



5 years of FRRouting



RIPE 84, May 2022, Berlin

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NetDEF / OpenSourceRouting

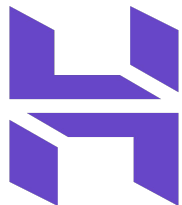


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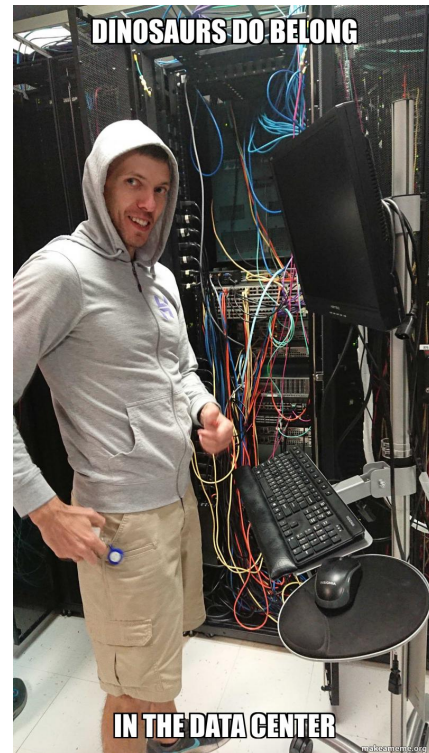


Who is this guy?

- Sysadmin, DevOps, SRE (since 2011)
- FRR maintainer (since 2019)
- SWE at NetDEF / OpenSourceRouting
- SRE at Hostinger



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Releases

- FRR employs **X.Y.Z** versioning scheme
- 3 releases per-year
- Stages
 - Freeze
 - Stabilization
 - RC
 - Release
- 2-3 release managers and rotate per release
- No LTS releases
 - Backports in two latest releases
 - @Mergifyio helps here

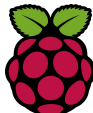
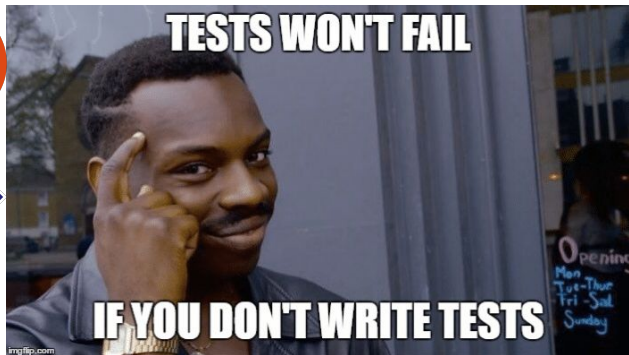
Release	2022-07-05
RC	2022-06-21
Stabilization branch	2022-06-07
Freeze	2022-05-24

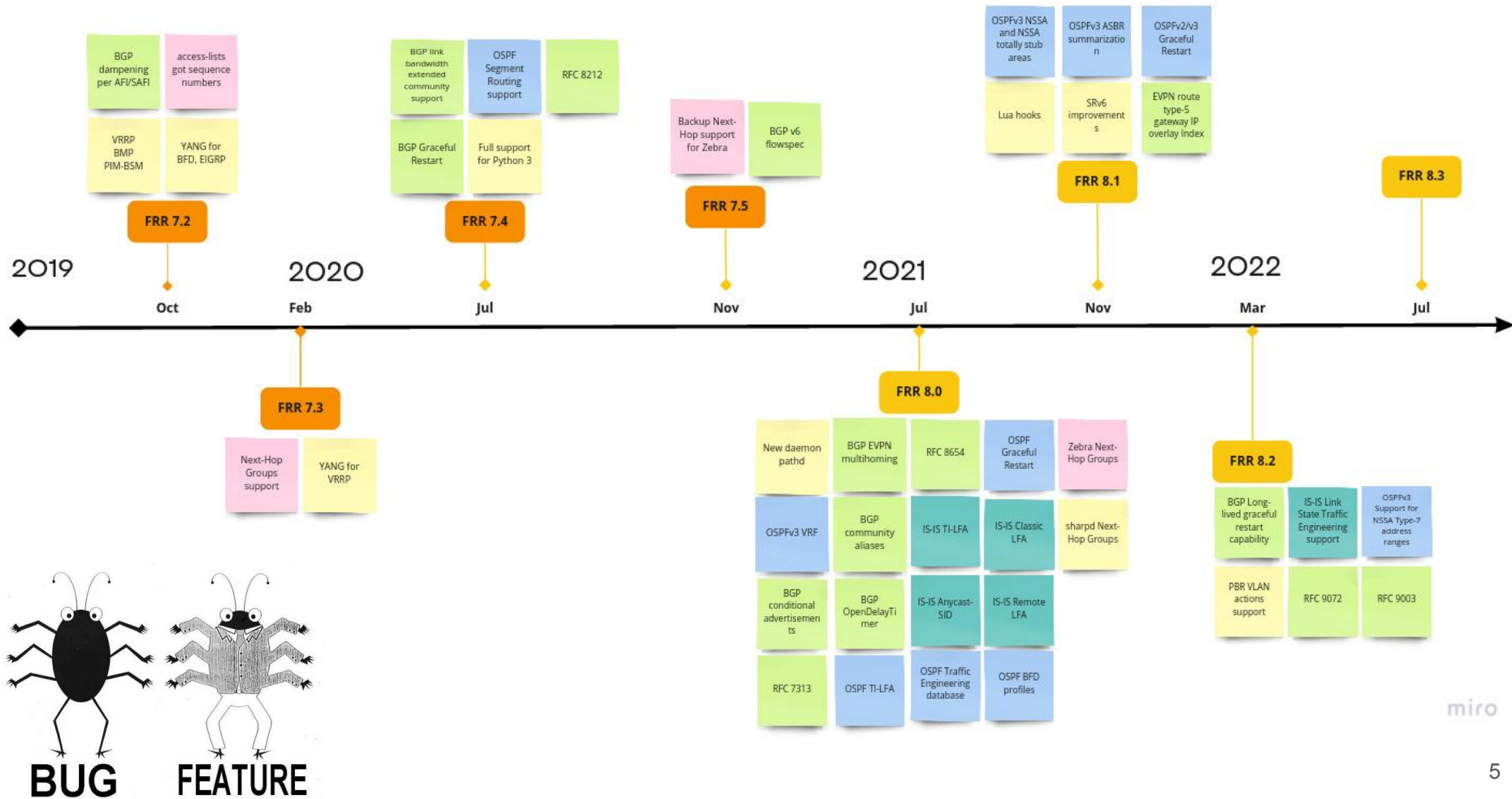




Continuous Integration

- @frrbot repo decorator (labels, styling suggestions, sanity checks for commits)
- Tests are mandatory for
 - All new features
 - Bug fixes that requires to be RFC compliance
- ~600 CI agents
 - ~70 Raspberry PI
 - CentOS 7, RedHat 8, Fedora 29
 - Debian 9/10/11, Ubuntu 16.04/18.04/20.04/22.04
 - FreeBSD 11/12, OpenBSD 7, NetBSD 9
 - Virtual Machines
 - Managed with Ansible
 - Build success rate: 50%
 - Average run: 130 minutes
 - Average time to fix a failure: 1 hour, 55 minutes
 - Average number of builds between fixes: 2.35 builds

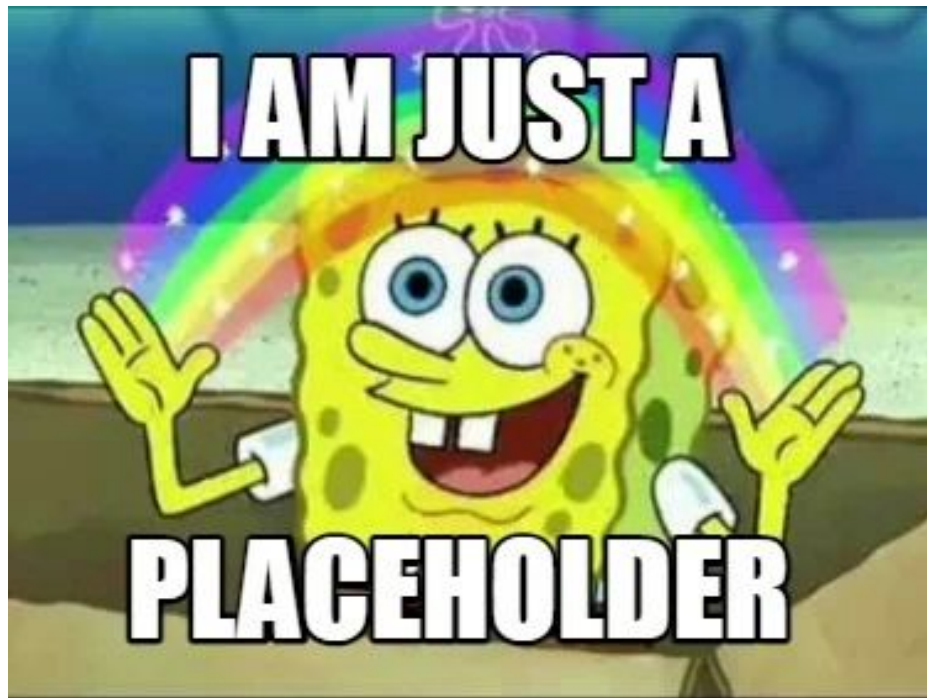






Discover unknown knowns

- Lua hooks
- sharpd daemon
- Tracing in FRR
- BGP Long-lived Graceful Restart
- BGP suppress-duplicates





Unknown feature: Lua hooks

```
$ cat /etc/frr/scripts/zebra.lua
local clients = {}
clients["172.16.13.1/32"] = { description = "client1" }
clients["172.16.13.2/32"] = { description = "client2" }

function on_rib_process_dplane_results(ctx)
    -- Log only newly added routes
    if ctx.zd_op ~= 1 then
        return {}
    end

    prefix = ctx.rinfo.zd_dest.network
    if clients[prefix] then
        log.info(clients[prefix].description)
    else
        log.warn("Unknown client")
    end
    return {}
end
```

```
zebra[162633]: [N9WAX-QFTTH] Unknown client
zebra[162633]: [JZMNV-MDH8J] New prefix 172.16.13.2/32, from client2
zebra[162633]: [VF3QY-FP1PP] Unknown client

spine(config)# zebra on-rib-process script zebra
Successfully added script clients for hook call on_rib_process_dplane_results
spine(config)#
```

- Since FRR 8.1
- Zebra RIB dataplane
 - Read-only
- BGP + route-map
- Lua 5.3
- *--enable-scripting*





Unknown feature: Lua hooks (cont.)

```
router bgp 65000
 neighbor 192.168.0.1 remote-as external
 !
 address-family ipv4 unicast
  neighbor 192.168.0.1 route-map peer in
 exit-address-family
 !
 route-map peer permit 10
  match script rmap
 exit
 !

$ vtysh -c 'show bgp ipv4 unicast neighbors 192.168.0.1 routes json' | jq
'.routes."172.16.1.0/24"[0].metric'
333
```

```
$ cat /etc/frr/scripts/rmap.lua
function route_match(prefix, attributes, peer,
    RM_FAILURE, RM_NOMATCH, RM_MATCH, RM_MATCH_AND_CHANGE)

    function on_match_and_change(prefix, attributes)
        attributes["metric"] = 333
        return {
            action = RM_MATCH_AND_CHANGE,
            attributes = attributes
        }
    end

    return on_match_and_change(prefix, attributes)
end
```

- <http://docs.frrouting.org/en/latest/scripting.html>
- <http://docs.frrouting.org/en/latest/zebra.html#scripting>



Unknown feature: sharpd

- Testing framework
 - No external software to generate millions of routes
- Verify
 - How fast the routes are processed?
 - How many resources do I need?
 - How does my router behave with millions of routes overall?
- Can send **opaque** data to Zebra

```
router bgp 65000
 address-family ipv4 unicast
   redistribute sharp
 exit-address-family
 !
exit

# sharp install routes 172.16.13.1 nexthop 192.168.0.1 254
# show ip route 172.16.13.0/24 longer-prefixes | include 172.16.13.1/32
D>* 172.16.13.1/32 [150/0] via 192.168.0.1, eth1, weight 1, 00:00:14

# sharp install routes 172.16.31.1 nexthop 192.168.0.2 1 opaque client1
# show ip route 172.16.31.1
Routing entry for 172.16.31.1/32
  Known via "sharp", distance 150, metric 0
  Last update 00:00:08 ago
    192.168.0.2, via eth1, weight 1
    Opaque Data: client1
Routing entry for 172.16.31.1/32
  Known via "bgp", distance 20, metric 0, best
  Last update 00:03:19 ago
    * 192.168.0.2, via eth1, weight 1
```

- <http://docs.frrouting.org/en/latest/sharp.html>



Unknown feature: Tracing (LTTng)

```
$ vtysh -c 'show version' | grep --color lttng
'--enable-systemd' '--enable-exampledir=/usr/share/doc/frr/examples/'
'--localstatedir=/var/run/frr' '--sbindir=/usr/lib/frr' '--sysconfdir=/etc/frr'
'--enable-vtysh' '--enable-isisd' '--enable-pimd' '--enable-watchfrr'
'--enable-ospfclient=yes' '--enable-ospfapi=yes' '--enable-multipath=64'
'--enable-user=frr' '--enable-group=frr' '--enable-vty-group=frrvty'
'--enable-configfile-mask=0640' '--enable-logfile-mask=0640' '--enable-rtadv'
'--enable-fpm' '--enable-ldpd' '--with-pkg-git-version'
'--with-pkg-extra-version=MyOwnFRRVersion' '--enable-rpki=yes'
'--enable-sharpd' '--enable-lttng=yes'

$ systemctl show frr | grep Envir
Environment=LD_PRELOAD=liblttng-ust-fork.so # Required only for LTTng

$ lttng list --userspace | grep --color frr_bgp:process_update
frr_bgp:process_update (loglevel: TRACE_INFO (6)) (type: tracepoint)

$ lttng create frr --output=/root/lttng-traces/frr
$ lttng enable-event --userspace frr_bgp:process_update
$ lttng start && sleep 10 ; lttng stop
```

```
$ lttng view
Trace directory: /root/lttng-traces/frr

frr_bgp:process_update: { cpu_id = 6 }, { peer = "192.168.0.1",
prefix = "172.16.1.0/24", addpath_id = 0, afi = 1, safi = 1,
attribute_ptr = 0x7FFD3537DB00 }
```

- Not
 - sysdig, strace, tcpdump, ...
- Linux Trace Toolkit Next-Generation
- Since FRR 8.0
- *--enable-lttng*

- <https://docs.frrouting.org/projects/dev-guide/en/latest/tracing.html>
- <https://lttng.org>



Unknown feature: Tracing (SystemTap)

```
$ vtysh -c 'show version' | grep --color usdt
  '--enable-systemd' '--enable-examplendir=/usr/share/doc/frr/examples/'
'--localstatedir=/var/run/frr' '--sbindir=/usr/lib/frr' '--sysconfdir=/etc/frr'
'--enable-vtysh' '--enable-isis' '--enable-pimd' '--enable-watchfrr'
'--enable-ospfclient=yes' '--enable-ospfapi=yes' '--enable-multipath=64'
'--enable-user=frr' '--enable-group=frr' '--enable-vty-group=frrvty'
'--enable-configfile-mask=0640' '--enable-logfile-mask=0640' '--enable-rtadv'
'--enable-fpm' '--enable-ldpd' '--with-pkg-git-version'
'--with-pkg-extra-version=MyOwnFRRVersion' '--enable-rpki=yes'
'--enable-sharpd' '--enable-usdt=yes'

$ readelf -n /usr/lib/frr/bgpd | grep process_update -A2
  Name: process_update
  Location: 0x000000000014b2b8, Base: 0x000000000029ad81, Semaphore:
0x0000000000000000
  Arguments: 8@%r14 8@%r15 4@-616(%rbp) 4@%r12d 4@%ebx 8@-624(%rbp)

$ stap -L 'process("/usr/lib/frr/bgpd").mark("*")' | wc -l
28

$ stap -L 'process("/usr/lib/frr/bgpd").function("bgp_create@bgpd/bgpd.c:3069")'
process("/usr/lib/frr/bgpd").function("bgp_create@bgpd/bgpd.c:3069")
$inst_type:enum bgp_instance_type $name:char const* $as:as_t*
```

```
$ cat process_updates.stp
probe process("/usr/lib/frr/bgpd").mark("process_update")
{
  aspath = @cast($arg6, "attr")->aspath;
  printf("> %s via %s (%s)\n",
        user_string($arg2),
        user_string(@cast($arg1, "peer")->host),
        user_string(@cast(aspath, "aspath")->str));
}

$ stap -m process_updates -p4 process_updates.stp
$ staprun process_updates.ko
> 172.16.1.0/24 via 192.168.0.1 (65001)
> 172.16.0.0/24 via 192.168.0.1 (65001)
```

- User-Space probing (uprobes)
- Kernel hacking (with Guru mode)
- *--enable-usdt*
- Kernel module
- Can't use with LTTng

- <https://docs.frrouting.org/projects/dev-guide/en/latest/tracing.html>
- <https://sourceware.org/systemtap>



Unknown feature: BGP Long-lived Graceful Restart

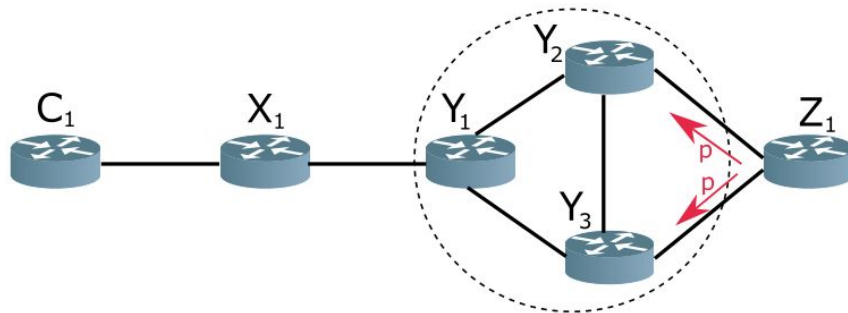
```
router bgp 65000
  bgp long-lived-graceful-restart stale-time 30
  bgp graceful-restart restart-time 5
  bgp graceful-restart
!
BGP routing table entry for 192.168.100.1/32, version 103
Paths: (2 available, best #2, table default)
  Advertised to non peer-group peers:
    donatas-pc(192.168.10.17)
  65000 65066, (stale)
    192.168.0.2(spine1-debian-11) from spine1-debian-11(192.168.0.2) (0.0.0.0)
    Origin incomplete, metric 0, localpref 190, valid, external
    Community: llgr-stale
    Last update: Thu Mar 31 10:37:39 2022
    Time until Long-lived stale route deleted: 28
  65003
    192.168.10.17(donatas-pc) from donatas-pc(192.168.10.17) (192.168.100.1)
    Origin incomplete, metric 0, valid, external, best (First path received)
    Last update: Thu Mar 31 10:22:48 2022
```

- *bgp graceful-restart restart-time* (0-4095) (~1.1h)
- Communities
 - Routes with LLGR_STALE are less-preferred
 - Routes with NO_LLGR are flushed immediately
- Since FRR 8.2

- <http://docs.frrouting.org/en/latest/bgp.html#graceful-restart>
- <http://docs.frrouting.org/en/latest/bgp.html#long-lived-graceful-restart>



Unknown feature: `bgp suppress-duplicates`



```
bgp community-list standard c1 seq 1 permit 65004:2
bgp community-list standard c1 seq 2 permit 65004:3
!
route-map c1 permit 10
  set comm-list c1 delete
!
```

- X1 receives paths with communities
 - 65004:2
 - 65004:3
- Disable the link Y1-Y2
- Communities are stripped at egress from X1 towards C1
- Updates are forced for
 - Graceful Restart
 - Route Refresh
- Since FRR 8.0
- Enabled by default

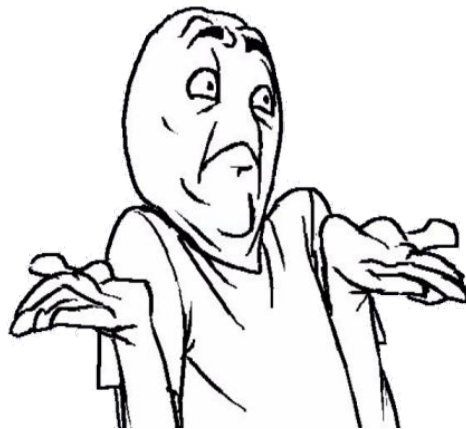
- <http://docs.frrouting.org/en/latest/bgp.html#suppress-duplicate-updates>
- <https://www.cmand.org/communityexploration>



How to start contributing?

How did I start?

- 4 years ago
- Never been a programmer
- Motivation to work on huge open-source projects
 - Took open issues and tried to solve
 - The first Pull Request I created was to implement route-map (set) for default-originate



```
router bgp 65000
  neighbor 2001:db8::1 remote-as external
  !
  address-family ipv6 unicast
    neighbor 2001:db8::1 default-originate route-map default
  exit-address-family
  !
  route-map default permit 10
    set community 65000:900
  !
```



How to start contributing? (cont.)

TL;DR: I have a fix, how to propose it?

- Create a fork of [frrouting/frr](https://github.com/frrouting/frr) repository to your own account
- Create a separate branch based on the master branch
 - `git checkout -b fix/bgpd_nhlen`
- Make changes and stage
 - `git add`
- Apply code formatting
 - `git clang-format`
- Run unit tests
 - `make check`
 - `make dist`
- Commit changes
 - Documentation is a **MUST** if the changes introduce a new CLI (or deprecate)
 - Topology tests are **REQUIRED** as well for new functionality
 - Do not forget to properly signed off for every commit
 - `git commit -s`
 - Every commit should have a decent description
 - Add a prefix for every commit to distinguish a daemon (bgpd: add, pimd: fix, ospfd: remove)
- Take off
 - `git push`



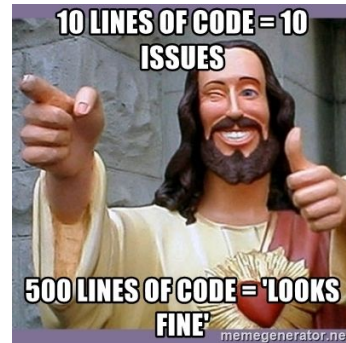
- <http://docs.frrouting.org/projects/dev-guide/en/latest/workflow.html>



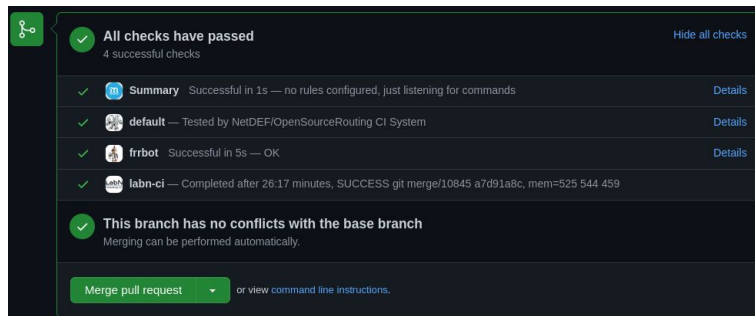
How to start contributing? (cont.)

TL;DR: I have a fix, how to propose it? (cont.)

- Create Pull Request on Github
- Wait for CI to kick in
 - 50% success ratio
 - `ci:rerun` failed `test_ospfv3_single_area`
- Once it's **green**, usually people start reviewing
 - Pull Requests marked as **Draft** as skipped from reviews
 - It can take even weeks if the changes require further discussions or changes
 - Technical community call on every Tuesday
- Use FRRouting Slack to ask for help
- Less-known mailing lists also exist



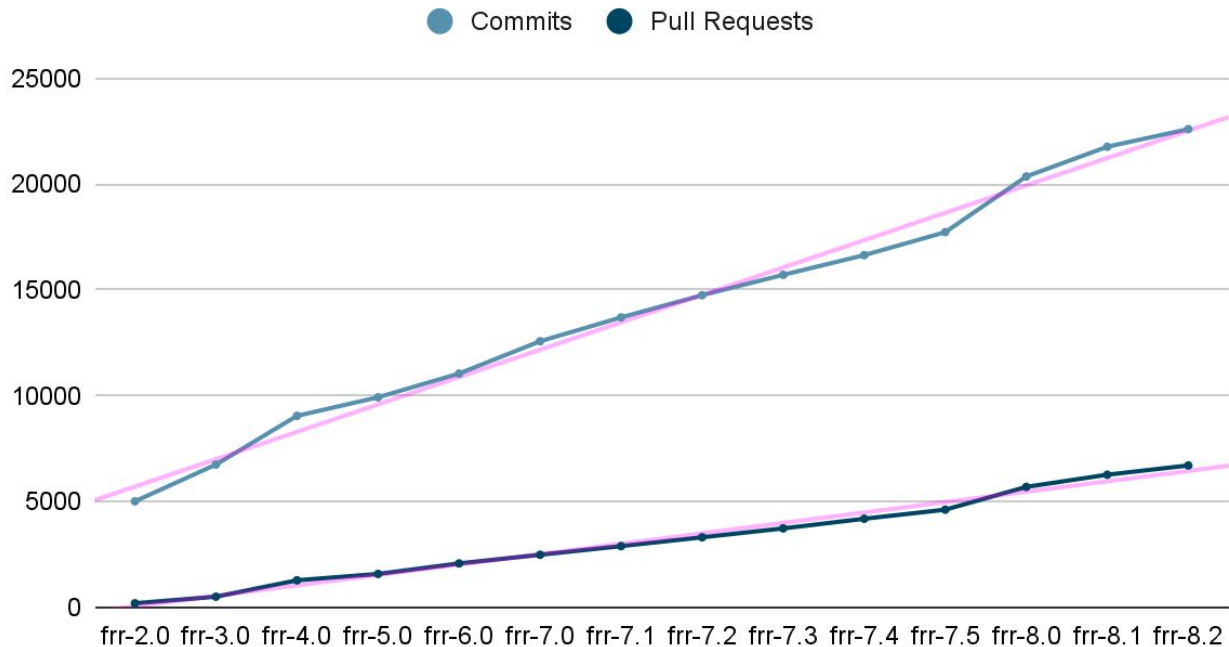
- <https://frrouting.org/community>
- <https://lists.frrouting.org>





Show me the numbers

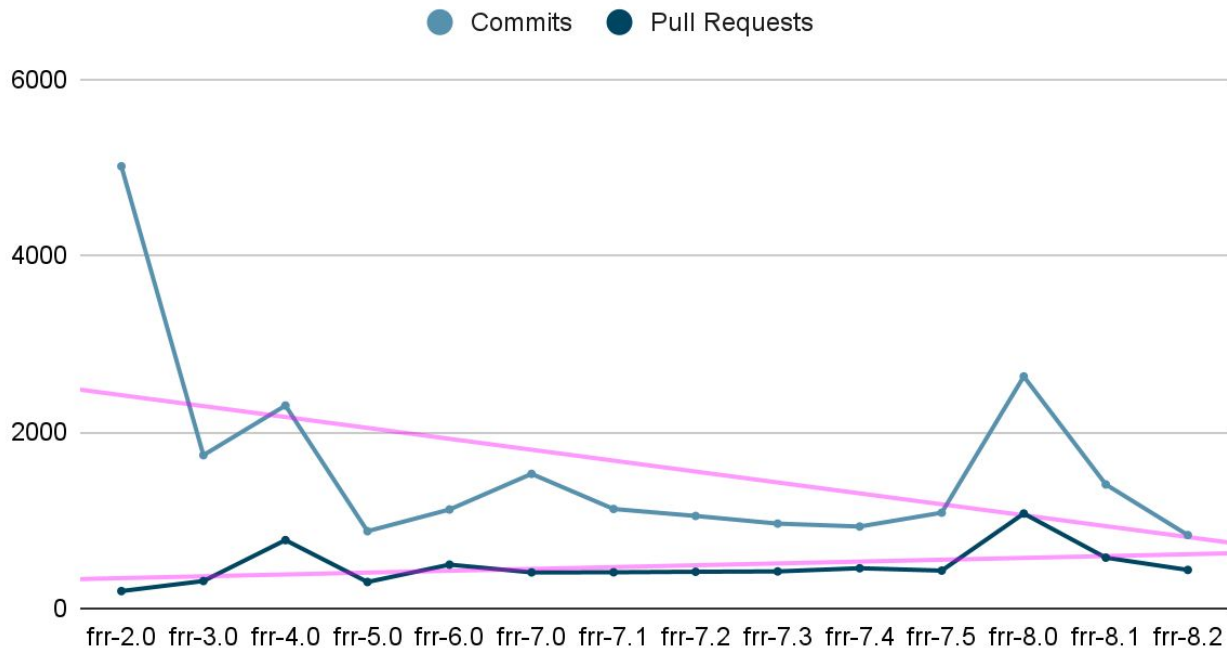
Commits/Pull Requests (overall)





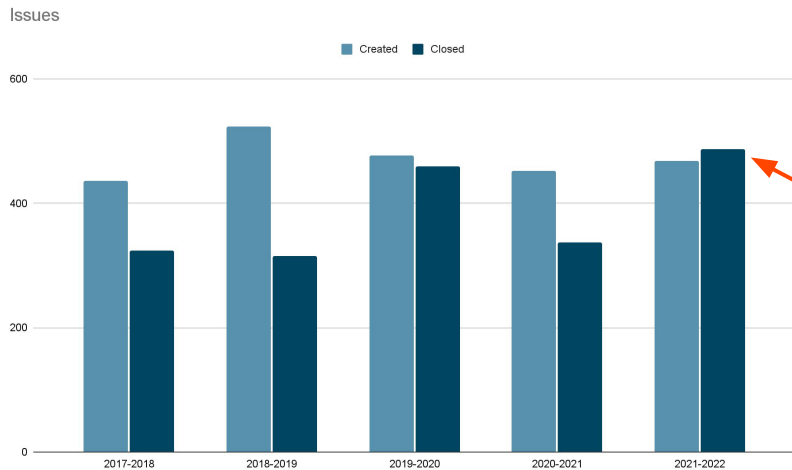
Show me the numbers

Commits/Pull Requests (per release)





Show me the numbers

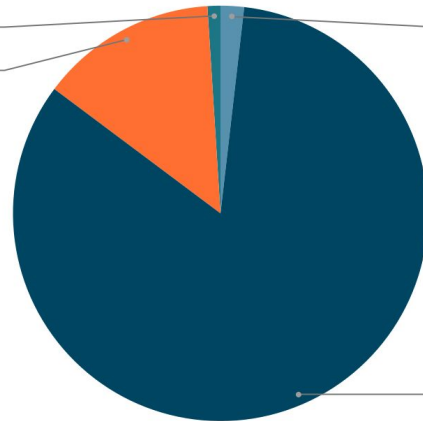


Pull Requests

Drafts
1.0%
Closed
13.8%

Open
1.8%

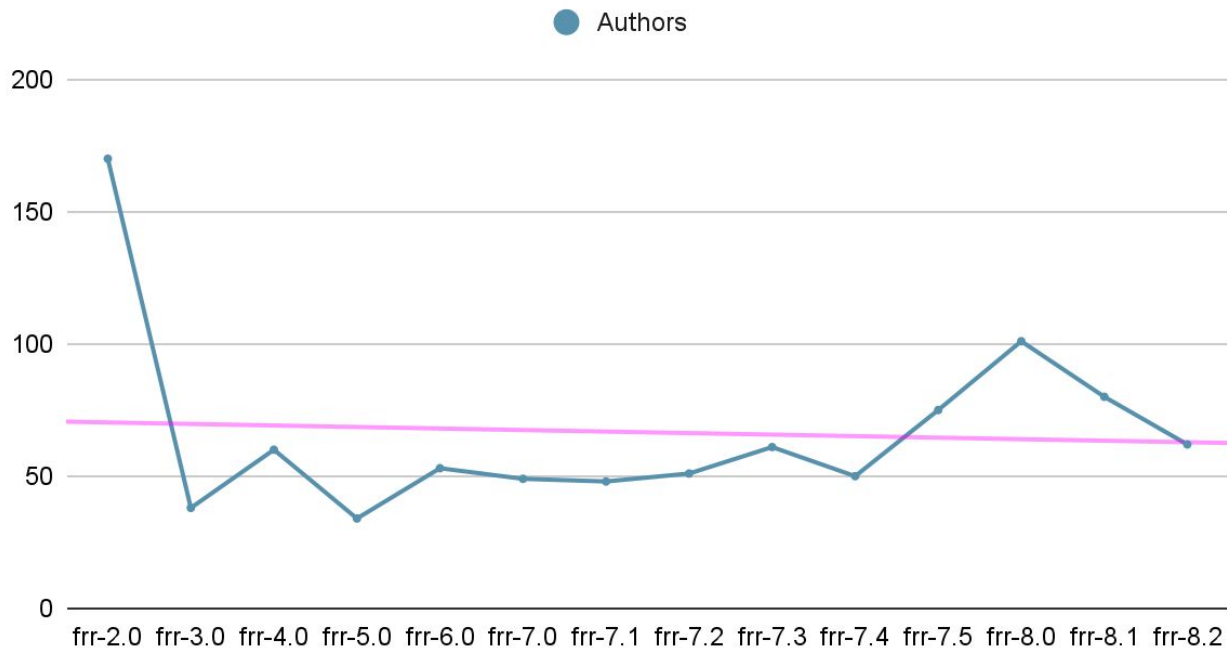
Merged
83.4%





Show me the numbers

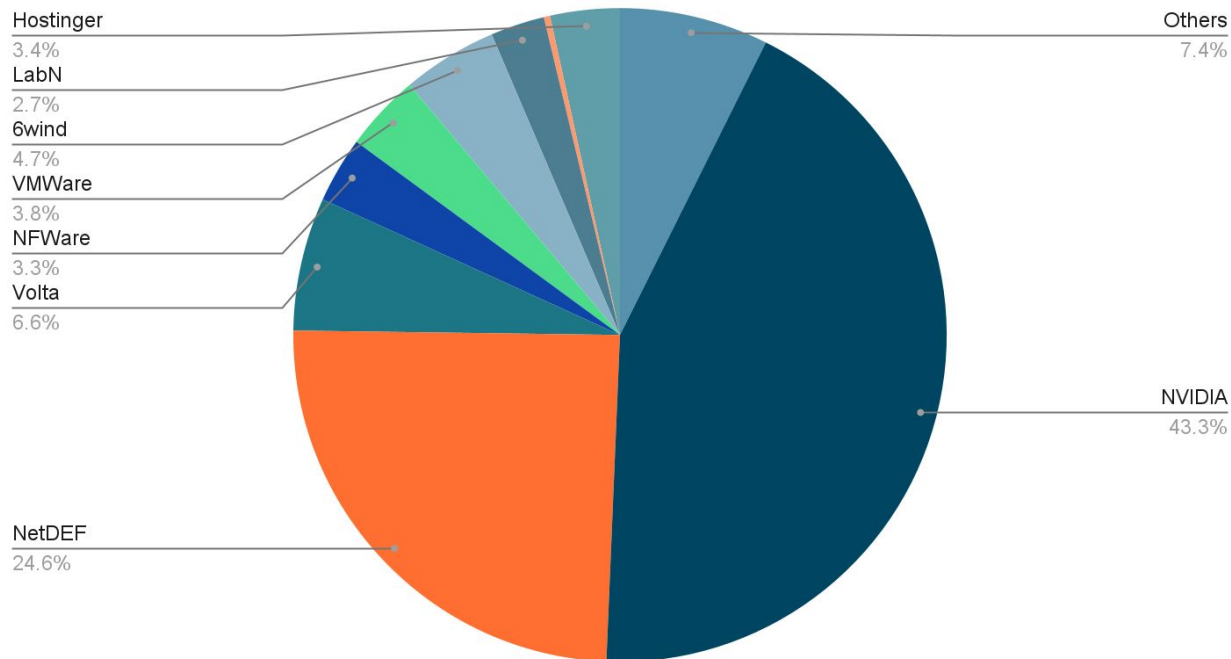
Authors (per release)





Show me the numbers

The percentage of commits per company (since frr-2.0)





@abradona



/ton31337

Donatas Abraitis



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