

Dual-Stack Lite

Analyzing how to deliver Internet applications over DS-lite

NANOG 50

Yiu L. Lee
Comcast Office of the CTO

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Before the Presentation

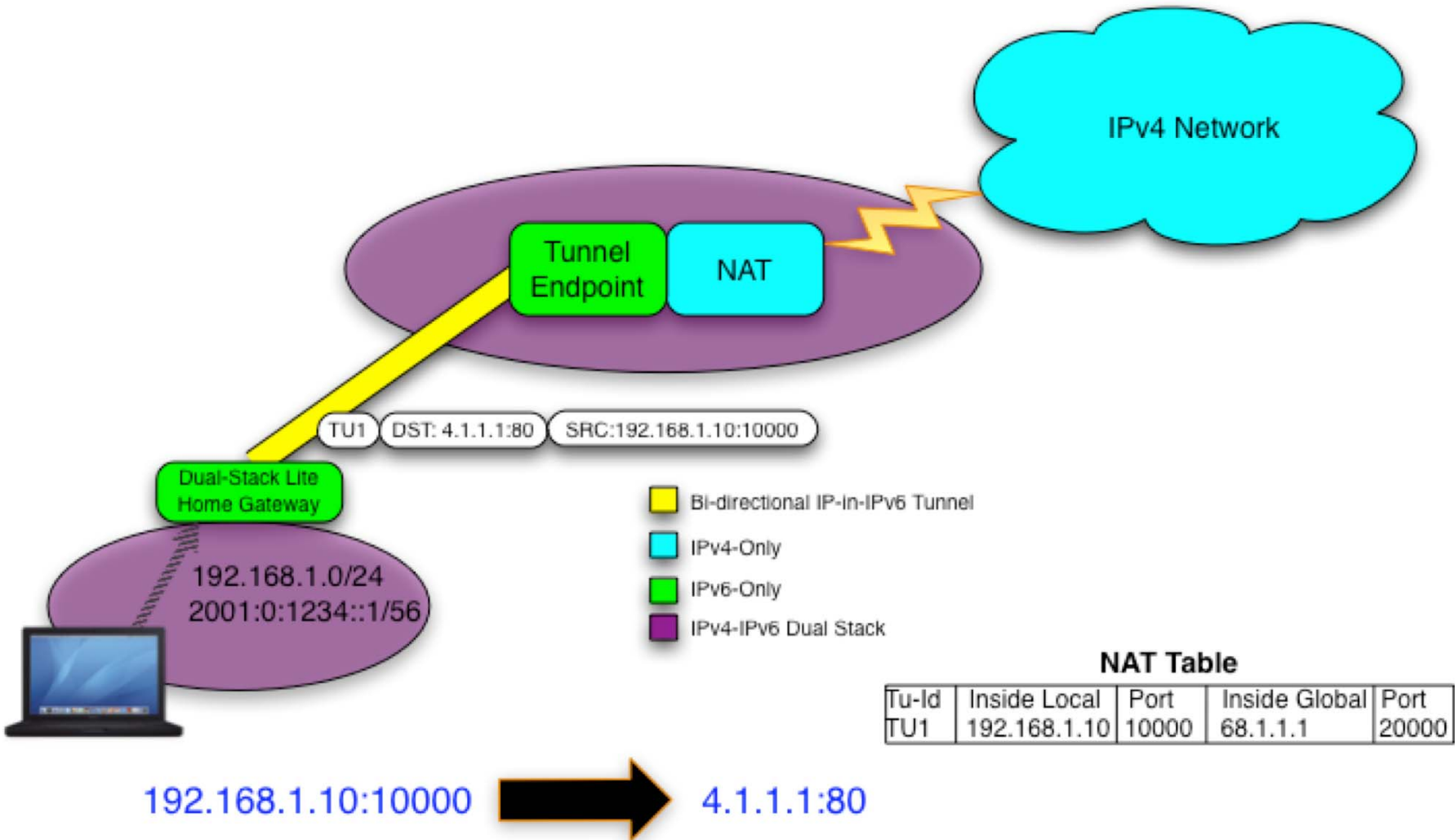
- This presentation gives a brief overview a transition technology.
- This transition technology is called “*Dual-Stack lite*” (DS-lite) which is standardized by Internet Engineering Task Force (IETF).
- This presentation also gives some test results of running Internet applications over DS-lite.
- The goal of this presentation is to give readers a general understanding of the technology.

Disclaimer: *Comcast is not committing to deploy DS-lite.*

DS-lite Overview

- DS-lite is a transition technology to provide dual-stack to users while the network multiplexes a single public IPv4 address among users in multiple households.
- DS-lite allows incremental IPv6 upgrade inside an ISP and continues to provide IPv4 services.
- DS-lite brings native IPv6 to users and encourages users and applications to adopt IPv6.
- DS-lite isn't designed to prolong IPv4 indefinitely. Multiplexing IPv4 addresses adds complexity to the network and costs more to operate and manage the network.
- DS-lite encapsulates IPv4 packet over IPv6 in the access network. NAT function will be performed in the network instead of in the home gateway. This increases port utilization and allows a single public IPv4 address to be shared by more than one household.
- DS-lite is a tunneling technology, not an address translation technology.

DS-lite High-Level Architecture



Compare DS-lite to NAT444

NAT444	DS-lite
No Home Gateway Upgrade	Require New Home Gateway
No Access Network Upgrade	Full Network Upgrade
No Encapsulation Overhead	Must Account Encapsulation Overhead
Double NAT	Single NAT
IPv4-only Client	IPv4 and IPv6 Client
Multiple Routing Domains (Federated Net-10)	Single IPv6 Routing Domain
NAT split may move clients to different routing domain	NAT split does not affect clients

DS-lite Compatible Tests

Application/Service	Results	Comments
Web (http and https)	Yes	
Email/POP	Yes	
IPSec VPN	Yes	UDP/TCP
Public IM Clients (Video/Text)	Yes	
Video Streaming	Yes	
Peer-to-Peer Download and Seeding	Yes	Over TCP
Multiplayer Online Games (PC & Consoles)*	Yes	
Apps requiring UPnP-IGD Protocol	No	
Apps requiring specific source port	No	

* We only tested some recent popular games. We didn't test every multiplayer game available in the market.

What Requires Further Investigation

- Applications Required UPnP-IGP Protocol
 - DS-lite client (B4) can't learn what ports are available from the network (AFTR).
 - A new protocol (Port Control Protocol) is being developed in IETF to work around this issue.
- Applications requiring specific source port number(s)
 - Since not all ports are available to users, applications requiring a specific source port will require more investigation.
- These challenges are not specific to DS-lite. Any transition technology required to share IPv4 addresses and ports will suffer from the same challenges.

Some Rules Will Change

- When delivering IPv4 service, we can no longer assume a public IPv4 represents an individual or a single family. To identify a user, we must use <Time, Protocol, IP address, Port Number>.
 - E.g. Content providers should not put an IP address to jail when receiving an attack. Most spontaneous mechanism should be used to identify the attack.
- IPv4 addresses and Ports are shared among users. This may affect some applications which assume a user has full control of all the ports.
 - E.g.: Sling box streaming TV to Internet may not work without modification.

IPv6 is preferred because it will solve all the technical challenges and will enable end-to-end communication between users and content providers.

Conclusions

- DS-lite provides dual-stack to users without provisioning any IPv4 address to the CPE.
- DS-lite uses IPv6 in the access network to ease the IPv4 exhaustion issue. This motivates IPv6 upgrade for service providers.
- DS-lite is still new and developing. Our analysis has been done based on the current shape of the technology and is only a snapshot of time (Sept, 2010). This may change when a future revision is released.
- Content Providers should prepare to identify users by <IPv4 Address + Port> and begin adopting IPv6.
- IPv6 is preferred because it will solve all the technical challenges and will enable end-to-end communication between users and content providers.

Open Source Projects

- Both AFTR and B4 implementations are public available.
- You can get the AFTR source code from
 - <http://www.isc.org/software/aftr>
- You can get the B4 binary from
 - <http://sourceforge.net/p/dslite-6rd>