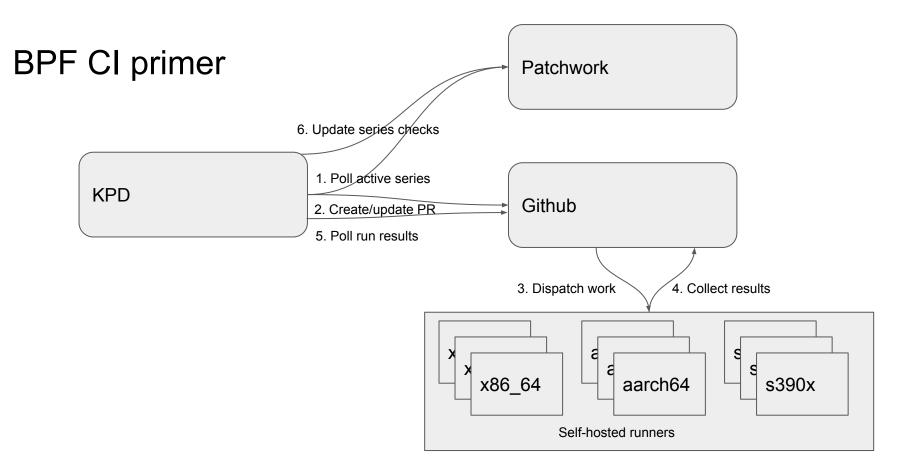
# BPF CI One year later

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LSFMMBPF 2022: https://docs.google.com/presentation/d/1RQZjLkbXmSFOr\_4Sj5BdQsXbUh\_vMshXi7w09pUpWsY/

# Using CI before sending to ML [0]

- Fork kernel-patches/bpf
- Create a branch off bpf/bpf-next branch
- Push branch to your fork
- Create PR against kernel-patches/bpf@bpf{-next,}\_base

Note: First-time contributors need approval [1]

[0] <u>https://tinyurl.com/bpf-ci-test</u>

[1] https://docs.github.com/en/actions/managing-workflow-runs/approving-workflow-runs-from-public-forks

# CI coverage

#### • 2022:

- Architectures: x86\_64 and s390x
- Kernel Compilation: gcc
- o Build kernel, selftests, and run selftests in VM

#### • Now:

- Architectures: x86\_64, s390x, and aarch64
- Kernel compilation: gcc and llvm for x86\_64/aarch64, gcc only for s390x
- $\circ$   $\;$  Build kernel, selftests, and run selftests in VM  $\;$
- Run veristat on x86\_64 to catch regressions
- 75% of kernel/bpf covered per LCOV

## Infra/Testing changes

- x86\_64/aarch64 running on bare metal
  - More cores to share
  - Faster VM runs (KVM not available on AWS VMs)
  - Build + test time from 14 min to 8 min
- test\_\* run in parallel
  - Overhead of building VM image for each test runs
  - Parallelized test time
  - More resources traded for faster turn around/clearer fault isolation
- Incremental kernel build
  - Beneficial for GH hosted runners
  - Shave few minutes off build time on s390x

## **UI** improvement

- Failed test/error logs directly accessible from GH UI
- Accessible from Workflow summary

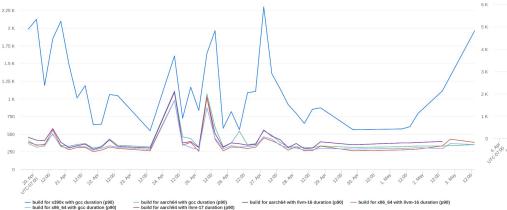
test_progs-no_alu32 - Testing test_progs-no_alu32
▶ collect_status - Collect status
▶ shutdown - Shutdown
Notice: Success: 355/3013, Skipped: 13, Failed: 1
VError: #141 netcht
Error: #141 netcnt
serial_test_netcnt:PASS:netcnt_progopen_and_load 0 nsec
serial_test_netcnt:PASS:malloc(percpu_netcnt) 0
serial_test_netcnt:PASS:testjoin_cgroup 0 nsec
serial_test_netcnt:PASS:attach_cgroup(bpf_nextcnt) 0 nsec
serial_test_netcnt:PASS:ping6 ::1 -A -c 10000 -q > /dev/null 0 nsec
serial_test_netcnt:PASS:bpf_map_get_next_key 0 nsec
serial_test_netcnt:PASS:bpf_map_lookup_elem(netcnt) 0
<pre>serial_test_netcnt:PASS:bpf_map_lookup_elem(percpu_netcnt) 0 nsec</pre>
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serial_test_netcnt:PASS:MAX_PERCPU_PACKETS 0 nsec
serial_test_netcnt:FAIL:packets unexpected packets; actual 10001 != expected 10006
serial_test_netcnt:PASS:bytes 0 nsec
Test Results:
bpftool: PASS
test_progs-no_alu32: <b>FAIL</b> (returned 1)
chutdown (CLEAN

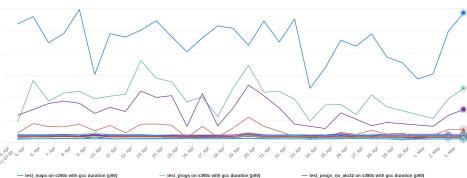
## Observability

- GH actions UI is limited
  - success/failure/cancelled
  - historical list of runs
  - Some limited filters
  - Generic to cater for wide audience
- REST API gives access to run results
  - Run, jobs, steps name, durations, results
  - Base commit, PR commit....
- Can poll API to collect and save data for later analysis/10,000ft overview
- Can answer:
  - "when did this test regress"
  - "how long does it take to build X, test X, per compiler, per arch..."
  - o "rate of successes/failure, number of cancelled jobs"

#### Observability

Job Annotation   Rach   Replie   Cempler   Network   Network   Samples     1 alure: #24 btf_dump:falure: #24/14 btf_dump/btf_dump: struct_data   arc64   sca   12(1364)   12(13						
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		x86 64	llvm-16	Successful test r		1 (1.1%)





- test\_maps on s390x with gcc duration (p90) - test\_verifier on s390x with gcc duration (p90) test\_progs\_no\_alu32 on aarch64 with llvm-16 duration (p90)
test\_progs on aarch64 with llvm-17 duration (p90) - test maps on aarch64 with gcc duration (p90) - test progs no alu32 on aarch64 with llym-17 duration (p90)

test\_verifier on aarch64 with llvm-16 duration (p90)

- test\_verifier on x86\_64 with llvm-16 duration (p90)

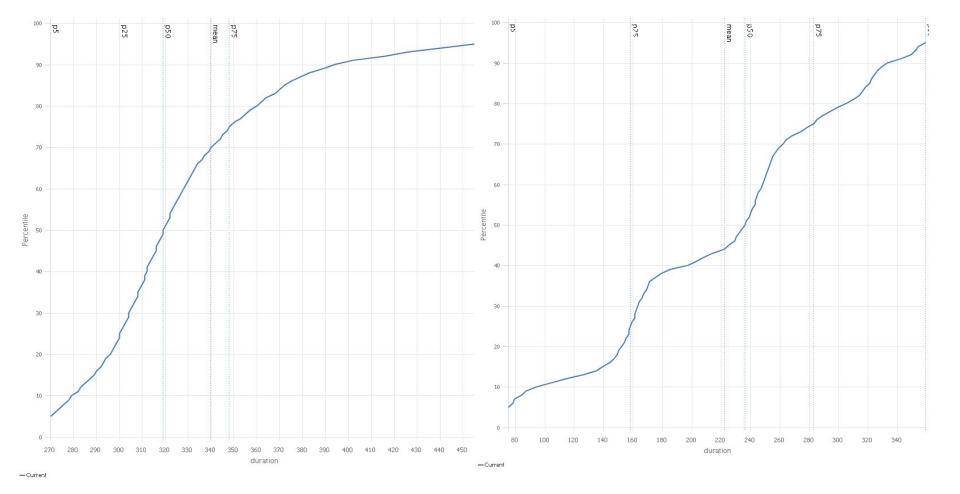
test\_progs on aarch64 with llvm-16 duration (p90) test\_progs on x86\_64 with llvm-16 duration (p90) test\_progs\_no\_alu32 on aarch64 with gcc duration (p90) - test progs no alu32 on x86 64 with llvm-16 duration (p90) - test maps on x86 64 with llvm-16 duration (p90)

- test\_maps on x86\_64 with gcc duration (p90) - test\_verifier on x86\_64 with gcc duration (p90)
- test\_progs\_no\_alu32 on s390x with gcc duration (p90) test\_progs\_no\_autoz on solow win gcc duration (ps0)
  test\_progs on aarch64 with gcc duration (ps0)
  test\_progs on aarch64 with gcc duration (ps0)
  test\_progs\_no\_autoz on x86\_64 with gcc duration (ps0)
  test\_progs\_no\_autoz on x86\_64 with gcc duration (ps0)

- test verifier on aarch64 with gcc duration (p90)
- test\_maps on aarch64 with llvm-17 duration (p90)
- test\_verifier on aarch64 with llvm-17 duration (p90)

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- Hide Legend Multi-axis Point Markers Normal \*



Build x86\_64/arm64, p90 ~400s

Tests x86\_64/arm64, p90 ~330s

#### Challenges: Flaky tests

1 flaky test turns CI red

"High" job success rate, yet low run success rate



#### Challenges: Flaky tests

- Relying on exact count + network
  - netcnt: serial\_test\_netcnt:FAIL:packets unexpected packets: actual 10001 != expected 10000
  - migrate\_reuseport: count\_requests:FAIL:count in BPF prog unexpected count in BPF prog: actual 22 != expected 25
- Probably exacerbated when running in a VM
- More investigation needed to understand source of flakiness

#### Discussion

- How to make community more aware of/invested in CI health?
  - Could export telemetry to external datasink/grafana
  - Preferably no extra infra to maintain
- Get reliable base
  - to be more aggressive on enforcing a green CI
  - Possibly sending test results to series author on failure
- flaky tests
  - How to detect early, minimize their noise (FLAKYLIST turning them into warning? Multiple retries)
- Requiring coverage for new functionalities
- Increasing community participation
- Repro error environment is complicated, lot going on within GH actions