Connecting Engineering Data with KiWi
About Me!

- Born in the Himalayan Valley
- I love math and writing code
- MSc Computer Science graduate from Trinity College Dublin
- Kubernetes Certified Application Developer
- At Koneksys since April 2021:
  - Built ML pipelines on Kubeflow
  - Built data transformation pipeline between 2 non-compatible cloud storage platforms
  - Main developer behind Kiwi
Why Connect Data

- In multidisciplinary engineering contexts, to build non-linear CI/CD pipelines for
  - Increased Automation
  - Faster Error Detection
  - Feedback Loops (Have all test cases passed after change in requirement?)
Solution: Kiwi

- Kiwi is an application that allows linking **resources** from different **REST APIs**, without any modification to the REST APIs.

- Inspired by **Istio’s service mesh architecture**, kiwi is brought to life by **Kubernetes**.
Demo
The velocity of the ball should be **2 units/second²**, **1.5 sec** after release.

**Requirement**

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**Scenario**

Ball launched from a height of 7 units.

**Result**

Ball velocity at **1.5 sec** is **2 units/second²**

**Simulation Model**

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**ValidatedBy**

**SimulationModel**

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**Status:** Pass

**Description:** Requirement is satisfied.

**Test Case**
Our APIs

- Simulation API
- Requirement API
- Test Case API
Kiwi proxy
Kiwi proxy – Link Creation

API Client

PUT requirement/1
{"validatedBy": "app:testcase-api/1"}

KiWi Proxy

POST requirement/1
{"validatedBy": "app:testcase-api/1"}

Response 1: Invalid Request

Response 2: Success

Link Created!

Koneksys
Kiwi proxy – Link Discovery

API Client

GET testcase/1

Response 1 + Response 2

Proxy

GET testcase/1

Response 1

Response 2

GET linked resources to testcase/1

Testcase API

Link Store
Change in Requirement
Limitations of Connecting REST API resources

- REST APIs conform to specific schemas not allowing the addition of new links to existing resources.

- Questions to answer:
  - Can we have centrally defined linking rules to avoid chaos?
  - Can we have a centralized link store?
  - How to achieve centralized configuration management?
Kiwi Control Plane

```
{
  "app:requirement-api": [
    {"link_type": "validatedBy", "link_target": "app:testcase-api", "multiplicity": "N"}
  ],

  "app:testcase-api": [
    {"link_type": "simulationModel", "link_target": "app:simulation-api", "multiplicity": "N"}
  ]
}
```
Kiwi

- Kiwi is an application that allows linking resources from different REST APIs, without any modification to the REST APIs.

- Inspired by Istio’s service mesh architecture, kiwi is brought to life by Kubernetes.
Kubernetes
Kubernetes – platform to deploy containerized applications.

What are containerized applications?

“A container is a standard unit of software that packages up code and all its dependencies so the application runs quickly and reliably from one computing environment to another.”
Kubernetes Architecture

User interface

UI

CLI
kubectl

Control plane

API Server
Scheduler
Controller-Manager
etcd

Worker node 1

Pod 1
Container 1
Container 2
Container 3

Pod 2
Container 1

Pod 3
Container 1
Container 2

Worker node 2

Pod 1
Container 1
Container 2
Container 3

Pod 2
Container 1

Pod 3
Container 1

Docker
kubelet
Kube-proxy

Docker
kubelet
Kube-proxy
Exposing containers outside their pods.
Managing Services

Istio
Istio Architecture

Data Plane: Envoy Proxies for services that intercept network traffic.

Control Plane: Configures and Manages the envoy proxies.

Traffic management and routing is thereby taken over by envoy proxies and becomes centralized.
Kiwi Architecture
Next Steps

- As kiwi employs the automatic sidecar deployment in Kubernetes, it can only be used for REST APIs hosted on a Kubernetes cluster. Explore ways in which Kiwi can be employed outside of Kubernetes.
- **All** REST APIs are hosted on the same Kubernetes cluster. Can we link resource across different clusters?
Summary

- Kiwi connects resources in different REST APIs **without** any modification to the resources in the REST APIs.
- Kiwi uses sidecar proxies to achieve linking resources.
- Kiwi manages link store and linking configuration centrally via the control plane. It is heavily inspired by Istio’s service mesh architecture.
- Kiwi can only be used if all REST APIs reside on the same Kubernetes cluster.
Thanks!

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