



IPv6 at CiscoLive 2013

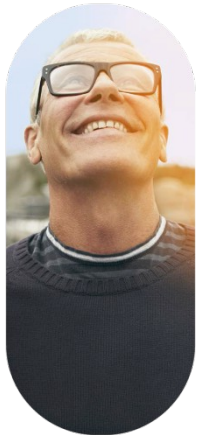
Daryl Tanner – Virgin Media

Andrew Yourtchenko - Cisco



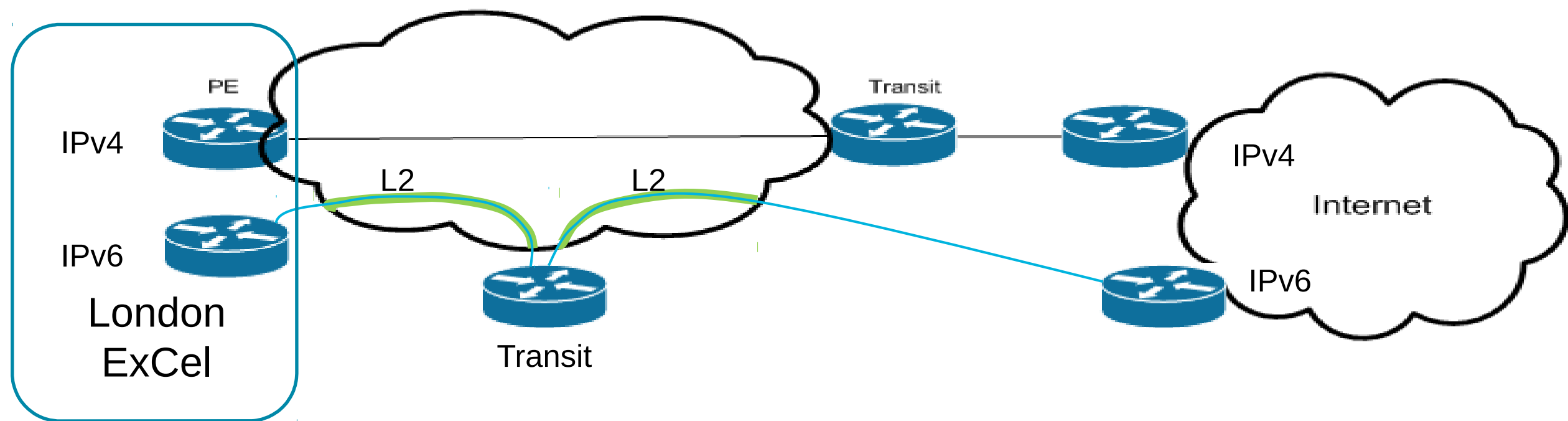


IPv6 comes from your ISP...



The challenge

- Virgin Media were asked in mid-October 12 if we could provide native IPv6 for Cisco Live 2013
- At the time we had
 - An IPv6 address allocation from RIPE 👍
 - no IPv6 transit in place 👎
 - IPv6 was ‘not allowed’ on the network 👎
 - Testing not completed 👎
 - A ‘No’ from Security team 👎
 - No operational support 👎

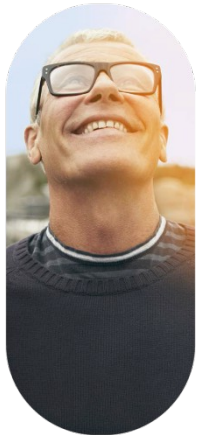


The solution

- Dedicated IPv6-only transit router
 - Installed on 6th December
 - IPv4 for management
- Isolated transit link
 - Ge fibre
 - IPv6 /32 advertised via BGP
 - Cross-connect installed on 2nd January
- Assortment of internal connections / configurations
 - Numerous people involved in the physical and logical connections
 - Borrowed an 'unused' fibre into ExCel London
- Cisco ASR1002 Access router
 - Received on 13th December to configure and test
 - Moved to ExCel London on 18th January
- Ready for service – with one week spare



Meanwhile, downstream...



What a typical CiscoLive Europe network looks like

- Lots of gear
 - ~ 2-4 core switches (usually 6500)
 - ~ 15-20 distribution switches
 - ~ 200-250 access switches
 - ~ 250-300 Access Points
 - ~ 4-6 Wireless LAN Controllers
 - ... a lot of other pingable things
- Quick build, short lifespan: 4 days build; 1 week online, 1 day teardown
- IPv6 on wired is “easy” – main focus is on wireless: attendees.

CiscoLive 2012 IPv6 WiFi recap

- WiFi on 7.2 code (“official” IPv6 support)
- Discovered iOS aggressively creating new temp IPv6 address
- Temporary workaround: set very short lifetimes for the binding table
 - Required very short prefix lifetimes
 - Necessary to send RAs more frequently
 - Probably created more problems than solved
- Long-term solution in the code: change the binding table management

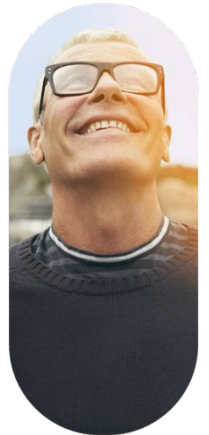


IPv6 privacy addresses demo





iOS privacy address behavior demo



WLC 7.3 FHS source-guard + iOS =



CISCO

MONITOR

WLANs

CONTROLLER

WIRELESS

SECURITY

MANAGEMENT

COMMANDS

HELP

FEEDBACK

Monitor

Summary

Access Points

Cisco CleanAir

Statistics

CDP

Rogues

Clients

Multicast

Clients > Detail

MAC Address

5c:95:ae:61:22:b9

IPv4 Address

0.0.0.0

IPv6 Address

fe80::5e95:aeff:fe61:22b9,
2001:6f8:3d4:3:5e95:aeff:fe61:22b9,
2001:6f8:3d4:3:4500:dbf8:242a:1b6,
2001:6f8:3d4:3:45e7:df68:2ca1:7595,

< Back

Link Test

Remove

Client Properties

AP Properties

AP Address

00:21:a0:e4:9d:b0

AP Name

whiteAP

Neighbor Binding table in 7.3: the defaults work !

CISCO

MONITOR

WLANS

CONTROLLER

WIRELESS

SECURITY

Controller

General

Inventory

Interfaces

Interface Groups

Multicast

Internal DHCP Server

Mobility Management

Ports

NTP

CDP

IPv6

Neighbor Binding

RA Throttle Policy

RA Guard

mDNS

Neighbor Binding

Down Lifetime (0-86400)

30

Reachable Lifetime (0-86400)

300

Stale Lifetime (0-86400)

86400

Unknown Address Multicast NS Forwarding

Disable

Operational consideration: mcast IPv6 → Multicast CAPWAP

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SECURITY

MANAGEMENT

CO

Save Configur

Controller

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Internal DHCP Server

Mobility Management

Ports

General

Name

AYWLC

802.3x Flow Control Mode

Disabled

LAG Mode on next reboot

Disabled

Broadcast Forwarding

Disabled

AP Multicast Mode

Multicast

239.100.100.100

Multicast Group Address

AP Fallback

Enabled

Fast SSID

Enabled

Ensure your CAPWAP-carrying infrastructure has IPv4 multicast routing configured properly

SSM: simplest way to ensure multicast routing

- “ip pim ssm default”
- Use SSM default range 232.x.x.x in WLC for multicast group address

```
ip pim rp-address 10.127.0.254
ip pim ssm default

interface Vlan7
  Description SER203-00-ACCESS-POINTS
  ip address 10.7.3.1 255.255.255.0
  ip helper-address 10.6.1.6
  ip helper-address 10.6.2.6
  no ip redirects
  no ip unreachable
  no ip proxy-arp
  ip verify unicast source reachable-via rx
  no ip route-cache
  ip pim sparse-mode
  ip igmp version 3
  ip igmp limit 500
  ip ospf network point-to-point
  ip ospf 1 area 0
  ipv6 address 2A02:88FE:DE30:0703::1/64
  no ipv6 redirects
  no ipv6 unreachable
  ipv6 verify unicast source reachable-via rx
  ipv6 ospf network point-to-point
  ipv6 ospf 1 area 0
  no shutdown
!
```


Too much of IPv6: multicast solicited RAs

```
22:15:25.308623 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:15:25.309215 IP6 fe80::217:dfff:fe76:fc40 > 2a02:88fe:de30:501:5fe:13a0:afad:c700: ICMP6, neighbor
22:16:29.961204 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:16:33.030970 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:16:36.123642 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:16:42.808234 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:16:46.881731 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:16:50.850732 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:00.235141 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:04.324473 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:07.342607 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:13.411358 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:16.440376 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:19.469278 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:22.498330 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:25.527292 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:28.642138 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:31.689689 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:34.927601 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:38.318309 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:17:41.403313 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:18:26.249138 IP6 andrews-macbook-air.local > ff02::2: ICMP6, router solicitation, length 8
22:18:26.253591 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:18:27.485346 IP6 andrews-macbook-air.local > ff02::2: ICMP6, router solicitation, length 8
22:18:28.406047 IP6 andrews-macbook-air.local > ff02::2: ICMP6, router solicitation, length 8
22:18:29.344763 IP6 fe80::217:dfff:fe76:fc40 > ff02::1: ICMP6, router advertisement, length 64
22:18:29.357259 IP6 andrews-macbook-air.local > ff02::2: ICMP6, router solicitation, length 8
```


Multicast RA throttling

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WLANs

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Interface Groups

Multicast

▶ Internal DHCP Server

▶ Mobility Management

Ports

▶ NTP

▶ CDP

▼ IPv6

Neighbor Binding

RA Throttle Policy

RA Guard

▶ mDNS

RA Throttle Policy > Edit

Enable RA Throttle Policy

☒

Throttle Period (10-86400 seconds)

Max Through (0-256)

No Limit ☐

Interval Option

Allow At-least (0-32)

Allow At-most (0-256)

No Limit ☐

Bonjour: great in a small network, tough in a large network

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MONITOR

WLANs

CONTROLLER

WIRELESS

SECURITY

MANAGEMENT

COMMANDS

Save Configuration | Ping

Security

▼ AAA

General

▼ RADIUS

Authentication

Accounting

Fallback

▶ TACACS+

LDAP

Local Net Users

MAC Filtering

Disabled Clients

User Login Policies

AP Policies

Password Policies

▶ Local EAP

▶ Priority Order

▶ Certificate

▼ Access Control Lists

Access Control Lists

CPU Access Control Lists

FlexConnect ACLs

Access Control Lists

New...

Enable Counters ☐

| Name | Type |
|--------------------------|------|
| Bonjour4 | IPv4 |
| Bonjour6 | IPv6 |

| Seq | Action | Source IPv6/Prefix Length | Destination IPv6/Prefix Length | Protocol | Source Port | Dest Port |
|-------------------|--------|---------------------------|--------------------------------|----------|-------------|-----------|
| 1 | Deny | :: / 0 | :: / 0 | UDP | Any | 5353 |
| 2 | Permit | :: / 0 | :: / 0 | Any | Any | Any |

| Seq | Action | Source IP/Mask | Destination IP/Mask | Protocol | Source Port | Dest Port | DSCP | Direction |
|-------------------|--------|-------------------------|-------------------------|----------|-------------|-----------|------|-----------|
| 1 | Deny | 0.0.0.0 / 0.0.0.0 | 0.0.0.0 / 0.0.0.0 | UDP | Any | 5353 | Any | Any |
| 2 | Permit | 0.0.0.0 / 0.0.0.0 | 0.0.0.0 / 0.0.0.0 | Any | Any | Any | Any | Any |

Applying the ACLs for Bonjour

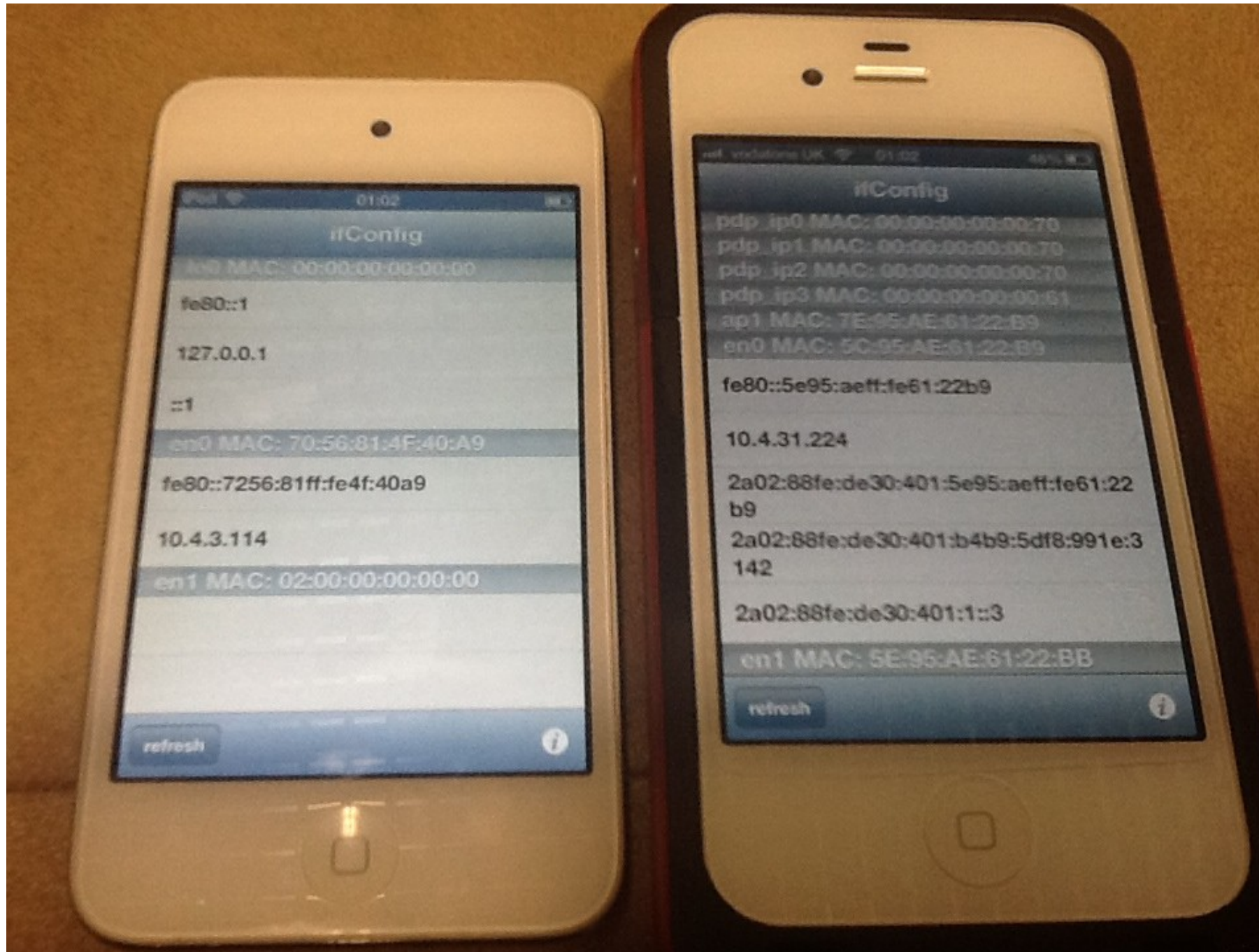
MONITOR **WLANs** **CONTROLLER** **WIRELESS** **SECURITY** **MANAGEMENT**

WLANs > Edit 'dualstack'

General **Security** **QoS** **Advanced**

| | | |
|------------------------------------|--|------------------------|
| Allow AAA Override | <input type="checkbox"/> Enabled | |
| Coverage Hole Detection | <input checked="" type="checkbox"/> Enabled | |
| Enable Session Timeout | <input checked="" type="checkbox"/> 1800 | Session Timeout (secs) |
| Aironet IE | <input checked="" type="checkbox"/> Enabled | |
| Diagnostic Channel | <input type="checkbox"/> Enabled | |
| Override Interface ACL | IPv4 Bonjour4 | IPv6 Bonjour6 |
| P2P Blocking Action | Disabled | |
| Client Exclusion 3 | <input checked="" type="checkbox"/> Enabled 60 | |

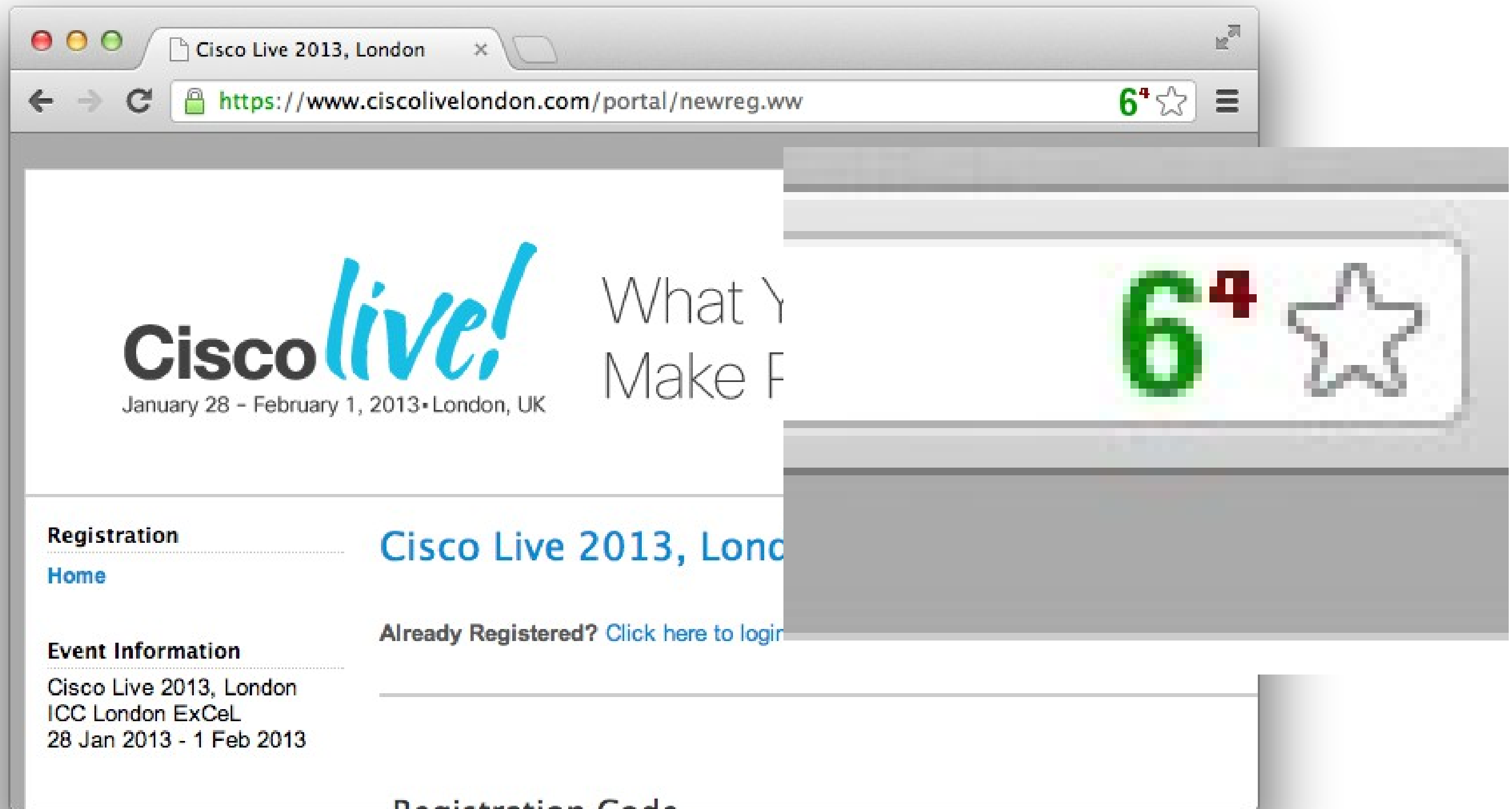
Endpoints sometimes do not act consistently




Both devices are on the same BSSID (i.e. same AP)

iPod started to work correctly after reboot.

Wired IPv6 is easy: onsite ciscolive london.com dualstacked



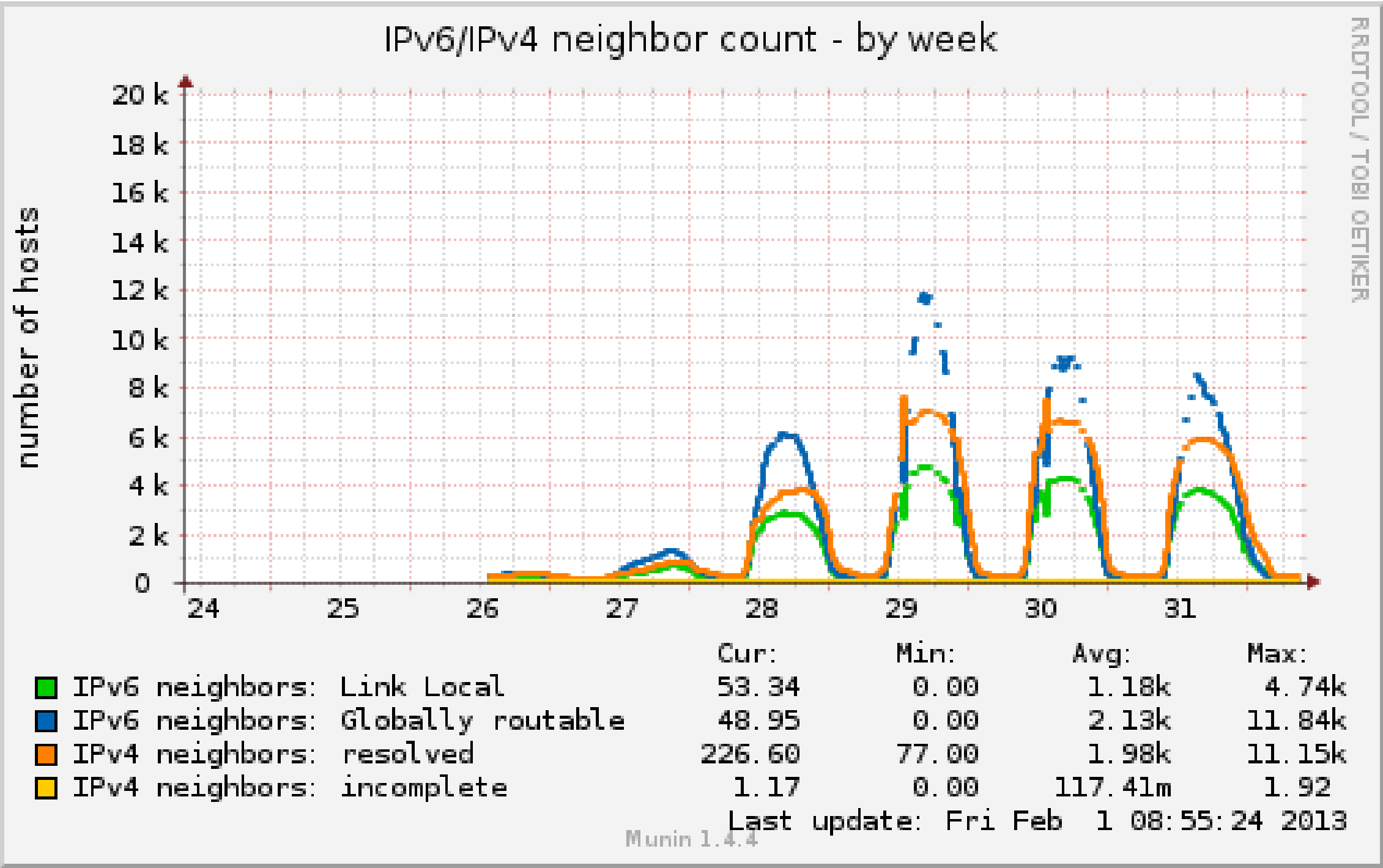


“Out of 22,149 unique IP addresses that have hit www.ciscolivelondon.com since Sunday. 9,794 have been IPv6 addresses. 249 of those have been addresses external to the venue network.”

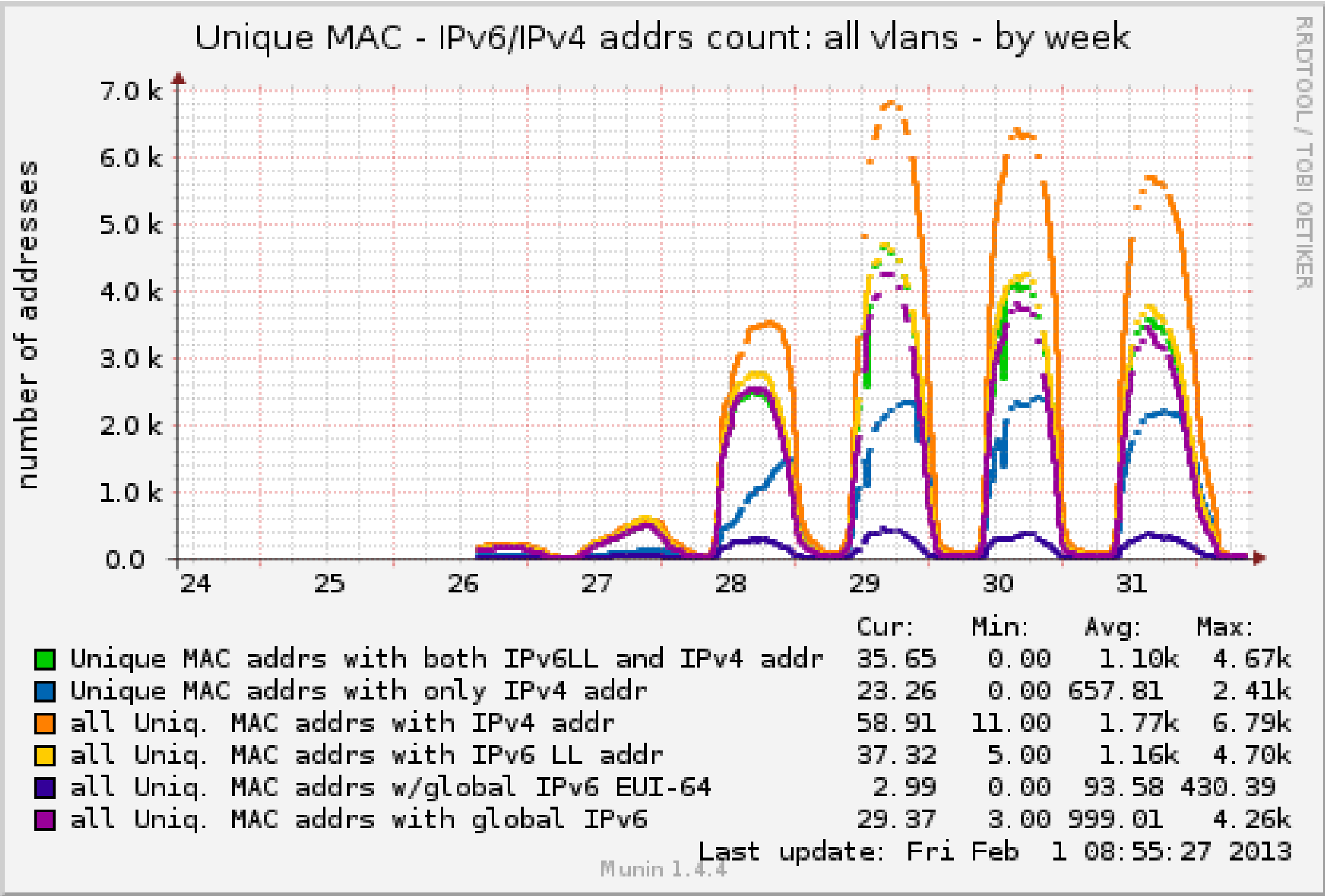
Jason Williams

ciscolivelondon.com team

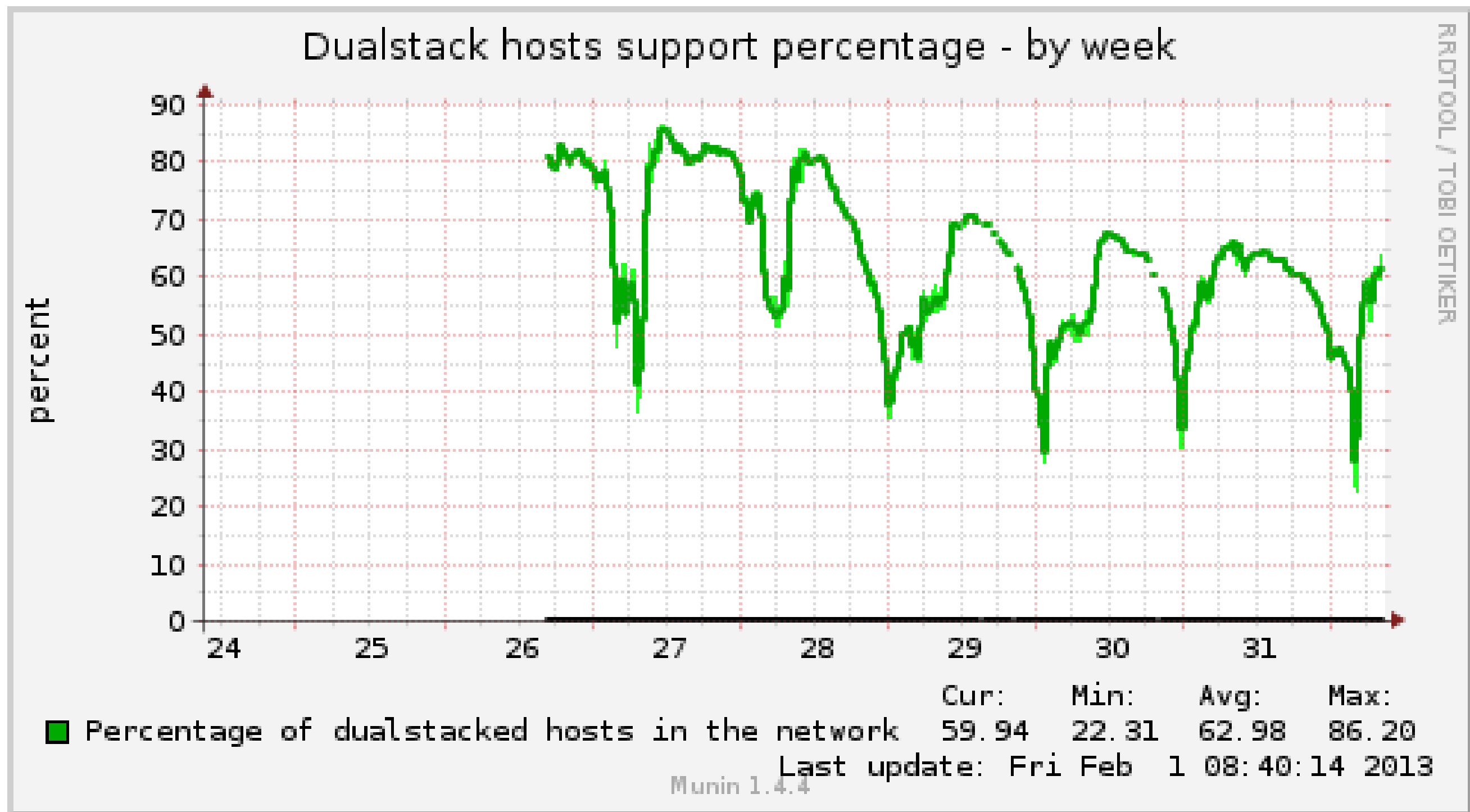
11.15K Entries in the ARP cache, 11.84K global IPv6 addresses ?



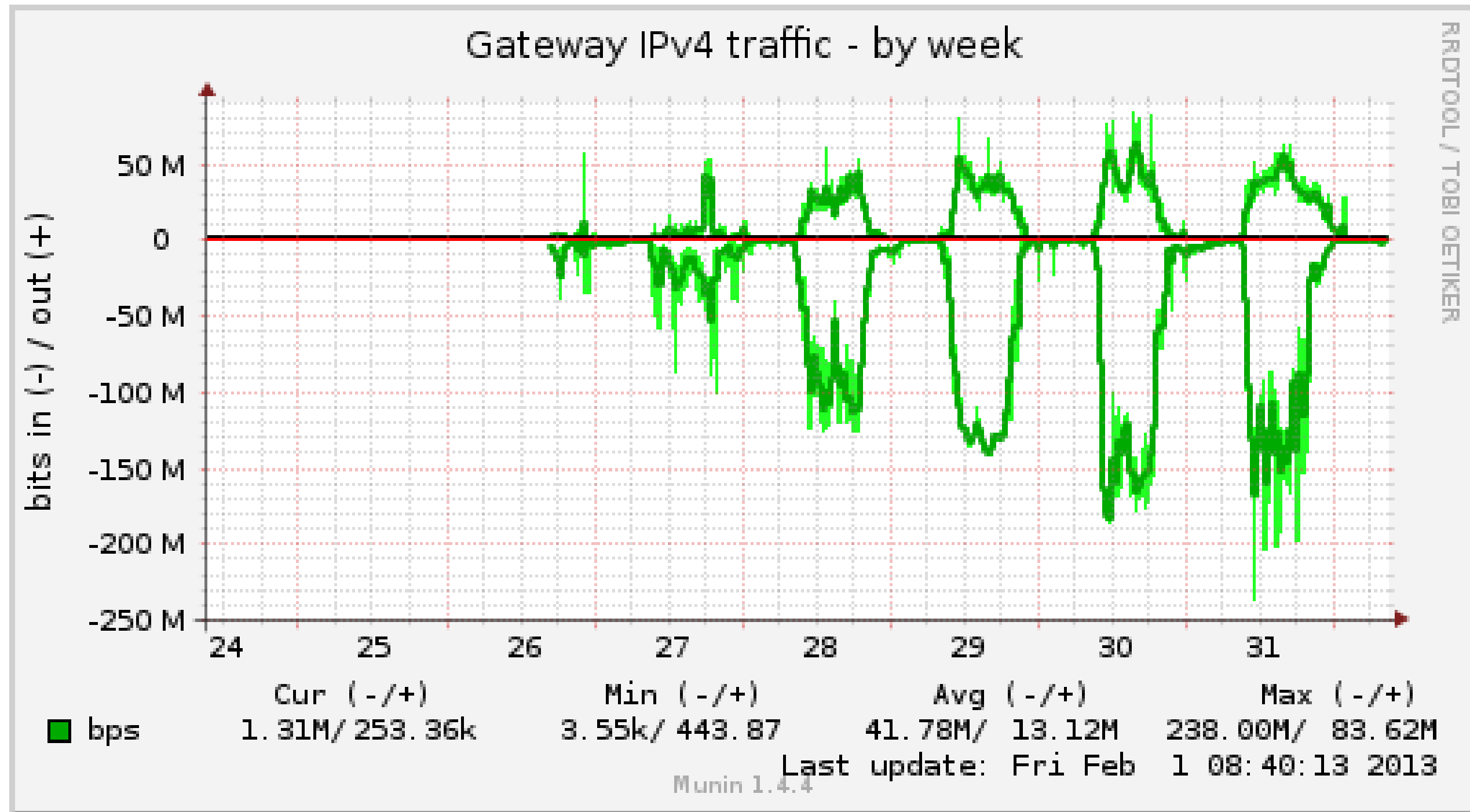
Peak: 4.67K unique MAC addresses in the ND cache



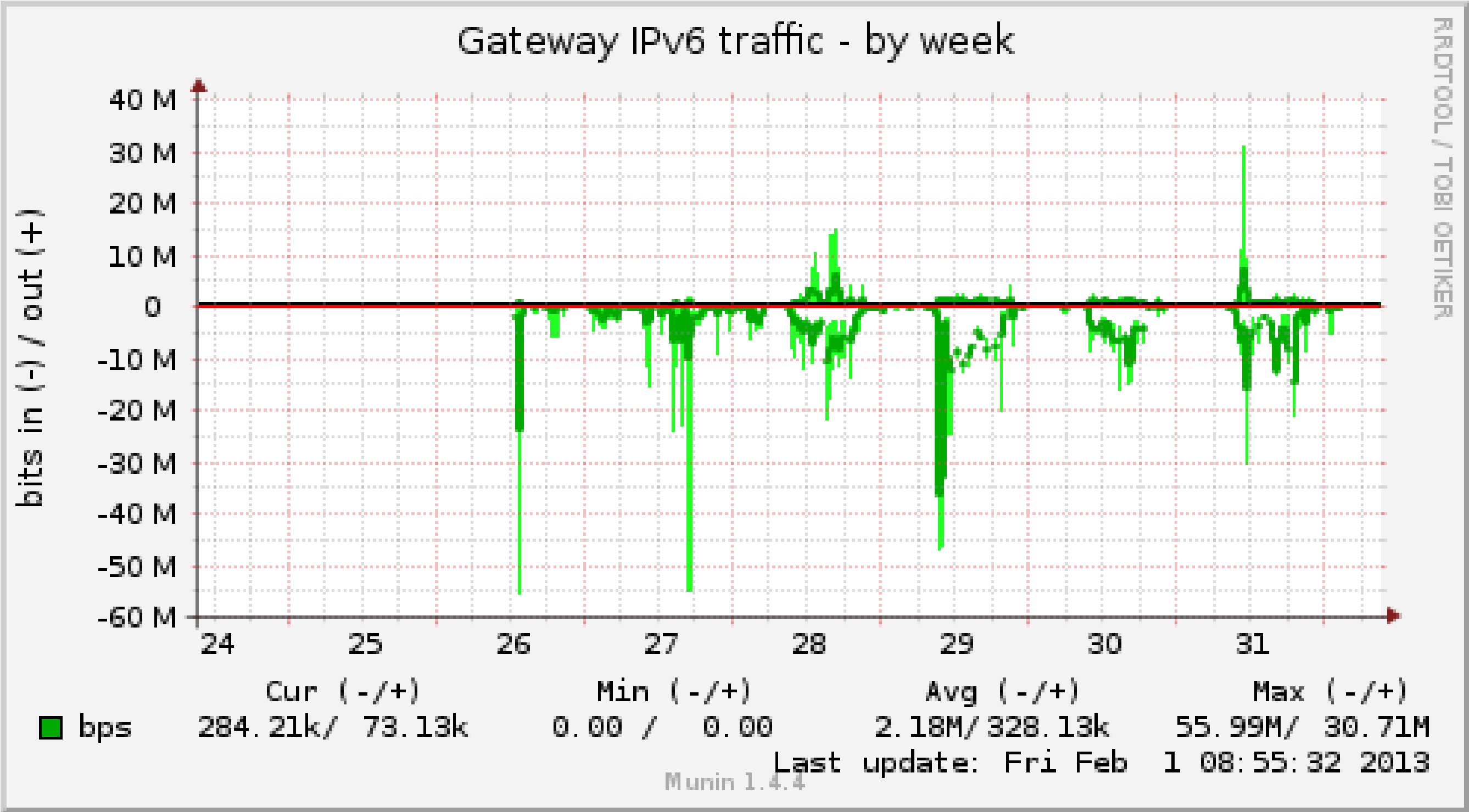
~65% peak of dualstack hosts during the show



Traffic stats: <http://stats.ciscolive-ipv6.com/>



Traffic stats: IPv6 on average ~5% of IPv4 traffic; 45Mbps peak



Conclusions

- IPv6 works
- The earlier you act – the more experience you get
 - Both for your employer and for yourself as a professional

