Developing a CD pipeline with Knative

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Andrea Frittoli
Developer Advocate
andrea.frittoli@uk.ibm.com
@blackchip76

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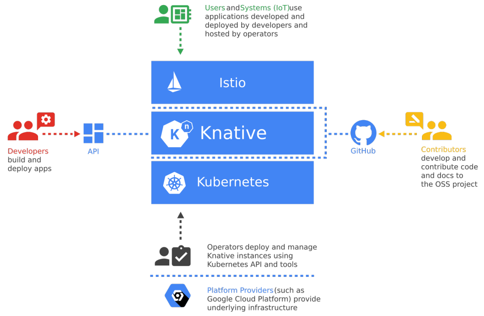
DevOps Meetup Singapore

IBM Cloud

A Bit of History

Knative

- Beginning of 2018...
- Knative:
  - Build
  - Eventing
  - Serving
- Contributors:
  - Google
  - Pivotal
  - IBM
  - RedHat
  - Cloudbees
  - ...and others


Users and Systems (IoT) use applications developed and deployed by developers and hosted by operators
Istio
Developers build and deploy apps
API
Knative
GitHub
Contributors develop and contribute code and docs to the OSS project
Kubernetes
Operators deploy and manage Knative instances using Kubernetes API and tools
Platform Providers (such as Google Cloud Platform) provide underlying infrastructure

~Sept 2018: Knative Pipelines

Latest news!

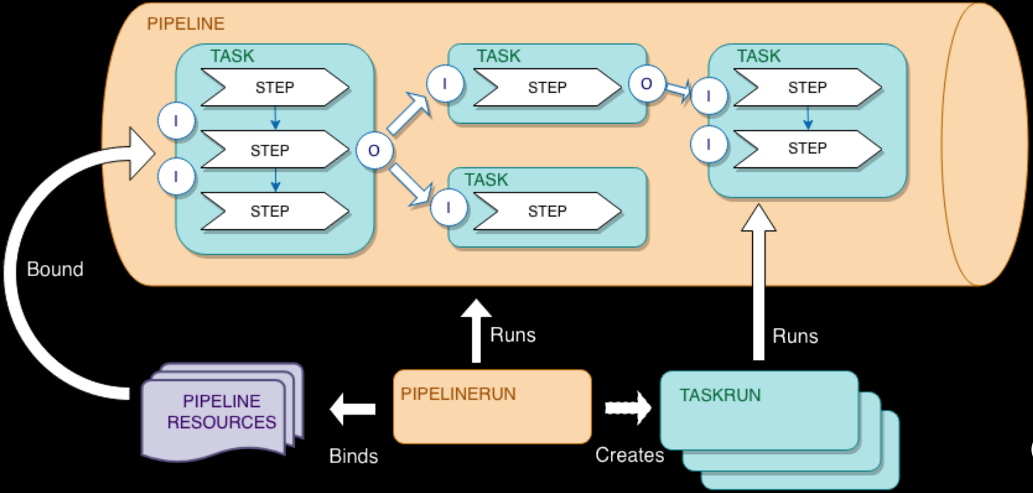
- Focus on CI/CD
- Deploy “anywhere“
- Compatible with Knative Build
- *tektoncd/pipeline*
  - New logo
  - @CD Foundation
  - Roadmap WIP
  - Alpha APIs

Community

- *Valid for Knative. Tekton TBD.*
- Steering Commitee (SC)
- Technical Oversight Commitee (TOC)
- Various Contribution profiles
- Design, issues: on GitHub
- Communication:
  - Weekly video meetings, recorded, Build WG
  - Asynch: Knative Users / Developers ML
  - Sync: slack.knative.dev

Tekton Pipelines

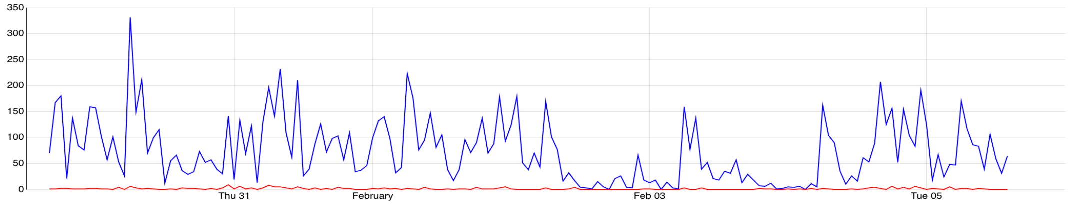
Cloud Native Pipelines



OpenStack Health is a dashboard for visualizing test results of OpenStack CI jobs.

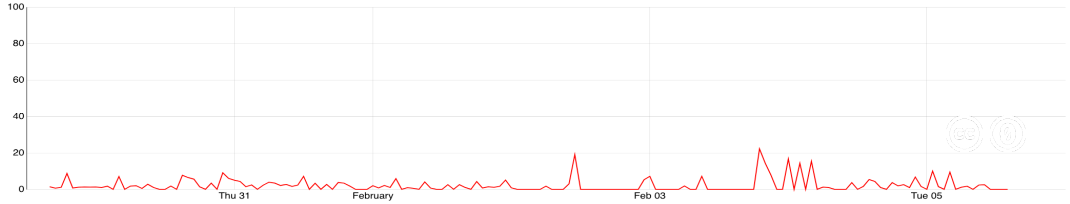
Total Jobs

Search for project with regex



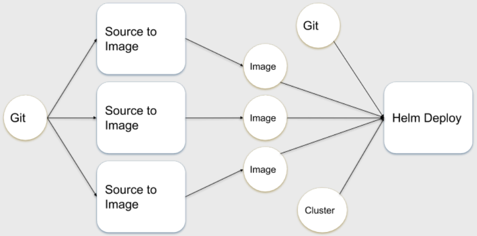
Job Failure Rate

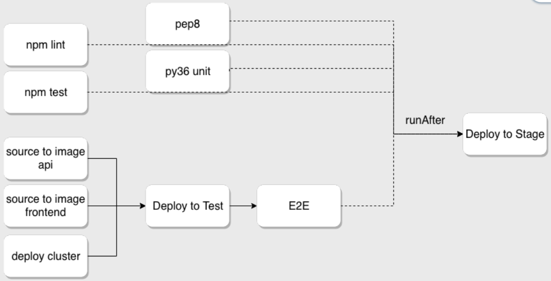
Search for project with regex



Inputs, Outputs & DAG

- Steps are sequential
- Tasks are a Directed Acyclic Graph
- Order defined by:
  - *from*: input from another task's output
  - *runAfter*: enforced task ordering





Under the Hood

Custom Resources

CRDs: Task(Run), Pipeline(Run), PipelineResource

Services in the *tekton-pipelines* namespace:

- Webhook Service: resource validation
- Controller Service:
  - Handles inputs and outputs
  - Calculates the DAG
  - Provisions pods and containers

Custom Resource Provisioning:

- Via YAML
- Via Go API
- Labels!

Pods, Entrypoints & Volumes

Steps (of a Task):

- Containers in one POD (single node)
- Any container image
- Entrypoint re-written
- Serial execution
- Resource allocation?

TaskRun:

- Provisions a POD
- Deployes entrypoint tool
- Input/output containers
- User containers (steps)

Volumes:

- EmptyDir for workspace/home
- Tools (entrypoint)
- Secrets
- Any user ConfigMap / Volume
- (Optionally) Pipeline Share

PipelineRun:

- Several PODs, different nodes
- Shared storage: PVC or GCS

Source to Image to Deploy

IBM Cloud

- Private Registry:
  - Tekon Images (push/pull)
  - User Images (push/pull)
- Service Accounts:
  - *tekton-pipelines-controller*
  - Pipeline/Task service account

- Knative @ IBM Cloud
  - Experimental Add-on
  - *ibmcloud ks cluster-addon-enable knative*

CD Pipeline as code

- Pipeline and Tasks in git (YAML)
- Parameters for env/run specific
- Security?

```
apiVersion: tekton.dev/v1alpha1
kind: PipelineResource
metadata:
  name: health-helm-git-knative
  labels:
    tag: agreatrelease
spec:
  type: git
  params:
    - name: revision
      value: knative
    - name: url
      value: https://github.com/afrittoli/health-helm
```

```
metadata:
  name: mycluster
spec:
  type: cluster
  params:
    - name: name
      value: mycluster
    - name: url
      value: https://mycluster.containers.cloud.ibm.com
    - name: username
      value: admin
  secrets:
    - fieldName: token
      secretKey: tokenKey
      secretName: cluster-secrets
    - fieldName: cadata
      secretKey: cadataKey
      secretName: cluster-secrets
```

```
metadata:
  name: health-api-image
spec:
  type: image
  params:
    - name: url
      value: registry.ng.bluemix.net/andreaf/health-api
```

Using Kaniko

- Features:
  - Build from Context and Dockerfile
  - Unpriviledged
  - Reproducible
  - Remote caching of layers
  - Base images caching (warmer)

- Dockefile?
  - Most common changes last
  - Careful with COPY/ADD
  - Remove what you don’t need

Using Kaniko

Source to Image (spec only):

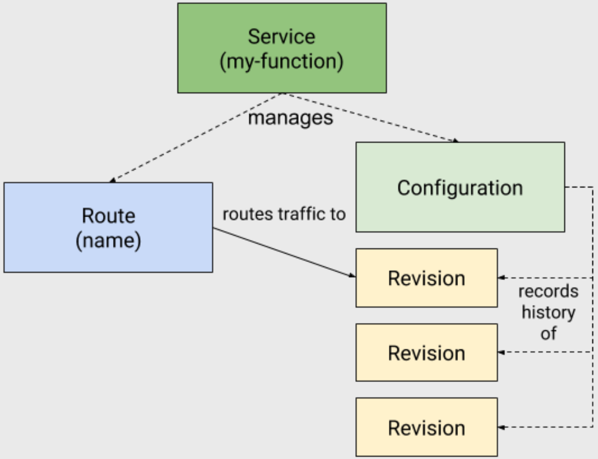
```
inputs:
  resources:
    - name: workspace
      type: git
  params:
    - name: pathToDockerFile
      default: Dockerfile
    - name: pathToContext
      default: .
    - name: useImageCache
      default: "true"
    - name: imageTag
      default: "default"
outputs:
  resources:
    - name: builtImage
      type: image
volumes:
  - name: kaniko-base-image-cache
    persistentVolumeClaim:
      claimName: kaniko-base-image-cache
steps:
  - name: build-and-push
    image: gcr.io/kaniko-project/executor
    command:
      - /kaniko/executor
    args:
      - --cache=${inputs.params.useImageCache}
      - --cache-dir=/cache
      - --dockerfile=${inputs.params.pathToDockerFile}
      - --reproducible
      - --destination=${outputs.resources.builtImage.url}:
${inputs.params.imageTag}
      - --context=/workspace/workspace/${inputs.params.
pathToContext}
    volumeMounts:
      - name: kaniko-base-image-cache
        mountPath: /cache
```

Cache Warmer (spec only):

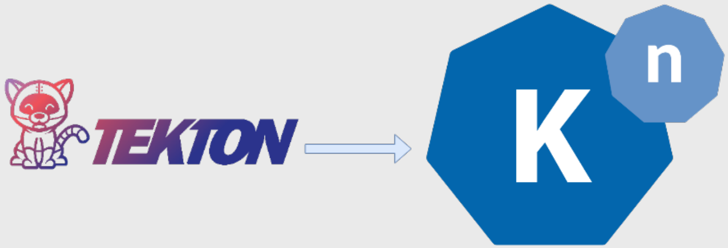
```
volumes:
  - name: kaniko-base-image-cache
    persistentVolumeClaim:
      claimName: kaniko-base-image-cache
steps:
  - name: prepare-cache
    image: gcr.io/kaniko-project/warmer
    args:
      - --cache-dir=/cache
      - --image=python:3.6-slim-stretch
      - --image=postgres:alpine
      - --image=nginx:latest
    volumeMounts:
      - name: kaniko-base-image-cache
        mountPath: /cache
```

Tekton and Knative

Knative Serving



Pipelines and Knative Build



CI with Tekton Pipelines

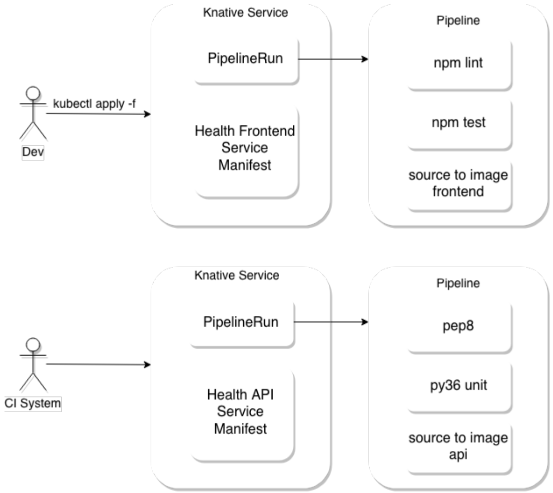
You need a “CI“ application:

- Prow, JenkinsX, Zuul…
- Pipelines triggered by a CI app
- …or by a developer

Tekton to CI for Tekton (AKA Dogfooding) \o/

What about security?

- Malicious users
- Running a pipeline from a PR
- Access to secrets

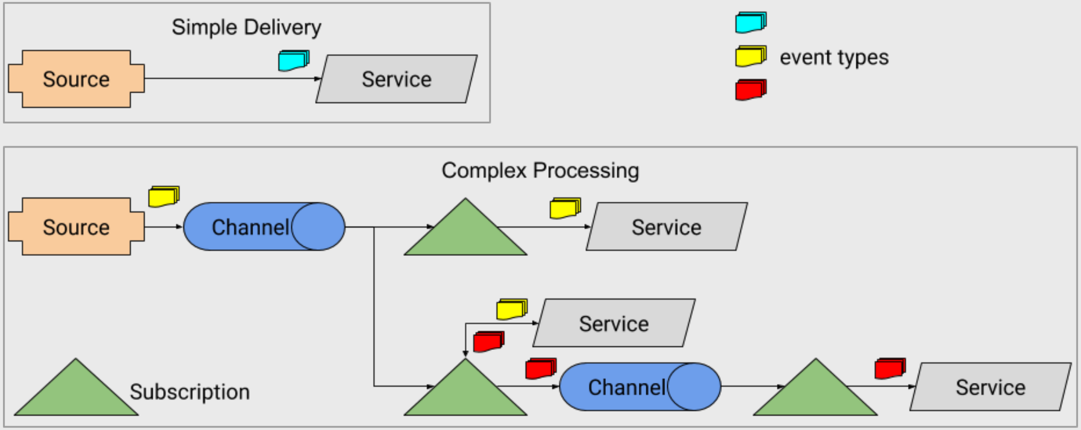


KService for Health Frontend

```yaml
apiVersion: serving.knative.dev/v1alpha1
kind: Service
metadata:
  name: health-frontend
  labels:
    app: health
    component: frontend
    tag: "__TAG__"
spec:
  runLatest:
    configuration:
      build:
        apiVersion: tekton.dev/v1alpha1
        kind: PipelineRun
        metadata:
          labels:
            app: health
            component: frontend
            tag: "__TAG__"
        spec:
          pipelineRef:
            name: dev-test-build-frontend
          params:
            - name: imageTag
              value: "__TAG__"
            - name: nodeTestImage
              value: __NODE_IMAGE_NAME__
          trigger:
            type: manual
          resources:
            - name: src
              resourceRef:
                name: __GIT_RESOURCE_NAME__
            - name: builtImage
              resourceRef:
                name: __IMAGE_RESOURCE_NAME__
      revisionTemplate:  # template for building Revision
        spec:
          container:
            image: us.icr.io/andreaf/health-frontend:__TAG__
            imagePullPolicy: Always
            env:
              - name: API_URL
                value: http://health-api.containers.domain
            ports:
              - name: http1
                containerPort: 80
                protocol: TCP
            livenessProbe:
              httpGet:
                path: /
            readinessProbe:
              httpGet:
                path: /
```

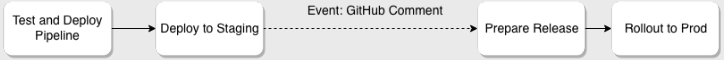
Asynchronous Pipelines

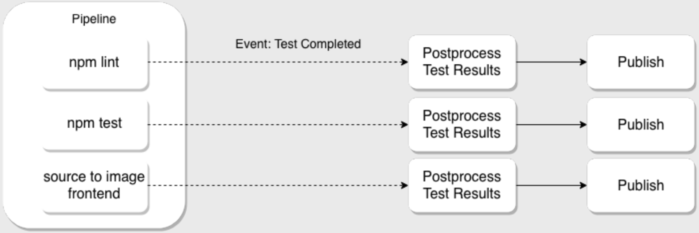
Knative Eventing



Triggering and Knative Eventing

- Manual trigger for *PipelineRun*
- Native Eventing triggers TBD
- What about async pipelines?
  - GitHub Source
  - Container Source
  - Pipeline Output as a Source





Tekton and Development

- It depends.
- What can go wrong?
  - Building the container image
  - Provisioning and I/O of shared storage
  - Pipeline Output as a Source
- What do I gain?
  - Same building blocks used in CI/CD
  - Run in containers from the start
  - Parallel execution

Conclusions

Roadmap

- Conditional Execution
- Build Results and Logs
- Pluggable Tasks
- Triggering
- Community Library

References

- This Talk: https://github.com/afrittoli/tekton_pipelines_knative_intro
- https://tekton.dev/, https://cd.foundation/
- https://github.com/tektoncd/pipeline
- https://github.com/knative/docs/tree/master/community
- https://github.com/tektoncd/pipeline
- https://github.com/tektoncd/pipeline/blob/master/api_compatibility_policy.md
- https://github.com/tektoncd/pipeline/blob/master/roadmap-2019.md
- https://github.com/GoogleContainerTools/kaniko
- https://github.com/afrittoli/health-helm/tree/knative
- https://github.com/afrittoli/openstack-health/tree/knative-eventing
- https://andreafrittoli.me
- https://cloud.ibm.com

Q&A