# AI-Powered Performance Insights

## Integrating OVS/OVN automatic performance regression analysis with LLMs

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Perf&Scale Engineering

# whoarewe

- 13 years in the Performance Team
- Worked on Virt, SPEC, OpenStack, and OpenShift

**Joe**
Talerico

**JOSE**
CASTILLO LEMA

- 6 years in Red Hat
- 4 years in perf/scale department
- 2 years as Telco Cloud Architect in the Solutions & Technology Practices team

- 10 years in Red Hat
- 6 years in the OCP Perf&Scale Team
- 4 years in the Iberia Services Team

**Raúl**
Sevilla

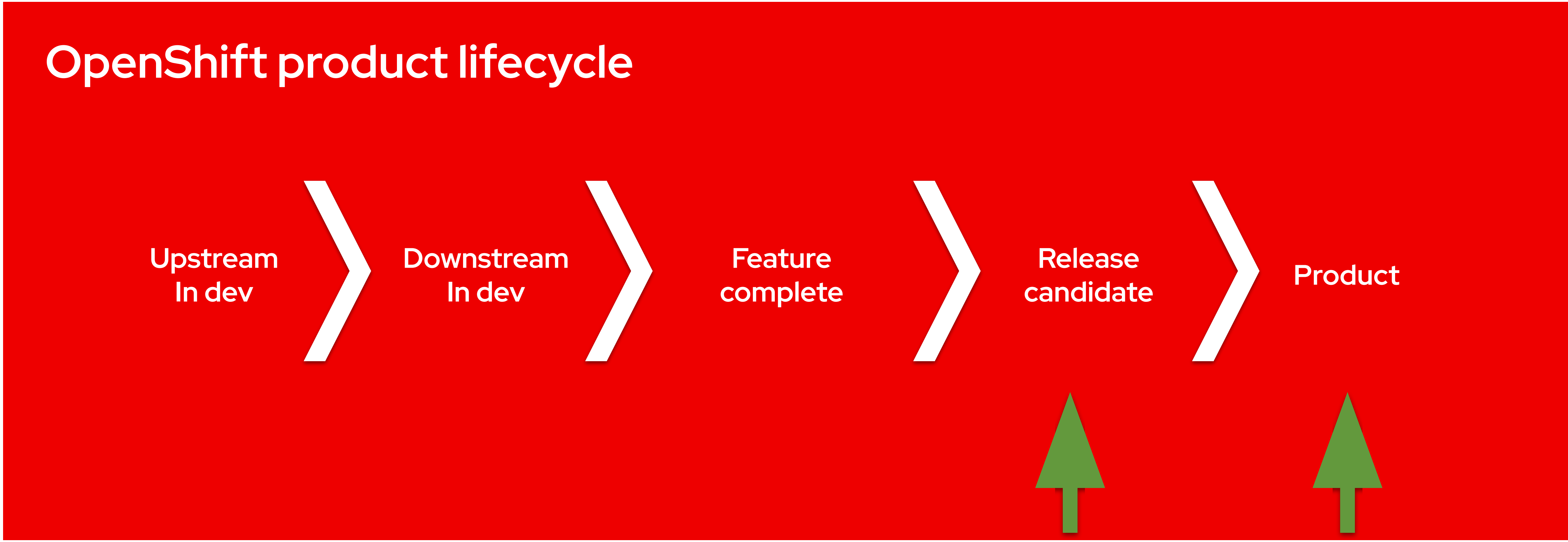
# Agenda

1. The problem
2. Shift-left engineering
3. Continuous Performance Testing (CPT)
4. Workflow
5. Tooling
6. How does AI fit in?
7. Challenges and next steps

# The problem

- Performance testing often occurs **too late in the pipeline**
- Late detection of performance issues increases **cost**
- Real-world consequences: downtime, latency, etc.

# Performance Testing – The past

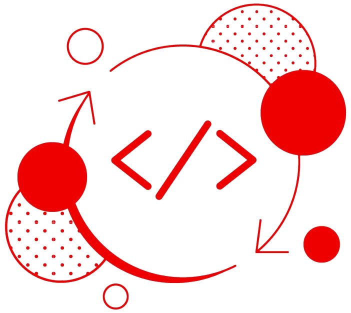


## OpenShift product lifecycle

Upstream In dev
Downstream In dev
Feature complete
Release candidate
Product

At best we normally would fit in at the end of the development cycle

# Shift-left engineering



**Development**

**Shift left**

**Performance Engineering**

- Testing
- Tuning
- Capacity planning

**Shift right**

**Operations**

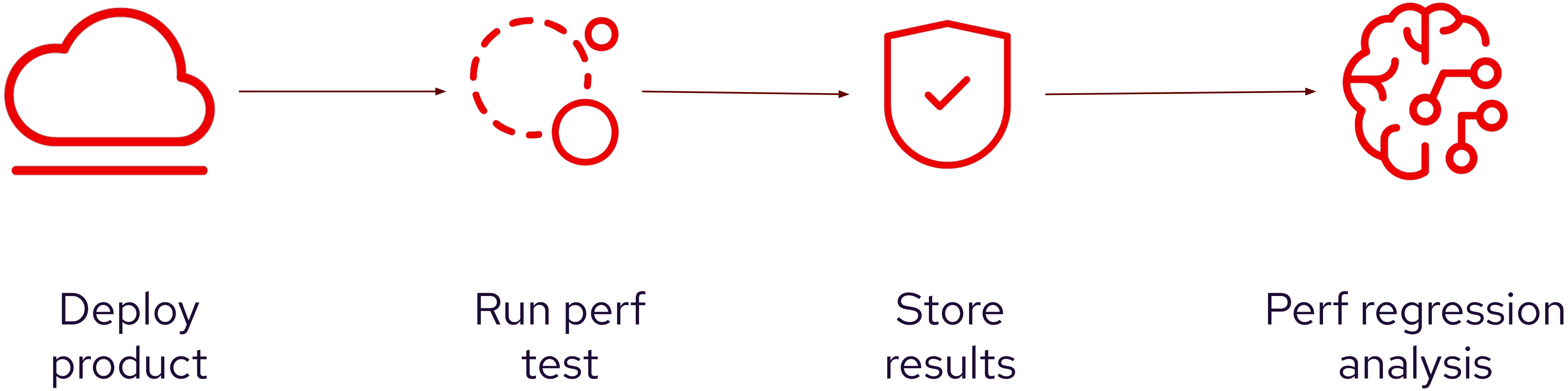
- Monitoring
- Capacity planning

# What is CPT?

**Continuous Performance Testing** (CPT) is the practice of executing performance benchmarks (tests) continuously throughout the development lifecycle.

The execution of said Performance benchmarks is **orchestrated in an automated pipeline** (like Jenkins, Prow, etc.), preferably in the pipeline your developers are working out of.

# Workflow



Deploy product

Run perf test

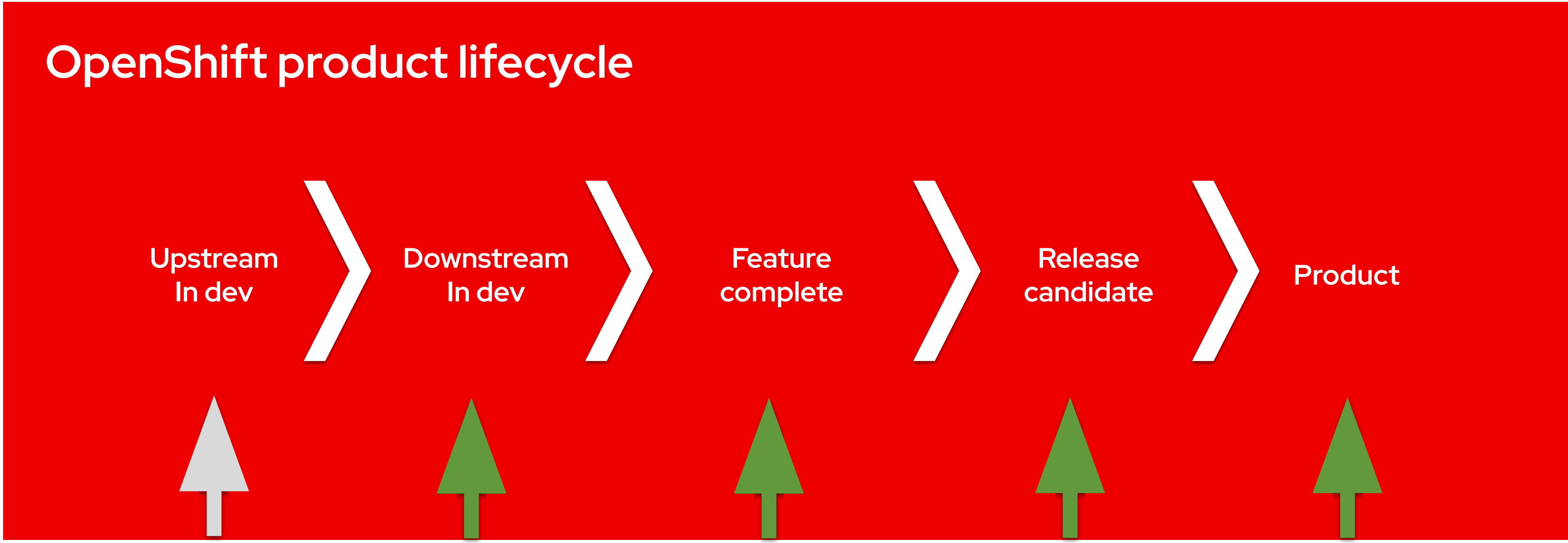
Store results

Perf regression analysis

# Why CPT?

- Shifts Performance testing left
- Earlier feedback enables faster fixes
- Reduces overall testing costs
- Improves developer ownership of performance → Continuous Improvement Mindset
- More time for technical improvements
- Allows us to drastically improve the coverage matrix and frequency of the testing
  - More data → Need for automatic **performance regression frameworks**
    - **Change point detection** mechanisms

# CPT - Goals



## OpenShift product lifecycle

Upstream In dev

Downstream In dev

Feature complete

Release candidate

Product

After adopting CPT, where we fit into the lifecycle.

We would like to see how we can enable the same process upstream!

# Cultural shift

- From siloed to **dev + Performance collaboration**
- Embed performance mindset in development sprints
- Performance as part of 'Definition of Done'

Key principles to **navigate change**:

- Document workflows and KPI's
- Collaboration with QE counterparts is key
  - Handoffs
  - Responsibility matrix

# PerfScale x Openshift Networking

## 2025 in review

- Net New Workloads added (Control & Data-path)
  - UDN L2 & L3
  - Virt UDN
  - Networkpolicy
  - Egress IP
  - BGP
- 30+ downstream bugs opened
- Improved tooling to identify regressions in a PR
- BiWeekly engagement with developers

# Achievements

- Catch performance/scalability regressions in an early stage
- Redefined a new test/platform coverage matrix standard

## 5 platforms

AWS, Azure, GCP, IBM, Baremetal +
Managed services offerings: ROSA and ARO

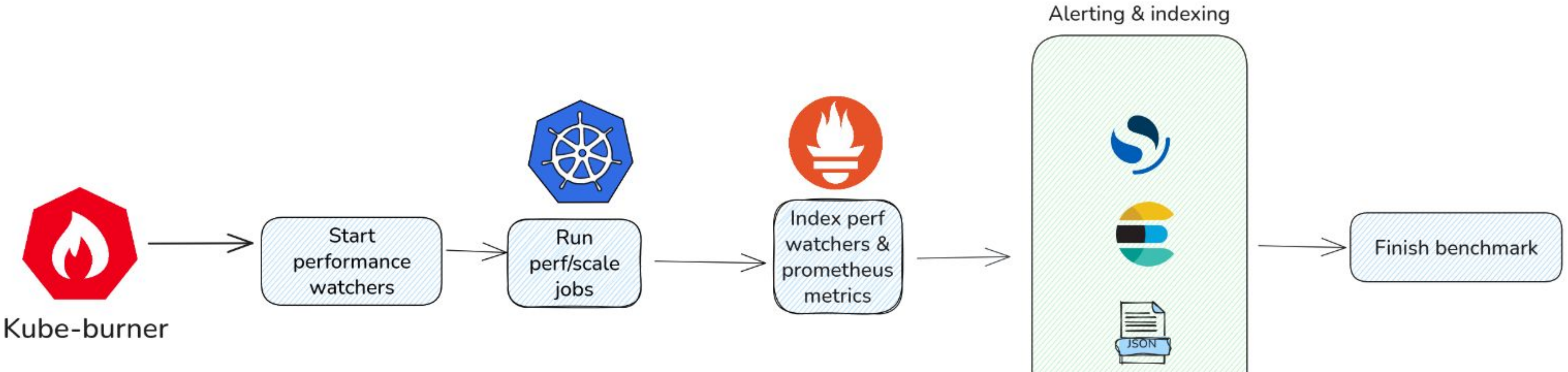
## +100 weekly tests

Covering nightly, early candidates, release candidates, stable releases and long term support

Platform +

- OpenShift Virtualization
- Layered products (OLS, ACS, Kepler, ...)

# Control-Plane Tooling

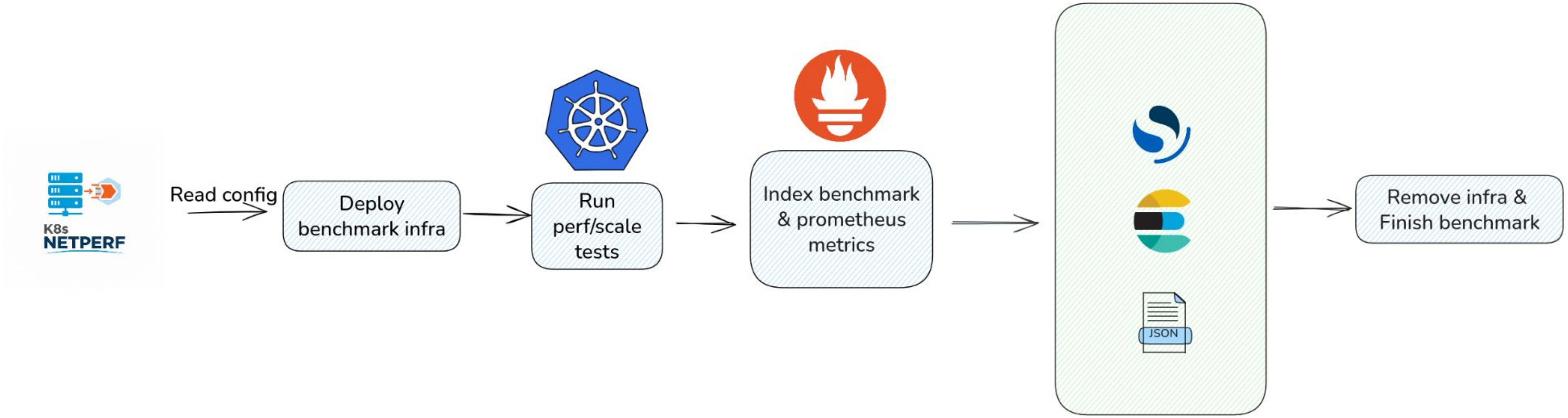


Supported indexers:
- OpenSearch
- Elasticsearch
- Local file

Main relevant KPIs:

- Pod/VM ready latency
- Hardware usage of CNI components
- Cluster stability

# Data-Plane Tooling - k8s-netperf



Supported indexers:
- OpenSearch
- Elasticsearch
- Local file

k8s-netperf:

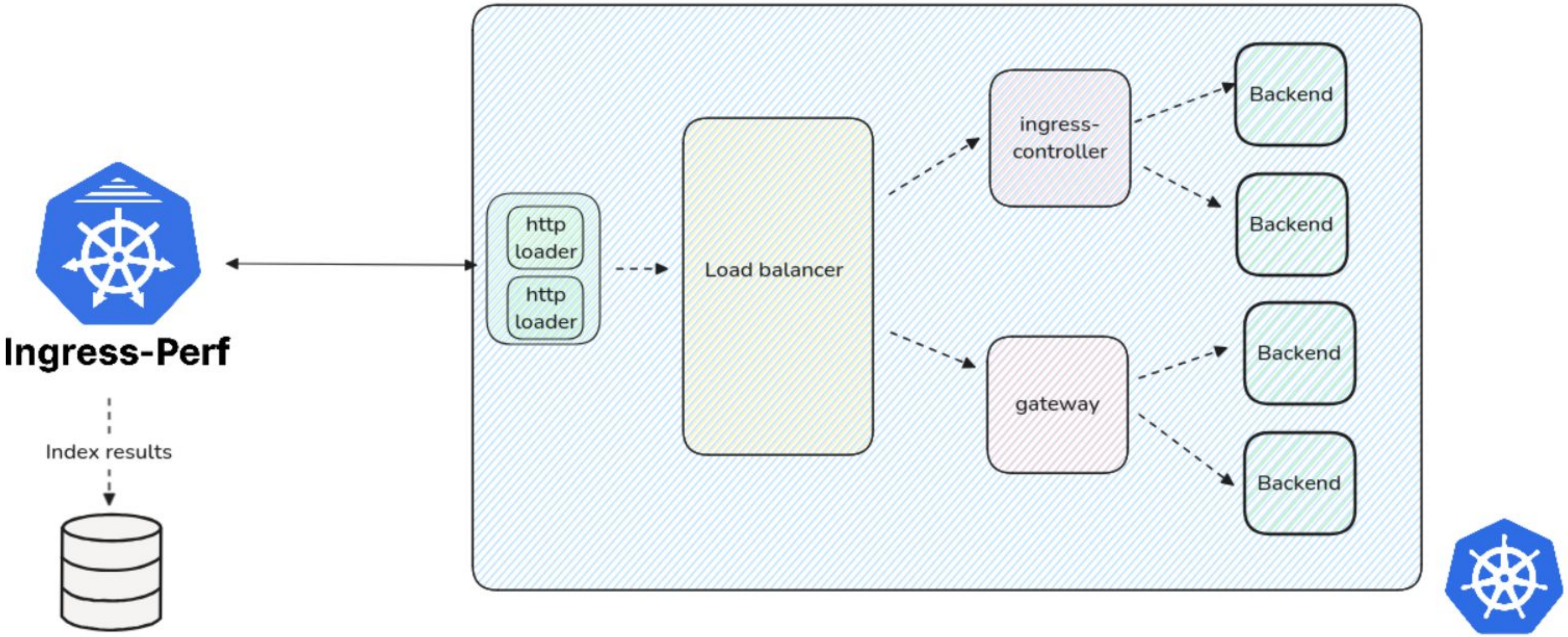
- Deploys benchmark assets in the given cluster
- Drives benchmark orchestration and results collection
- Normalizes and index benchmark results along with Prometheus metrics in local files or ElasticSearch/OpenSearch
- Garbage collects benchmark assets

Supports throughput and latency benchmarks:

- Pod 2 pod via SDN or hostNetwork (including VMs)
- Pod 2 service
- Multiple drivers: netperf, uperf, iperf3, ib_write_bw (RoCE traffic)

# Data-Plane Tooling - ingress-perf

Red Hat Confidential - Associates only

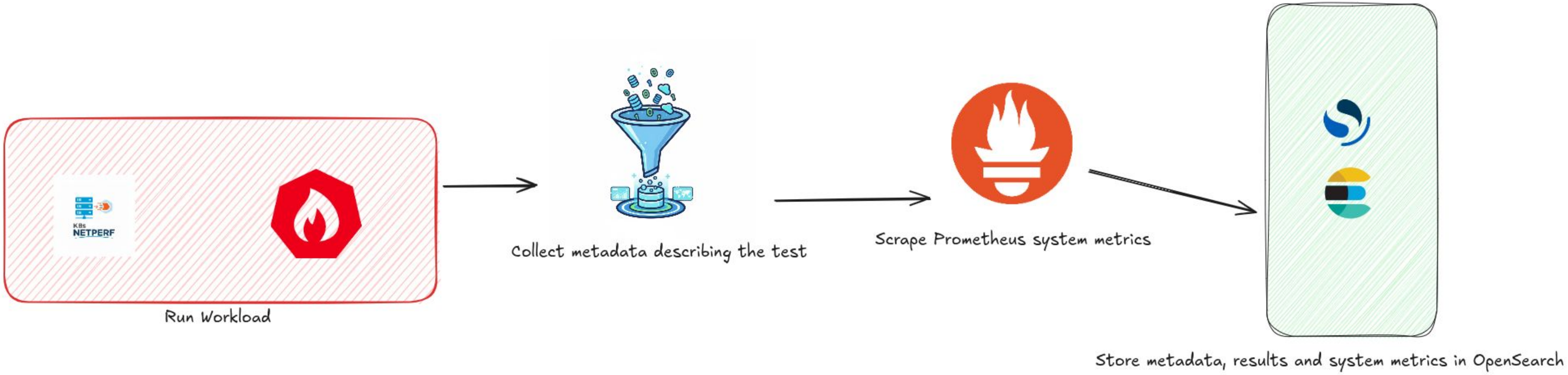


Ingress-perf:

- Deploys benchmark assets in the given cluster
- Drives benchmark orchestration and results collection
- Normalizes and index benchmark results along with Prometheus metrics in local files or ElasticSearch/OpenSearch
- Garbage collects benchmark assets

# Regression Analysis - Tooling

Across all of our Performance and Scale Tooling, there is a common workflow.


K8s NETPERF
Run Workload
Collect metadata describing the test
Scrape Prometheus system metrics
Store metadata, results and system metrics in OpenSearch

With this common workflow and data warehouse, we can use a common tool for the regression analysis, called [Orion](#)

Orion works by querying the data warehouse for all results that *match a specific fingerprint*. Once we have all the matches, Orion will then collect the desired system metrics the user provided and run the provided regression analysis algorithm against the dataset – We use Apache Otava (e-divisive means algorithm, [learn more](#))

# Regression Analysis - Tooling

Example of an Orion configuration:

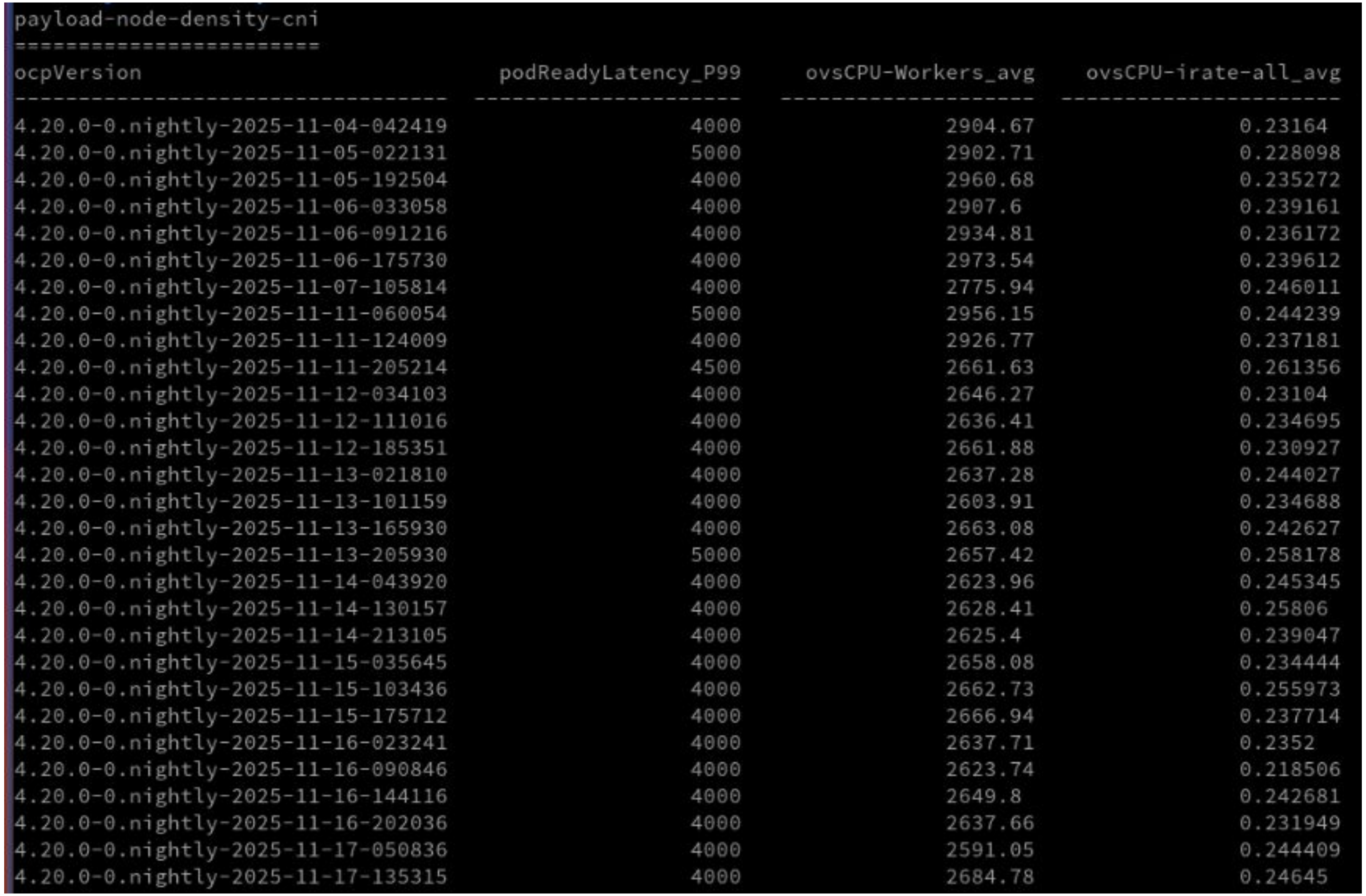
```
tests :
  - name : 24-node-scale-cdv2
    index: {{ es_metadata_index }}
    benchmarkIndex: {{ es_benchmark_index }}
    metadata:
      platform: AWS
      clusterType: self-managed
      masterNodesType: m6a.xlarge
      masterNodesCount: 3
      workerNodesType: m6a.xlarge
      workerNodesCount: 24
      benchmark.keyword: cluster-density-v2
      ocpVersion: {{ version }}
      networkType: OVNKubernetes
      jobType: {{ jobtype | default('periodic') }}
      not:
        stream: okd
```

**This example fingerprint will retrieve**:

- all runs on AWS
- `m6a.xlarge` control-plane
- `m6a.xlarge` workers
- 24 workers
- The benchmark was cluster-density-v2

# Regression Analysis - Tooling

Example of an Orion OVN analysis:



```
payload-node-density-cni
========================
ocpVersion                            podReadyLatency_P99     ovsCPU-Workers_avg    ovsCPU-irate-all_avg
----------------------------------  ---------------------   --------------------  ----------------------
4.20.0-0.nightly-2025-11-04-042419                   4000                2904.67                0.23164
4.20.0-0.nightly-2025-11-05-022131                   5000                2902.71                0.228098
4.20.0-0.nightly-2025-11-05-192504                   4000                2960.68                0.235272
4.20.0-0.nightly-2025-11-06-033058                   4000                2907.6                 0.239161
4.20.0-0.nightly-2025-11-06-091216                   4000                2934.81                0.236172
4.20.0-0.nightly-2025-11-06-175730                   4000                2973.54                0.239612
4.20.0-0.nightly-2025-11-07-105814                   4000                2775.94                0.246011
4.20.0-0.nightly-2025-11-11-060054                   5000                2956.15                0.244239
4.20.0-0.nightly-2025-11-11-124009                   4000                2926.77                0.237181
4.20.0-0.nightly-2025-11-11-205214                   4500                2661.63                0.261356
4.20.0-0.nightly-2025-11-12-034103                   4000                2646.27                0.23104
4.20.0-0.nightly-2025-11-12-111016                   4000                2636.41                0.234695
4.20.0-0.nightly-2025-11-12-185351                   4000                2661.88                0.230927
4.20.0-0.nightly-2025-11-13-021810                   4000                2637.28                0.244027
4.20.0-0.nightly-2025-11-13-101159                   4000                2603.91                0.234688
4.20.0-0.nightly-2025-11-13-165930                   4000                2663.08                0.242627
4.20.0-0.nightly-2025-11-13-205930                   5000                2657.42                0.258178
4.20.0-0.nightly-2025-11-14-043920                   4000                2623.96                0.245345
4.20.0-0.nightly-2025-11-14-130157                   4000                2628.41                0.25806
4.20.0-0.nightly-2025-11-14-213105                   4000                2625.4                 0.239047
4.20.0-0.nightly-2025-11-15-035645                   4000                2658.08                0.234444
4.20.0-0.nightly-2025-11-15-103436                   4000                2662.73                0.255973
4.20.0-0.nightly-2025-11-15-175712                   4000                2666.94                0.237714
4.20.0-0.nightly-2025-11-16-023241                   4000                2637.71                0.2352
4.20.0-0.nightly-2025-11-16-090846                   4000                2623.74                0.218506
4.20.0-0.nightly-2025-11-16-144116                   4000                2649.8                 0.242681
4.20.0-0.nightly-2025-11-16-202036                   4000                2637.66                0.231949
4.20.0-0.nightly-2025-11-17-050836                   4000                2591.05                0.244409
4.20.0-0.nightly-2025-11-17-135315                   4000                2684.78                0.24645
```

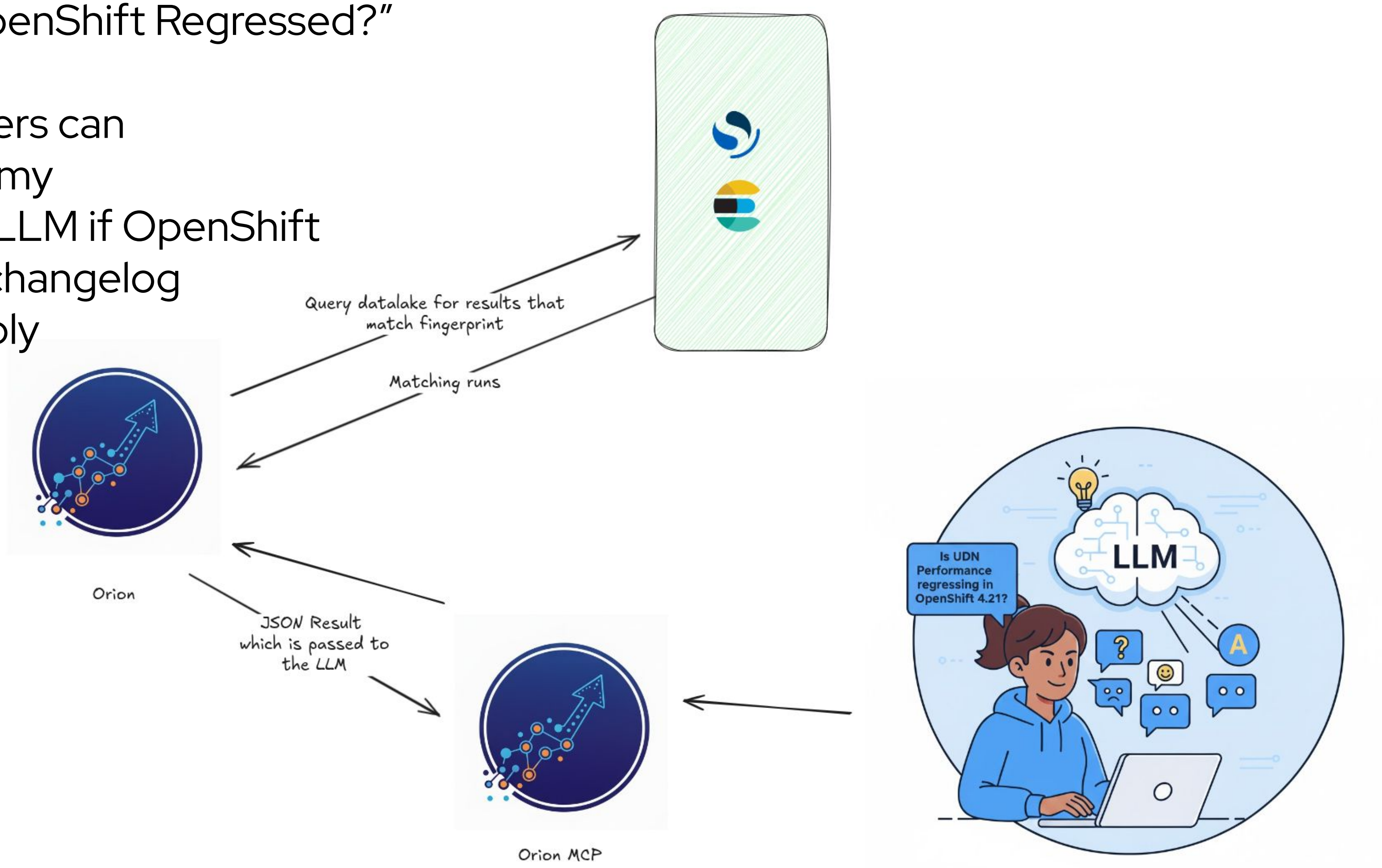
*Cropped due to size

# Where is the AI?

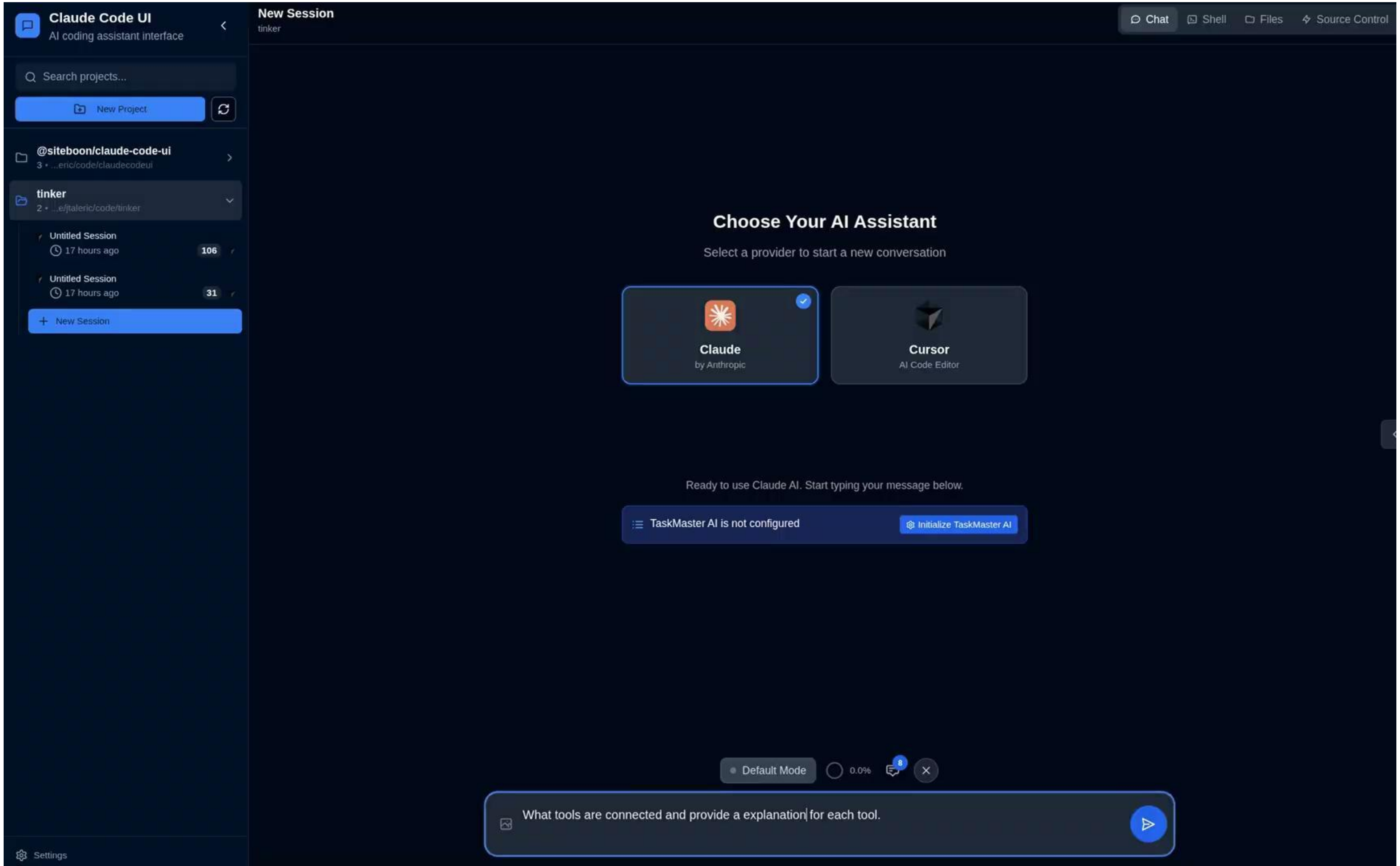
Now that we have established our workloads and methodologies… The obvious question is, where is the AI?

We have recently introduced Orion-MCP, which allows developers and users to ask their favorite LLM that is connected to our MCP server, “Has OpenShift Regressed?”

This isn’t limited to simple requests, users can ask more complex questions, like “Has my PR introduced a regression” or for the LLM if OpenShift has regressed to look through the PR changelog and determine what PR could of possibly introduced the regression.


Query datalake for results that match fingerprint
Matching runs
Orion
JSON Result which is passed to the LLM
Orion MCP
LLM
Is UDN Performance regressing in OpenShift 4.21?

# Orion-mcp with LLM - Demo



Choose Your AI Assistant

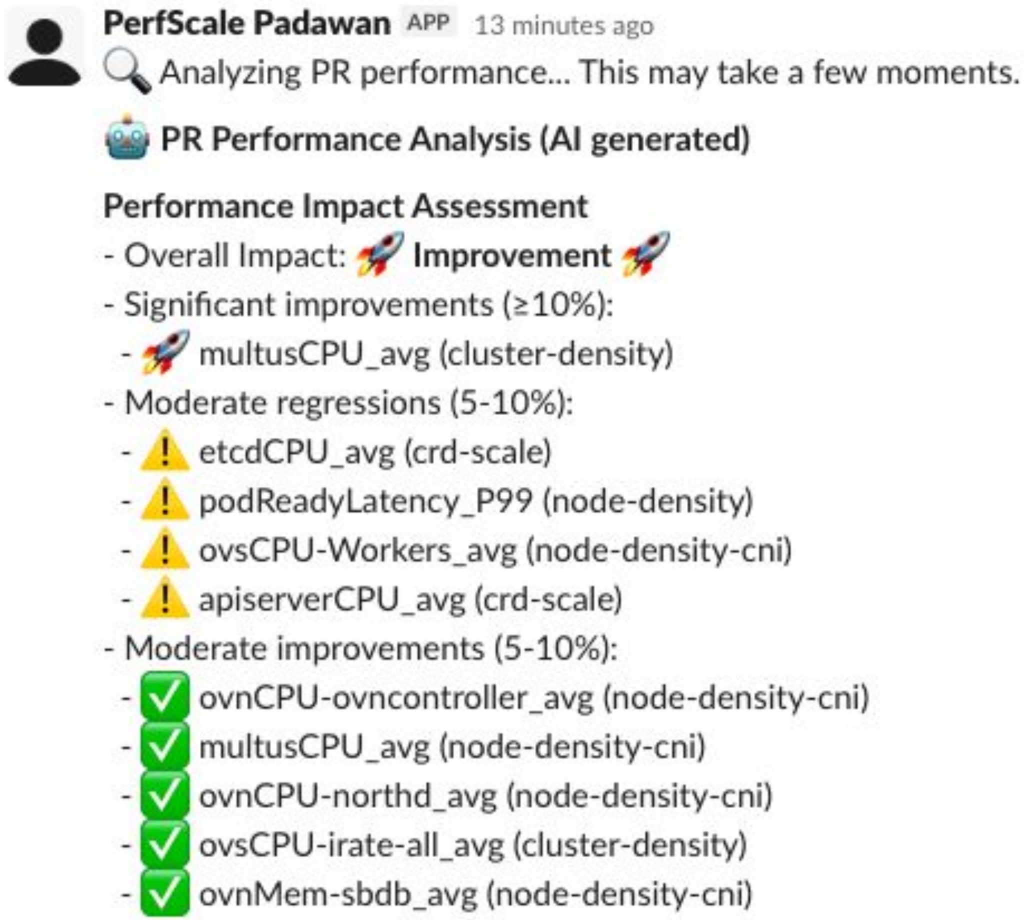
Select a provider to start a new conversation

Ready to use Claude AI. Start typing your message below.

TaskMaster AI is not configured

What tools are connected and provide a explanation for each tool.

# Orion-mcp slack integration



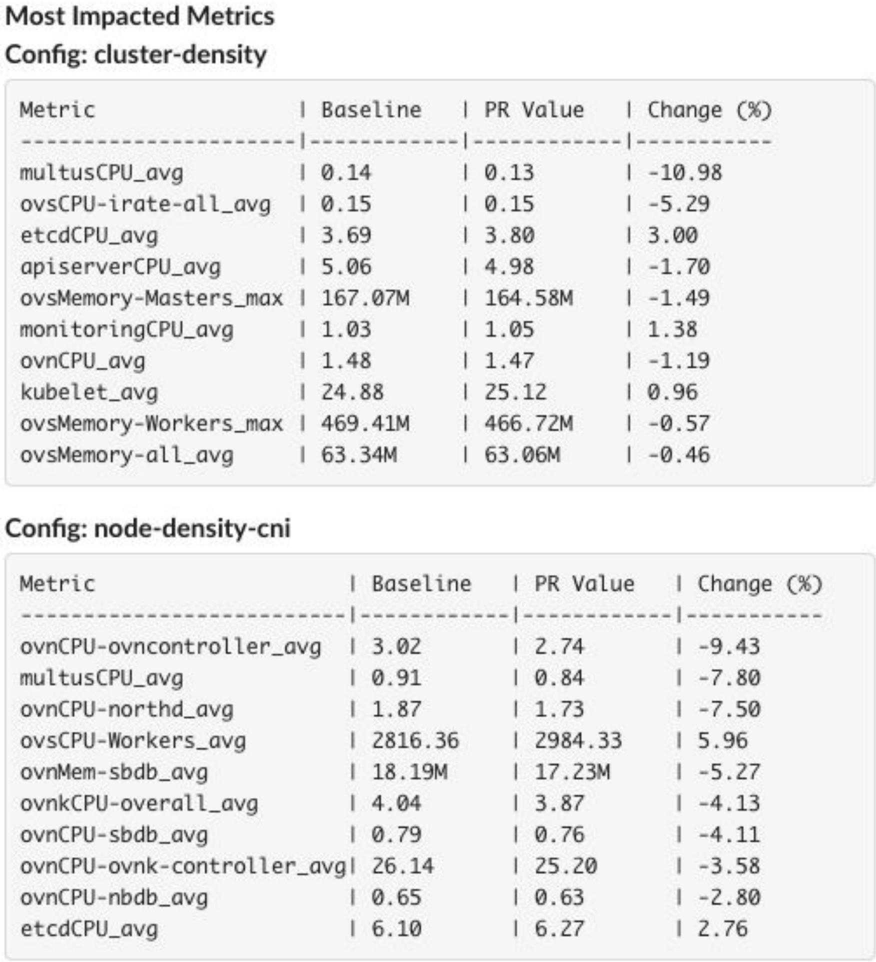
**PerfScale Padawan** APP 13 minutes ago

🔍 Analyzing PR performance... This may take a few moments.

🤖 **PR Performance Analysis (AI generated)**

**Performance Impact Assessment**

- Overall Impact: 🚀 **Improvement** 🚀
- Significant improvements (≥10%):
  - 🚀 multusCPU_avg (cluster-density)
- Moderate regressions (5-10%):
  - ⚠️ etcdCPU_avg (crd-scale)
  - ⚠️ podReadyLatency_P99 (node-density)
  - ⚠️ ovsCPU-Workers_avg (node-density-cni)
  - ⚠️ apiserverCPU_avg (crd-scale)
- Moderate improvements (5-10%):
  - ✅ ovnCPU-ovncontroller_avg (node-density-cni)
  - ✅ multusCPU_avg (node-density-cni)
  - ✅ ovnCPU-northd_avg (node-density-cni)
  - ✅ ovsCPU-irate-all_avg (cluster-density)
  - ✅ ovnMem-sbdb_avg (node-density-cni)



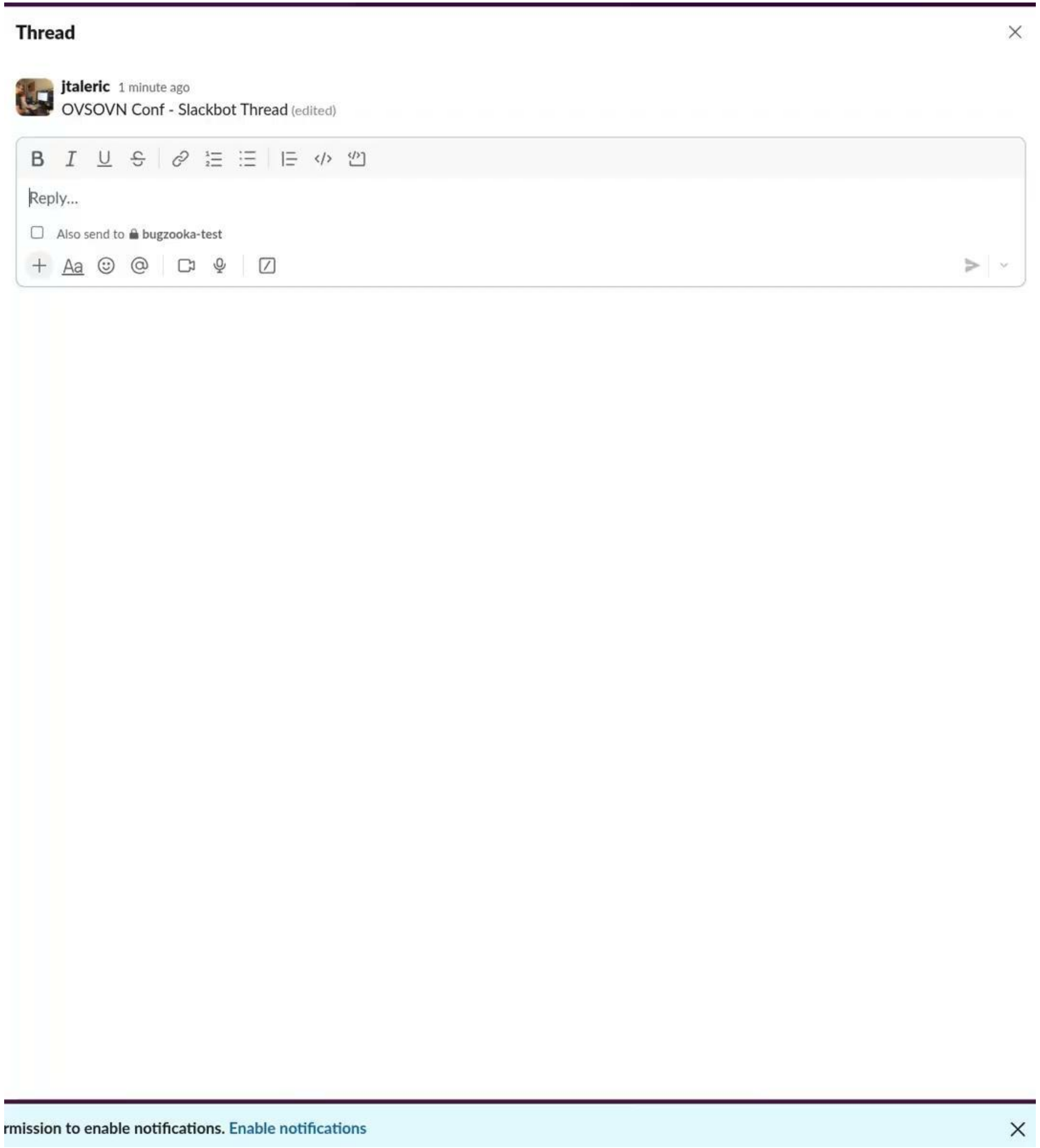
**Most Impacted Metrics**

**Config: cluster-density**

```
Metric                 | Baseline    | PR Value    | Change (%)
-----------------------|------------|------------|-----------
multusCPU_avg          | 0.14        | 0.13        | -10.98
ovsCPU-irate-all_avg   | 0.15        | 0.15        | -5.29
etcdCPU_avg            | 3.69        | 3.80        | 3.00
apiserverCPU_avg       | 5.06        | 4.98        | -1.70
ovsMemory-Masters_max  | 167.07M     | 164.58M     | -1.49
monitoringCPU_avg      | 1.03        | 1.05        | 1.38
ovnCPU_avg             | 1.48        | 1.47        | -1.19
kubelet_avg            | 24.88       | 25.12       | 0.96
ovsMemory-Workers_max  | 469.41M     | 466.72M     | -0.57
ovsMemory-all_avg      | 63.34M      | 63.06M      | -0.46
```

**Config: node-density-cni**

```
Metric                   | Baseline    | PR Value    | Change (%)
-------------------------|------------|------------|-----------
ovnCPU-ovncontroller_avg | 3.02        | 2.74        | -9.43
multusCPU_avg            | 0.91        | 0.84        | -7.80
ovnCPU-northd_avg        | 1.87        | 1.73        | -7.50
ovsCPU-Workers_avg       | 2816.36     | 2984.33     | 5.96
ovnMem-sbdb_avg          | 18.19M      | 17.23M      | -5.27
ovnkCPU-overall_avg      | 4.04        | 3.87        | -4.13
ovnCPU-sbdb_avg          | 0.79        | 0.76        | -4.11
ovnCPU-ovnk-controller_avg| 26.14       | 25.20       | -3.58
ovnCPU-nbdb_avg          | 0.65        | 0.63        | -2.80
etcdCPU_avg              | 6.10        | 6.27        | 2.76
```



Thread

jtaleric 1 minute ago
OVSOVN Conf - Slackbot Thread (edited)

Reply...

□ Also send to bugzooka-test

rmission to enable notifications. Enable notifications

# Orion-mcp metadata (wip)

> Show me the **ovsCPU workers usage** of the last 5 results of OCP 4.19 on the daily virtualization bare metal runs and display the **corresponding OVN, OVN-k8s and OVS versions**, without images.

| Run | ovsCPU workers | **OVN** | **OVN-k8s** | **OVS** | OCP |
|---|---|---|---|---|---|
| 1 (most recent) | 2904 | **25.09** | **1.1** | **3.11** | 4.21 |
| 2 | 2910 | **25.09** | **1.1** | **3.11** | 4.21 |
| 3 | 2897 | **25.03** | **1.0** | **3.11** | 4.20 |
| 4 | 2910 | **24.11** | **1.0** | **3.9** | 4.19 |
| 5 | 2900 | **24.11** | **1.0** | **3.9** | 4.19 |

# Challenges and next steps

- Consider adding to the ovn-ci tests one of our performance workloads to start identifying performance and scale issues **upstream** in ovn-kubernetes?
- **Agentic** AI workload for CPT
- Increase **test coverage**
  - I.e.: localnets, etc.
- More **metadata** context
- More/better **integrations**:
  - Slack
  - Github

# Thank you

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