# Counting MAC in IPv6

George Michaelson

APNIC R&D

# EUI-64 derived addresses

- EUI-64:
  - 'extended unique identifier' ™ –an IEEE ™ TM ™
    - Encompasses the EUI-48 space we all know and love
    - Registry of 24 bit unique vendor prefixes, no substructure implied: they're just unique labels
    - Also known as OUI
    - YOUR ACTUAL "MAC" ADDRESS
      - Remember ARP? Remember DECnet?

- For all unicast addresses, except those that start with the binary value 000, Interface IDs are required to be 64 bits long and to be constructed in Modified EUI-64 format. (RFC 4291).

# EUI-64 into IPv6

1. Take MAC address eg: 39:A7:94:07:CB:D0
2. Divide in half

   39:A7:94        07:CB:D0

3. Insert the magic 0xff:fe into the address

   39:A7:94 FF:FE 07:CB:D0

4. Set bit 7 to 1: 39 (00111001) -> 3B (00111011)

   3B:A7:94:FF:FE:07:CB:D0

5. Low order 64 bits of IPv6 address now set
6. 3FFE:DEAD:BEEF:CAFE:3BA7:94FF:FE07:CBD0

# We can reverse this..

- Take an IPv6 Address with FF:FE in it
- Unset bit 7 of the low /64
- Re-derive the EUI-64/MAC address
- Look it up in the IEEE™ registry of Vendors
- Count instances
- What do we find?
- Collect 24h DNS queries on servers for ip6.arpa  ranges… and look at the data

# The IPv6 Vendor Beauty Pageant

- Two sub-classes
- What Vendors are used to source DNS queries?
  - What Vendors MAC addresses appear in ff:fe structured IPv6 address plans, as the IPv6 src of a DNS query.
- What vendors are targets of PTR queries?
  - What vendors MAC addresses appear in ff:fe structured IPv6 address plans, as the value of a PTR query against ip6.arpa.

# Query sources.
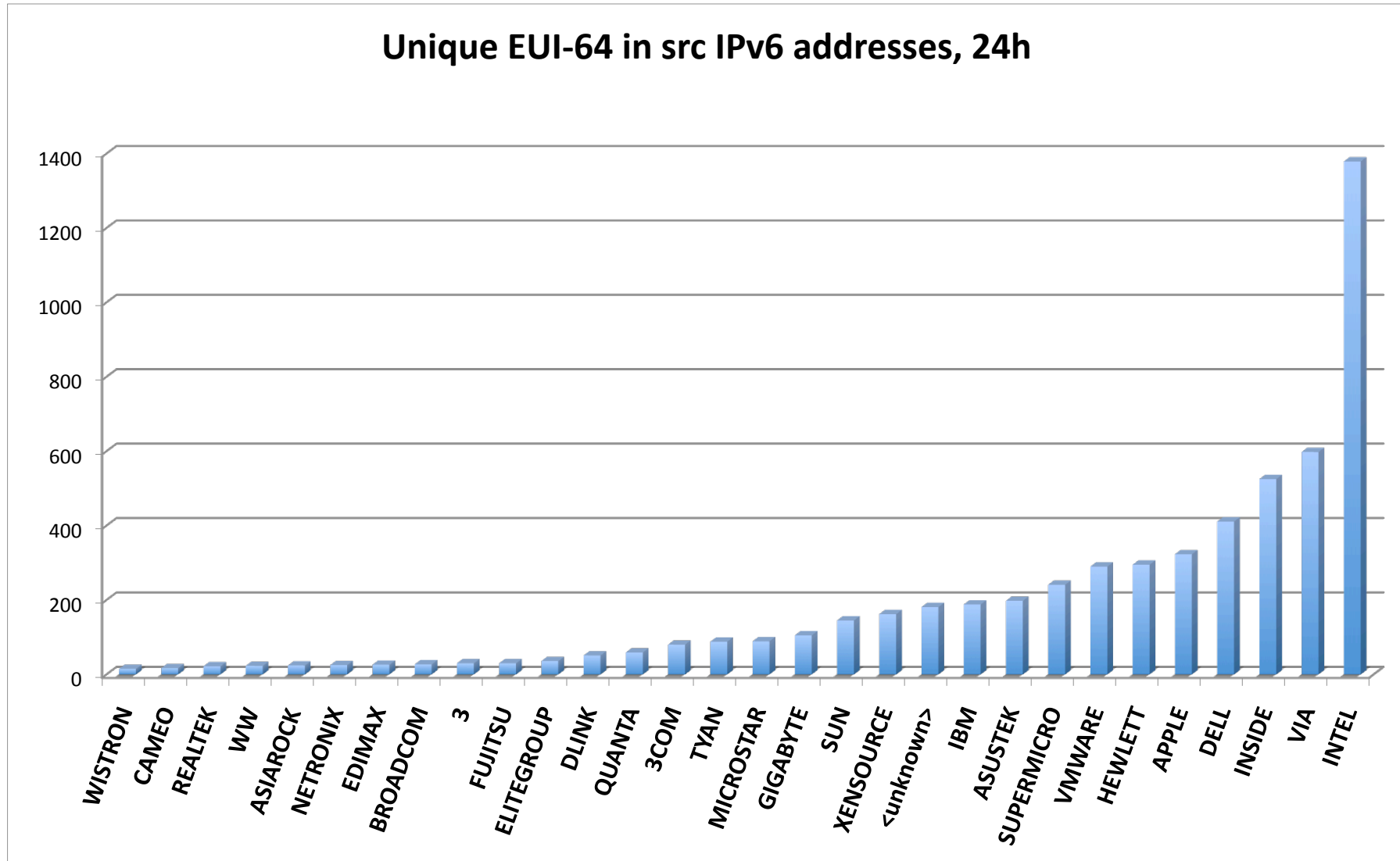
# No Surprises

- Lots of infrastructure still runs Sun, IBM
  - But more runs HP, Dell or virtualized.
- Dell, HP  own-brand their equipment
  - Intel spans the vendor-set, greybox to rackables
  - Less Cisco/Linksys than I expected
    - 10 seen, all Linksys
  - Cisco have 445 prefixes in the IEEE registry
- Is Xensource and VMWare on blade chassis?

# PTR ip6.arpa targets
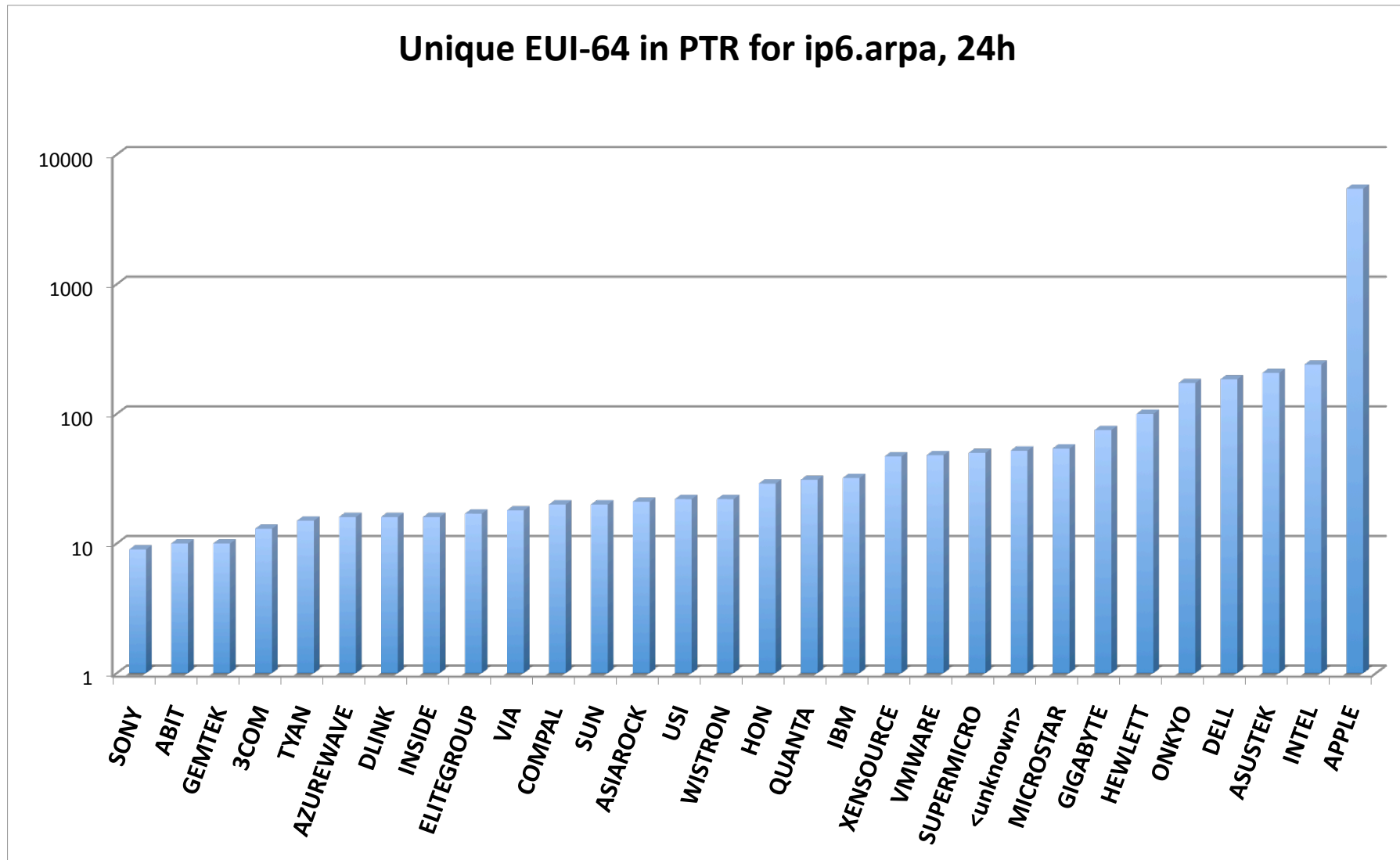


Unique EUI-64 in PTR for ip6.arpa, 24h
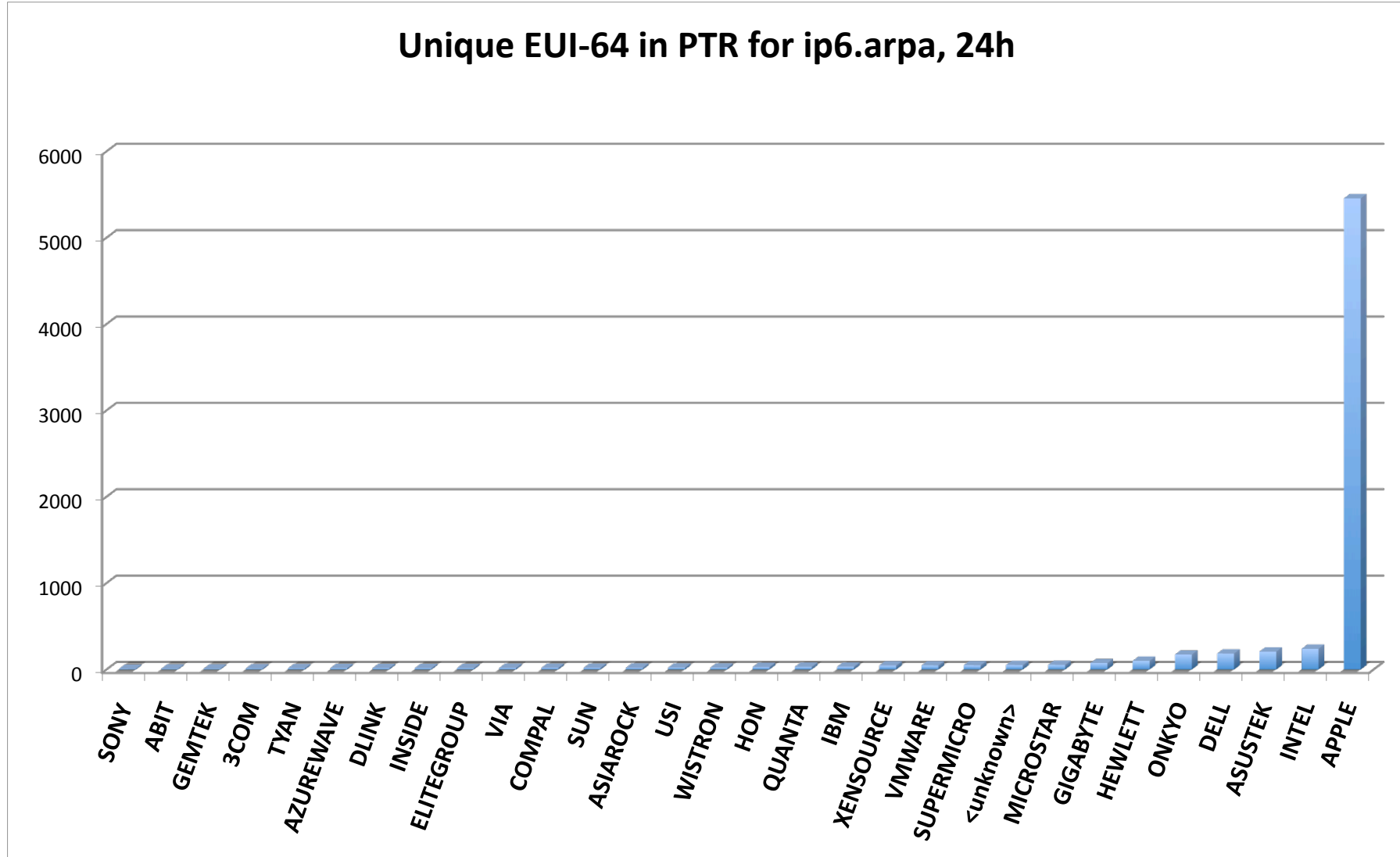
# No.. Wait a minute.

- Yes. Its APPLE.
  - Its apple all the way.
  - Maybe this is an artifact of somebody abusing the structured IPv6 number space in some way
  - Or, maybe Apple are just really popular with people who wind up running IPv6?
  - Hint: Apple have 47 entries in the IEEE registry. And, they use their core Apple numbering for Appliances like the time machine and airport express

# Once more in slomo (log scale)



**Unique EUI-64 in PTR for ip6.arpa, 24h**

# 2002 (6to4) sources..



Unique EUI-64 in src IPv6 addresses, 24h
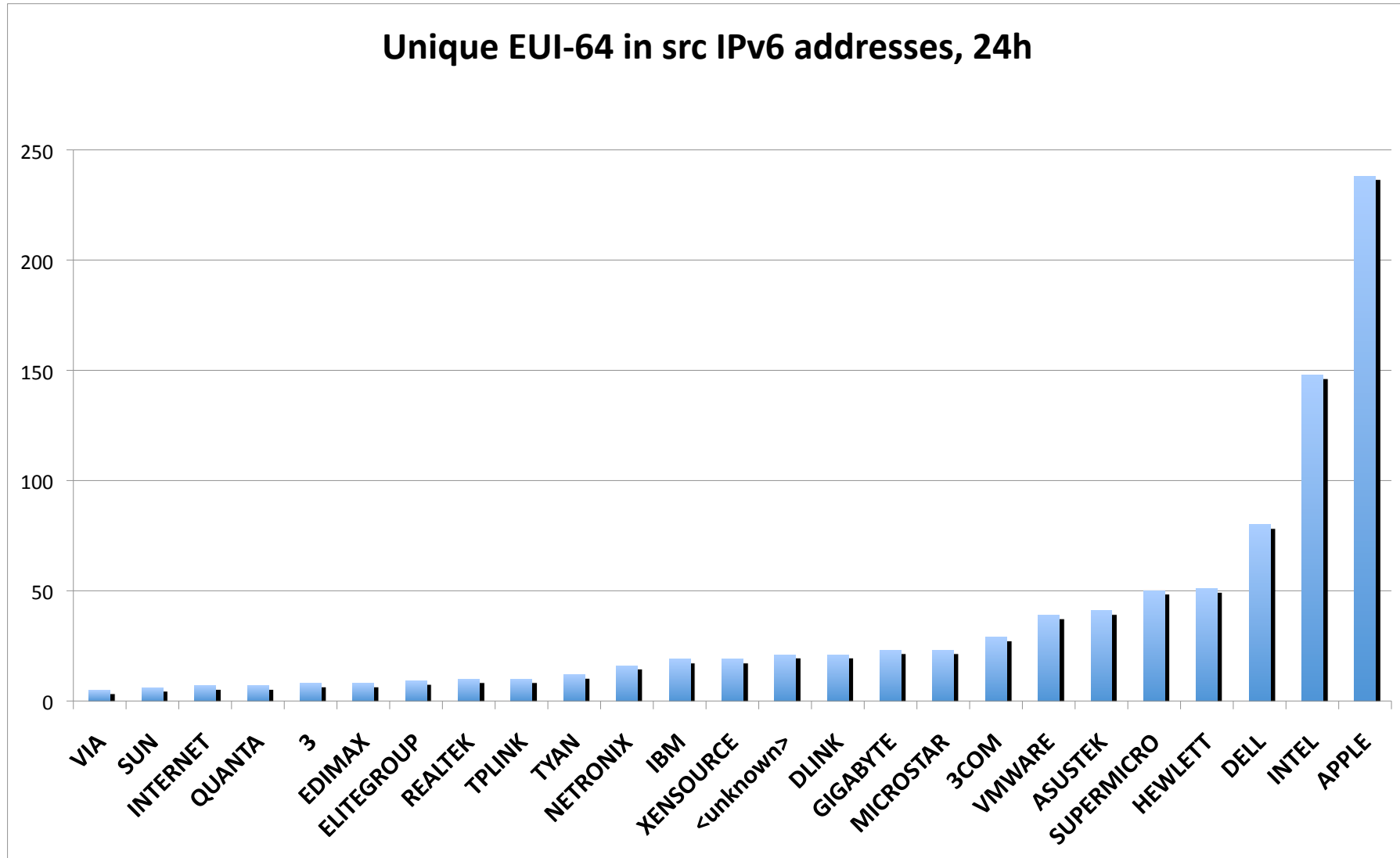
# conclusions

- Don't draw any conclusions from this, it's a beauty pageant.

- Its not who you buy your MAC address from, its how easy it is to use it in IPv6 which counts

- The numbers went further into the white box vendor space
  - 196 vendor codes seen.

- But I'm going to keep monitoring it.