Improving performance through BGP Graceful Shutdown

draft-ietf-grow-bgp-gshut

Fredrik “hugge” Korsbäck
hugge@nordu.net
hugge@sunet.se
What is BGP Graceful Shutdown?

• A simple procedure to reduce the negative impact of shutting down BGP sessions

• Can be combined with RFC 8203 “Shutdown Communication” (feel free to bitch to your vendor about becoming compliant to BGP RFC again)

• Can be part of the operational procedure as outlined in draft-ietf-grow-bgp-session-culling

• Graceful Shutdown is a “Make Before Break” mechanism

• Does not help against unplanned outages

• Not to be confused with BGP Graceful Restart (which is somewhat crazy stuff)
Context

When organizations established direct EBGP sessions, we assume two parties are interested in exchanging traffic with as little packet loss as possible and low latency in an economically sound way.

If you are not looking to minimize packet loss, “Graceful Shutdown” is not for you.
When does blackholing happen with vanilla shutdown?

- Lack of an alternative route on some routers
- Transient routing inconsistency
- A route reflector may only propagate its best path
- The backup ASBR may not advertise the backup path because the nominal path is preferred

Admittedly, the above scenarios usually are short periods of blackholing, but why accept that if they can easily be prevented?
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ASBR

RR

ASBR

Peer

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650 000 IPv4
40k IPv6

100 IPv4
20 IPv6

6 min

10 min

2 seconds

RPF

RPF

Peer
Graceful Shutdown triggers “path hunting”

- Initiated by the operator on the router before maintenance by sending the GRACEFUL_SHUTDOWN well-known community (65535:0 as per IANA)
- Receiving EBGP peer sets LOCAL_PREFERENCE to 0 and selects paths to route traffic away from the initiator, (similar to setting overload in an ISIS)
- When BGP session goes down, minimizes impact to traffic because alternate paths have already been installed

```
1) Signal “lower LOCAL_PREF”
2) ANNOUNCE with LP=0
3) Receive New path from RR
4) shutdown session (cease)
```
Normal vs Graceful

- Operator types “shutdown” on Router A
- Router A sends “CEASE NOTIFICATION”
- Router B generates a BGP WITHDRAW message for all prefixes received from Router A
- Until Router B’s ASN reconvergences there may be micro blackholes

- Operator types “shutdown” on Router A
- Router A sends UPDATES for all prefixes with community 65535:0
- Receiving Router lower’s LOCAL_PREFERENCE for all routes and UPDATES the rest of the ASN
- Router A drinks cup of coffee while router B’s AS reconverges
- Router A shuts down BGP session (CEASE NOTIFICATION)
Usage Guidelines

• To support receiving graceful shutdown, update your routing policy to
  • Match the GRACEFUL_SHUTDOWN well-known community (65535:0)
  • Set the LOCAL_PREF attribute to a low value, like 0
  • **Do not strip** the community when propagating the prefix

• To send graceful shutdown, update your routing policy to
  • Send the GRACEFUL_SHUTDOWN well-known community (65535:0) before you start maintenance
  • When to/from traffic from the peer has stopped, start maintenance and use BGP shutdown communication (usually just a few minutes)
  • Remove the GRACEFUL_SHUTDOWN well-known community when you are done
GRACEFUL_SHUTDOWN signals:

“Hello everyone, if you consider this path your ‘best path’, please start considering this path the ‘worst path’ and if you find anything better install that into your FIB. This path will disappear within a few minutes.”
Configuration Example – Simple to Implement

IOS XR

```plaintext
! route-policy AS64497-ebgp-inbound
    if community matches-any (65535:0) then
        set local-preference 0
    endif
end-policy
!
router bgp 64496
    neighbor 2001:db8:1:2::1
    remote-as 64497
    address-family ipv6 unicast
        send-community-ebgp
        route-policy AS64497-ebgp-inbound in
    !
```

Arista/Brocade/IOS/Quagga/FRR

```plaintext
! ip community-list standard \gshut 65535:0
!
route-map ebgp-in permit 10
    match community gshut
    set local-preference 0
    continue
!
```

Nokia/Alcatel

```plaintext
community "gshut" members "65535:0"
policy-statement "ebgp-in"
    entry 10
        from
            community "gshut"
        action accept
            local-preference 0
        exit
exit
exit
```

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Configuration Example – Simple to Implement

```plaintext
hugge@se-tug-re0> show configuration policy-options policy-statement peering-in term draft-ietf-grow-bgp-gshut
from community GRACEFUL_SHUTDOWN;
then {
    local-preference add 0;
}

hugge@se-tug-re0> show configuration routing-instances NDN-CPS protocols bgp group NETNOD neighbor 195.245.240.156
description "Com Hem AB";
import [ peering-in i2-cps-import comhem-in ];
family inet {
    unicast {
        prefix-limit {
            maximum 20;
            teardown 80 idle-timeout 60;
        }
    }
}
export [ netnod-out i2-cps-export peering-out reject-rest ];
peer-as 39651;
```
Making use of GRACEFUL SHUTDOWN on IOS XE

neighbor 10.0.0.1
  remote-as 65000
  graceful-maintenance
  activate

A single neighbor

neighbor-group test
  graceful-maintenance
  activate

A neighbor group
What does this look like in AS 2603 NORDUnet global network?

• Since we assume networks connect to us for mutual benefit, it makes sense to facilitate those networks to perform maintenance without introducing packet loss. Why are we otherwise connected, if not to forward packets?

• NORDUnet honors the well-known 65535:0 BGP community on all EBGP sessions. This includes:
  • Customer EBGP sessions
  • Peering partner EBGP sessions

• For any prefix sent to AS 2603 with community 65535:0, NORDUnet will lower the LOCAL_PREFERENCE to 0 to facilitate maintenance. The low LP triggers the search for alternative paths within an ASN.
What about you?

• Would you allow NORDUnet (and others) to perform hitless maintenance by honoring the 65535:0 GRACEFUL_SHUTDOWN community?

• This deviates from the standard practice of “not honoring any communities from peering partners” – but does that ‘standard’ actually make sense in context of cooperation and preventing packet loss?

• The receiving side implementation is trivial, this can be done on anything from an IOS/Brocade box up to and including the most modern operating systems.

GTT (AS 3257), Github (AS 36459), NTT (AS 2914), Coloclue (AS 8283), Amsio (AS 8315), BIT (AS 12859) ComHem (39651) deployed support... who else? 😊
What about Sweden!?

• SOF is having discussions and reaching consensus that this is awesome (join in mailinglist on https://sof.isoc.se)
• Implementations ongoing, some done, some testing
• Overall goal is to be able to make hitless maintenance.
• *Sweden first, World second.*
• **Whos doing it in Sweden?** NORDUnet (2603) SUNET (1653) ComHem (39651) DGC Systems (21195)
• **Whos soon doing it in Sweden (and abroad)?** Telia (3301/1299) Tele2 (1257) SVT (201641) Netnod (8674) Bahnhof (8473)...
• You???
The science behind gracefully shutting down BGP sessions
