ECLIPSE CON2022

Why Eclipse Kura and Eclipse Kapua treat EdgeOps headaches better then ibuprofen?

Kapua

kura™

Motivation

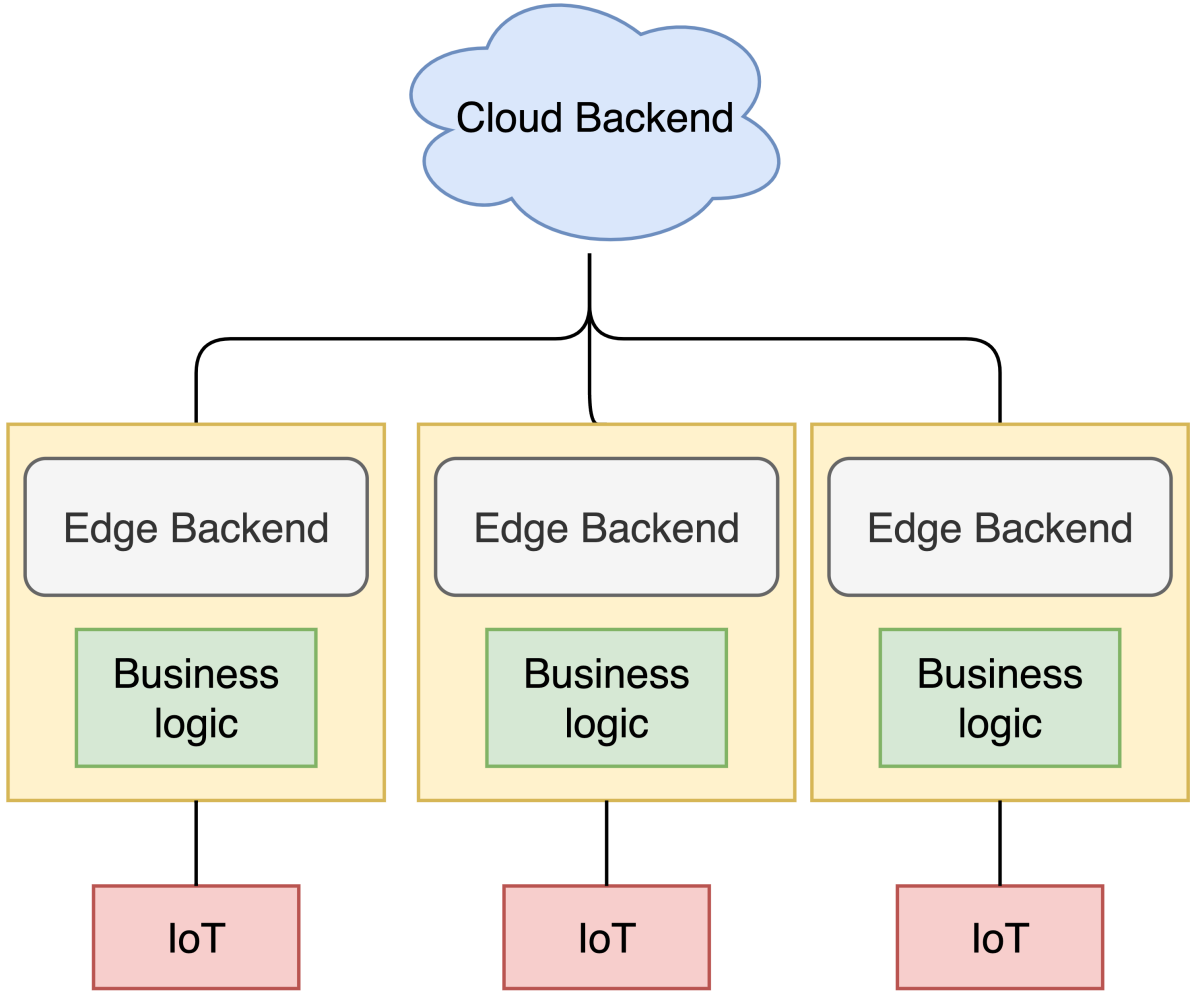
“Data is the new oil” - Clive Humby

Edge and **IoT** systems maximize the amount of data we can capture.

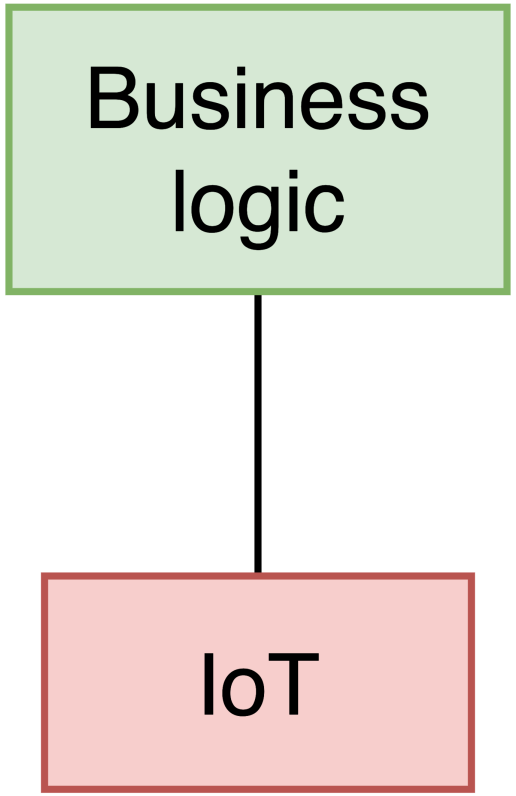
Why start from scratch when good **Edge** frameworks already exist?

Isn’t business logic enough of a headache on its own?

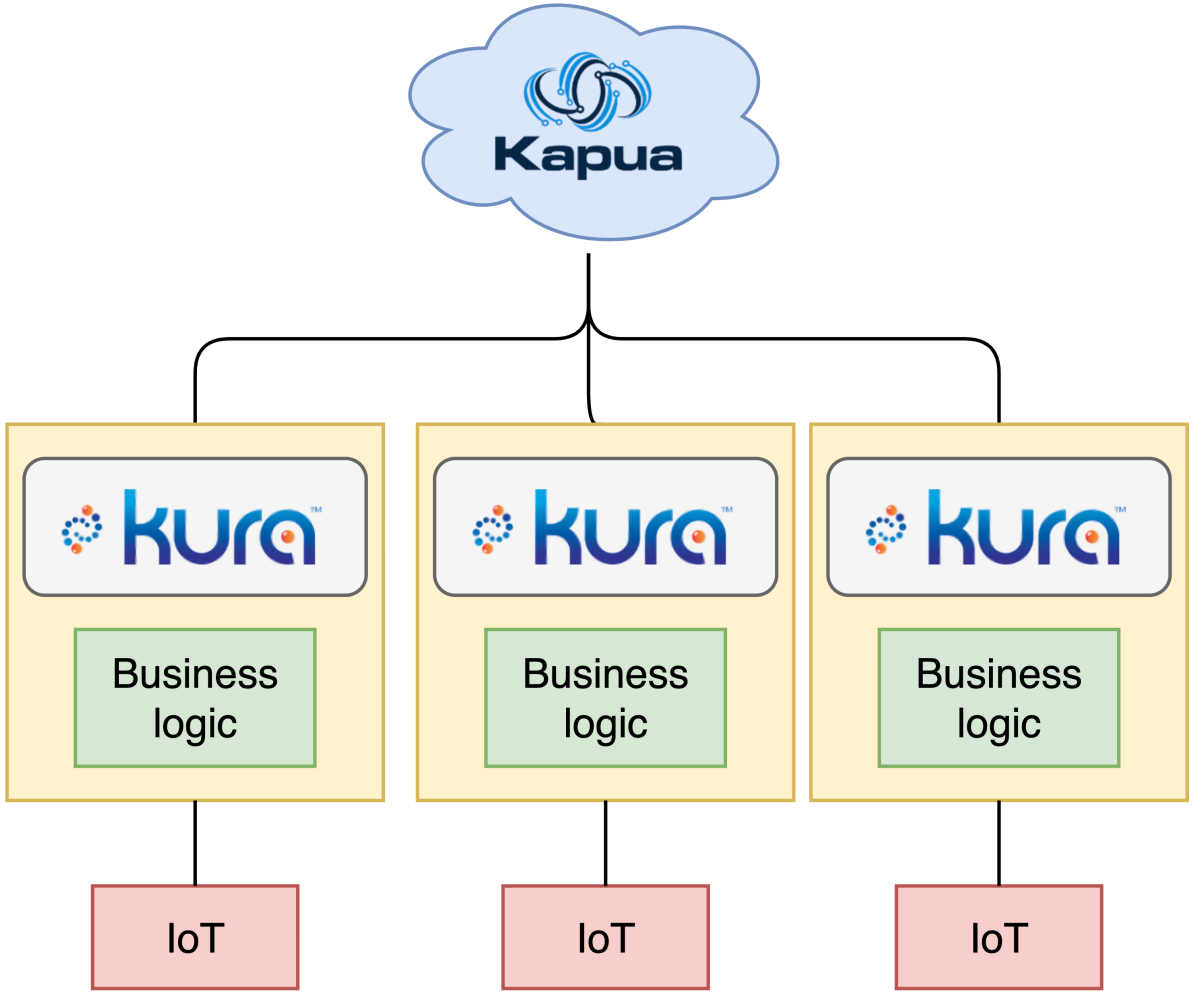
What you need to build your own Edge from scratch



What you need to build when using Eclipse Kura & Kapua



Why? – Kura & Kapua have your backend solved.



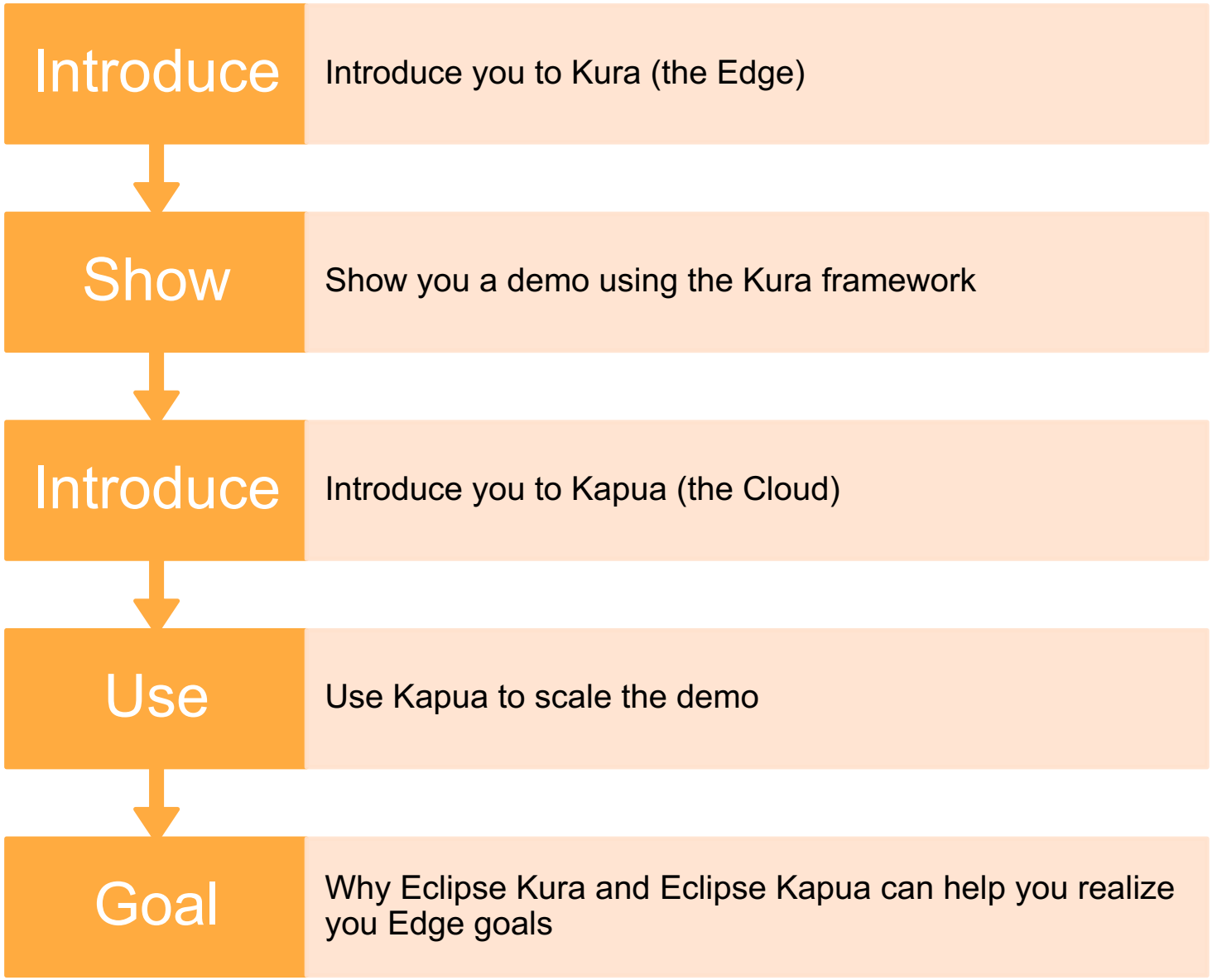
$ whoami : Gregory Ivo

- Currently ESF/Kura Engineer at Eurotech inc.

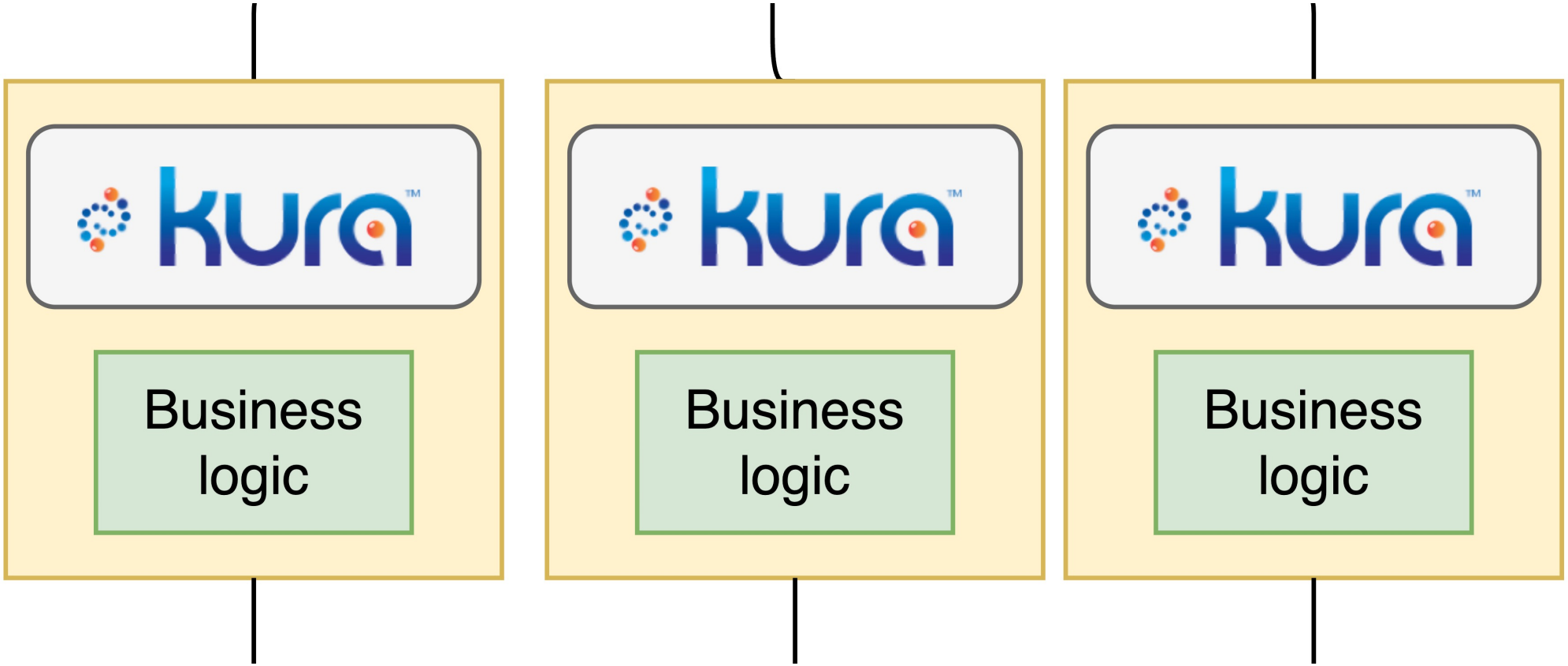
- Intern @ Eclipse in 2021

- Graduated from the University of Ottawa, Canada (BASc Computer Engineering) – December 2022

Agenda


Introduce
Introduce you to Kura (the Edge)
Show
Show you a demo using the Kura framework
Introduce
Introduce you to Kapua (the Cloud)
Use
Use Kapua to scale the demo
Goal
Why Eclipse Kura and Eclipse Kapua can help you realize you Edge goals

Let’s start With the Edge



What is Kura™

EDGE FRAMEWORK THAT RUNS ON CONFINED DEVICES (I.E. RASPBERRY PI)

KURA-WIRES ALLOWS USERS TO VISUALLY PROGRAM DATA FLOWS

ORCHESTRATES CONTAINERS

SENDS & ACCEPTS MQTT DATA STREAMS

SAFELY STORES CONFIGURATIONS & SECRETS

USER FRIENDLY WEB ACCESSIBLE UI

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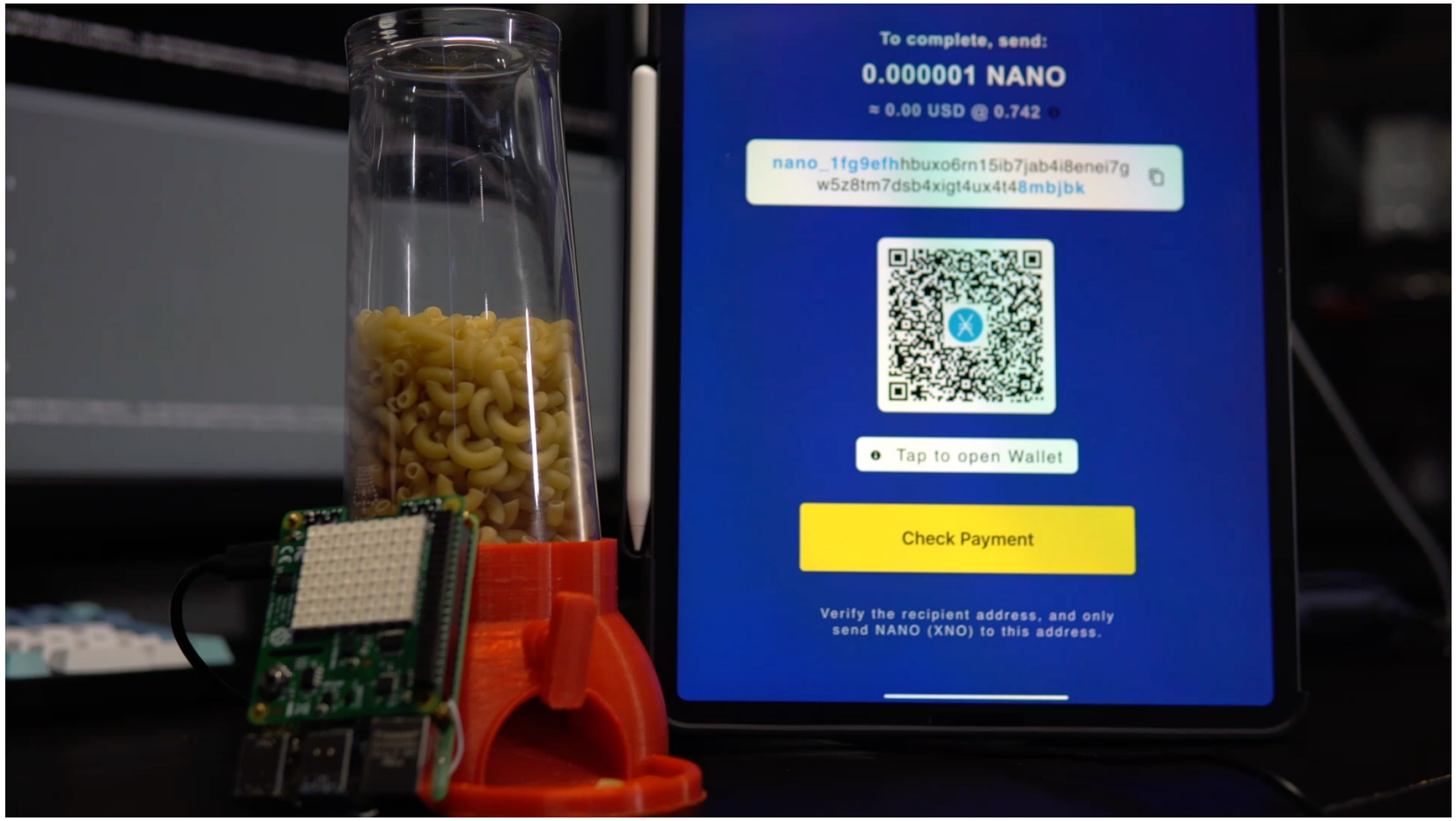
Set the Scene – The Kura Candy Machine

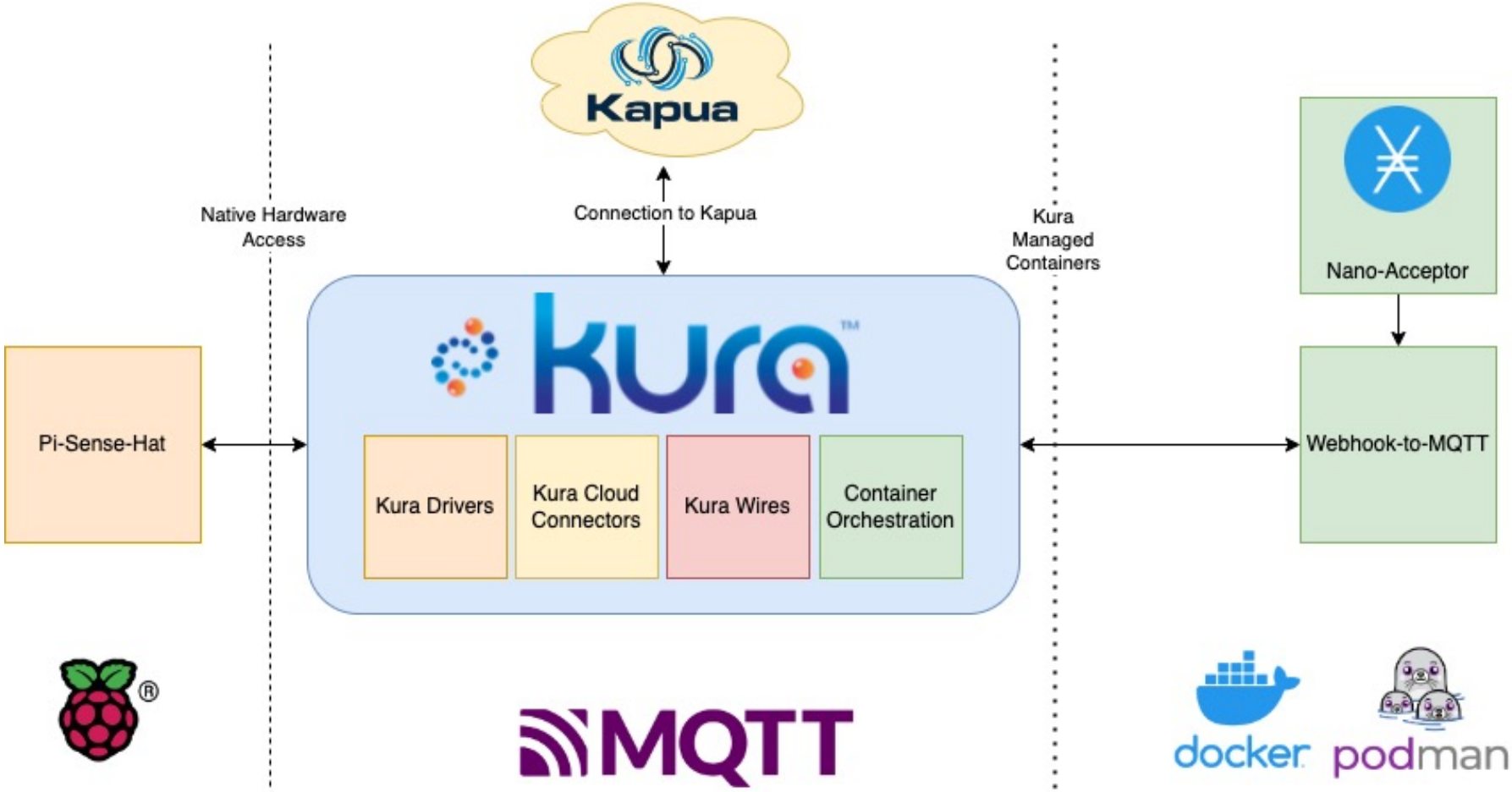
Let's make a Candy machine with the following Criteria:

1. Accepts payment and dispenses something of value in return;
2. Detects when someone is trying to tamper with it;
3. Reports data back to the cloud (i.e. when a sale is made and if has been tampered with); and,
4. Is easily scalable so that the company can deploy as many machines as necessary.

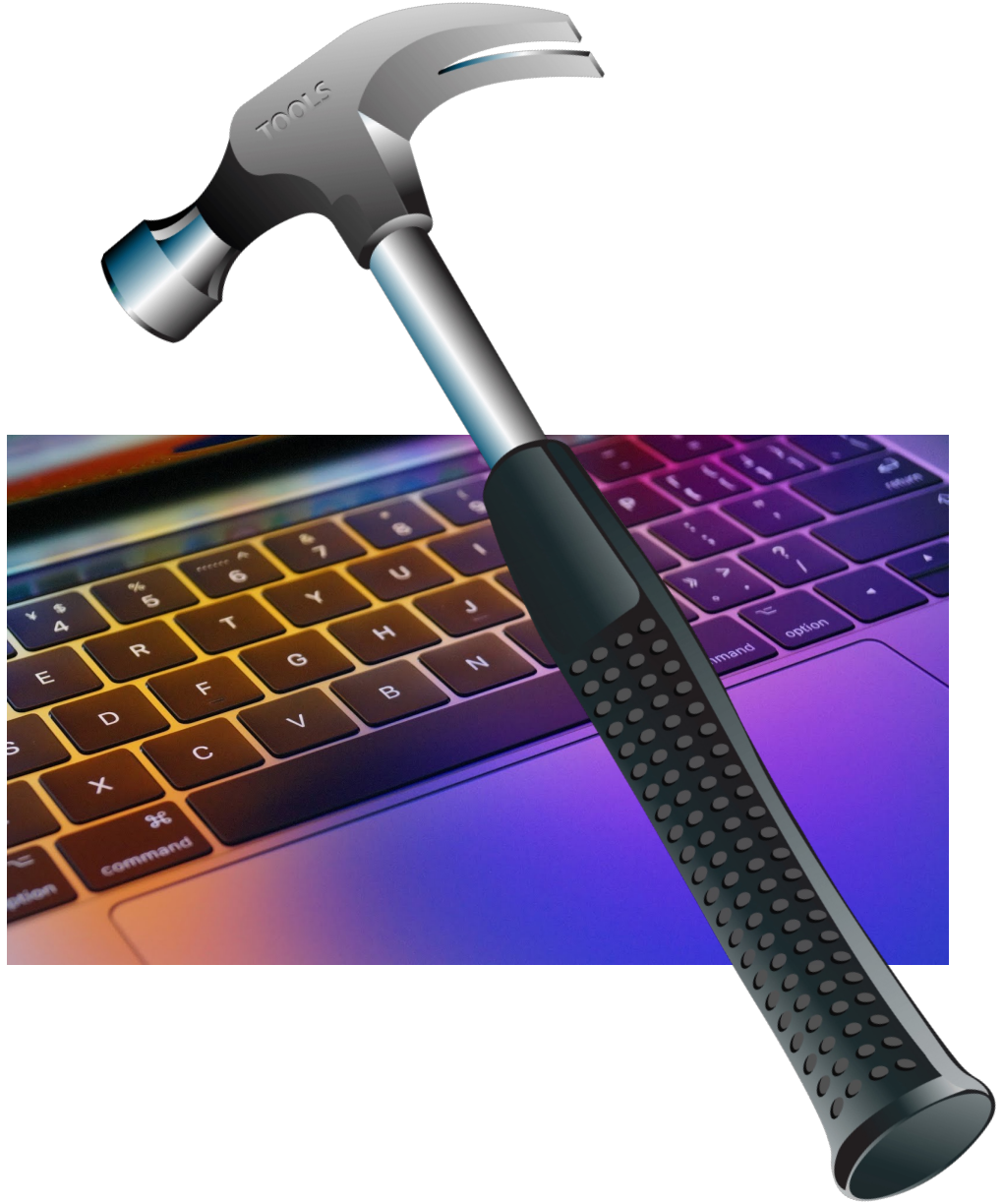
The Demo


To complete, send:
0.000001 NANO
≈ 0.00 USD @ 0.742
nano_1fg9efhhbuxo6rn15ib7jab4i8enei7g
w5z8tm7dsb4xigt4ux4t48mbjbk
Tap to open Wallet
Check Payment
Verify the recipient address, and only
send NANO (XNO) to this address.

How our Gumball machine works?



How Kura Helped Build It?



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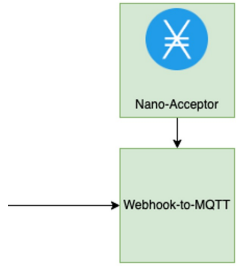
Kura – Container Manager/Orchestrator



- Interfaces with Docker/Podman and manages containers for you
- Containers are language agnostic – Run anything on top of Kura
- Kura Container Dashboard

Device

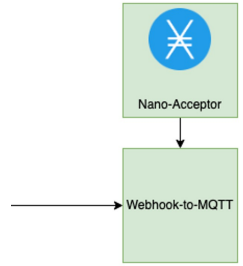
Summary information about the current hardware and software configuration of this device.

Profile | Bundles | Containers | Threads | System Packages | System Properties | Command | System Logs

▶ Start Container | ■ Stop Container | ↻ Refresh

Asset Type	ID	State	Name	Version	Framework Managed
Containers	nano-paymentConnector	Active	geevo/nanopaymentconnector	latest	true
Images	nano-websocketMQtt	Active	heleon19/http-mqtt-bridge	latest	true

Kura – Container Manager Cont.



ContainerInstance - nano-paymentConnector

Allows for the creation of containers.

✔ Apply | ✖ Reset | 🗑 Delete

Enabled *

Enables this container

◉ true ○ false

Image name *

The image the container will be created with. The value will need to be expressed in the form registryURL/imagename in case of a custom registry. Please fill the following registry credentials in case of pulling from a custom or authenticated Docker hub registry.

geevo/nanopaymentconnector

Image tag *

ContainerInstance - nano-websocketMQtt

Allows for the creation of containers.

✔ Apply | ✖ Reset | 🗑 Delete

Enabled *

Enables this container

◉ true ○ false

Image name *

The image the container will be created with. The value will need to be expressed in the form registryURL/imagename in case of a custom registry. Please fill the following registry credentials in case of pulling from a custom or authenticated Docker hub registry.

heleon19/http-mqtt-bridge

Image tag *

Authentication Registry URL

Url for docker registry. Required only for authenticated registries

Authentication Username

Username for container registry. Required only for authenticated registries

Password

Password for container registry. Required only for authenticated registries

Image Download Retries *

The number of retries to pull the container image. Set to 0 for unlimited retries

5

Image Download Retry Interval *

The interval (in milliseconds) between retries to pull the container image

30000

Image Download Timeout *

Image download timeout. Value specified in seconds

500

Internal Ports

A comma-separated list of ports. If no protocol is specified tcp will be used. Note, the number of internal ports must be equal to the number of external ports. A port internet protocol can also be specified with a colon and text after the port number. Example: 80, 443:udp, 8080:tcp.

80:tcp

External Ports

A comma separated list of ports. Note, the number of external ports must be equal to the number of internal ports. Example: 8080, 443.

8080

Privileged Mode *

Give the container privileged access. (Warning: use this option at your own risk as privileged containers can be dangerous)

○ true ◉ false

Environment Variables

Additional container enviroment variables. Example: example_var_1=123, example_var_2=123.

Entrypoint Override

Comma separated list which is used to override the command used to start a container. Example: ./test.sh,-v,-d,--human-readable

Memory

The maximum amount of memory the container can use in bytes. Set it as a positive integer, optionally followed by a suffix of b, k, m, g, to indicate bytes, kilobytes, megabytes, or gigabytes. The minimum allowed value is platform dependent (i.e. 6m). If left empty, the memory assigned to the container will be set to a default value by the native container orchestrator.

CPUs

Specify how many CPUs a container can use. Decimal values are allowed, so if set to 1.5, the container will use at most one and a half cpu resource.

GPUs

Specify how many Nvidia GPUs a container can use. Allowed values are 'all' or an integer number. If there's no Nvidia GPU installed, leave the field empty.

Volume Mount

The path on the container at which you would like to mount a file or folder. Example: /path/on/host1:/path/on/container1, /path/on/host2:/path/on/container2.

Peripheral Device

Used to pass physical devices to a container. Example: /dev/gpiomem, /dev/ttyUSB0. (Generally Requires privileged mode to be enabled)

Networking Mode

Used to specify what networking mode the container will use. Possible Drivers: bridge, none, container:{container id}, host. Note: This field is case-sensitive.

Logger Type *

Used to specify what logging driver the container will use. By default, containers will log to a JSON-FILE on the gateway.

DEFAULT

Logger Parameters

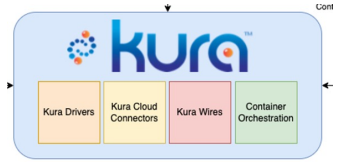
Used to pass logger parameters to a container's logging driver. Example: max-buffer-size=4m, labels=location.

Restart Container On Failure *

Automatically restart the container when it has failed.

○ true ◉ false

Kura – MQTT comes built in



MQTT

Services

Search

Simple Artemis MQTT Broker

ActiveMQ Artemis Broker

BrokerInstance - Simple Artemis MQTT Broker

A simple MQTT broker instance based on Apache ActiveMQ Artemis

Apply | Reset | Delete

Enabled *

Enables the broker instance

true / false

MQTT address

The address the MQTT broker listens for incoming connections. Be sure to check if the firewall is configured correctly to allow access to this address.

0.0.0.0

MQTT port *

The port of the MQTT broker. Be sure to check if the firewall is configured correctly to allow access to this port.

1883

User name

The user name required to access to the broker

mqtt

Password of the user

The password required to connect. If the password is empty, no password will be required to connect.

••••••••••

ActiveMQ Artemis Broker instance, configured using XML

Apply | Reset | Delete

Enabled *

Enables the broker instance

true / false

Broker XML

Broker XML configuration. An empty broker configuration will disable the broker.

```
<?xml version="1.0" encoding="UTF-8"?>

<configuration xmlns="urn:activemq"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="
urn:activemq https://raw.githubusercontent.com/apache/activemq-artemis/master/artemis-server/src/main
/resources/schema/artemis-server.xsd
urn:activemq:core https://raw.githubusercontent.com/apache/activemq-artemis/master/artemis-server
/src/main/resources/schema/artemis-configuration.xsd
urn:activemq:jms https://raw.githubusercontent.com/apache/activemq-artemis/master/artemis-jms-server
```

Required protocols

A comma seperated list of all required protocol factories (e.g. AMQP or MQTT)

MQTT

User configuration *

User configuration in the format: user=password|role1,role2,...

mqtt=mqtt|guest

Default user name

The name of the default user

mqtt

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Kura – Cloud Connectors

- Extendable
- MQTT is supported out of the box
- Can be used to broker a connection to the internal MQTT server (or any other MQTT server)
- Can be used to communicate with Kapua (send telemetry)
- Supports Concurrent Multi-Cloud Connections
- AWS, Azure

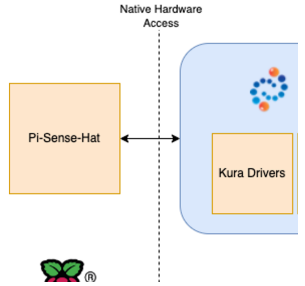
Cloud Connections

Setup connections to your preferred Cloud Platforms and manage publishers and subscribers.

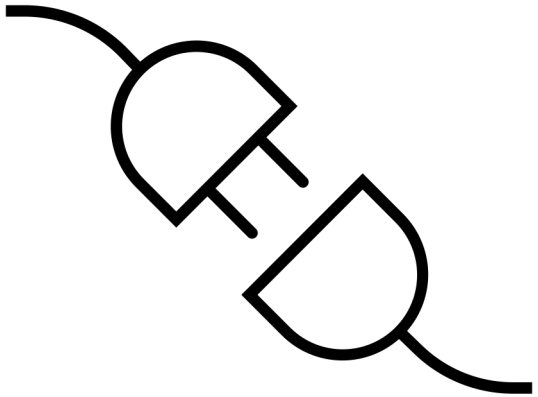
+ New Connection | + New Pub/Sub | Delete | Connect/Disconnect | Refresh

Service PID	Type	Status	Factory PID
org.eclipse.kura.cloud.CloudService	Cloud connection	Connected	org.eclipse.kura.cloud.CloudService
paymentPub	Publisher		org.eclipse.kura.cloud.publisher.CloudPublisher
tamperPub	Publisher		org.eclipse.kura.cloud.publisher.CloudPublisher
org.eclipse.kura.cloud.CloudService-2	Cloud connection	Connected	org.eclipse.kura.cloud.CloudService
paymentSub	Subscriber		org.eclipse.kura.cloud.subscriber.CloudSubscriber

Kura - Drivers



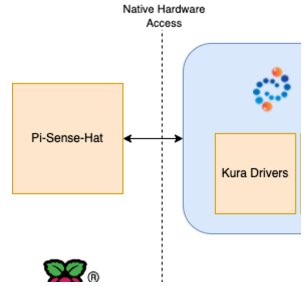
- Extendable
- Add support for various protocols
- Can be even used for protocol conversion
- Field Protocols in vertical markets
    - Proprietary Protocols
    - Modbus
    - PLC



In our Demo

- Used the ‘SenseHat Driver’ from the Eclipse Market Place
- It Allows us to read & write the I^2c bus from pi’s GPIOs to communicate with sense hat

Kura – Drivers Cont.



Drivers and Assets

Create and manage your Drivers and Assets instances. Inspect and change the Assets values.

+ New Driver | + New Asset | Delete

Service PID	Type	Factory PID
driver-sensehat	Driver	org.eclipse.kura.driver.sensehat
-> asset-sensehat	Asset	org.eclipse.kura.wire.WireAsset
-> asset-sensehat-write	Asset	org.eclipse.kura.wire.WireAsset

Channels (driver-sensehat)

enabled	name	type	value.t..	sc	of	up	lis	resource
☑	ACC_X	READ	FLOAT				☐	ACCELERATION_X
☑	ACC_Y	READ	FLOAT				☐	ACCELERATION_Y
☑	ACC_Z	READ	FLOAT				☐	ACCELERATION_Z
☑	GYRO_X	READ	FLOAT				☐	GYROSCOPE_X
☑	GYRO_Y	READ	FLOAT				☐	GYROSCOPE_Y
☑	GYRO_Z	READ	FLOAT				☐	GYROSCOPE_Z
☑	HUMIDITY	READ	FLOAT				☐	HUMIDITY
☑	PRESSURE	READ	FLOAT				☐	PRESSURE
☑	TEMP_HUM	READ	FLOAT				☐	TEMPERATURE_FROM_HUMIDITY
☑	TEMP_PRESS	READ	FLOAT				☐	TEMPERATURE_FROM_PRESSURE

Channels (driver-sensehat)

enabled	name	type	value.type	sc	of	up	lis	resource
☑	LED_MATRIX_BACK_COLOR_B	WRITE	FLOAT				☐	LED_MATRIX_BACK_COLOR_B
☑	LED_MATRIX_BACK_COLOR_G	WRITE	FLOAT				☐	LED_MATRIX_BACK_COLOR_G
☑	LED_MATRIX_BACK_COLOR_R	WRITE	FLOAT				☐	LED_MATRIX_BACK_COLOR_R
☑	LED_MATRIX_CHARS	WRITE	STRING				☐	LED_MATRIX_CHARS
☑	LED_MATRIX_FRONT_COLOR_B	WRITE	FLOAT				☐	LED_MATRIX_FRONT_COLOR_B
☑	LED_MATRIX_FRONT_COLOR_G	WRITE	FLOAT				☐	LED_MATRIX_FRONT_COLOR_G
☑	LED_MATRIX_FRONT_COLOR_R	WRITE	FLOAT				☐	LED_MATRIX_FRONT_COLOR_R

Kura – Snapshots

The time machine that sci-fi movies always promised us.

- DeLorean not needed
- Allow us to reverse changes and go ‘back in time’
- Allow us to apply configurations from other devices and go ’back to the future’
- Snapshots are in XML/JSON, can be easily customized and shared

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Kura – Snapshots

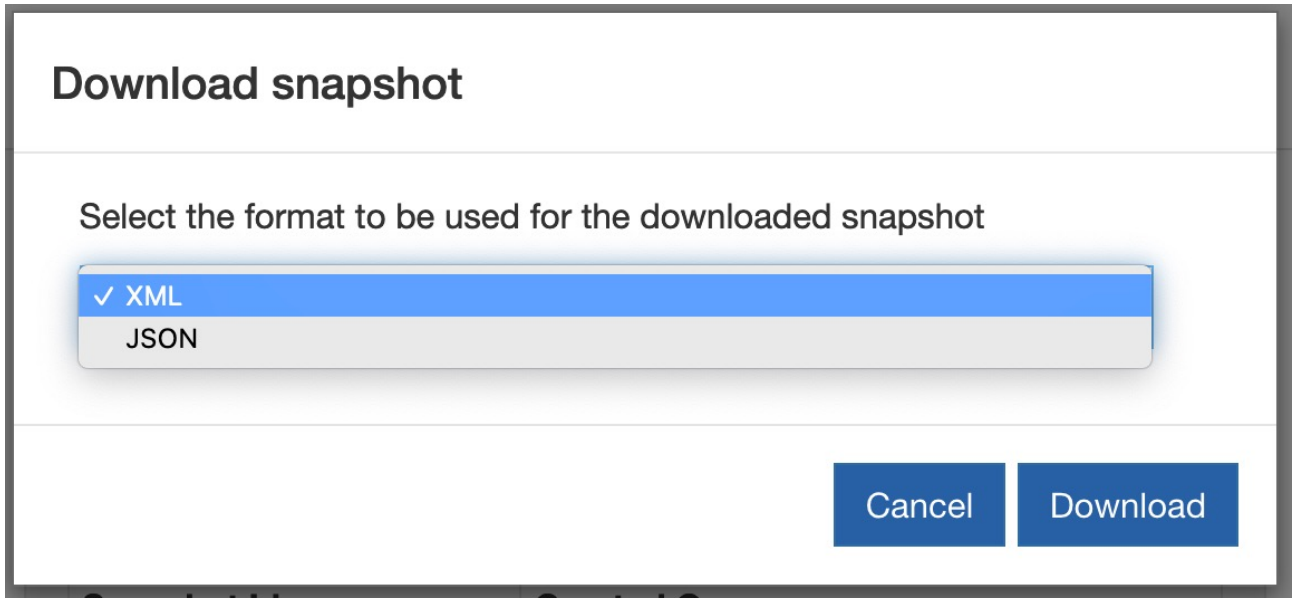
Settings

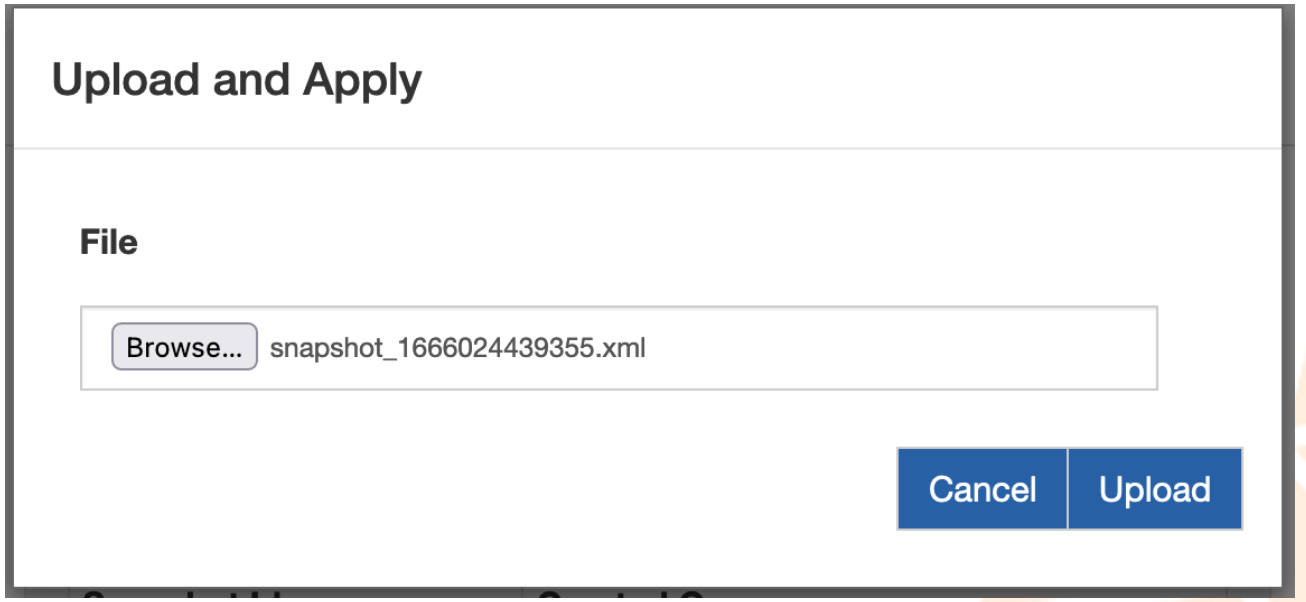
Review and update the available system settings.

Snapshots

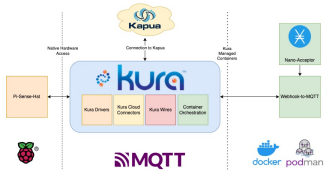
Download | Rollback | Upload and Apply | Refresh

Snapshot Id	Created On
1666024439355	Today 12:33:59 PM
1665873821310	Oct 15, 2022, 6:43:41 PM
1665873753767	Oct 15, 2022, 6:42:33 PM
1665873720646	Oct 15, 2022, 6:42:00 PM
1665873141893	Oct 15, 2022, 6:32:21 PM
1665863190536	Oct 15, 2022, 3:46:30 PM
1665863032656	Oct 15, 2022, 3:43:52 PM
1665863016395	Oct 15, 2022, 3:43:36 PM
1665862997867	Oct 15, 2022, 3:43:17 PM
0	Dec 31, 1969, 7:00:00 PM

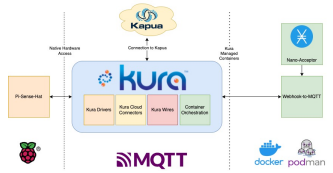




Kura - Extendibility



- Designed with extendibility in mind
- If a feature is missing, just write a Kura native component
- Kura is written in Java-OSGi so plugins can be loaded at runtime
- Many add-ons in the eclipse marketplace for Kura
- drag and drop to add to Kura



Kura – Extendibility Cont.

Install from Eclipse Marketplace™

In order to install a deployment package from Eclipse Marketplace drag and drop here the Install button available in the software description page.

+ Install/Upgrade | − Uninstall

Name	Version	Signed
org.eclipse.kura.raspberrypi.sensehat	1.2.0	false
org.eclipse.kura.example.driver.sensehat	1.0.300	false
org.eclipse.kura.wire.script.filter	1.1.0	false

eclipse marketplace

SenseHAT example driver for Eclipse Kura 4/5

Sensehat Support Library Bundle for Eclipse Kura 4/5

Wires Script Filter for Kura 4/5

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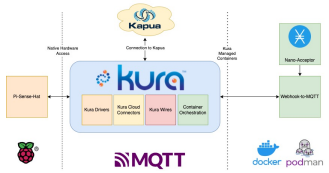
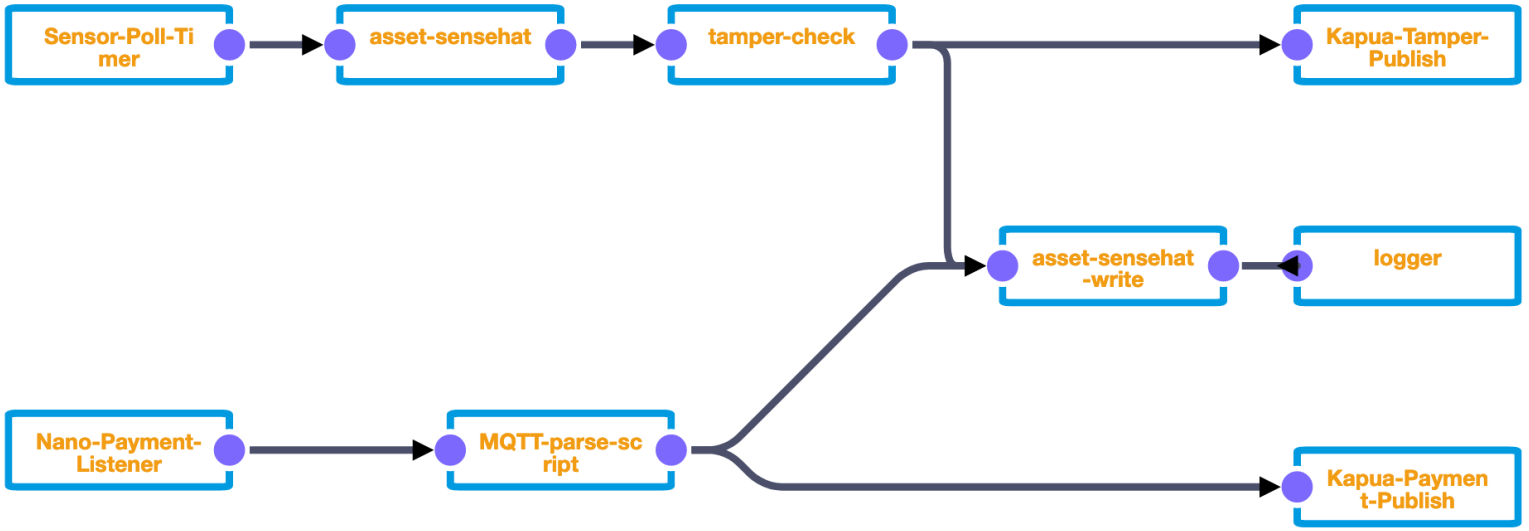


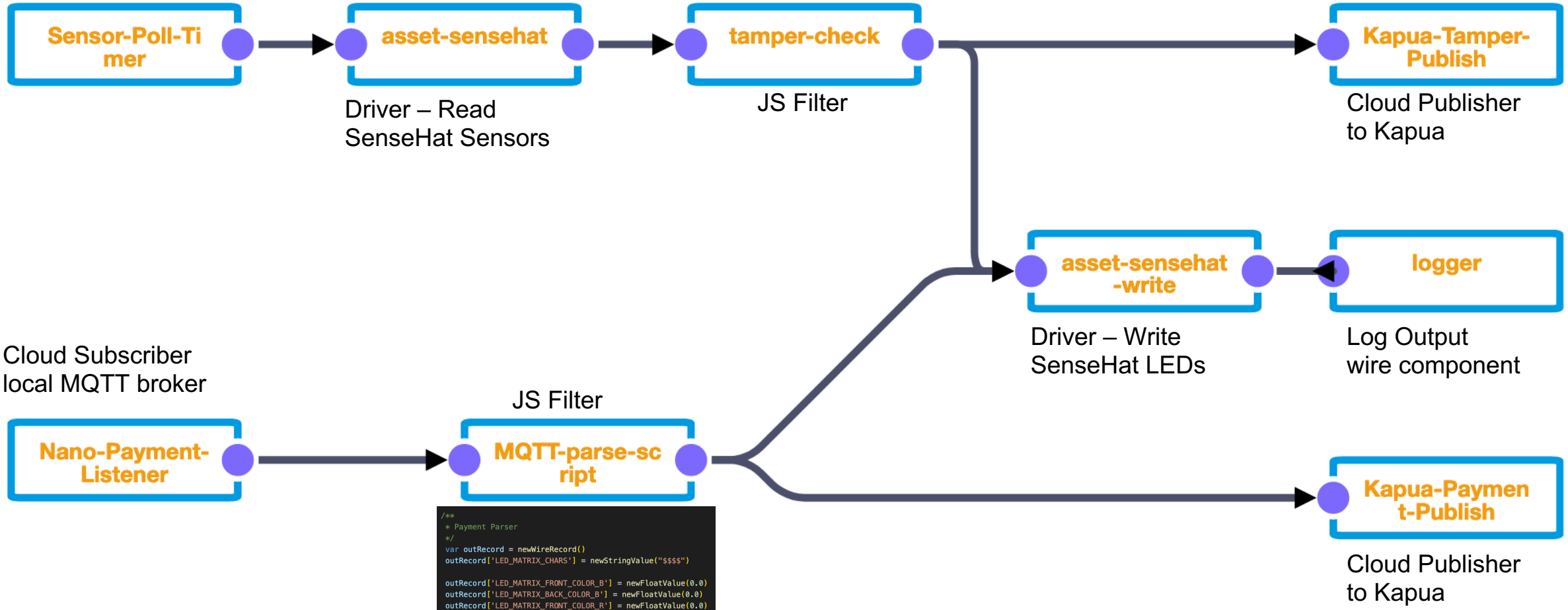
Kura - Wires

- Wire the demo together
- Data flows and logic, programmed visually
- Drag, drop and connect wire-assets to define your business logic



Timer Wire Component

```
/**
 * tamper detection
 */
var inRecord = input.records[0]
var outRecord = newWireRecord()

if(inRecord.ACC_X.getValue() > 2 || inRecord.ACC_Y.getValue() > 2 || inRecord.ACC_Z.getValue() > 2){

    outRecord['LED_MATRIX_CHARS'] = newStringValue("TAMPER")

    outRecord['LED_MATRIX_FRONT_COLOR_B'] = newFloatValue(0.0)
    outRecord['LED_MATRIX_BACK_COLOR_B'] = newFloatValue(0.0)


    outRecord['LED_MATRIX_FRONT_COLOR_R'] = newFloatValue(1.0)
    outRecord['LED_MATRIX_BACK_COLOR_R'] = newFloatValue(0.0)
    outRecord['LED_MATRIX_FRONT_COLOR_G'] = newFloatValue(0.0)
    outRecord['LED_MATRIX_BACK_COLOR_G'] = newFloatValue(0.0)

    outRecord['status'] = netStringValue("Tamper Detected. Please Service Machine")
    outRecord['time'] = newLongValue(Date.now())

    output.add(outRecord)
}
```




```
/**
 * Payment Parser
 */
var outRecord = newWireRecord()
outRecord['LED_MATRIX_CHARS'] = newStringValue("$$$$")

outRecord['LED_MATRIX_FRONT_COLOR_B'] = newFloatValue(0.0)
outRecord['LED_MATRIX_BACK_COLOR_B'] = newFloatValue(0.0)
outRecord['LED_MATRIX_FRONT_COLOR_R'] = newFloatValue(0.0)
outRecord['LED_MATRIX_BACK_COLOR_R'] = newFloatValue(0.0)
outRecord['LED_MATRIX_FRONT_COLOR_G'] = newFloatValue(1.0)
outRecord['LED_MATRIX_BACK_COLOR_G'] = newFloatValue(0.0)


outRecord['status'] = netStringValue("Payment Accepted.")
outRecord['time'] = newLongValue(Date.now())

output.add(outRecord)
```

Deploy, Distribute and Scale

What is Eclipse Kapua?

Holistic and fully featured Approach to the Edge.

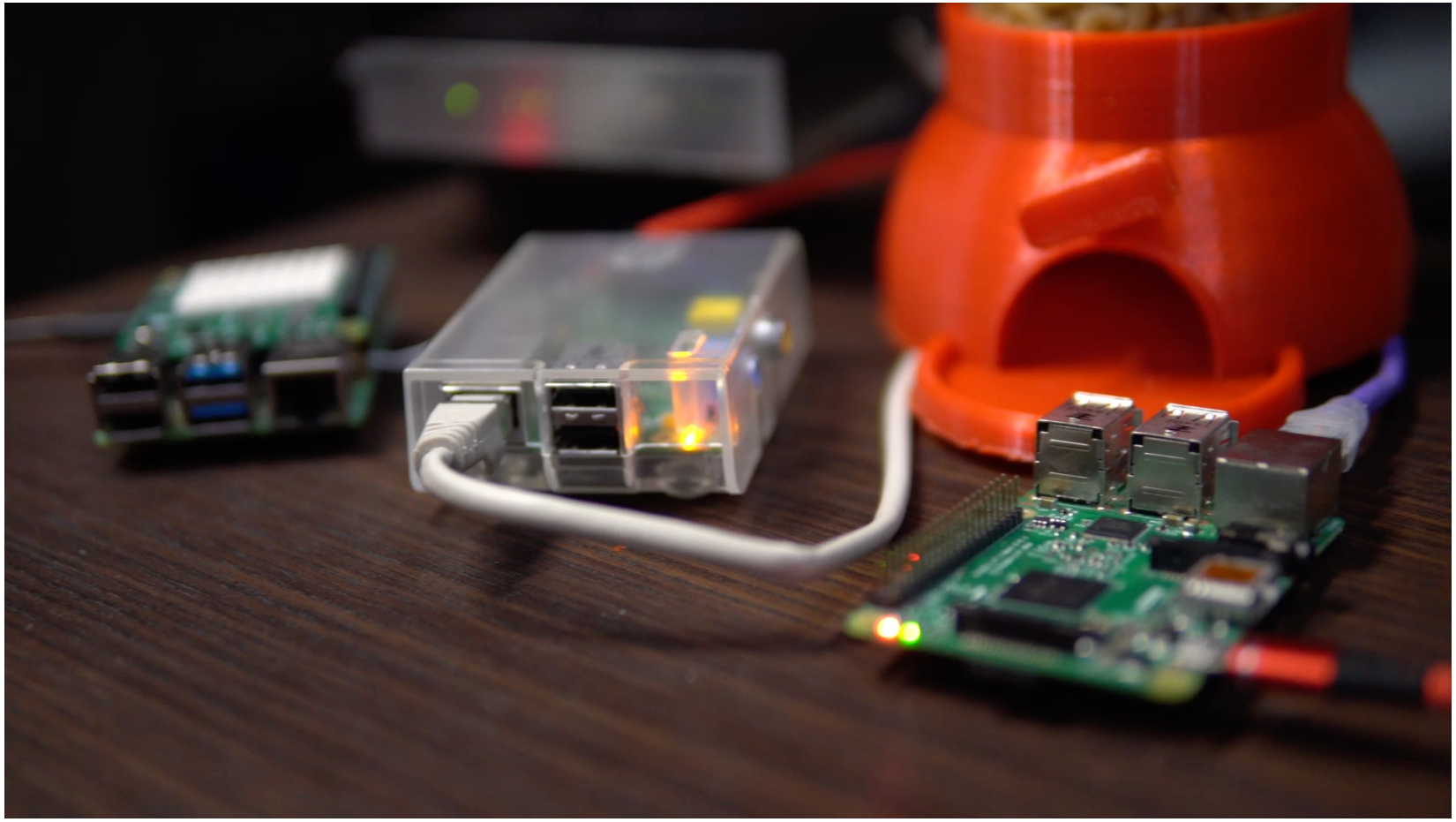
- IoT Cloud platform that integrates and manages IoT Gateways
- Manages the connectivity of IoT, and Edge gateways
- Supports many protocols MQTT, AMQP, and HTTP
- Sophisticated multi-tenant account management
- Easy data pipelines for collecting mass amounts of information from connected devices
- RESTful API for integration with custom applications
- intuitive web UI

Set the Scene – The Kura Candy Machine

Let's make a Candy machine with the following Criteria:

1. ~~Accepts payment and dispenses something of value in return;~~
2. ~~Detects when someone is trying to tamper with it;~~
3. Reports data back to the cloud (i.e. when a sale is made and if has been tampered with); and,
4. Is easily scalable so that the company can deploy as many machines as necessary.

Let’s Put our Gumball machines all over the world



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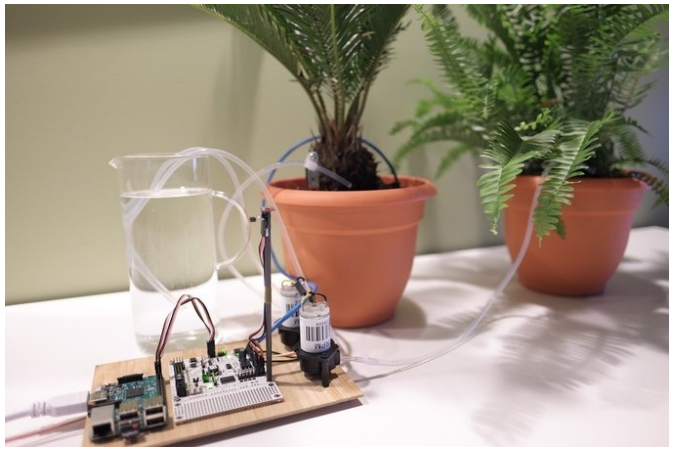
With Kura + Kapua you can do the following…

Kapua – Device Connections

- Brokered via MQTT
- Does not require ports to be opened on the Edge device
- Edge devices are expected to not have the best network quality



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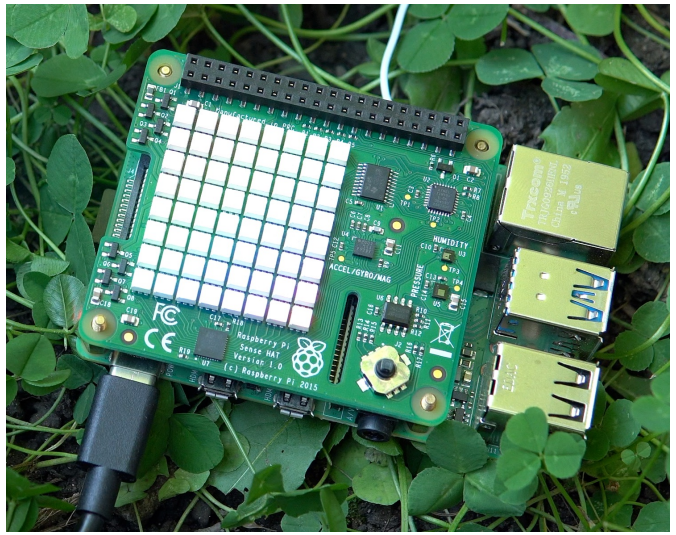
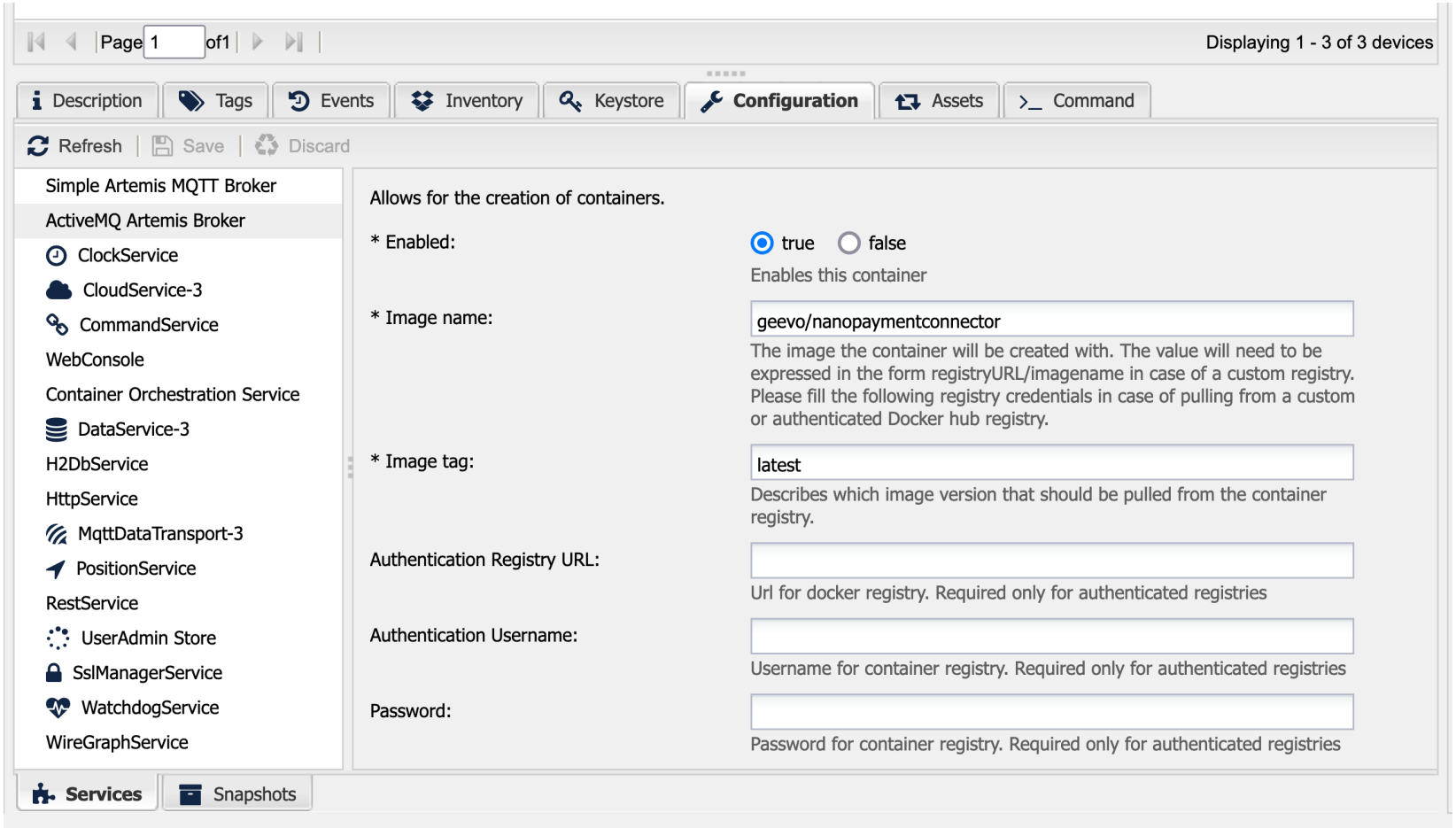


Kapua – Configuration Service

Configure Edge settings from the cloud



Kapua – Snapshot Service

The Kura Time Machine in the cloud….. This is how we scale.

Description | Tags | Events | Inventory | Keystore | **Configuration** | Assets | Command

Refresh | Download | Rollback To | Upload And Apply

Snapshot ID	Created On
1665965183056	Sun 16 Oct 2022 20:06:23 GMT-04:00
1665965177813	Sun 16 Oct 2022 20:06:17 GMT-04:00
1665965114952	Sun 16 Oct 2022 20:05:14 GMT-04:00
1665965090858	Sun 16 Oct 2022 20:04:50 GMT-04:00
1665965044599	Sun 16 Oct 2022 20:04:04 GMT-04:00
1665965038064	Sun 16 Oct 2022 20:03:58 GMT-04:00
1665965032491	Sun 16 Oct 2022 20:03:52 GMT-04:00
1665965026641	Sun 16 Oct 2022 20:03:46 GMT-04:00
1665965019744	Sun 16 Oct 2022 20:03:39 GMT-04:00
0	Seeded Snapshot

Services | Snapshots

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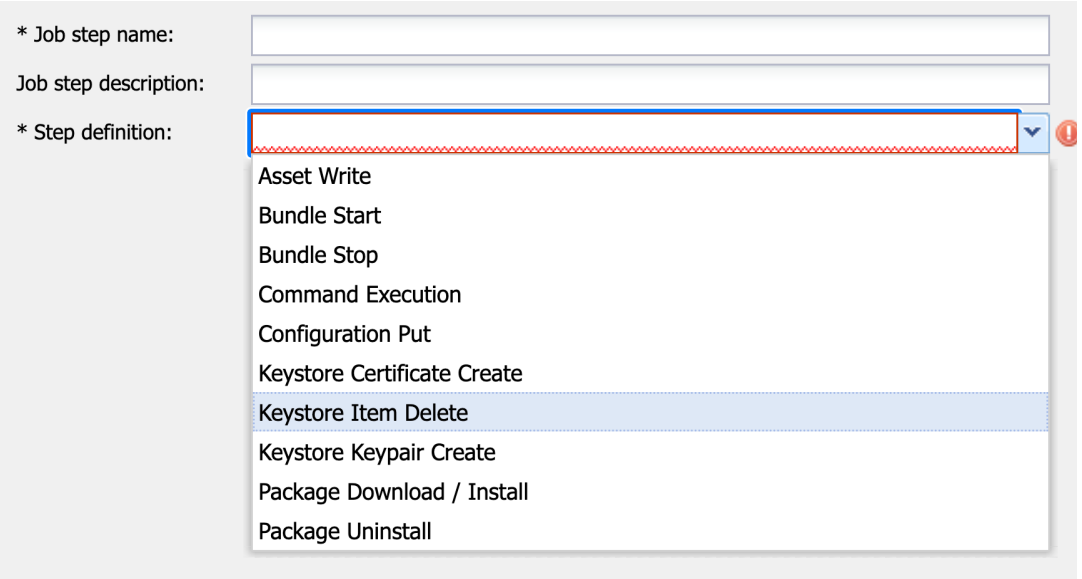
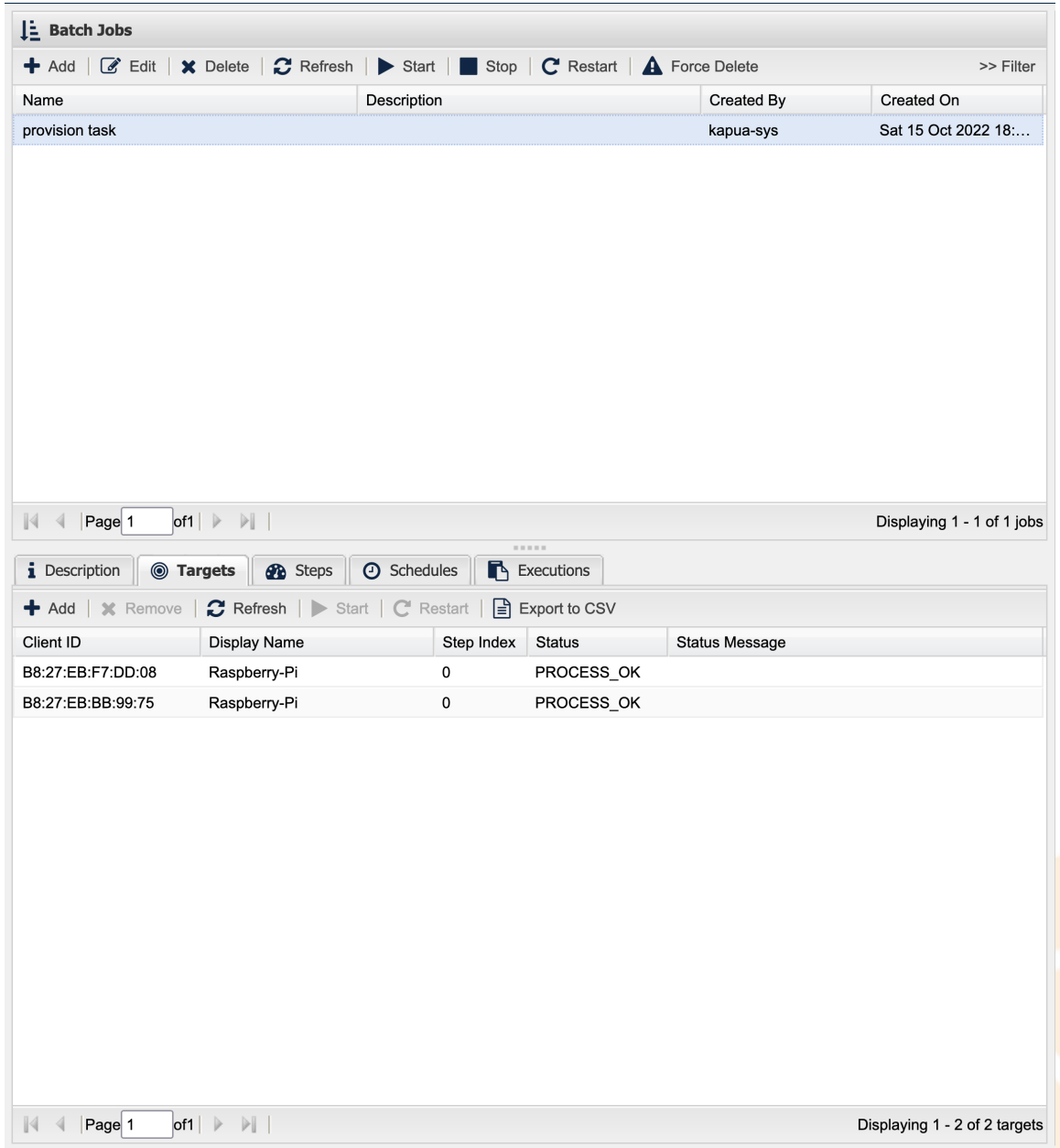
Kapua – Batch Jobs

- For large deployments
- Define a procedure of steps
- Apply to all gateways connected



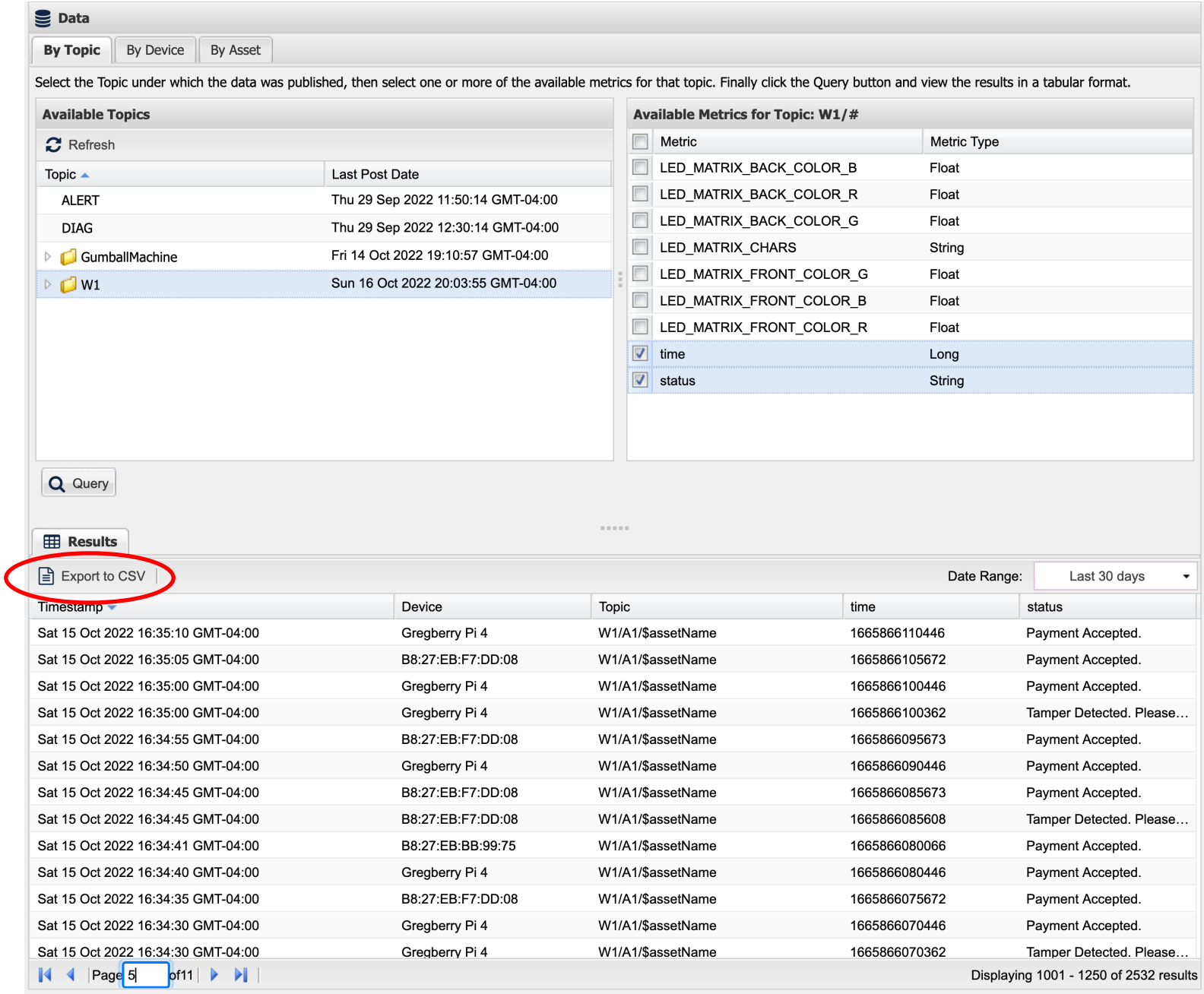


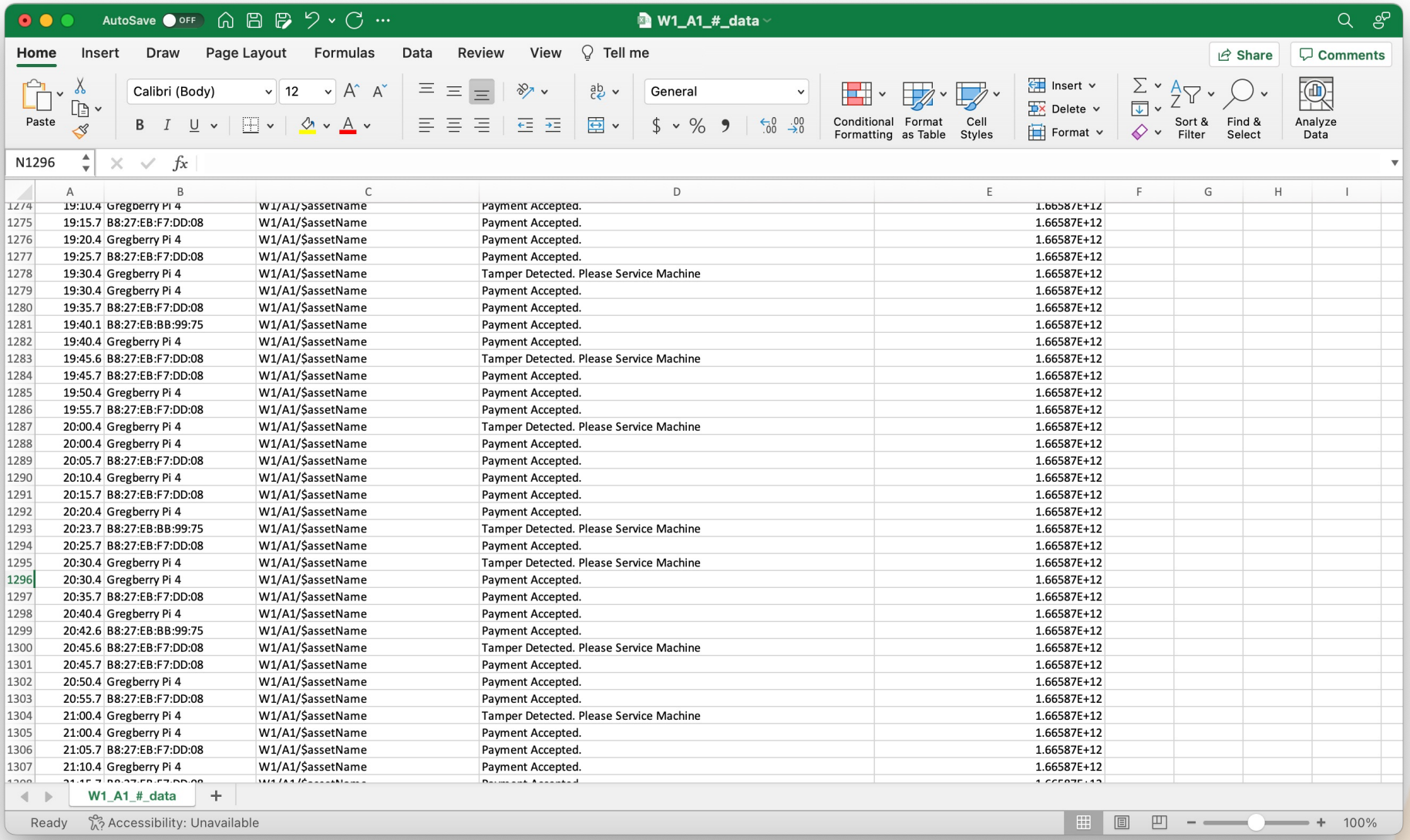
Kapua – Data Collection

Tool that helps you Query and Aggregate messages from the Edge

All exportable to a CSV file

AKA: The feature that will make your boss/shareholders happy


Data
By Topic
By Device
By Asset
Select the Topic under which the data was published, then select one or more of the available metrics for that topic. Finally click the Query button and view the results in a tabular format.
Available Topics
Refresh
Topic
Last Post Date
ALERT
Thu 29 Sep 2022 11:50:14 GMT-04:00
DIAG
Thu 29 Sep 2022 12:30:14 GMT-04:00
GumballMachine
Fri 14 Oct 2022 19:10:57 GMT-04:00
W1
Sun 16 Oct 2022 20:03:55 GMT-04:00
Available Metrics for Topic: W1/#
Metric
Metric Type
LED_MATRIX_BACK_COLOR_B
Float
LED_MATRIX_BACK_COLOR_R
Float
LED_MATRIX_BACK_COLOR_G
Float
LED_MATRIX_CHARS
String
LED_MATRIX_FRONT_COLOR_G
Float
LED_MATRIX_FRONT_COLOR_B
Float
LED_MATRIX_FRONT_COLOR_R
Float
time
Long
status
String
Query
Results
Export to CSV
Date Range:
Last 30 days
Timestamp
Device
Topic
time
status
Sat 15 Oct 2022 16:35:10 GMT-04:00
Gregberry Pi 4
W1/A1/$assetName
1665866110446
Payment Accepted.
Sat 15 Oct 2022 16:35:05 GMT-04:00
B8:27:EB:F7:DD:08
W1/A1/$assetName
1665866105672
Payment Accepted.
Sat 15 Oct 2022 16:35:00 GMT-04:00
Gregberry Pi 4
W1/A1/$assetName
1665866100446
Payment Accepted.
Sat 15 Oct 2022 16:35:00 GMT-04:00
Gregberry Pi 4
W1/A1/$assetName
1665866100362
Tamper Detected. Please…
Sat 15 Oct 2022 16:34:55 GMT-04:00
B8:27:EB:F7:DD:08
W1/A1/$assetName
1665866095673
Payment Accepted.
Sat 15 Oct 2022 16:34:50 GMT-04:00
Gregberry Pi 4
W1/A1/$assetName
1665866090446
Payment Accepted.
Sat 15 Oct 2022 16:34:45 GMT-04:00
B8:27:EB:F7:DD:08
W1/A1/$assetName
1665866085673
Payment Accepted.
Sat 15 Oct 2022 16:34:45 GMT-04:00
B8:27:EB:F7:DD:08
W1/A1/$assetName
1665866085608
Tamper Detected. Please…
Sat 15 Oct 2022 16:34:41 GMT-04:00
B8:27:EB:BB:99:75
W1/A1/$assetName
1665866080066
Payment Accepted.
Sat 15 Oct 2022 16:34:40 GMT-04:00
Gregberry Pi 4
W1/A1/$assetName
1665866080446
Payment Accepted.
Sat 15 Oct 2022 16:34:35 GMT-04:00
B8:27:EB:F7:DD:08
W1/A1/$assetName
1665866075672
Payment Accepted.
Sat 15 Oct 2022 16:34:30 GMT-04:00
Gregberry Pi 4
W1/A1/$assetName
1665866070446
Payment Accepted.
Sat 15 Oct 2022 16:34:30 GMT-04:00
Gregberry Pi 4
W1/A1/$assetName
1665866070362
Tamper Detected. Please…
Page 5 of 11
Displaying 1001 - 1250 of 2532 results



	A	B	C	D	E
1274	19:10.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1275	19:15.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1276	19:20.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1277	19:25.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1278	19:30.4	Gregberry Pi 4	W1/A1/$assetName	Tamper Detected. Please Service Machine	1.66587E+12
1279	19:30.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1280	19:35.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1281	19:40.1	B8:27:EB:BB:99:75	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1282	19:40.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1283	19:45.6	B8:27:EB:F7:DD:08	W1/A1/$assetName	Tamper Detected. Please Service Machine	1.66587E+12
1284	19:45.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1285	19:50.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1286	19:55.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1287	20:00.4	Gregberry Pi 4	W1/A1/$assetName	Tamper Detected. Please Service Machine	1.66587E+12
1288	20:00.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1289	20:05.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1290	20:10.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1291	20:15.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1292	20:20.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1293	20:23.7	B8:27:EB:BB:99:75	W1/A1/$assetName	Tamper Detected. Please Service Machine	1.66587E+12
1294	20:25.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1295	20:30.4	Gregberry Pi 4	W1/A1/$assetName	Tamper Detected. Please Service Machine	1.66587E+12
1296	20:30.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1297	20:35.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1298	20:40.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1299	20:42.6	B8:27:EB:BB:99:75	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1300	20:45.6	B8:27:EB:F7:DD:08	W1/A1/$assetName	Tamper Detected. Please Service Machine	1.66587E+12
1301	20:45.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1302	20:50.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1303	20:55.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1304	21:00.4	Gregberry Pi 4	W1/A1/$assetName	Tamper Detected. Please Service Machine	1.66587E+12
1305	21:00.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1306	21:05.7	B8:27:EB:F7:DD:08	W1/A1/$assetName	Payment Accepted.	1.66587E+12
1307	21:10.4	Gregberry Pi 4	W1/A1/$assetName	Payment Accepted.	1.66587E+12

In Summary

emma
@negansvoid
Follow
name a more iconic duo.. I'll wait.
kura™
+
Kapua

End of slide show, click to exit.

In Summary

Kura

- Container Manager
- MQTT Server Built-in
- Cloud Connectors
- Drivers
- Snapshots
- Wires

Kapua

- Device Connections via MQTT
- Configuration Service
- Batch Jobs
- Data Collection

Conclusion

Eclipse Kura and Eclipse Kapua treat EdgeOps headaches better then ibuprofen because...

- Handle the boring parts of IoT/Edge deployments
- Together Act as your backend
- Mature and Stable
- Provide Cutting Edge tools
- **Configured to Scale**
- **Enterprise Ready**

Eclipse Kura and Eclipse Kapua can and Will help you realize you Edge goals

Check us out on GitHub

Thank you!

Special thanks to:

- Mattia, Pier, and Marcello for tech support & Coaching
- Salvatore, Nicola, Matteo and the rest of the ESF dev team & Eurotech
- Eclipse foundation for hosting this amazing event

- Finally, thank **you** for listening