# OVN Testing and CI - an update

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# Agenda

- Overview of current OVN contributions
- In-tree “unit” and system tests
- End-to-end tests with ovn-kubernetes
- Control plane scale tests with ovn-heater
- Control plane scale tests with real CMS
- Data plane performance regression testing
- OVN CI: what, where, when?
- How do we improve all this?

# Current OVN contributions

- OVN is still a very active project!

  **~30** features/user visible changes contributed in the last 12 months:

```
$ last_year=$(git log --format=format:"%H" origin/main --since=11/26/2022 | tail -1)
$ git diff $last_year..origin/main -- NEWS | grep '^+  -' -c
30
```

  **568** patches contributed in the last 12 months:

```
$ git log --oneline origin/main --since=11/26/2022 --until=11/26/2023 | wc -l
568
```

- For each patch developers, reviewers, maintainers must ensure:
  - it does what it's supposed to (review/manual testing/etc)
  - the code quality is acceptable (review)
  - it doesn't break existing functionality (**CI**)
  - it doesn't introduce control plane scalability regressions (**CI**)
  - it doesn't introduce data plane performance regressions (**CI**)
- Most patch series have more than one revision!

# In-tree “unit” tests

```
$ make check TESTSUITEFLAGS="-l"
[...]
 806: ovn-ic.at:386     ovn-ic -- route sync -- ovn-northd -- parallelization=yes -- ovn_monitor_all=yes
 807: ovn-ic.at:386     ovn-ic -- route sync -- ovn-northd -- parallelization=yes -- ovn_monitor_all=no
[...]
```

In total **834 tests** split in:

- actual unit tests (hint: they use `ovstest ...` to run unit tests): ovn-features.at, ovn-ipam.at, ovn-lflow-cache.at, ovn-vif-plug.at, etc.
- system tests “in disguise” (hint: `ovn.at`):
  - often test complex scenarios (multiple simulated hypervisors, complicated logical topologies)
  - run in OVN sandboxes
  - use the OVS “dummy” datapath with the userspace conntrack implementation
  - workloads are simulated with dummy interfaces
  - some of these are run multiple times, varying arguments like:
    - ovn-monitor-all (yes/no)
    - parallelization (yes/no)*



* Most tests are run with parallelization=yes, the only exceptions are in ovn-northd.at.

# In-tree system tests

In total **167 tests**:

- they bring up a real **single node** OVS and OVN environment
- 3 flavors of datapath:
  - kernel (netlink datapath)
  - netdev (userspace datapath)
  - dpdk (userspace datapath)
- workloads are actual veths running in network namespaces
- some of these are run multiple times, varying arguments like:
  - ovn-monitor-all (yes/no)

```
$ make check-kernel TESTSUITEFLAGS="-l"
[...]
 147: system-ovn.at:11226 ovn mirroring -- ovn-northd -- parallelization=yes -- ovn_monitor_all=yes
 148: system-ovn.at:11226 ovn mirroring -- ovn-northd -- parallelization=yes -- ovn_monitor_all=no
[...]
```

# In-tree multi-node system tests

Just one set of tests for now:

- they bring up an OVN cluster running in containers (ovn-org/ovn-fake-multinode)
- configure a logical network topology and run traffic across different components of the network
- what is ovn-fake-multinode?
  - originally created by Numan Siddique to deploy “plain” OVN clusters with individual “fake” chassis running as containers
  - inspired from kind (kubernetes in docker)
  - each controller/compute node runs in its own container
  - each container looks like a “real” OVN chassis:
    - runs OVS
    - runs ovn-controller
    - central containers run NB/ovn-northd/SB
- Allows us to run upgrade-like tests (ovn-controllers running newer OVN versions, ovn-northd running older versions)

```
$ make check-multinode TESTSUITEFLAGS="-l"
[...]
   1: multinode.at:3    ovn multinode basic test
[...]
```

# End-to-end tests with ovn-kubernetes

***ovn-kubernetes is the community's own kubernetes CNI plugin:*** https://github.com/ovn-org/ovn-kubernetes

- Be nice people: try to ensure we don't break ovn-kubernetes with OVN changes.
- Essentially, run a subset of ovn-kubernetes' own tests on any OVN version (tree):
  - Build a custom ovn-kubernetes container image (with OVS/OVN compiled and patched from scratch).
  - Bring up a kubernetes cluster running in containers (kind) with ovn-kubernetes as CNI.
  - Run a (subset of) upstream kubernetes *conformance* tests:

```
- {"target": "shard-conformance", "ha": "HA", "gateway-mode": "local", "ipfamily": "ipv6", "disable-snat-multiple-gws": "snatGW"}
- {"target": "shard-conformance", "ha": "HA", "gateway-mode": "local", "ipfamily": "dualstack", "disable-snat-multiple-gws": "snatGW"}
- {"target": "shard-conformance", "ha": "HA", "gateway-mode": "shared", "ipfamily": "ipv4", "disable-snat-multiple-gws": "snatGW"}
- {"target": "shard-conformance", "ha": "HA", "gateway-mode": "shared", "ipfamily": "ipv6", "disable-snat-multiple-gws": "snatGW"}
```

  - Run a (subset of) upstream ovn-kubernetes control plane tests:

```
- {"target": "control-plane", "ha": "HA", "gateway-mode": "shared", "ipfamily": "ipv4", "disable-snat-multiple-gws": "noSnatGW"}
- {"target": "control-plane", "ha": "HA", "gateway-mode": "shared", "ipfamily": "ipv4", "disable-snat-multiple-gws": "snatGW"}
```

# Control plane scale tests with ovn-heater

- Scale testing OVN control plane challenges:
  - testing a real cluster (OpenStack/Kubernetes) is complex: lots of CMS-specific knowledge required; bottlenecks identified in terms of CMS-specific components
  - not straightforward to find the right community/people to fix the bottleneck
  - harder to proactively implement a CI/CD pipeline from the control plane perspective: all tests can only be run whenever core OVN changes are consumed by the CMS (often that's months later).

- https://github.com/ovn-org/ovn-heater *"Mega script to install/configure/run a simulated OVN cluster deployed with ovn-fake-multinode."*
  - python & ansible based automation that relies on ovn-fake-multinode to set up and provision "fake" OVN nodes
  - contains its own collection of libraries to define workloads (uses python-ovs to configure the OVN databases)
  - integrated data collection (logs, perf traces, etc) and results interpretation (charts, latency stats, etc)
  - allows a faster test development pace for (new) OVN features
  - straightforward to use for CI/CD

## Control plane scale tests with ovn-heater

- Rather specific “real world” workload simulations
  - together with CMS (cloud management system) contributors we defined scenarios that are interesting to simulate at scale:
    - ovn-kubernetes-like topologies: number of nodes, density of pods per node, number of services and service endpoints, etc
    - OpenStack-like topologies: number of computes/controllers, projects, external/internal networks, density of VMs, etc
  - came up with templated test scenarios implementing the above:
    - https://github.com/ovn-org/ovn-heater/blob/main/ovn-tester/cms/ovn_kubernetes/ovn_kubernetes.py
    - https://github.com/ovn-org/ovn-heater/blob/main/ovn-tester/cms/openstack/openstack.py
- **Note**: testing control plane scalability on public resources is not that easy; for reproducibility of results and full control of the deployment, ovn-heater tests run on bare-metal lab infrastructure downstream.
- it turned out to be a very prolific exercise from a performance perspective:
  - lots of improvements in OVN components (ovn-controller, ovn-northd)
  - lots of improvements on the ovsdb-server side (more details in Ilya’s OVSCon’22 presentation)

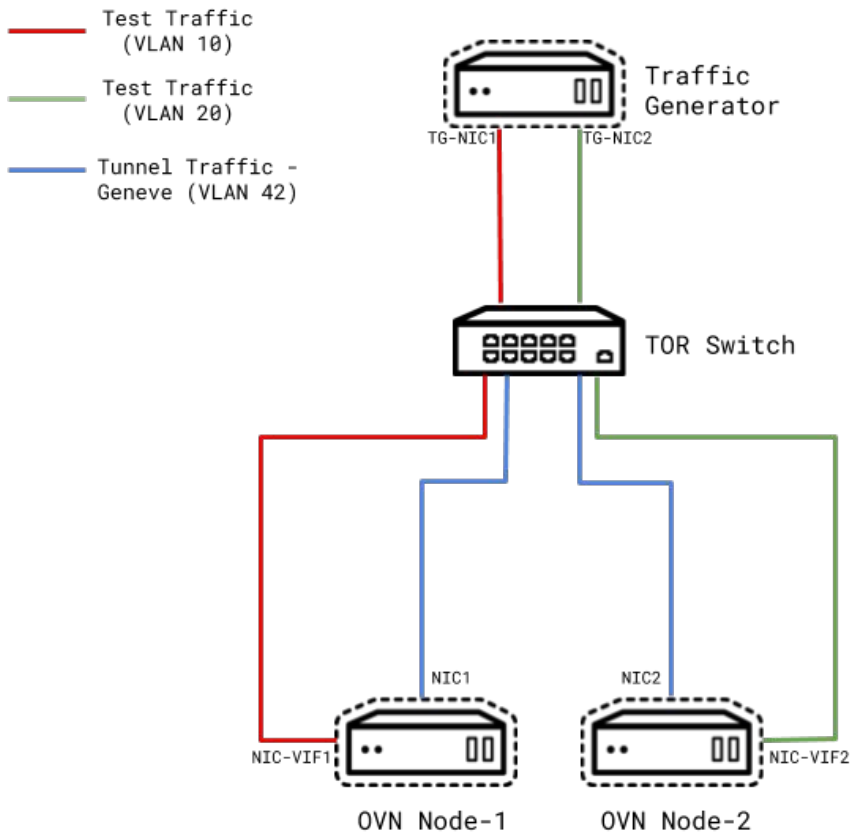
More info about ovn-heater in this community meeting presentation from earlier this year.

# Control plane scale tests with real CMS (OpenShift)

- What better way to scale test how a CMS would use OVN than to actually deploy that CMS and run tests against it?
- Together with dedicated performance and scale teams we test OpenShift downstream at scale:
  - Bring up large clusters: 120, 250, 500, 1000 nodes
  - Run real workloads on these clusters: https://github.com/cloud-bulldozer/kube-burner/tree/master/examples/workloads
  - Collect relevant OVN information (logs, databases) and relevant metrics for the tested workloads.
- Pros:
  - Full fledged OpenShift => no potential gap between simulation and real CMS behavior.
- Cons:
  - Harder to integrate upstream.
  - Requires even more CMS specific knowledge when debugging/interpreting results.
  - More complex to set up than other control plane test tools (ovn-heater).
  - Usually triggered on demand.
- Note:
  - There are ways of deploying OpenShift clusters on baremetal (in VMs), with custom ovn-kubernetes images => it's possible to create a CI pipeline to test real OpenShift at scale with vanilla upstream OVN code (WIP).

# Data plane performance regression testing

- Periodic test runs with OVN-only cluster automation
- Various combinations of traffic patterns trying to replicate common kubernetes/OpenStack scenarios
- Really focused on the dataplane performance (no control plane tests):
  - hardware traffic generator -> a couple of OVN nodes (geneve) -> hardware traffic generator
  - test for TCP/UDP throughput and latency



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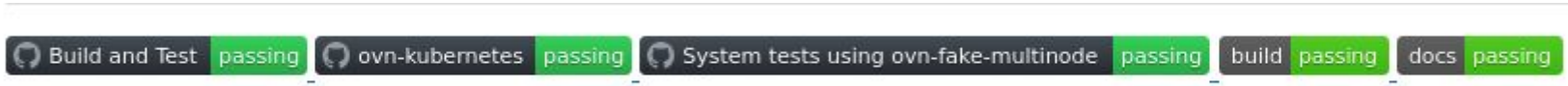
# OVN CI: what, where, when?

| Event | Who | Action | Report |
|---|---|---|---|
| PATCH posted to dev mailing list.<br>([ovs-dev,v3] controller: Don't artificially ...) | ovsrobot/pw-ci | Apply patch to corresponding branch, run checkpatch, push series branch to ovsrobot ovn fork | ovs-build email reply |
| commit pushed to ovsrobot/ovn fork | ovsrobot/pw-ci | GitHub actions triggered | GitHub actions results |
| ovsrobot fetches results of the GH actions | ovsrobot/pw-ci | Parse GH actions result | ovs-build email reply (link to GH actions unit and system test results and also ovn-kubernetes test results) |
| maintainer applies patch to OVN | GitHub | GitHub actions triggered but **also** CirrusCI actions triggered (unit and system tests on ARM) | GitHub actions results<br>CirrusCI results<br>Build badges (see bottom) |



# OVN CI: what, where, when?

| Event | Who | Action | Report |
|---|---|---|---|
| Schedule (weekly) | GitHub | Run system tests with ovn-fake-multinode. | GitHub actions results |
| Schedule (weekly) | GitHub | Run unit and system tests (with OVS most recent stable branch). | GitHub actions results |
| Schedule (weekly) | GitHub | Build custom ovn-kubernetes container images with latest OVN main code. | GitHub actions results |
| Schedule (weekly) | Downstream automation | Trigger ovn-heater runs in Red Hat lab; matrix:<br>- 20, 120, 250, 500 nodes<br>- IPv4 & IPv6<br>- density-light/heavy/cluster-density/network-policy tests | Potentially through emails, bug reports, upstream patches (no automated mechanism) |
| Schedule (weekly) | Downstream automation | Trigger dataplane tests in Red Hat lab to verify for potential performance (throughput/latency) regressions. | Potentially through emails, bug reports, upstream patches (no automated mechanism) |

# How do we improve all this? - stability

- Improve in-tree CI:
  - Detect unstable in-tree unit/system tests: avoid hiding failures via recheck
  - Fix unstable in-tree unit/system tests: **100+** commits to fix tests in the last 12 months
  - Pin versions of non-OVN components to avoid noise in testing: "ci: Pin Python, Fedora and Ubuntu runner versions." and "Allow to use different container images per branch."
  - Improve complex and slow tests (e.g., use fmt-pkt more often now that it's becoming fast)
- Use stable ovn-kubernetes releases(*) in ovn-org/ovn CI (avoid noise from bleeding-edge code in ovn-kubernetes)

(*) ovn-kubernetes has no stable releases at the moment

# How do we improve all this? - coverage

- Expand control plane scale testing (ovn-heater):
  - Add support for running OVN-IC clusters with ovn-heater (initial work is merged, last part is under review)
  - Add OVN-IC tests to downstream test matrix
  - Add more OpenStack scenarios
  - Automate result reporting downstream -> upstream
- Expand the data plane testing infrastructure:
  - Add more traffic patterns
  - Automate result reporting downstream -> upstream
- Complete downstream CI pipeline to deploy OpenShift/kubernetes at scale on baremetal with vanilla upstream OVN:
  - Run control and data plane CMS specific tests
  - Automate result reporting downstream -> upstream

# Questions, suggestions, feedback?

# Thank you!



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