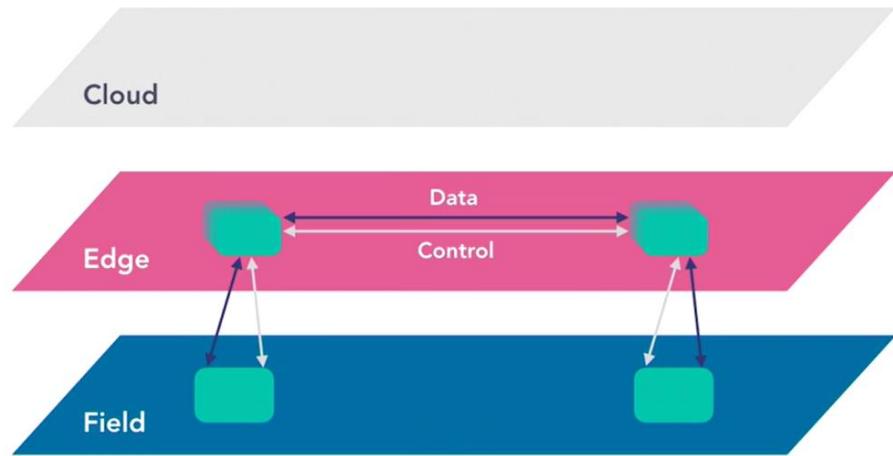
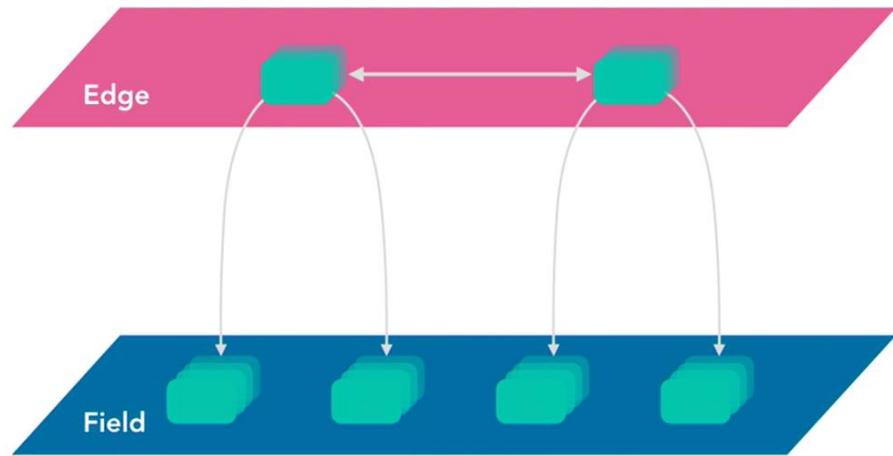


## End-to-End Connection



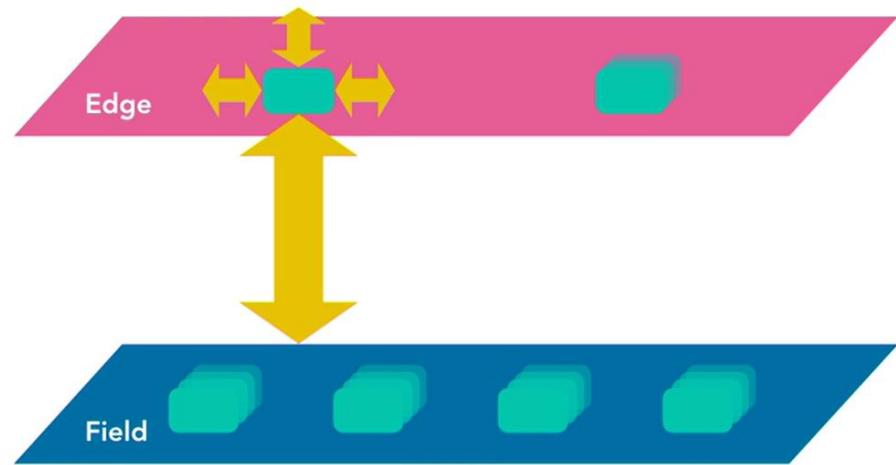
▶ ⏪ ⏴ ⏵ 1:14 / 3:00 1.5x CC ⏴ ⏵

## Edge Computing for Industrial Applications



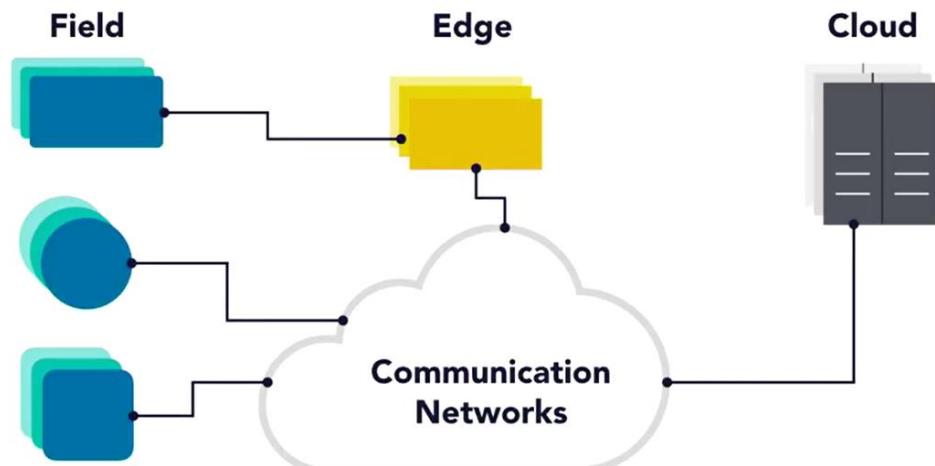
▶ ⏪ ⏴ ⏵ 1:39 / 3:00 1.5x CC ⏴ ⏵

## Edge Computing at a Single Edge Device



▶ ⏪ ⏴ ⏵ 1:55 / 3:00 1.5x CC ⏴ ⏵

## Edge Computing at the Gateways

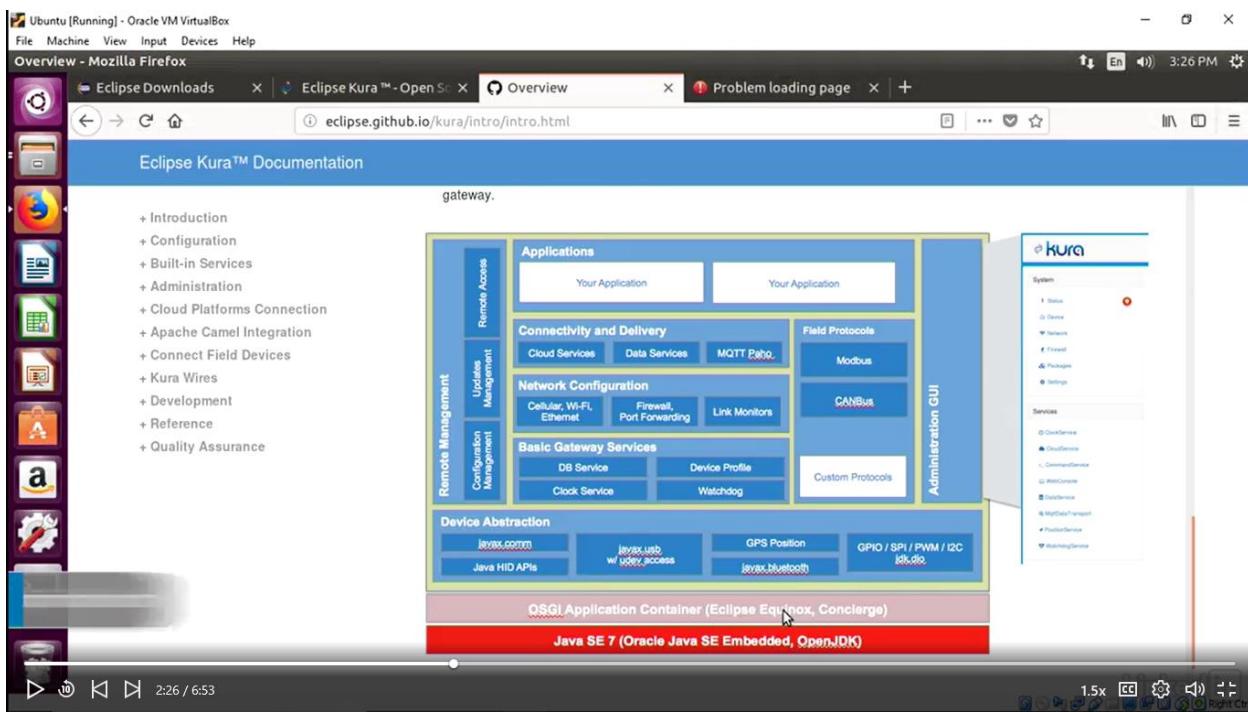
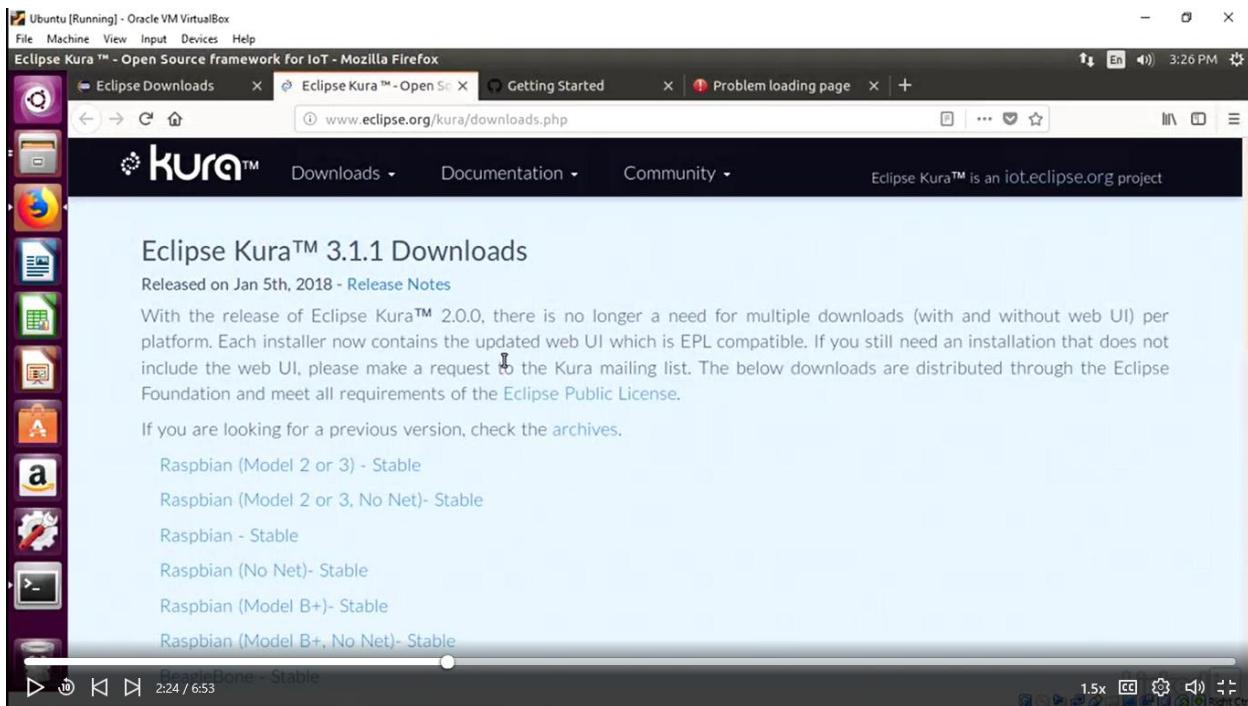


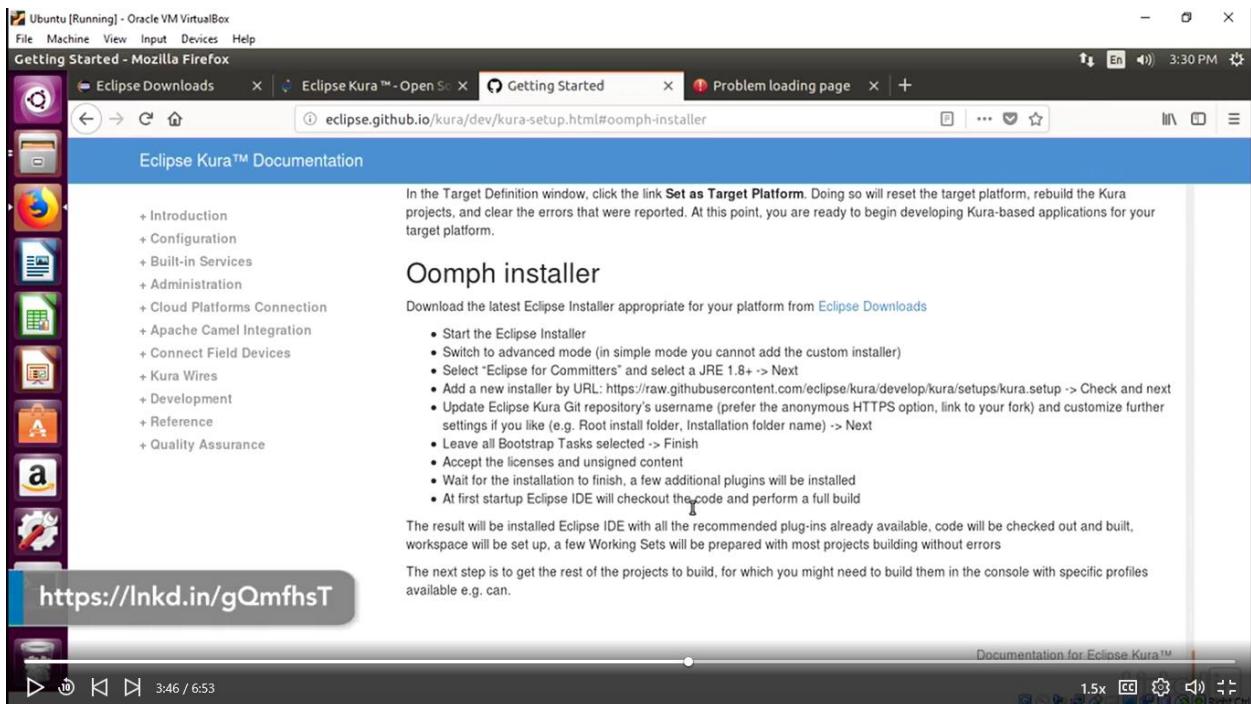
▶ ⏪ ⏴ ⏵ 0:08 / 6:53 1.5x CC ⏴ ⏵

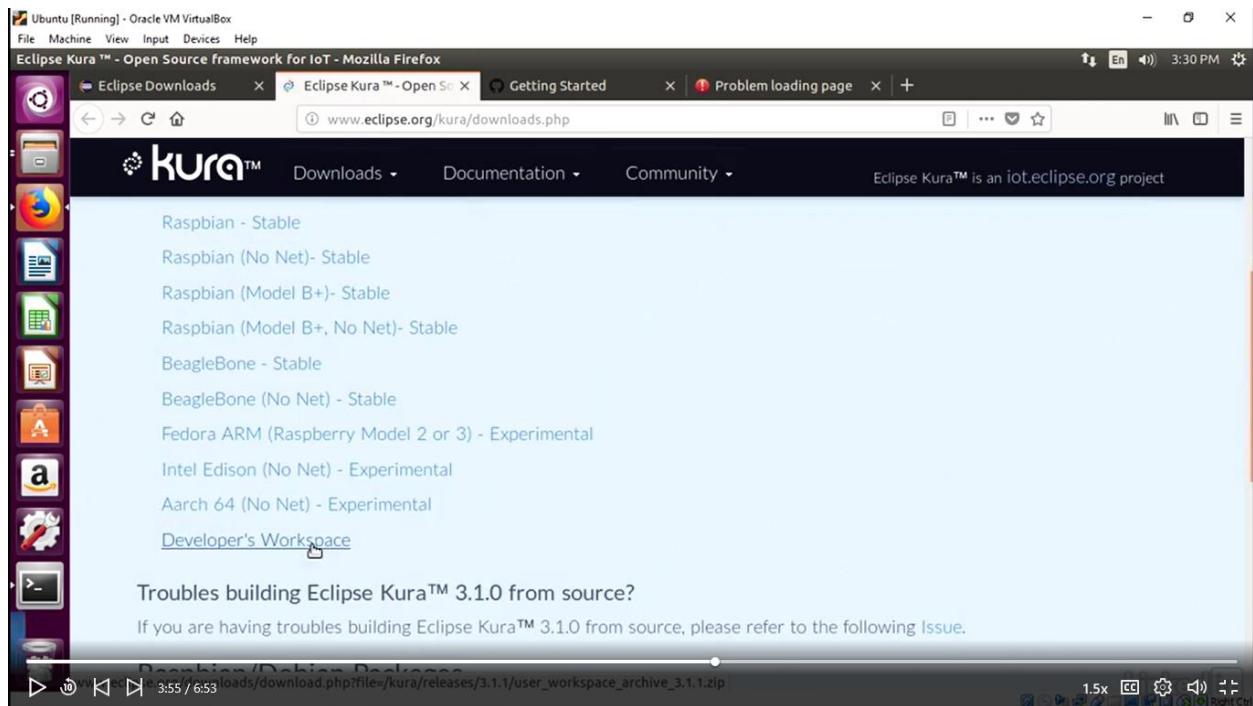
# Eclipse Kura

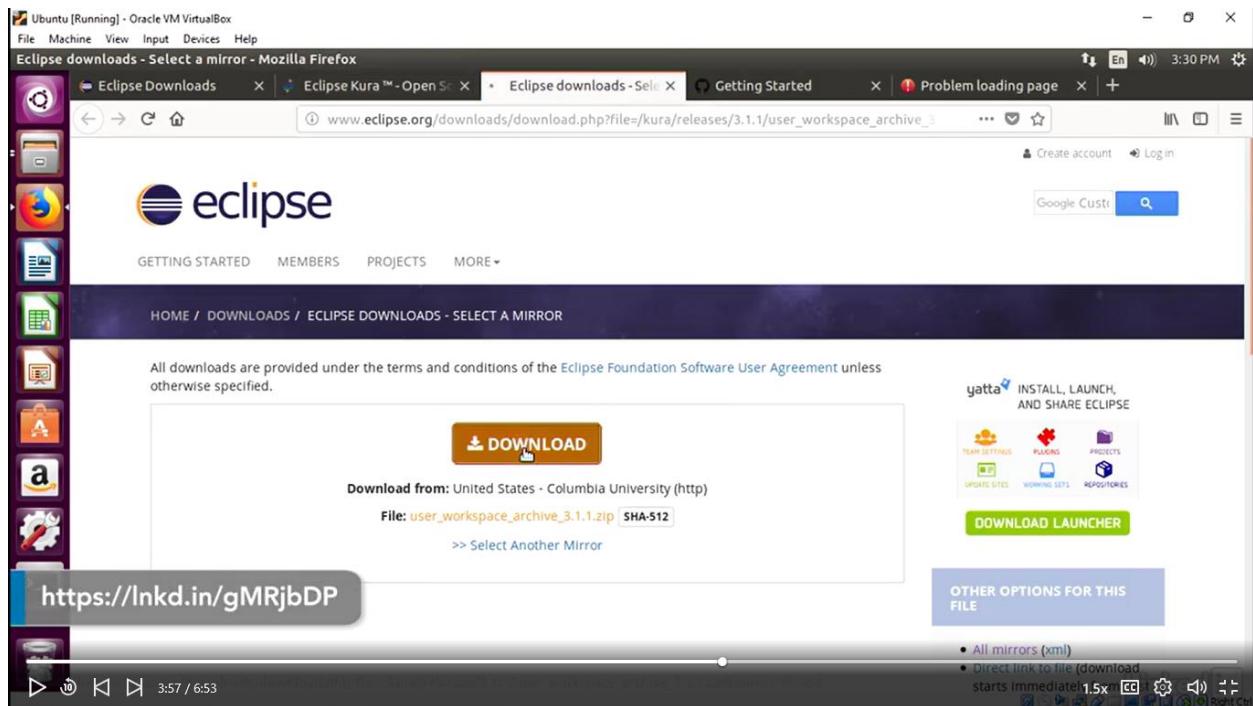
- Java-based framework for edge computing applications and gateways
- Support popular communication protocols (MQTT, Modbus, OPC UA, etc.)

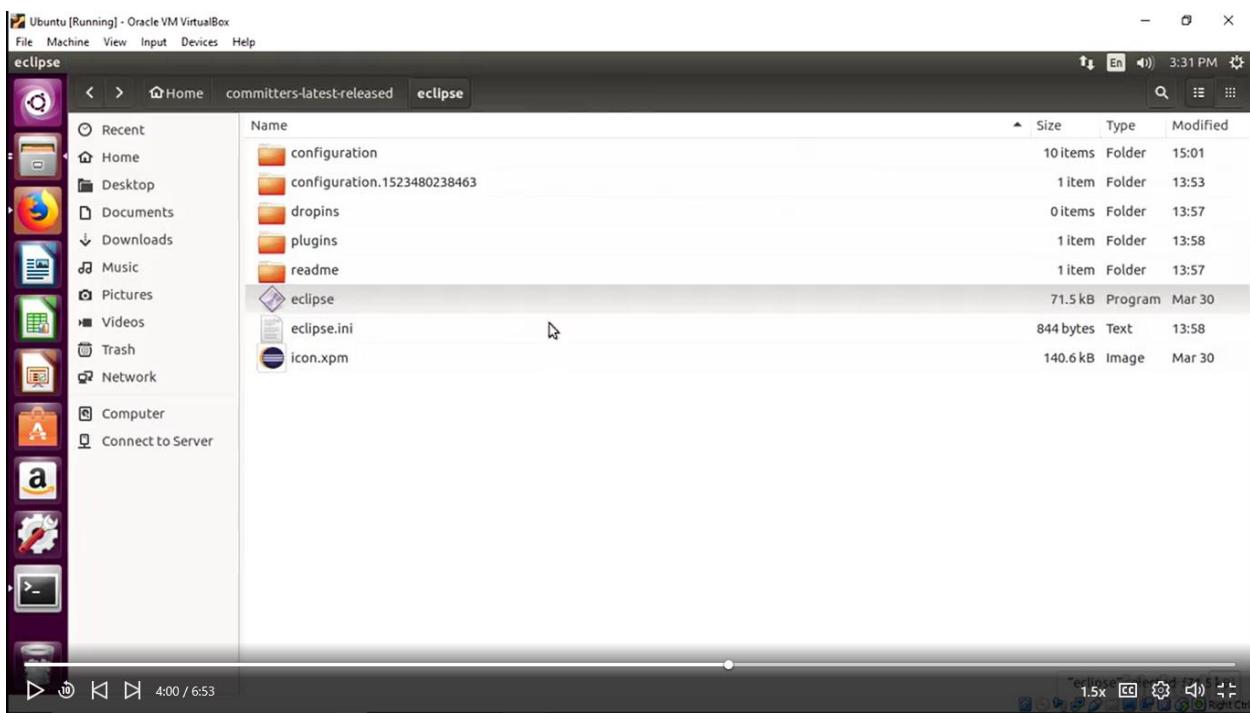
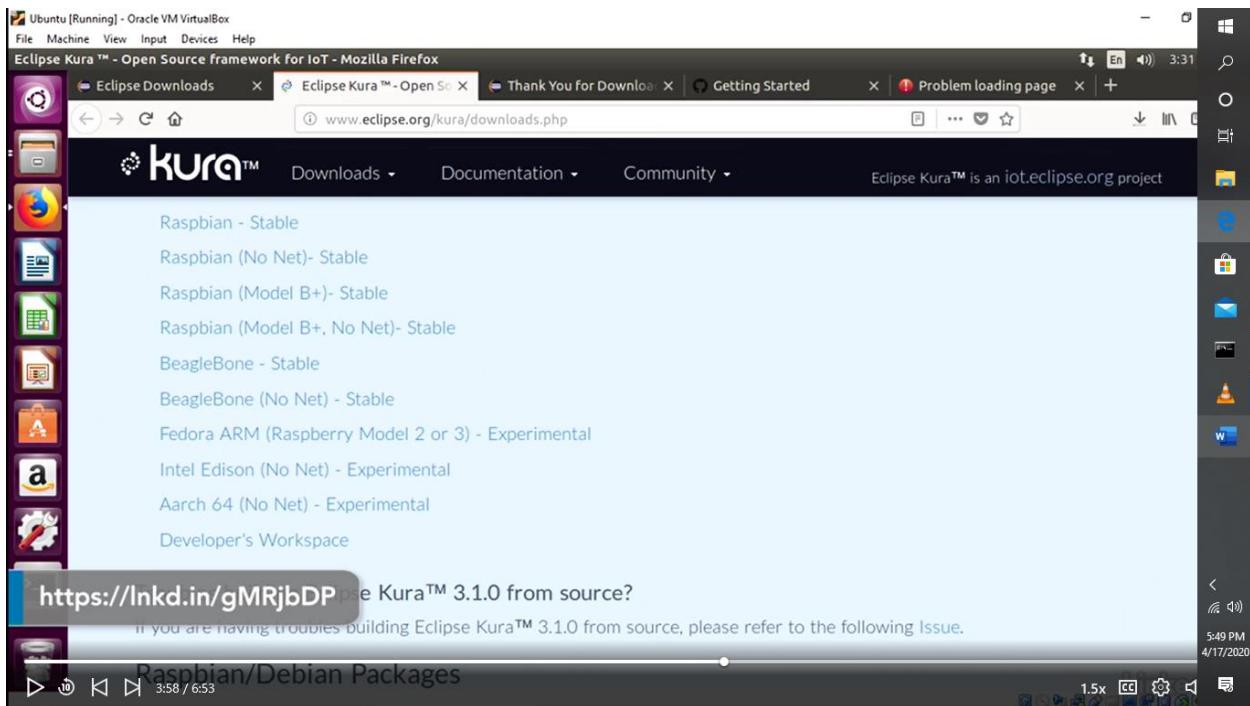


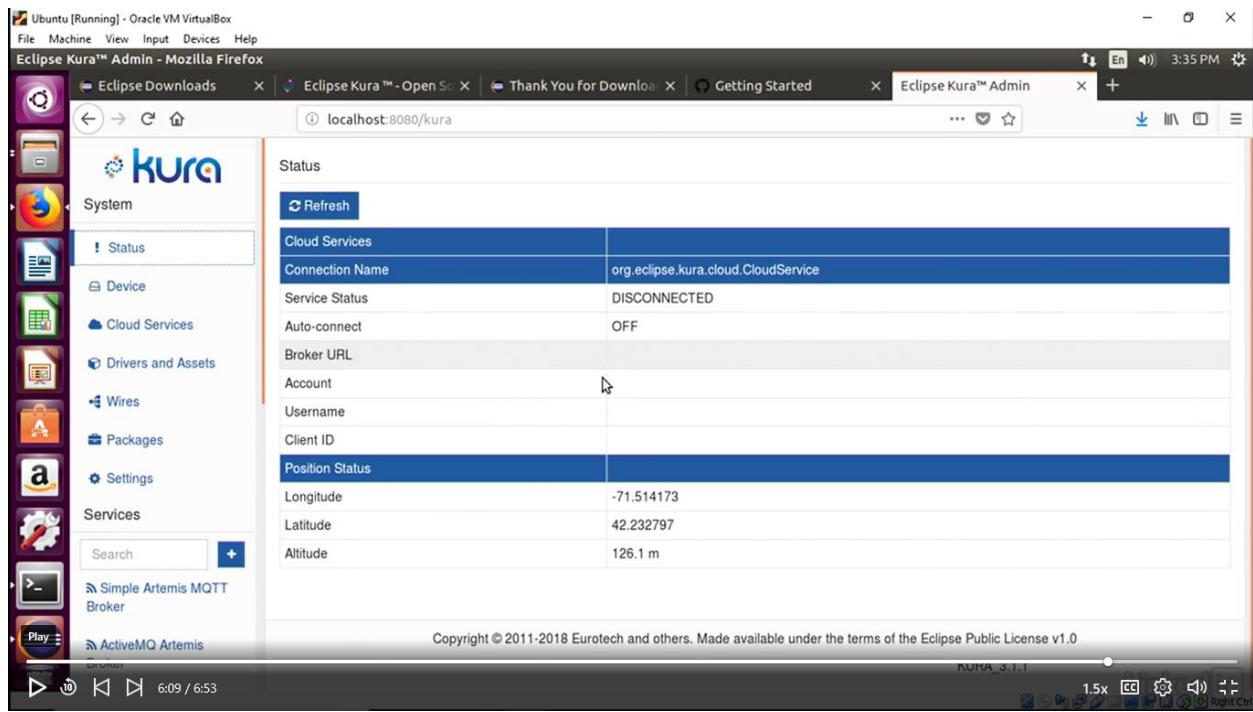
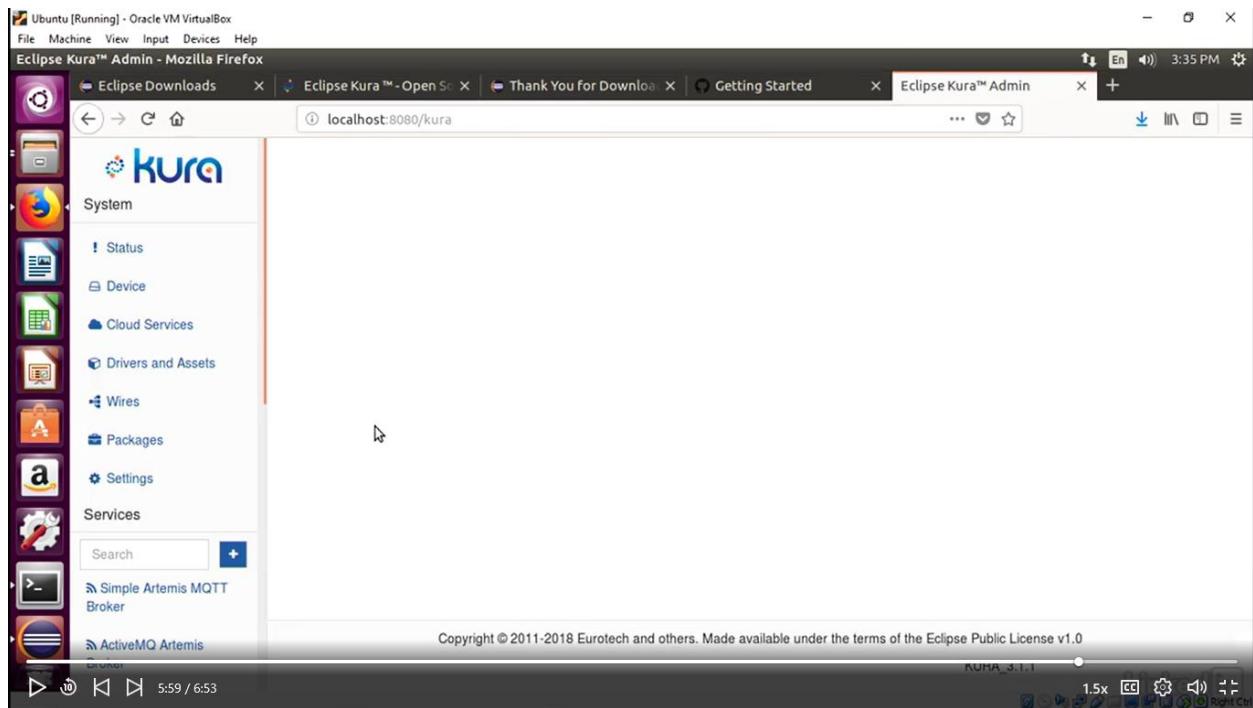




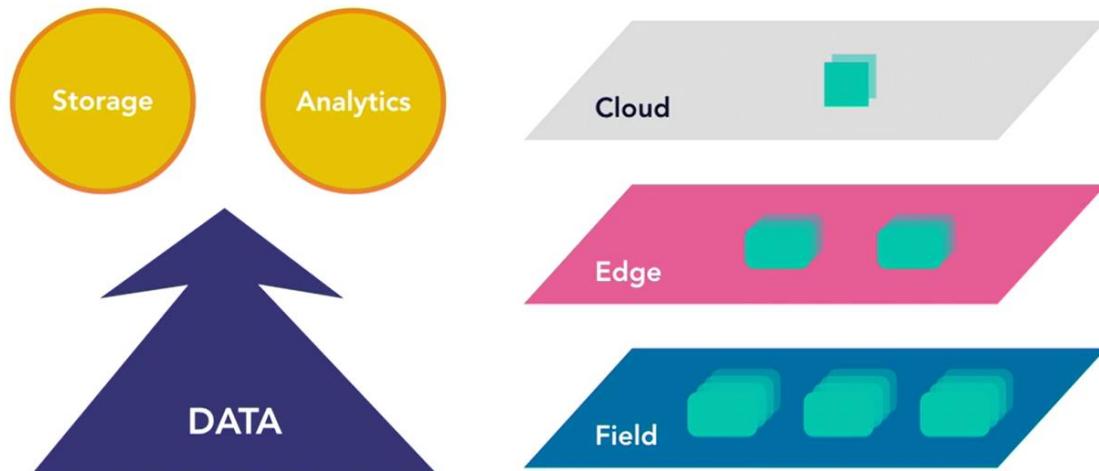






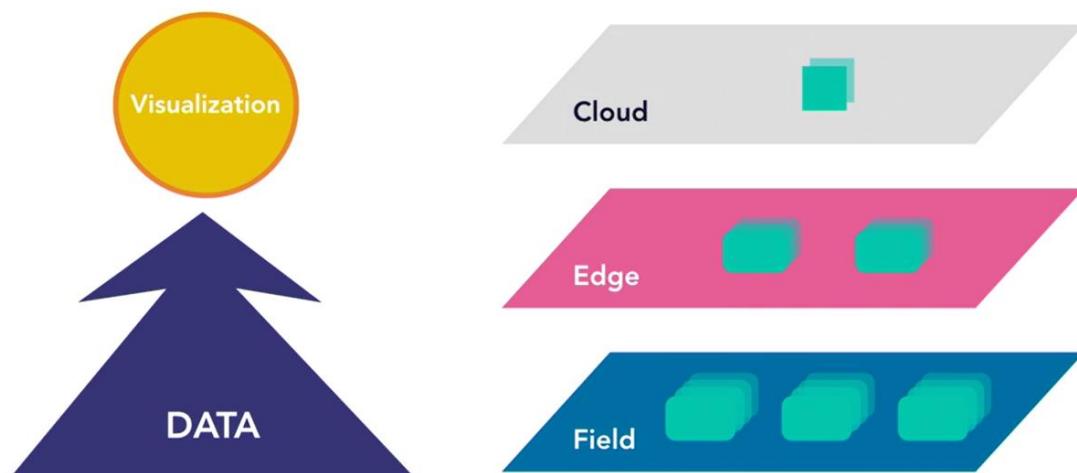


## Data Storage and Analytics



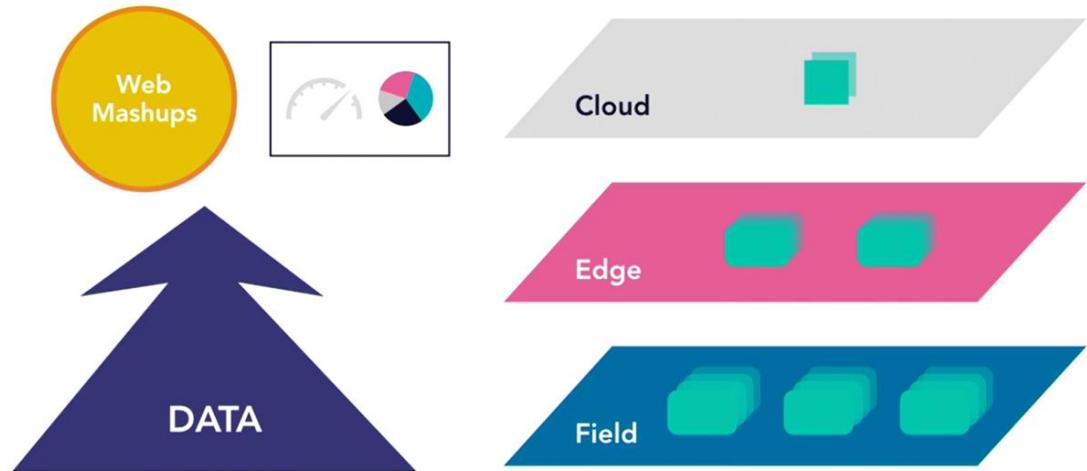
0:40 / 2:51 1.5x CC ⌂ ⌃ ⌁ ⌂

## Data Visualization

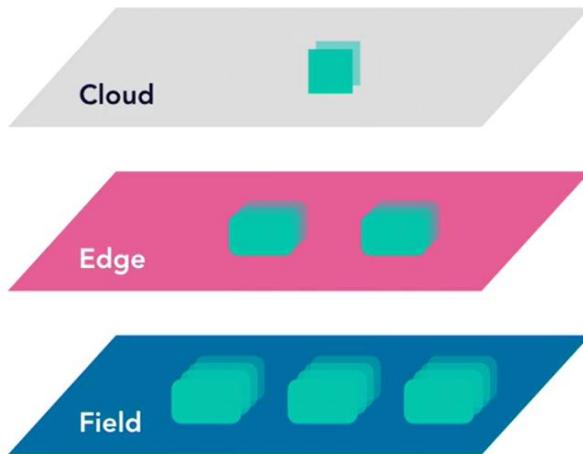


1:01 / 2:51 1.5x CC ⌂ ⌃ ⌁ ⌂

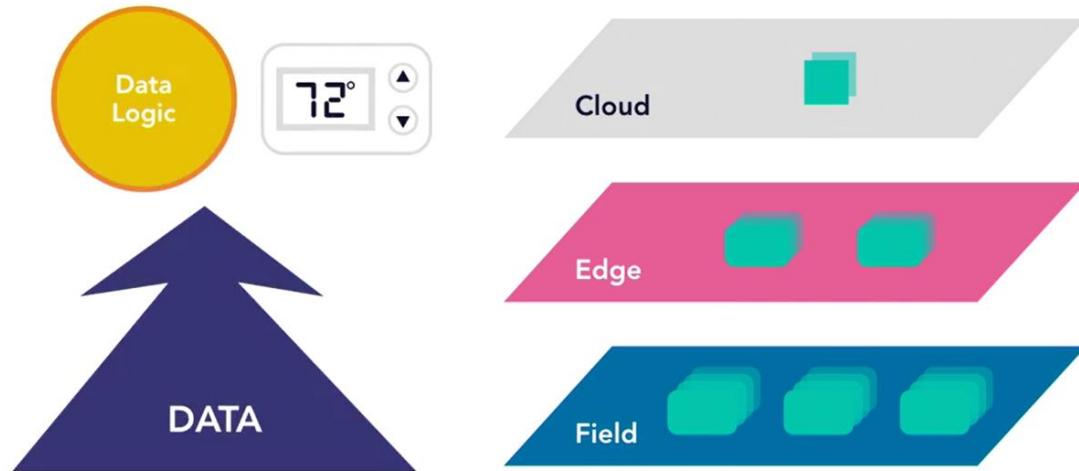
# Web Mashups



# Data Logic

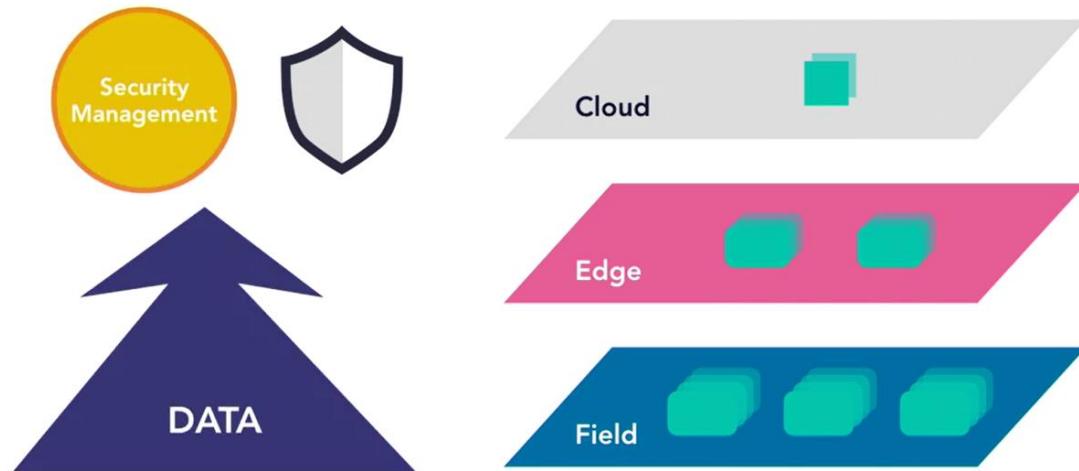


## Data Logic



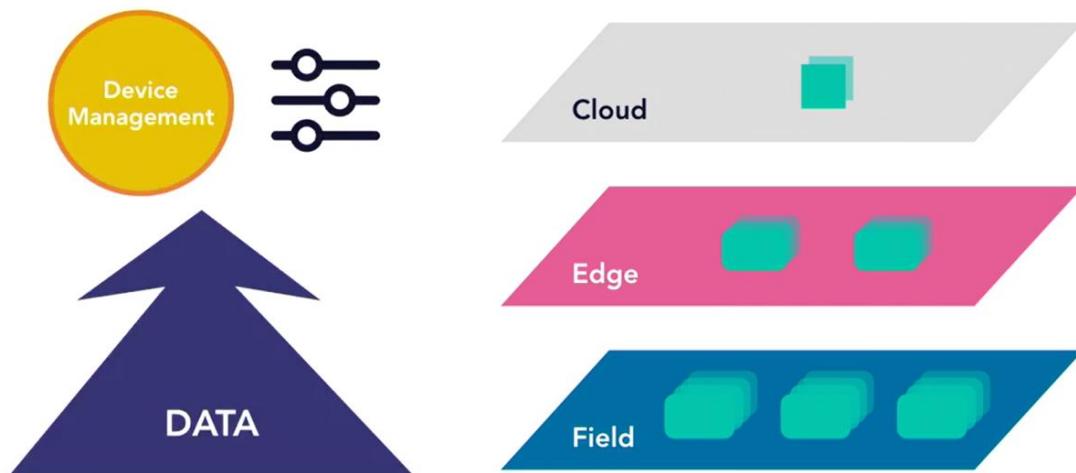
▶ ⏪ ⏴ ⏵ 1:46 / 2:51 1.5x CC ⏹ ⏸ ⏹ 🔍

## Data Security

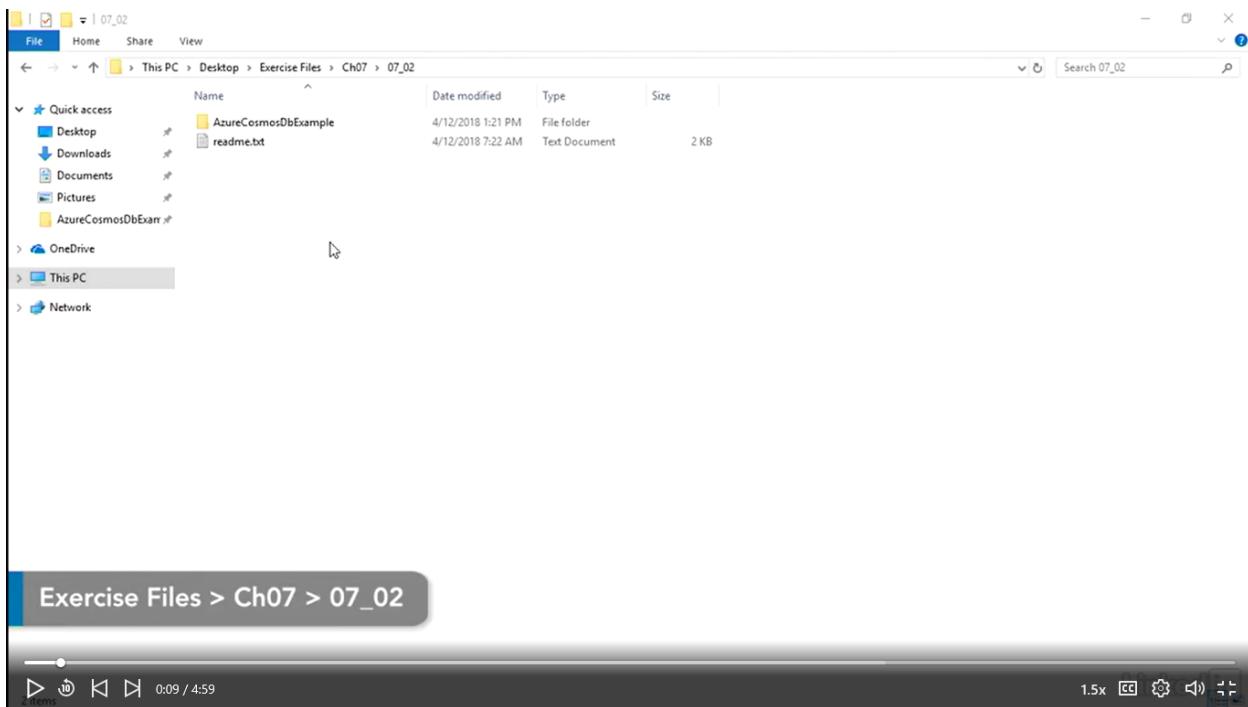


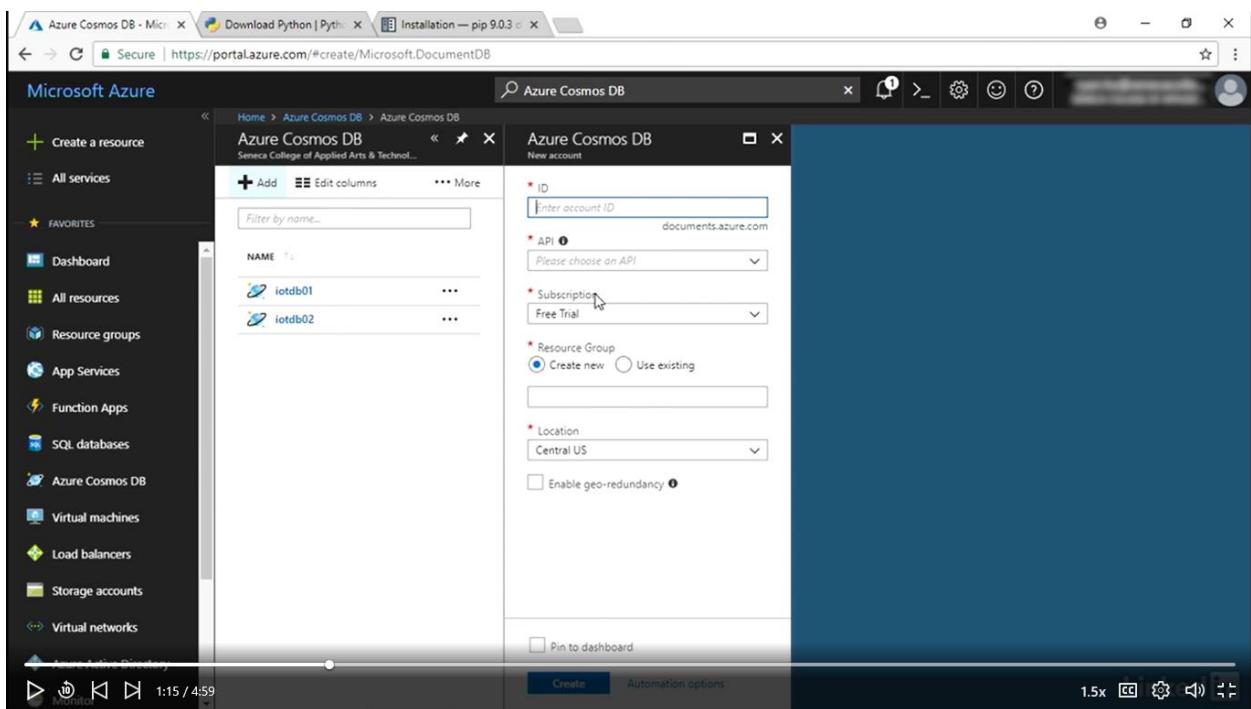
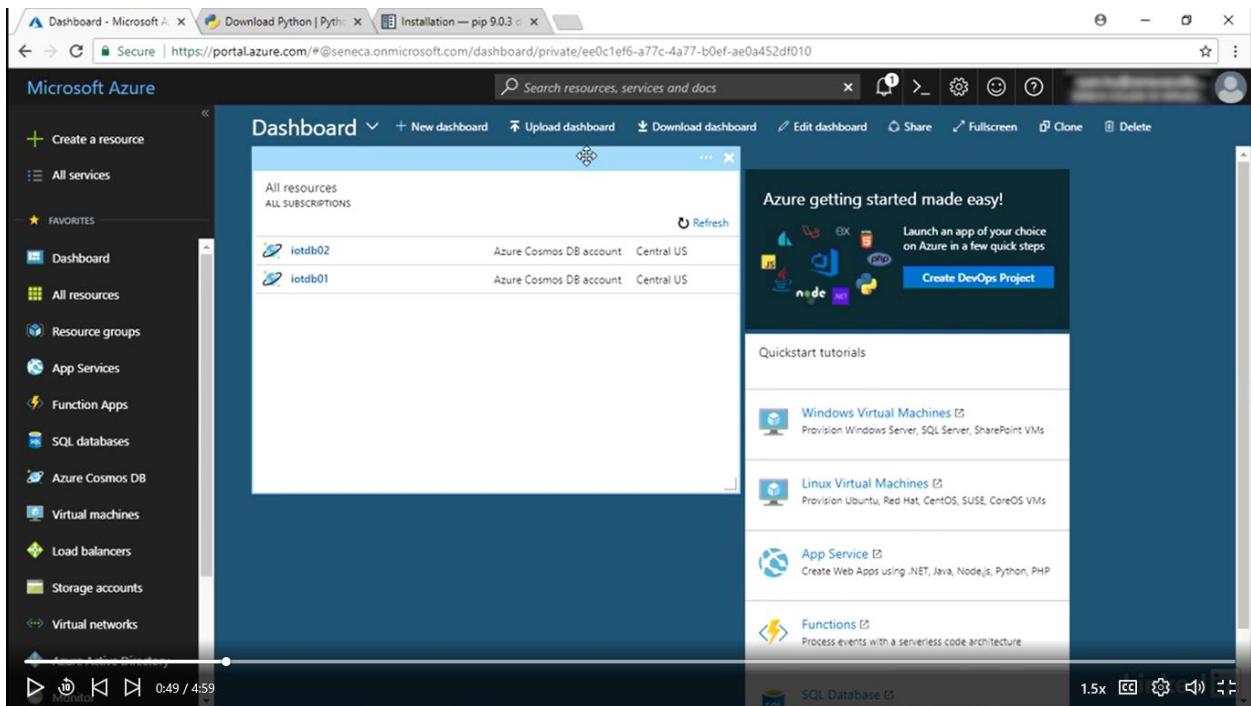
▶ ⏪ ⏴ ⏵ 2:14 / 2:51 1.5x CC ⏹ ⏸ ⏹ 🔍

# Device Management

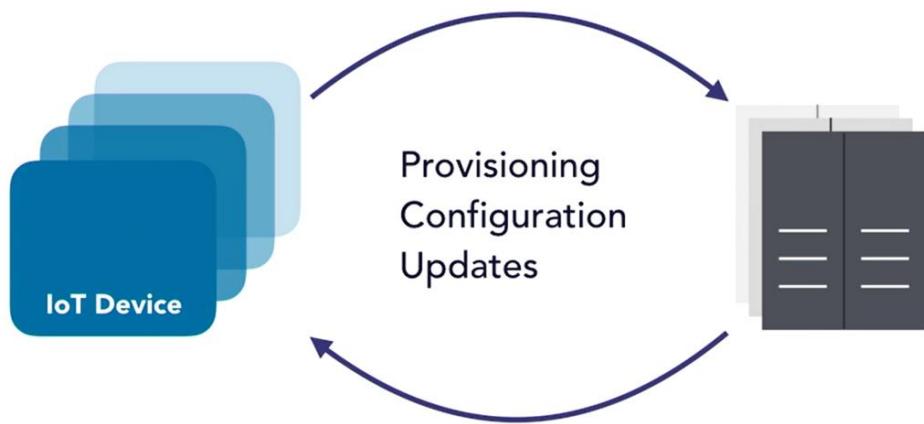


▷ ⏪ ⏴ ⏵ 2:34 / 2:51 1.5x CC ⏷ ⏸ ⏹ ⏺

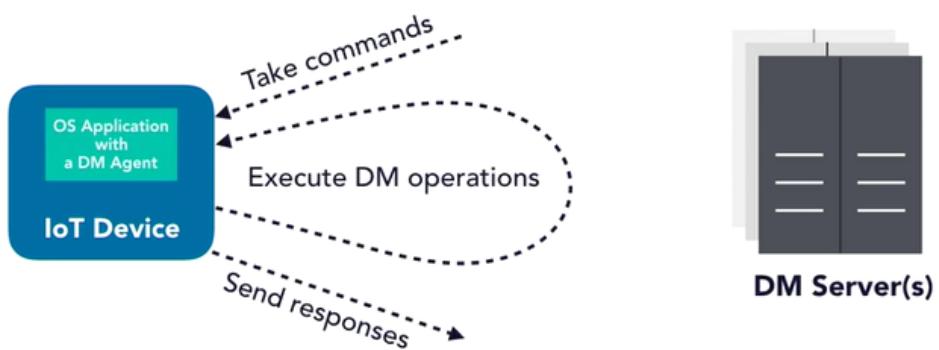




# Device Management



## Example Device-Level Support for DM



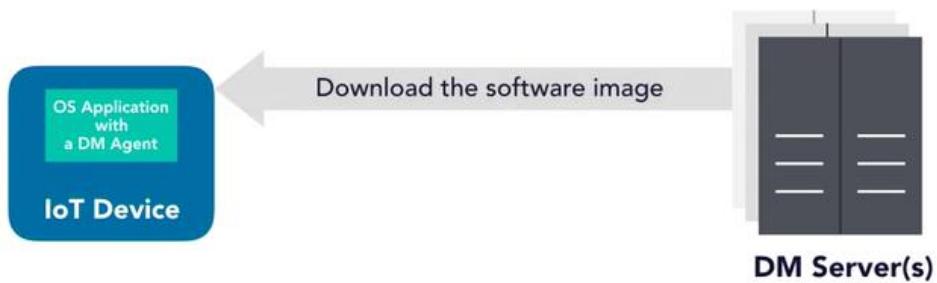
linkedin.com switched to full screen (Esc to exit).

Okay

Exit now

X

# Over-the-Air (OTA) Software Update

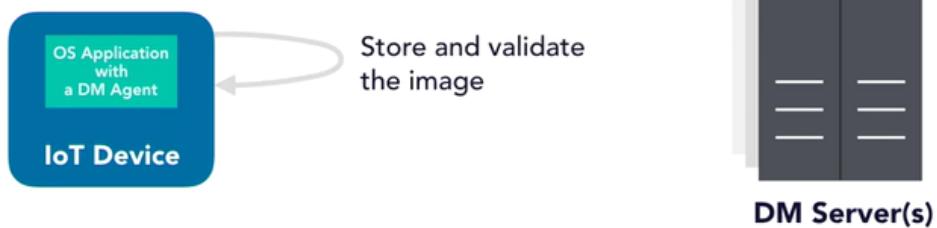


LinkedIn

▷ ⏪ ⏴ ⏵ 2:05 / 3:38

1.5x CC ⚙️ 🔍

# Over-the-Air (OTA) Software Update



linkedin.com switched to full screen (Esc to exit).

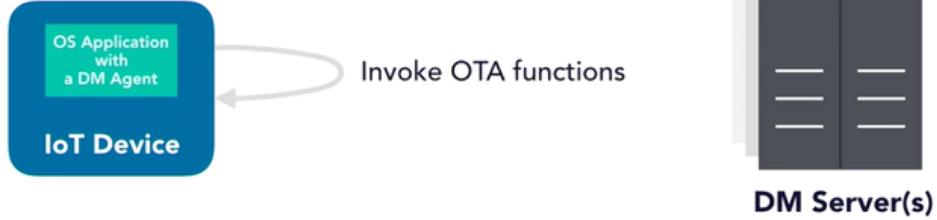
Okay

Exit now

X

LinkedIn

# Over-the-Air (OTA) Software Update



LinkedIn

▷ ⏪ ⏴ ⏵ 2:25 / 3:38

1.5x CC ⚙️ 🔍

# Over-the-Air (OTA) Software Update



Perform a rollback  
process in case of a  
failure



DM Server(s)

LinkedIn

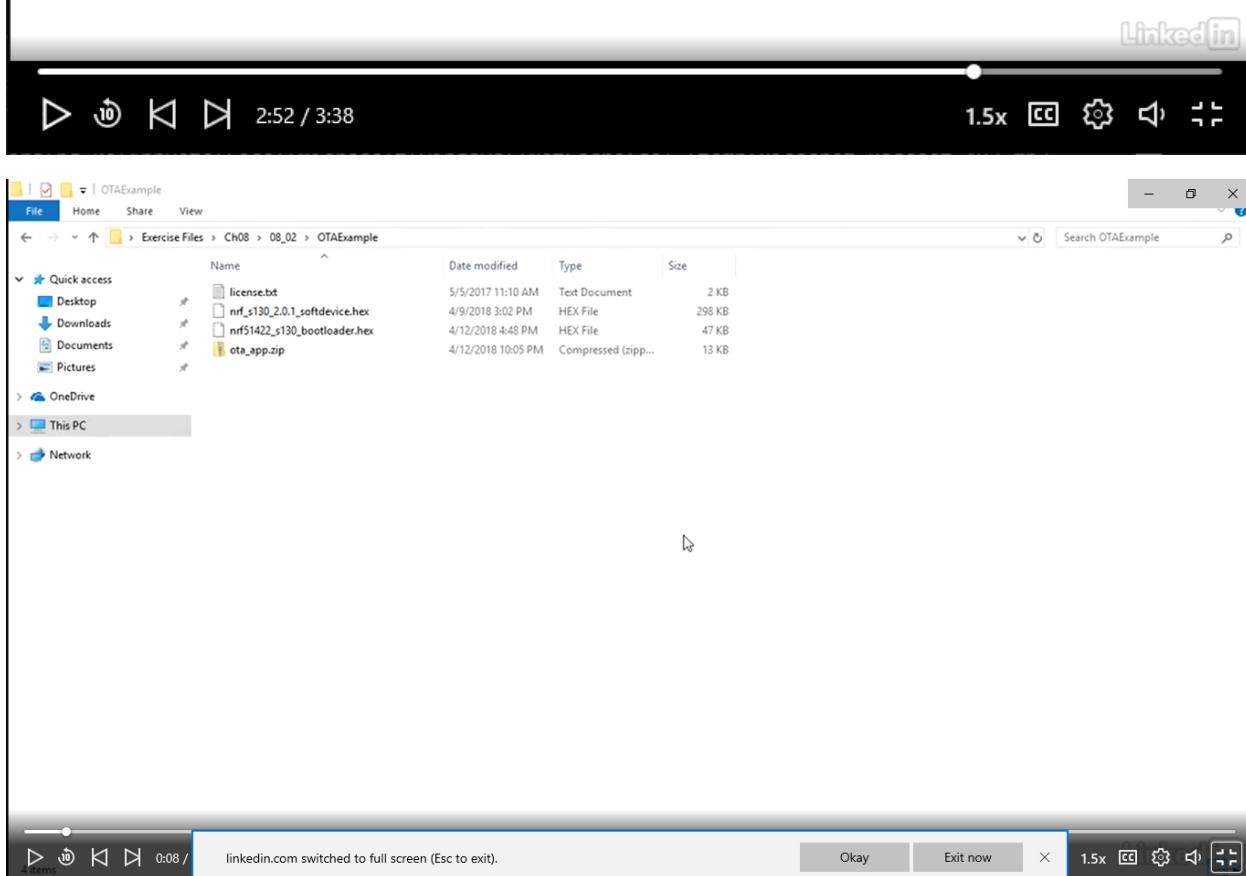


2:33 / 3:38

1.5x



# Over-the-Air (OTA) Software Update



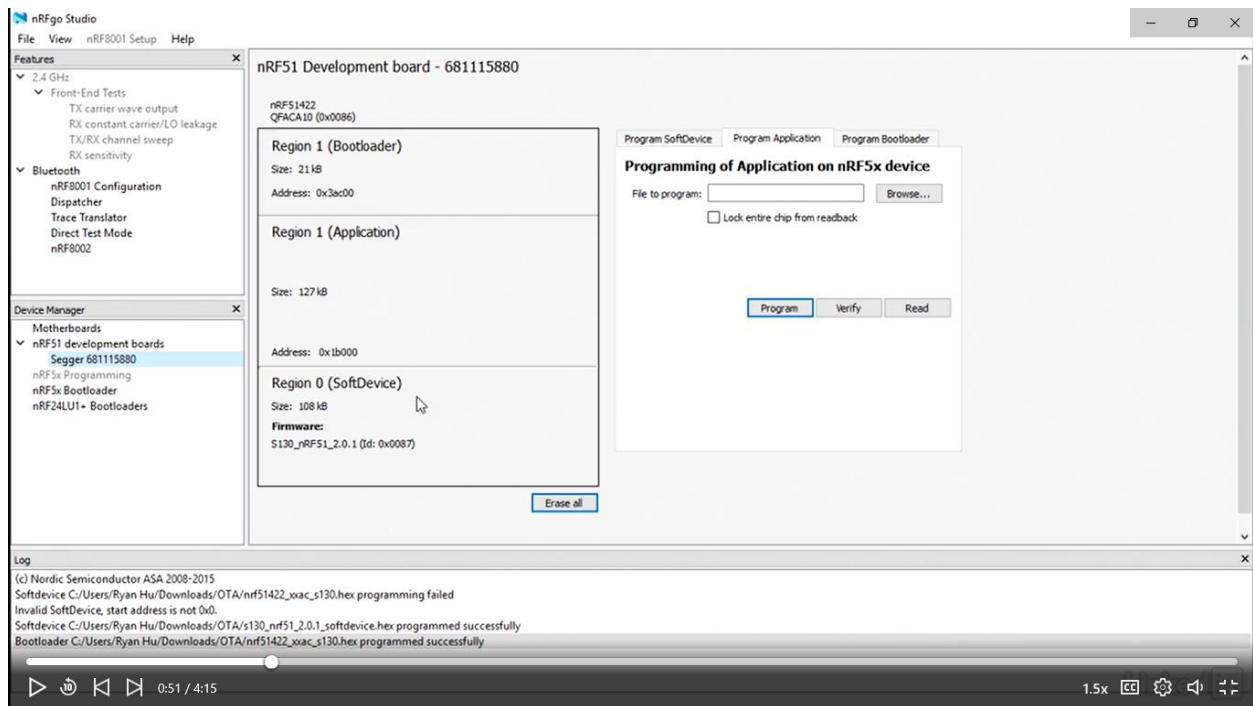
The screenshot shows a web browser window with the following details:

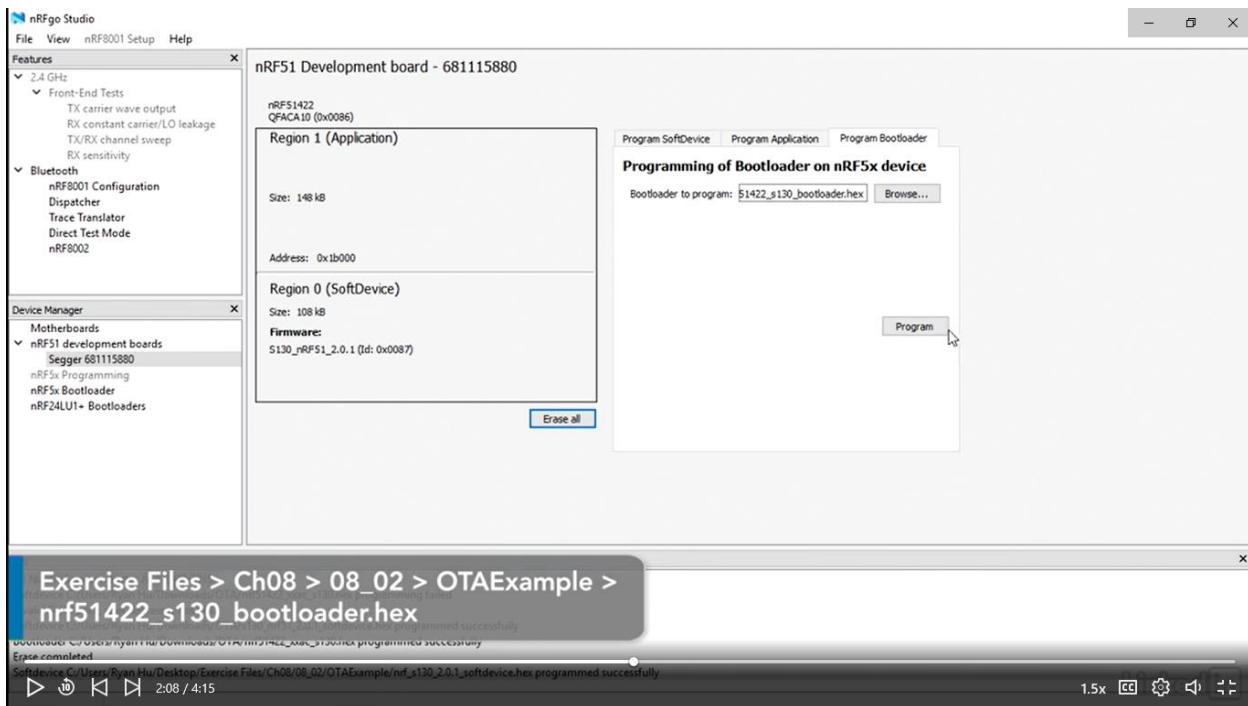
- Address Bar:** https://www.nordicsemi.com/eng/nordic/Products/nRFgo-Studio/nRFgo-Studio-Win64/14964
- Page Title:** Ultra Low Power Wireless Solutions from NORDIC SEMICONDUCTOR
- Header:** Nordic Semiconductor ASA [NO] | Documentation | English | MyPage | Smarter Things
- Navigation:** About us, Products, Applications, Support & Community, Investors, Popular Products, Search.
- Breadcrumbs:** Home / Products / 2.4GHz RF / nRFgo Studio / nRFgo Studio-Win64
- Left Sidebar (PRODUCTS):**
  - BLUETOOTH 5
  - BLUETOOTH LOW ENERGY
  - LOW POWER CELLULAR IOT
  - ANT™
  - 2.4GHZ RF
  - SUB 1-GHZ RF
  - IEEE 802.15.4 / THREAD
- Right Content Area:**

### nRFgo Studio-Win64

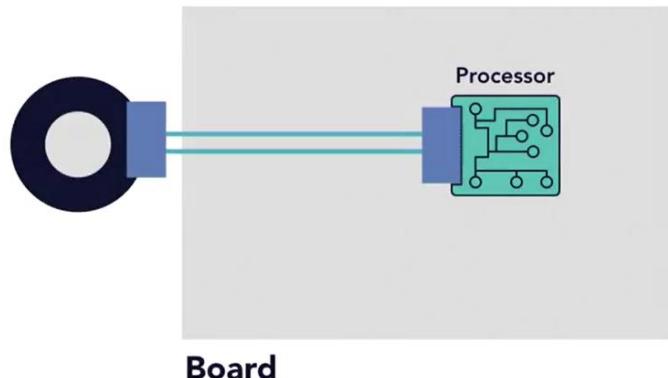
Versions: Changelog

Version	Description	Download
1.21.2	Bug-fix that allows you to recover nRF52-devices that are locked. This fix will also improve the stability of programming nRF5x-devices.	Download
1.21.1	CHANGED FEATURES: Installer: Updated version of nRFTools to 8.0.0 FIXED ISSUES: nRF5x Programming: Fixed an issue related to recovery of devices. nRF5x Programming: Fixed an issue related verification of large hex files. KNOWN ISSUES: nRF51: Application may terminate directly after updating the SEGGER firmware.	Download
1.21.0	NEW FEATURES: nRF5x Boot loader: Added support for signed dfu packages; nRF8002: Changed minimum values for connection interval; Installer: Updated version of nRFTools to 7.5.2. FIXED ISSUES: nRF5x Programming: Fixed an issue related to programming certain nRF51 devices. KNOWN ISSUES: nRF51: Application may terminate directly after updating the SEGGER firmware.	Download
1.10.2	Added the option to verify the content of the NV data area when verifying the content of the flash.	

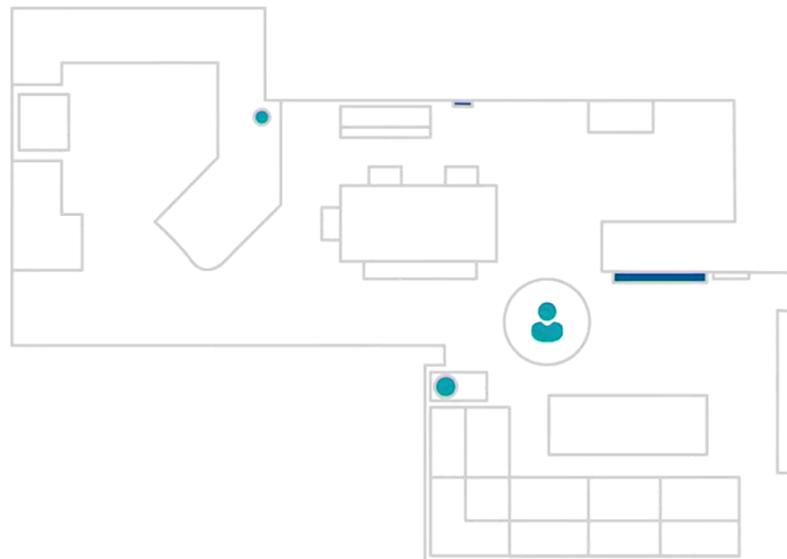




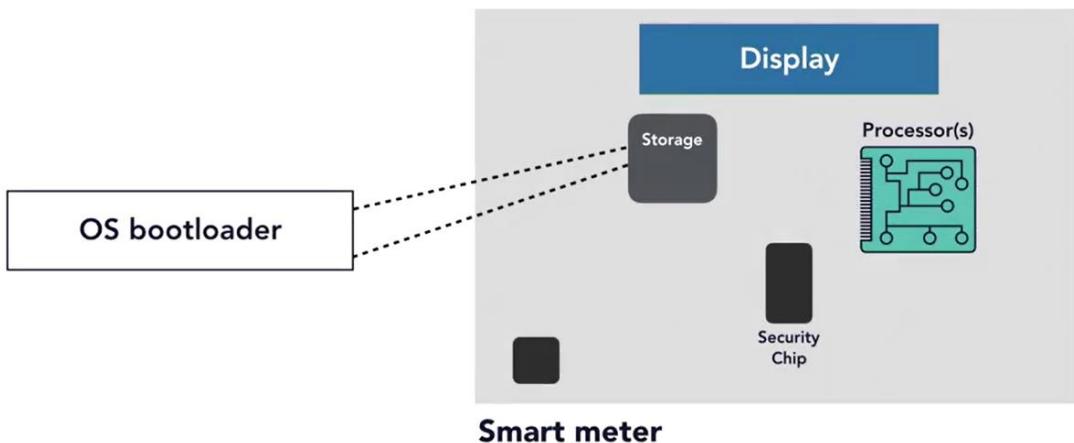
# Security



Board

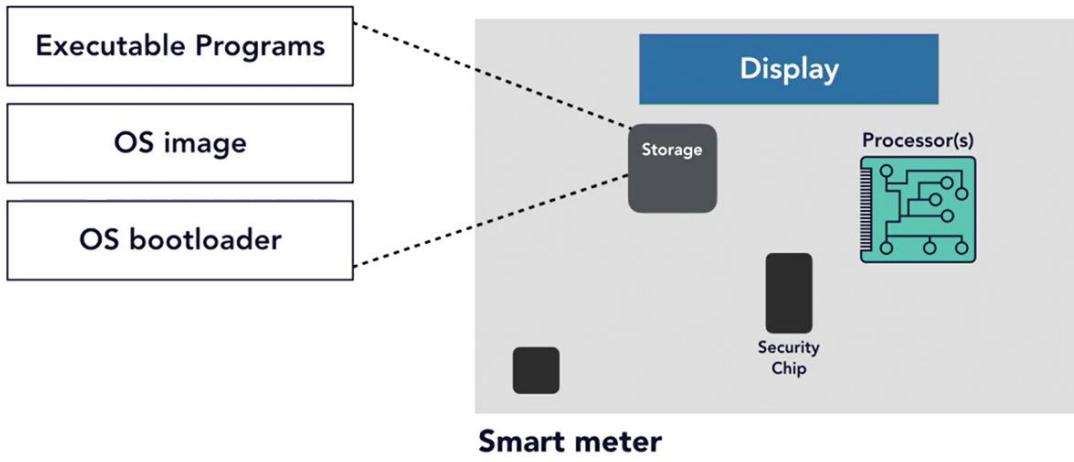


# Device-Level Security



▶ ⏪ ⏴ ⏵ 1:54 / 4:33 1.5x CC BY-SA

# Device-Level Security



▶ ⏪ ⏴ ⏵ 2:48 / 4:33 1.5x CC BY-SA

# Trusted Platform

**Implementation dependent on processors**

## **Arm TrustZone technology**

Protection from unauthorized updates

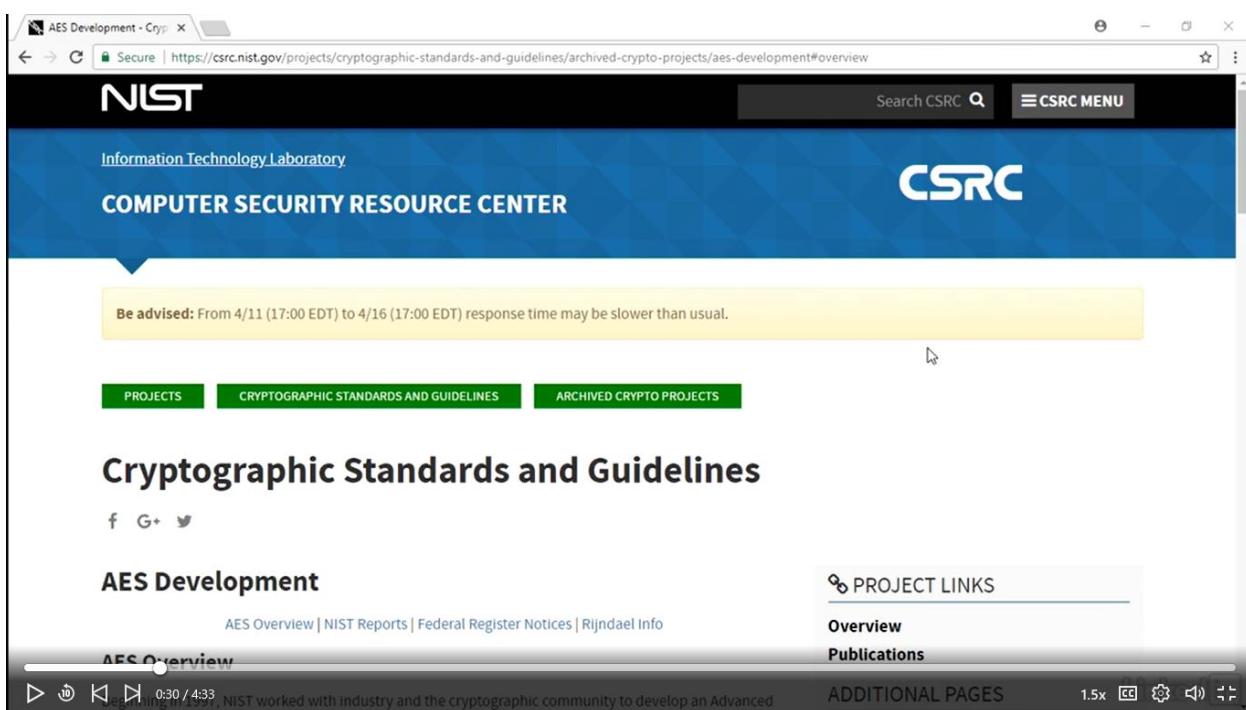
Access for OS threads and handlers

# Security Features

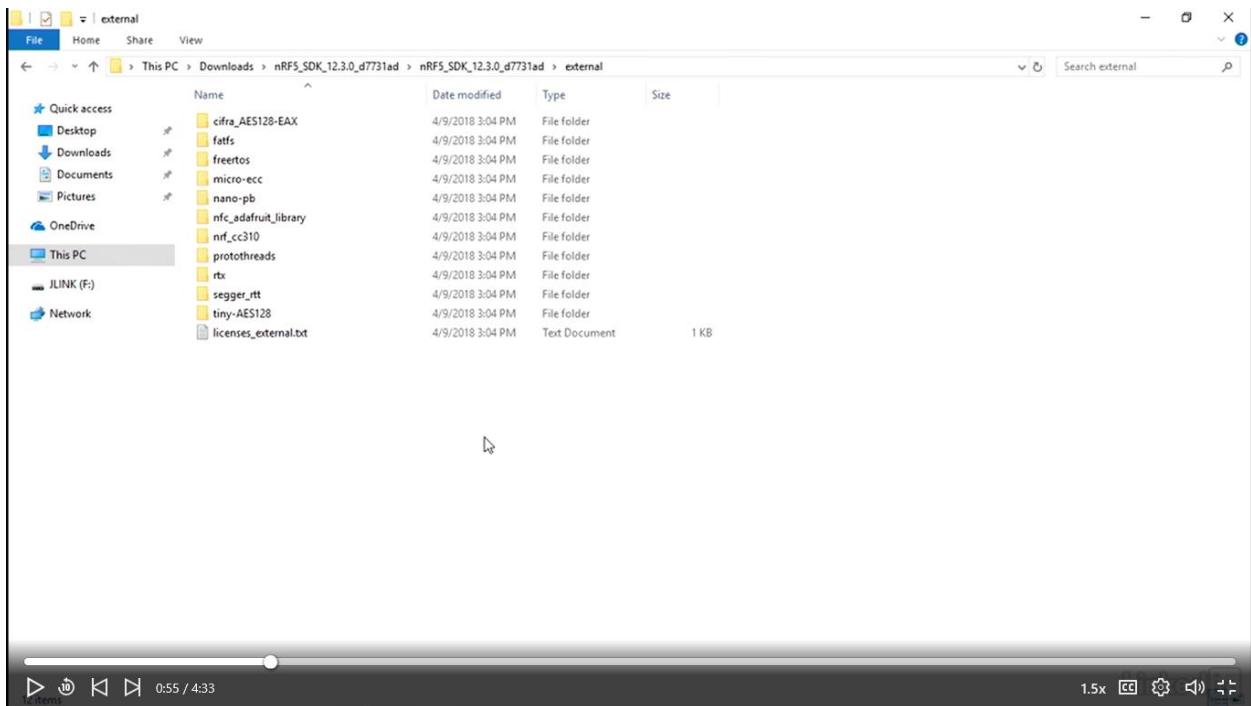
- System audits
- Forensic analysis
- Reduce damages

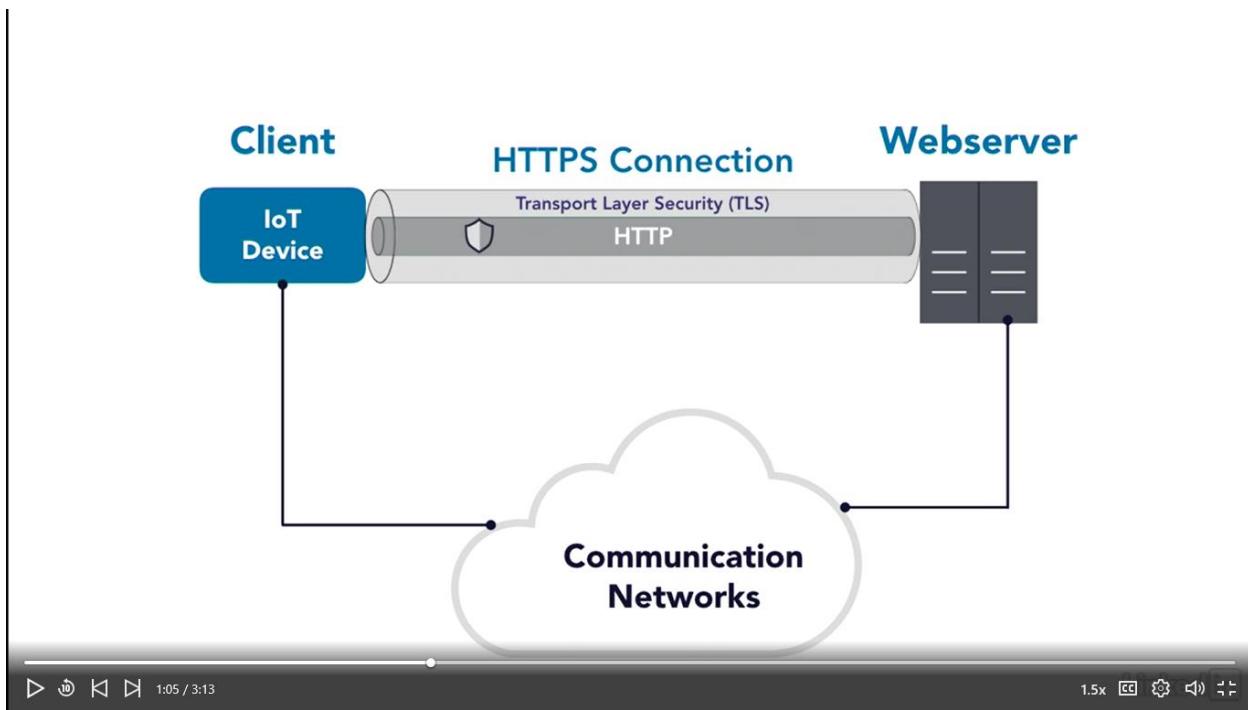
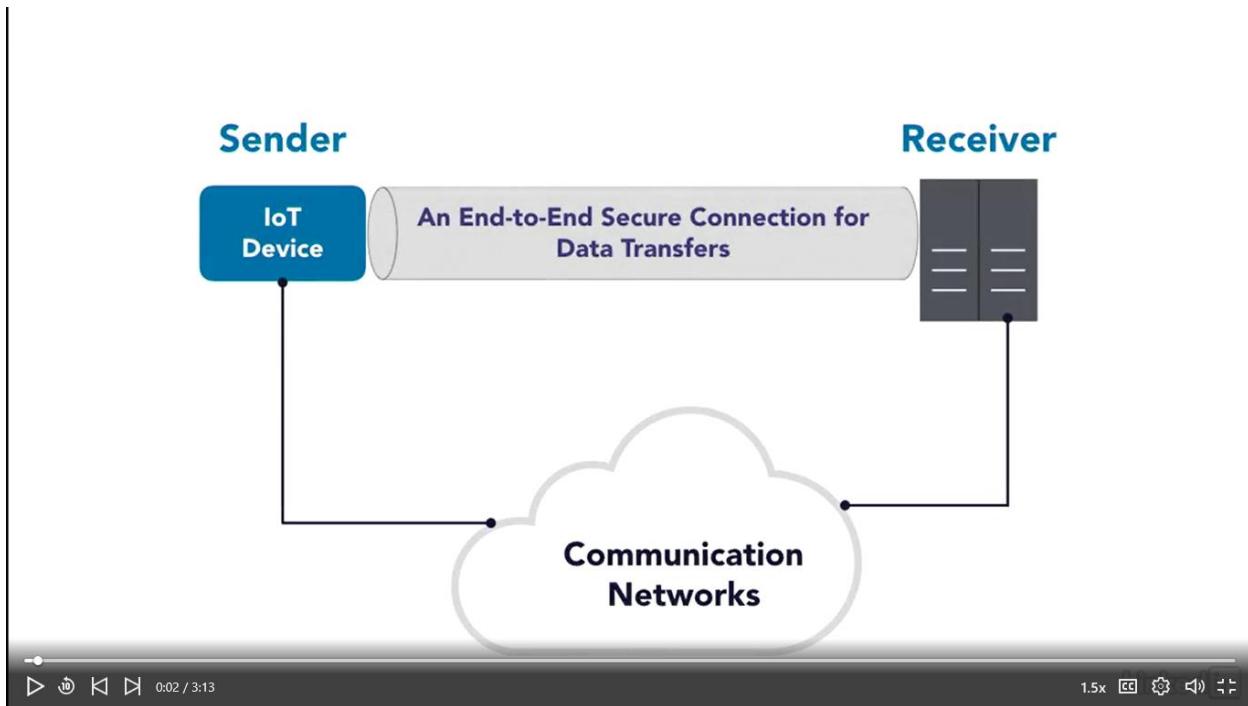


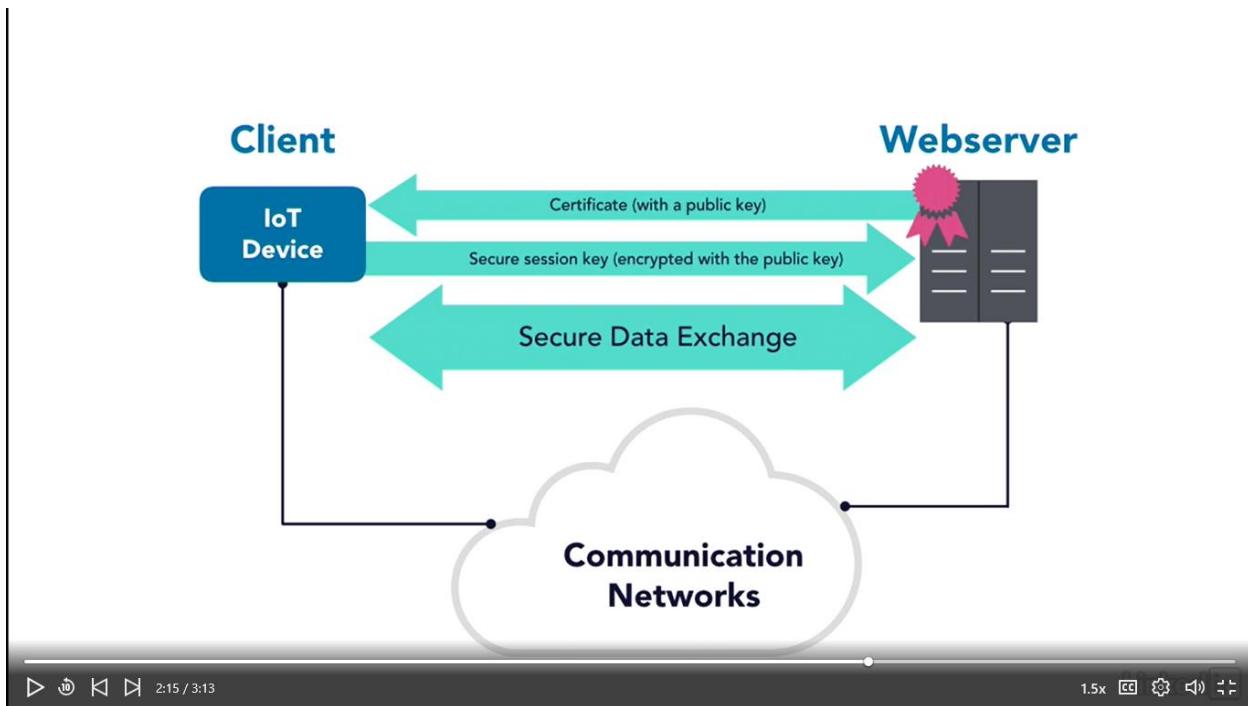
A screenshot of a video player interface. At the top, there is a blue header bar with the title "Security Features". Below the header is a white content area containing a bulleted list of security features. At the bottom of the content area is a dark footer bar with various control icons (play, pause, volume, etc.) and a timestamp "4:30 / 4:33".



A screenshot of a web browser displaying the NIST CSRC website. The page has a blue header with the NIST logo and "CSRC" text. Below the header, there is a yellow banner with the text "Be advised: From 4/11 (17:00 EDT) to 4/16 (17:00 EDT) response time may be slower than usual." The main content area features a section titled "Cryptographic Standards and Guidelines" with a sub-section for "AES Development". There are navigation links for "PROJECTS", "CRYPTOGRAPHIC STANDARDS AND GUIDELINES", and "ARCHIVED CRYPTO PROJECTS". On the right side, there is a sidebar titled "PROJECT LINKS" with "Overview" and "Publications" sections. At the bottom of the page, there is a footer bar with a timestamp "0:30 / 4:33" and some descriptive text about the AES development process.

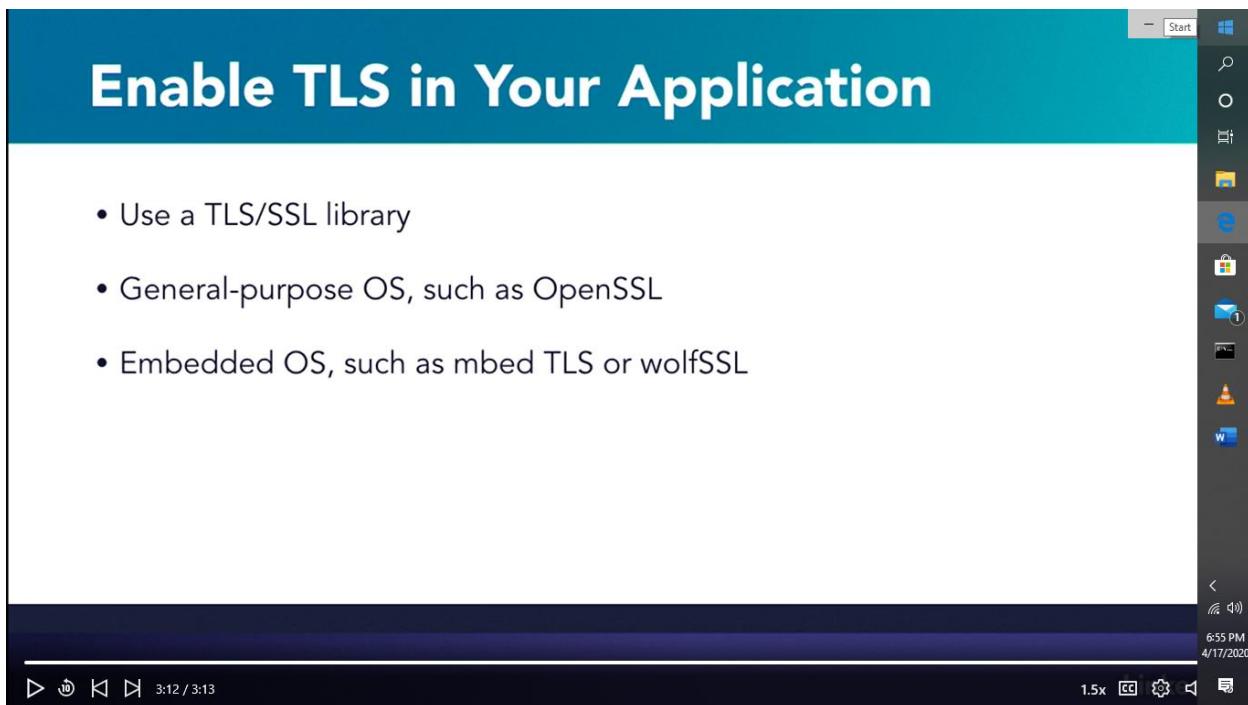




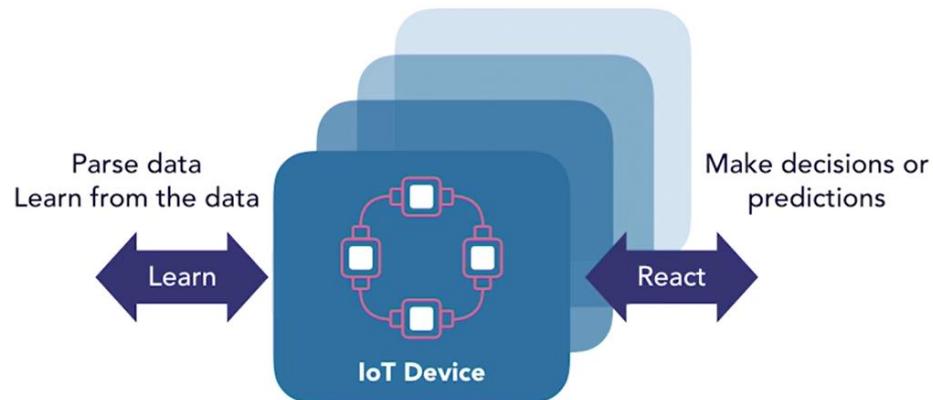


## Enable TLS in Your Application

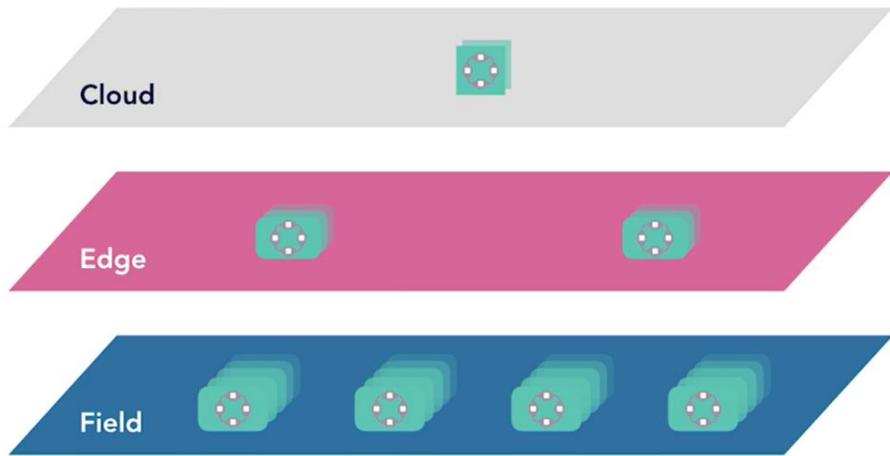
- Use a TLS/SSL library
- General-purpose OS, such as OpenSSL
- Embedded OS, such as mbed TLS or wolfSSL



# Machine Learning

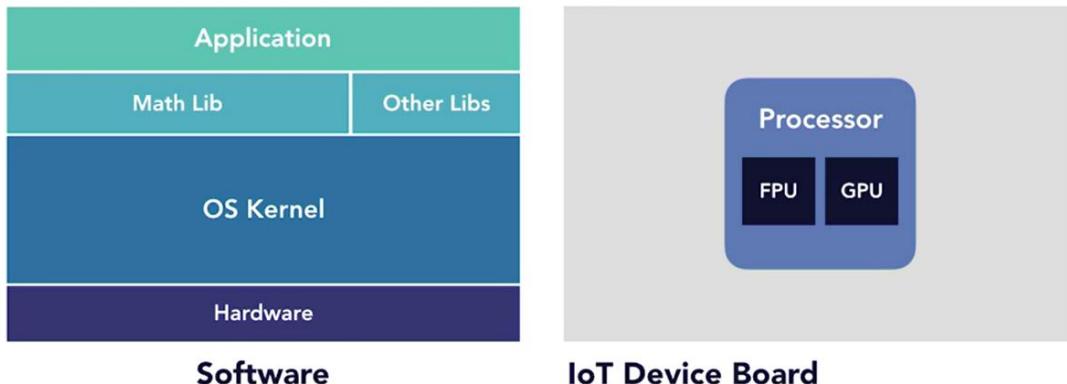


# Enabling Intelligence



▶ ⏪ ⏴ ⏵ 2:52 / 4:15 1.5x CC ⏹ ⏸ ⏹ 🔍

## Math Processing



▶ ⏪ ⏴ ⏵ 3:14 / 4:15 1.5x CC ⏹ ⏸ ⏹ 🔍

# Machine Learning

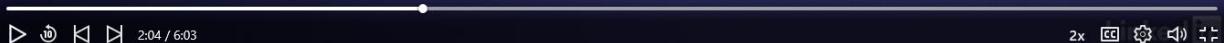
- Use software to make predictions on data
- Give insights into the data collected through our IoT system
- Supervised learning is a common task



1.5x CC ⌂ ⌂ ⌂

## Supervised Learning for Classifying Data

- Several typical algorithms including Normal Bayes Classifier
- Use the Normal Bayes Classifier with a math or machine learning library



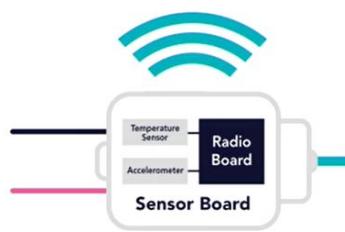
2x CC ⌂ ⌂ ⌂

# Use OpenCV

- OpenCV is released in packages for regular OS and cross-platform uses, such as Linux or Windows, Android, and iOS
- A machine learning library is included

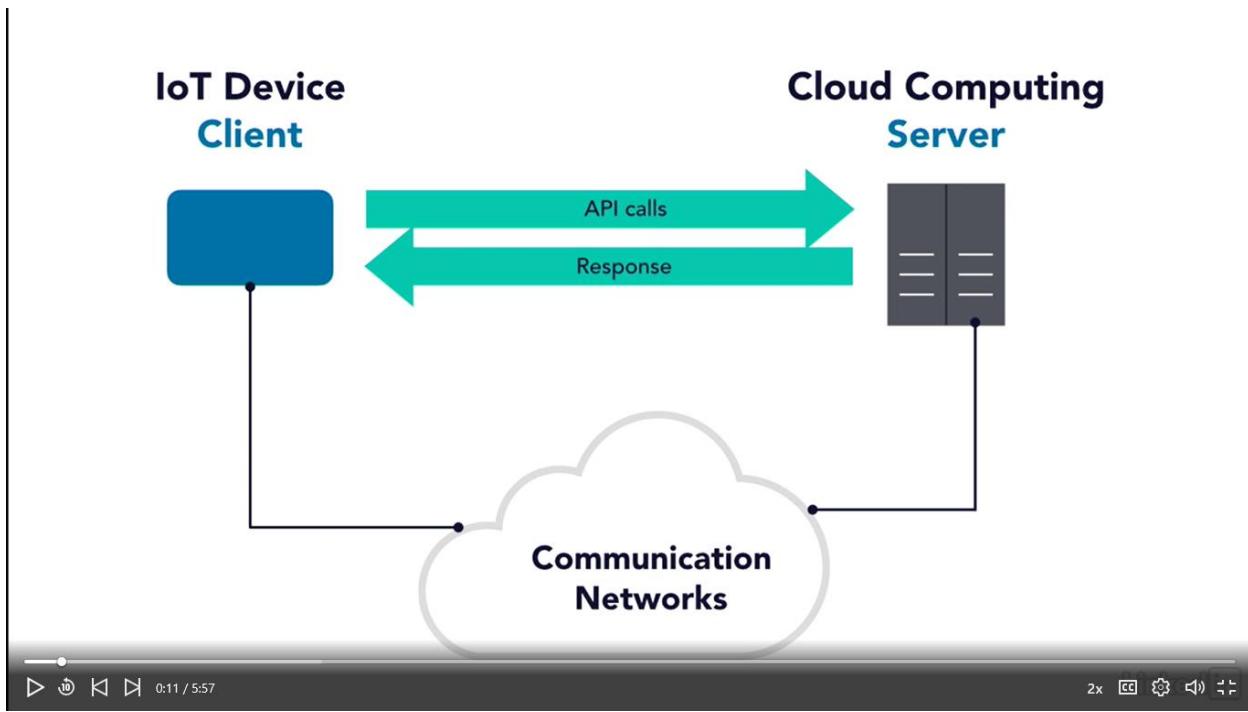


	OK			WARNING			ERROR		
Amplitude (mils)	0.11	0.29	0.42	0.98	1.12	1.2	1.2	1.25	1.5
Temperature (F)	155	170	170	200	219	230	260	240	300



An electric motor





# Enabling Machine Learning at Cloud

- Option 1: Use a virtual machine at cloud and deploy an API endpoint for ML
- Option 2: Use an ML solution from a cloud computing service vendor

