Benchmarking The Neighbor Discovery Protocol

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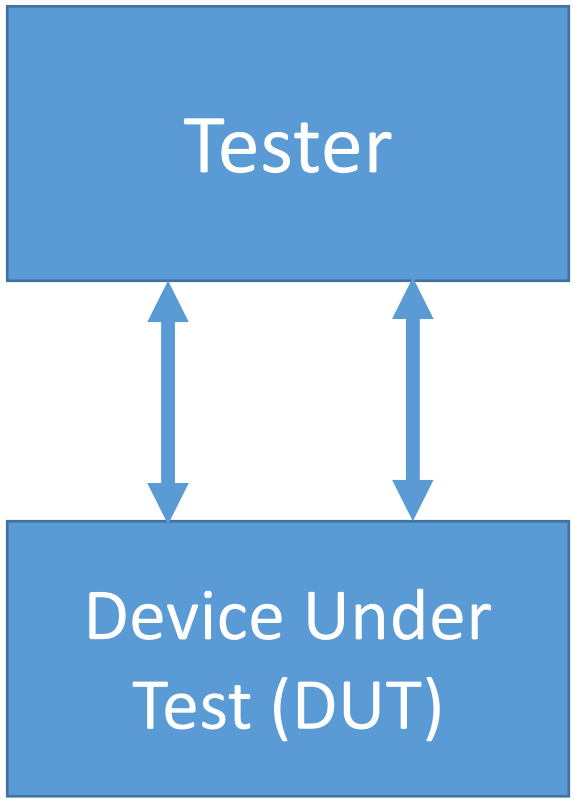
Motivation

- For IPv6, Neighbor Discovery (ND) replaces the Address Resolution Protocol (ARP)
  - IPv6 ND is based upon ICMPv6
- IPv4 subnetwork are typically numbered small address blocks
  - /24 contains 255 elements
  - ARP scaling is not an issue
- IPv6 subnetworks are always numbered from /64 or larger
  - /64 contains 18,446,744,073,709,551,616 elements
  - ND scaling is an issue
  - RFC 6583 demonstrates that a port scan can be fatal to a naïve ND implementation

Approach

- Baseline Test
  - Send a stream that does not stress ND through DUT
  - Every packet in stream carries the same destination address
  - No loss should be observed
- Scaling
  - Send a stream that stresses ND through the DUT
  - Stream is identical to baseline in every way except that it carries many destination addresses
  - Loss will be observed



Results

- METRIC: NDP-MAX-NEIGHBORS
  - How many addresses can the stream carry before loss is observed
- Observation: What happens when NDP-MAX-NEIGHBORS is exceeded
  - Implementation crashes?
  - New neighbors cannot be acquired, but connectivity to previously acquired neighbors remains stable?
  - New neighbors can be acquired, but connectivity to previously acquired neighbors is lost?

Scaling Test Procedure Details

- NDP configured with RFC 4861 defaults
- Counters (2 per destination address)
  - One on transmit interface, one on receive interface
  - Both reset on first receive (allow for initial packet loss)
- Test procedure
  - Start flow with single destination
  - Set N to 2
  - Until N is equal to MAX-NDP-NEIGHBORS * 1.1
    - Set timer
    - Add a destination to the flow
    - Wait for reception of first packet with new destination or timer to expire
- Counters reflect loss for each destination

Next Steps

- WG Last Call