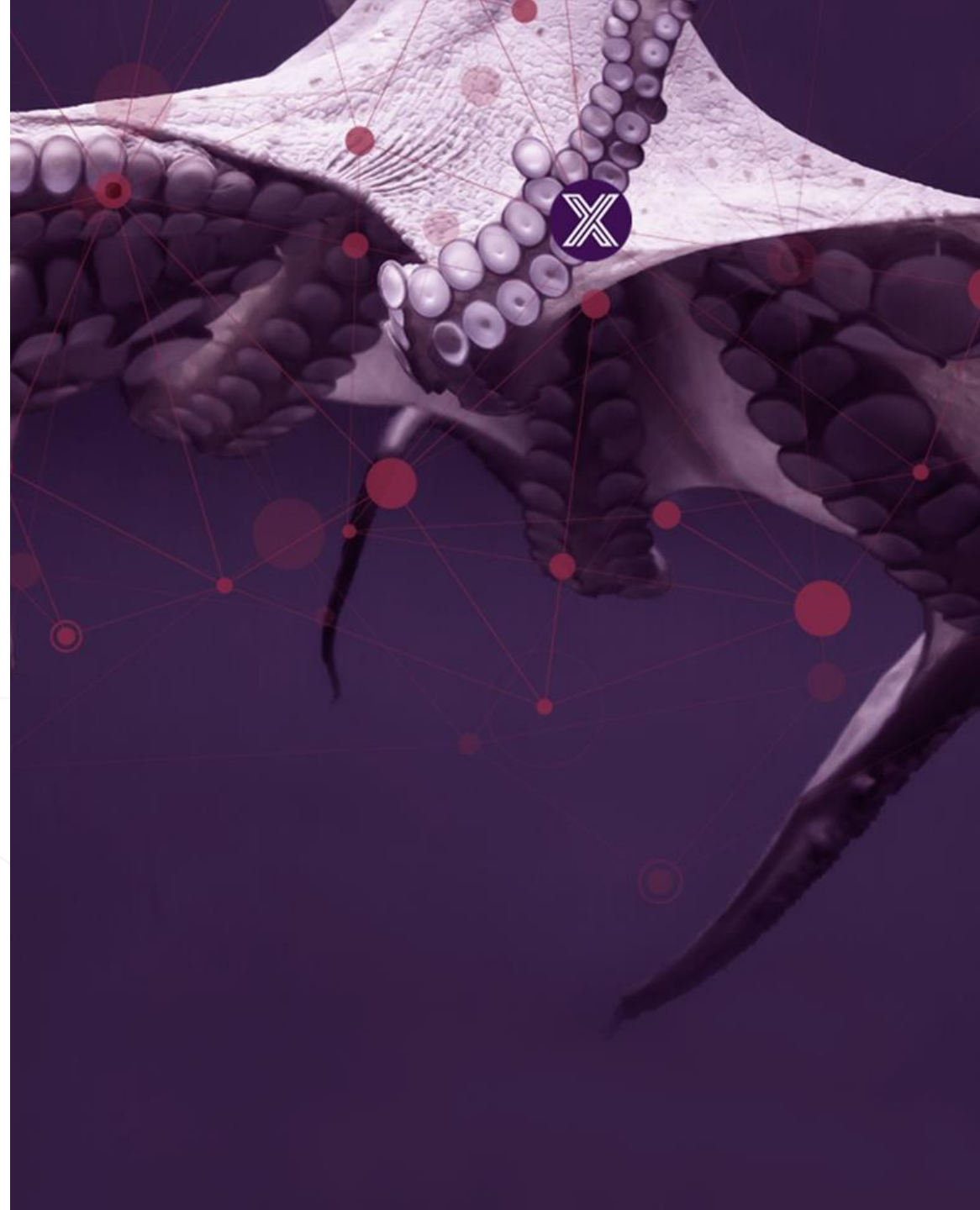# EDGE X FOUNDRY™

EdgeX DevKits

Tech Talks – Session 12

Today's Agenda

- What are EdgeX DevKits?

- EdgeX reminder/overview

- The first EdgeX Community DevKit
  - Raspberry Pi and Grove Sensors
  - Grove Device Service
  - How to use it
  - Example scenario

- Demo

- Q & A

James Butcher

- Senior Solutions Architect at IOTech

- 15 years working in middleware and IoT

- Focused on usability, adoption and roll-out of the technology

- Email - james@iotechsys.com

What are EdgeX DevKits?

- Aimed at helping users get started quickly with EdgeX

- Pre-configured software to work against specific hardware and sensor combinations

- Good for learning EdgeX – get real sensor data flowing quickly

- Can easily sketch out and prototype Edge IoT Proof of Concepts

- Verify real use cases with the sensors and then transition to real/industrial devices

- Both Community and Commercial DevKit options available

Quick EdgeX Reminder

Introducing EdgeX Foundry

- An open source, vendor neutral project (and ecosystem)

- A **micro service**, loosely coupled software framework for IoT edge computing

- Hardware and OS agnostic, optional use of containers

- Linux Foundation, Apache 2 project

- Goal: enable and encourage growth in IoT solutions
    - The community builds and maintains common building blocks and APIs
    - Plenty of room for adding value and getting a return on investment
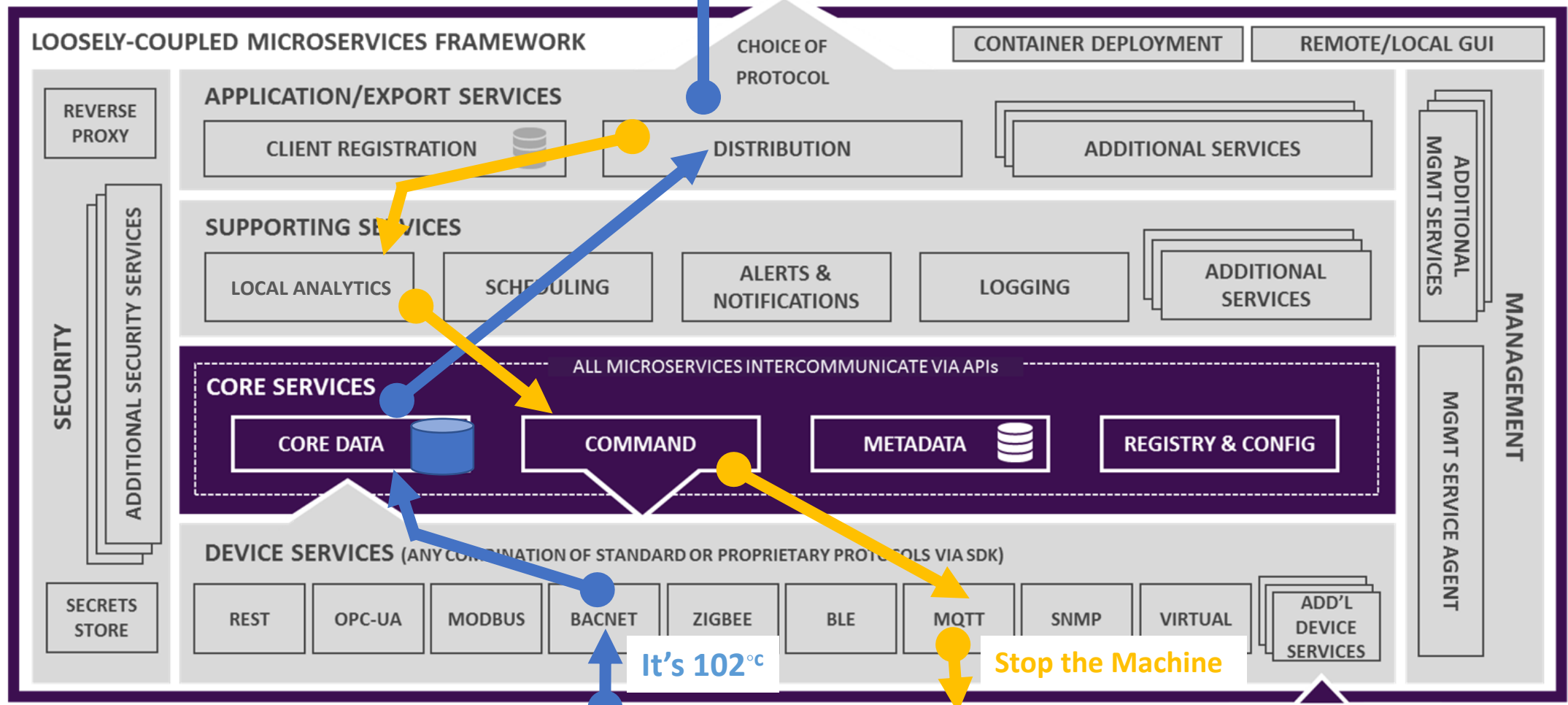   - Collaborative approach, allowing best-of-breed solutions

EDGE X FOUNDRY™
Platform Architecture

EdgeX Micro Service Layers

- Contextually, EdgeX micro services are divided into 4 layers

- Crudely speaking, the layers of EdgeX provide a dual transformation engine
  - 1x - Translating information coming from sensors and devices via hundreds of protocols and thousands of formats into EdgeX
  - 2x - Delivering data to applications, enterprises and cloud systems over TCP/IP based protocols in formats and structures of customer choice

- **The DevKits are going to use and demonstrate all of the layers!**

EXPORT SERVICES

"North side"

SUPPORTING SERVICES

CORE SERVICES   ALL MICROSERVICES INTERCOMMUNICATE VIA APIs

DEVICE SERVICES (ANY COMBINATION OF STANDARD OR PROPRIETARY PROTOCOLS VIA SDK)

"South side"

Grove Sensors

edgexfoundry.org | @edgexfoundry

What are Grove Sensors?

- Seeed Studios Grove Kit consist of the base shield and numerous available sensors

- Supported on Raspberry Pi and other dev boards

- Communicates via I2C interface

- Sensors use GPIO/AIO pins

- Light, Sound, Rotary Angle, Relay, LEDs, LCD, Buzzer, etc

- Easy to use, low cost and widely available

An EdgeX Grove Device Service

- Needed to write a southbound Device Service that can interface with the Grove Devices

- Implemented with C Device Service SDK

- Based on open source libmraa
  https://github.com/intel-iot-devkit/mraa/

- Requires Device Profile (see next page)

- Typically ran as Docker container with default port 49992
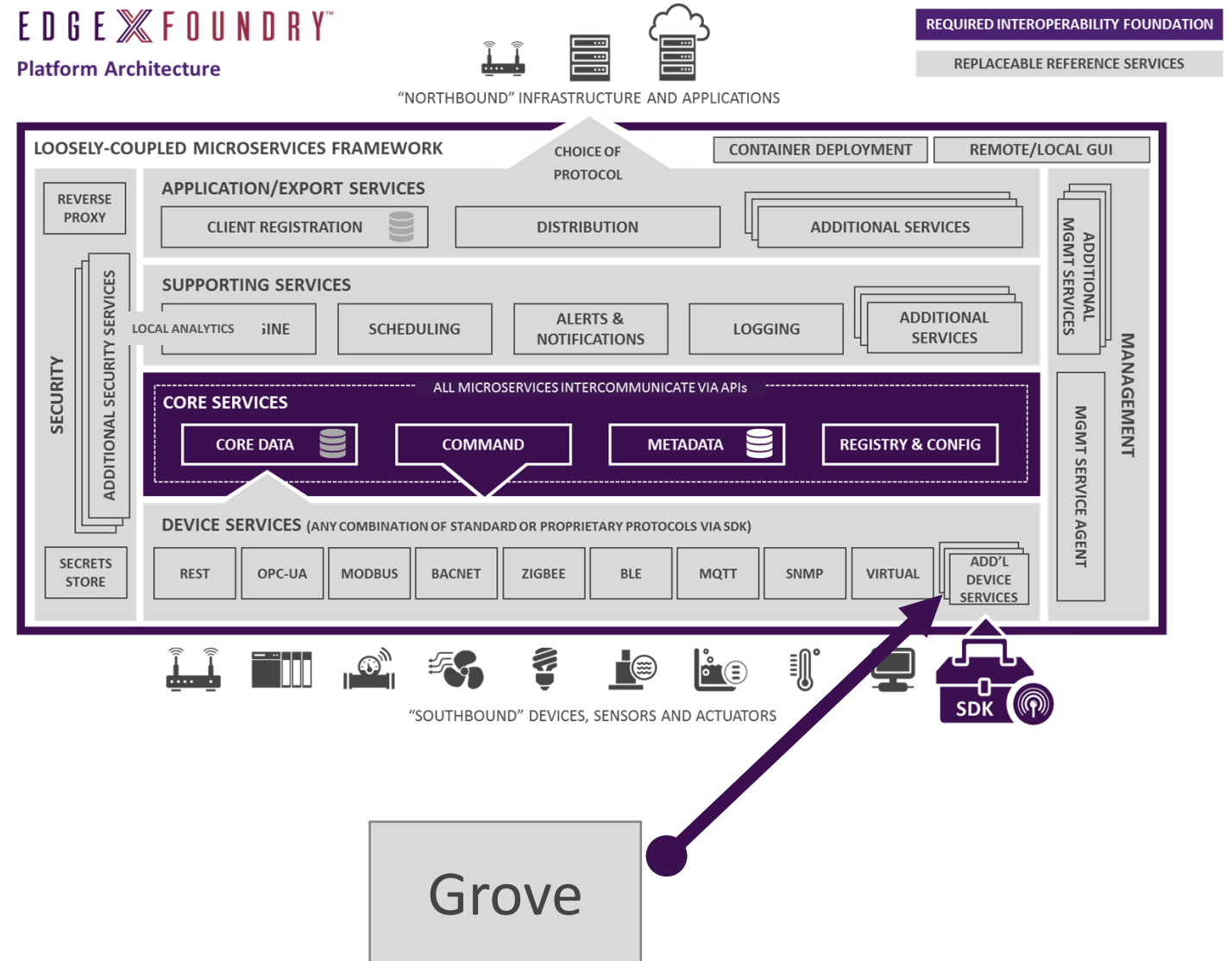
Grove Device Profile

- Maps each sensor's input/output to EdgeX variables within an EdgeX Device (see table)

- Initially supports sensors from GrovePi+ starter kit

- Two options:

  1. **Single Grove Device** which lists Resources & Commands all of the sensors

  2. **Multiple Grove Devices** with Resources & Commands for each sensor

- Default profile automatically creates a single device named "GroveDevice" – i.e. option 1

- /res/configuration.toml and /res/Grove_Device.yaml

- Individual devices modelled as yaml files under /profiles

Port	Interface	Grove Sensor
D2	GPIO	Blue LED
D3	GPIO	Green LED
D4	GPIO	Button
D6	GPIO	Red LED
D7	GPIO	Relay
D8	GPIO	Buzzer
A0	AIO	Light Sensor
A1	AIO	Sound Sensor
A2	AIO	Rotary Angle Sensor
I2C-2	I2C	RGB Backlit LCD

Grove Device Profile – Blue LED example

EDGE X FOUNDRY™
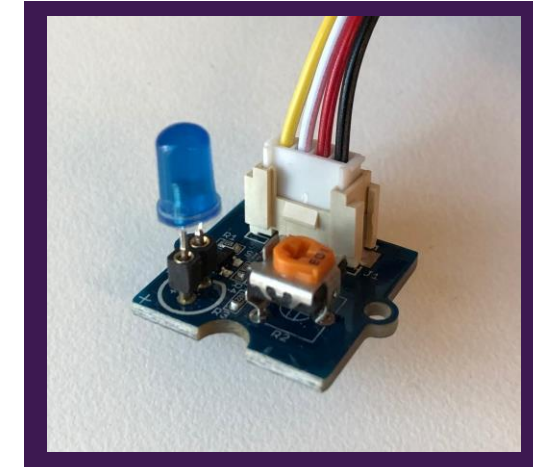

```
name: "Grove_Device"
manufacturer: "Seeed"
labels:
- "Grove LED, Grove Button, Grove Buzzer, Grove LCD, Grove LightSensor, Grove Relay, Grove RotarySensor, Grove SoundSensor"
description: "Grove Device to Read/Write sensors connected to GrovePI."

deviceResources:
- name: Blue-LED
  description: "Turn the Blue LED to On/Off"
  attributes:
   { Pin_Num: "D2", Interface: "GPIO", Type: "OUT" }
  properties:
   value:
    { type: "Bool", readWrite: "RW", size: "1", minimum: "0", maximum: "1", defaultValue: "0" }
   units:
    { type: "String", readWrite: "R", defaultValue: "Enabled/Disabled" }

resources:
- name: Set_BlueLed
  set:
  - { operation: "set", object: "Blue-LED", property: "value", parameter: "Blue-LED" }

Commands:
- name: Set_BlueLed
  put:
   path: "/api/v1/device/{deviceId}/Set_BlueLed"
   parameterNames: ["Blue-LED"]
   responses:
   - code: "204"
     description: "valid and accepted"
     expectedValues: []
   - code: "400"
     description: "bad request"
     expectedValues: []
   - code: "503"
     description: "service unavailable"
     expectedValues: []
```

Port	Interface	Grove Sensor
D2	GPIO	Blue LED
D3	GPIO	Green LED
D4	GPIO	Button
	GPIO	Red LED
	GPIO	Relay
	GPIO	Buzzer
	AIO	Light Sensor
	AIO	Sound Sensor
	AIO	Rotary Angle Sensor
I2C-2	I2C	RGB Backlit LCD

To turn LED on:

curl '{" BlueLED": "true"}' http://localhost:49992/api/v1/device/all/Set_BlueLed

To turn LED off:

curl '{"BlueLED" : "false"}' http://localhost:49992/api/v1/device/all/Set_BlueLed

Using a DevKit

Where to get an EdgeX DevKit?

- Community and Commercial DevKit options referenced from EdgeX website

- First EdgeX Community version just released:

  - **Raspberry Pi 3 64 bit with GrovePi+ Sensors**
  - See https://www.edgexfoundry.org/devkits/
  - Links to buy a Pi and GrovePi+ Sensor Kit
  - Instructions to install custom 64 bit Ubuntu OS image
  - Instructions to download and run the EdgeX software

Aim to Validate Real Use Cases

- Simulate real world scenarios with easy to use sensors

- Can span multiple industries and use cases

- Collect, visualize and make decisions with real data at the edge

- Prove there is value in the project

- Verify that EdgeX technology helps with this

- Evolve to use more industrial devices

Today's DevKit Demo – Smart Factory

- ## Production / Output Quality Monitoring
  - Validate that the factory output meets required QA levels
  - e.g. bottles, cartons, packages, etc
  - Monitor and analyze size and weight of each item
  - Actuate control devices

- ## Production Line / Machine Monitoring
  - Validate machinery is operating correctly
  - Safety of human operators
  - Spot performance degradation ahead of breakage
  - Perform timely maintenance routines
  - Visualize on dashboards
  - Send to Cloud for storage and analysis

Today's DevKit Demo – Smart Factory

What does the demo do?

- Collect sensor data from some of the Grove Sensors with Grove Device Service

- Ingest into EdgeX through Core Services

- Translate data to northbound side, e.g. to MQTT

- Display data and make decisions at the Edge, e.g. with Node-RED:

  - Easy dashboarding

  - Flow programming capability

  - MQTT subscriptions to get data

  - REST calls to actuate
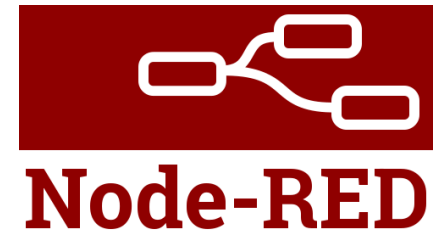
✓ For convenience, Mosquito broker and Node-RED both come pre-installed on supplied Ubuntu Image

Today's DevKit Demo – EdgeX Architecture
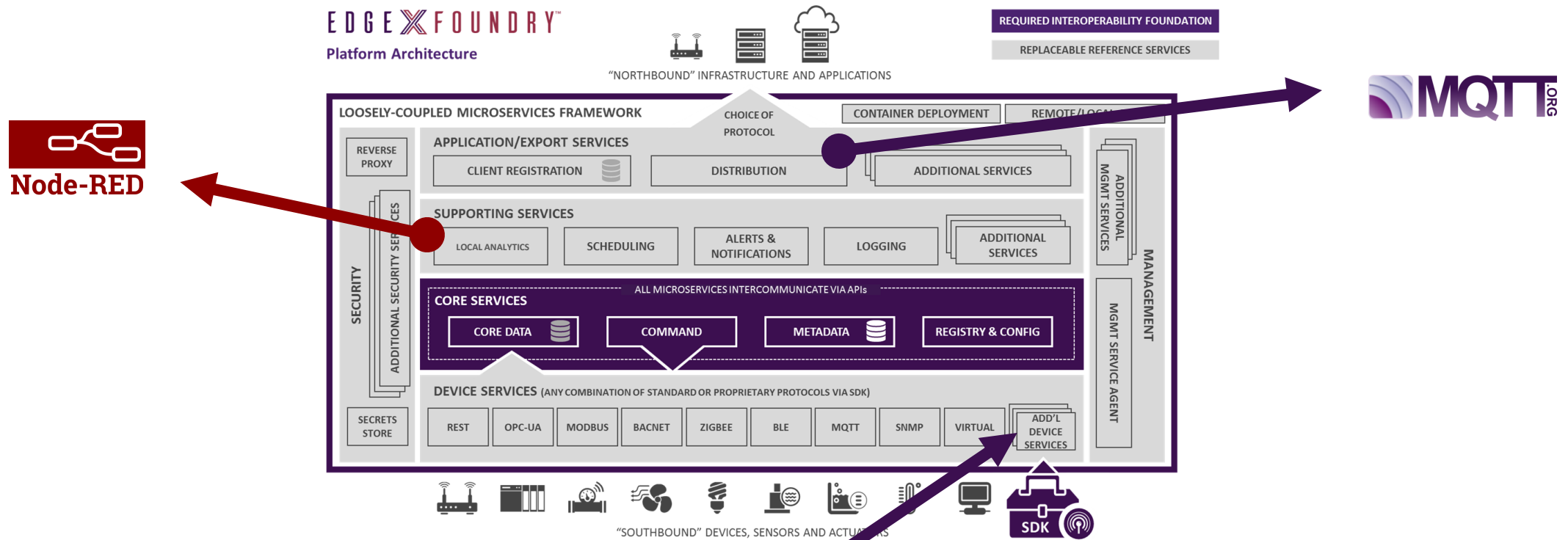
Package Monitoring

Grove

Production Line Monitoring
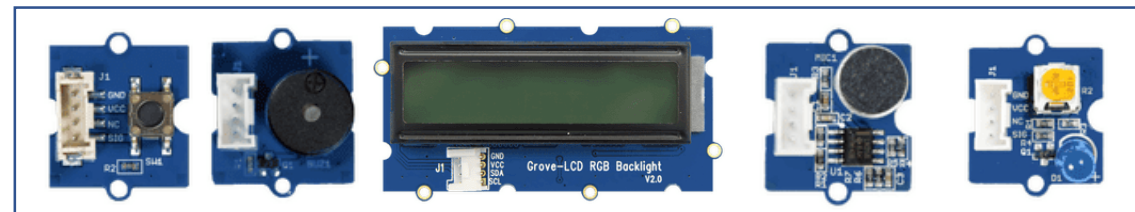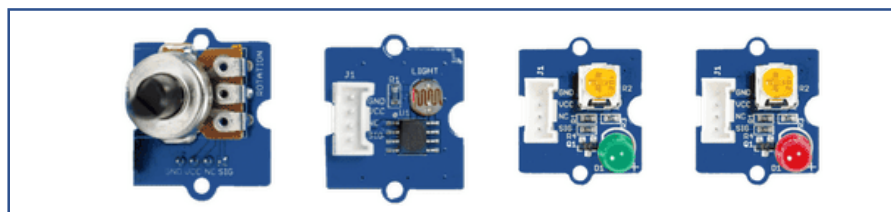
Today's DevKit Demo – Physical Architecture
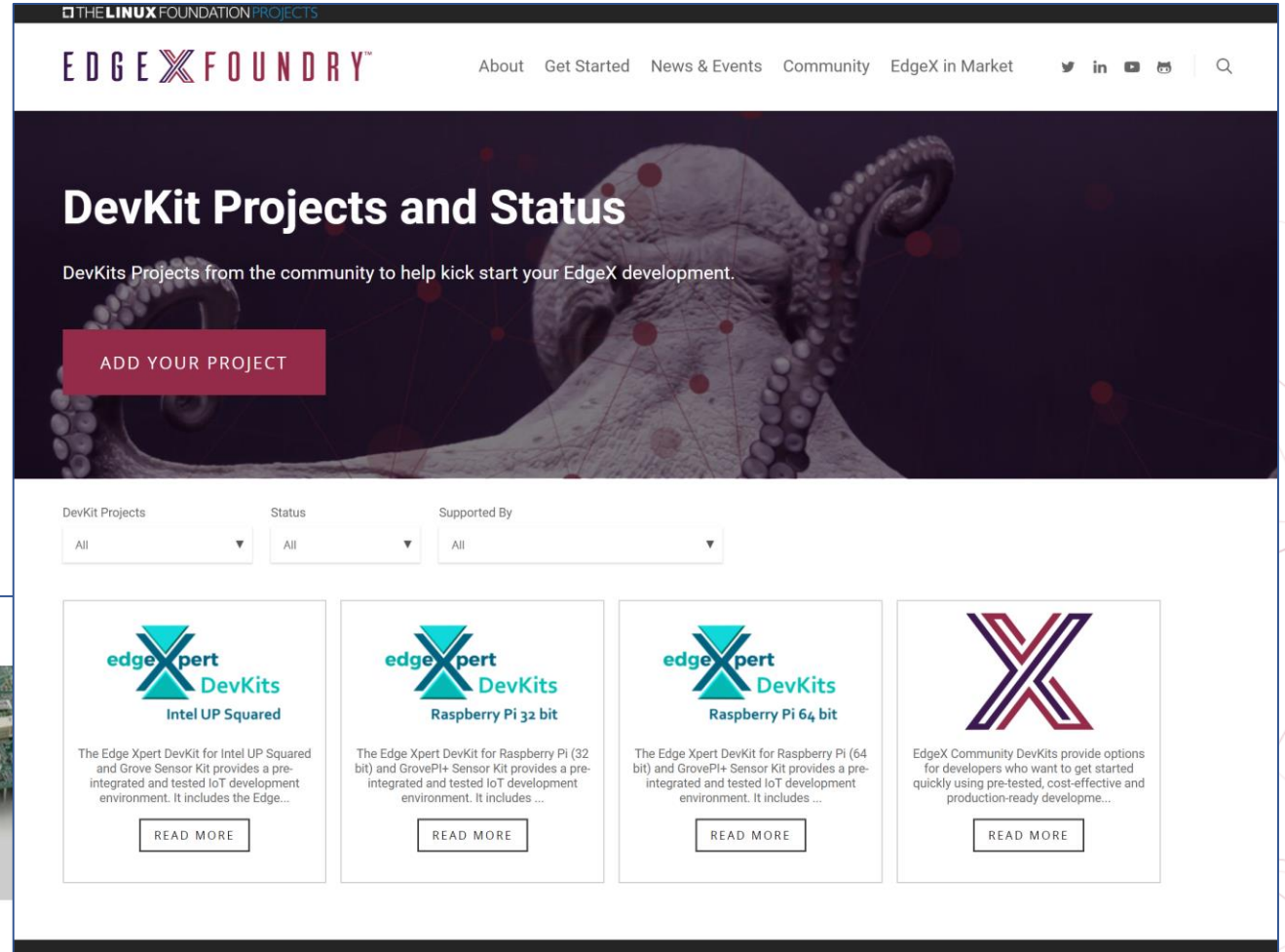
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	Edge Decision Making and Dashboard	Node-RED
	MQTT Broker	MQTT ORG
	EdgeX Core Services	X
	Grove Device Service	

Web Browser — Laptop

Grove

Rotary Angle Sensor	Light Sensor	LEDs	Sound Sensor	Button	Buzzer	LED / LCD

Package Monitoring:
Weight and Size

Line Monitoring:
Vibrations and Emergency Buttons
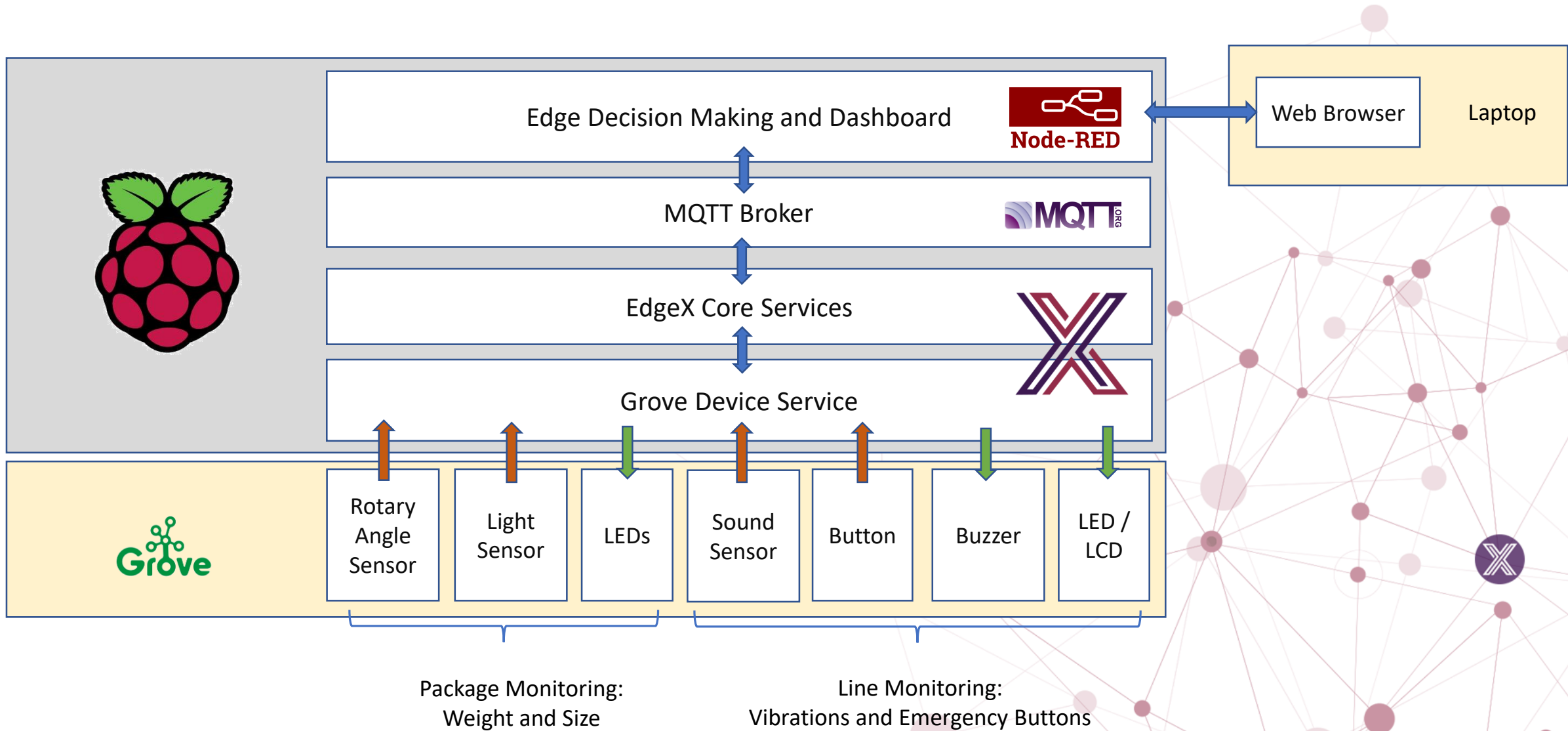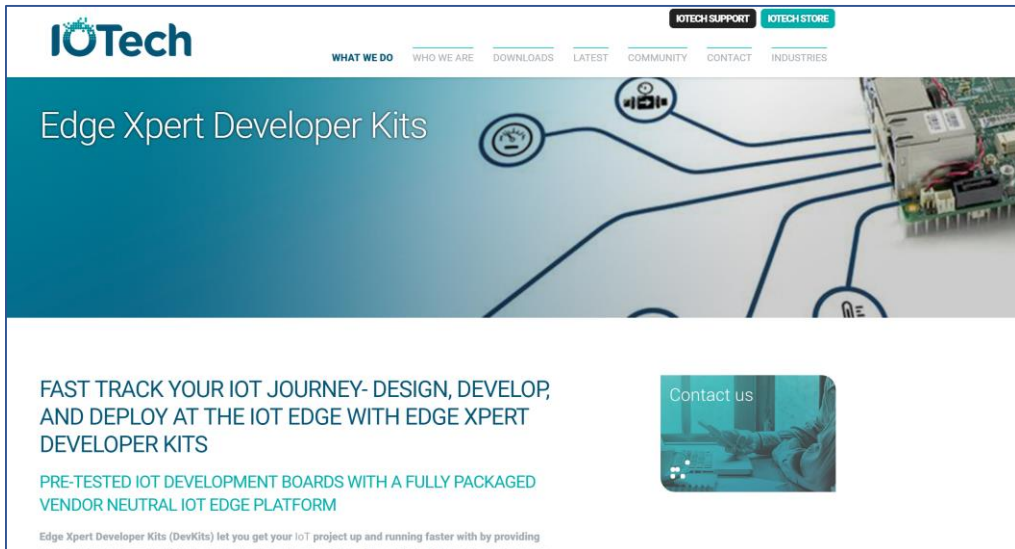
Demo Time!!

Following On

- More DevKits - different environments and sensors

- Sample use cases for different industries

- Blogs/Videos/Tutorials

Key Project Links

EDGE X FOUNDRY™

Access the code:

https://github.com/edgexfoundry

Access the technical documentation:

https://docs.edgexfoundry.org/

Access technical video tutorials:

https://wiki.edgexfoundry.org/display/FA/EdgeX+Tech+Talks

EdgeX Blog:

https://www.edgexfoundry.org/news/blog/

Join an email distribution:

https://lists.edgexfoundry.org/mailman/listinfo

Join the Slack Channels:

https://edgexfoundry.slack.com

Become a project member:

https://www.edgexfoundry.org/about/members/join/

LinkedIn:

https://www.linkedin.com/company/edgexfoundry/

Twitter:

https://twitter.com/EdgeXFoundry

Youtube:

https://www.youtube.com/edgexfoundry

EdgeX DevKits:

https://www.edgexfoundry.org/devkits/community-devkit/

Question and Answer Time

Email: james@iotechsys.com