DTunnels: GEC 5 Demo

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Overview

This demonstration shows the interconnection of the BGP session multiplexer ("BGP Mux") with two upstream "providers"—one at Georgia Tech and one at University of Wisconsin—as well as the integration of both the control and data planes with the BGP Mux with an OpenVZ-based virtual network. The main goal of this demonstration is to show the following:

- *Upstream connectivity.* BGP Muxes in Atlanta and Wisconsin connected to upstream "providers" (i.e., the border routers of the campuses at both Georgia Tech and University of Wisconsin).
- *Downstream connectivity to virtual networks.* A downstream client network, connected to the BGP muxes via Ethernet GRE tunnels, with full BGP connectivity from both the Atlanta and Madison BGP muxes.
- *Data plane.* A working data plane from a downstream client virtual network—packets flowing to and from the experiment from the Internet.

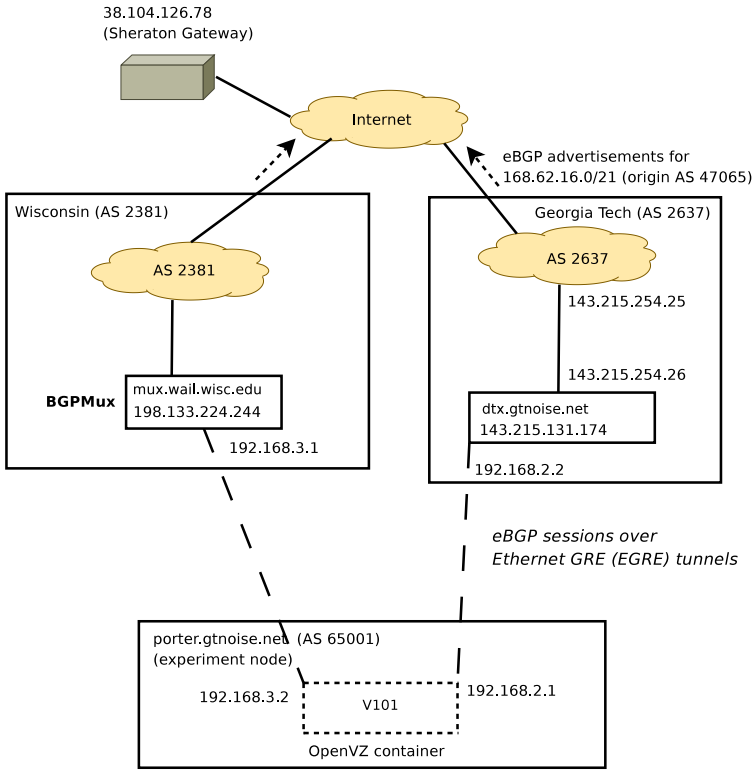

Figure 1: Demo Setup

Demonstration Details

In this section, we describe details of the overall demonstration setup, and next steps for integration.

Upstream connectivity We presently have upstream BGP connectivity via three upstream providers. We have upstream connectivity through Georgia Tech (AS 2637), via which we have direct connectivity to

NLR and Internet2, as well as the commodity Internet. Second, we have upstream connectivity through PSGNet (AS 3130), which has upstream connectivity via Verio (AS 2914) and Sprint (AS 1239). Finally, we have connectivity via the University of Wisconsin at Madison (AS 2381).

The BGP Muxes at both Georgia Tech and Wisconsin are connected via a VLAN with the border router on the respective campus networks. On each site, a dedicated server on the local network acts as the BGP Mux and has a dedicated interface for the VLAN to the border router. This point-to-point link is numbered with a /30 IP prefix, with one address for each side of the connection.

Downstream connectivity to virtual networks These nodes run the *DTunnels* Linux kernel, which allows the Mux to establish downstream connections to the client network via Ethernet GRE (EGRE) tunnels. This EGRE-based downstream connectivity reflects progress over the demonstration at GEC 4, where these downstream connections were established over layer 3 (eBGP multihop). This direct connectivity is only currently possible at Georgia Tech and University of Wisconsin, where we have direct control over the kernel on the BGP session multiplexer itself.

Data plane This demonstration shows the first functional BGP Mux data plane. The current setup shows data traffic (i.e., pings) traveling between the downstream virtual network and the Sheraton hotel gateway. Currently, due to both route and packet filtering issues at various locations, we are forcing all traffic into and out of the Georgia Tech network (with AS path prepending to control outbound traffic and local preference to control outbound traffic).

Next Steps

We have demonstrated an initial integration of the DTunnel framework, with the data plane working for both upstream and downstream connectivity. Several issues remain:

1. **Multiple downstream client networks.** Currently, we have a single virtual network downstream from the BGP Muxes at both Georgia Tech and Wisconsin. We next plan to test the BGP Mux's ability to exchange traffic with multiple client networks, which will involve forwarding incoming traffic based on the client network's assigned IP address space. For outbound traffic, the BGP Mux must forward traffic to the upstream ISP that the client has selected based on the client network's MAC address.
2. **Multiple upstream ISPs.** We also plan to extend the BGP Mux so that it connects to multiple upstream ISPs in at least one location. This will allow us to test: (1) whether an experimental network can connect to a subset of upstream ISPs; (2) whether the mux can correctly forward traffic to the client network's chosen upstream ISP, given multiple possible choices for upstreams.
3. **Develop RSpec for BGP Mux.** Configuring a downtream network currently requires manual configuration of the EGRE tunnels and BGP sessions on both sides. We plan to develop RSpecs for the BGP Mux service so a ProtoGENI experimenter can have the EGRE tunnels and BGP sessions for the BGP Mux automatically configured.
4. **Increase the number of BGP Mux deployments.** We are planning to add BGP Mux deployments in KDDI (Japan), Utah, Princeton, and several other locations to increase the locations from which experiments can obtain upstream BGP connectivity.