Developing a CD pipeline with Knative

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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

~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

TEKTON

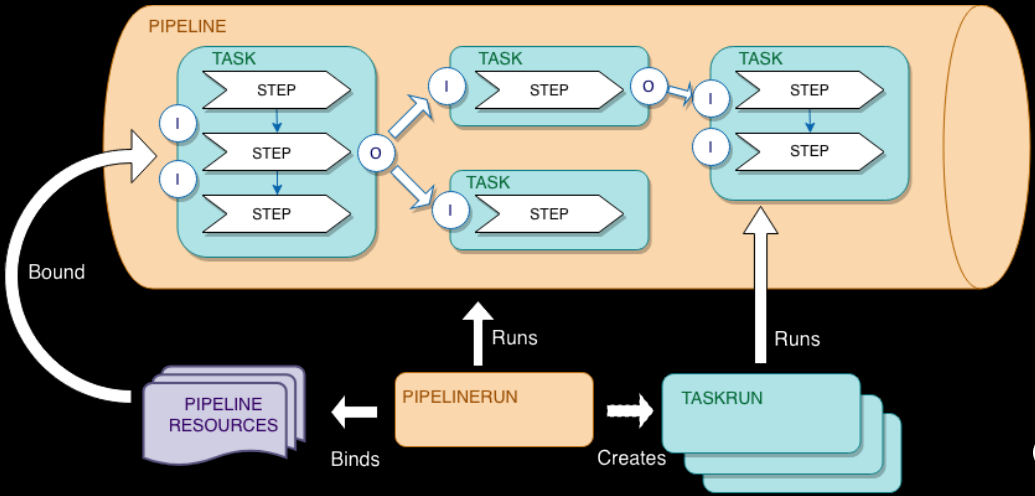
CD.FOUNDATION

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

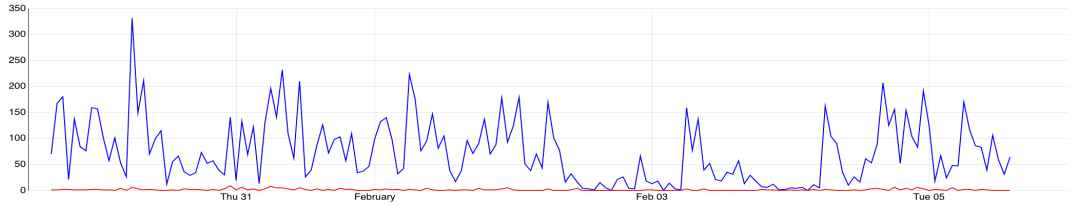
Cloud Native Pipelines



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

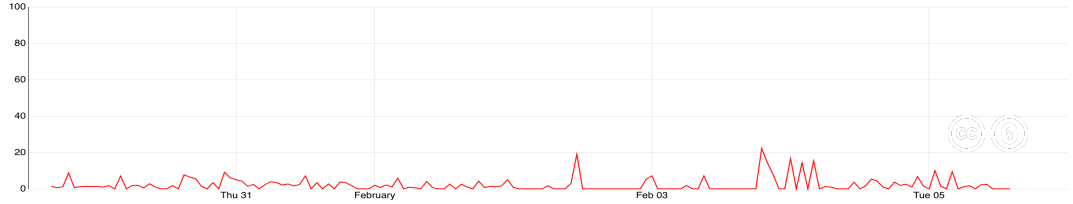
Total Jobs

Search for project with regex



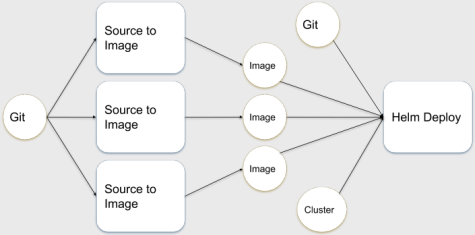
Job Failure Rate

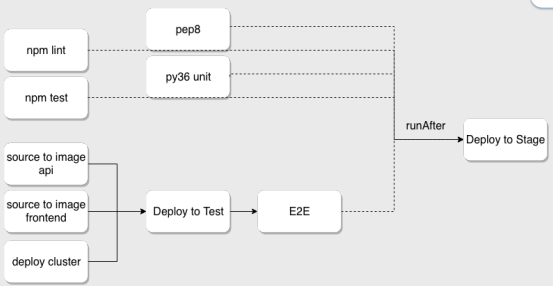
Search for project with regex



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?

Volumes:

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

TaskRun:

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

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?

```yaml
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
```

```yaml
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
```

```yaml
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):

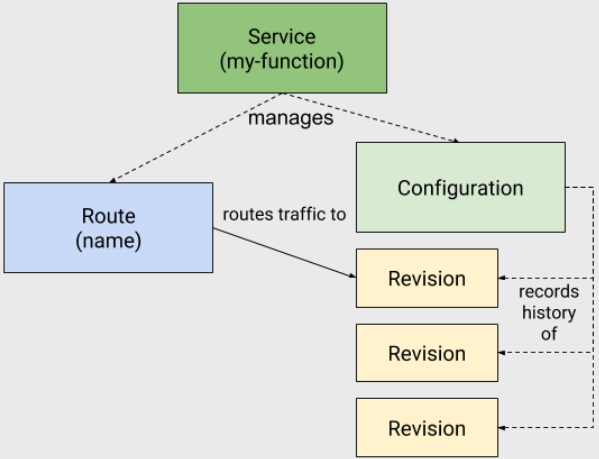
```
inputs:
  resources:
    - name: workspace
      type: git
  params:
    - name: pathToDockerFile
      default: Dockerfile
    - name: pathToContext
      default: .
    - name: useImageCache
      default: "true"
    - name: imageTag
      default: "default"
outputs:
  resources:
    - name: builtImage
      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):

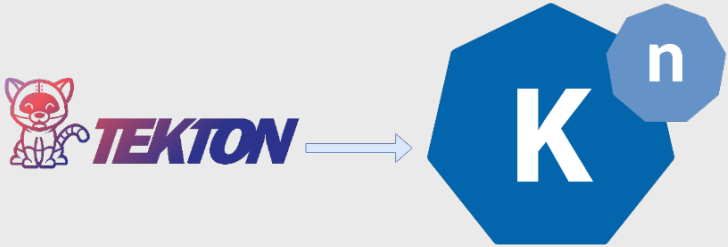
```
volumes:
  - name: kaniko-base-image-cache
    persistentVolumeClaim:
      claimName: kaniko-base-image-cache
steps:
  - name: prepare-cache
    image: gcr.io/kaniko-project/warmer
    args:
      - --cache-dir=/cache
      - --image=python:3.6-slim-stretch
      - --image=postgres:alpine
     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

Tekton and Knative

Knative Serving



Pipelines and Knative Build



CI with Tekton Pipelines

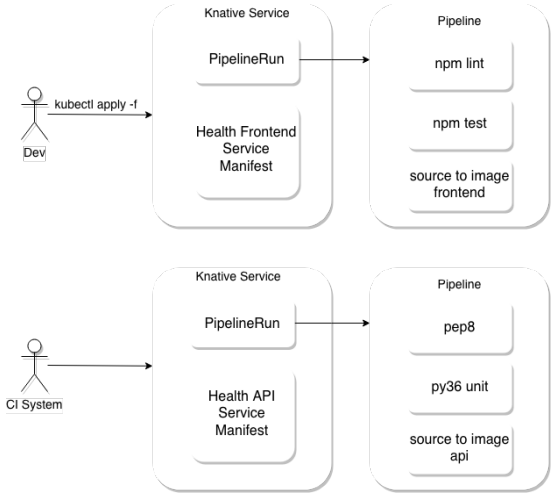
You need a “CI“ application:

- 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

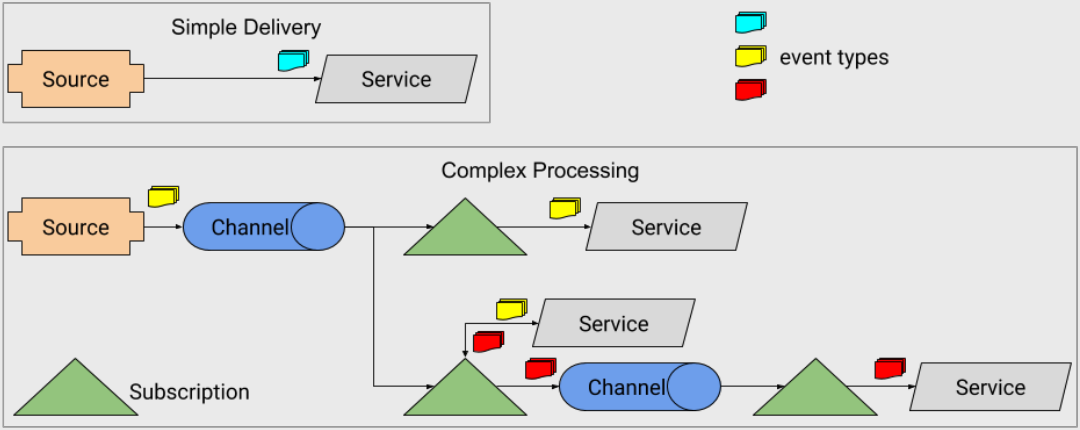


KService for Health Frontend

```
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: /
```

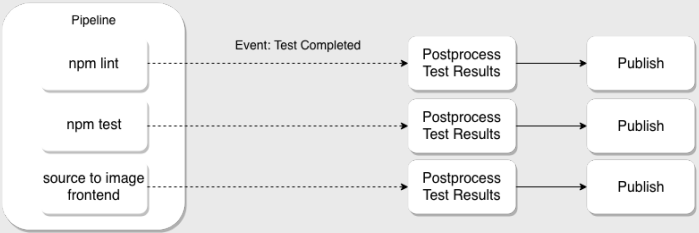
Asynchronous Pipelines

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

Conclusions

Shall I use Tekton Pipelines?

Roadmap

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
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- 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