



**KubeCon**



**CloudNativeCon**

THE LINUX FOUNDATION



**AI\_dev**  
Open Source GenAI & ML Summit

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**China 2024**

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China 2024

# What if Your System Experiences an Outage?

Let's Build a Resilient Systems with Chaos Engineering



## Litmus

Maintainer @LitmusChaos  
(CNCF incubating)



CNCF Ambassador

# Agenda: What is this talk about



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- **Programming distributed applications is challenging**
- **The average cost of downtime**
- **Impact of outage**
- **What is Chaos Engineering**
- **LitmusChaos**
- **Talk is cheap. Show me the code. (demo)**

# Programming distributed applications is challenging



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**Andy Stanley** ✓

@AndyStanley

If you don't know why it's working when it's working, you won't know how to fix it when it breaks.

3:25 AM · May 23, 2019

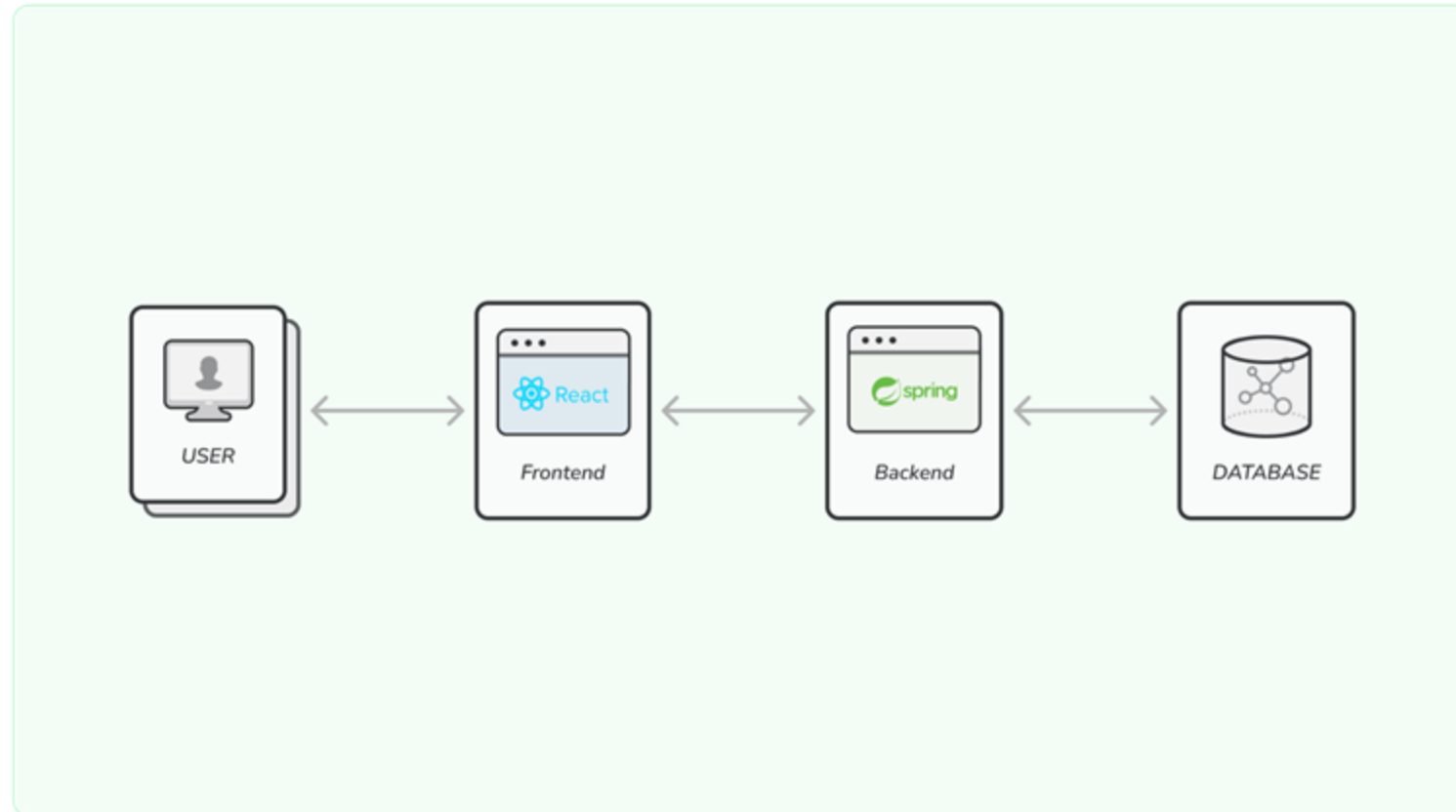
**179** Reposts   **11** Quotes   **750** Likes   **8** Bookmarks

<https://x.com/AndyStanley/status/1131264931297419264>



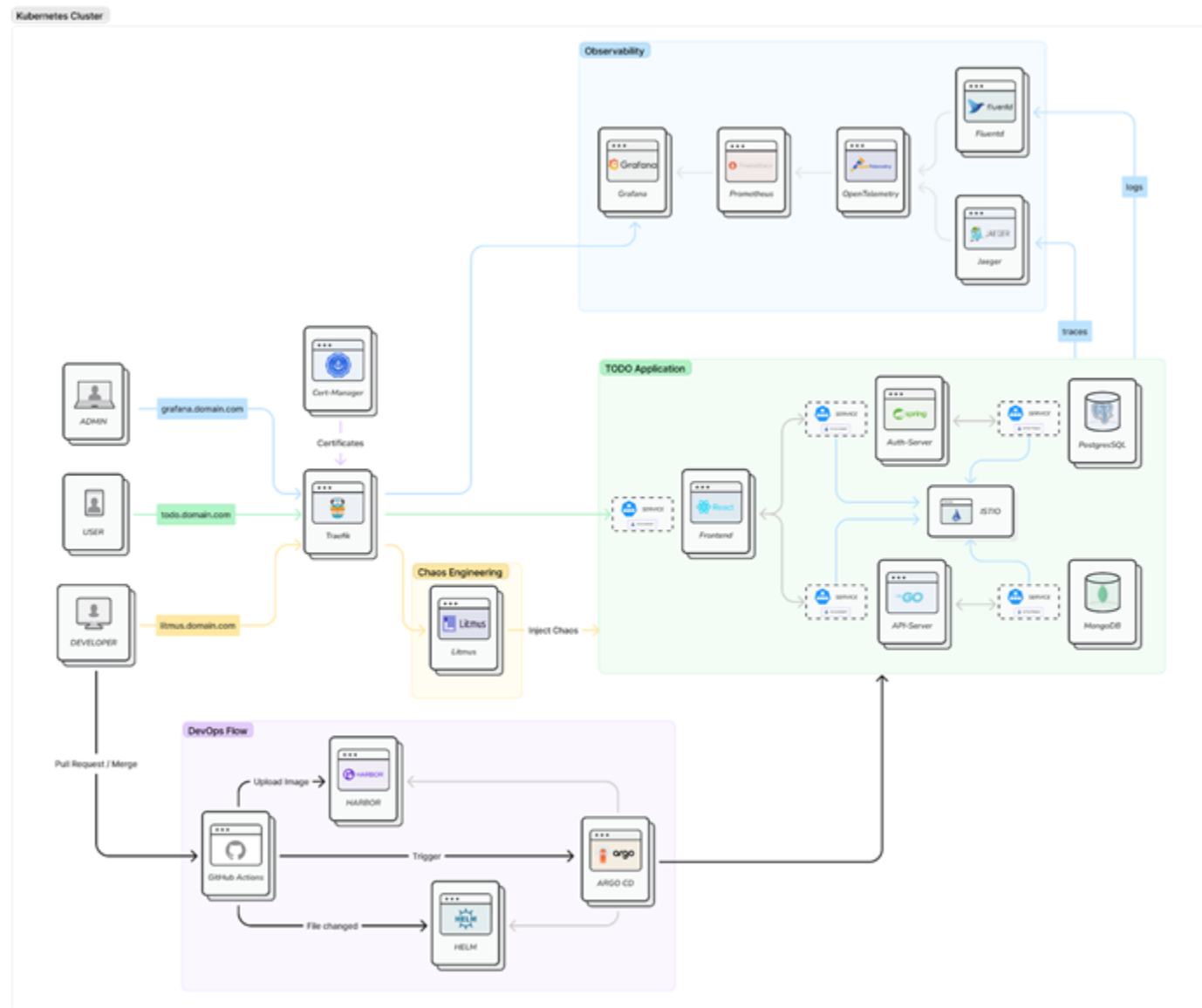
# Programming distributed applications is challenging

A long time ago...



# Programming distributed applications is challenging

Cloud native era..

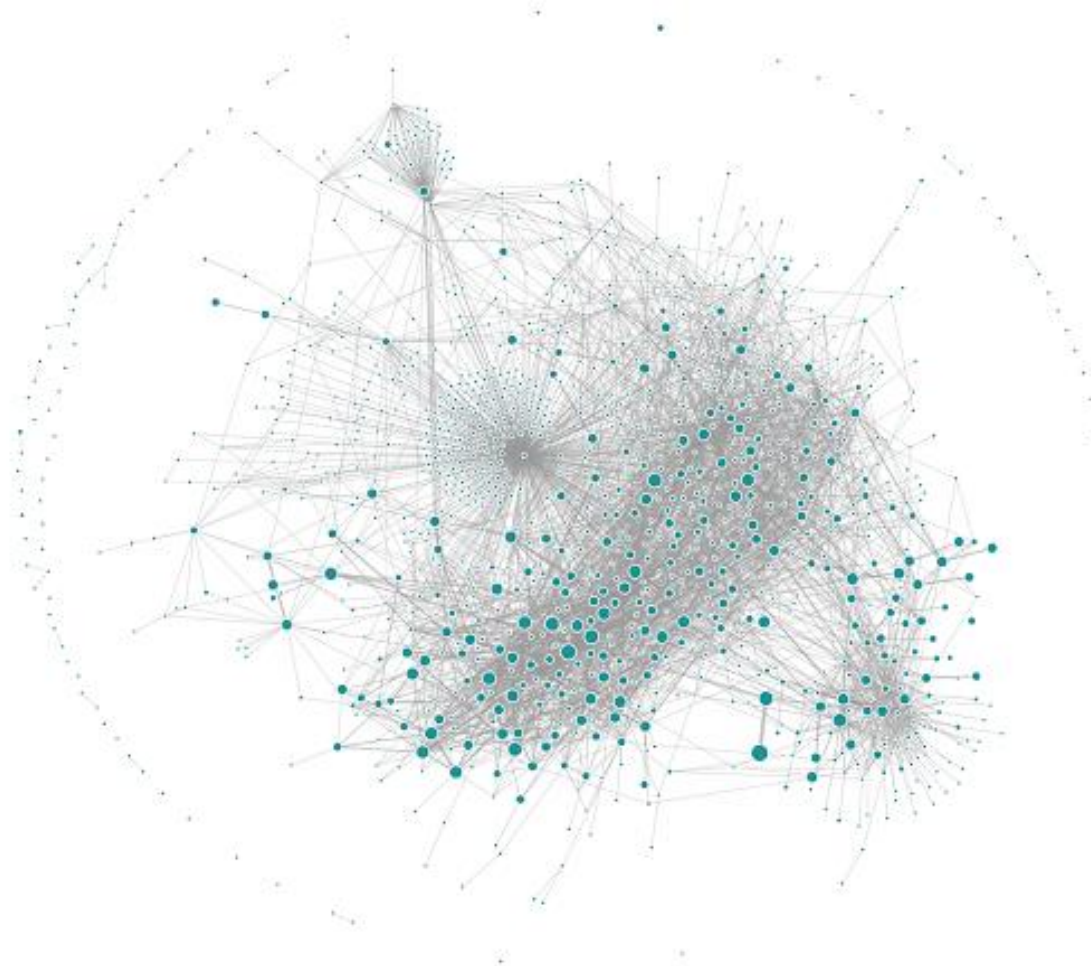


# Programming distributed applications is challenging



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Nowadays...



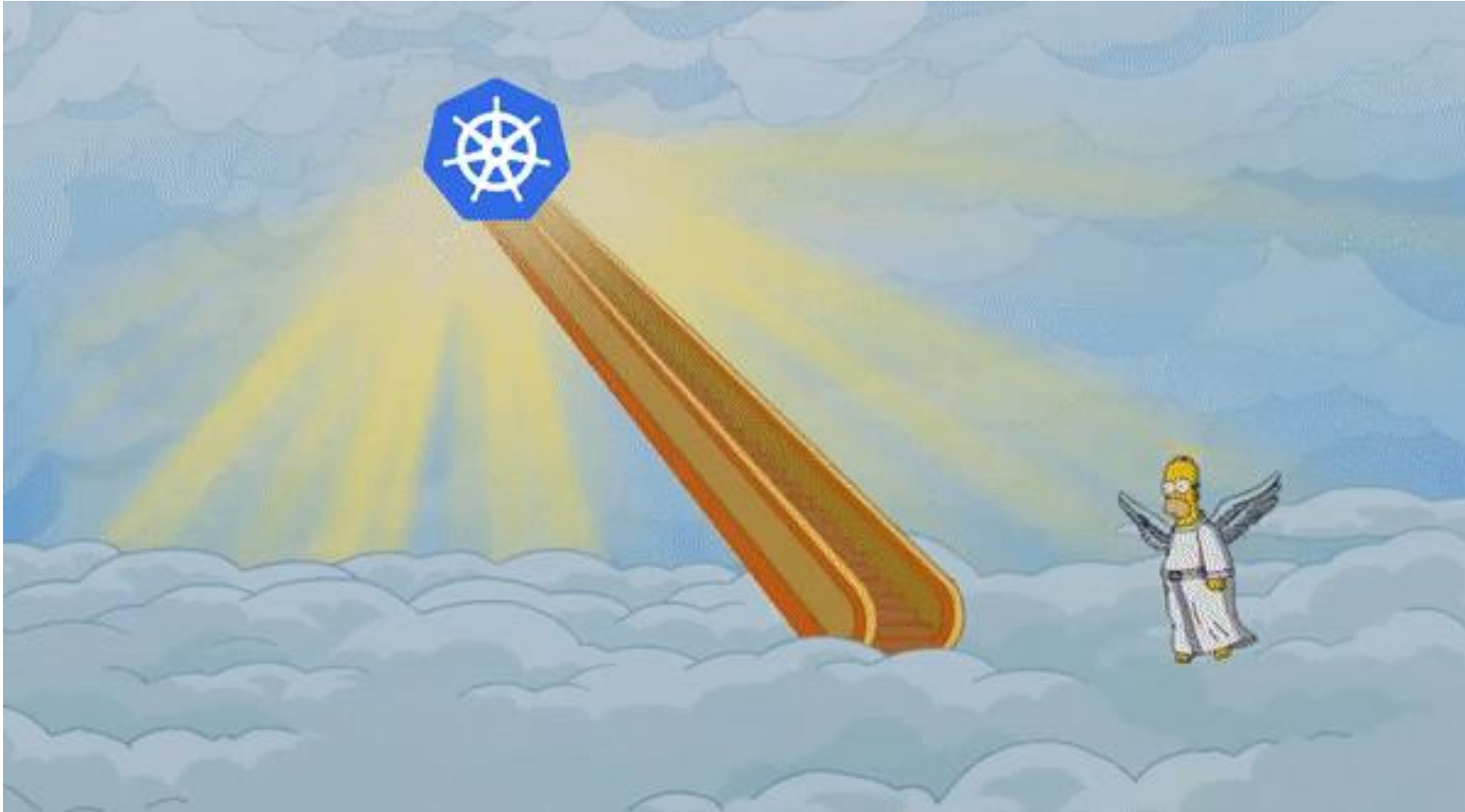
<https://www.uber.com/en-KR/blog/microservice-architecture/>



# Programming distributed applications is challenging



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<https://x.com/memenetes/status/1637861860039876624>

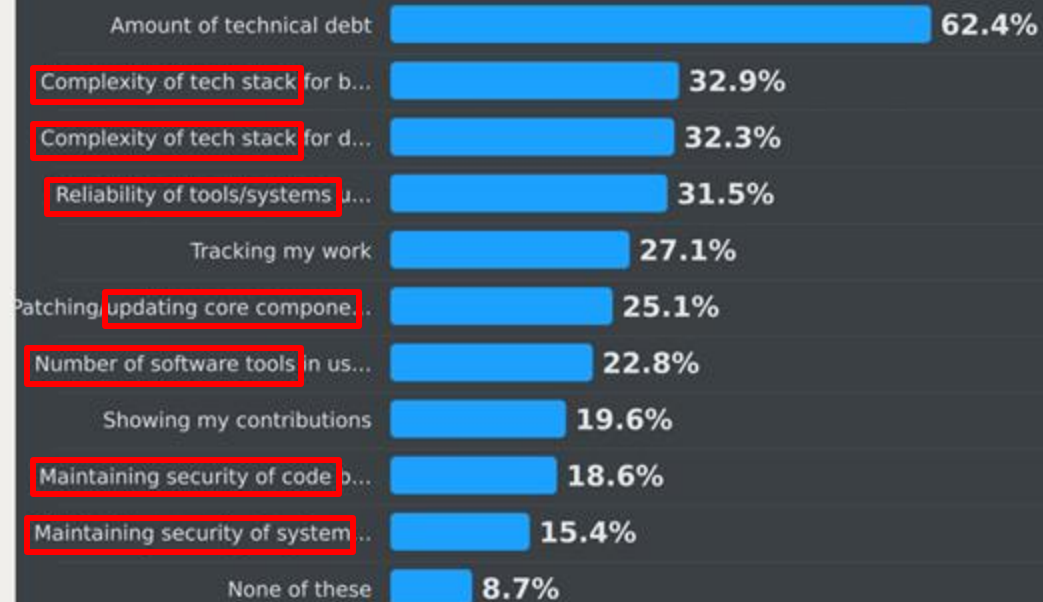
# Programming distributed applications is challenging



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Developer Experience / All Respondents

## Most common frustrations



Source: [survey.stackoverflow.co/2024](https://survey.stackoverflow.co/2024)  
Data licensed under Open Database License (ODbL)

<https://survey.stackoverflow.co/2024/professional-developers#developer-experience-frustration>

# The average cost of downtime



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**\$25k/h**

Small business

**\$540k/h**

large business

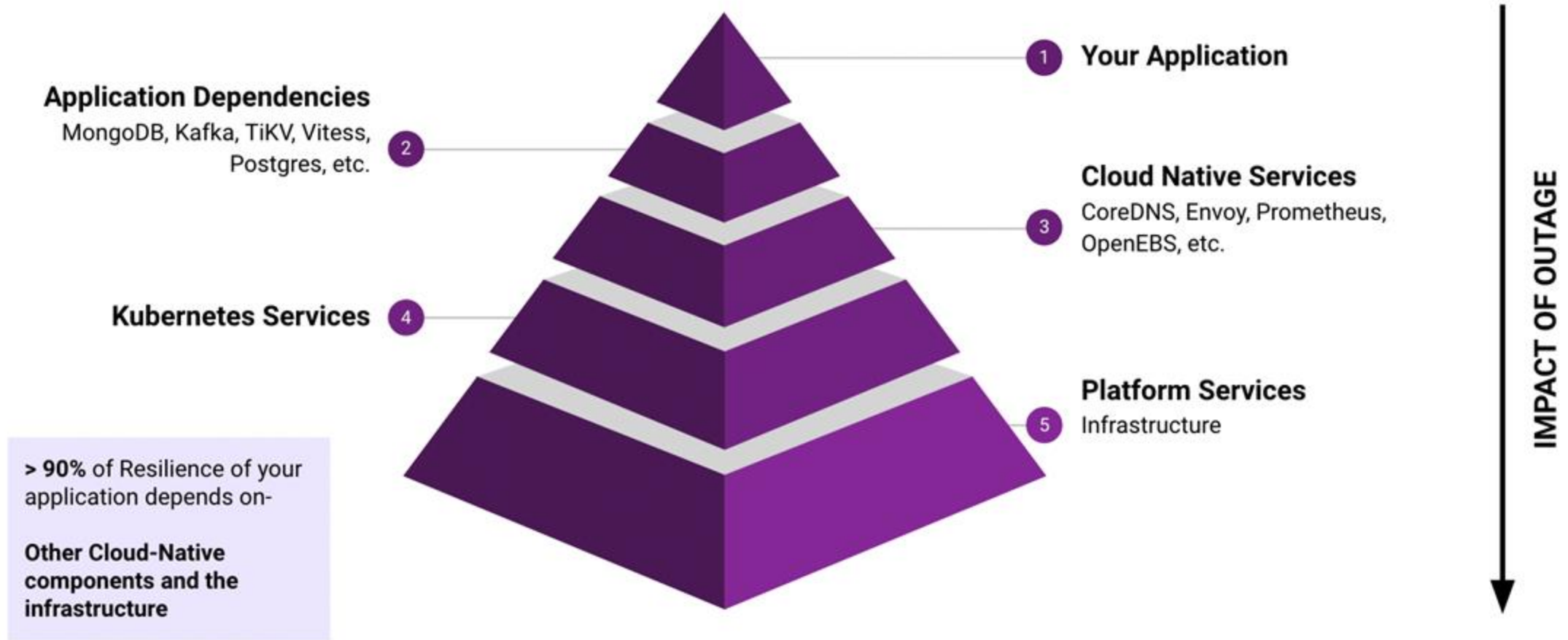
**\$1 million/h**

Fortune 1000 companies

# Impact of outage



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# Here comes chaos engineering!



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We need to identify **weaknesses** before they manifest in system-wide, aberrant behaviors.



# What is Chaos Engineering



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**“Chaos Engineering** is the discipline of experimenting on a system in order to build confidence in the system’s capability to withstand turbulent conditions in production.”

—Principles of Chaos Engineering

# What is Chaos Engineering



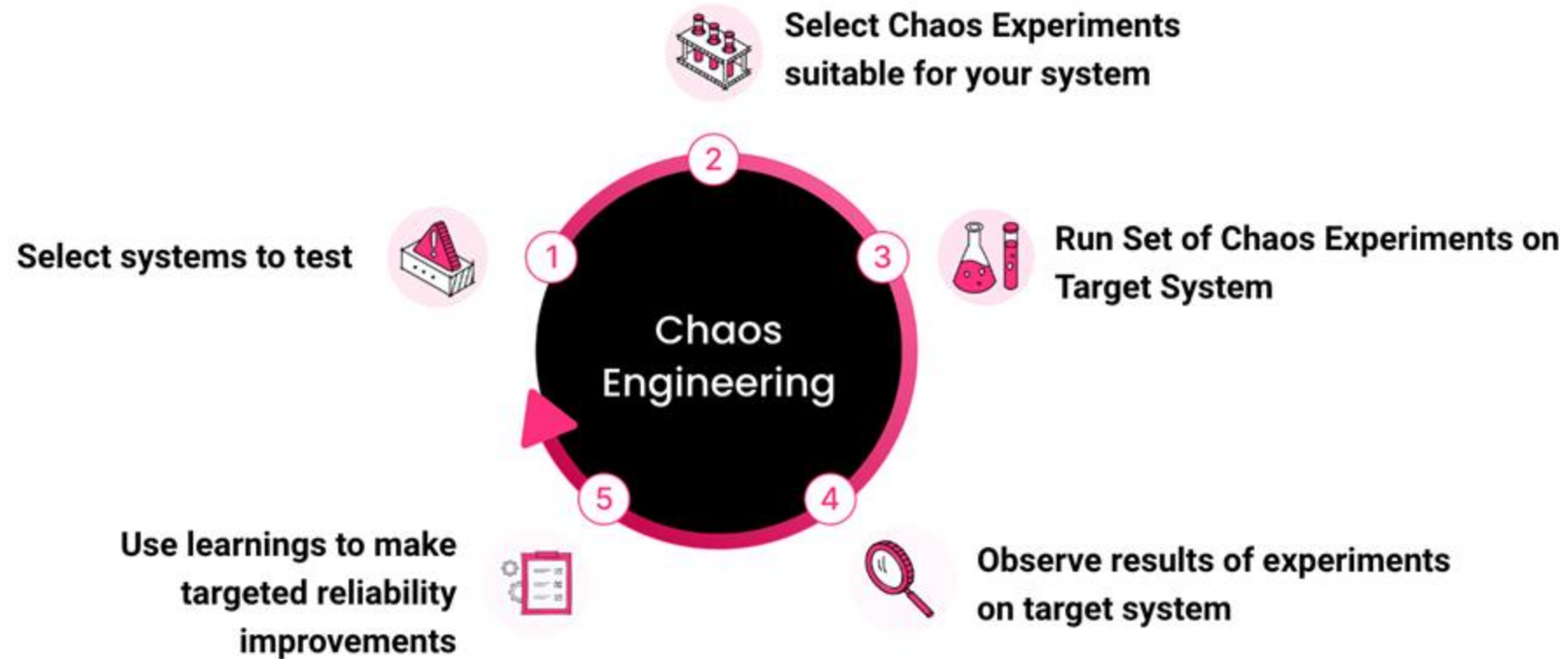
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Chaos Engineering enables teams to identify weaknesses & potential outages in infrastructures by inducing chaos tests in a **controlled way**.

# What is Chaos Engineering



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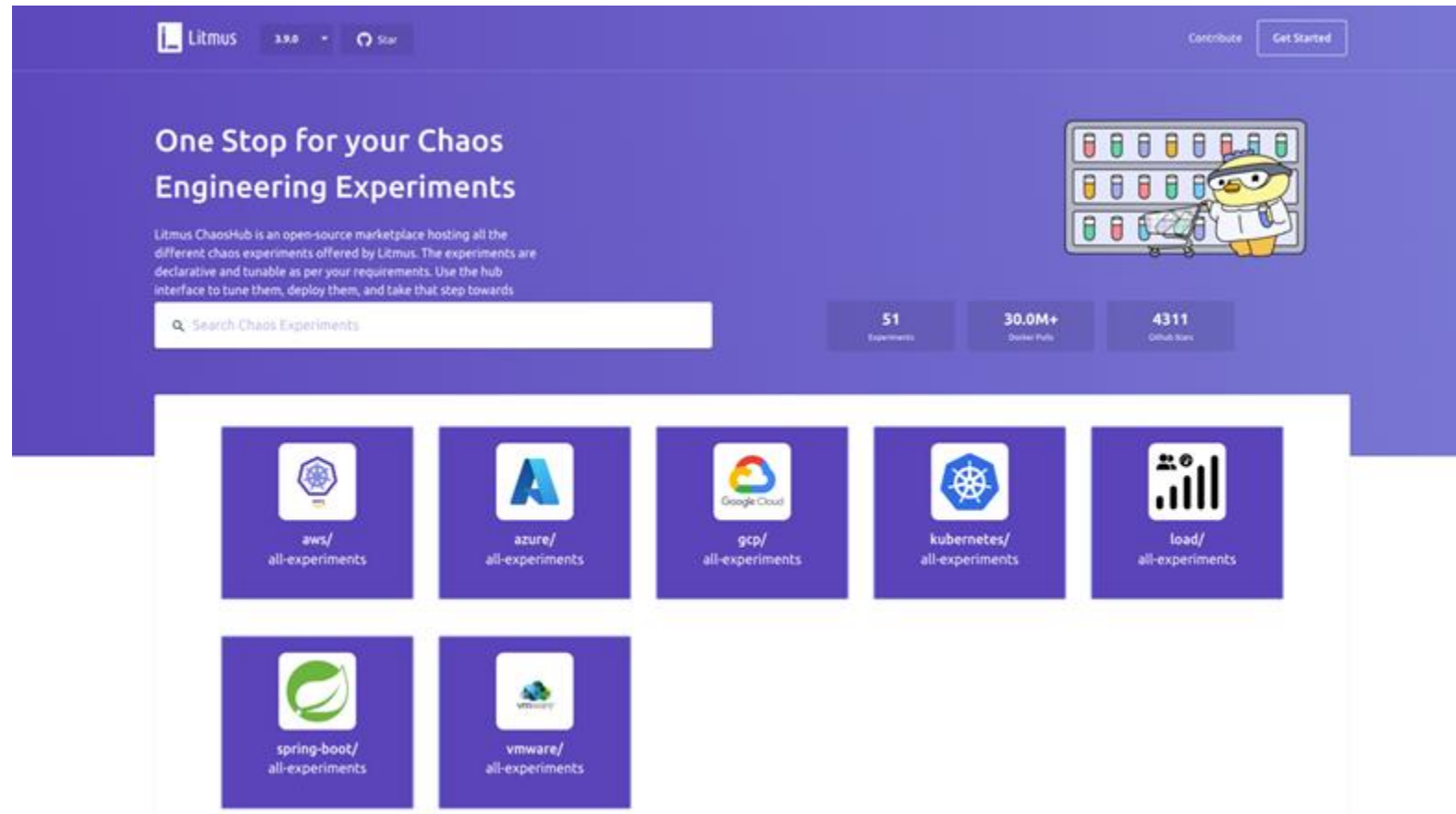
<https://docs.litmuschaos.io/docs/introduction/usage>



# Litmus

**LitmusChaos** is an Open Source Cloud-Native Chaos Engineering Framework with cross-cloud support. It is a CNCF incubating project with adoption across several organizations

Litmus has 50+ experiments, supports Kubernetes, Cloud Vendor(AWS, GCP, Azure) and Application(Spring, k6) chaos!





# Talk is cheap. Show me the code.



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## GitHub Repo



# Key Open Sources used in Demo



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## Distributed Application Runtime



**Dapr** is a portable, event-driven runtime that makes it easy for any developer to build resilient, stateless and stateful applications that run on the cloud and edge and embraces the diversity of languages and developer frameworks.

## Load testing



**Grafana k6** is an open-source, developer-friendly, and extensible load testing tool. k6 allows you to prevent performance issues and proactively improve reliability.

# Key Open Sources used in Demo



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## Monitoring



**Prometheus** is an open-source systems monitoring and alerting toolkit. Prometheus collects and stores its metrics as time series data, i.e. metrics information is stored with the timestamp at which it was recorded, alongside optional key-value pairs called labels.

## Developer Portal

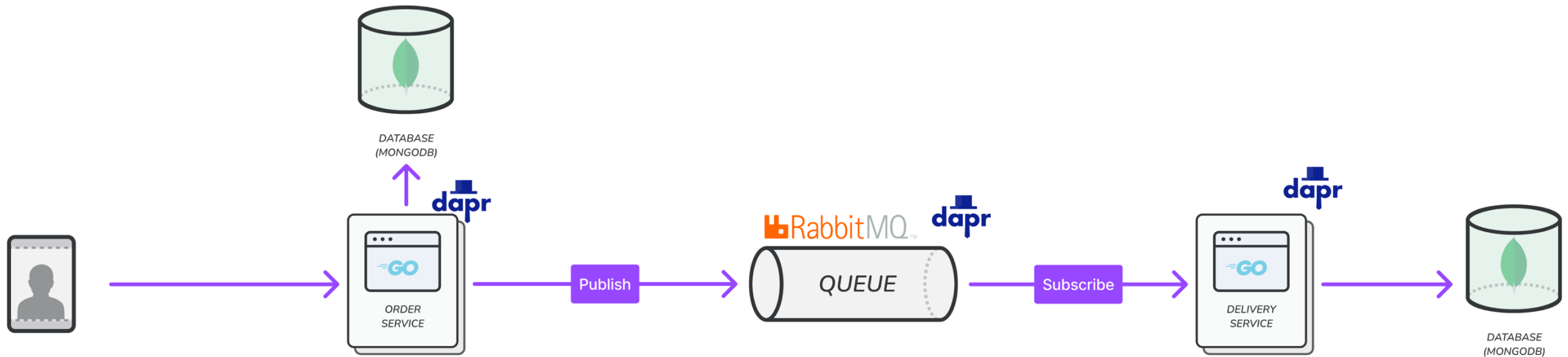


**Backstage** is an open source framework for building developer portals. Powered by a centralized software catalog, Backstage restores order to your microservices and infrastructure and enables your product teams to ship high-quality code quickly without compromising autonomy.

# Demo Scenario

A simple order and delivery app

- Using message queue
- Using dapr (easy to make microservice)



# Demo - Version 1



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```
{  
  _id: ObjectId('66baf429344a55e434f0047f'),  
  orderID: 'a8c456e1-26e4-465b-bd56-ce0636a8391e',  
  isDelivered: false  
}
```

by



Updated when delivery app received pub/sub messages

```
{  
  _id: ObjectId('66baf429344a55e434f0047f'),  
  orderID: 'a8c456e1-26e4-465b-bd56-ce0636a8391e',  
  isDelivered: true  
}
```

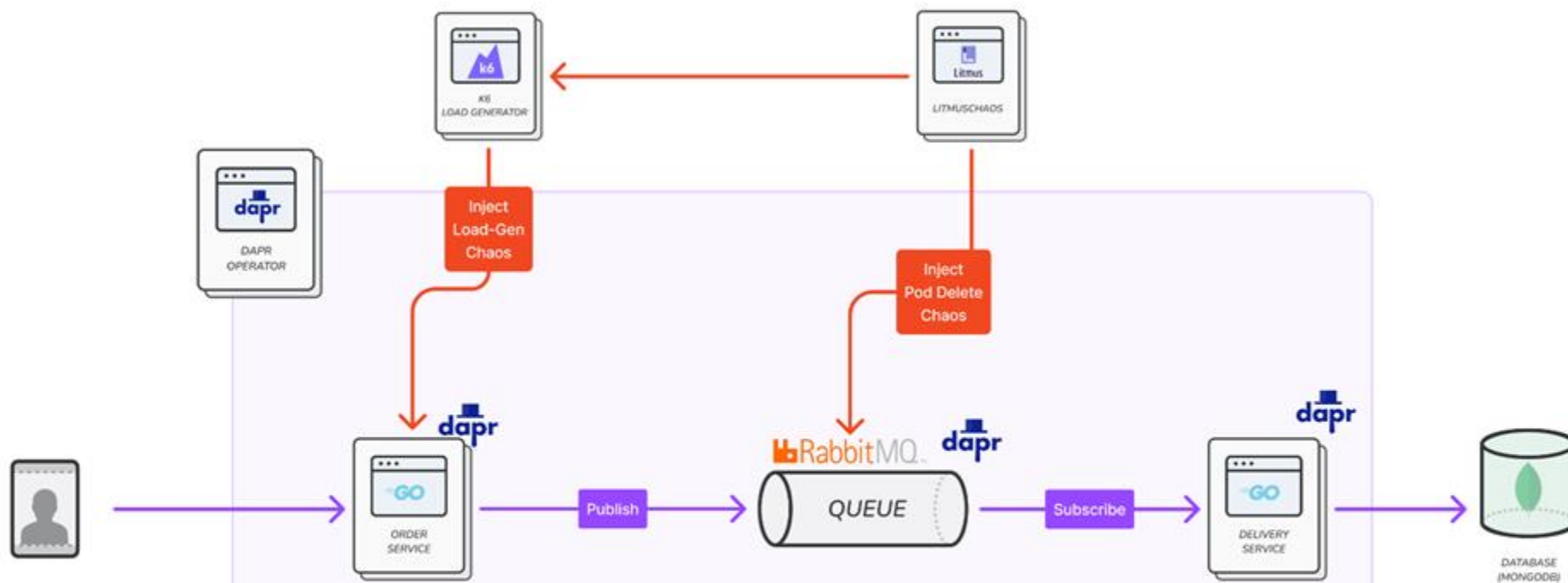
by





# Demo - Version 1

v1



# Demo - Chaos Engineering Plan



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## Hypothesis

When sending **100 requests per second** to the order app, **all messages should be delivered** to the delivery app **without loss**, even if the message queue pod is randomly deleted.

# Demo - Chaos Engineering Plan



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## Hypothesis

Load testing (100 req / s)

-> Steady state: All data must have "isDelivered" set to true. (Use a cmd chaos)

Message queue pod delete

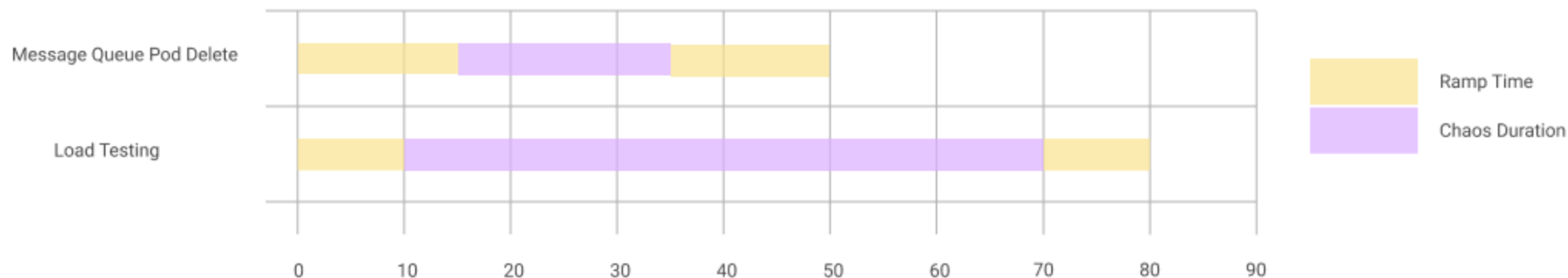
-> Steady state: Should be re-created after one of the pods is deleted. (Use a http probe)

# Demo - Chaos Engineering Plan



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## Testing plan



# Demo - Version 1



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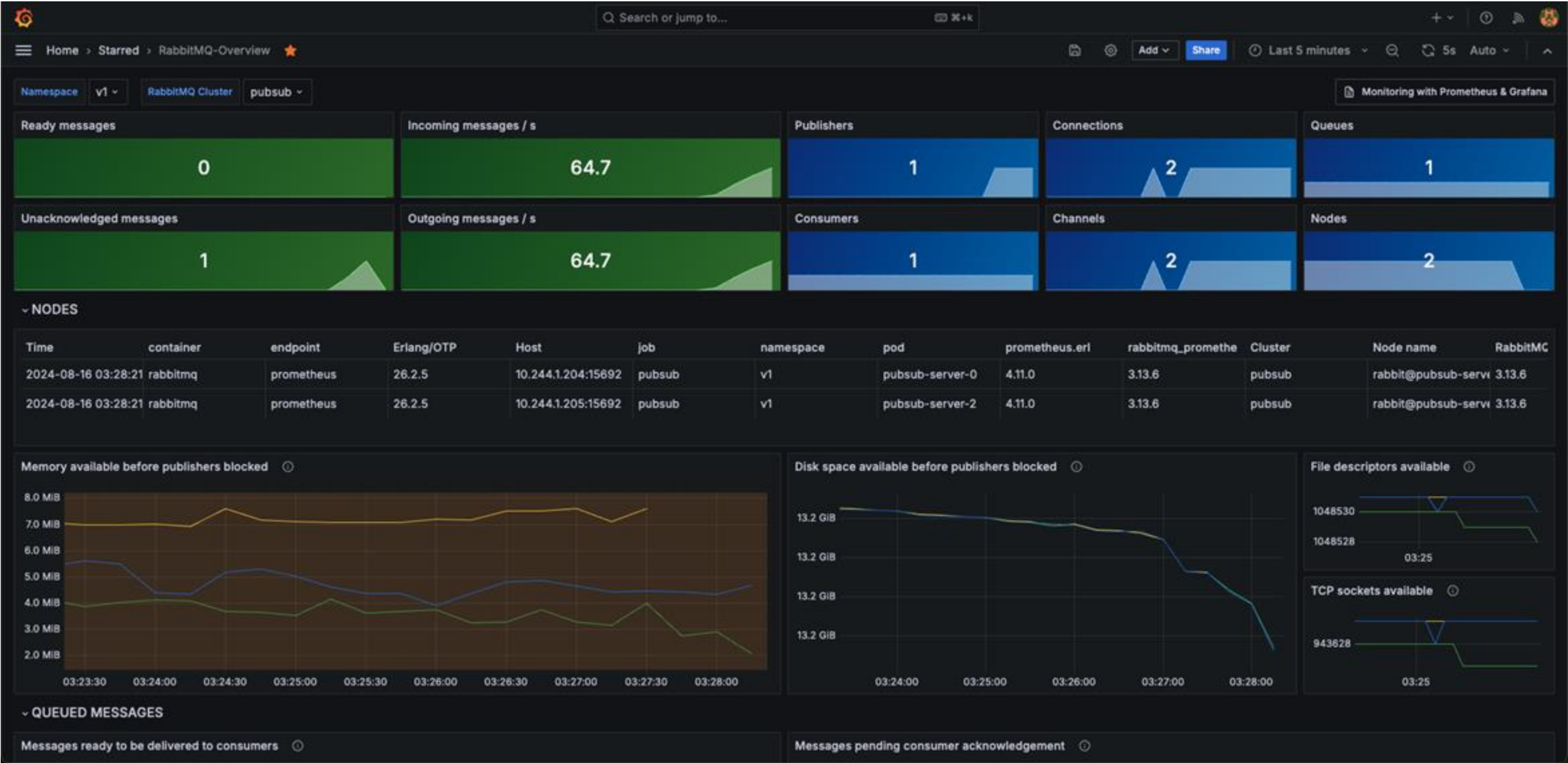
**Let's Chaos** 🔥 🔥



# Demo - Version 1



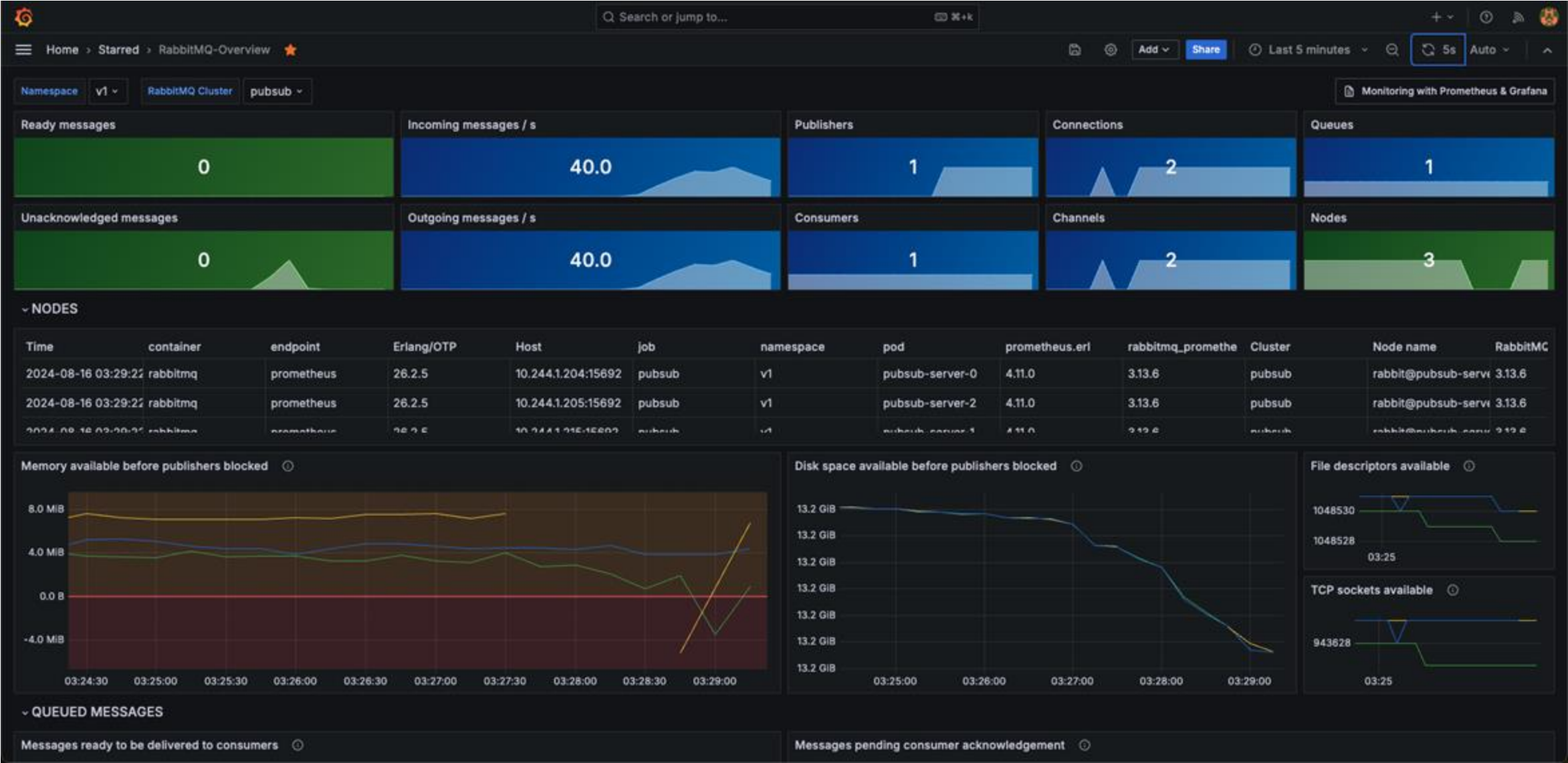
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# Demo - Version 1



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# Demo - Version 1



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Litmus

Project

admin-project >

Overview

Chaos Experiments

Environments

Resilience Probes

ChaosHubs

PROJECT SETUP

ADMIN

Litmus 3.0

My Project > Chaos Experiments > test1 >

test1

(Execution ID: 15)

COMPLETED

Hosted on Infrastructure: testt

Duration 16 Aug 2024, 03:26 - 03:30 3m 34s

install-chaos-faults

↓

k6-loadgen-63q

↑

pod-delete-gtu

↺

cleanup-chaos-resources

↻

Resilience Score

50%

Fault: k6-loadgen-63q

COMPLETED

Probe Result (Total 1)

0 Passed

1 Failed

Duration: 16 Aug 2024, 03:26 - 03:29 3m 4s

Namespace: litmus

Probes

Logs

Fault Configuration

assert-v1

Type cmdProbe

Mode EOT

FAILED

Probe Summary

Actual value: 9. Expected value: should be equal to 0

View Probe Details

View Probe Properties

Run

Edit

Clone

Download Manifest

## What's the problem of V1?

- The order service fails to publish messages when the queue pod is deleted.
- When a message queue pod is deleted, the stored messages are deleted with it and cannot be recovered.

# Demo - Shift to Version 2



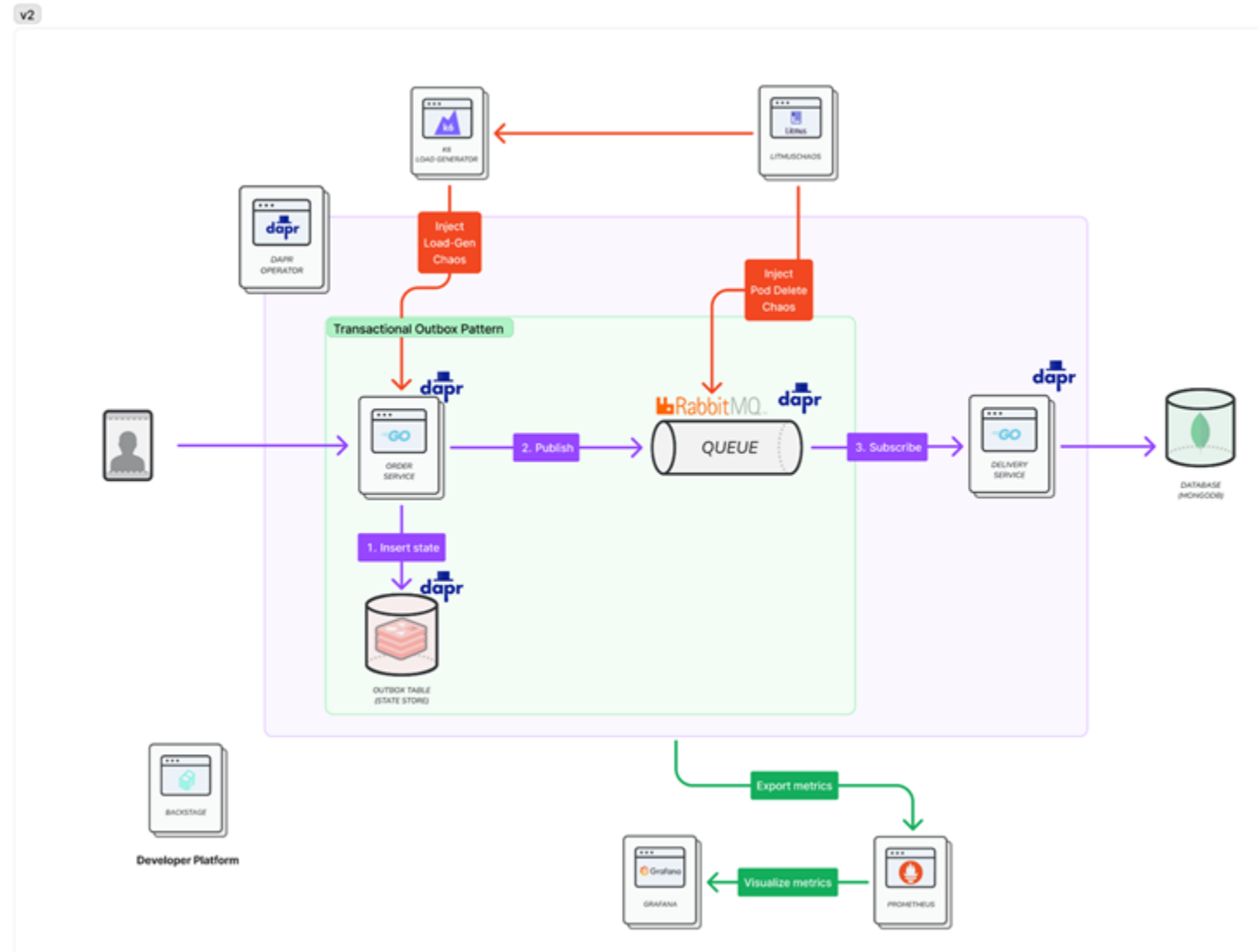
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## What's changed

- The order service fails to publish messages when the queue pod is deleted.
  - > Adopted a transactional outbox pattern ([Dapr supports!](#))
- When a message queue pod is deleted, the stored messages are deleted with it and cannot be recovered.
  - > Deployed RabbitMQ as a high-availability mode (Queue Mirroring)



# Demo - Version 2



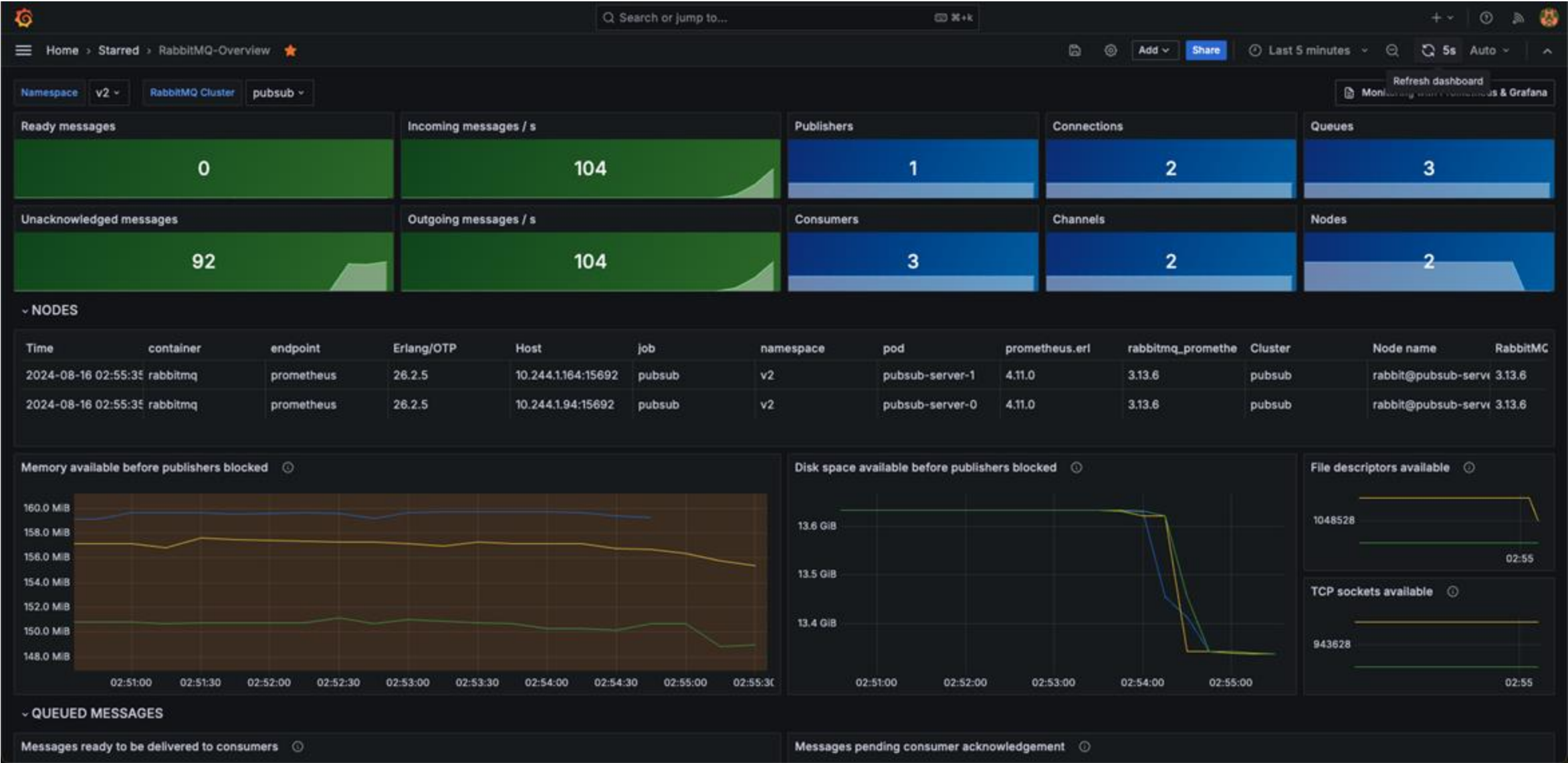


**Let's Chaos Again 🔥🔥**

# Demo - Version 2



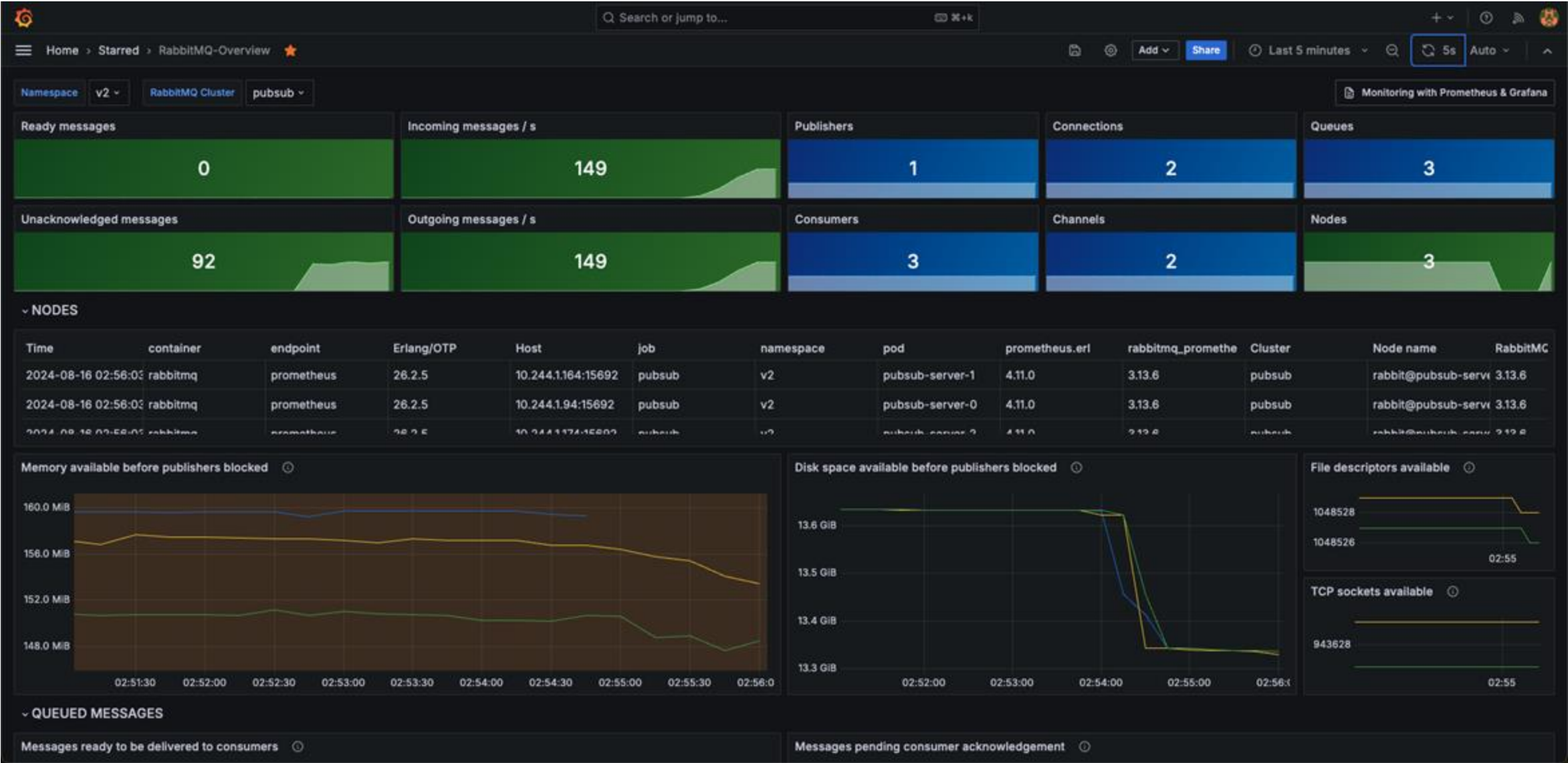
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# Demo - Version 2



China 2024



# Demo - Version 2



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Litmus

Project

admin-project

Overview

Chaos Experiments

Environments

Resilience Probes

ChaosHubs

PROJECT SETUP

ADMIN

My Project > Chaos Experiments > test2 >

**test2** (Execution ID: 18) COMPLETED

Hosted on infrastructure: testt | Duration 14 Aug 2024, 18:13 - 18:17 3m 43s

Resilience Score

100%

Fault: k6-loadgen-o7f COMPLETED

Probe Result (Total 1) 1 Passed 0 Failed

Duration: 14 Aug 2024, 18:13 - 18:16 3m 2s

Namespace: litmus

Probes

Logs

Fault Configuration

assert-v2

Type cmdProbe

Mode EOT

PASSED

Probe Summary

Actual value: '0'. Expected value: '0'

View Probe Details

View Probe Properties

# How about Backstage?



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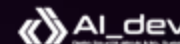
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**We can manage all of things at once with Backstage 😎**



# How about Backstage?



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Backstage

Search

Home

APIs

Docs

Create...

Settings

About

<> VIEW SOURCE

VIEW TECHDOCS

DESCRIPTION

No description

OWNER

guests

SYSTEM

examples

TYPE

website

LIFECYCLE

experimental

TAGS

No Tags

Dashboards

TITLE	FOLDER
Dapr Sidecar Dashboard	dapr
Dapr System Services Dashboard	dapr
RabbitMQ-Overview	dapr

Litmus

EXPERIMENT RUNS

CHAOSHUBS

INFRAS

EXPERIMENTS

GITOPS

Go to Dashboard →

Search or jump to...

Sign in

Home > D... > dapr > RabbitMQ-Overv...

Namespace v2

RabbitMQ Cluster

pubsub

Monitoring with Prometheus & Grafana

Ready messages	Incoming message...	Publishers	Connecti...	Queues
0	95.1	1	2	4
Unacknowledged ...	Outgoing message...	Consumers	Channels	Nodes
100	95.1	3	2	3



# How about Backstage?



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Backstage

Search

Home

APIs

Docs

Create...

Settings

pubsub ☆

guests experimental

OVERVIEWLITMUSCI/CDDEPENDENCIESDOCS

Dev Info

Experiment Docs

Litmus API Docs

Litmus Docs

Litmus ChaosHub

Litmus Community

Chaos Hubs

NAME	EXPERIMENTS	FAULTS
Litmus ChaosHub	10	51
custom	10	51

Environments

NAME	TYPE	IS_REMOVED	INFRA
ttt	pre-prod	false	1

Experiments

NAME	NEXT RUN	RECENT EXPERIMENT RUNS	INFRA
test1	Non-Cron	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>	testt
test2	Non-Cron	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>	testt



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**Thank you!**