Sparking the Next Generation of Arm-Based Cloud-Native Smart Camera Designs

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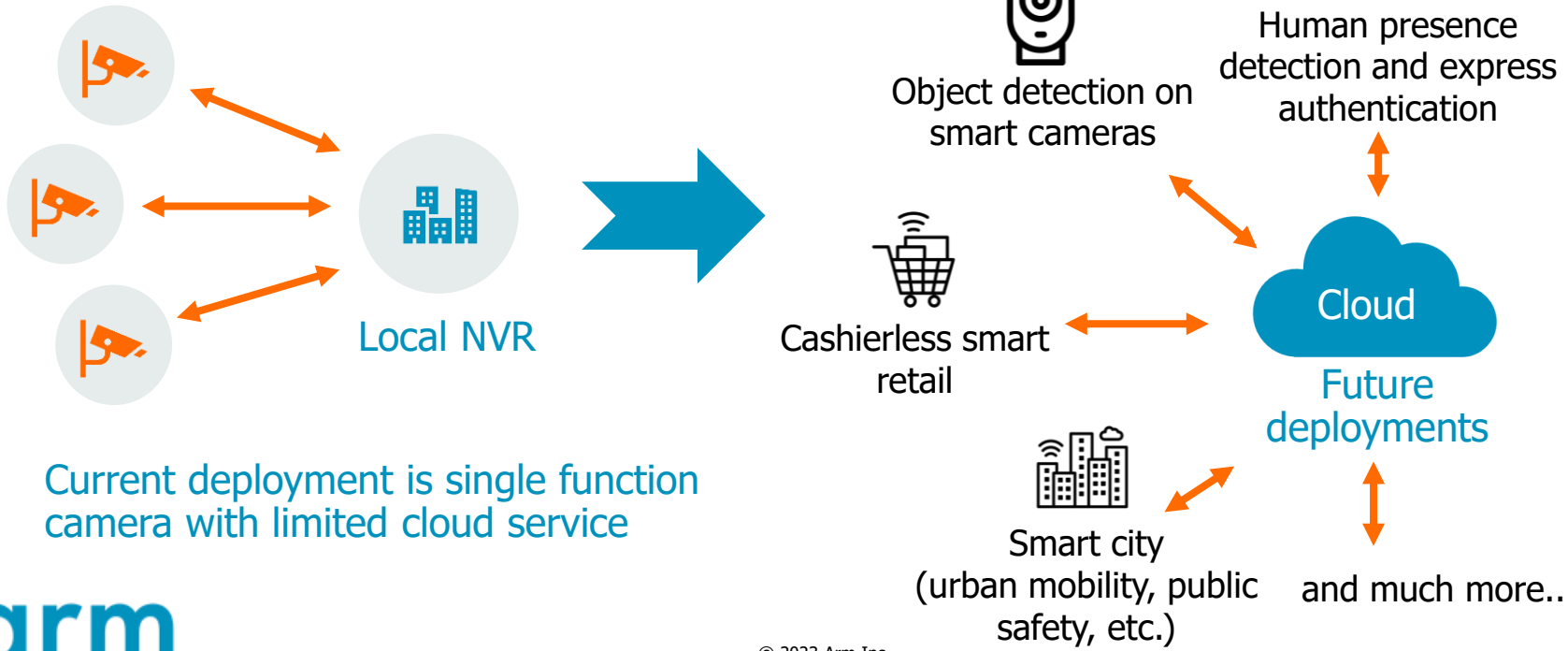
Introduction to the Future of Smart Camera

- Where are the changes happening?



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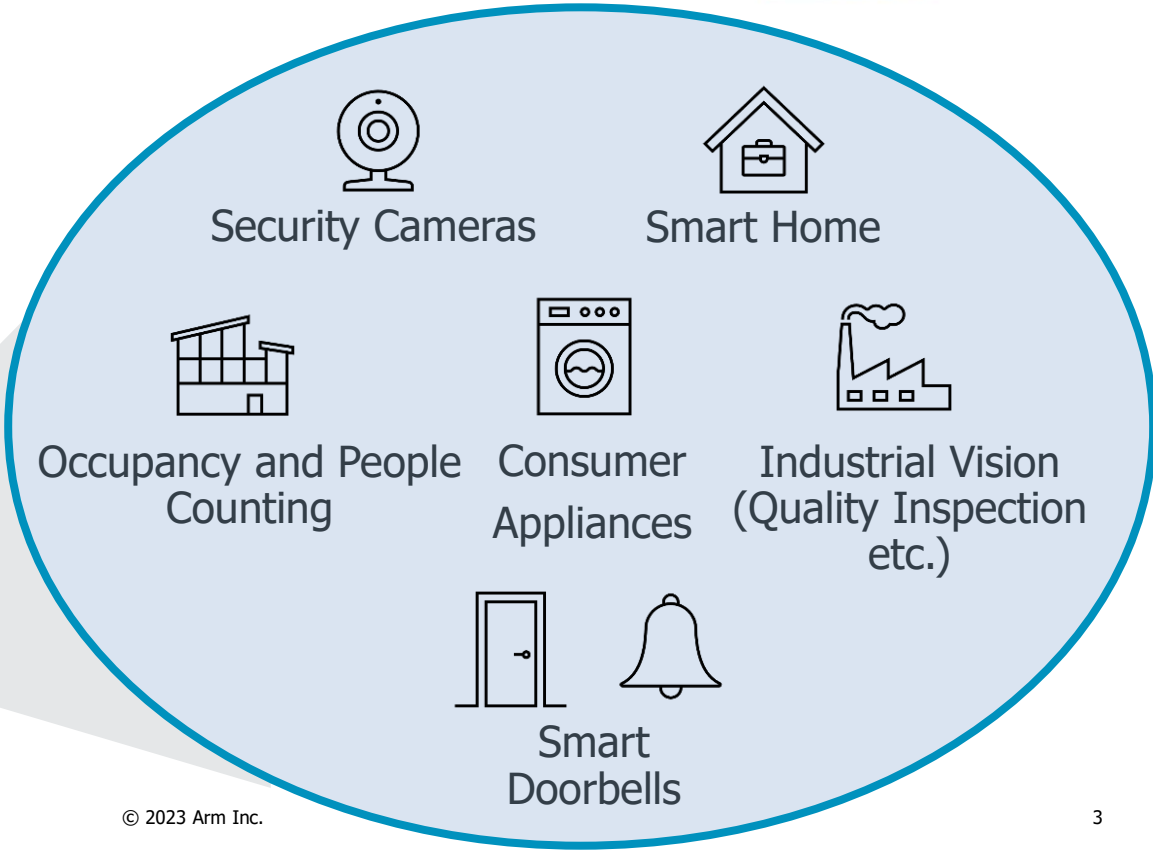
Why Are the Changes Happening?

- Machine learning is everywhere
- Need an efficient way to make it easier to support multiple platforms with varying ML capabilities



Machine Learning

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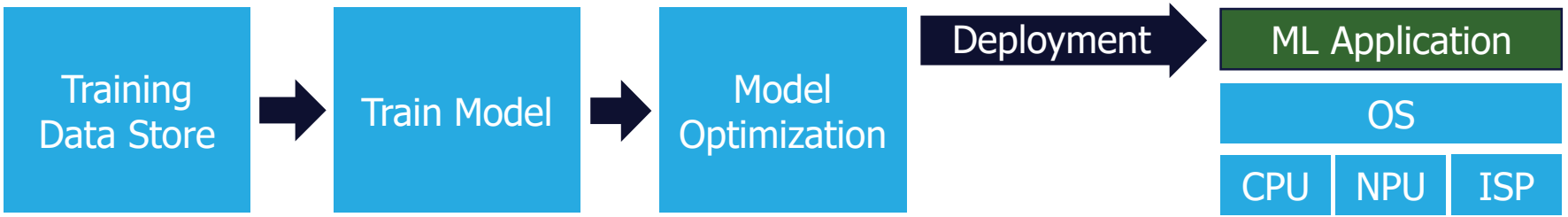
Review of Typical Native Only Development Flow

- Time-consuming to develop solutions including hardware, software and integrate cloud service provider (CSP) services
- Rigid machine learning (ML) use case due to single ML-model deployment
- Lack of software ecosystem to deploy multiple ML applications



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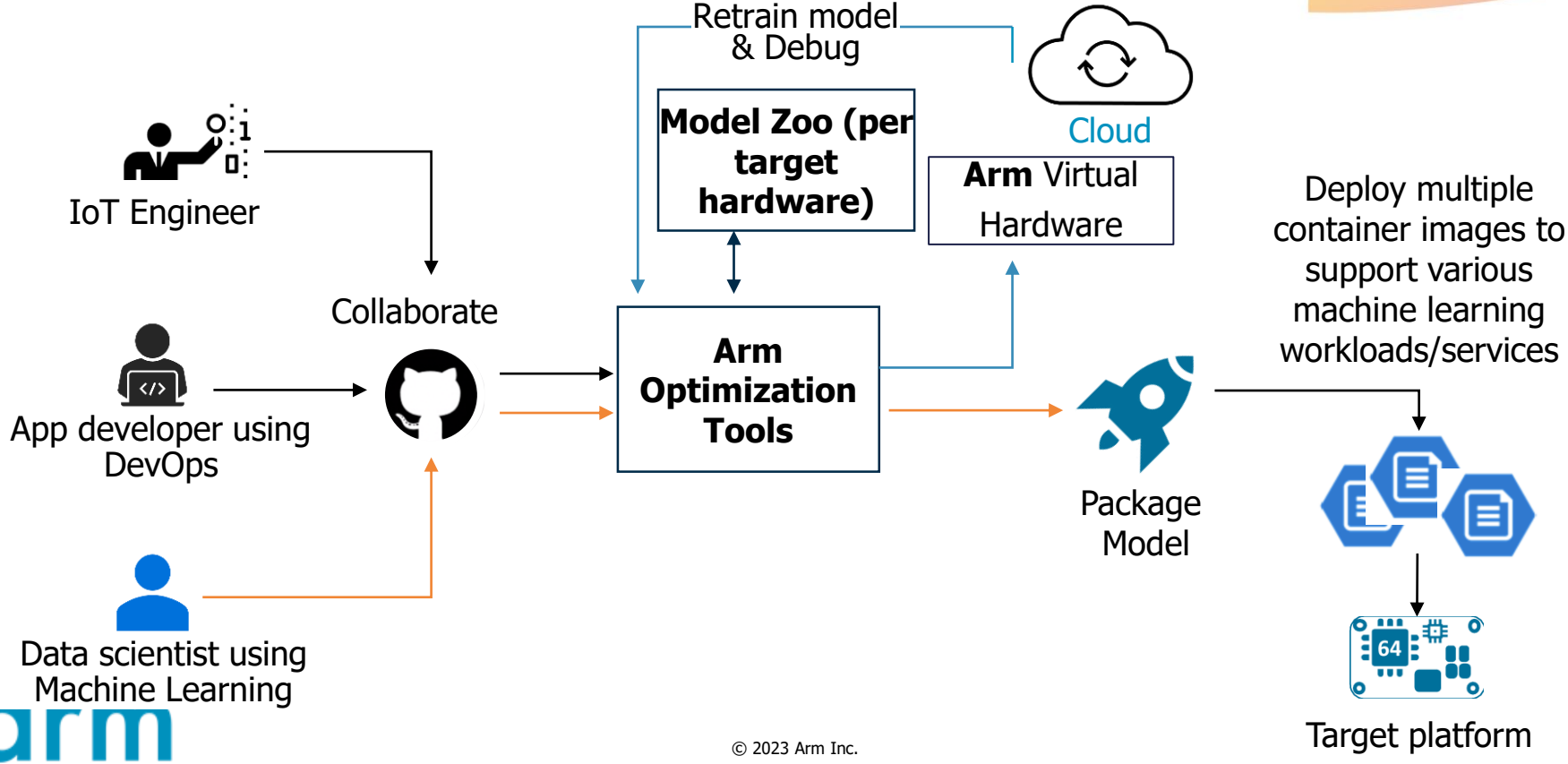
Building an Arm-Based Cloud-Native Smart Camera



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Arm Vision Solution Makes it Easier than Ever to Design a Cloud-Native Smart Camera

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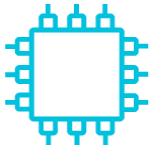
Overview of Arm Vision Solution

Accelerate time to market by building on Arm's proven technology

Power multiple ML use cases and new application development

Enable software developers to easily access Arm's strong software ecosystem



Reference System Architecture

Open Source Reference SW Stack

Arm Virtual Hardware/FPGA

Power/Perf Reports

Demonstrator and Documentation

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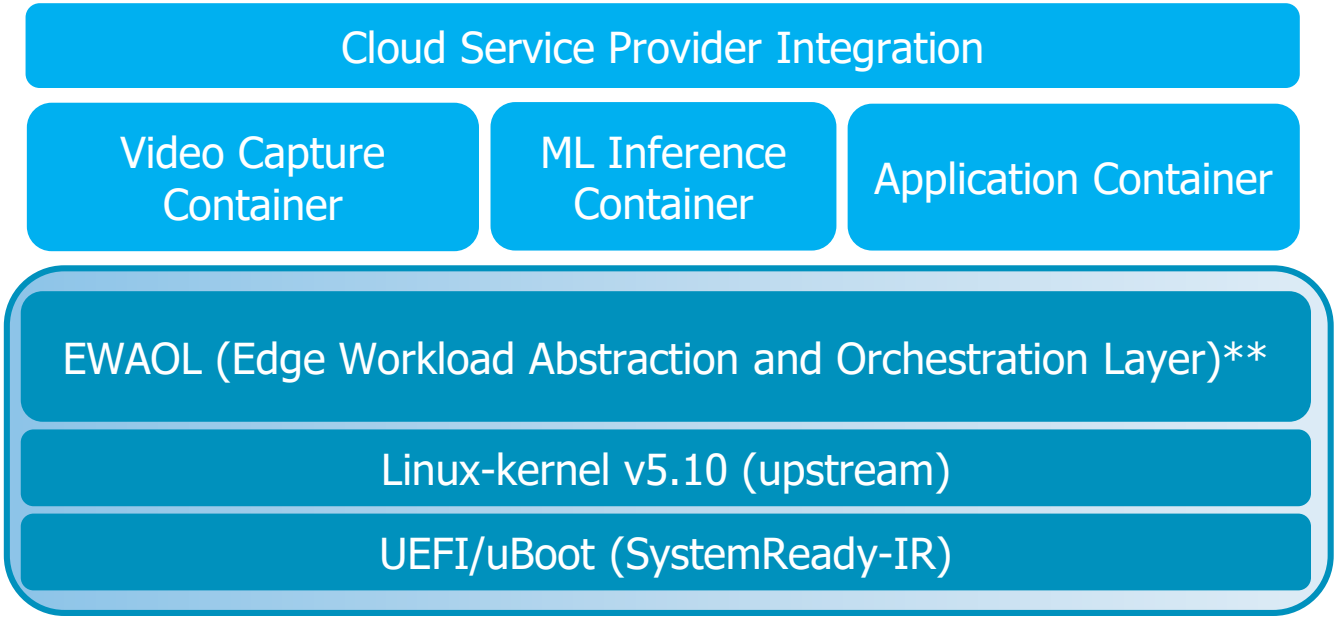
BSP and Software Ecosystem

- The software ecosystem of Arm Vision solution



** EWAOL project provides users with a standards-based framework using containers. See https://gitlab.com/Linaro/ewaol/meta-ewaol

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Software in Arm Vision Solution

- BSP, includes U-Boot, Linux- Yocto Hardknott 5.1 and EWAOL
- Integrated drivers cover:
  - Cortex-A, Cortex-M communication
  - ISP VPU and NPU
- Model Zoo
- Example application
- Object recognition example with Yolov3

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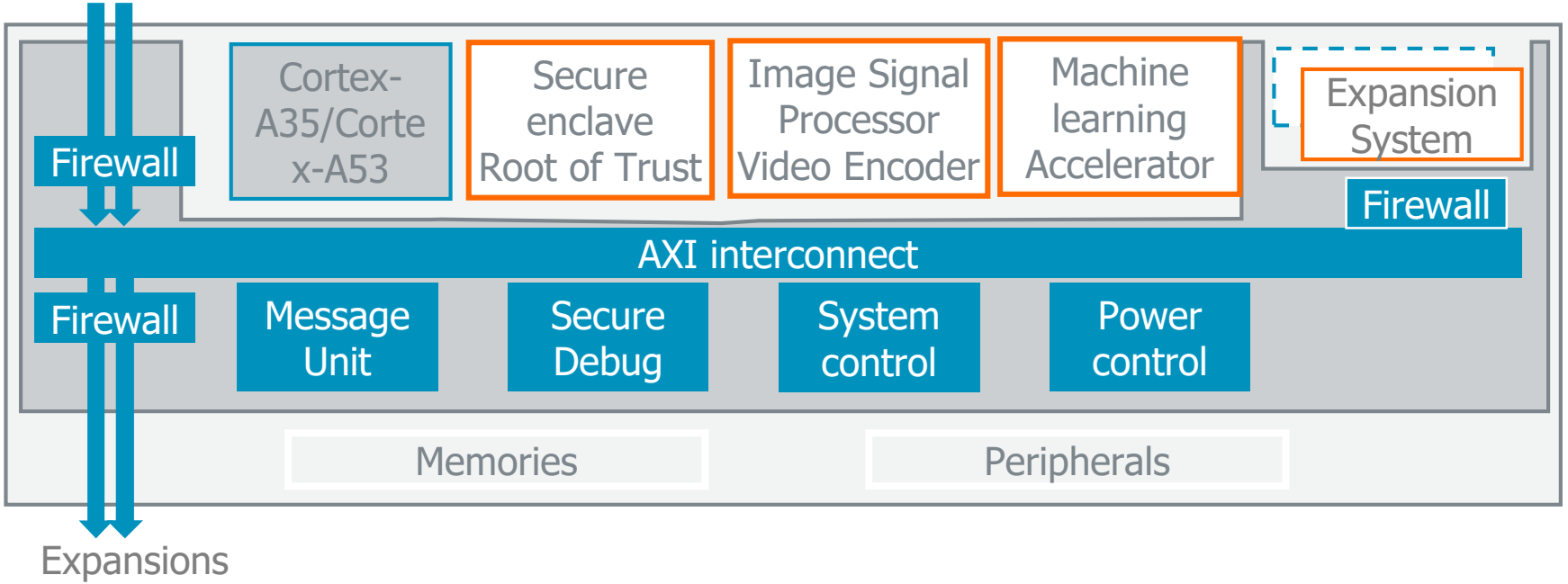
Block Diagram of Arm Vision Solution



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Hardware in Arm Vision Solution

- CPU
  - Up to 4 cores of Cortex-A35 or Cortex-A53
  - Always On Cortex-M55 with Helium support
- ISP (Mali-C55) – Up to 4K 30 fps with IMX415
- Neural Processing Engine – Up to 4 TOPS
- Video Encoder – H.265/H.264 & JPEG multi-streaming channel
- 128 bits Interconnect NIC-450
  - Integrated interrupt controller, power management, Coresight secure debug
  - Clock domain control
  - Inter-processor communication MHU

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Deployment Examples

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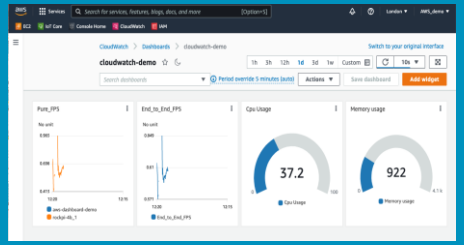
Smart Retail- Arm Vision Solution

embedded VISION SUMMIT

CSP Dashboard



Cloud Service Provider

Preprocessing + Web-UI Container

Video Capture

Inference Container

ML Model

CSP integration container

Docker Container Runtime

Base Yocto based OS (SmartCamera Reference Software Stack)

Arm Hardware Platform

Smart Retail

- Cashierless check out
- Store maintenance, shelf management or safety
- Customer flow, store occupancy
- Customer sentiment

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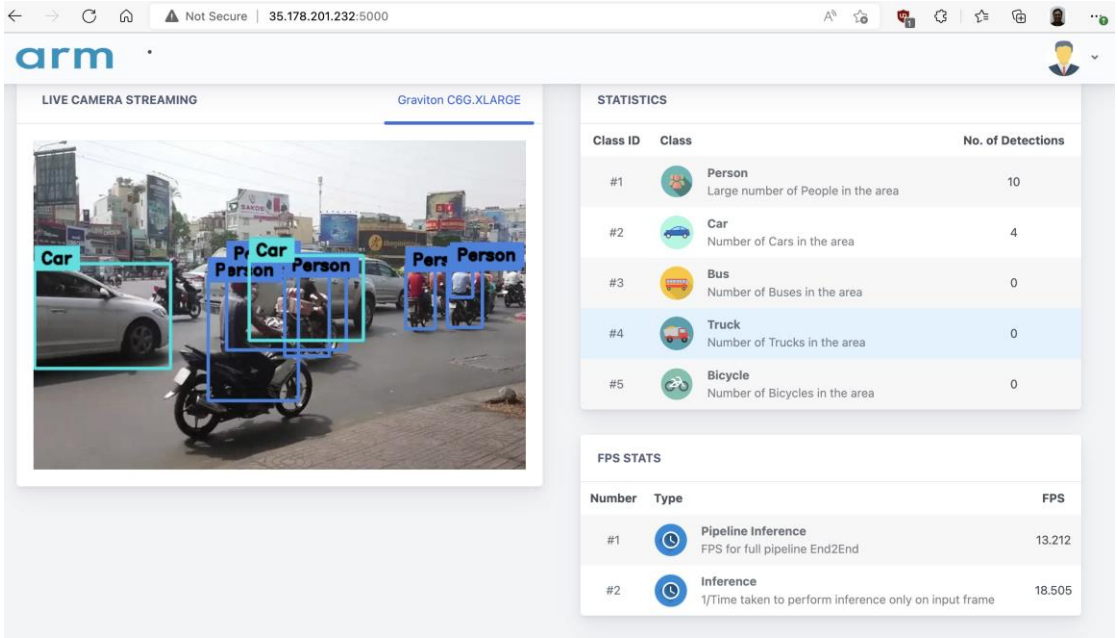
Smart City- Arm Vision Solution

- Vehicle detection
- Vehicle tracking
- Pedestrian detection
- Social distancing
- And much more….



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Summary

- In typical native-only development, it is time-consuming to integrate CSP services, there's too little flexibility to deploy varying ML functionality, and there is an insufficient software ecosystem
- Arm is enabling the next generation cloud-native smart camera by providing a reference design to:
  - Accelerate time to market by building solution on Arm's proven technology
  - Power multiple ML use cases and new application development
  - Enable software developers to easily access Arm's strong software ecosystem

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Resources

Arm Solutions for IoT: https://www.arm.com/markets/iot/total-solutions-iot

Arm Developer Tools and Software for IoT: https://www.arm.com/markets/iot/total-solutions-iot

Arm Virtual Hardware: https://www.arm.com/products/development-tools/simulation/virtual-hardware

Arm Demos at the 2023 Embedded Vision Summit:

"Arm Total Solution for Smart Vision"

"Optimized AI Model Built for Arm Virtual Hardware with NetsPresso® by Nota AI"

"Single chip AI/ML Pipeline on Cortex-M55/Ethos-U55 by Alif Semiconductor"

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Thank You

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