Using BGP Flow-Spec for distributed micro-segmentation

Davide Pucci / 12019364

Attilla de Groot / Cumulus Networks

Data Center micro-segmentation

Layer 2 segmentation

VLANs to isolate multiple flows over the same link.

Layer 3 segmentation

VRFs to separate routing tables.

Micro-segmentation

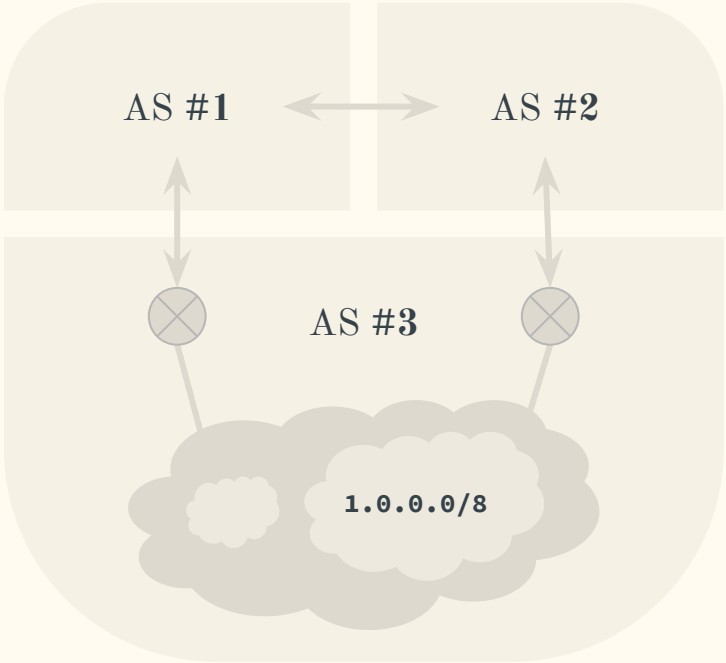
Apply custom security filtering within the same VLAN.

Border Gateway Protocol (BGP)

BGP is the *de-facto* Internet routing protocol.

Pulls intra-Autonomous System prefixes, relying on iBGP.

Exchanges these internal prefixes with neighbouring Autonomous Systems to enable proper routing, relying on eBGP.



BGP Flow Specification

Extension of BGP, born with the only aim of DDoS attacks mitigation.

The Flow-Spec controller spreads filtering policies to its neighbours, the clients.

Regulate actions against given prefixes with extended communities, relying on BGP for the diffusion.

RFC 5575

Dissemination of Flow Specification Rules

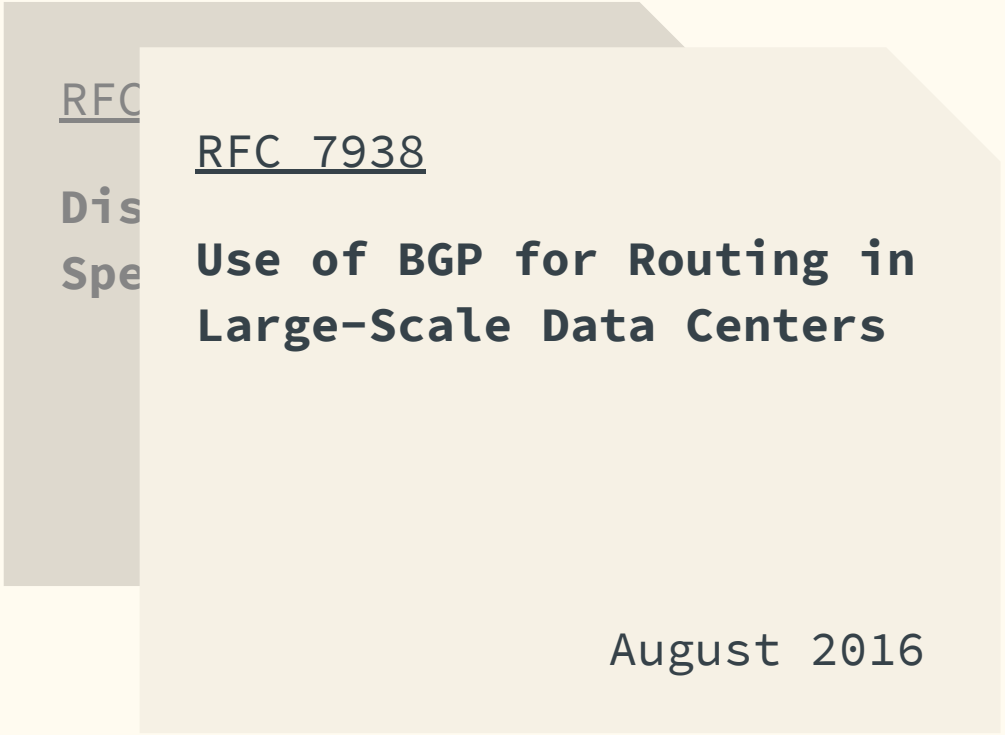
August 2009

BGP in Data Centers

Third-wave applications moved most of the traffic to a east-west direction.

This change introduced the need of more elastic Data Centers.

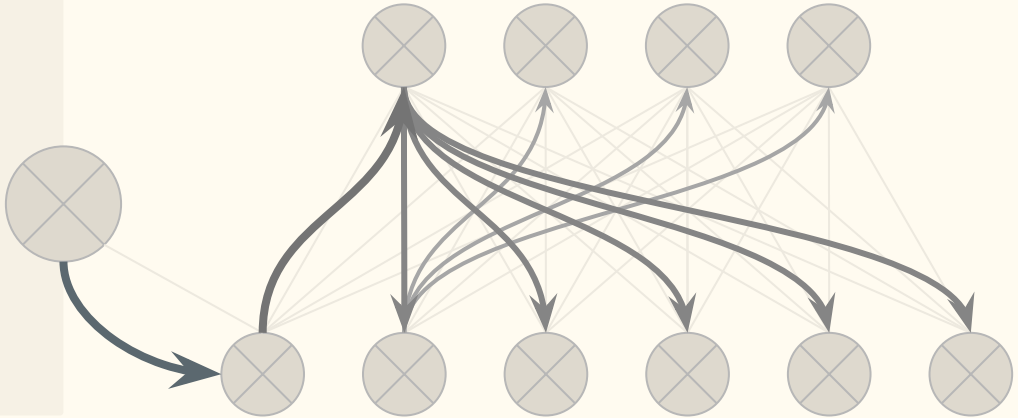
All the switches represent a (private) Autonomous System.



Is the **BGP Flow Specification** applicable for Data Center **micro-segmentation?**

Distributed micro-segmentation with Flow-Spec

```
route flow4 {
  src 2.0.0.1/32;
  dst 1.0.0.1/32;
} {
  bgp_ext_community.add(
    (generic, 0x80060000, 0x0)
  );
};
```



Flow Specification controller

Flow Specification clients

Open source implementations

Bird for controller capabilities

FRR for client capabilities

as none of them implements routes injection over the underlying system

Custom utility for rules injection

Open source implementations

Bird

Starting from version 2.0,
it correctly implements the whole
Flow-Spec specification.

FRR

Used to be unable to relay
Flow-Spec announcements, later
patched by working together
with Cumulus Networks
developers.

Rules fetcher ~ iptables on the controller

```
fs-controller:~# iptables -L FORWARD

Chain FORWARD (policy DROP)

num target  prot  opt   source    destination

1   ACCEPT  all   --    2.0.0.1   1.0.0.1
```

Rules fetcher ~ Flow-Spec routes on Bird

```
# default policy

route flow4 {
  src 0.0.0.0/0;
  dst 0.0.0.0/0;
} {

  # traffic drop
  bgp_ext_community.add(
    (generic, 0x80060000, 0x0)
  );

};
```

```
# rule 1

route flow4 {
  src 2.0.0.1/32;
  dst 1.0.0.1/32;
} {

  # traffic-mark as rule number
  bgp_ext_community.add(
    (generic, 0x80090000, 0x1)
  );

};
```

Rules transit

BIRD
controller

FRR
clients

Rules injector ~ Flow-Spec routes on FRR

```
fs-client# show bgp ipv4 flowspec detail json
```

```
{
  "to":"1.0.0.1/32",
  "from":"2.0.0.1/32"
},
{
  "ecomlist":"FS:marking 1"
},
{
  "time":"00:00:09"
}
```

```
{
  "to":"0.0.0.0/0",
  "from":"0.0.0.0/0"
},
{
  "ecomlist":"FS:rate 0.000000"
},
{
  "time":"00:00:09"
}
```

Rules injector ~ iptables on the controller

```
fs-client:~# iptables -L FORWARD
Chain FORWARD (policy ACCEPT)
num target   prot  opt  source    destination
1   FLOWSPEC all   --   anywhere  anywhere
[...]

fs-client:~# iptables -L FLOWSPEC
Chain FLOWSPEC (1 references)
num target   prot  opt  source    destination
1   ACCEPT   all   --   2.0.0.1   1.0.0.1
2   DROP     all   --   anywhere  anywhere
```

Flow Specification is suitable for such a purpose

and

A. **Rules numbering** must be carried along with routes, preferably with own extended community sub-type
B. A proper implementation of **routes injection** in the underlying system is still missing
C. Rules application can be filtered at a BGP level, using the **Route Target** extended community to achieve higher scalability

Thank you.

Davide Pucci
https://davidepucci.it

Cumulus Networks
https://cumulusnetworks.com

Security and Network Engineering
https://os3.nl

University of Amsterdam
https://uva.nl