IPv6-IPv4 Performance Comparison

The Effect of NAT

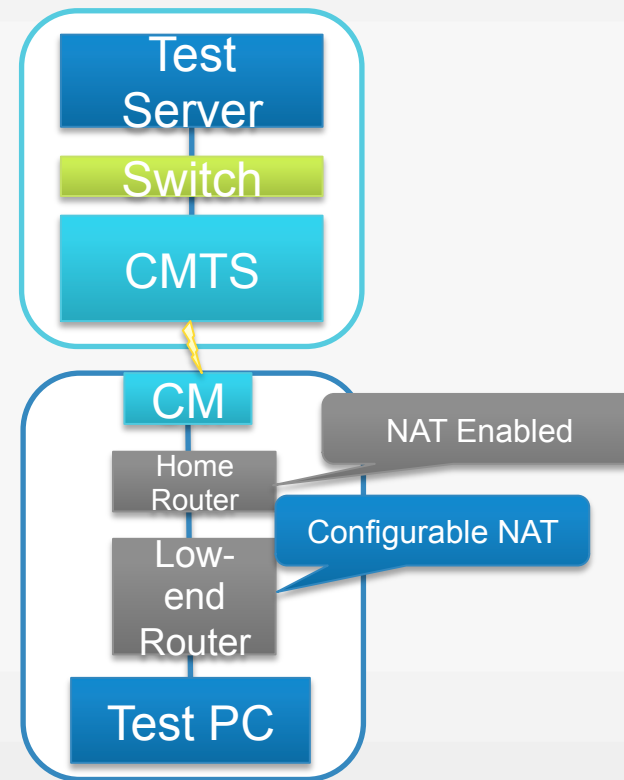**Cable**Labs®

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Is IPv6 faster than IPv4?

- CableLabs has been conducting IPv6 interops since 2009
  - Observed subtle but persistent v6 performance improvements
- Conducted lab testing to measure v4/v6 performance
  - Native IPv6
  - IPv4 with one layer of NAT
  - IPv4 with two layers of NAT

Methodology

- Conducted matched v4-v6 ping tests over the course of an IPv6 interop
  - First sets: 2 NATS enabled
  - Second sets: 1 NAT enabled
- Identify effect of NAT without v4-v6 path differences
- Did NOT measure effects of traffic engineering or differentiated peering

Test Server

Switch

CMTS

CM

NAT Enabled

Home Router

Configurable NAT

Low-end Router

Test PC

Results – One Layer of NAT
Common Scenario Today

- Could NAT be responsible for slower v4 performance?
- IPv6 performed measurably better than IPv4
  - Lower mean, median, standard deviation, and minimum
  - Statistically significant differences

	IPv4	IPv6
Mean	12.02	9.39
Median	9.42	8.75
Standard Dev.	5.76	3.51
Max	29.79	46.17
Min	7.68	7.38
Samples	122	129

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Results – Two Layers of NAT
Possible CGN effect

- WHAT!
- One NAT showed differences, two show nearly identical results
  - 81% chance that the means are really the same
  - V4 in both cases still shows higher variability
  - V6 performed better half the time across 6 test runs

	IPv4	IPv6
Mean	10.00	10.06
Median	9.48	9.65
Standard Dev.	2.03	1.74
Max	17.79	15.99
Min	7.90	7.60
Samples	112	111

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Conclusions (?)

- IPv4 NAT *IN SOME ROUTERS* does affect performance
- Your mileage may vary – NAT performance seems to vary across different platforms
- Other network effects such as tunnels, traffic engineering, network congestion are likely to produce larger effects

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