IPv6 @ NANOG, APRICOT and other places

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Netnod IPv6 Workshop

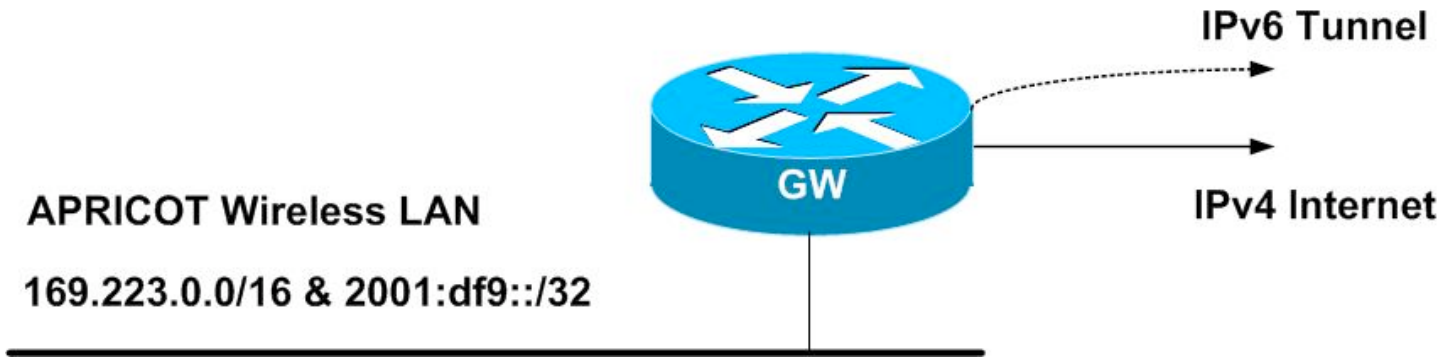
23rd April 2008

Stockholm

Introduction

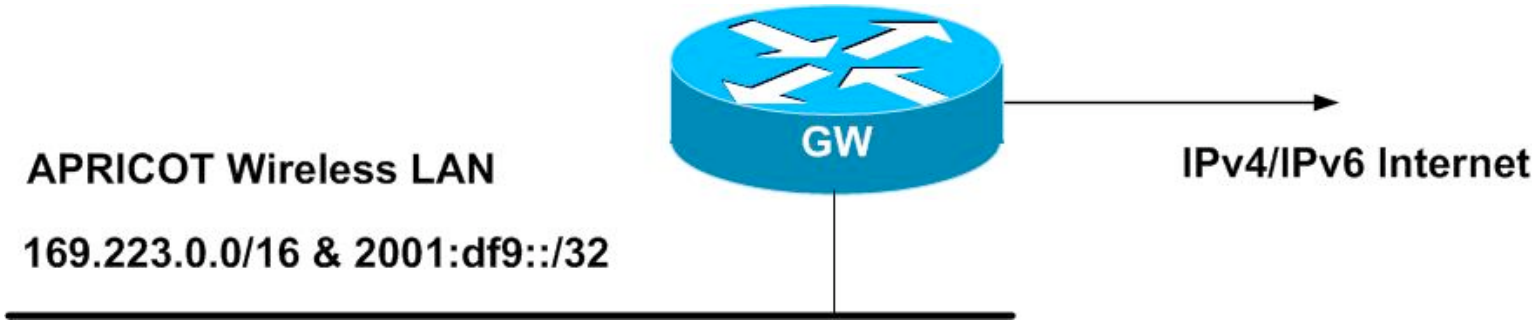
- Historically, IPv6 transport provided by default at many network operation conferences since the late 90's
  - Dual stack
  - IPv6 tunnel from conference to "6bone"
  - Usage was light, mostly from *BSD/Linux users and early adopters using Win2K and latterly WinXP
  - More Mac users, and MacOS 10.2+ IPv6 on by default…
  - Launch of Windows Vista with IPv6 on by default…
- Dual stack is fine, but what are the dependencies on IPv4??

Early APRICOT LANs



- Network was provided with IPv4 and IPv6
- Upstream ISP had no native IPv6 capability, so:
  - Used 6bone or
  - Tunnelled to IPv6 node somewhere

Recent APRICOT LANs



- From around 2002, requirement was that local conference connectivity host supplied native IPv6
  - Didn't happen, usually
  - Even APRICOT 2008 in Taiwan, IPv6 was via a tunnel

IPv6 Hour Background

- With imminent IANA IPv4 free-pool depletion, idea to provide more “realistic” environment representative of post 2010
  - Can’t assume public IPv4, or even NAT’ed private IPv4
- NANOG & APRICOT IPv6 Hours:
  - NANOG Steering Committee: NANOG 42
  - APRICOT Management Committee: APRICOT 2008
  - Small team of cross-industry interested contributors:
    - Wiki (http://www.civil-tongue.net/6and4/) and mailing list

IPv6 Hour Design

- Plan to offer a “pure” IPv6 network
  - No IPv4 at all
- IPv6 Internet isn’t as extensive as IPv4!
  - How can IPv6-only hosts reach IPv4-only devices?
  - Only way (just now) is NAT-PT
- NAT-PT translates between IPv6 and IPv4
  - RFC2766 (Proposed Standard)
  - RFC4966 (Informational) concludes that NAT-PT should be declared historical

Design Phase Discoveries

- Windows XP cannot do DNS resolution over IPv6
  - Microsoft indicates the fix is to “upgrade” to Vista
  - Need to provision special wLAN with IPv4 resolver, just for XP
- Firefox, Thunderbird, etc
  - Ship with IPv6 support, but is turned off depending on platform
  - Need instructions on how to switch on IPv6 per client
- Only Vista has DHCPv6
  - No plans for MacOS
  - “Early” clients available for *BSD/Linux systems

Design Summary

- Original wLAN provision

  IPv4, IPv6, DHCPv4, dual stack DNS resolver (as before)

  Added DHCPv6 for Vista etc

- IPv6-only wLAN provision

  IPv6 only, DNS resolver, DHCPv6, NAT-PT

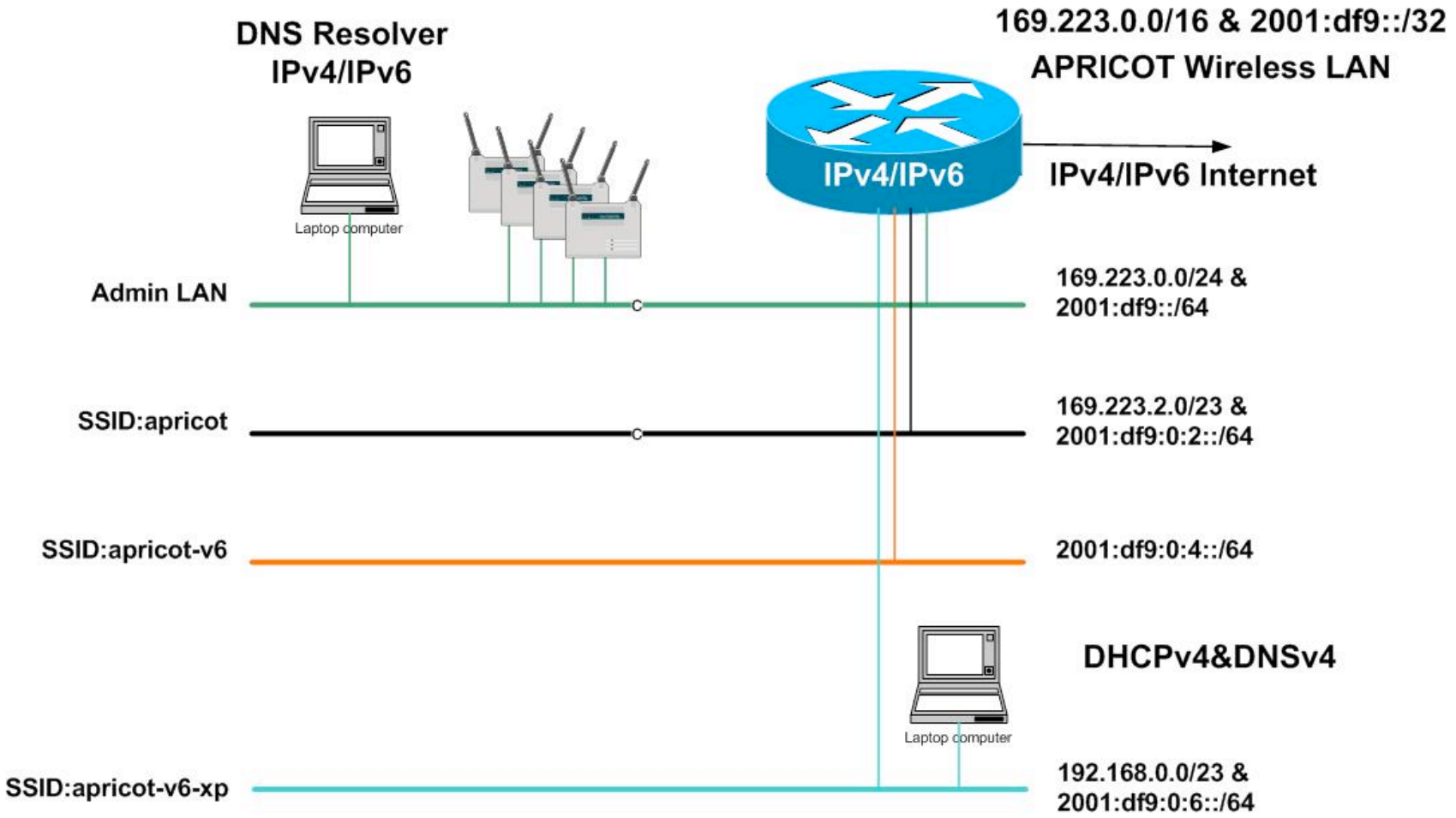
- IPv6-XP wLAN provision

  IPv6 only, IPv4 (private & non-routed) by DHCP, DNS resolver, DHCPv6, NAT-PT

Admin & Infrastructure

- Admin LAN
  - Wireless access points
  - DNS resolver (dual stack)
  - Monitoring systems
  - Netflow collector
- NAT-PT
  - Runs on conference router
  - DNS Application Layer Gateway
  - (Also supports FTP ALG)

IPv6 Hour: APRICOT



SSID: apricot

- IPv4 wLAN dual stack with IPv6

  Default Gateway: 169.223.2.1 & 2001:df9:0:2::1

- DHCPv4 server running on router

  169.223.2.0/23 for IPv4 LAN

- DHCPv6 server running on router

  2001:df9:0:2::/64 for IPv6 LAN

- DNS resolver on Admin LAN

  169.223.0.5 and 2001:df9::5

- No NAT-PT here

SSID: apricot-v6

- Pure IPv6 LAN

  Default Gateway: 2001:df9:0:4::1

- DHCPv6 server running on router

  2001:df9:0:4::/64 for IPv6 LAN

- DNS resolver on Admin LAN

  169.223.0.5 and 2001:df9::5

- NAT-PT here

  Stand-in address: 2001:df9:0:8::/96

  IPv4 pool: 169.223.8.0/23

SSID: apricot-v6-xp

- IPv6 LAN supporting Windows XP

  Default Gateway: 2001:df9:0:6::1

- DHCPv4 server running on router

  192.168.0.0/23 for IPv4 LAN – non-routed

- DHCPv6 server running on router

  2001:df9:0:6::/64 for IPv6 LAN

- Local DNS resolver

  192.168.0.5 – gives IPv6 responses over IPv4

- NAT-PT here

  Stand-in address: 2001:df9:0:8::/96

  IPv4 pool: 169.223.8.0/23

What happened: NANOG

- Switched off IPv4 wireless during “IPv6 Hour”
  - Just kept nanog-v6 and nanog-v6-xp wLANs
- Couldn’t get Cisco IOS NAT-PT to work
  - IOS release (12.4(11)T3) had a bug
- Used NAT-PT on Linux PC instead
  - Chose Tomicki **natptd**
  - Was relatively unreliable, falling over every few minutes
- DNS resolver went on v6 and v6-xp LANs
  - Used public domain **totd** running on DNS server fronting the resolver to translate IPv4 queries into IPv6

What happened: NANOG

- User experiences:
  - Some didn't care – they had 3G cards in laptops
  - Reasonable percentage used alternative LANs
  - A few whined
- Problems we found:
  - Clearing browser caches needed
  - MacOS wouldn't accept "A" in IPv6 addresses – "a" was fine
  - http://www.civil-tongue.net/6and4/wiki/NANOG42-Lessons
- Positives:
  - Dual stack sites were fully accessible
  - MacOS, *BSD/Linux & Vista "just worked"

What happened: APRICOT

- Network design wasn't implemented as described earlier
- Switched off IPv4 wireless during "IPv6 Hour"
  - Just kept apricot-v6 and apricot-v6-xp wLANs
  - IPv4 switched off before explanation complete – users couldn't get to website to find out what to do
- Cisco IOS NAT-PT worked well
  - Used IOS release 12.4(15)T3 on 7206VXR-G2
  - About 12000 simultaneous mappings
  - Surprising level of CPU consumption – 25%
  - Default interface in-queue of 75 spots not enough!!

APRICOT: NAT-PT statistics

```
NAT-PT#sh ipv6 nat statistics
Total active translations: 12086 (0 static, 12086 dynamic; 1162 extended)
NAT-PT interfaces:
  GigabitEthernet0/1.1, GigabitEthernet0/1.2, GigabitEthernet0/1.3, NVI0
Hits: 0  Misses: 0
Expired translations: 40212
NAT-PT#sh proc cpu
CPU utilization for five seconds: 27%/16%; one minute: 24%; five minutes: 21%
NAT-PT#sh proc cpu | i IPv6
 237       95928   2077589         46  2.03%  2.61%  2.07%   0 IPv6 Input
 239         176    123780          1  0.00%  0.05%  0.07%   0 IPv6 ND
 243          48     34936          1  0.00%  0.02%  0.00%   0 IPv6 NAT-PT
  Ager
NAT-PT#sh int gig 0/1
GigabitEthernet0/1 is up, line protocol is up
  Input queue: 0/2000/0/0 (size/max/drops/flushes); Total output drops: 0
  30 second input rate 2143000 bits/sec, 604 packets/sec
  30 second output rate 1276000 bits/sec, 345 packets/sec
```

What happened: APRICOT

- User experiences:
  - Some used alternative LANs
  - Many whined because of the lack of coordination
- Problems as NANOG plus:
  - Mozilla.org and google.com seemed to break
  - Cisco docs need to be much better
  - iChat, Gizmo and Skype all hang at login or thereabouts
  - Chicken of VNC can't use IPv6
  - Adium can only use jabber
  - http://www.civil-tongue.net/6and4/wiki/APRICOT2008-Lessons

What happened: MENOG

- Left IPv4 wireless running
  - Other networks available throughout conference
- Couldn’t get Cisco IOS NAT-PT to work
  - IOS release 12.4(8a) suffering from same problems as at NANOG
  - Didn’t try upgrading
- IPv6 tunnel to PSG.com as no native IPv6 available
- IPv4 tunnel to PSG.com as well, as IPv4 available was single public IPv4 address from hotel LAN

What happened: MENOG

- User experiences:

  Some participated – IPv6 worked fine

- Problems we found:

  IOS NAT-PT – seems as though 12.4(15)T3 is minimum working release now

  On-site DNS server (RHEL3) paused for 30 seconds when doing IPv6 lookups

- Positives:

  As NANOG & APRICOT

  Gained experience at setting up vlan mapped SSIDs

Others

- Other events trying this:

  ARIN tried the APRICOT configuration – failed to make it function

  IETF held their own IPv6 Hour

  RIPE plan to try the IPv6 Hour, including IPv4 switch-off

- Hints:

  Use the collected hints/tips and configurations on our wiki:

  http://www.civil-tongue.net/6and4/wiki/

Summary

- Pure IPv6 isn't as ready as we like to think it is
  - Still lots of IPv4 dependencies even to make IPv6 connectivity
- NAT-PT isn't the magic bullet – but it helps for basic needs
  - Cisco IOS docs woeful – published "working" configs don't always work
- OSes need work
  - Windows XP in general
  - DHCPv6 client support across the board

Deployment experiences worldwide

Successful Deployments

- Two ISPs who have publicly discussed their IPv6 deployment experiences

  What worked and what didn't – in depth

- Claranet in the UK

  David Freedman's presentation at UKNOF and MENOG:

  http://www.menog.net/meetings/menog2/presentations/david-freedman-ipv6-deployment-claranet.pdf

- AfricaOnline in Zimbabwe

  Mark Tinka's presentation at MENOG:

  http://www.menog.net/meetings/menog2/presentations/mark-tinka-ipv6-afol.pdf

Other deployment news

- MPLS enabled ISPs have simply added IPv6 as another “vrf” across their backbone
- Some offering commercial service:

  NTT, OpenTransit, Reliance/FLAG, TATA International,…
- Some have deployed, but no known commercial service:

  Sprint, Level3,…
- Many ISPs claim they are working on plans

Deployment issues: Operational

- "Is Oct 2010 really the IPv4 run-out"
  - Playing "wait and see"
  - IPv6 Forum/PC has cried wolf too many times
- Figuring out addressing plans
  - Much confusion still
  - RIR policy muddle with /48s, /56s, /64s for sites
- Lack of customer demand
  - Customers not asking
  - Waiting to watch competitors' plans
  - Return on (substantial) investment??

Deployment issues: Technical

- ADSL, Dial, Cable
  - Especially the CPE devices
  - Especially the customer clients (Win98/ME/2K/XP)
- Content
  - Switches & load balancers
  - Content servers (Apache supports IPv6, but so few turned on)
- Forwarding
  - IPv4 in hardware but only IPv6 in software on some platforms

Deployment Issues: Others

- Concern about IPv6 security not being “tested as well as IPv4”
- Regional ISPs “have no plans”
  - “Global transit ISPs” have mostly deployed IPv6
  - Local ISPs are looking at IPv6
  - But the regionals by and large seem to have no plans
- Network Management Systems
  - Management is over IPv4, but how to provision and manage the IPv6 portion of the configuration?

Conclusion

- IPv6 Hours have helped with awareness
- More operators now seriously looking at IPv6
- Everything needs work:
  - Operating Systems
  - Applications & Servers
  - Network infrastructure devices
- There is a difference between “IPv6 is supported” and “IPv6 is usable”