ClickHouse

Rollout Automation with Temporal

How to upgrade 1000+ ClickHouse Clusters

July / 2024

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01 ClickHouse Cloud

What is “ClickHouse Cloud” and how does it work behind the scenes?

What is ClickHouse?

Open source

- Developed since 2009
- OSS 2016
- 35k+ Github stars
- 1k+ contributors
- 300+ releases

column-oriented

- Best for aggregations
- Files per column
- Sorting and indexing
- Background merges

distributed

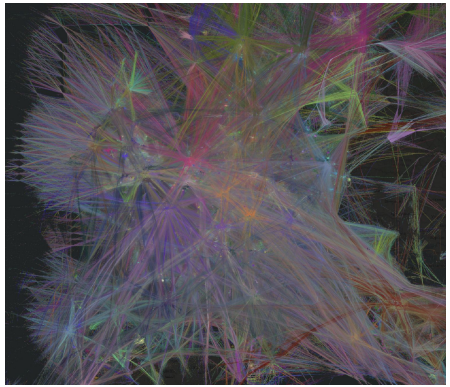
- Replication
- Sharding
- Multi-master

OLAP database

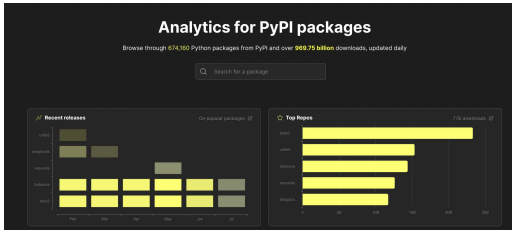
- Analytics use cases
- Aggregations
- Visualizations
- Mostly immutable data

What is ClickHouse?

adsb.exposed



clickpy.clickhouse.com



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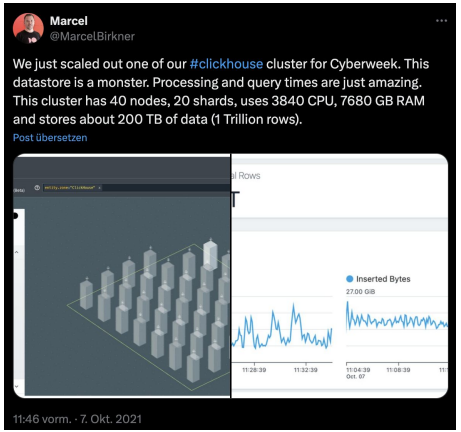

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What is special about ClickHouse “Cloud”?

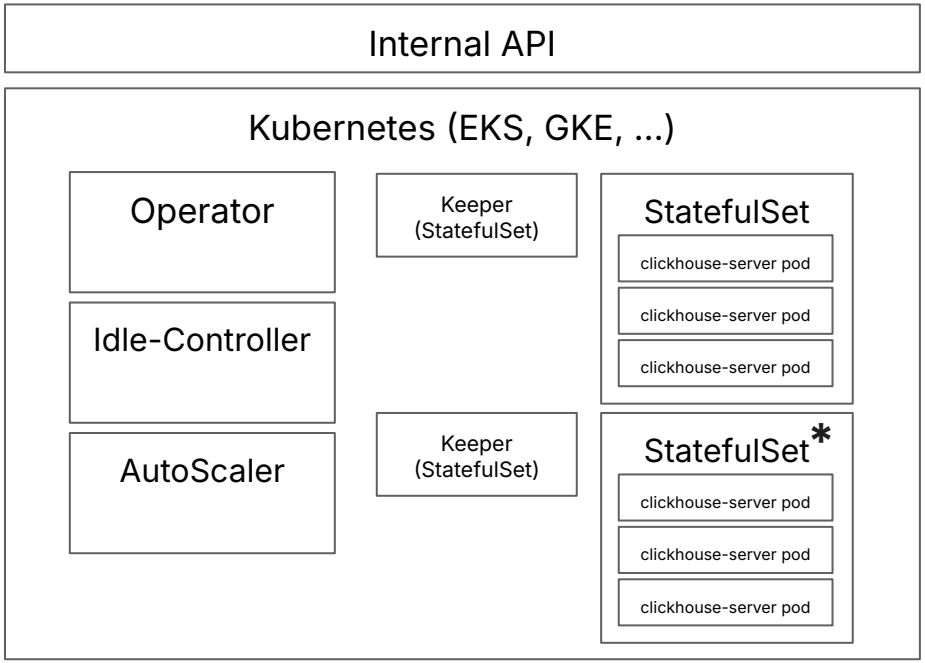
- It’s a **service** - sign up and start using it

- Separation of Storage and Compute
  - Unlimited Storage (S3, GCS, Azure BlobStorage)
  - Compute scales independently

Architecture of ClickHouse Cloud

(quite complex)

Amazon S3



Cloud Console

&

SQL Console

Proxy

* We actually have one StatefulSet per Pod - see Manish's KubeCon talk
"Fantastic Ordinals and How to Avoid Them: Auto-Scaling Challenges in a Cloud Database"

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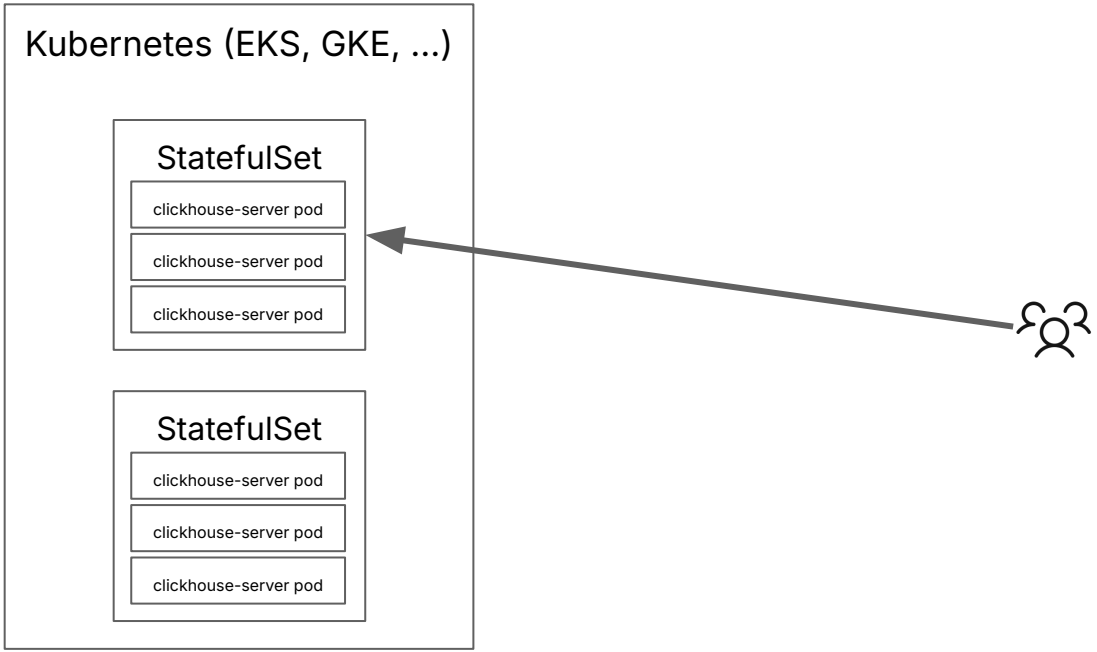
Architecture of ClickHouse Cloud

(simplified)



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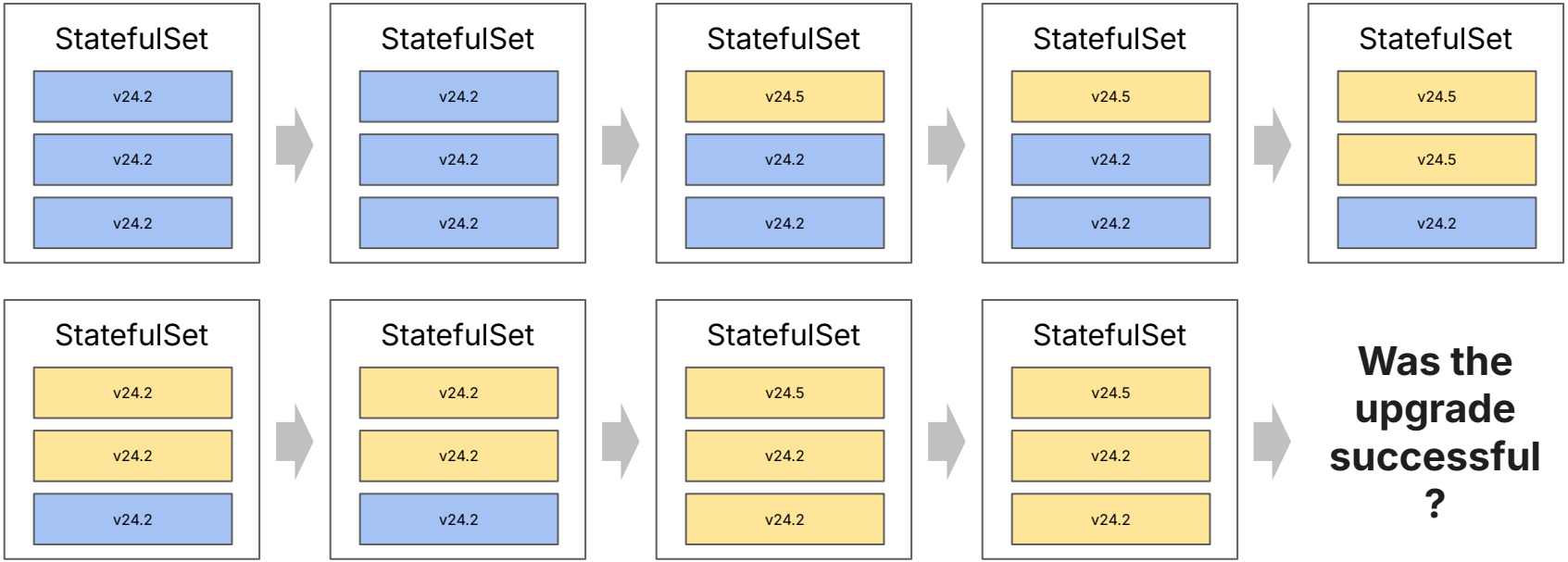
02 Upgrading ClickHouse

What's the challenge of upgrading ClickHouse clusters in the cloud?

Upgrading a ClickHouse cluster

```
kubectl patch sts my-clickhouse -p \
    '{"spec": {"template": {"spec":{"containers":[{"name":"clickhouse","tag":"24.5"}]}}}}'
```



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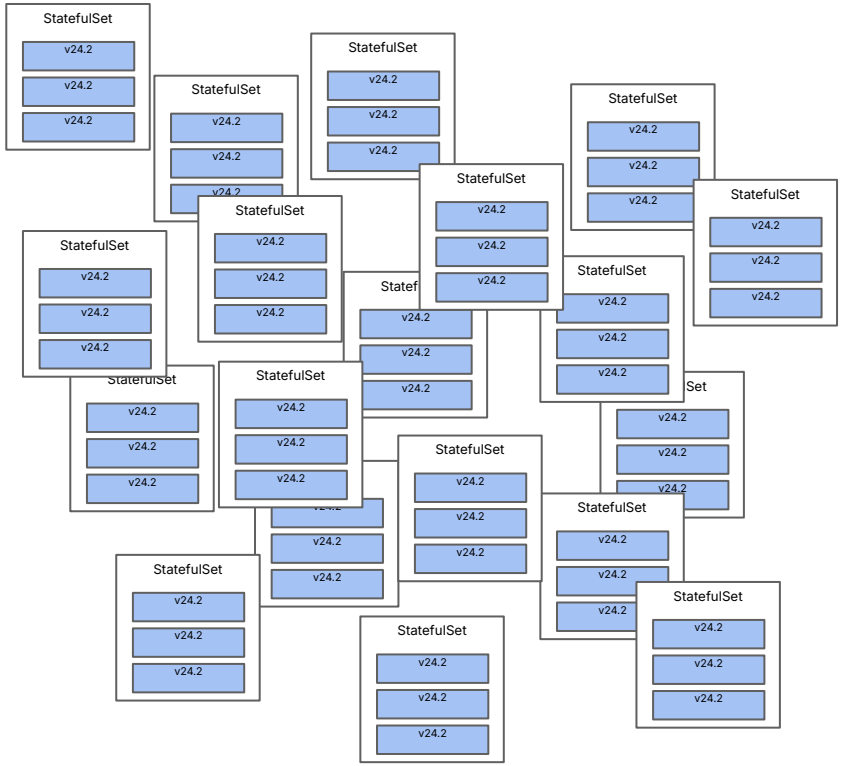
Upgrading 1000+ ClickHouse Clusters



Naive Approach: all at once

- Will overload infrastructure
- Huge blast radius of potential bugs

Naive Approach #2: one after the other

- Too slow

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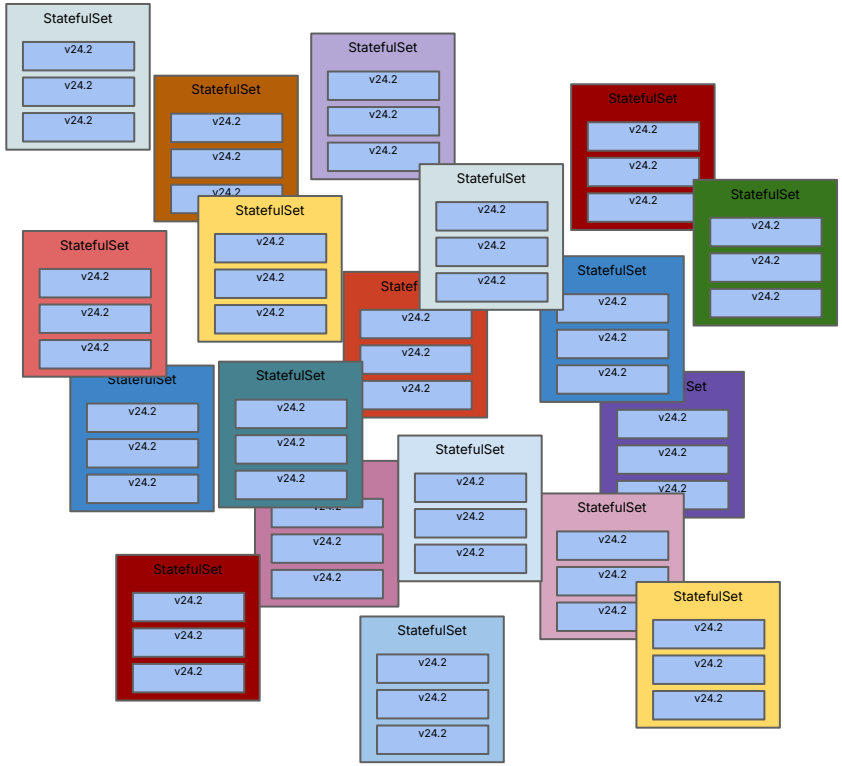
Upgrading 1000+ ClickHouse Clusters



- **Vastly different use cases** (a new version can be perfectly fine for 98% of the customers and break horribly for the 20 remaining clusters)
- Slightly different configurations and feature flags
- Differences across cloud providers
- ...

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Upgrading 1000+ ClickHouse Clusters

Requirements for a rollout automation system

- As fast as possible, but slow enough to still give time to react
- Runs unattended for several days
- Ability to inspect progress
- Allows interaction with engineers (e.g. pause & resume)
- Can integrate with other systems and tools
  (e2e tests, monitoring, slack, github)
- Flexible

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03 Temporal

What is “Durable Execution” and why is perfect for rollout automation?

How hard can it be ...

- to call an unreliable API reliably
- wait for up to 3h for a result
- repeat these steps 1000 times
- **even if the process is restarted a dozen times in between**

What is “durable execution”?

https://temporal.io/blog/building-reliable-distributed-systems-in-node

> Durable execution systems run our code in a way that **persists each step** the code takes. If the process or container running the code dies, the code automatically continues running in another process with all state intact, including call stack and local variables.

Temporal Concepts

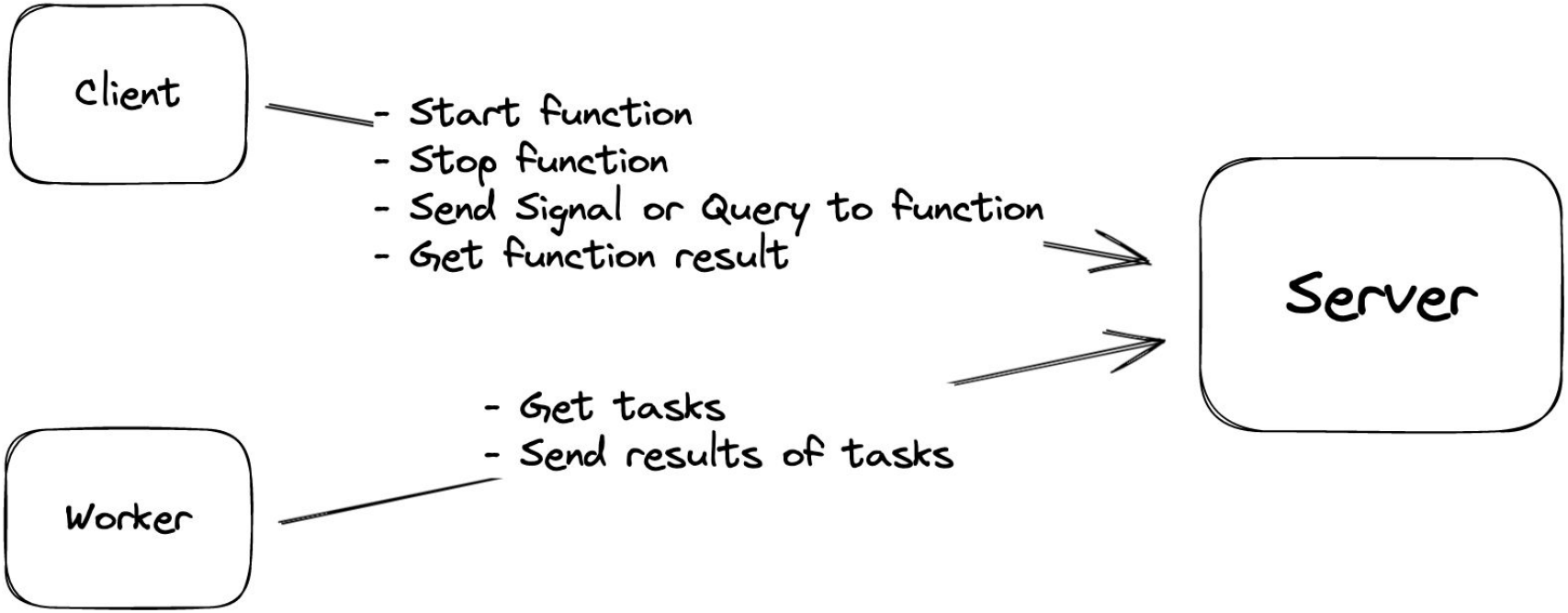
Workflow

> A Temporal Workflow defines the overall flow of the application. Conceptually, a Workflow is a sequence of steps written in a general-purpose programming language.

Activity

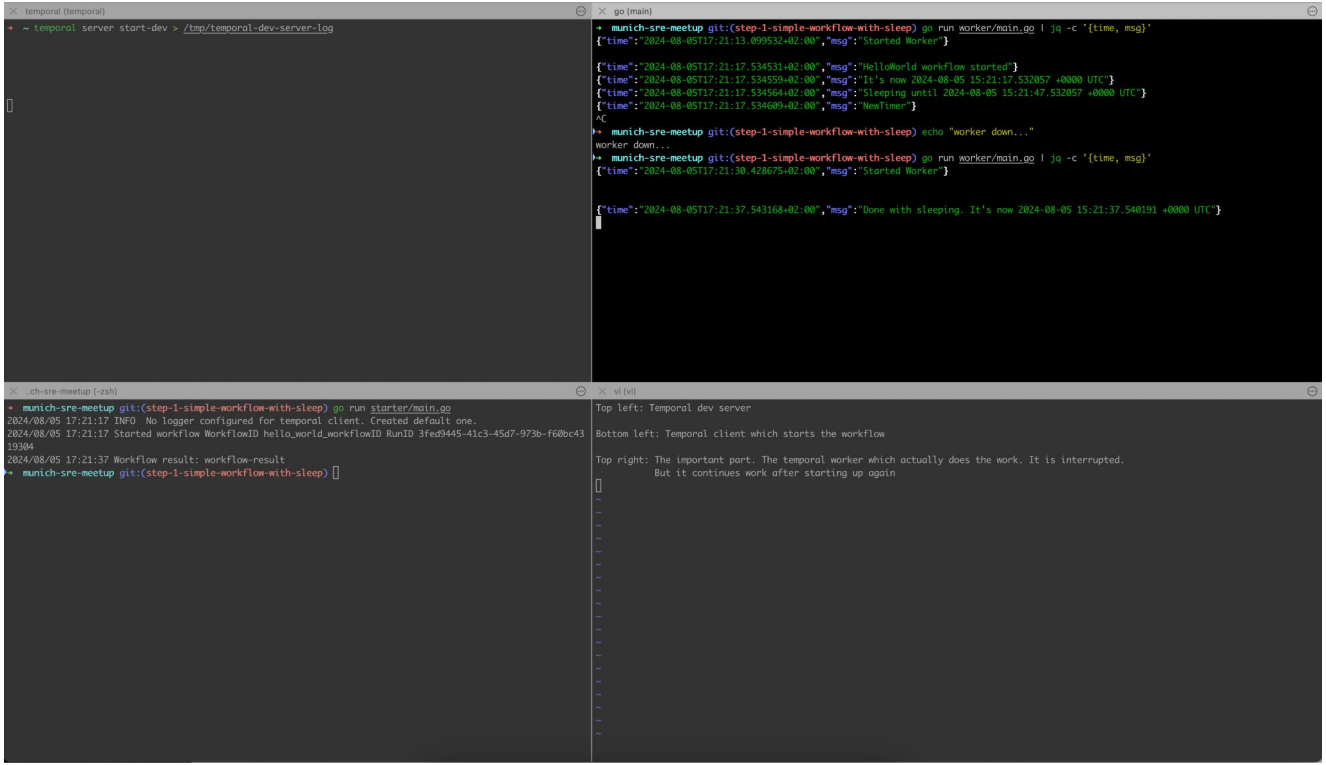
> An Activity is an implementation of a task to be performed as part of a larger Workflow. [..] It is in the Activities where all operations that affect the desired results must be implemented.

How does “durable execution” work?



Demo

Demo 1 - Workflow continues after worker interrupted



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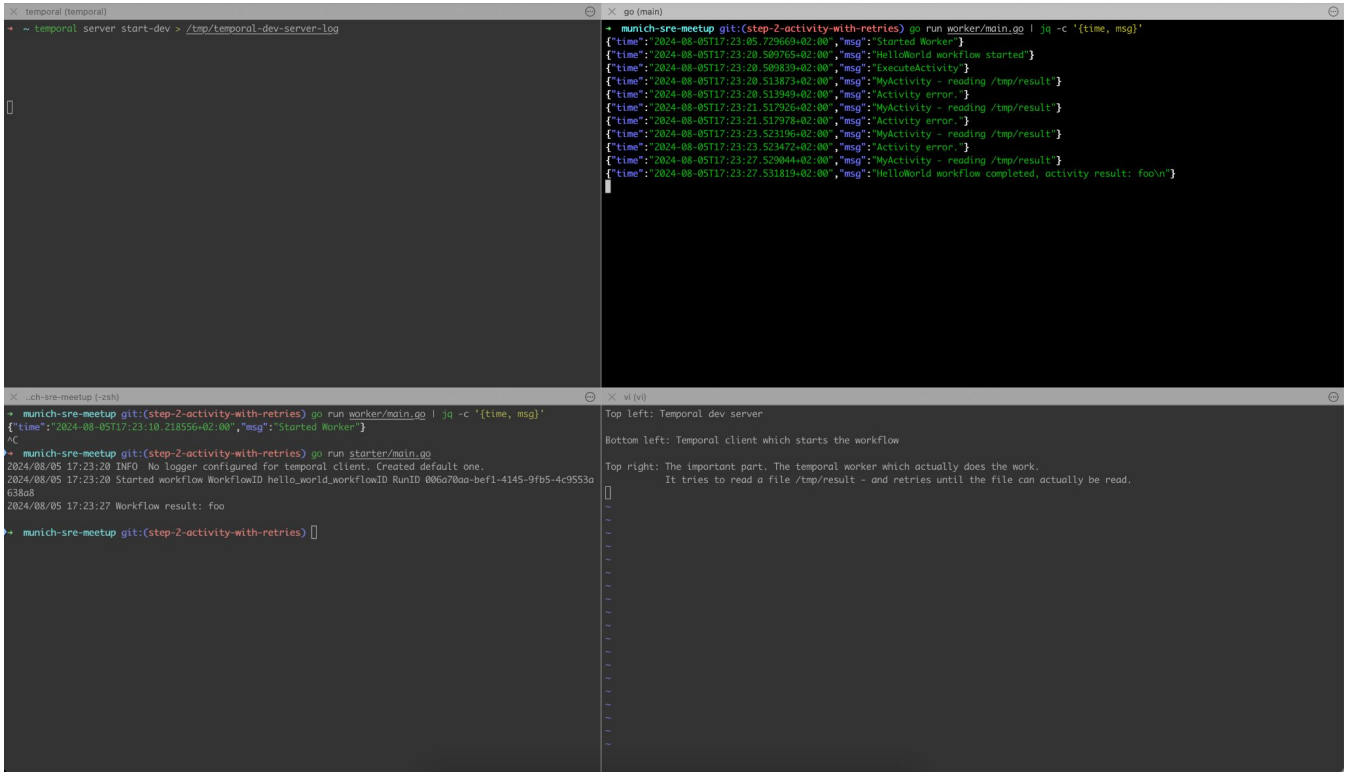
Demo 2 - Temporal takes care of retries



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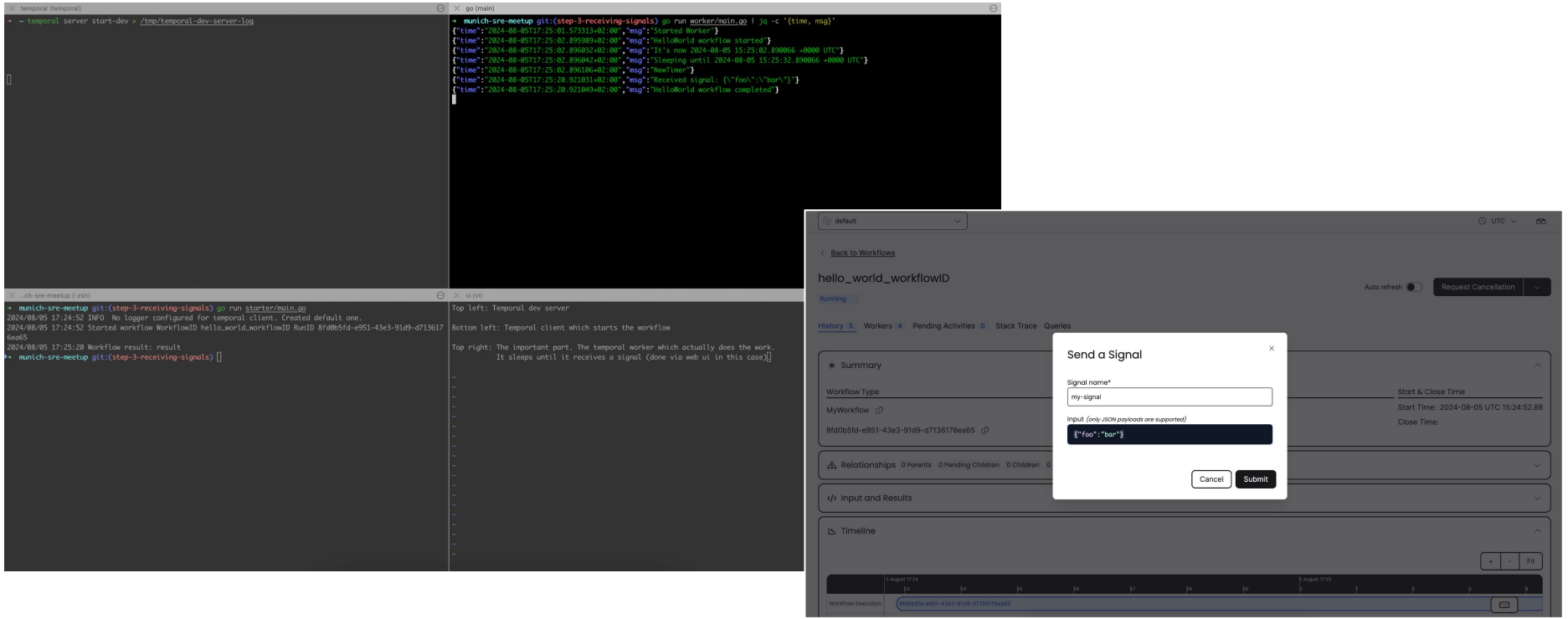
Demo 3 - Interacting with the workflow using signals



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04 Our solution

Some examples how we do rollouts today (compared to one year ago)

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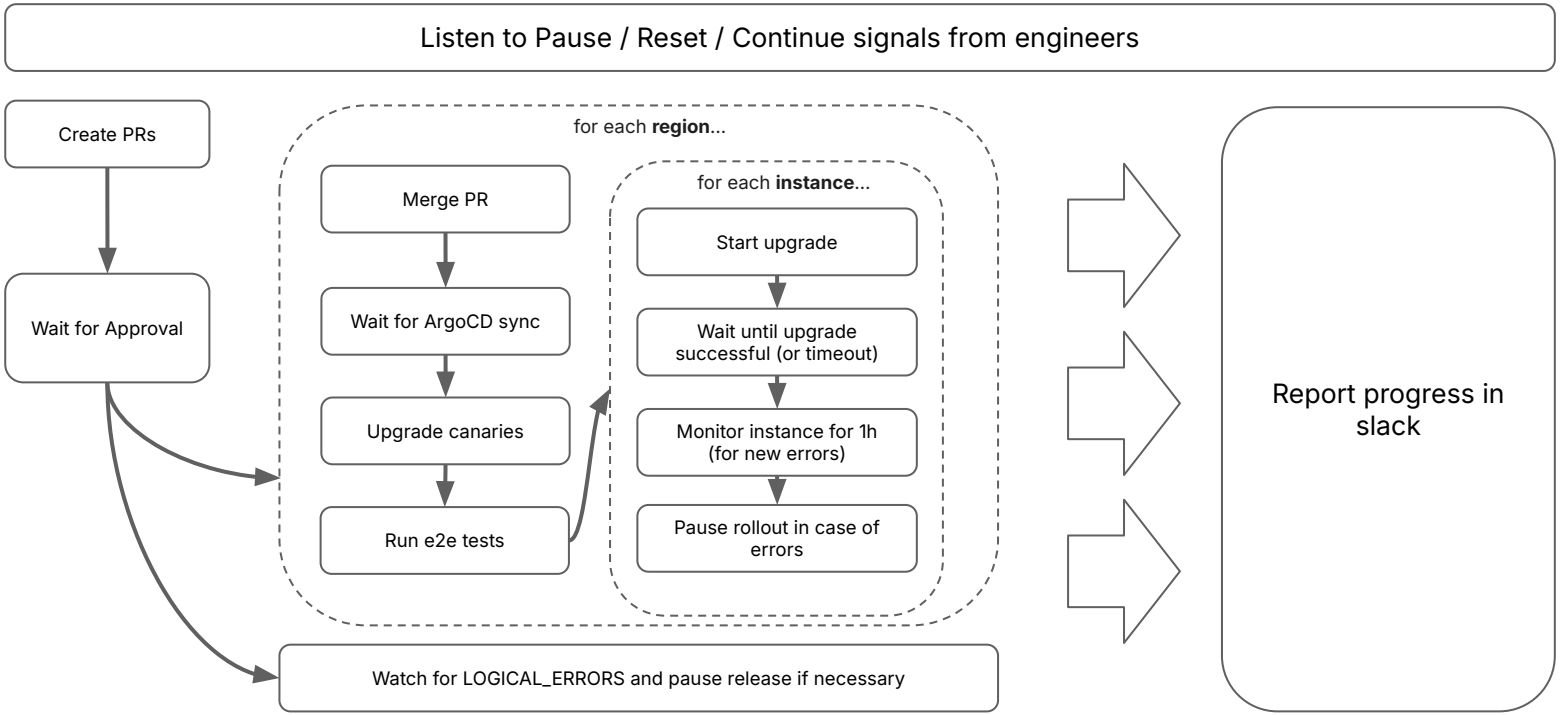

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ClickHouse Molen

Data-plane bot APP 12:50
Main-distracted_northcutt
Started new ClickHouse release: distracted_northcutt
Release Engineer: nikitamikhaylov@clickhouse.com

Please review PRs
To start rollout send `Continue` signal to the main workflow. Send `Cancel` to cancel the rollout and cleanup PRs
Release Schedule:
* Production small regions
* Prod AWS eu-central-1, wait 1h0m0s
* Prod AWS eu-west-1, wait 1h0m0s
* Prod GCP europe-west4, wait 1h0m0s

```
- description: Update ClickHouse version
  operation: add_or_update
  path: clickhouse.version
  value: "23.9.2.47465"
- description: Change user-level setting
  operation: add_or_update
  path: extraConfig.users.profiles.default.cluster_for_parallel_replicas
  value: "default"
```

47 replies Last reply today at 14:47

Data-plane bot APP 4 days ago
Release-adoring_turing
Starting next stage 'Staging dev tier' in 0s at 16 Nov 23 15:17 UTC

Data-plane bot APP 4 days ago
Release-adoring_turing
Starting stage: Staging dev tier

Data-plane bot APP 4 days ago
Group_rollout-adoring_turing-staging_dev_tier-staging_dev_tier
Starting updating instances in group: Staging dev tier

Data-plane bot APP 4 days ago
Group_rollout-adoring_turing-staging_dev_tier-staging_dev_tier
Instance update failedInstance tan-dn-76 in staging/aws/eu-west-1 failed to update with error: 'initialState: degraded, instance update marked as failed as it exceeded the autoupdate_ttu timeout (type: NonRetryAbleError, retryable: false)'

Data-plane bot APP 4 days ago
Group_rollout-adoring_turing-staging_dev_tier-staging_dev_tier
Instances in group Staging dev tier updated.

Data-plane bot APP 4 days ago
Release-adoring_turing
*Stage Staging dev tier is done*Starting next stage 'Staging prod tier' in 0s at 16 Nov 23 15:59 UTC

Data-plane bot APP 4 days ago
Release-adoring_turing
Starting stage: Staging prod tier

Data-plane bot APP 4 days ago
❌ E2E-distracted_northcutt-aws-production-eu-central-1
E2E tests finished for: aws/production/eu-central-1Seed: 2652460134
Success: false
To check failed specs follow this link.
Logs: logs in DD

Data-plane bot APP 4 days ago
❌ Update_base_configurations-distracted_northcutt-prod_aws_eu_central_1-prod_aws_eu_central_1
*Child workflow E2E-distracted_northcutt-aws-production-eu-central-1 failed.*To ignore this failure and continue release send `Continue` signal to this workflow, otherwise send `Cancel` signal.

Data-plane bot APP 4 days ago
Errors_checks-distracted_northcutt-prod_aws_eu_central_1
*Logical errors detected*Found logical errors in Cloud: aws Environment: production Region: eu-central-1 Cluster type: data-plane Cluster name: prod-production-eu-central-1-data-plane Namespace: ns-bisque-wa-97

Data-plane bot APP 2 minutes ago
Group_rollout-adoring_turing-staging_prod_tier-staging_prod_tier
Rollout paused for all groups in stageStage will be paused because error rate 12 is over the limit 10. Send 'Continue' or 'Reset' to resume the rollout

Data-plane bot APP 3 days ago
tada Main-zealous_mclean
ClickHouse release zealous_mclean is done

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Temporal

Great

- It’s code
  testing, tooling, CI 🎉
- Active development
  test SDK, replay testing didn’t exist when we started
- Flexible
  recently added better error monitoring and soft/hard timeouts

Challenging

- Workflow versioning
  “nondeterministic workflow definition code or incompatible change”
- Limits
  Actions per Workflow, Child workflows, “ContinueAsNew”, Size of Activity Input/Output
- Things work different than in normal go code - You need to embrace the paradigm!