



LFN Developer & Testing Forum

Containerizing Traffic Generators for K8S Performance testing

Opportunities and Challenges

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Kubernetes Testing

- Existing Works and Specs
 - Kubernetes E2E tests
 - <https://github.com/kubernetes/kubernetes/tree/master/test/e2e>
 - Conformance
 - <https://github.com/kubernetes/community/blob/master/contributors/devel/sig-architecture/conformance-tests.md>
 - <https://github.com/cncf/k8s-conformance/blob/master/docs/KubeConformance-1.21.md>
 - CNF-Specific:
 - <https://github.com/cncf/cnf-conformance>
 - Draft version.
 - CNTT – RA2/RI2/RC2
 - ETSI-NFV?

Kubernetes e2e

- Developer focused.
- Test Types:
 - Slow: 5mins+
 - Serial: Tests that cannot run in parallel
 - Disruptive: Impact 'others'
 - Flaky: Too hard to fix in short term (1-engineer-week)
 - Feature: Non-default ones (Performance, Ingress, etc)
 - MinKubeletVersion: Requires certain version of kubelet
 - Conformance: Most Important! (previleged, deprecated, internet, alpha, beta)
 - Linux-Only
- Many ways to run these e2e tests: kubetests, sonobuoy, KinD, etc.

Kubernetes e2e – N/W Performance

Test-Category	Sub-category	Details
Network - Dataplane: Iperf and Netperf.	Topologies	Same VM using Pod IP (iperf2-TC, iperf2-UDP, netperf) Same VM using Virtual IP (iperf2-TC, iperf2-UDP, netperf) Remote VM using Pod IP (iperf2-TC, iperf2-UDP, netperf) Remote VM using Virtual IP (iperf2-TC, iperf2-UDP, netperf) Hairpin Pod to own Virtual IP (iperf2-TCP)
Other Networking	DNS	https://github.com/kubernetes/perf-tests/tree/master/dns
Other Performance.	Cluster-Loader	https://github.com/kubernetes/perf-tests/blob/master/clusterloader2/testing/load/config.yaml
Others	Results-Analyzer	Analyze results from e2etests (Stale) https://github.com/kubernetes/perf-tests/tree/master/compare
	Performance Dashboard	https://github.com/kubernetes/perf-tests/tree/master/perfdash
	SLO-Monitor	https://github.com/kubernetes/perf-tests/tree/master/slo-monitor
	Performance Comparison (API-Lacenty, Pod-Startup)	https://github.com/kubernetes/perf-tests/tree/master/benchmark

CNCF Conformance – Categories

Platform	Workload
Compatibility	
	Statefulness
Security	
	Microservice
	Scalability
	Configuration and Lifecycle
Observability	
Hardware Resources and Scheduling	
	Installable and Upgradable
Resilience	

* Possible opensource solutions are also listed.

CNI conformance, alpha, beta and GA endpoint usage

Only mention of resetting usecase

privileged mode, access to files/folders

Start-up time and image size

Scaling, auto-scaling.

Only mention of resetting usecase

Opensource solutions, opentelemetry and openmetric

How CNF accesses H/W resources & Performance Testing

Helm V3

different failures, crashes, impairments

CNTT – RA/RC/RI 2

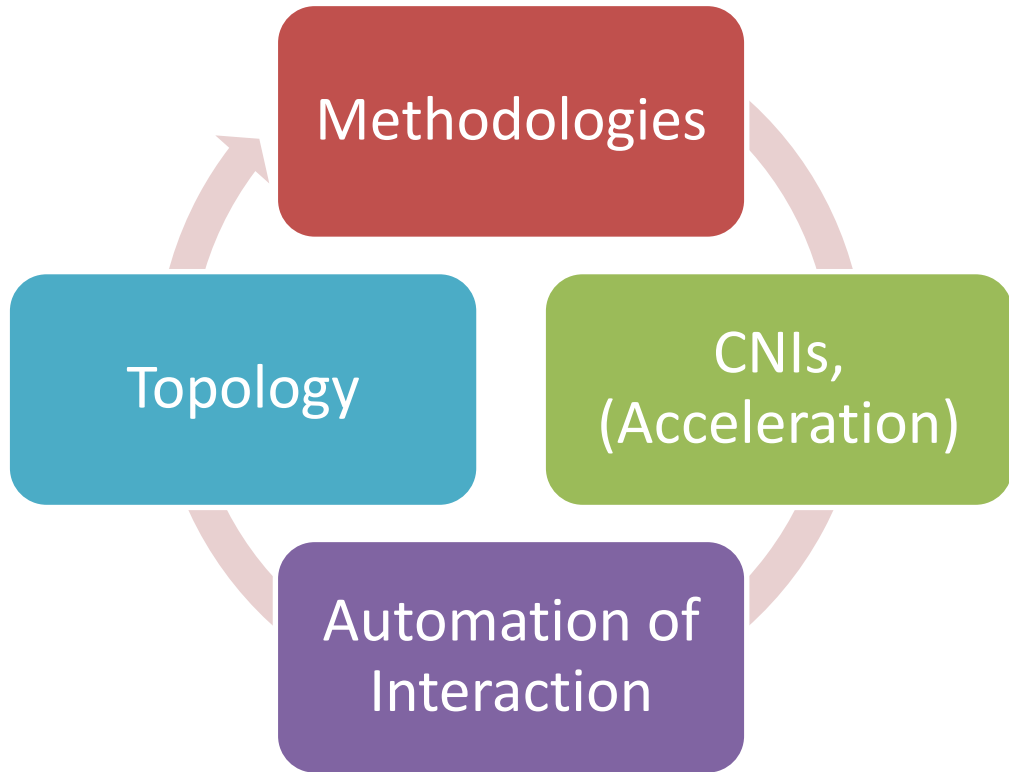
CNTT		
Kubernetes API testing	Extensive list (create, delete of deployment, pod, namespace, replicaset, etc.)	
Kubernetes API benchmarking	Extensive list with Count (10)	
SIG Testing E2E tests except the ones that are - Disruptive, Flaky and Alpha. Also skipped: [Feature:CrossNamespacePodAffinity], [Feature:StorageVersionAPI]	Labels	Mandatory
	Conformance	X
	None	X
	Feature:ComprehensiveNamespaceDraining	X
	Feature:CrossNamespacePodAffinity	
	Feature:PodPriority	X
	Feature:ScopeSelectors	X
	Feature:StorageVersionAPI	
Security Testing	Functest K8S Security: 2 test cases based on kube-hunter and kube-bench https://www.cisecurity.org/benchmark/kubernetes/	
	(Opensource) CNF onboarding and testing	
Functest: clearwater IMS with Kubectl and Helm (2 tests)		

Performance Testing ..

- For Non-NFV Usecases, Network performance testing 'may be' sufficiently specified
- For NFV usecases, Network performance testing specification is still weak.
 - Anuket-CNTT is working to fill this gap.
 - Important to comply with specifications (Ex: ETSI-NFV)

Challenges

- Focus:
Opensource
Traffic
Generators
- Challenges are opportunities for community to join hands.



Challenge 1/4 : Methodologies

- Existing works uses following tools
 - iperf2/iperf3
 - netperf/flent
 - nuttcp
- With these tools, running standards-based tests to meet the requirements of specifications (Ex: ETSI-NFV) is very challenging.
 - Traffic
 - Metrics
- In addition, using acceleration with these tools is also difficult.

Challenge 2/4 : Acceleration

- Lack of opensource traffic Generator with Shared memory (Virtio or memif) Interface Support.
 - T-Rex
 - SRIOV-Yes, Userspace CNI: Not available till date.
 - Methodology support implemented in ViNePerf
 - Pktgen.
 - No Methodology support, no automation (config & result-collection) support.
 - DPPD-PROX – Work in Progress.
 - Both methodology and automation support.
 - Joint effort of Anuket SampleVNF and ViNePerf

Challenge 3/4 : Automation

- Automation of Interaction with deployed Traffic generator.
 - Interaction: Configuration and Results-Collection
 - Mechanisms to expose the Pod for external access.
 - Similar to floating-IP of openstack.
 - Existing Options:
 - Kubectl - NA
 - Pod/Cluster-IP with SSH tunnel
 - Nodeport.
 - External IP
 - Loadbalancer
 - Open-Problem.

Challenge 4/5 : Topology

- Not all topologies can be used for all traffic generators
- Some Traffic generators do not support 'dual' instances.
 - One as Sender and Another as Receiver.
 - Test: Pod-to-Pod Communication.
 - Ex: T-Rex

Network Performance Testing: ViNePerf

- Dataplane
 - East-West
 - Phase-2 (L-Release)
 - Working on Challenges listed.
 - North-South
 - Thorough study – Publication.
 - Different topologies, CNIs, pod-resource, etc.
 - VinePerf – Opensource and Commercial Traffic Gens.
 - Network Services
 - Control-Plane
- } L+ Releases.



OLF NETWORKING

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Come Join the Anuket Community !!!!!
Opportunity to work on these challenges