



Scaling Pipelines with Tekton

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Scaling Tekton



Introduction
Authoring
Running
Bottlenecks
Roadmap
Q&A



Introduction



Photo by Mike Benna, CC0



Tekton is an open-source framework for creating CI/CD systems

Cloud Native
Serverless,
Scalable
Pipelines



Standardization
Built In Best
Practices
Maximum
Flexibility

Core Projects
➤ Pipeline
➤ Triggers
Tooling:
➤ CLI *tkn*
➤ Dashboard
➤ Operator

Discovery:
➤ Catalog
➤ Hub
Adds-on:
➤ Results
➤ Chains
➤ Experiments

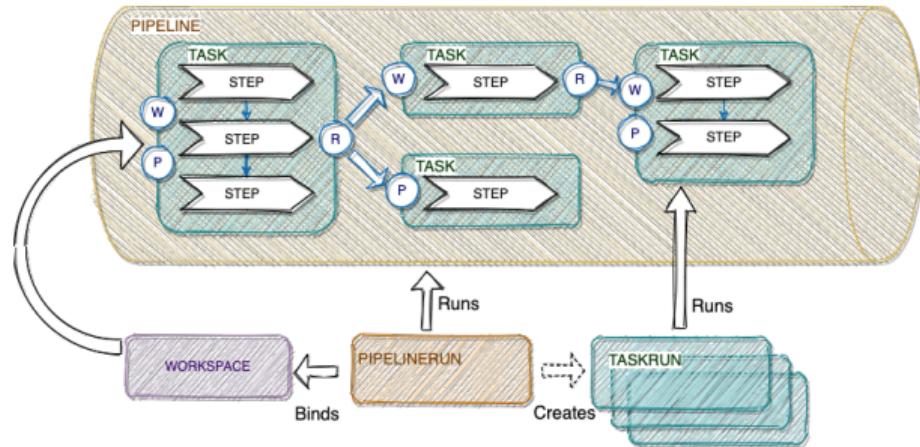


A bit of history

- › From Knative Built, to Pipeline
- › Extend the k8s API with CRDs
- › Tekton and the CDF



- › Definitions: Step, Task, Pipeline
- › Bindings: Workspaces, Parameters, Results
- › Execution: TaskRun, PipelineRun



Authoring



Building Blocks



Steps:

- Off the Shelves containers
- Small scripts

Tasks:

- Solve one specific problem
- Owned by a team
- Distributed maintenance

Reusability:

- Discovery
- Versioning
- Best Practices



Catalog and Hub

Discovery:

- › Kubernetes cluster
- › Tekton Catalog
- › Tekton Hub & API

Versioning:

- › Tekton Bundles
- › tkn bundle [push|list]
- › gcr.io/tekton-releases/catalog/upstream/

The screenshot shows the Tekton Hub interface. At the top, there's a search bar with 'build' and a 'Login' button. Below it, a banner says 'Welcome to Tekton Hub' and 'Discover, search and share reusable Tasks and Pipelines'. The main area has a sidebar with 'Sort By' dropdown, 'Kind' filter (Task), 'Catalog' filter (Tekton), and a 'Category' sidebar with various options like Automation, Build Tools, CLI, Cloud, Deploy, Editor, Git, Image Build, Language, Messaging, Monitoring, Notification, Others, Security, and Storage.

The main content area displays a grid of tasks:

- buildid**: v0.1. Description: Given a base version, this task generates a unique build id by appending the base-version to the current timestamp. Updated 3 months ago. Type: build-tool.
- buildah**: v0.2. Description: Buildah task builds source into a container image and then pushes it to a container registry. Updated 3 months ago. Type: image-build.
- buildkit**: v0.1. Description: This Task builds source into a container image using Moby BuildKit. Updated 3 months ago. Type: image-build.
- buildpacks**: v0.2. Description: The Buildpacks task builds source into a container image and pushes it. Updated 3 months ago. Type: image-build.
- buildpacks-photon**: v0.1. Description: The Buildpacks Photon task builds source into a container image and pushes it. Updated 3 months ago. Type: image-build.
- golang build**: v0.1. Description: This Task is Golang task to build Go projects. Updated 3 months ago. Type: image-build.

On the right side of the screen, there is a large JSON object representing the definition of the 'golang build' task.

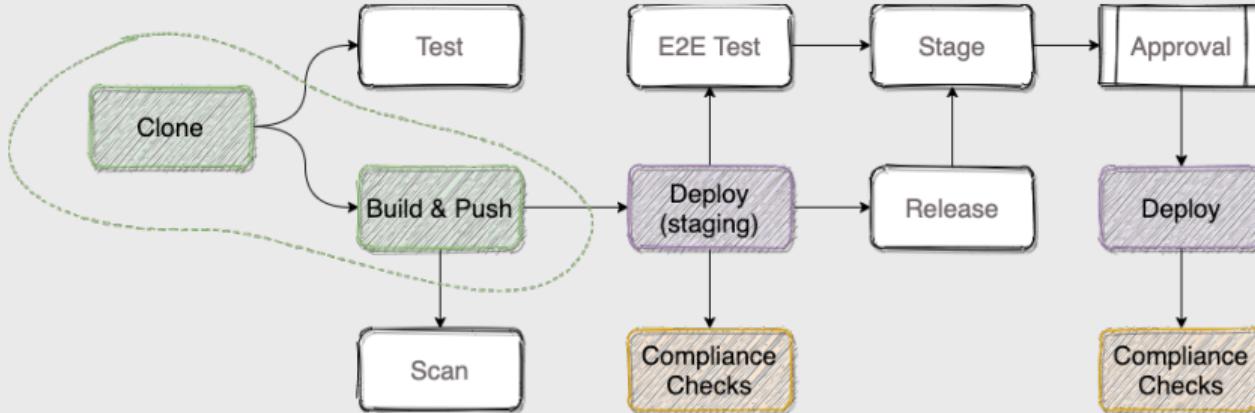
```
{
  "id": 34,
  "name": "git-cli",
  "catalog": {
    "id": 0,
    "type": "Task"
  },
  "owner": "tekton",
  "type": "Community"
},
{
  "id": 34,
  "name": "git",
  "catalog": {
    "id": 0,
    "type": "Task"
  },
  "owner": "tekton",
  "type": "Community"
},
{
  "id": 40,
  "name": "golang-build",
  "catalog": {
    "id": 1,
    "type": "Task"
  },
  "owner": "tekton",
  "type": "Community"
},
```

Best Practices:

- › Params, Results, Workspaces
- › Portability



Pipelines



Short pipelines:

Building blocks

- Conditions
- Optional Inputs

Large Pipelines:
How to:

- Add a Branch
- Swap a Block
- Access Control
- Distribute

Distribute:

- Team
- Access
- Namespace
- Cluster
- Platform

One workflow:

- Pipeline in Pipeline (experimental)
- CloudEvents



Running



Photo by Ray Bilcliff, CC0



Triggers

Run Pipelines on Events:

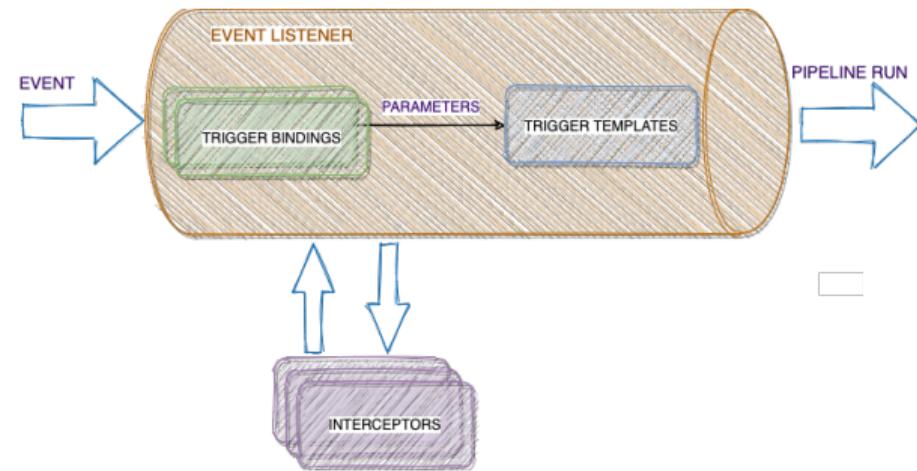
- › HTTP POST
- › Pull Request, Image Published

Components:

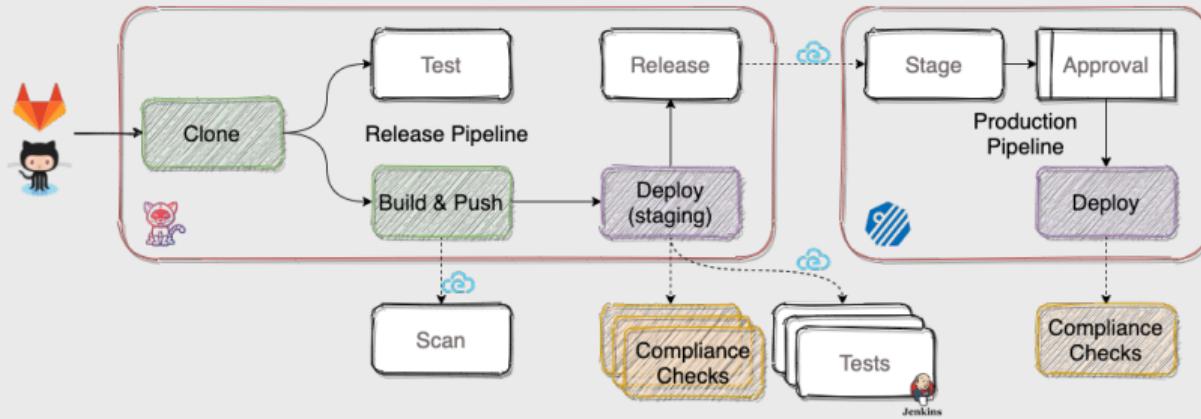
- › Receive: Event Listener
- › Filter: Interceptors
- › Run: Binding and Templates

Generate Events:

- › k8s and CloudEvents
- › Start, Run and Stop



Events



Receiving and sending events

Composite Workflow

Separate Ownership

Dynamically add tasks

Reuse pipeline

Heterogeneous parts

Issues:
Custom integrations
Orchestration
Visibility

Events in CI/CD
Special Interest Group



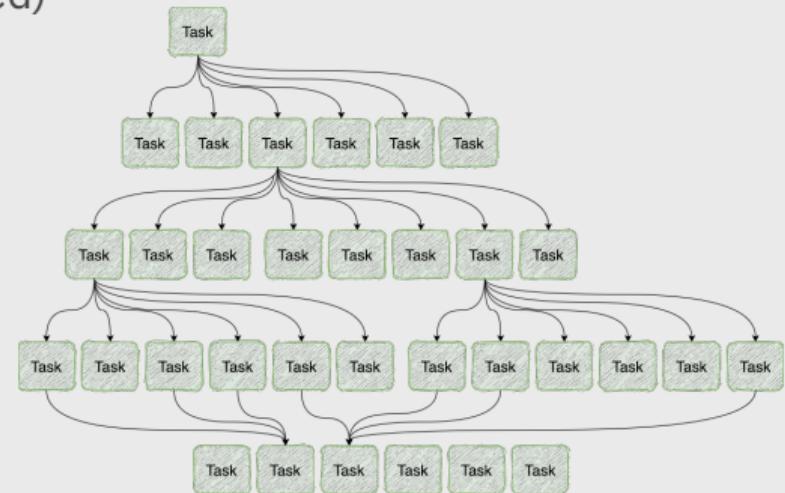


Bottlenecks



Very Large pipelines

- › Directed Acyclic Graphs
- › Large Pipelines (100 nodes, densely connected)
- › Scale Issues?
- › DAG build on every reconcile
- › Hundreds of nodes and connections
- › Optimized code in the DAG computation
- › Maintainability
- › Pod Overhead



Under Pressure - Running **many** Pipelines

Concurrent execution

- Cached K8s API calls: Informers
- Scale Up Controllers: LeaderElection
- Cluster Resources: K8s scheduler

In real life

- Thousands Tasks/month upstream
- Millions containers/month @IBM
- Throttling (for security too)

Potential enhancements:

- Throttling pipeline execution
- Optimize Execution Runtime
- Tekton custom scheduler

Cluster pollution?

- Tekton Results



Conclusions & Roadmap

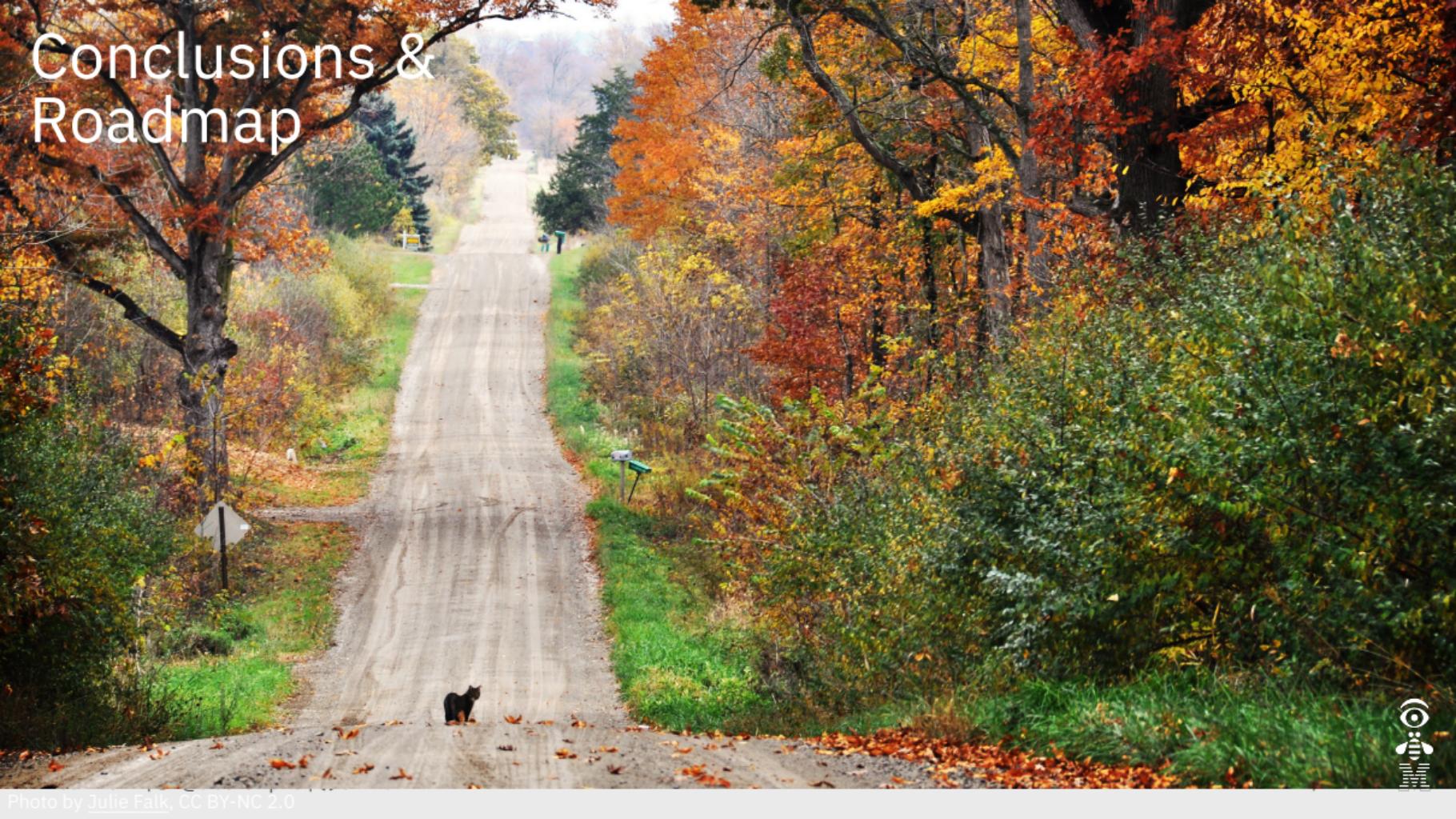


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Author Time Scalability:

- Best Practices
- Reusable Tasks and Pipelines
- Versioning & Sharing
- Break Down Large Pipelines

Run Time Scalability:

- Cloud Native & Scalable
- Execution Throttling
- Pod execution overhead

Roadmap

- › Continue Dogfooding Tekton at Scale!
- › Pipelines in Pipelines TEP-0056
- › Remote Resource Resolution TEP-0060
- › Decouple Task Composition from Scheduling TEP-0044
- › Runtime Task Bundle Definitions TEP-0068
- › Implement the SIG Events format of Cloud Events





Thank You! Questions?

References

- › Come and Join Us at Tekton!
- › Tekton community: github.com/tektoncd/community
- › Slides: github.com/afrittoli/scaling_pipelines_with_tekton
- › Tekton: tekton.dev
- › Tekton on GitHub: github.com/tektoncd
- › Tekton Results: github.com/tektoncd/results
- › Tekton Hub: hub.tekton.dev
- › Tekton TEPs: github.com/tektoncd/community/tree/main/teps

