



FRROUTING

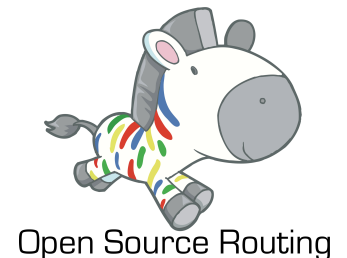
The work behind an Open Source Routing stack

SWINOG - Oct 30, 2018

Martin Winter
NetDEF / OpenSourceRouting

About me...

- ▶ **FRRouting Maintainer**
- ▶ **FRRouting TSC Member**
- ▶ **Runs CI System for community**
- ▶ **Co-Founder NetDEF (a US non-profit)**
 - (OpenSourceRouting is a project by NetDEF)
- ▶ **Past:**
 - Quagga
 - Cisco (Engineering)
 - Large ISP (Network Architecture)



What is FRRouting

Quick Introduction

What is FRR ?

(for the not so technical People)



- ▶ **Open Source (GPLv2+) Routing Stack**
- ▶ **Implements RIP, RIPng, OSPF (v2&v3), ISIS, BGP, PIM, LDP, NHRP, Babel, EIGRP, BFD, ...**
- ▶ **Fork of Quagga**
- ▶ **Works on Linux and most BSD based systems**
- ▶ **For use in many Clouds as virtual routers, white box vendors and network providers (full routing stack)**

FRR - Why a fork?



Community Led and Driven

Fast & Open Development

Open Community Model

FRR - Who is behind the Fork?



FRR Major features added since Fork

▶ **2.0 (April 2017)**

- RFC 5549 Unnumbered Support (most protocols)
- LDP IPv4/IPv6
- VRF lite
- JSON output support

▶ **3.0 (Oct 2017)**

- BGP EVPN base
- PIM Sparse Mode
- NHRP

▶ **4.0 (March 2018)**

- BGP RPKI
- BGP EVPN Type 3 & 4
- BGP MPLS Ethernet VPN & Multicast
- BABEL
- EIGRP

FRR Major features added since Fork

- ▶ **[continue] 4.0 (March 2018)**
 - Static VRF route leaking
 - OSPFv2 Segment Routing
- ▶ **5.0 (July 2018)**
 - PIM Multicast Trace [draft-ietf-idmr-traceroute-ipm]
 - IS-IS 3-way Handshake [RFC5303]
 - BGP VPN-VRF route leaking per [RFC4364]
 - BGP VRF with NETNS backend
 - New Policy Based Routing Daemon
- ▶ **6.0 (Oct 2018)**
 - BFD daemon
 - Static Routes moved from zebra to it's own daemon
 - IS-IS Src-Dest Routing [draft-ietf-isis-ipv6-dst-src-routing]

FRR Major features added since Fork

▶ **Current development branch**

- OpenFabric Draft [draft-white-openfabric]
- YANG Northbound (= Configuration) API
- Work on Southbound (= Kernel) API/Interface

JOIN US on future development

<https://github.com/frrouting>

The life of a PR (Git pull request)

What happens when someone pushes a pull request

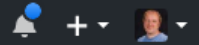
Key Points on Testing:

- We can't afford time for manual testing. Automate. Everything.
- Automated responses should be clear to first time users. We can't afford time to explain test failures.



Search or jump to...

Pull requests Issues Marketplace Explore



FRRouting / frr

Unwatch 139 Unstar 683 Fork 287

Code Issues 288 Pull requests 41 Projects 0 Wiki Insights Settings

Northbound API #2705

Edit

Open rwestphal wants to merge 38 commits into FRRouting:master from opensourcerouting:northbound-yang-v2

Conversation 35 Commits 38 Checks 0 Files changed 113 +15,504 -2,382



rwestphal commented on Jul 23

Member + 😊 ...

I think it's about time to open this PR. After months of refactoring and bug fixing I think the northbound API is now solid enough to be considered for inclusion.

Right now I'm in the process of writing documentation [1] so I wouldn't recommend anyone to review the code until the docs are ready (should take a few days). Nonetheless everyone is free to take a sneak peek at the code.

At this point only *ripd* was converted to the new northbound model and it should be a long journey until all other daemons are converted as well. Support from the community will be crucial to make this happen.

The CI systems should fail because of the new libyang mandatory dependency. I'll provide more details later.

[1] <https://github.com/opensourcerouting/frr/wiki>

rwestphal added `iterating` `needs-docs` labels on Jul 23

donaldsharp requested review from riw777 and donaldsharp on Jul 24

qlyoung assigned qlyoung and unassigned qlyoung on Jul 25

Reviewers ⚙️

ajones-rvbd

riw777 ✓

manuhalo ✓

qlyoung ✓

donaldsharp ✓

louberger ●

Assignees ⚙️

No one—assign yourself

Labels ⚙️

None yet

Projects ⚙️

None yet

Milestone ⚙️

No milestone

Step 1 Github Pull Request is pushed

Add more commits by pushing to the `deb-kill-backports` branch on `opensourcerouting/frr`.



Some checks haven't completed yet

[Hide all checks](#)

1 pending check



 **default** Pending — NetDEF CI System for FRR-FRRPULLREQ

[Details](#)



This branch has no conflicts with the base branch

Merging can be performed automatically.

Merge pull request

You can also open this in [GitHub Desktop](#) or view [command line instructions](#).


Step 2

CI System is triggered by Github

 Styling with Markdown is supported

Close pull request

Comment

 **ProTip!** Add comments to specific lines under [Files changed](#).

Build dashboard / FRRouting / FRR-Pull-Requests

Build #5,772

← ✓ ✓ ✓ ! ✓ ✓ ✓ ! ! ⏪ ⏩ Run ⚙️ Actions

Step 3 – First CI Phase

CI System Builds on all supported Distros

#5772 is building – 55 mins remaining – Custom build by Github Hook with revision master

Summary Commits Artifacts Logs

Get Sourcecode

✓ Checkout Code

- Building Stage**
- CentOS 6 amd64 build
 - Centos 7 amd64 build
 - Debian 8 amd64 build
 - Debian 9 amd64 build
 - Fedora 24 amd64 build
 - FreeBSD 10 amd64 build
 - FreeBSD 11 amd64 build
 - NetBSD 6 amd64 build
 - NetBSD 7 amd64 build
 - OmniOS amd64 build
 - OpenBSD 6 amd64 build
 - Ubuntu 12.04 amd64 build
 - Ubuntu 14.04 amd64 build
 - Ubuntu 16.04 amd64 build
 - Ubuntu 16.04 i386 build
 - Ubuntu 18.04 amd64 build
- Basic Tests**
- AddressSanitizer Topotest
 - CentOS 6 RPM Pkg Check
 - CentOS 7 RPM Pkg Check

Build result summary

Details

Started 25 Oct 2018, 3:22:26 PM – 9 minutes ago

Flags **CUSTOM REVISION** **CUSTOM BUILD**

Labels `version=frr-6_1-dev-633-g15822adb2`
`git=https://github.com/frrouting/frr_git`
`buildurl=https://ci1_netdef_org/browse/frr-frrpullreq-5772`
`branch=master`

Revision `master`

Custom variables

Custom revision `master`

github_base_sha `dd5c280ab3ae493e038ca13b672da148ade58f61`

github_pullreq `3221`

github_branch `master`

github_repo `FRRouting/frr`

github_merge_sha `15822adb2dd002b88ba2ad84935cba606899df63`

Comments

 **Github Hook**
 GitHub Merge Request 3221 for GitHub Repo FRRouting/frr, branch master

Request to merge from opensourcerouting/frr
 Merge Git Commit ID 15822adb2dd002b88ba2ad84935cba606899df63 on top of base Git Commit ID dd5c280ab3ae493e038ca13b672da148ade58f61

Delete • about 6 minutes ago

 Write a comment...

Code commits

Author	Commit	Message	Commit date
 Quentin Young	<code>dd5c280...</code>	Merge pull request #3247 from	3 hours ago

Compiling... (on VMs)

All build on x86 (64bit) architecture except where noted

Ubuntu



ubuntu.

Ubuntu 14.04
Ubuntu 16.04 (x86_64 +
i386 + ARMv7 + ARMv8)
Ubuntu 18.04

CentOS



CentOS

CentOS 6
CentOS 7

Debian



debian

Debian 8
Debian 9 (x86_64 + ARMv7
+ ARMv8)

FreeBSD



FreeBSD®

FreeBSD 10
FreeBSD 11

NetBSD



NetBSD 6
NetBSD 7

OpenBSD



OpenBSD 6

OmniOS



OmniOS

Alpine (in testing)



Alpine 3.8

And building again... Packages



- **Ubuntu 14.04** for 64bit Intel
- **Ubuntu 16.04** for 32/64bit Intel, ARM7, ARM8
- **Debian 8** for 64bit Intel
- **Debian 9** for 64bit Intel, ARM7, ARM8
- **CentOS 6 / 7** for 64bit Intel
- **Snap Package** for 32/64bit Intel, ARM7, ARM8

Linux only (to save time)

**Testing uses packages
- whenever possible**



Basic Tests

- AddressSanitizer Topotest
- CentOS 6 RPM Pkg Check
- CentOS 7 RPM Pkg Check
- Debian 8 Deb Pkg Check
- Debian 9 Deb Pkg Check
- Fedora 24 RPM Pkg check
- IPv4 LDP Protocol on Ubuntu 16.04
- IPv4 Protocols on Ubuntu 14.04
- IPv6 Protocols on Ubuntu 14.04
- Static Analyzer (Clang)
- Topology Tests on Ubuntu 16.04 amd64
- TopoTest Tests on Ubuntu 16.04 i386
- Ubuntu 12.04 Deb Pkg Check
- Ubuntu 14.04 Deb Pkg Check
- Ubuntu 16.04 Deb Pkg Check

Final

- Final

Code commits

Author	Commit	Message	Commit date
Quentin Young	dd5c280...	Merge pull request #3247 from opensourcerouting/spelchek *: spelchek	1 hour ago

Step 4

Testing Phase

Shared artifacts

Artifact	File size
SourceCode	4 MB
VersionInfo	781 bytes
CentOS 6 x86_64 RPMs	12 MB
CentOS 7 x86_64 RPMs	13 MB
Debian 8 (Jessie) x86_64 Packages	0 bytes
Debian 9 (Stretch) x86_64 Packages	0 bytes
Fedora 24 x86_64 RPMs	13 MB
Ubuntu 12.04 x86_64 Packages	0 bytes
Ubuntu 14.04 x86_64 Packages	0 bytes
Ubuntu 16.04 x86_64 Snap Package	11 MB

4 more shared artifacts...

Live activity log for

```

25-Oct-2018 13:58:18 R:70 r4 Remote Registration cleared 1 0
25-Oct-2018 13:58:18 PASSED
25-Oct-2018 13:58:28 bgp_l3vpn_to_bgp_direct/test_bgp_l3vpn_to_bgp_direct.py::test_memory_leak <- lib/ltemplate.py 2018-10-25 13:58:28,061 INFO: r4:
stopping bgpd
25-Oct-2018 13:58:28 2018-10-25 13:58:28,064 INFO: r4: stopping ldpd
25-Oct-2018 13:58:28 2018-10-25 13:58:28,071 INFO: r4: stopping ospfd
25-Oct-2018 13:58:28 2018-10-25 13:58:28,094 INFO: r4: stopping staticd
25-Oct-2018 13:58:28 2018-10-25 13:58:28,102 INFO: r4: stopping zebra
25-Oct-2018 13:58:28 2018-10-25 13:58:28,102 INFO: r4: waiting for daemons stopping (2 seconds)
25-Oct-2018 13:58:30 2018-10-25 13:58:30,159 INFO: r1: stopping bgpd
25-Oct-2018 13:58:30 2018-10-25 13:58:30,168 INFO: r1: stopping ldpd
    
```



Packages Test: Install/Uninstall



- Install package with no errors/warnings
- Start all routing daemons
- Kill each routing daemon and verify automatic restart
- Uninstall package with no errors/warnings

Run on Intel 64-bit:

- Ubuntu 14.04
- Ubuntu 16.04
- Ubuntu 18.04
- CentOS 6
- CentOS 7
- Debian 8
- Debian 9



Basic Protocol functionality



- **Install package on Ubuntu 16.04**
- **Verify basic protocol functionality (2-5 basic tests each protocol):**
 - RIP (IPv4)
 - RIPng (IPv6)
 - OSPFv2 (IPv4)
 - OSPFv3 (IPv6)
 - ISIS (IPv4 & IPv6)
 - BGP (IPv4 & IPv6)
 - LDP (with MPLS) (IPv4)

Tests use commercial Ixia IxANVL RFC Compliance Tests Suites



Static Analysis: Clang-Analyzer

frr-2.0-rc1-8-geaa09cb (stable/2.0 @ 20170120.162233 UTC)

Source Git:	GitHub (https://github.com/freerangerouting/frr.git)
Git Commit:	eaa09c8a3cb6308d8a5736a9e1bd33f1454ae9cc
Configure command:	scan-build-3.8 ./configure CFLAGS="-std=gnu99 -g -Os" --enable-vtysh \ --enable-watch\$(PROJECT) --enable-ospfclient=yes \ --enable-ospfapi=yes --enable-multipath=0 --enable-rtadv \ --enable-user=root --enable-tcp-zebra --enable-fpm --enable-pimd \ --prefix=/usr/local
Make command:	scan-build-3.8 -maxloop 16 make
Clang Version:	clang version 3.8.0-2ubuntu3~trusty4 (tags/RELEASE_380/final)
Date:	Fri Jan 20 11:43:36 2017

Bug Summary

Bug Type	Quantity	Display?
All Bugs	115	<input checked="" type="checkbox"/>
API		
Argument with 'nonnull' attribute passed null	3	<input checked="" type="checkbox"/>
Dead store		
Dead assignment	26	<input checked="" type="checkbox"/>
Dead increment	3	<input checked="" type="checkbox"/>
Dead initialization	12	<input checked="" type="checkbox"/>
Logic error		
Assigned value is garbage or undefined	1	<input checked="" type="checkbox"/>
Branch condition evaluates to a garbage value	1	<input checked="" type="checkbox"/>
Called function pointer is null (null dereference)	3	<input checked="" type="checkbox"/>
Dereference of null pointer	56	<input checked="" type="checkbox"/>
Garbage return value	1	<input checked="" type="checkbox"/>
Uninitialized argument value	5	<input checked="" type="checkbox"/>
Memory Error		
Memory leak	2	<input checked="" type="checkbox"/>
Use-after-free	2	<input checked="" type="checkbox"/>

Comparing to previous build for Pull Requests to find new potential issues

*Note: This output is from FRR 2.0
The current FRR 6.0 has no warnings
or errors found by Clang SA*

Reports

Bug Group	Bug Type	File	Function/Method	Line	Path Length
API	Argument with 'nonnull' attribute passed null	lib/msg.c	msg_get	185	8 View Report
API	Argument with 'nonnull' attribute passed null	zebra/kernel_netlink.c	rta_addattr_l	345	4 View Report
API	Argument with 'nonnull' attribute passed null	zebra/kernel_netlink.c	addattr_l	324	4 View Report
Logic error	Assigned value is garbage or undefined	pimd/pim_sock.c	pim_socket_recvfromto	309	7 View Report

CI System: Topology Tests

FRR test framework for specific (complex) Networks

- Testing features which are specific to FRR or lack existing test tools
- Should be easy for everyone in community to run
- Tests exist for various protocols and features
- Allows anyone in community to add test which are executed by CI system (CI executes all the topology tests)
- Topology Simulations with Mininet on Ubuntu 16.04 on x86_64, i386, ARMv7 and ARMv8
- Uses pytest framework

<https://github.com/frrouting/topotests>

CI System: Address Sanitizer

- ▶ **Rebuilds and runs Topotests with Address Sanitizer**
 - Similar to Valgrind – Finds:
 - Buffer Overflows
 - Memory leaks
 - Use after free/return
 - Better performance than Valgrind
 - (so far) no false positives!

<https://github.com/google/sanitizers/wiki/AddressSanitizer>



NetDEF-CI commented on Sep 19

Collaborator + 😊 ...

Continuous Integration Result: FAILED

See below for issues.

CI System Testrun URL: <https://ci1.netdef.org/browse/FRR-FRRPULLREQ-5360/>

This is a comment from an EXPERIMENTAL automated CI system.
For questions and feedback in regards to this CI system, please feel free to email
Martin Winter – mwinter (at) opensourcerouting.org.

Get source and apply patch from patchwork: Successful

Building Stage: Failed

Ubuntu1204 amd64 build: Successful

CentOS6 amd64 build: Failed

DejaGNU Unittests (make check) failed for CentOS6 amd64 build

see PyTest log at https://ci1.netdef.org/browse/FRR-FRRPULLREQ-5360/artifact/CI006BUILD/ErrorLog/log_pytests.txt

CentOS6 amd64 build: config.status output from configure script can be found at
<https://ci1.netdef.org/browse/FRR-FRRPULLREQ-5360/artifact/CI006BUILD/config.status/config.status>

FreeBSD9 amd64 build: Failed

DejaGNU Unittests (make check) failed for FreeBSD9 amd64 build

see PyTest log at https://ci1.netdef.org/browse/FRR-FRRPULLREQ-5360/artifact/CI004BUILD/ErrorLog/log_pytests.txt

FreeBSD9 amd64 build: config.status output from configure script can be found at
<https://ci1.netdef.org/browse/FRR-FRRPULLREQ-5360/artifact/CI004BUILD/config.status/config.status>

Debian9 amd64 build: Failed

DejaGNU Unittests (make check) failed for Debian9 amd64 build

see PyTest log at https://ci1.netdef.org/browse/FRR-FRRPULLREQ-5360/artifact/CI021BUILD/ErrorLog/log_pytests.txt

Step 5 CI Results

Step 5 (better...)

CI Results



NetDEF-CI commented on Sep 27 Collaborator + 😊 ...

Continuous Integration Result: SUCCESSFUL

Congratulations, this patch passed basic tests

Tested-by: NetDEF / OpenSourceRouting.org CI System

CI System Testrun URL: <https://ci1.netdef.org/browse/FRR-FRRPULLREQ-5478/>

This is a comment from an EXPERIMENTAL automated CI system.
For questions and feedback in regards to this CI system, please feel free to email
Martin Winter – mwinter (at) opensourcerouting.org.

CLANG Static Analyzer Summary

- Github Pull Request 3051, comparing to Git base SHA [9b00962](#)

Fixed warnings:

- Memory error: Use-after-free in ldpd/lde.c, function lde_address_list_free, line 1624
- Memory error: Use-after-free in lib/ormsg-buffer.c, function msgbuf_clear, line 199
- Memory error: Use-after-free in lib/ormsg.c, function ormsg_get_fd, line 305
- Logic error: Assigned value is garbage or undefined in lib/skiplist.c, function skiplist_insert, line 224

Static Analysis warning summary compared to base:

- Fixed warnings: 4
- New warnings: 0

Step 6

Manual Code Review

- ▶ **First manual step**
 - Manual review done by one or more of the maintainers
- ▶ **Back to submitter if questions or issues**
 - Any comments / disagreement need to be resolved in code or comments before a merge
- ▶ **Merge has to be done by a maintainer working for a different organization**
- ▶ **Missing / slow reviews or unresolved disagreements are addressed in weekly open meeting**
 - If still no agreement, then TSC has final decision

Step 7

Merge (finally!!)

*BUT - WAIT...
not yet done!*

*More testing after the merge of
the updated branch*

Testing the merged code

▶ Same tests as for PR plus:

- Build with more setups (incl slower ARM7 builds)
- Build packages for all platforms and publish on CI
- Build RPKI version of FRR with packages (and test them)
- Run full RFC compliance test
 - Ubuntu 16.04 only
 - Just single pass (time constrains – 4 VMs run for 18hrs)
- Coverity Scan (Commercial Static Analysis)

Coverity Scan

<https://scan.coverity.com/projects/freerangerouting-frr>

freerangerouting/frr

Overview Project Settings Analysis Settings Members Invite

coverity **passed**

Analysis Metrics

Version: FRR-master_2018-10-27_git.7508...

Oct 27, 2018 Last Analyzed	436,807 Lines of Code Analyzed	0.11 Defect Density
--------------------------------------	--	-------------------------------

Defect changes since previous build dated Oct 27, 2018

0 Newly detected	0 Eliminated
----------------------------	------------------------

Defects by status for current build

873 Total defects	46 Outstanding	68 Dismissed	759 Fixed
-----------------------------	--------------------------	------------------------	---------------------



DONE.
Pull Request completed

We do on average 4 merges per day
(incl weekends and holidays)

And a few less frequent tests...

RFC Compliance Test: Ixia IxANVL



RFC Compliance Test Report
BGP4 Results



	Master 2017-03-07	Release 2.0	3.0-dev 2017-04-25	Master 2017-05-17	3.0-dev 2017-05-24	Master 2017-06-02	Master 2017-06-26	3.0-dev 2017-06-30	Master 2017-07-20	Release 3.0-rc1
Type	FRR	FRR	FRR	FRR	FRR	FRR	FRR	FRR	FRR	FRR
Commit ID	1a664f5	3e71b5d	3d7746c	b84ccd4	f731a65	bade23d	f30a732	f92f83b	dceb5f8	c47b10c
Commit Date	2017-03-08	2017-04-02	2017-04-25	2017-05-16	2017-05-24	2017-06-02	2017-06-27	2017-07-01	2017-07-21	2017-08-09
ANVL-BGP4-1.1	ANVL, setup verification									
MUST	ANVL, Setup Verification DUT Listens on TCP port 179 for BGP4 Connection									
	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass
	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass
ANVL-BGP4-1.2	ANVL, setup verification									
MUST	ANVL, Setup Verification Establish BGP4 connection to the DUT and transit to Established state									
	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass
	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass
ANVL-BGP4-1.3	ANVL, setup verification									
MUST	ANVL, Setup Verification Router adds routes contained in the newly received Update Message to its routing table									
	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass
	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass
ANVL-BGP4-1.4	ANVL, setup verification									
MUST	ANVL, Setup Verification Router forwards new Update routes									
	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass
	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass
ANVL-BGP4-2.1	RFC4271, Sect. 4, p 11, Message Formats									
MUST	Message Formats The maximum message size is 4096 octets. All implementations are required to support this maximum message size.									
	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass
	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass
ANVL-BGP4-3.1	RFC4271, Sect.4.2, page 13, OPEN message format									
MUST	OPEN Message Format After a TCP connection is established, the first message sent by each side is an OPEN message.									
	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass	Ubuntu 16.04: pass
	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: untested	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass	FreeBSD 10.3: pass

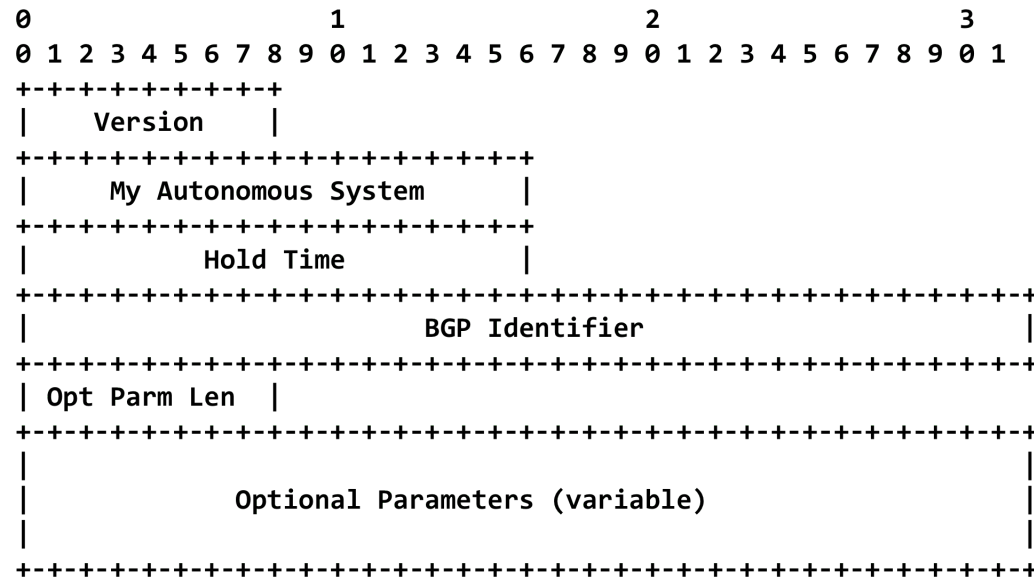
Protocol Performance & Scale

- ▶ **Executed on physical Linux PCs**
 - DUT Hardware needs consistency to compare
 - 4 x PCs (Quad-Core, 8GB RAM, 6 Ethernet [Lanner FW-7525D])
- ▶ **Test Equipment Ixia Chassis X16 (IxNetwork / IxAutomate)**
 - 40+ Gbit/s ports
- ▶ **Not yet automated**
 - Test mostly automated
 - Needs result parsing (Pass/Fail criteria?)



Protocol Fuzzer: Spirent SPS-8000

BGP OPEN Message Format (RFC 4271)

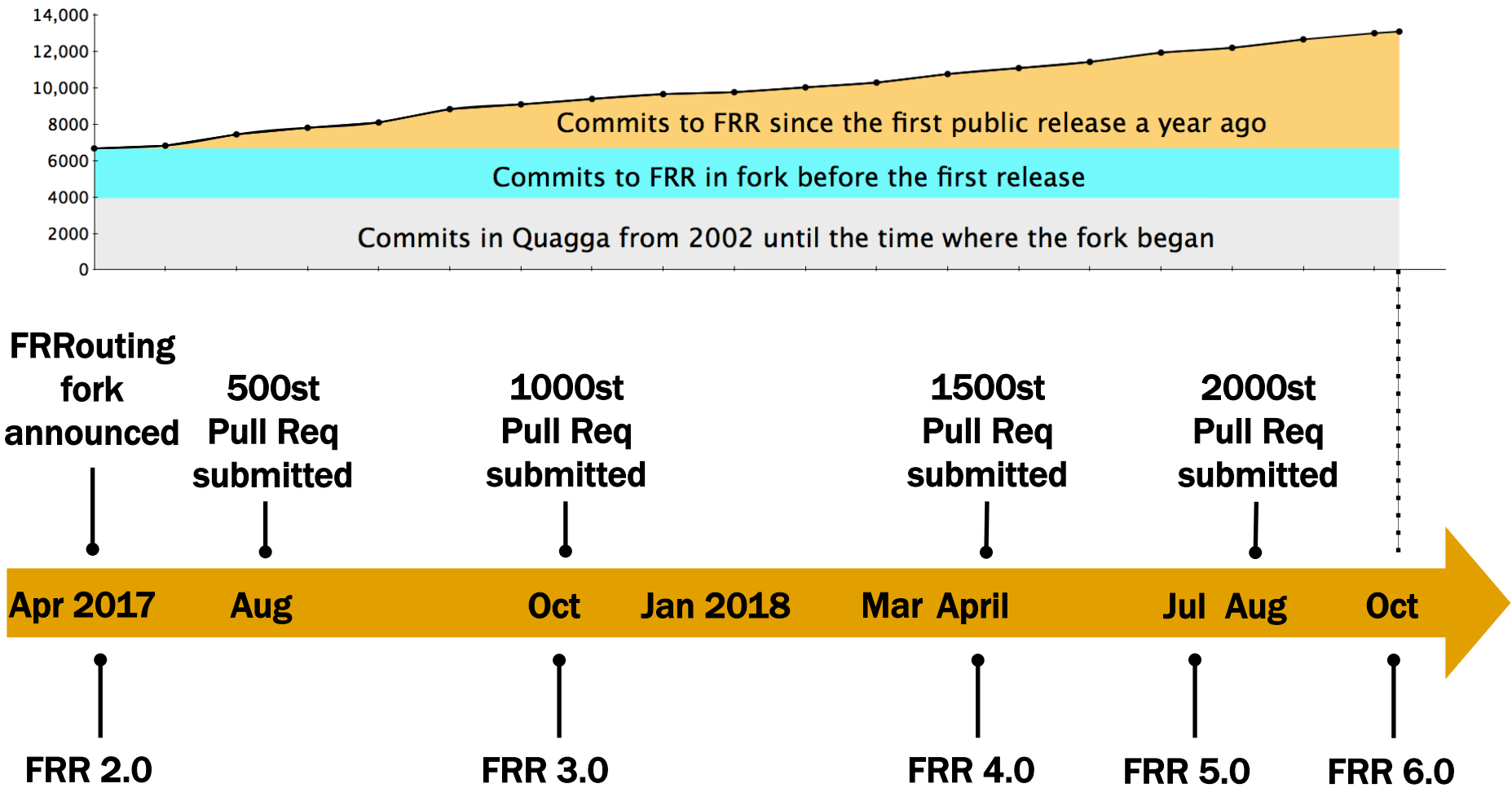


- Basic Function of the Fuzzer:
 - attacks the System with malformed packets.
 - Protocol Fuzzer knows packet and doesn't just random changes.
 - Fields missing, too long, too short
 - Value in field just 1 too high or too low
 - Negative values (or what might be negative if someone accidentally uses a signed integer)
 - Verifies recovery of system between each test (or multiple tests)

It all adds up to a lot of work...

FRRouting activity since the fork

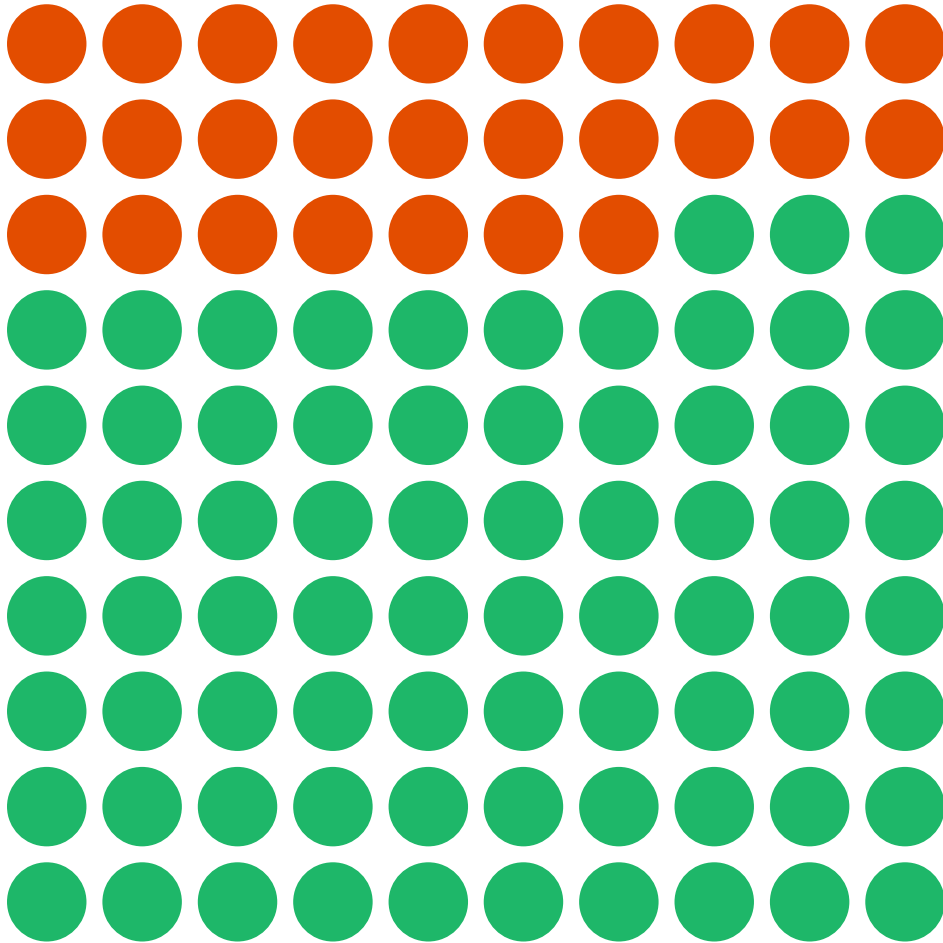
Code size doubled, > 2000 Pull Requests, > 9000 commits



Testing Executed

Total Runtime for Tests executed Jan until October 2018

Pull Request Create/Update	Pull Request Merge	Bi-Weekly & Release
<p>Github triggered Pull Request Testing</p> <ul style="list-style-type: none">▶ 5614 Runs<ul style="list-style-type: none">▶ Average runtime 79min▶ 25 nodes in parallel required <p>→ 21 years VM runtime</p>	<p>Github triggered extended tests (Merges)</p> <ul style="list-style-type: none">▶ 1610 Runs main<ul style="list-style-type: none">▶ Average runtime 131min▶ 30 nodes in parallel▶ 530 Runs RPKI<ul style="list-style-type: none">▶ Average runtime 58min▶ 11 nodes in parallel <p>→ 13 years VM runtime</p>	<p>Manual triggered in-depth testing</p> <ul style="list-style-type: none">▶ 1 214 000 single RFC Compliance tests<ul style="list-style-type: none">▶ Average runtime 3min▶ 2 nodes in parallel required <p>→ 14 years VM runtime (plus other manual tests)</p>



27%

Of the Pull Requests CI runs discover an error (and fail)

Giving instant feedback to contributor about commit without waiting for another community member to review

Challenges

- ▶ **Other package dependencies**
 - Testing quality?
 - Available for all our platforms?
 - We may need to run testing for them too...
- ▶ **More contributions**
 - → More testing work
- ▶ **Keep up Documentation**
- ▶ **Keep up with new tests**



JOIN US:

<https://frrouting.org>

[Github.com/frrouting](https://github.com/frrouting)

Mailing lists: lists.frrouting.org

FRRROUTING