Living on the Cloud's Edge

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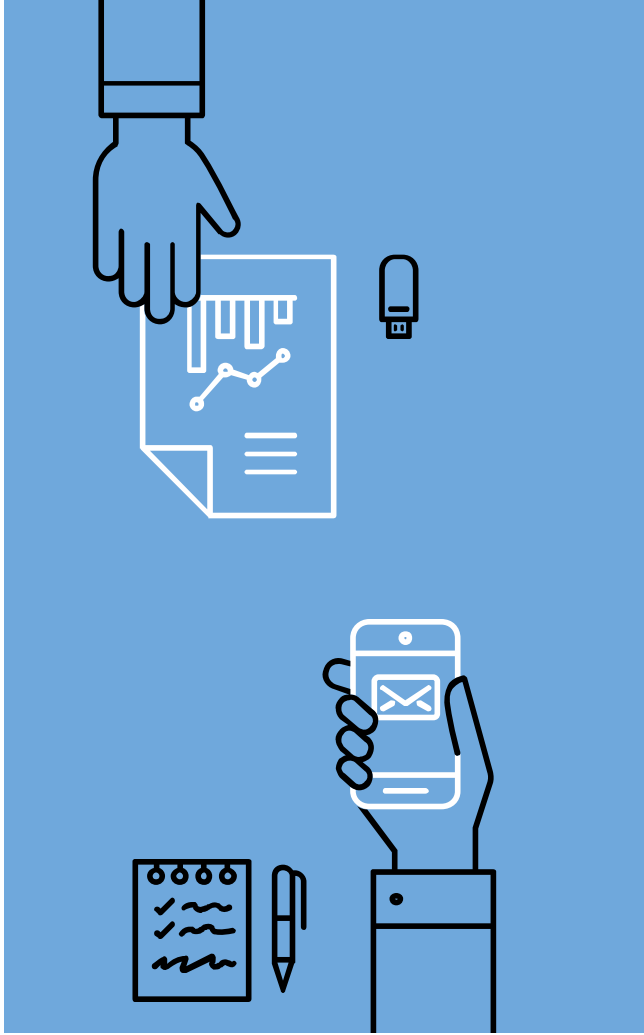
Building something...

- Comply with Strict Privacy Policy
- High Performance
- Quick (Low Latency)
- Cheap to Run



HELLO!

Rustam Mehmandarov

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computas

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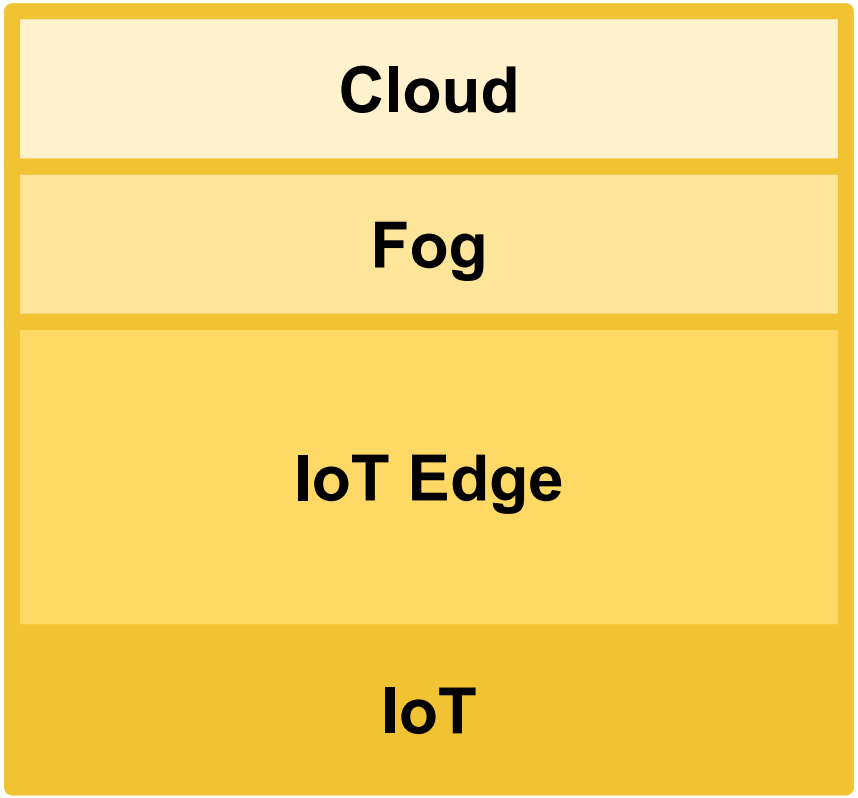
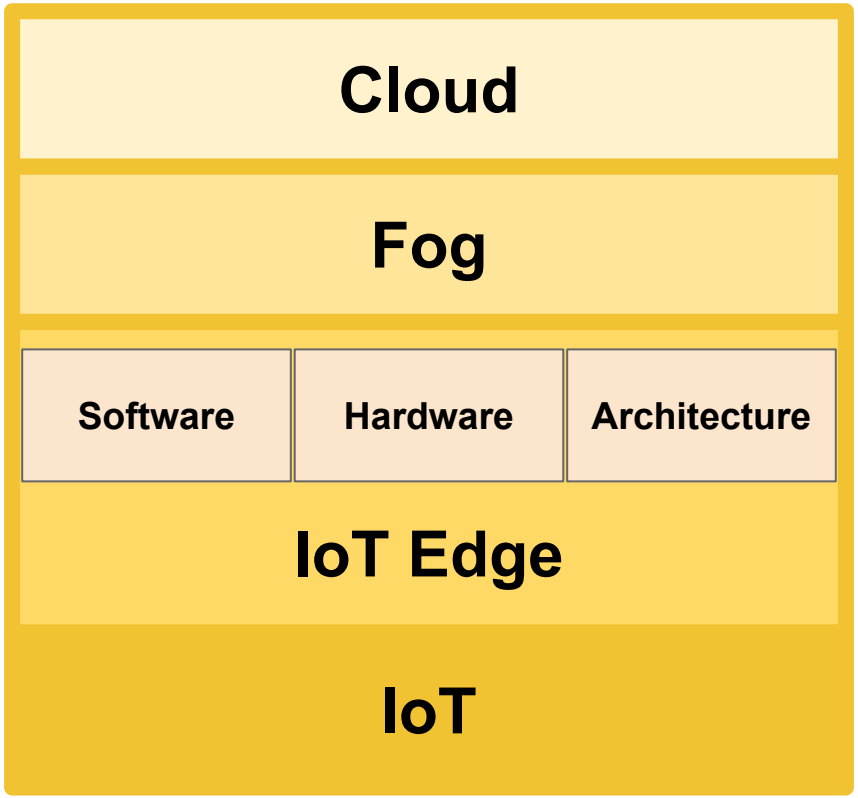
UiO : University of Oslo


Cloud
Fog
IoT Edge
IoT


Cloud
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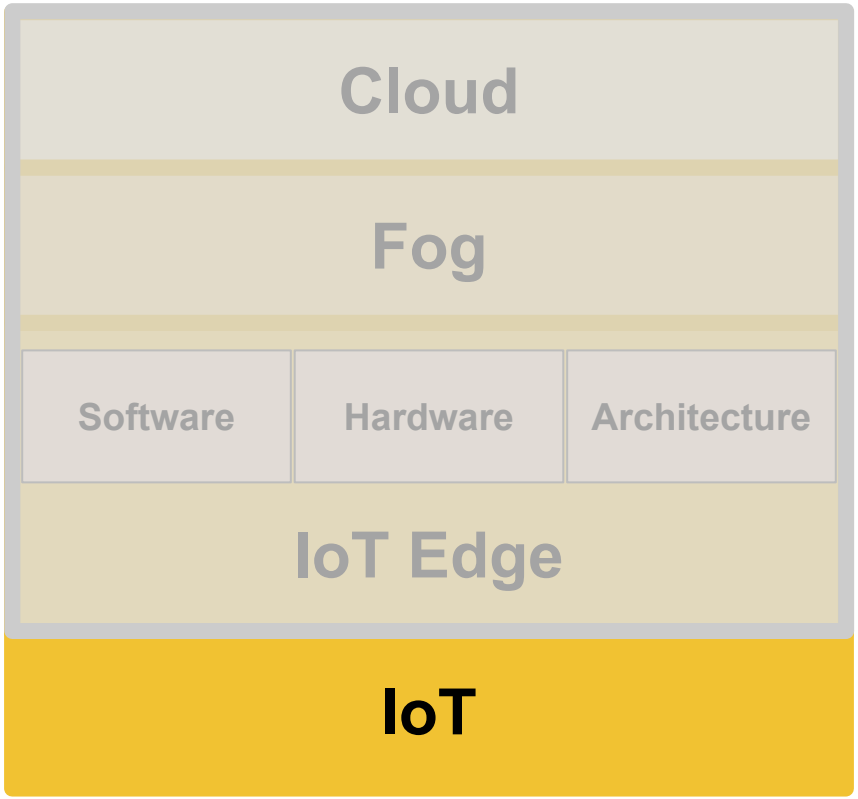
Cloud
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IoT

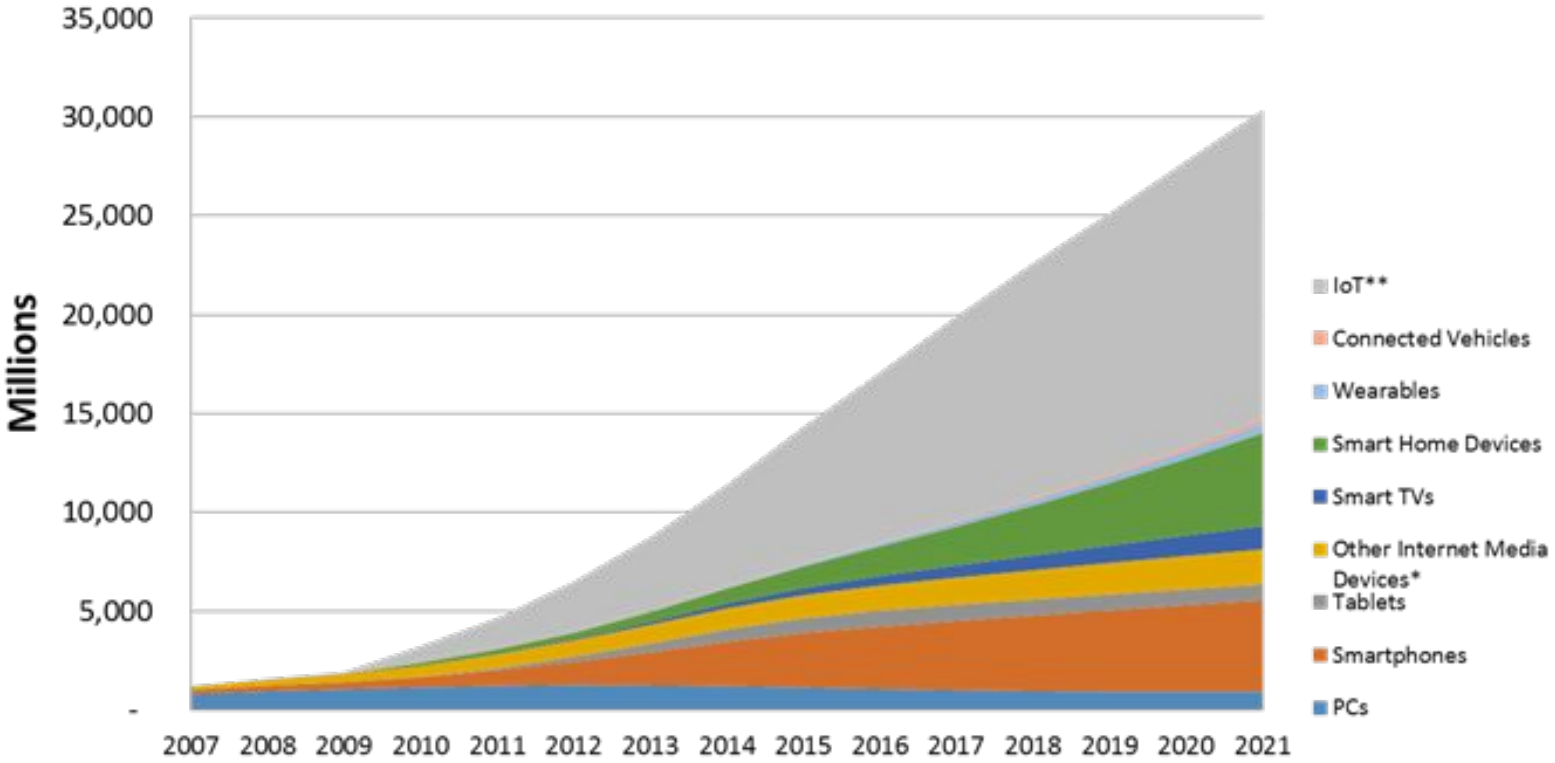
IoT

Internet of Things

Electronic devices with Internet connectivity that can be remotely monitored and controlled

STRATEGY ANALYTICS

Global Connected and IoT Device Installed Base Forecast



Source – Strategy Analytics research services ,October 2017: IoT Strategies , Connected Home Devices, Tablet and Touchscreen Strategies, Wireless Smartphone Strategies, Wearable Device Ecosystem, Smart Home Strategies

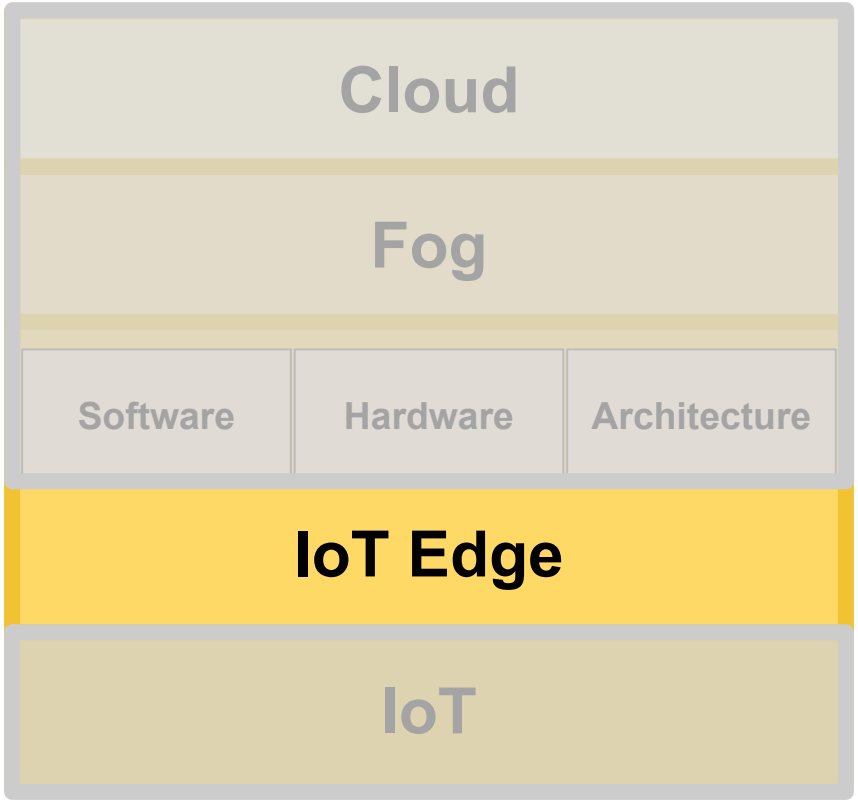
Internet of Things

\+

- Lead time processing
- Accessibility
- Mobility
- Tracking Ability
- Efficiency
- Cost

\-

- Data Security
- Privacy
- Massivity of Data
- Environment Issues
- Complexity
- Network dependent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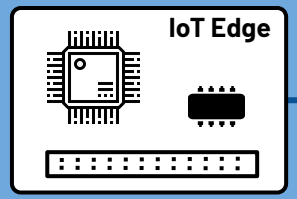
Edge Computing

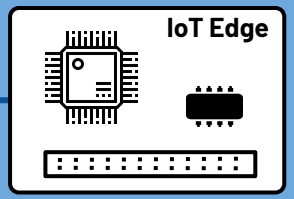
Improve operations
and cut costs



Edge computing is a mesh network of ***micro data centers*** *that* ***process or store*** *critical data locally and* ***push*** *it to a central data center or Cloud.*

— IDC

International Data Corporation



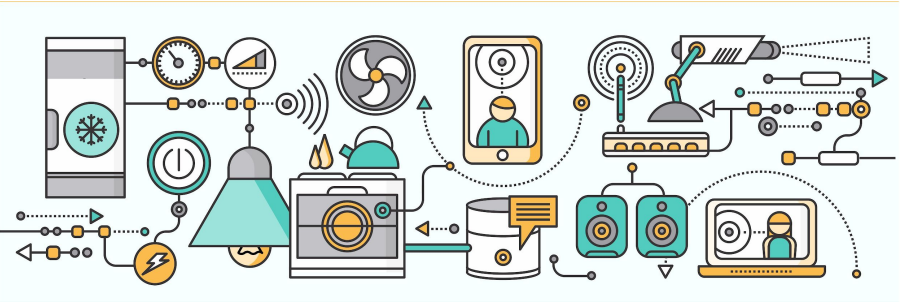
Edge Computing

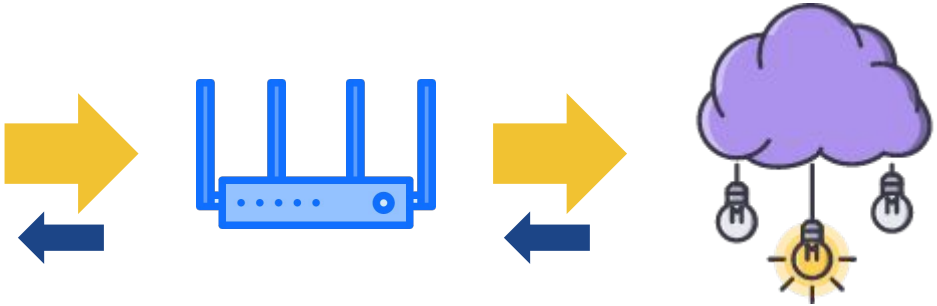
+

- Low Latency
- Privacy
- Real-Time Availability
- Real-Time Data Transmission
- Productivity Increase

-

- Limited (or no) Redundancy
- Potential Loss of Data
- Higher Risk in general





IoT “Smart Devices”, Assistants, etc.
(not Edge devices)

Gateway

Cloud

Rich Rogers
@RichRogersIoT

Følg

My wife asked me why I was speaking so softly at home.

I told her I was afraid Mark Zuckerberg was listening!

She laughed. I laughed.

Alexa laughed. Siri laughed.

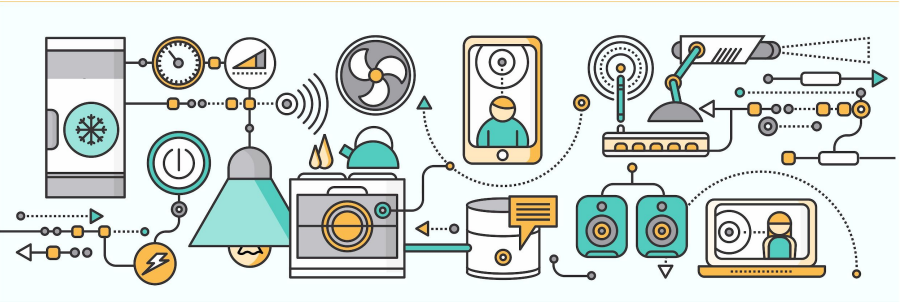
17:00 - 1. jun. 2019

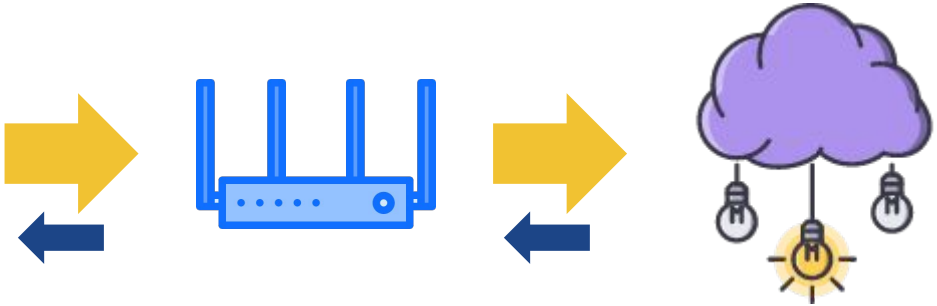
12 998 retweets **48 437** liker

346 13 K 48 K

https://xkcd.com/1807/

https://xkcd.com/1807/





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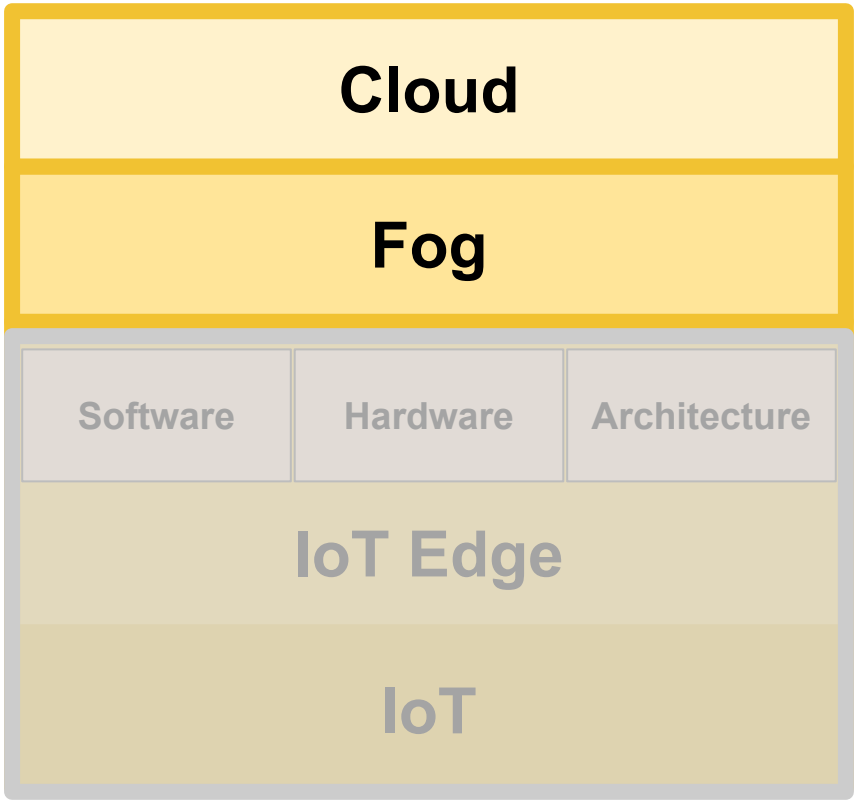
Cloud
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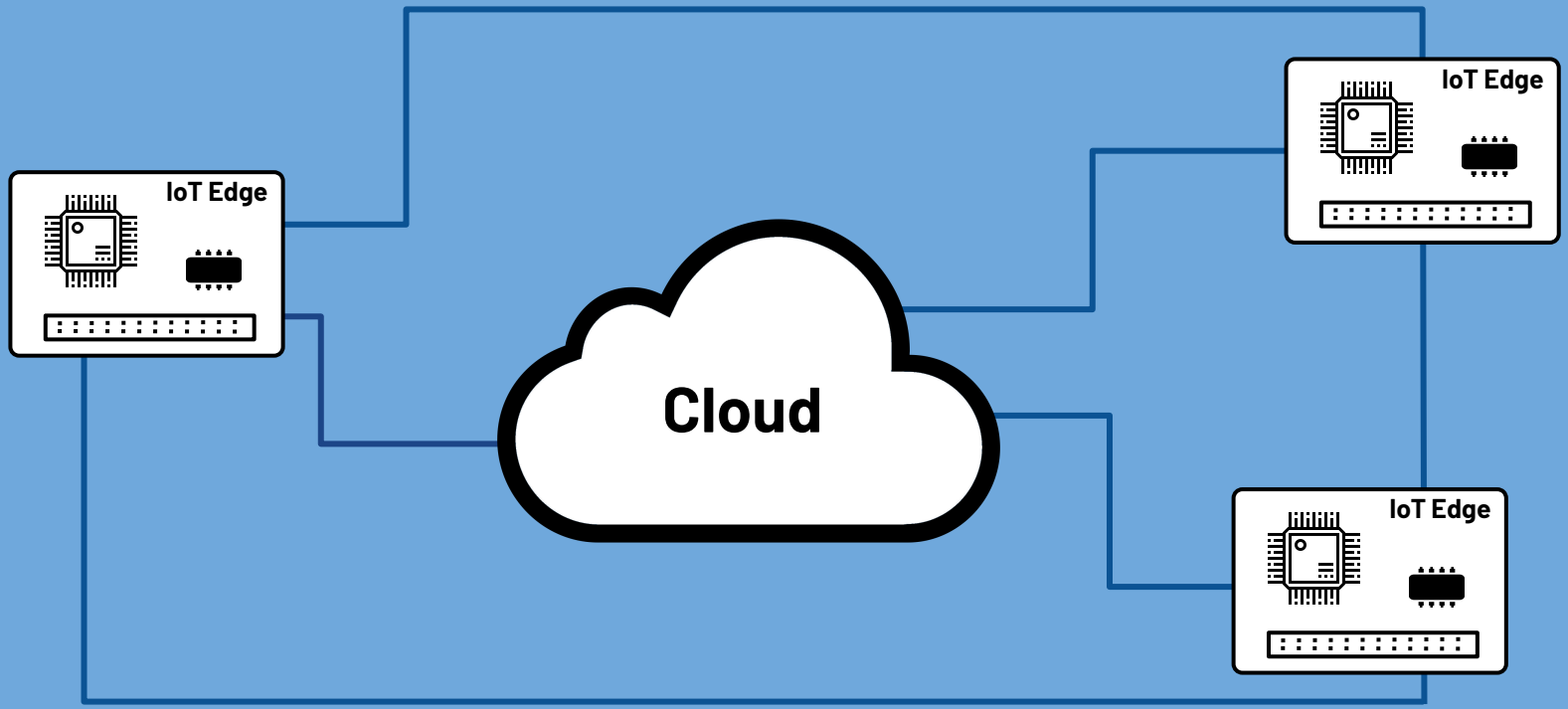
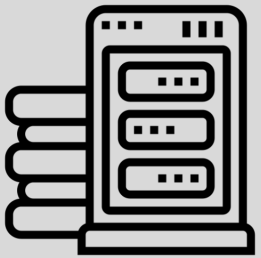
What is Fog Computing?

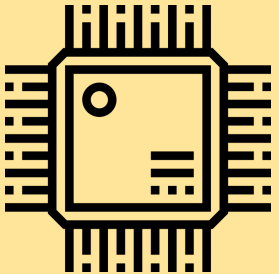


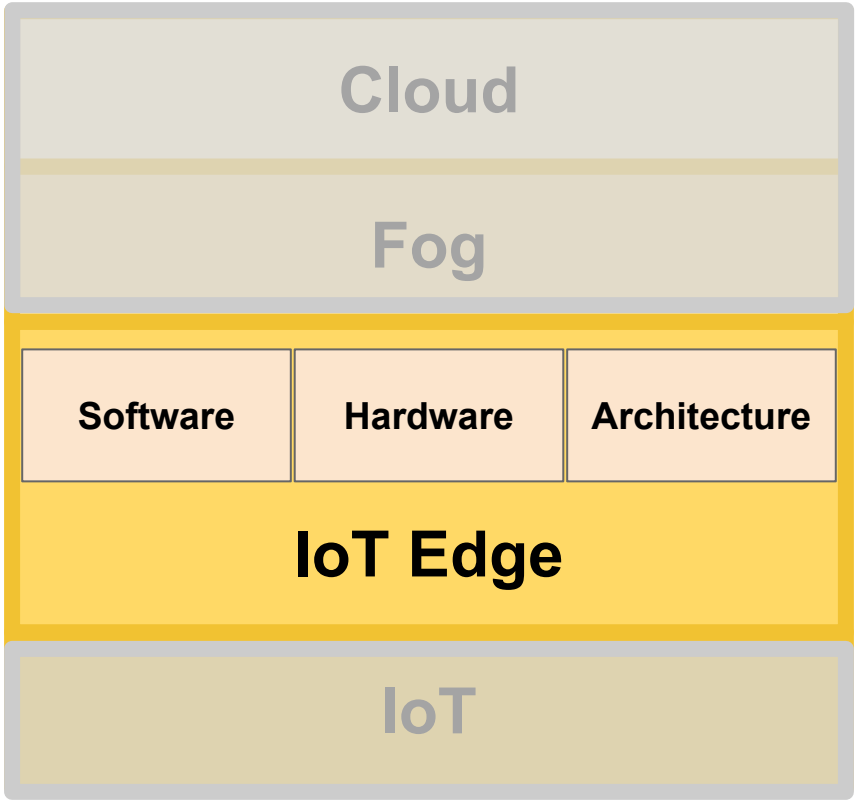
Cloud Computing

Fog Computing



Edge Computing




Cloud
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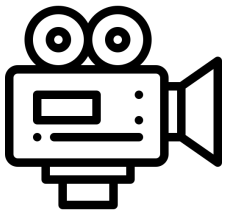
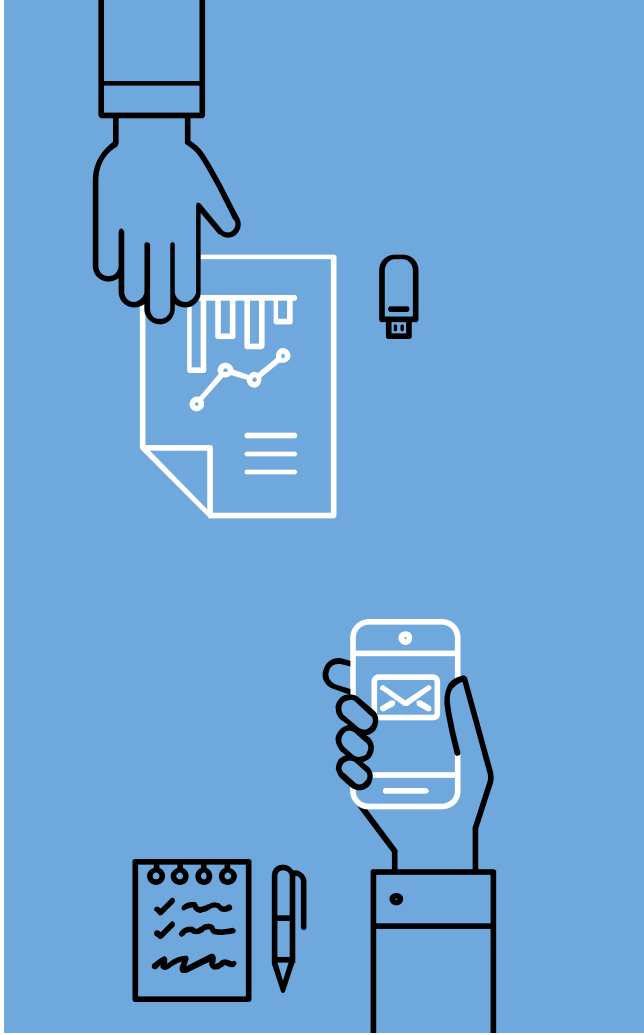
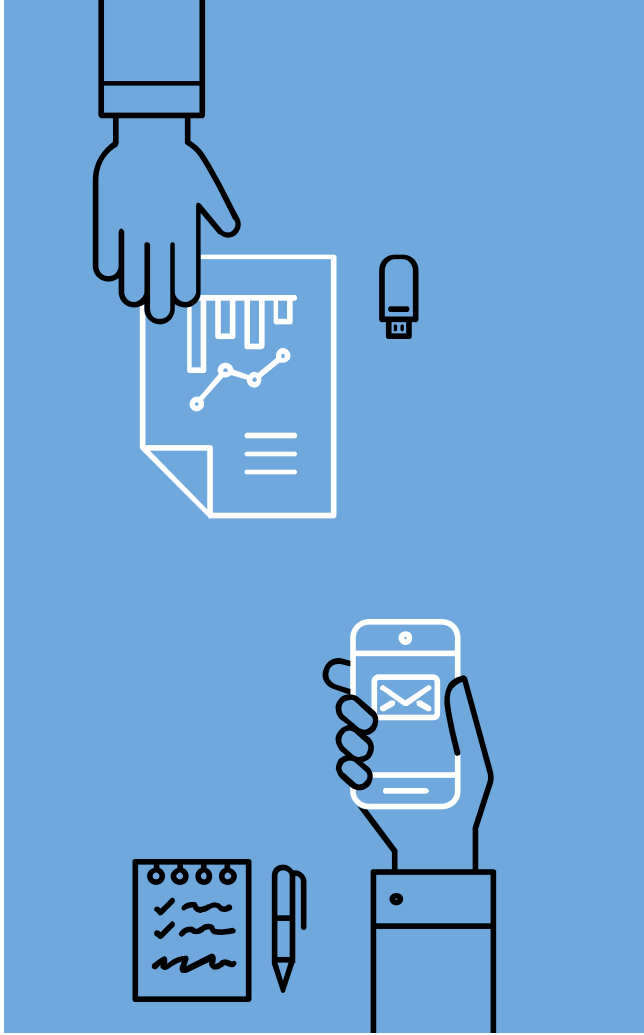
Real-Life Example





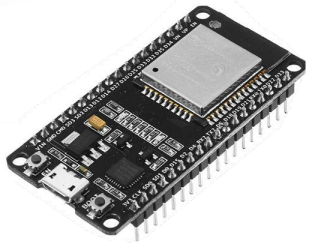
ML-based People Counter

- Privacy Concerns
- Performance
- Latency
- Cost



Edge Computing Devices

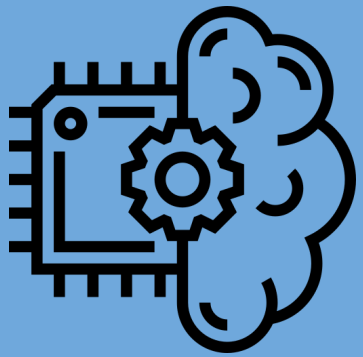
- Azure Sphere
- AWS FreeRTOS
- Google Coral



Raspberry Pi, Banana Pi, Intel Edison ++

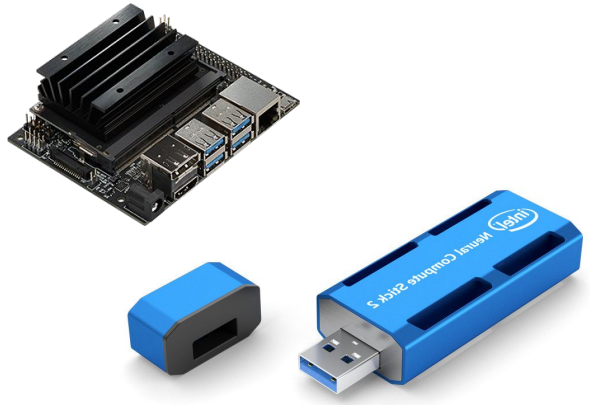
Edge AI Computing

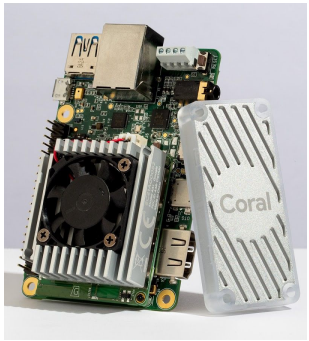
Edge Computing + AI =



AI Accelerators

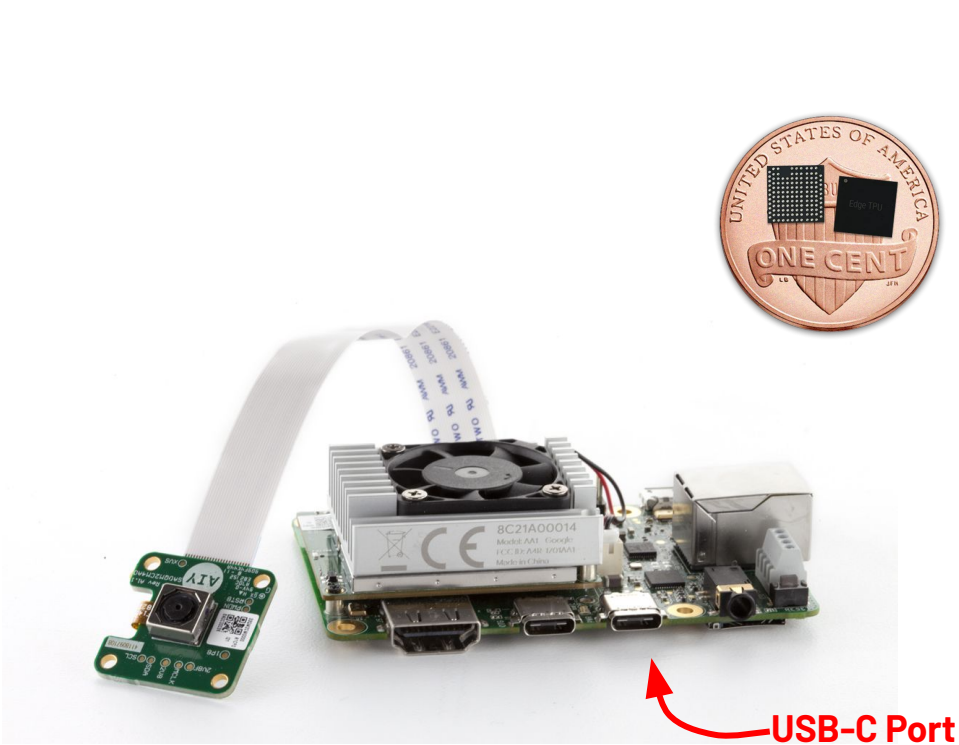
- NVIDIA Jetson
- Intel Movidius Myriad
- Google Edge TPU

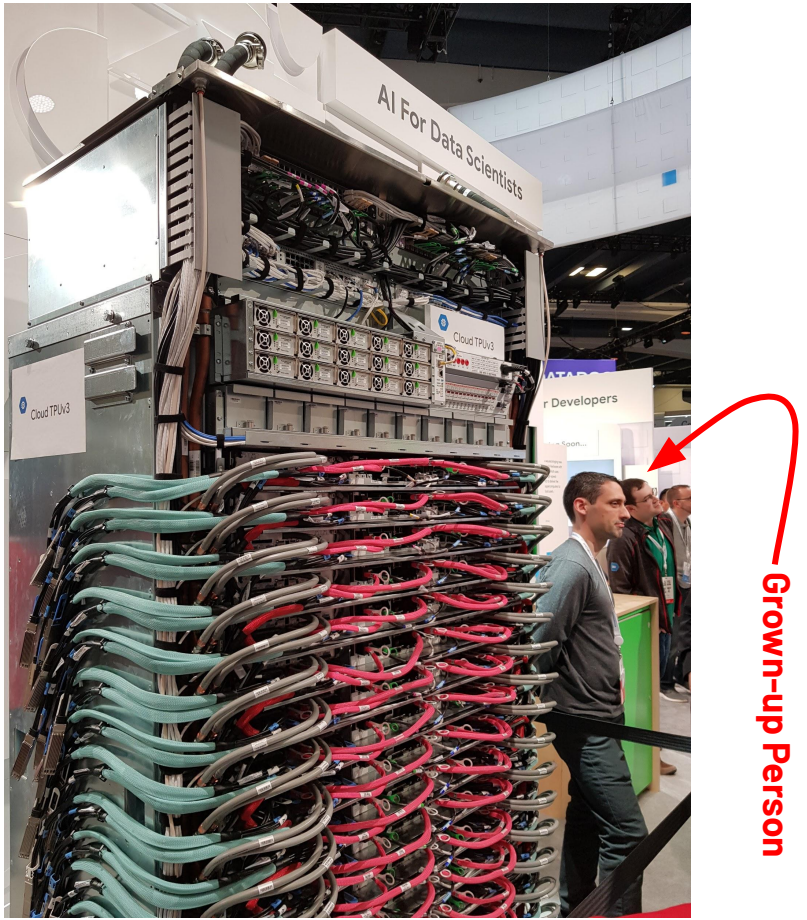




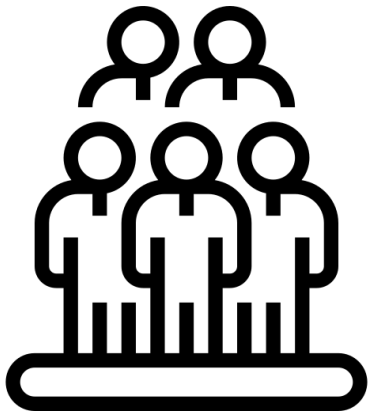
Google Coral Dev Board

Not all TPUs are alike...

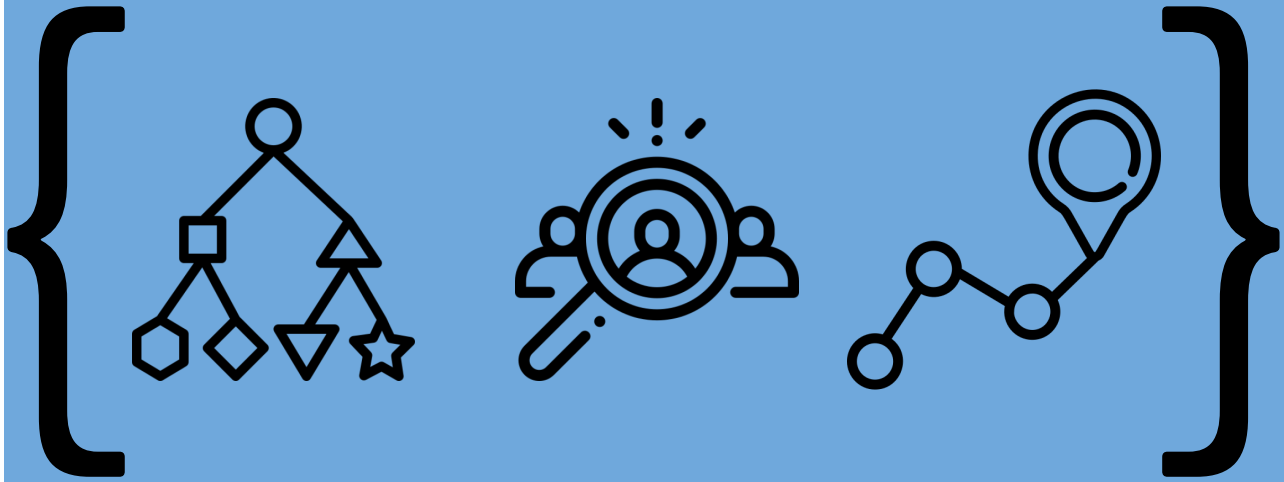




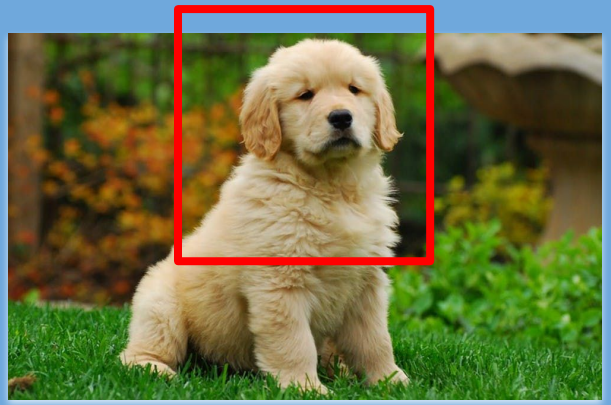
https://cloud.google.com/tpu/



People Counter



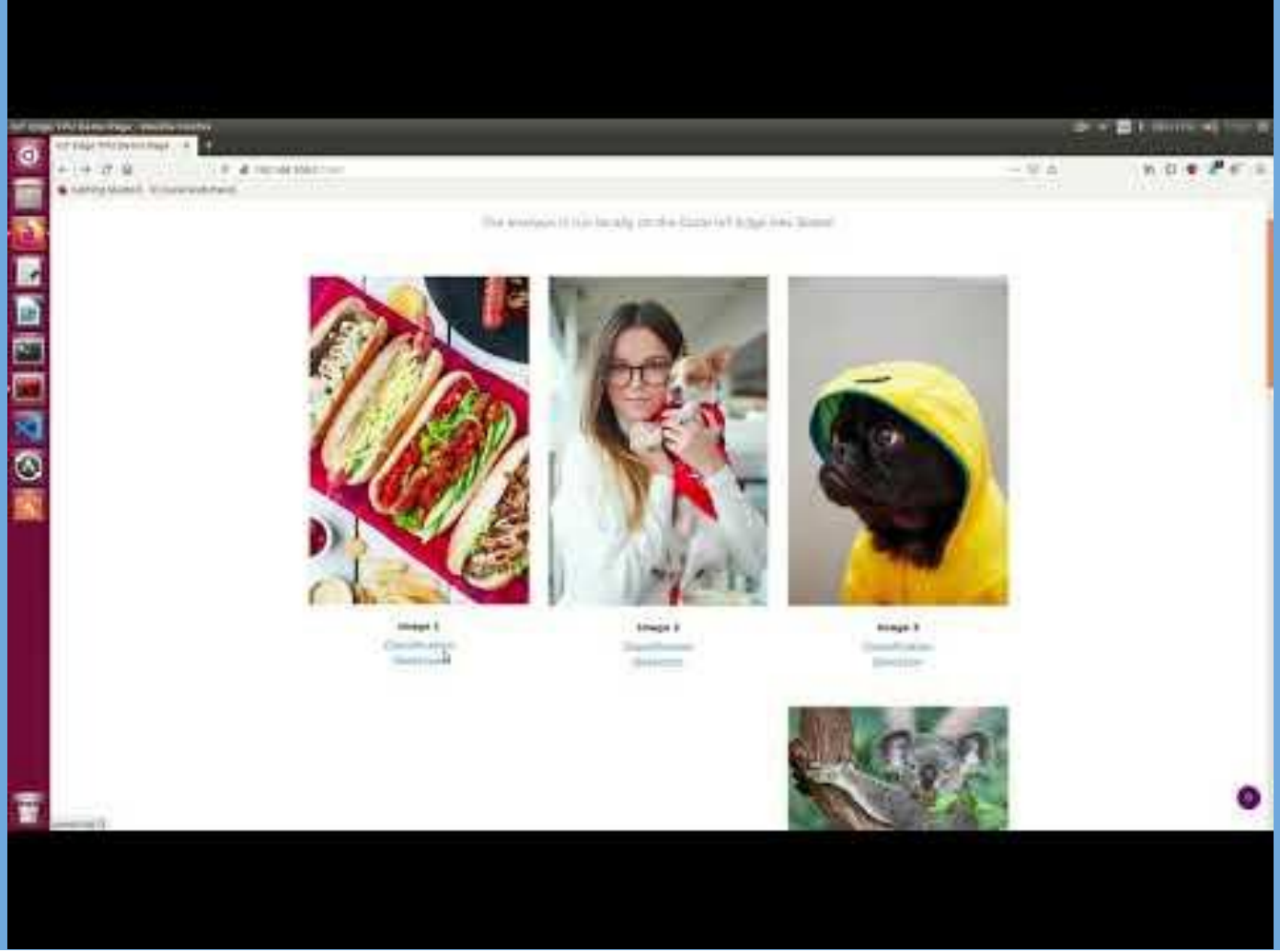
Classification Detection Tracking



Classification

Detection

Tracking



Detection vs. Tracking

- Video -> stream of images (fps)

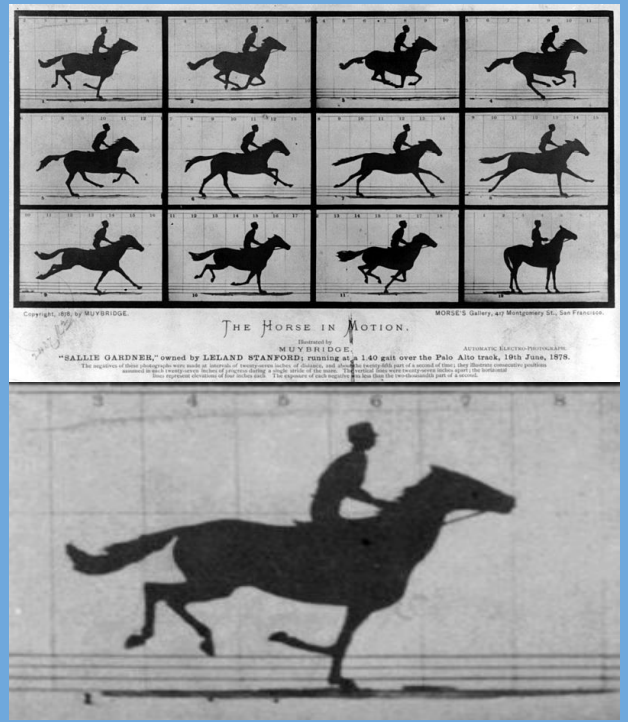
Lots of images!

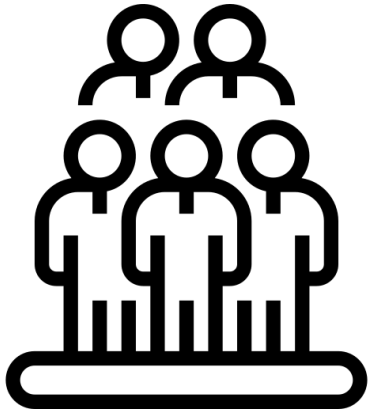
- Detect an object in each image.

ML is CPU intensive, but not for TPU!

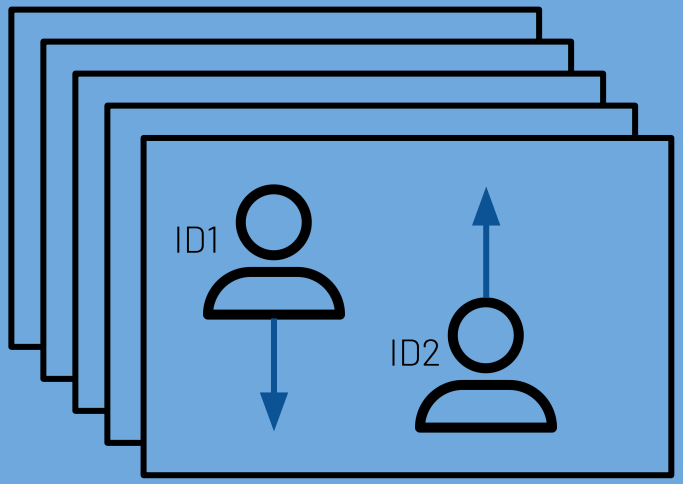
- Tracking = correlating objects between frames

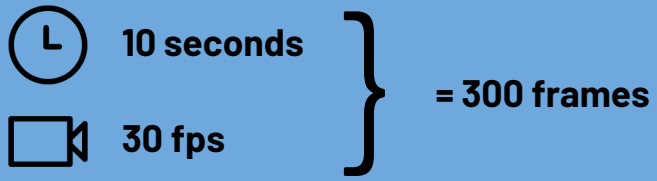
Quite CPU intensive and tricky!

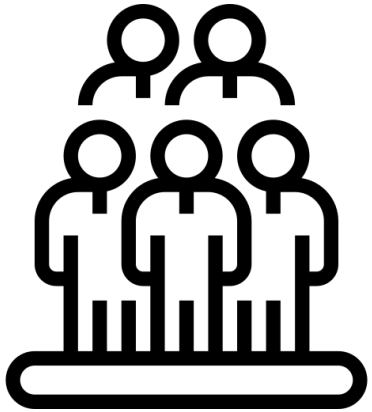




People
Counter







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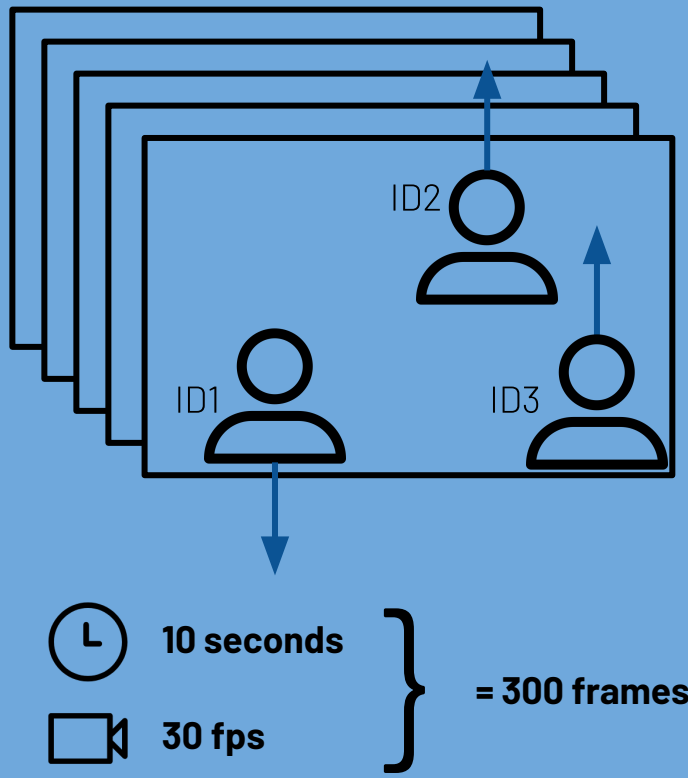
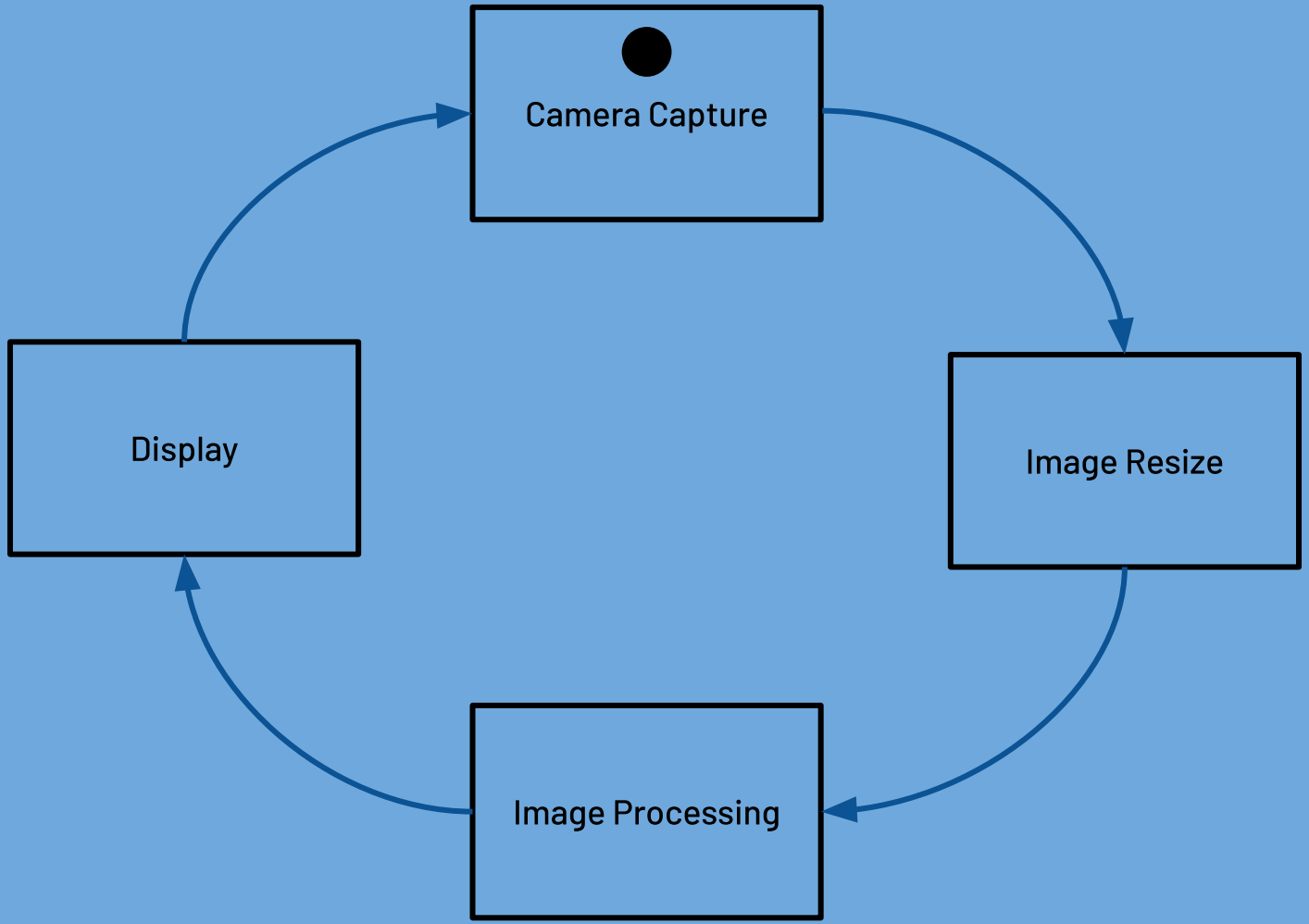
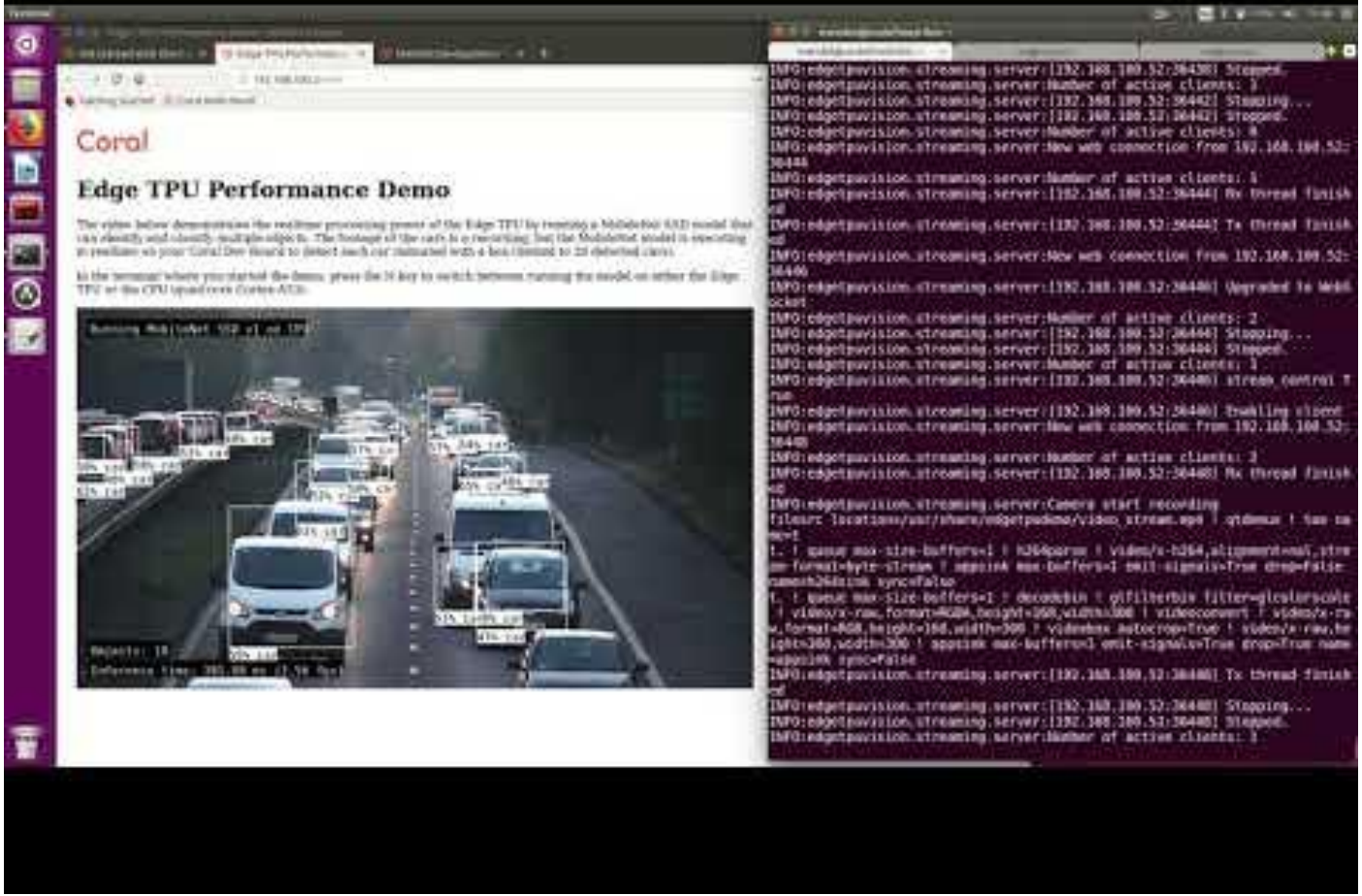


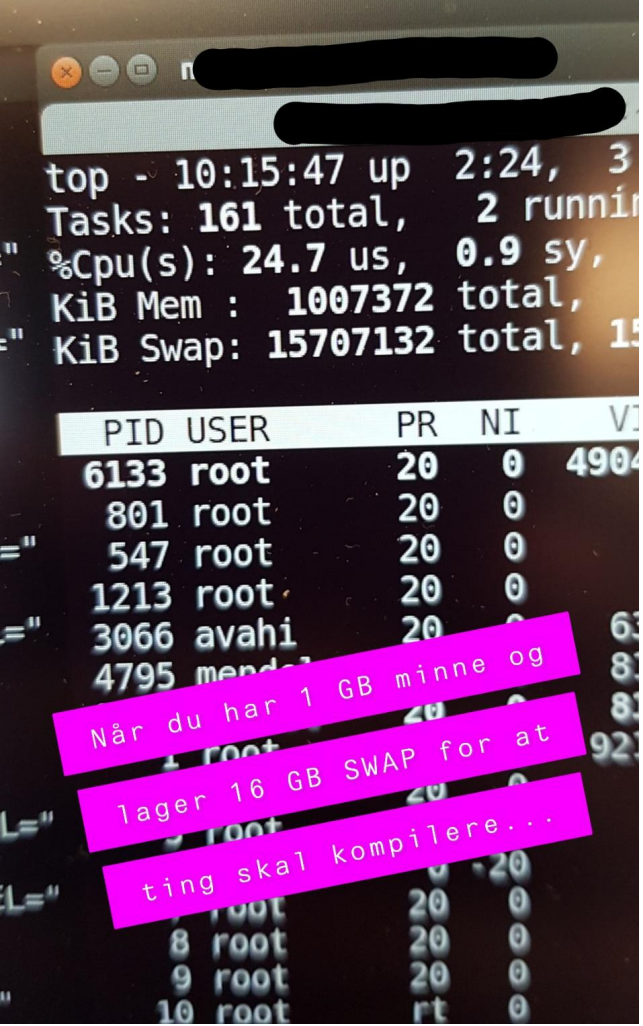

Camera Capture
Image Resize
Image Processing
Display

@rmehmandarov @tannaznvr

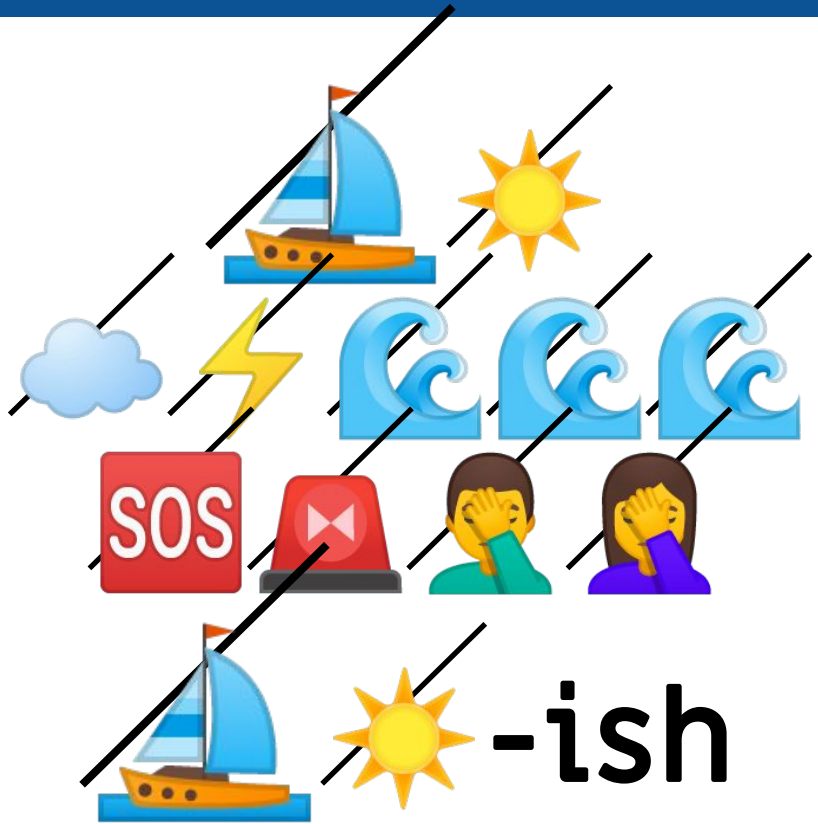

Coral
Edge TPU Performance Demo

Our Experiences

- Various models have difference performance
- Don’t put much code in synchronous functions
- Optimize, optimize, optimize



Smooth Sailing?



DEMO

THANK YOU!

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UiO : University of Oslo

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