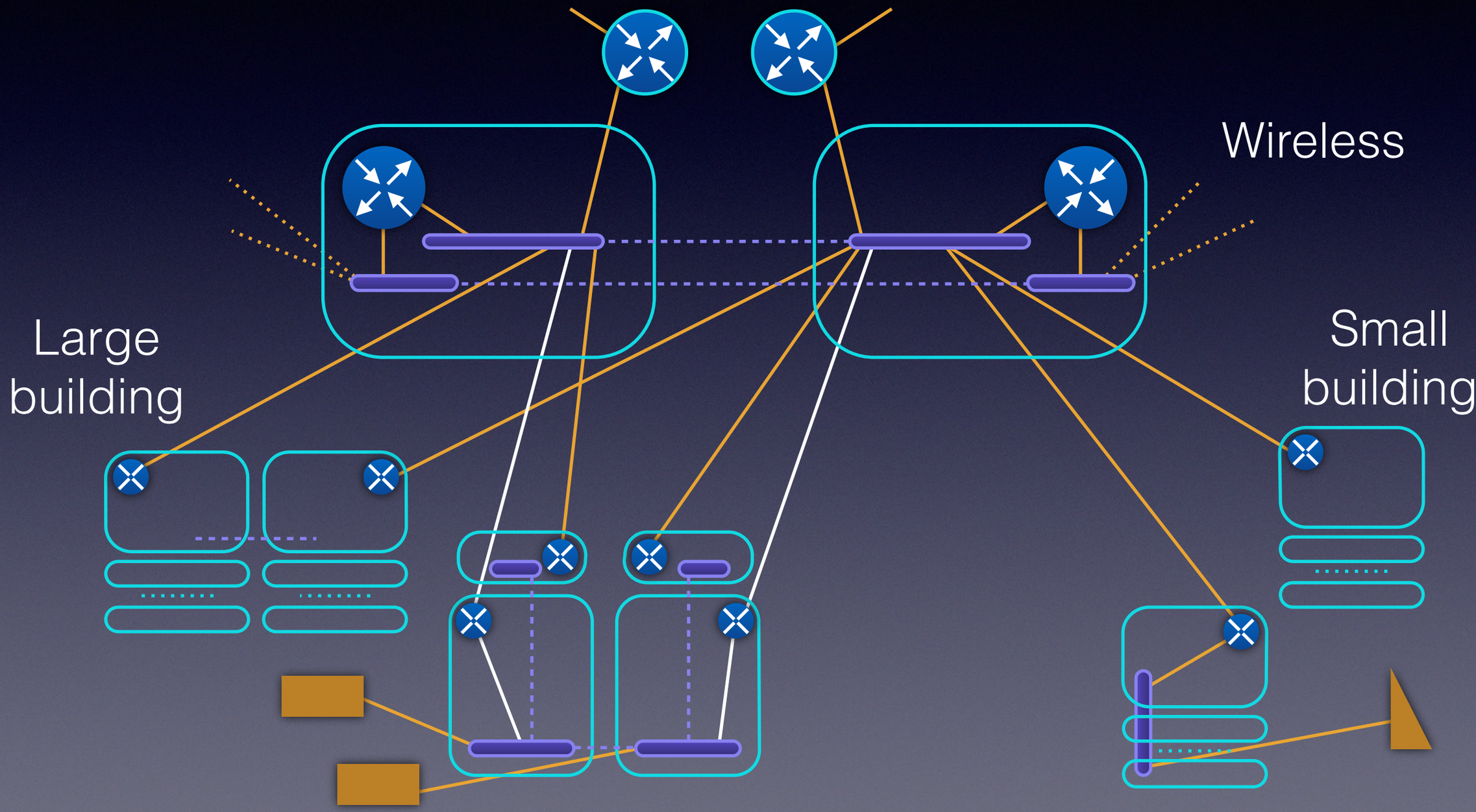
Operational Results

- ✔ OSPFv3 on backbone LAN
- ✔ Native IPv6 and BGP on upstream links
- ✔ Wireless and cabled
- ✘ BCP 38
- ✘ Replace by-pass routers with dual stack
- ✘ Missing-RA problem
- ✘ L2/L3 address binding and logging
- ✔ Retire test LAN

IPv6 status January 2014



IPv6 status April 2014



BCP 38

- Partial solution
- uRPF verification not available on access units
- Per-interface ACL as workaround

```
ipv6 access-list access-inward-101
   sequence 5 deny ipv6 any any routing
   sequence 50 permit ipv6 FE80::/10 any
   sequence 200 permit icmp 2001:770:98:101::/64 any nd-na log-input
   sequence 210 permit icmp 2001:770:98:101::/64 any
   sequence 300 deny ipv6 any 2001:770:98:2::/63
   sequence 400 permit ipv6 2001:770:98:101::/64 any
```

Dual-stack

- Border, core:
    - No difficulty
- Access:
    - Need recent kit running current software
    - Attention to switch database management (SDM)
- Server farm:
    - No opportunity for indicated software upgrade
    - By-pass routers added

Missing RA

- RA “lost” in transit of access switch stack
  - tcpdump shows RA is sent but never arrives
  - but intervening kit is “just switches”
  - ???
- Cause not identified
- Remedy: replace legacy kit with current

Address binding

- Available router images don’t track binding
- Logging entry in ACL misses some clients
- Wireless controller tracks binding
- Cabled net seems “unmanageable” for now

Assessment

- Support for IPv6 not evolved to “manageable”
- Available features depend on software image
- Software image constrained by actual hardware
- Management requirements not fully available
- Most existing plant needs capital for upgrade

Likely prospects

- Keep IPv6 for “eduroam” SSID
- Keep IPv6 in server farm
- Defer further IPv6 deployment until “manageable”

Those nagging e-mails

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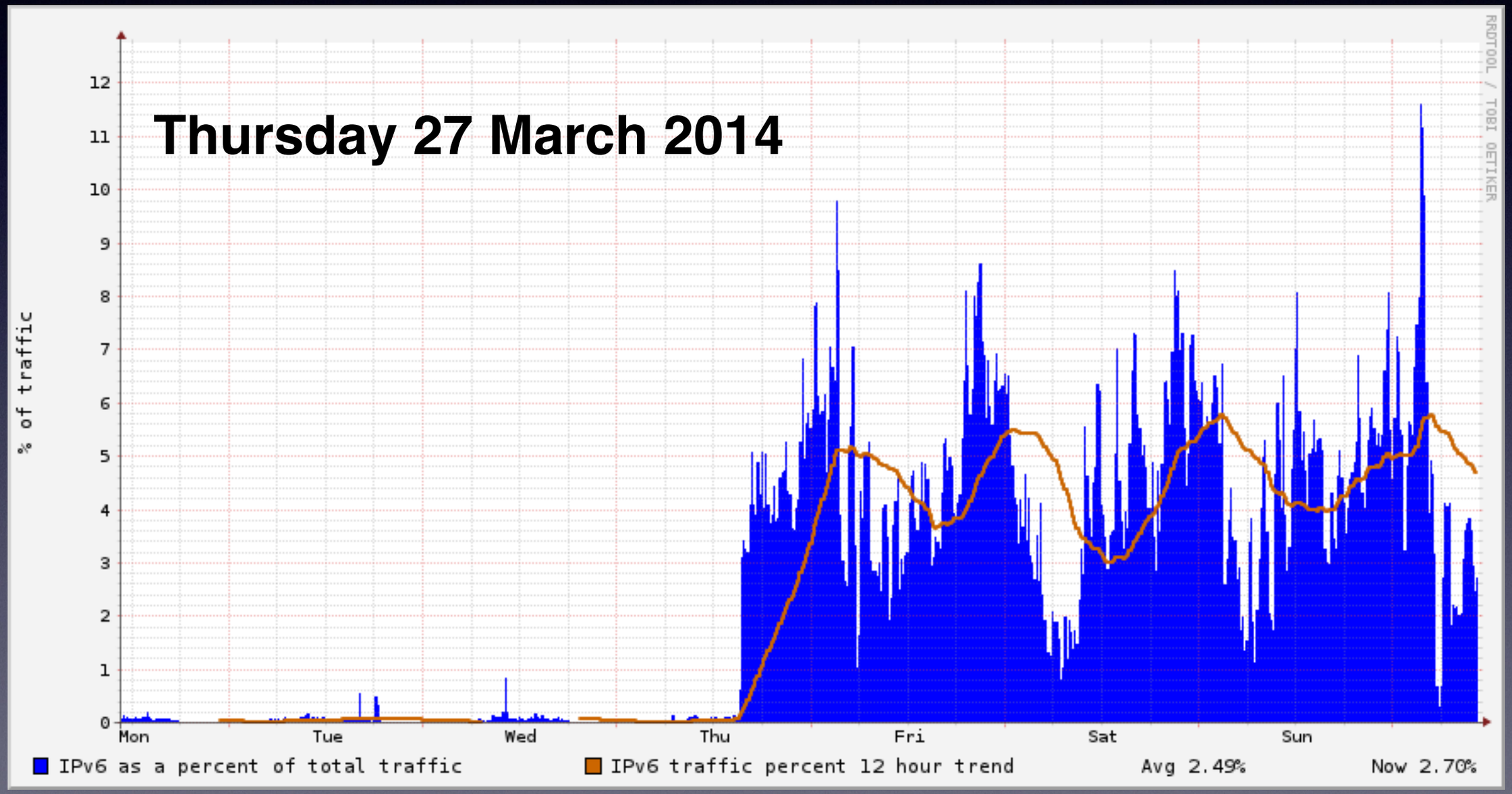
have you enabled IPv6 on something today...?

Answered!


Thursday 27 March 2014
% of traffic
0
1
2
3
4
5
6
7
8
9
10
11
12
Mon
Tue
Wed
Thu
Fri
Sat
Sun
IPv6 as a percent of total traffic
IPv6 traffic percent 12 hour trend
Avg 2.49%
Now 2.70%
RRDTOOL / TOBI OETIKER

Acknowledgements

- Colleagues at UCD
- HEAnet
- RIPE-NCC, SWITCH
- Loughborough University

Questions ?