BMP & YANG

GROW and NETCONF WG

IETF 111

July 19-23th, 2021

Virtual Hackathon

BMP Hackathon - Plan

Performance

- Measure CPU and memory consumption of BGP process when BMP Adj-RIB IN, OUT and Local-RIB with path-marking TLV is enabled.
  - draft-ietf-grow-bmp-local-rib (BGP Local RIB)
  - draft-grow-bmp-tlv (TLV support for BMP Route Monitoring and Peer Down Messages)
  - draft-cppy-grow-bmp-path-marking-tlv (Path Marking TLV)
- Measure impact of BMP when session is stable, unstable, and when BGP peer is flapping.
- Verify the completeness of information sent by BMP route-monitoring about BGP RIB state when BGP is congested.
- Verify possible BGP route-propagation delay impact when BMP is enabled on a transit node.

Hackathon – Software

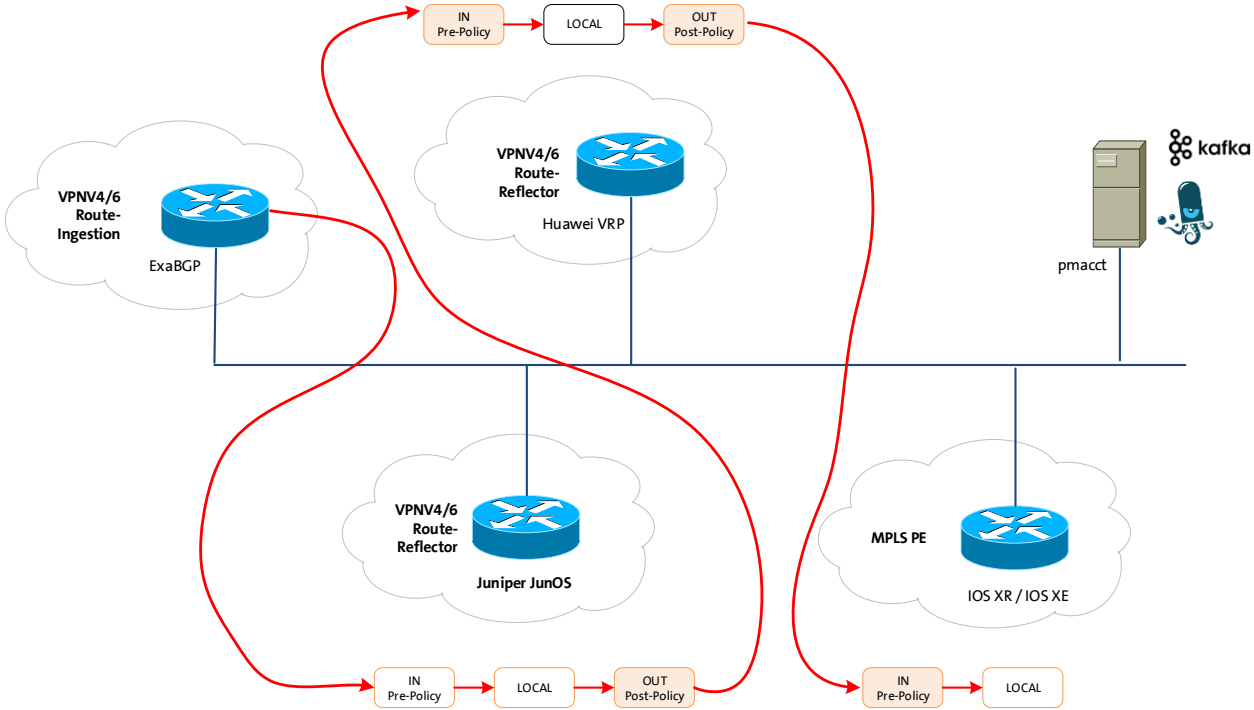
Software

- pmacct nfacctd for IPFIX and BMP data collection
- Apache Kafka as message broker
- Apache Druid as timeseries DB
- Pivot as user interface
- Wireshark BMP dissector for packet analysis
- ExaBGP for BGP VPnv4/6 route generation

Tutorial

- https://imply.io/post/add-bgp-analytics-to-your-imply-netflow-analysis

Hackathon - Network



- **VPNv4 1'000'000 path's** route generation with ExaBGP.
- **VPNv4 route-reflector** BMP Adj-RIB IN pre-policy and Adj-RIB Out post-policy. with draft-ietf-grow-bmp-tlv and draft-cppy-grow-bmp-path-marking-tlv on **Huawei VRP V800R013.**
- **VPNv4 route-reflector** BMP Adj-RIB Out post-policy on **Juniper JunOS 21.1R1.11.**
- **MPLS PE** BMP Adj-RIB IN pre-policy on **IOS XR 7.4.1 and IOS XE 17.6.1 EFT.**

Lab Environment

Achievements

- Test automation contains ExaBGP for sequenced BGP VPNv4 unicast route generation, BMP state initialization, BMP metric and YANG push cpu and memory process usage data collection.
- BMP route-monitoring prefix loss and delay can be automatically measured.
- CPU and memory usage now monitored on BGP process level.
- Comparison between 4 different operating systems.

Next Steps

- Redo same tests with higher scale and Cisco IOS XR being the route-reflector, Cisco IOS XE being the MPLS PE and improved timestamping on Huawei VRP.

BMP Timestamping

```
> Frame 5: 148 bytes on wire (1184 bits), 148 bytes captured (1184 bits)
> Ethernet II, Src: Cisco_a8:be:93 (bc:4a:56:a8:be:93), Dst: VMware_0e:d8:14 (00:0c:29:0e:d8:14)
> Internet Protocol Version 4, Src: 192.0.2.44, Dst: 192.0.2.1
> Transmission Control Protocol, Src Port: 53230, Dst Port: 1790, Seq: 275, Ack: 1, Len: 94
v BGP Monitoring Protocol, Type Route Monitoring
    Version: 3
    Length: 94
    Type: Route Monitoring (0)
  v Per Peer Header
      Type: Global Instance Peer (0)
    > 0000 0000 = Flags: 0x00
      Peer Distinguisher: 0:0
      Unused: 00000000000000000000000000
      Address: 198.51.100.52
      ASN: 65536
      BGP ID: 192.0.2.52
      Timestamp (sec): 1614866786
      Timestamp (msec): 954018
  > Border Gateway Protocol - UPDATE Message
```

Cisco IOS XR

```
> Frame 9: 503 bytes on wire (4024 bits), 503 bytes captured (4024 bits)
> Ethernet II, Src: JuniperN_d7:4d:f0 (64:64:9b:d7:4d:f0), Dst: VMware_0e:d8:14 (00:0c:29:0e:d8:14)
> Internet Protocol Version 4, Src: 192.0.2.51, Dst: 192.0.2.1
> Transmission Control Protocol, Src Port: 57353, Dst Port: 1790, Seq: 1045, Ack: 1, Len: 437
v BGP Monitoring Protocol, Type Route Monitoring
    Version: 3
    Length: 76
    Type: Route Monitoring (0)
  v Per Peer Header
      Type: Global Instance Peer (0)
    > 0100 0000 = Flags: 0x40, Post-policy
      Peer Distinguisher: 0:0
      Unused: 00000000000000000000000000
      Address: 192.0.21.161
      ASN: 65537
      BGP ID: 192.0.2.61
      Timestamp (sec): 1605017650
      Timestamp (msec): 621454
  > Border Gateway Protocol - UPDATE Message
```

Juniper JunOS

```
> Frame 5: 239 bytes on wire (1912 bits), 239 bytes captured (1912 bits)
> Ethernet II, Src: HuaweiTe_e6:67:ee (30:fb:b8:e6:67:ee), Dst: VMware_0e:d8:14 (00:0c:29:0e:d8:14)
> Internet Protocol Version 4, Src: 192.0.2.62, Dst: 192.0.2.1
> Transmission Control Protocol, Src Port: 54630, Dst Port: 1790, Seq: 294, Ack: 1, Len: 185
v BGP Monitoring Protocol, Type Route Monitoring
    Version: 4
    Length: 185
    Type: Route Monitoring (0)
  v Per Peer Header
      Type: Global Instance Peer (0)
    > 0000 0000 = Flags: 0x00
      Peer Distinguisher: 0:0
      Unused: 00000000000000000000000000
      Address: 198.51.100.52
      ASN: 65536
      BGP ID: 192.0.2.52
      Timestamp (sec): 1614867831
      Timestamp (msec): 0
  > Border Gateway Protocol - UPDATE Message
```

Huawei VRP

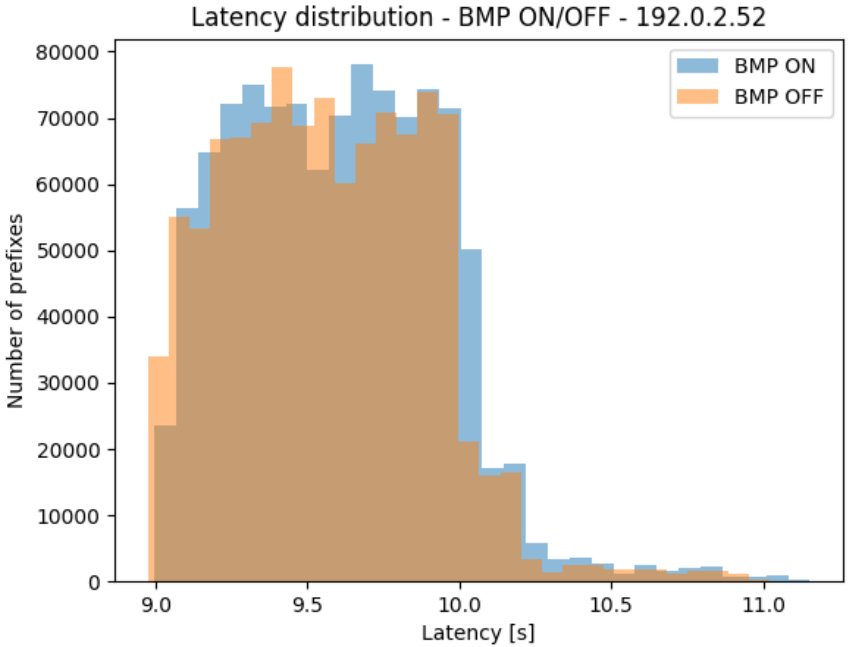
```
> Frame 27: 177 bytes on wire (1416 bits), 177 bytes captured (1416 bits)
> Ethernet II, Src: Cisco_ea:ac:8c (00:32:17:ea:ac:8c), Dst: HewlettP_16:78:4d (1c:98:ec:16:78:4d)
> Internet Protocol Version 4, Src: 138.190.128.171, Dst: 138.187.58.12
> Transmission Control Protocol, Src Port: 38296, Dst Port: 1790, Seq: 1781, Ack: 1, Len: 123
v BGP Monitoring Protocol, Type Route Monitoring
    Version: 3
    Length: 123
    Type: Route Monitoring (0)
  v Per Peer Header
      Type: RD Instance Peer (1)
    > 0000 0000 = Flags: 0x00
      Peer Distinguisher: 64499:1000990023
      Unused: 00000000000000000000000000
      Address: 169.254.0.1
      ASN: 65536
      BGP ID: 169.254.0.1
      Timestamp (sec): 1623215686
      Timestamp (msec): 557969
  > Border Gateway Protocol - UPDATE Message
```

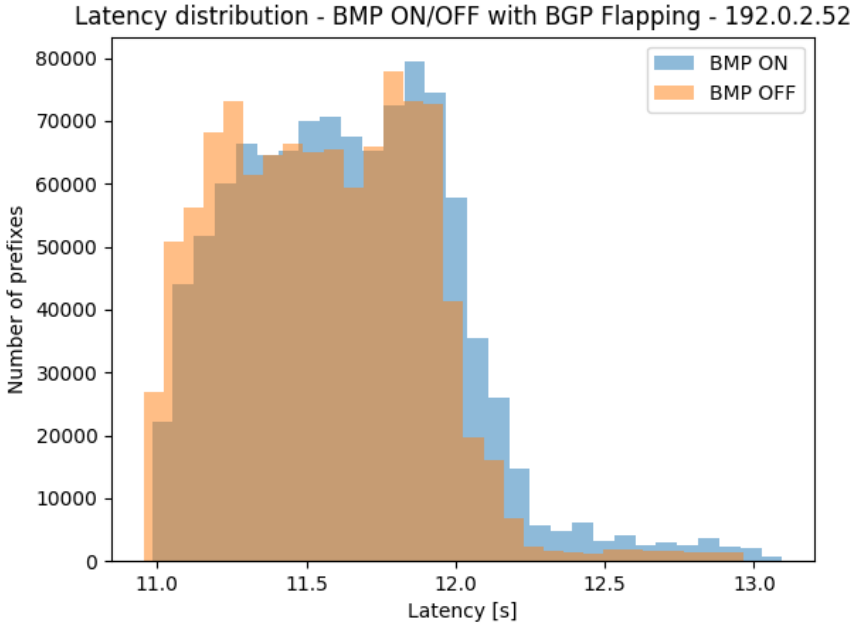
Cisco IOS XE
(msec in 17.6)

Device Measurement

Measurement	Huawei	IOS XR	IOS XE	JunOS
BGP process CPU	every 30 seconds	every 30 seconds	every 30 seconds	every 30 seconds
BGP process memory	every 30 seconds	every 30 seconds	every 30 seconds	every 30 seconds
RSP CPU	every 30 seconds	every 30 seconds	every 30 seconds	every 30 seconds
RSP memory	every 30 seconds	every 30 seconds	every 30 seconds	every 30 seconds
	With huawei-debug.yang, "display cpu-usage slot 3 | i BGP" and "display memory-usage slot 3 | i BGP"	With Cisco-IOS-XR-procmem-oper.yang, Cisco-IOS-XR-wdsysmon-fd-oper.yang, "show processes cpu thread pid","show processes memory detail pid"	With Cisco-IOS-XE-process-cpu-oper.yang and Cisco-IOS-XE-process-memory-oper.yang	With "show system processes extensive | match rpd"

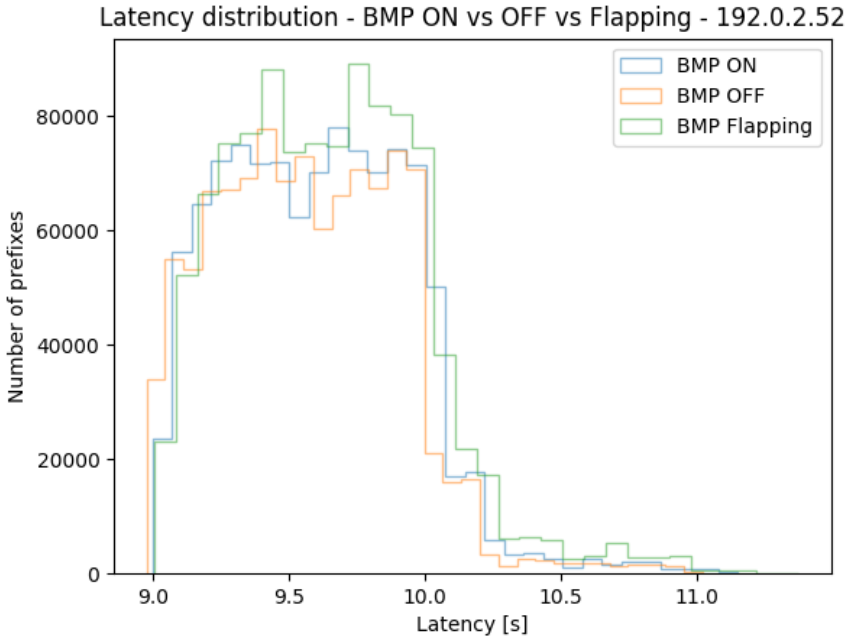
Huawei VPNv4 route-reflector
Impact of BMP on BGP Propagation Delay





1'000'000 BGP VPNv4 unicast paths advertised as fast as possible to 10 peers.
BMP session **on/off** - Stable vs. Flapped BGP.

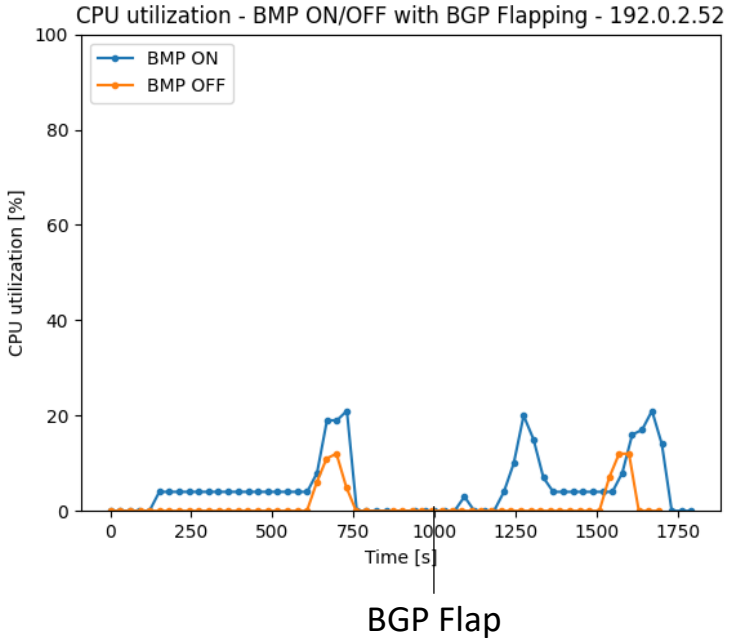
Huawei VPNv4 route-reflector
Impact of BMP on BGP Propagation Delay

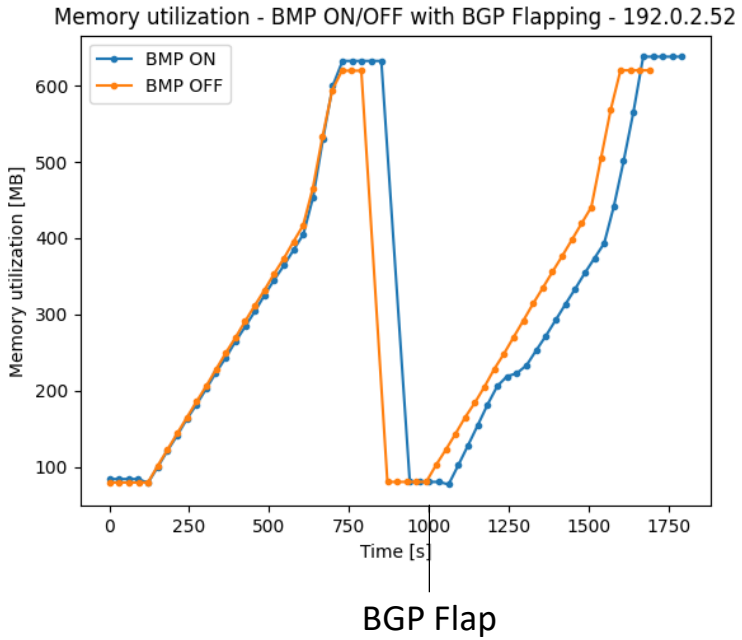


1'000'000 BGP VPNv4 unicast paths advertised as fast as possible to 10 peers.
Delay comparison between BMP enabled, disabled and BMP session flapping

Huawei VPNv4 route-reflector

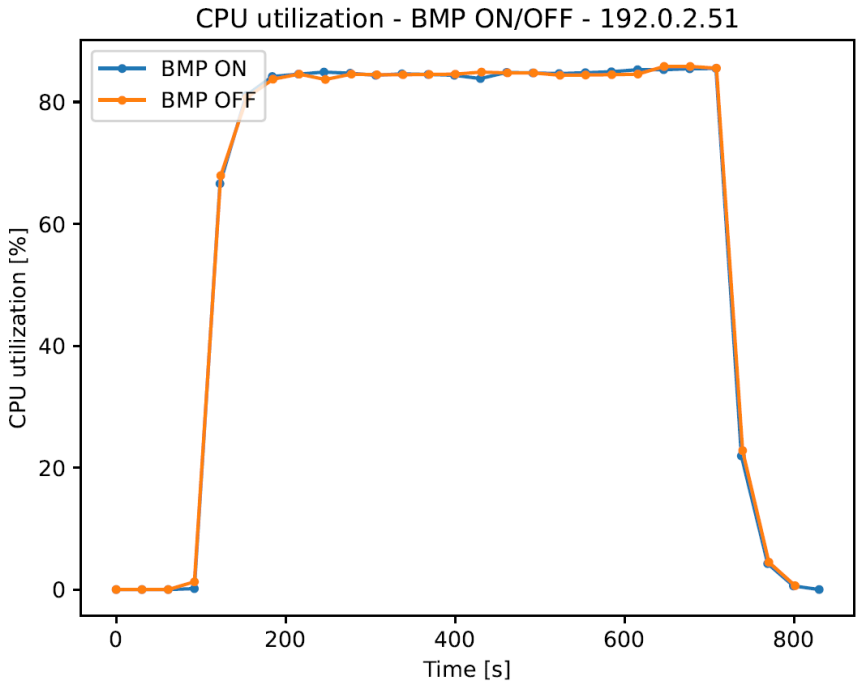
Memory and CPU impact before and after BGP Flap

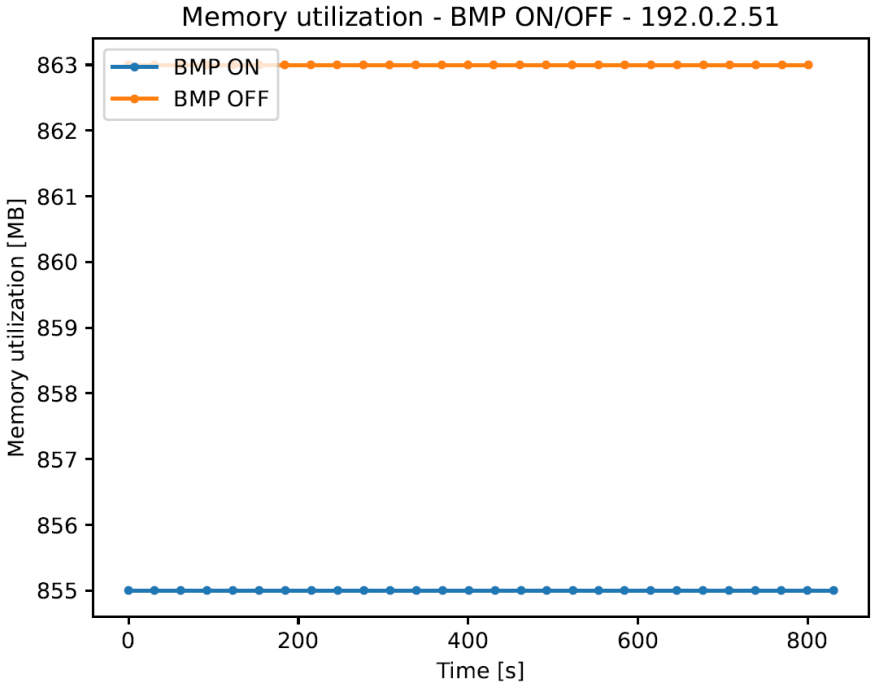




1'000'000 BGP VPNv4 unicast paths advertised as fast as possible to 10 peers.
Memory and CPU comparison between BMP enabled and disabled

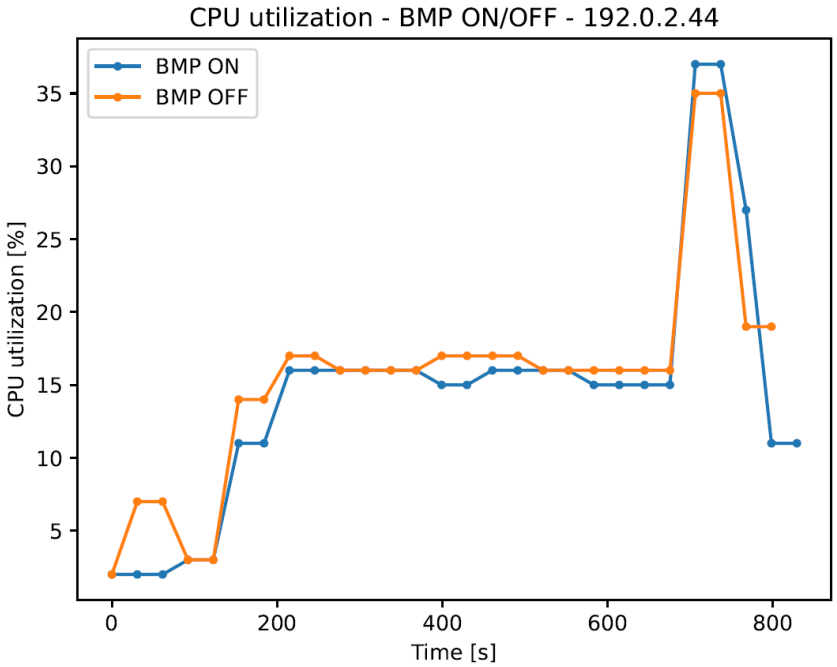
Juniper VPNv4 route-reflector
Memory and CPU impact

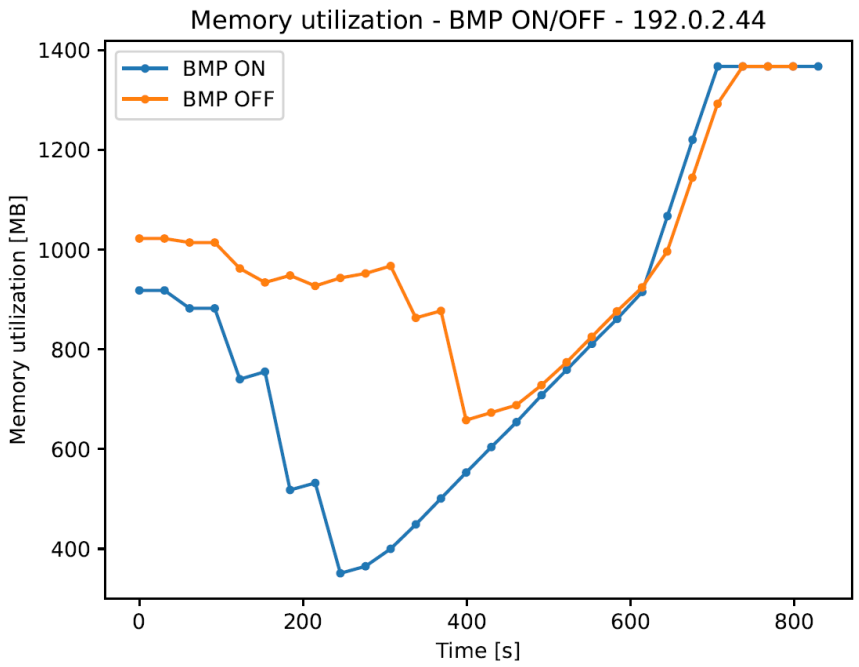




1'000'000 BGP VPNv4 unicast paths advertised as fast as possible to 10 peers.
Memory and CPU comparison between BMP enabled and disabled

Cisco IOS XR MPLS PE
Memory and CPU impact





1'000'000 BGP VPNv4 unicast paths advertised as fast as possible to 10 peers.
Memory and CPU comparison between BMP enabled and disabled

What we learned (again)

- Good
  - With the 6th hackathon, we know the drill. Consistency more and more pays off.
  - Good preparation, planning with test automation was gold.
- Bad
  - Testbed getting instable with 4'000'000 routes. Need to increase performance and stability.
  - Yet again, missing beers and cocktails after ☺

Thanks to…

- Alex Huang Feng – INSA
- Pierre Francois – INSA
- Paolo Lucente – NTT
- Marco Tollini - Swisscom
- Matthias Arnold - Swisscom
- Thomas Graf - Swisscom

…Imply for providing us the big data,
Huawei for the network environment and support,
and Cisco for Software and the test cases.