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Software Defined Smart Cameras

Smart Camera Deployments are Already Everywhere
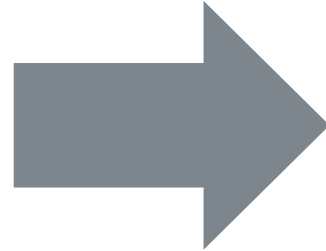

Industry 4.0

Cloud

Smart Home

Smart Cities

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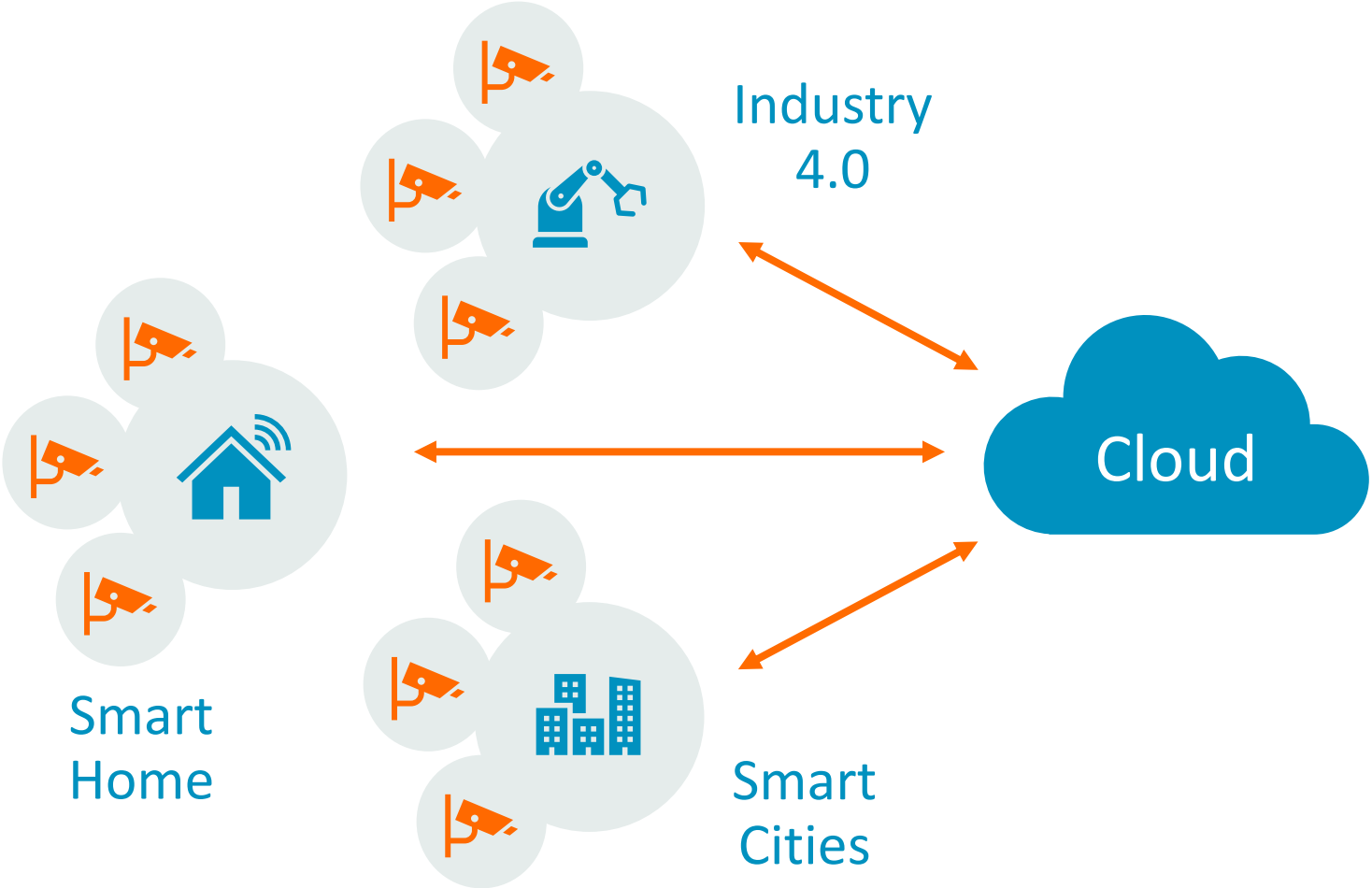
Smart Camera Market Bound for Large Growth Ahead

$44B
market by 2025*

13%
5 yr. CAGR
2020-2025*

*IDC Worldwide Video Surveillance Camera Forecast, 2020–2025

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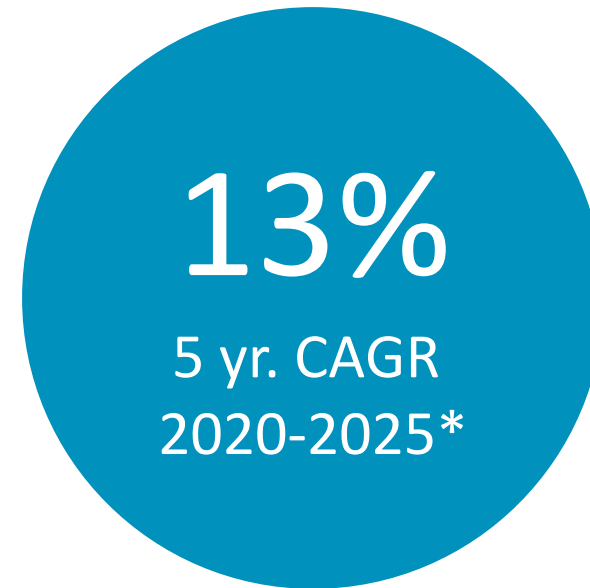
A Trend Pushing For a Large Increase of Functionalities

CCTV IN OPERATION
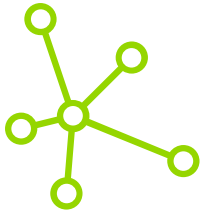
✓ Record video

✓ Record video
✓ Automated track/monitoring
✓ Person/object/activity Identification
✓ Cloud connectivity
✓ Many other services

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Smart Camera Transformation Underpinned by 3 Key Trends

Shift to Edge Compute

AI-enabled intelligent cameras
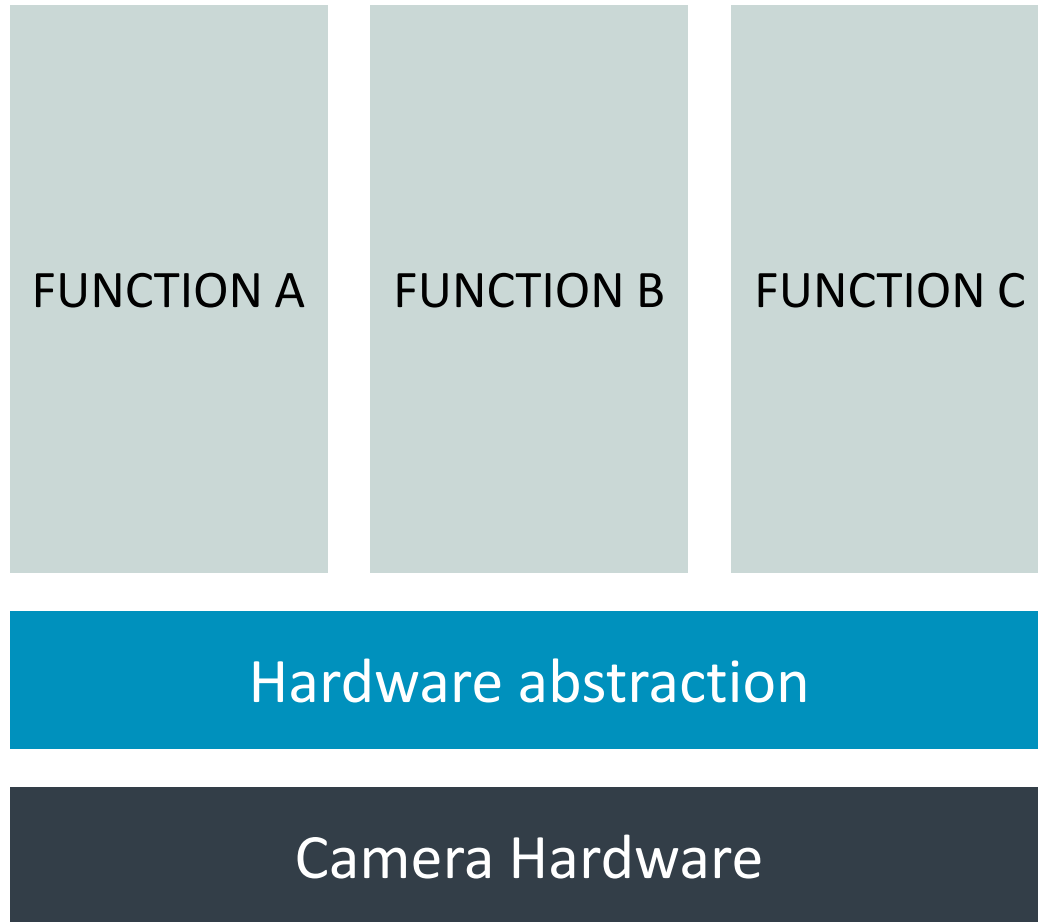
Increased Security Focus
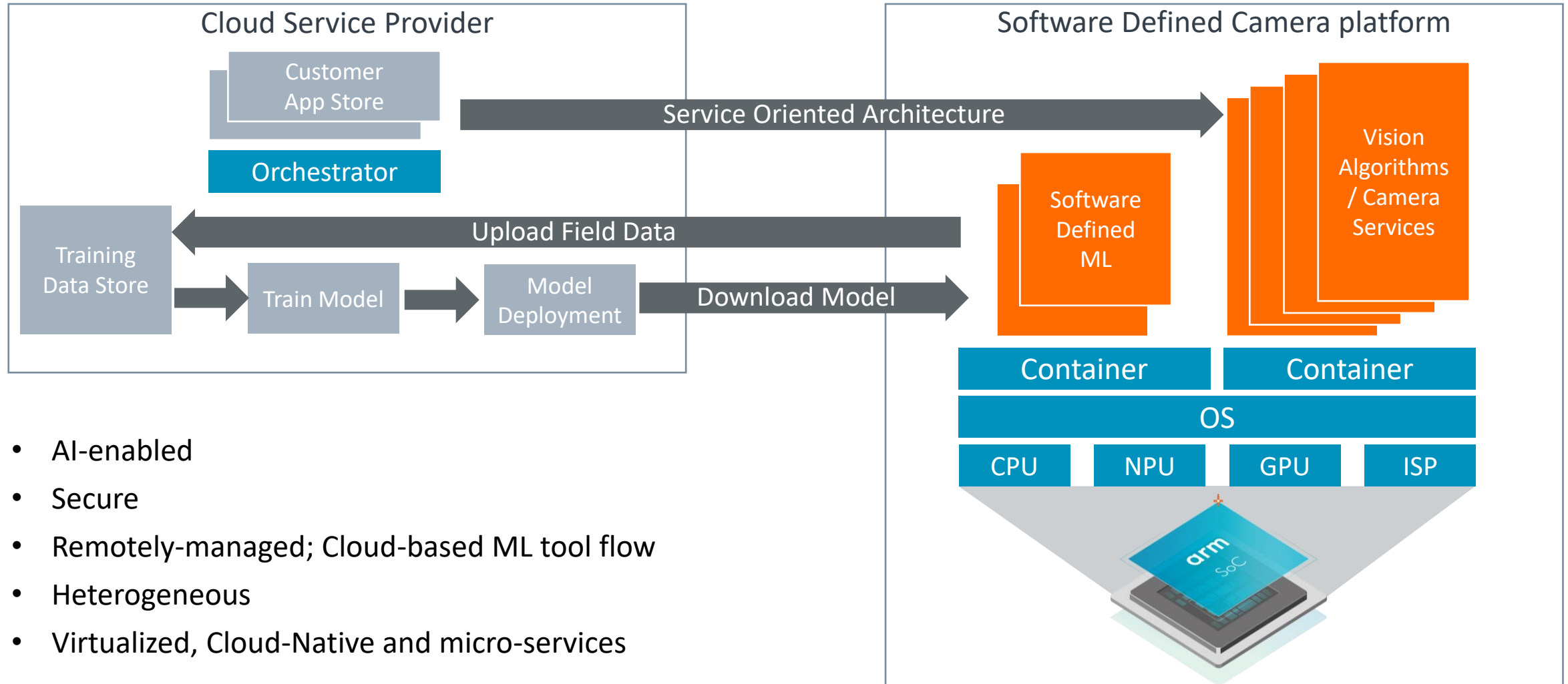
Resilient and secure deployments

Cloud Native

Run cloud-native applications and deploy services over time

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Smart Cameras Are Becoming "Software Defined"

| FUNCTION A	FUNCTION B	FUNCTION C

Hardware abstraction

Camera Hardware

❑ Functions enabled by software are abstracted from hardware

❑ Functions enabled using cloud-native Service-Oriented Architecture (SOA) software development model:

  ✓ Functions delivered as services are self-contained units of software
  ✓ System for publishing available services to the camera
  ✓ Centralized management of these services

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Edge Computing is Driving Architecture Evolution of Camera

Cloud Service Provider

Customer App Store

Orchestrator

Service Oriented Architecture →

← Upload Field Data

Training Data Store → Train Model → Model Deployment

Download Model →

Software Defined Camera platform

Vision Algorithms / Camera Services

Software Defined ML

Container | Container

OS

| CPU | NPU | GPU | ISP |

arm SoC

- AI-enabled
- Secure
- Remotely-managed; Cloud-based ML tool flow
- Heterogeneous
- Virtualized, Cloud-Native and micro-services

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New Applications Are Enabled by ML and AI
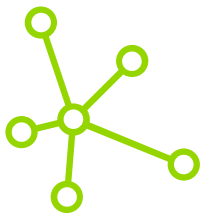
Location and Tracking

- Identify people and other objects
- Track direction and motion to predict location
- Enable hotspot detection

Smart and Secure

- Grant access onto property
- Privacy preserving with secure local inference
- Third party model/IP protection

Automatic Boundaries

- Create boundary conditions quickly with Image Segmentation

Increasing Intelligence

- Estimate actions with pose estimation and understanding
- Ability to interact verbally with security system

Person 1 99% Access Granted

Person 2 99% Access Granted

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Why Security Matters for Smart Cameras

Camera

Cloud

Data Transmission

Hardware attacks	Software attacks	Theft of footage	Denial of Service
Modification of footage	Theft of ML models	Unauthorized user access	Theft of data

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Ensuring Secure Deployments of Smart Cameras with PSA

1	2	3	4
Analyze	**Architect**	**Implement**	**Certify**
Methodically developed	Open architecture	Open Source (TF-M, TF-A, OP-TEE)	Enabling trust
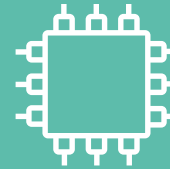
PSA Certified is an independent collaborative effort using open-source threat models and government best practices

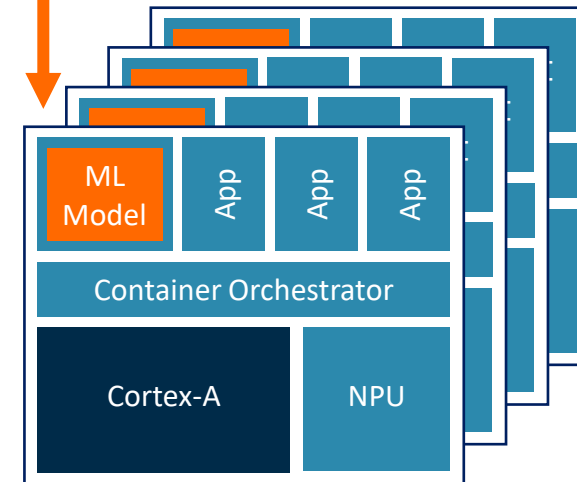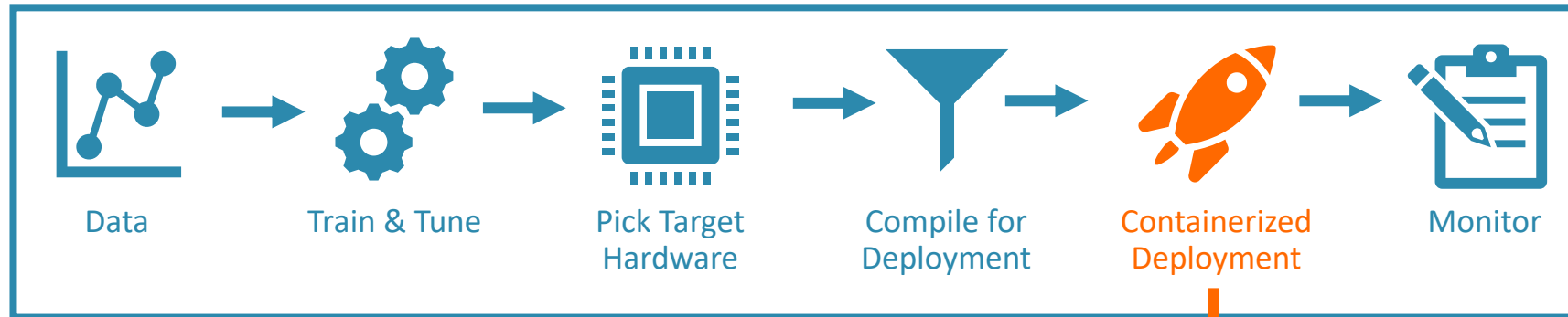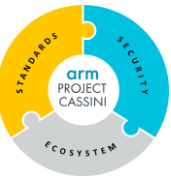psacertified™

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# Cloud-Native and Over-The-Air Update to Deploy Services

Cloud computing platform

Data → Train & Tune → Pick Target Hardware → Compile for Deployment → Containerized Deployment → Monitor

ML Model | App | App | App

Container Orchestrator

Cortex-A | NPU

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# SystemReady: Foundation to Enable Cloud-Native Software

- Implementation standards around the Arm architecture: HW & FW

- Standard, "off the shelf" community or commercial OS, containers and Hypervisors simply 'work' on Arm MPUs

- Wider choice of SoCs vendors for multiple camera platforms with frictionless SW portability and CD/CI development principles

- Opens access to the cloud native SW ecosystem

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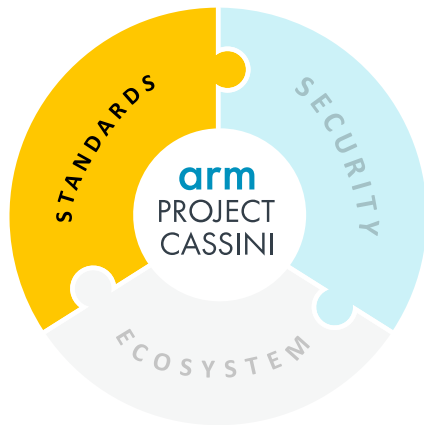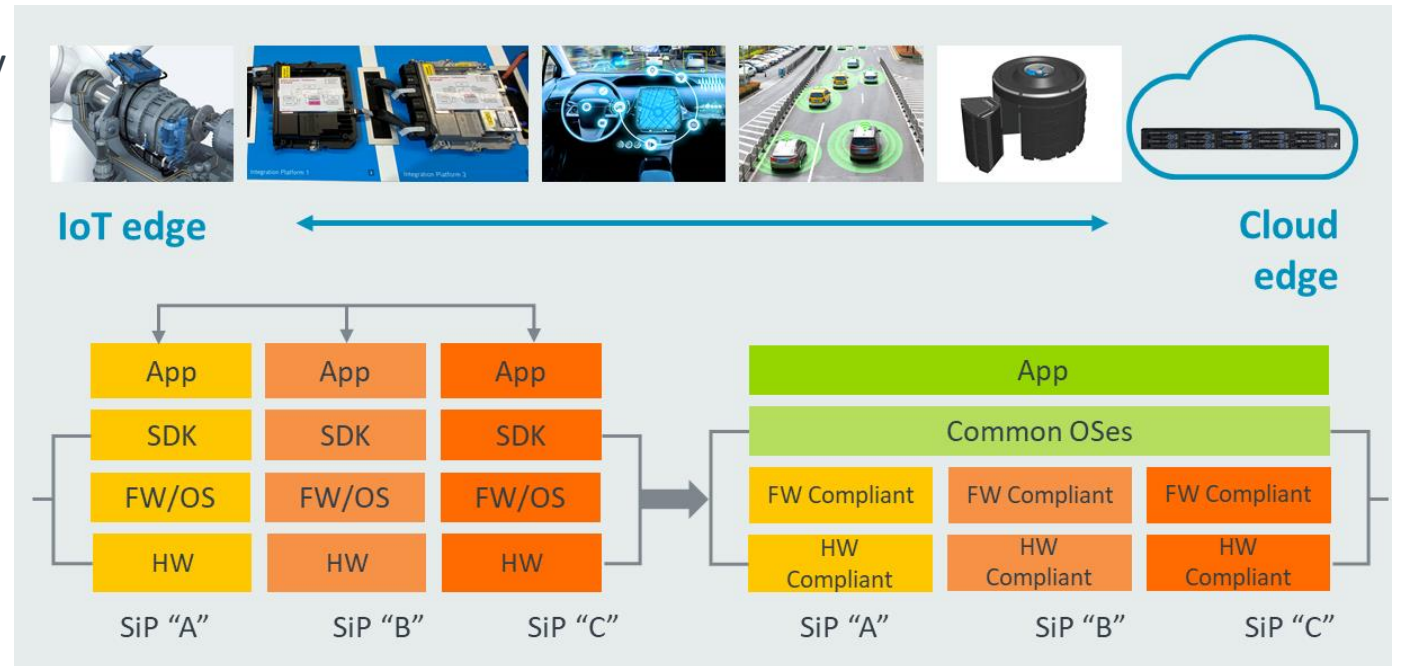
Software Defined Cameras Accelerate Deployments
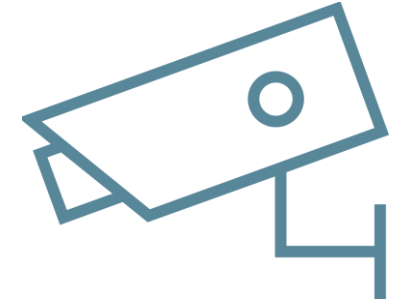
> Camera deployments are growing rapidly,
> with the market set to reach $44B by 2025

> Smart cameras are becoming edge computing devices,
> with ML workloads redefining their functionality

> Software Defined Cameras abstract hardware from software,
> enabling future-proofed device deployments with OTA updatable services

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Thank You
Danke
Merci
谢谢
ありがとう
Gracias
Kiitos
감사합니다
धन्यवाद
شكرًا
ধন্যবাদ
תודה

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