IPv6 & IPv4 coexistence

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IPv6… Becoming a Hot Topic Again

- **More inquires to Juniper and NSP mailers related to IPv6**
- **ISP and Content Provider are reconsidering IPv6**
- **IPv4 exhaustion happening faster than predicted a few years**
  - Current trends show it will happen as early as 2010 2011

Service and Content Providers

- **Business case unclear**
  - progress towards IPv6 was "very slow" because the benefits of adopting it are hard to quantify in the short term
- **No real content on IPv6-only sites today**
- **Need a good solution for IPv6 only hosts to communicate with IPv4 only hosts**
- **And other details to make it work**

ISCP Deployments

- **Cable SP**
  - Millions of set-top boxes to be addressed
  - It made sense to use IPv6 addresses rather than make the effort to get millions of IPv4 addresses
  - HW and infrastructure had to change
- **Giant Telco**
  - FTTH access to video servers
- **Content SP**
  - Has dual stack in network

What Do We Think Will Happen?

- **IPv4 address exhaustion is approaching in the next few years**
  - Consumption of IPv4 addresses is accelerating
  - Current trends predict that IANA will run out of addresses to assign as early as 2010 2011
- **This may create problems for the internet**
  - If we do nothing
    - Internet will keep working
    - Will be very challenging to grow

Challenges that need to be addressed

- **Handling the legacy**
  - Broadband Customers
    - Many have legacy devices that don't support ipv6
    - Though most recent OS support ipv6
    - Expecting all those to upgrade in near future to ipv6 is unrealistic
  - Little content available on IPv6
    - Most of the traffic generated by broadband customers will be sent to ipv4 nodes
    - This makes adoption of v6 by greenfield deployments difficult as well

Potential Mitigations for IPv4 exhaustion

- **Temporary Mitigations**
  - Return experimental blocks to the pool of regular addresses
    - Challenges there……
      - Requires standardization effort
      - Hw/sw upgrades will be required
      - Cost will be huge for a small gain
  - Reclaim unused addresses
    - May require renumbering due to fragmented address space
    - Requires changes in policies
    - Will take years….not cheap

Potential Mitigations for IPv4 exhaustion......

- **Temporary Mitigations…..**
  - Increased use of NAT (NAT: A Tool to Prevent IPv4 Exhaustion)
    - Has its own issues and challenges…scaling issues, expensive etc.
    - We'll see more networks with few global IPv4 addresses
    - They will still use private IP and NAT
  - Many proposals around tunneling with NAT (CGN) in IETF

Is NAT a Must?

- **Yes: must be supported for IPv4-only sites to communicate with IPv6-only sites**
- **No: Everything will be dual stack or IPv4-only**
  - This is fine as long as v4 addresses are available
  - But if they are not, this does not make sense
- **It's a necessary evil**

Transition to IPv6

- **Transition technologies include:**
  - dual stack
  - tunneling mechanisms
    - IPv6 over MPLS – applicable to core primarily
    - 6to4 etc.
    - Dual Stack Lite
  - NAT [Carrier Grade NAT] to help migrate to ipv6 over time
  - Many tunneling with Carrier Grade NAT proposals in IETF
  - Not cheap either but solution for ipv4 exhaustion issue

IPv6 Deployment

- **IPv6 in ISP networks**
  - Some backbones/core networks of ISPs have already made a move to IPv6
    - Either native IPv6 (dual stack)
    - Or using some kind of tunnels (including MPLS)
  - Some have concrete plans for supporting IPv6….matter of appropriate time
  - Why haven't all ISPs deployed IPv6
    - It does not imply new business/more revenue
    - Deploying dual stack increases short term cost (managing two protocols)

IPv6 Deployment…….

- **IPv6 in the end user platforms**
  - Many Operating Systems have supported ipv6 for years…..fair to say that all OS's marketed today support IPv6
  - Some IPv6 applications, such as peer-to-peer, may be cheaper to develop then IPv4 apps because of NAT implications

IPv6 Deployment….

- **Majority of Access/Edge networks (last-mile) don't yet support IPv6**
  - no economic incentive to update access networks
  - No new services to help pay for the upgrade cost
    - Most of the low cost residential routers are not ipv6 ready
- **No real content available on ipv6-only sites today**
  - No real incentive for Content Providers to move to IPv6
    - No new revenues are foreseen….not at least till new applications can be offered that take advantage of IPv6
    - No benefit of ipv6 when it comes to applications such as internet browsing, email, client-to-server apps
      – These work fine with NAT

IPv6 Deployment…..

- **What will/can make ISPs deploy IPv6**
  - Create customer awareness so that they request their ISPs for IPv6 service
    - But then again why when most of their apps work fine with ipv4?
  - Till customers' demand IPv6 service, ISPs have little incentive to move full fledge to IPv6
    - Demand from customers expected to grow in the next 24 months

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IPv6 in Research and Education Networks

- **IPv6 deployment an exception in NREN**
  - No business case required
  - Benefits research
  - GEANT (PAN European Research Network)
    - Connects 18 NRENs natively
    - Dual stack IPv6
  - Academic Deployments in general:
    - Validates production deployment for commercial ISPs
    - Leads technology awareness

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IPv6 Deployment around the globe…..

- **In North America networks are generally less IPv6 Ready as compared to Asia & Europe**
- **In Japan, some ISPs provide IPv6 up to the edge for residential customers….has not yet happened in North America**
- **Much larger percentage of ISPs in Asia and Europe support IPv6 in the core of their networks than in North America**
- **Most of the Research and Education networks and universities in Japan and Europe support IPv6**

Conclusion

- **IPv4 address exhaustion is happening**
  - There is not much time left
- **Good solution is required for IPv6 only sites to be able to communicate with IPv4 only sites**
- **Decisions need to be made soon**
- **Waiting till the last minute will become very expensive**
- **Experience to-date with IPv6 suggests that IPv6 deployment requires planning and co-ordination over several years**

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