Shifting Performance Engineering Left

Building Performance into the Development Lifecycle

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whoarewe

- **Joe Talerico** - 13 years in the Performance Team
- Worked on virt, SPEC, OpenStack, and OpenShift

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

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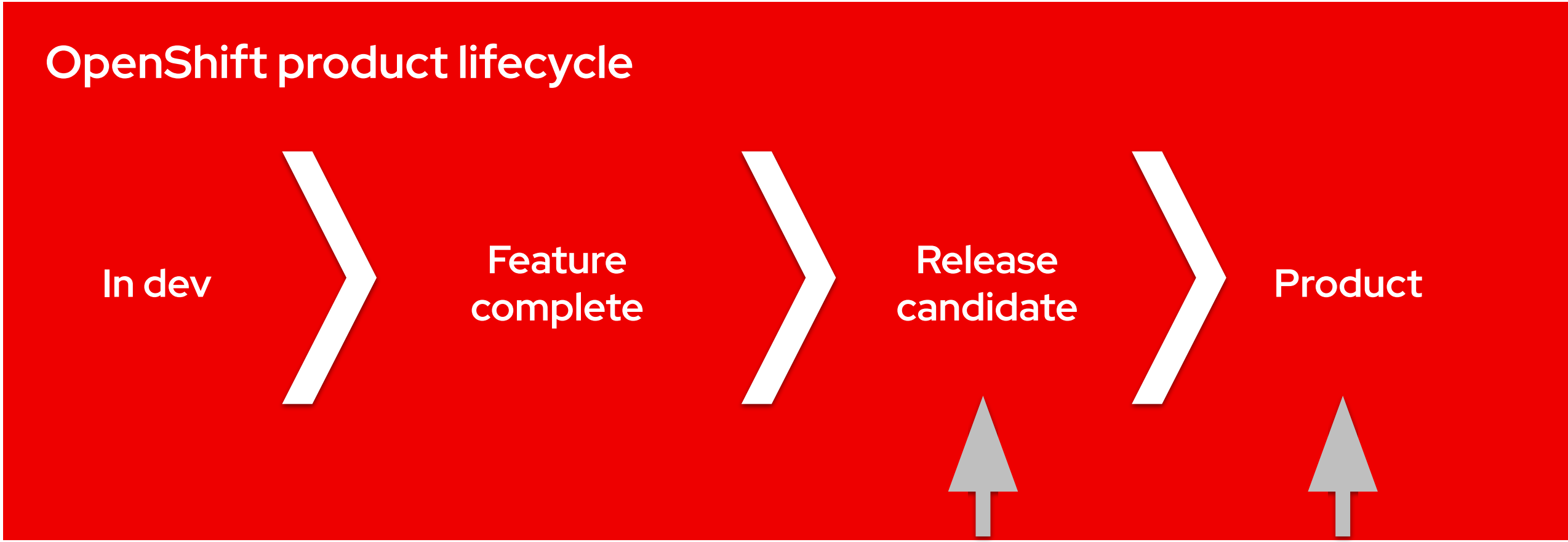
Agenda

1. The problem
2. Shift-left engineering
3. Continuous Performance Testing (CPT)
4. Workflow
5. Tooling
6. Real life case study
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



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

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What is CPT?

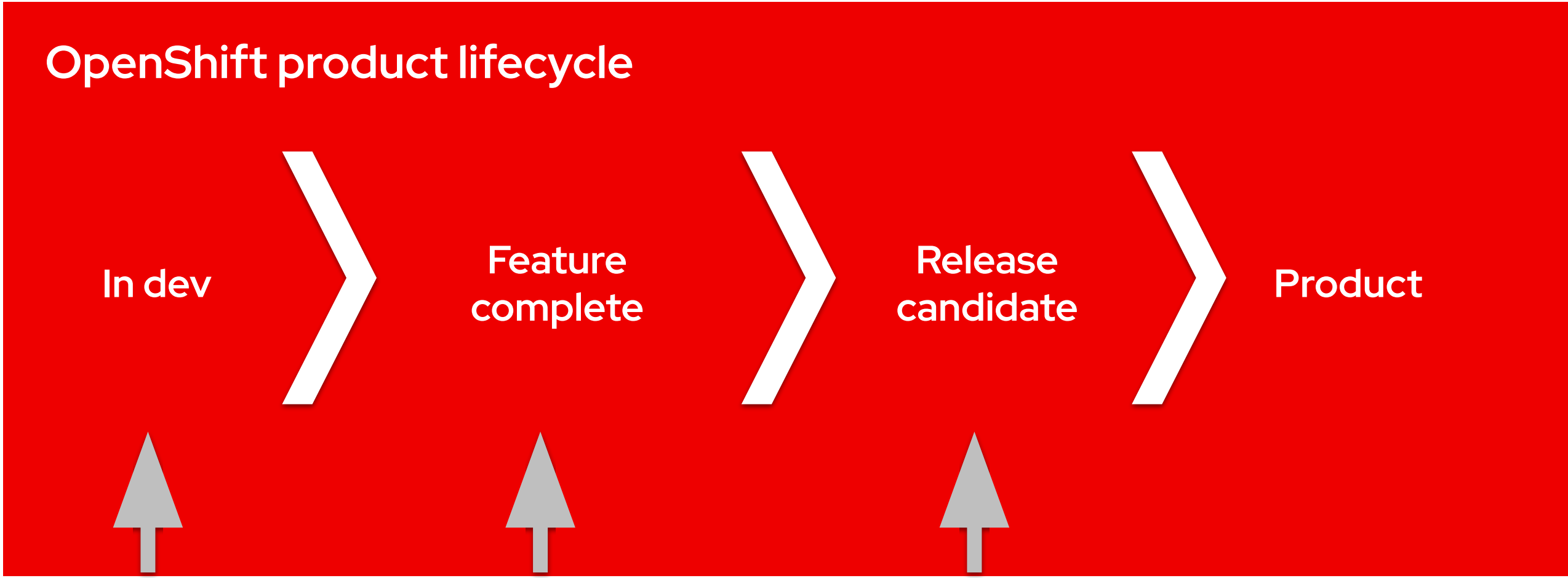
Continuous Performance Testing (CPT) is the practice of executing performance benchmarks (tests) continuously throughout the development lifecycle.

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.

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



Where we should fit in the development cycle

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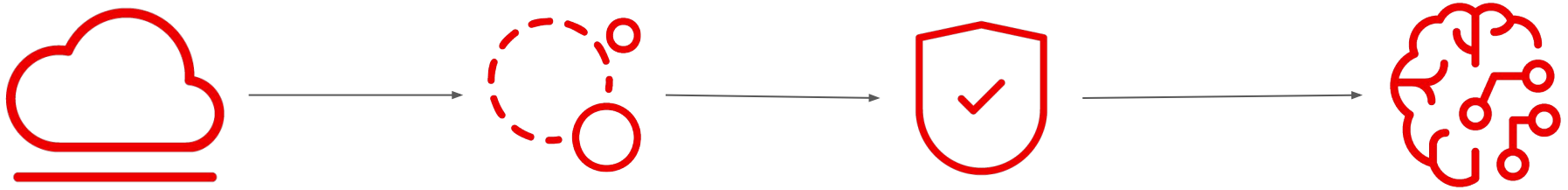
CPT – Cultural shift

- 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

CPT workflow



Deploy product

Run perf test

Store results

Perf regression analysis

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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

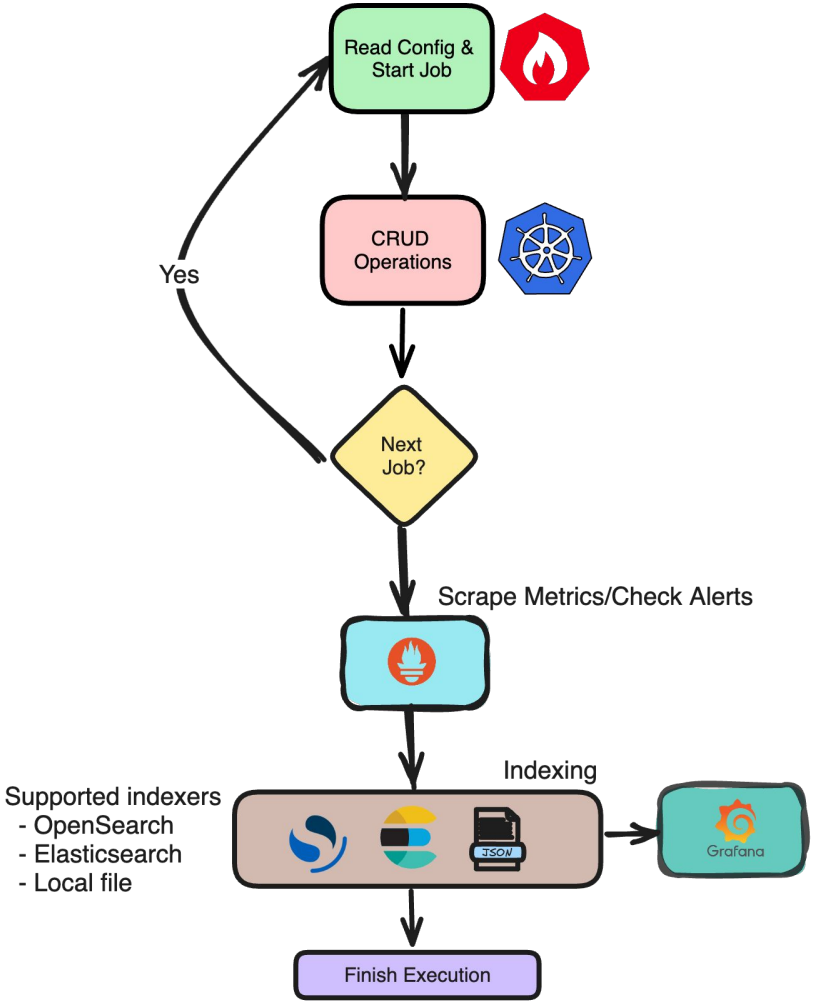
Covering nightly, early candidates, release candidates, stable releases and long term support

Platform +

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

Example Tooling

kube-burner



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Real life case study

time	uuid	buildUrl	readOnlyAPICallsLatency_max
2025-01-13 11:38:02 +0000	a485ef5b-..-e6d6b35532ca	https://prow...aws-4.19-..payload-control-plane-6nodes/1878744929488867328	0.984
2025-01-14 19:20:40 +0000	95446d27-..-f2d8d7d8ce27	https://prow...aws-4.19-..payload-control-plane-6nodes/1879221652647055360	0.984
2025-01-15 03:28:01 +0000	cc0b1a6d-..-68a59992b6b8	https://prow...aws-4.19-..payload-control-plane-6nodes/1879343743165796352	0.984
2025-01-15 07:43:23 +0000	20058cc2-..-7009402a6c13	https://prow...aws-4.19-..payload-control-plane-6nodes/1879411213251645440	0.976
2025-01-16 01:26:21 +0000	cdf21278-..-71782e3ab17e	https://prow...aws-4.19-..payload-control-plane-6nodes/1879675626953117696	0.984
2025-01-16 08:26:51 +0000	0b4d30e2-..-e056c094a622	https://prow...aws-4.19-..payload-control-plane-6nodes/1879784780980031488	0.984
2025-01-16 16:23:04 +0000	bfb0efa0-..-d1b0cda6dd41	https://prow...aws-4.19-..payload-control-plane-6nodes/1879902896481374208	0.9
2025-01-17 00:08:31 +0000	2d6b598f-..-64d5c98e4236	https://prow...aws-4.19-..payload-control-plane-6nodes/1880020138195947520	3.98
			+923.1% !!
2025-01-17 06:37:24 +0000	391817f4-..-557cd13bd32e	https://prow...aws-4.19-..payload-control-plane-6nodes/1880118891967942656	19.9
2025-01-17 11:39:51 +0000	db926aaf-..-da59c974574a	https://prow...aws-4.19-..payload-control-plane-6nodes/1880193587291885568	19.9
2025-01-17 18:23:02 +0000	5948ce33-..-94cc8cb517fb	https://prow...aws-4.19-..payload-control-plane-6nodes/1880291350289584128	3.94
2025-01-18 00:51:31 +0000	efa220e8-..-60e4876a3e52	https://prow...aws-4.19-..payload-control-plane-6nodes/1880388538206261248	19.6
2025-01-18 06:12:03 +0000	57aff787-..-28e24cf051f7	https://prow...aws-4.19-..payload-control-plane-6nodes/1880474335618011136	28.6
2025-01-18 12:57:00 +0000	11e53cf9-..-9f77ebfc9bdc	https://prow...aws-4.19-..payload-control-plane-6nodes/1880574934015545344	3.86
2025-01-18 18:16:42 +0000	82069eee-..-b3d06c2a1fa8	https://prow...aws-4.19-..payload-control-plane-6nodes/1880655151874707456	3.74

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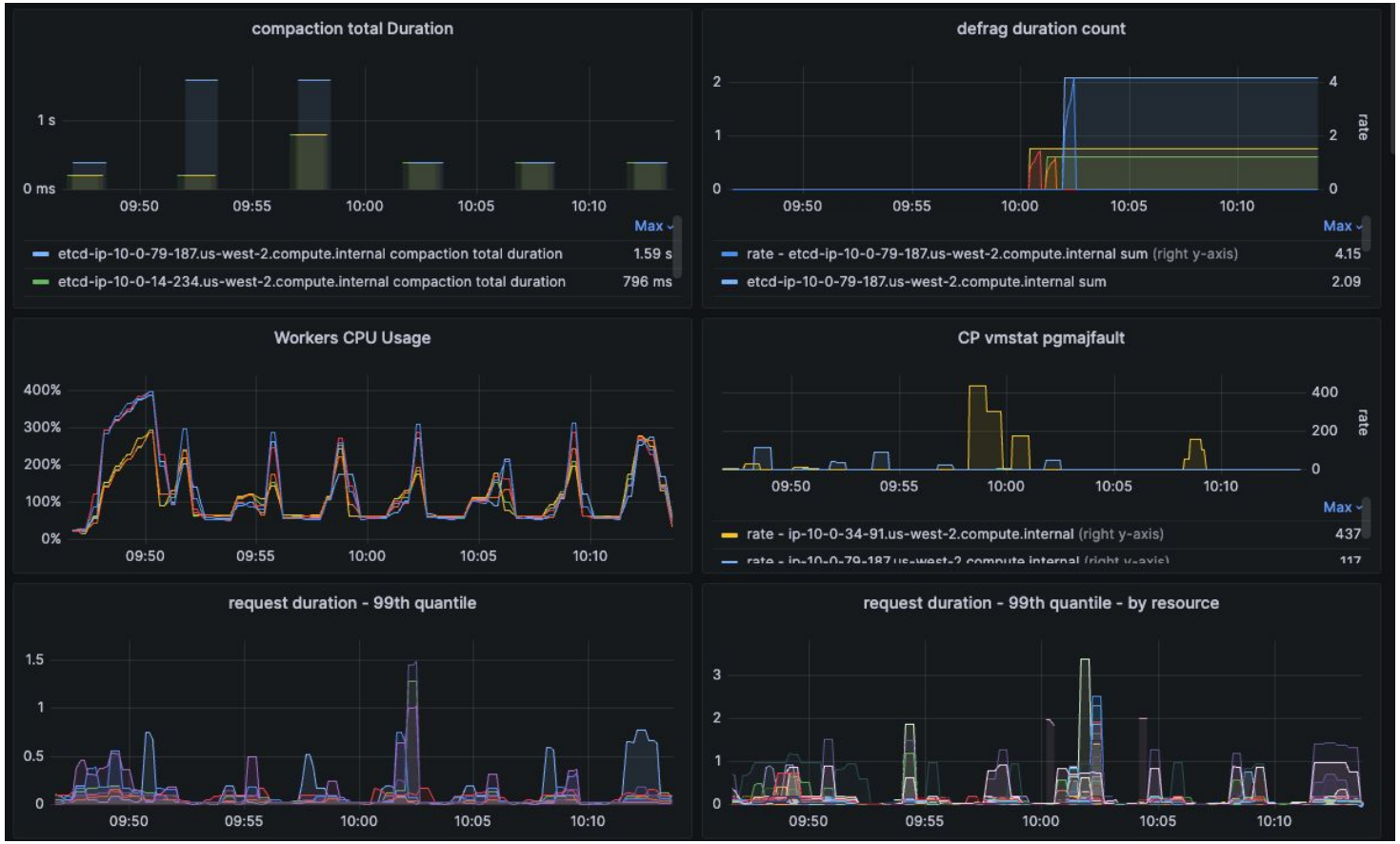
Real life case study



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Real life case study

- Look at changelog for the version in question
- Make a guess (RHCOS) at which OpenShift component changed
  - None of the other changes looked suspicious
- Confirm whether this change alone causes the issue
- Comparing RHCOS **good** (kernel 427) vs **bad** (kernel 570)
  - Separated by 143 builds
  - Forked in their own Z-streams (e.g. el9_4 and el9_6)
- Guess again: Pick the kernel

Real life case study

- Focus on one single build containing 618 commits
- Kernel team took bisection down through all commits to land on a single (or two) change(s)

The **madvise**() system call is used to give advice or directions to the kernel about the address range beginning at address *addr* and with size *size*. **madvise**() only operates on whole pages, therefore *addr* must be page-aligned. The value of *size* is rounded up to a multiple of page size. In most cases, the goal of such advice is to improve system or application performance.

MADV_RANDOM
Expect page references in random order. (Hence, read ahead may be less useful than normally.)

Challenges

- Resistance to change and lack of expertise
- Tooling integration issues
- We can only detect regressions on metrics we are tracking
- Avoid **duplicated testing**
  - Reduce redundant tested combinations
- Enable developers to **interpret** (and predict) performance results
  - Exploring the use of AI to help* analyze results

Solutions

Key principles to **navigate change**:

- Training
- Automation
- Establish a solid protocol for dealing with test failures and flakiness
- Champion roles

Roadmap – where to start

- Start with one service
- Educate teams on performance fundamentals
- Build integrated performance dashboards into CI/CD pipelines
- Include performance in code reviews

Food for thought:

- How can performance testing fit into your current sprint workflow?
- What's one thing you could shift left today?

Wrap up

1. Shift-left engineering
2. Continuous Performance Testing (CPT)
3. Workflow
4. Tooling
    a. kube-burner
5. Real life case study
    a. OCP → CoreOS → Kernel → syscall
6. Challenges and next steps

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