

# AARNet's experience with IPv6

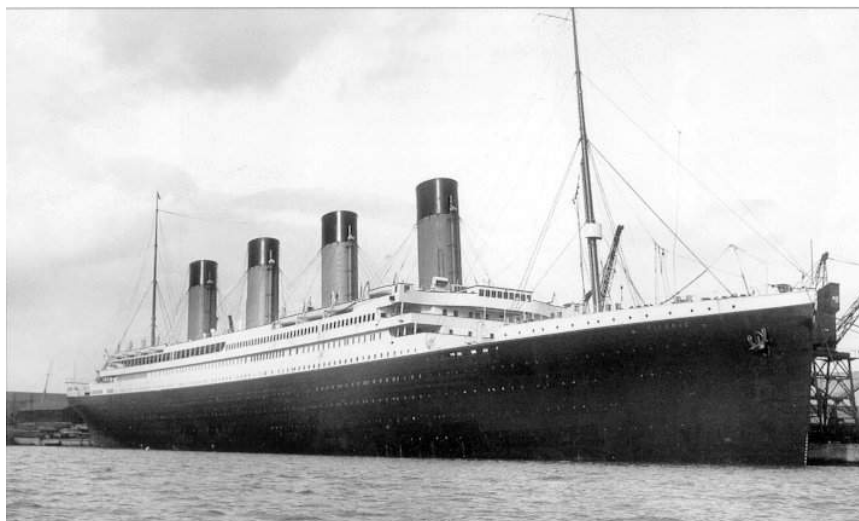
Glen Turner

2007-11-20

Australian 2007 IPv6 Summit



## Motivation



Universities take a long time to turn around  
IPv4 address exhaustion, an iceberg?  
Want considered adoption, not Y2K-style crisis management

# The good



## Configuration

```
interfaces {
  ge-0-0-0 {
    unit 0 {
      family inet {
        address {
          202.158.194.13/30;
        }
      }
      family inet6 {
        address 2001:388:1:5::/64; {
          eui-64;
        }
      }
    }
  }
}
```



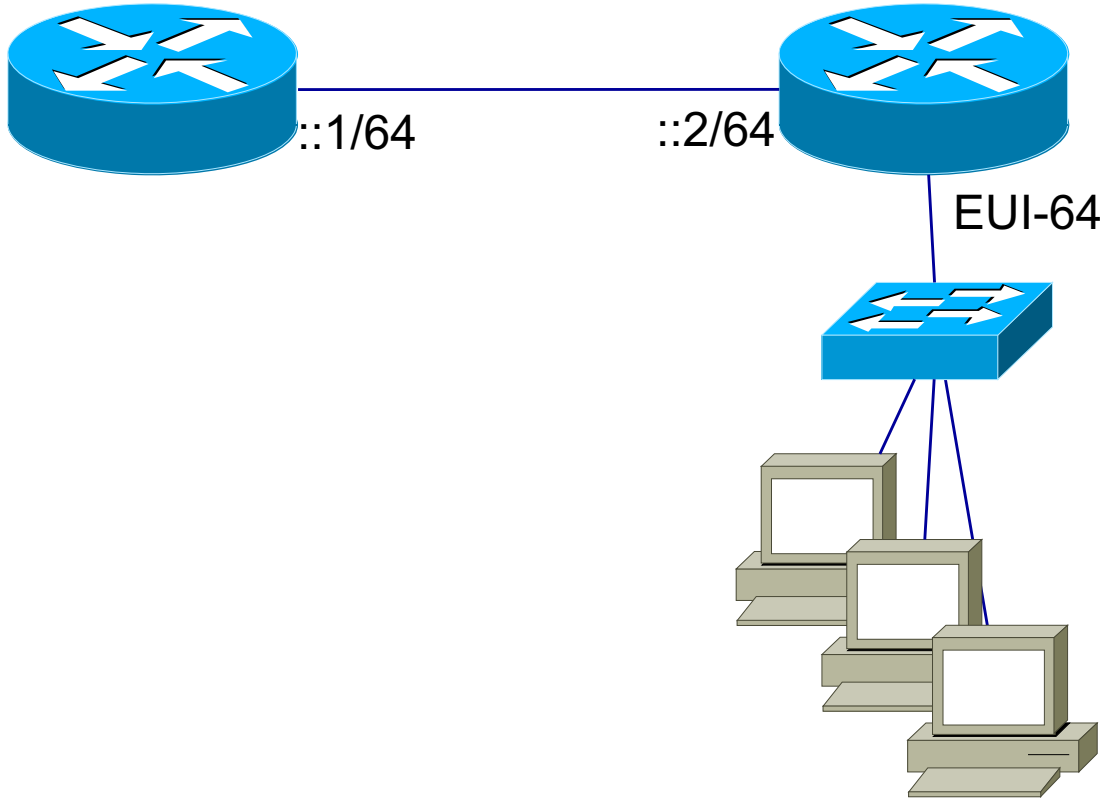
Easy peasy, lemon squeezy

```
interface GigabitEthernet0/0/0
  ip address 202.158.194.13 255.255.255.252
  ipv6 enable
  ipv6 address 2001:388:1:5::/64 eui-64
```

# Addressing

:fff::0015/128

:fff::0016/128

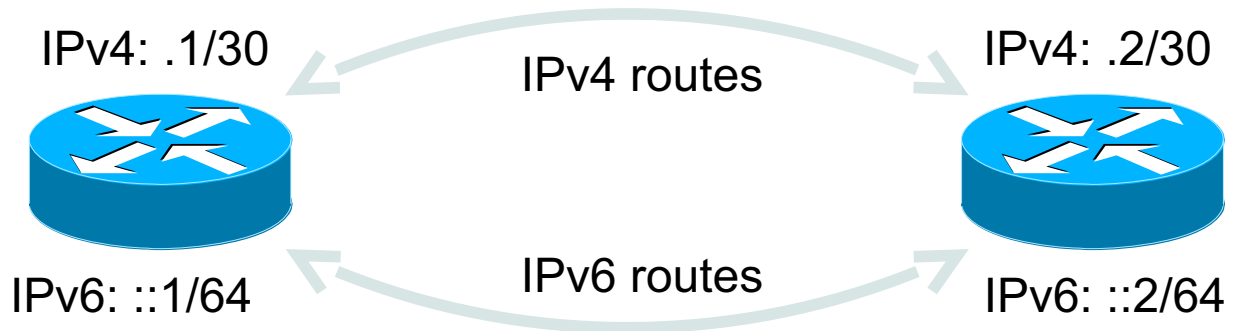


# Interior routing



Most corporate IPv4 routing is mis-configured or uses inadequate protocols  
Desirable that IPv6 routing be like “ships passing in the night”

# BGP



```
Router> show bgp ipv4 unicast summary
```

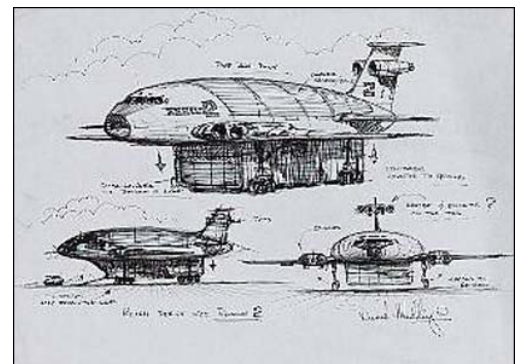
Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
202.158.192.1	4	7575	6846076	198323	31153526	0	0	9w5d	238782
202.158.192.27	4	7575	1008190	198116	31153526	0	0	2w0d	9688
202.158.199.122	4	64601	100241	106608	31153464	0	0	9w5d	1

```
Router> show bgp ipv6 unicast summary
```

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
2001:388:1::1	4	7575	313763	198321	207428	0	0	9w5d	985
2001:388:1::26	4	7575	14416	98321	207428	0	0	9w5d	1

## Hosts — *Thunderbirds are go!*

- Good
  - Patched Windows Server 2000
- Better
  - Windows Xp SP2
- Best
  - FreeBSD
  - Linux 2.6: Debian, Fedora, RHEL, Ubuntu
  - MacOS X
  - Windows Vista





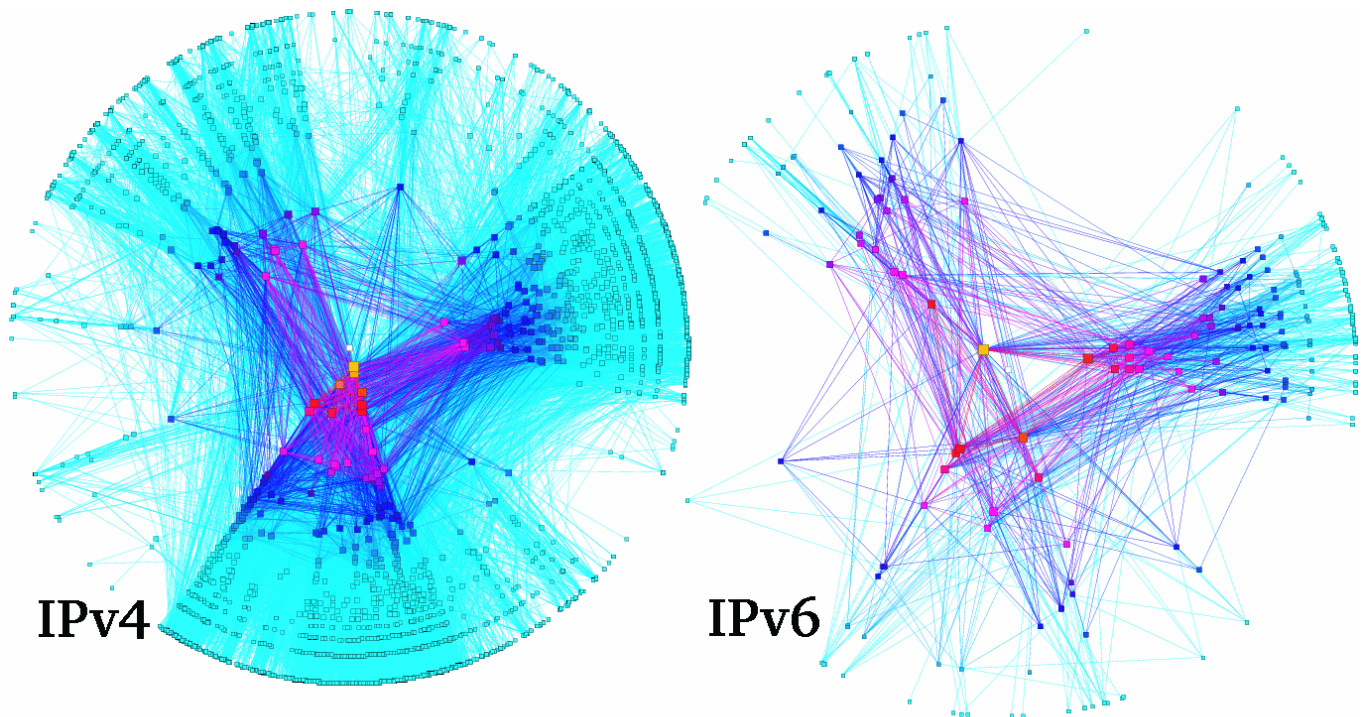
# The bad



## Two address families

- Implies two sets of resource usage
  - For routes
  - For forwarding hardware
- So dual-stack routers need to have more resources than a IPv4 router
- Resources can be hard to spot
  - CAM tables
  - Accounting registers

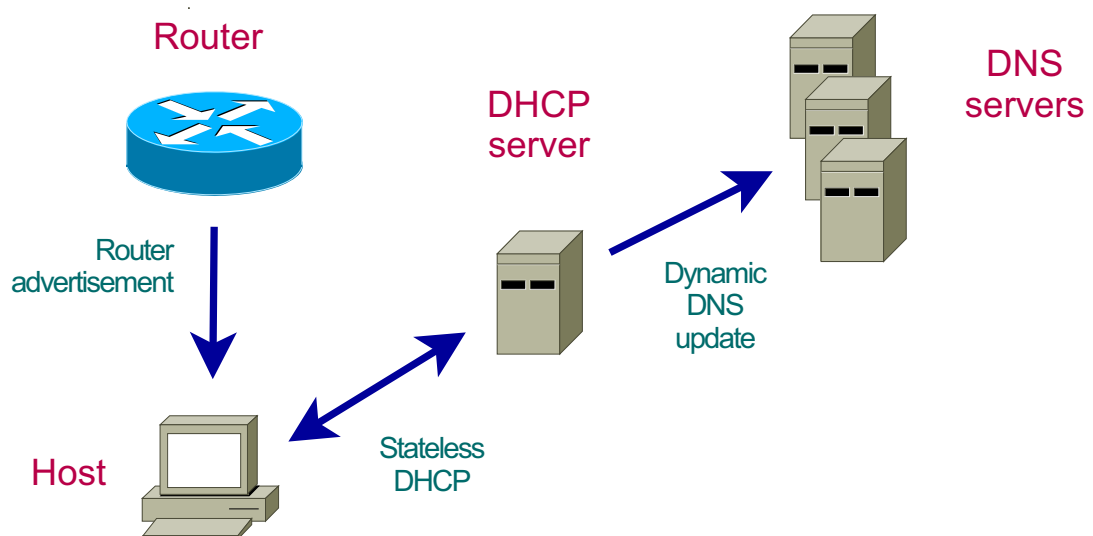
# Poorer exterior topology



IPv4 and IPv6 inter-AS connectivity, CAIDA, March 2005

# Domain name system

- Stateless autoconfiguration is convenient for everything but DNS AAAA and PTR records
  - *Servers*, hard code the EUI-64 address into DNS
  - *Clients*, hmm, we want this:



## No need for VRRP, HSRP or CARP

- Stateless configuration's IPv6 *Router Advertisement* removes the IPv4 assumption of one available default route
- So all the default address fakery used by VRRP and friends is no longer needed

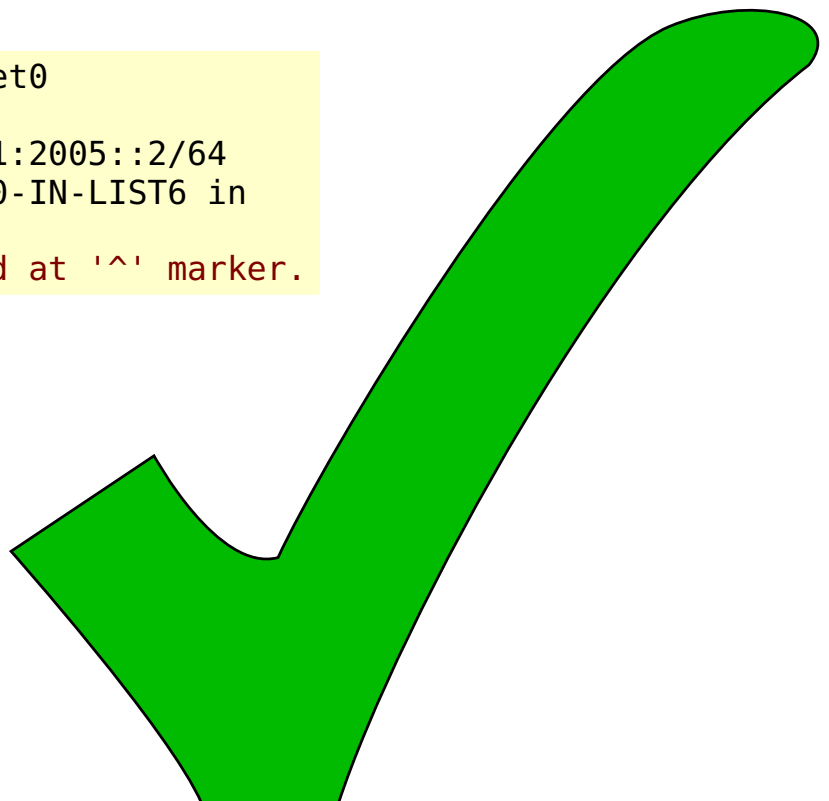
## DNS name resolution

- Migration requires AAAA be tried before A
- IPv6-only connectivity issues are immediately apparent
- Older code does not detect the absence of a IPv6 network and the attempt to connect to the AAAA address has to time out before the A address is tried

# The ugly

## Box ticking

```
interface GigabitEthernet0
  ipv6 enable
  ipv6 address 2001:388:1:2005::2/64
  ipv6 traffic-filter GI0-IN-LIST6 in
  ^
% Invalid input detected at '^' marker.
```





# Versions and code trains



says:

IPv6 Ready logo phase	Phase 2
Test category	IPv6 core protocol
Product version	Cisco IOS 12.4(9)T
Product description	Operating system for Cisco routers
Current status	Approved
Certificated date	20060421



says:

IOS T: ...functionality and hardware advances for security, voice, and wireless in enterprise, access and commercial networks

*83 bugs containing "IPv6" in "Routing" class found for 12.4(9)T*

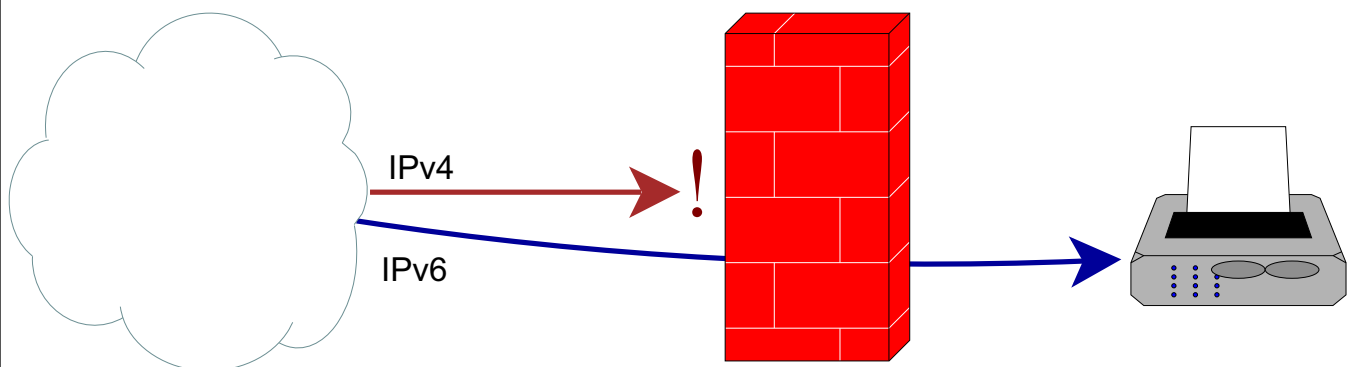
No IPv6 support with IS-IS in -k9- IOS

OSPF route-map not matching community-list, all routes redistributed

IPv6 ACL not working immediately after command, shutdown required

IPv6 loses all routers group

# Firewalls and middleboxes



# Switches

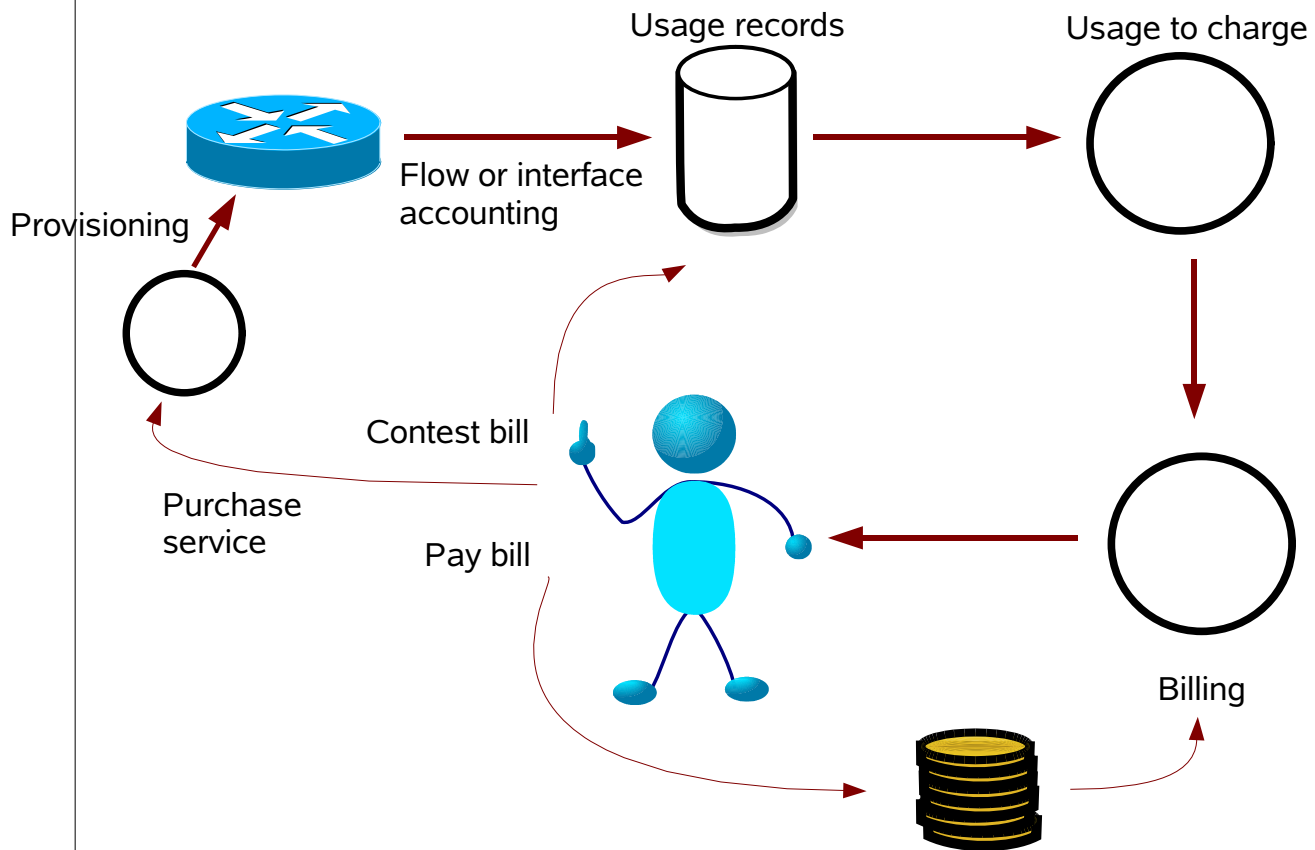
- Rich IPv4 features
  - IGMP snooping
  - DHCP snooping and source address enforcement
- Nowhere near the same richness of IPv6 support

# Validation of claims

- Essential
- Build your network in the lab
- Does it work?
- Don't buy until it does :-)



# Back-office systems



# Strategies

- Equipment purchased today will need to run IPv6 tomorrow. We mandate IPv6 support.
- We validate current IPv6 support
  - Decide before-hand how to handle non-compliance, since all vendors will fail
- We guesstimate future IPv6 support
- We don't encourage the slackers
  - We don't buy from slack vendors
  - Our network design avoids equipment from slack categories
- We try not to regress



# AARNet's experience with IPv6

[www.gdt.id.au/~gdt/presentations](http://www.gdt.id.au/~gdt/presentations)

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