High Availability with BGP Monitoring Protocol Data Collection

Master thesis proposal with Swisscom

Description


This architecture imposes that the BGP [7] RIB state, which is collected through BMP route-monitoring messages, needs to be cached at the data-collection. The preservation of BGP RIB state caching across daemons is challenging, especially if faced with reload or migration events due to software upgrades or re-balancing decisions.

During this thesis you will first learn what metrics are collected with Network Telemetry, how they relate in terms of control-plane, forwarding-plane and device characteristics and how this allows us to distinguish between measurements and different dimensions. You will also understand why network schema needs to be preserved for a metric correlation which enables network-wide visibility. Finally, you will realize how Swisscom uses (i) Anycast [8] with ECMP [9] to distribute traffic across Layer 3 links and routers; and (ii) SO_REUSEPORT with an eBPF enhancement [10] to distribute incoming telemetry data to different collection processes on a server.

You will research and document how BMP-collected BGP RIBs (Routing Information Base) can be cached in a redundant fashion at the data collection layer, for the purpose of enriching Flow Aggregation [6], while saving persistently only the master copy at the database layer in order to avoid data duplication. Then you will implement your ideas in C and test them in a lab setup.

Experts from Swisscom, INSA [11] and Pmacct [12] will support you with a test environment and IETF level expertise in Network Telemetry data-collection, Linux network kernel and C development. You will be working in a well-supported group. Finally, you can present your thesis results at the IETF 115 GROW working group between November 5-11th 2022 to other network operators, vendors and universities.

Requirements

Good understanding in C development and Linux network TCP/IP stack. Some basic understanding in TCP/IP transport protocols and BGP and routing protocols are an advantage. Don't be scared about the application and implementation parts.

Timetable

Table 1: Suggested schedule for 6 months (26 weeks)

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Estimated Effort</th>
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<tr>
<td><strong>Onboarding</strong>: Setting up and getting to know the IETF interoperability lab and the peers.</td>
<td>2 weeks</td>
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<tr>
<td><strong>Data Collection Baseline</strong>: Learn what BMP, IPFIX and YANG push is, how it enables network visibility and how BGP RIB state is cached.</td>
<td>3 weeks</td>
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<td><strong>Load Distribution Baseline</strong>: Learn how Anycast with ECMP works, discover similarities with SO_REUSEPORT and eBPF load balancing.</td>
<td>1 week</td>
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<td><strong>Preserve BGP RIB state cache</strong>: Research, develop, test and document data-collection enhancements.</td>
<td>17 weeks</td>
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<td><strong>Thesis Writeup</strong></td>
<td>3 weeks</td>
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References


