Software Defined Cameras
Smart Camera Deployments are Already Everywhere
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
A Trend Pushing For a Large Increase of Functionalities

✓ Record video
✓ Automated track/monitoring
✓ Person/object/activity Identification
✓ Cloud connectivity
✓ Many other services
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
Edge Computing is Driving Architecture Evolution of Camera

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

**Automatic Boundaries**
- Create boundary conditions quickly with Image Segmentation

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

**Increasing Intelligence**
- Estimate actions with pose estimation and understanding
- Ability to interact verbally with security system
Why Security Matters for Smart Cameras

- Hardware attacks
  - Modification of footage

- Software attacks
  - Theft of ML models

- Theft of footage
- Unauthorized user access
- Theft of data

Camera

Data Transmission

Cloud
Ensuring Secure Deployments of Smart Cameras with PSA

1. Analyze
   Methodically developed

2. Architect
   Open architecture

3. Implement
   Open Source (TF-M, TF-A, OP-TEE)

4. Certify
   Enabling trust

PSA Certified is an independent collaborative effort using open-source threat models and government best practices.
Cloud-Native and Over-The-Air Update to Deploy Services

Cloud computing platform:

1. Data
2. Train & Tune
3. Pick Target Hardware
4. Compile for Deployment
5. Containerized Deployment
6. Monitor

Diagram showing the process steps:
- ML Model
- App
- App
- App

Layers of technology:
- Cortex-A
- NPU
- Container Orchestrator
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
Smart Cameras Are Becoming “Software Defined”

- 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
Software Defined Camera Software Architecture Proposal

Camera and Vision Software Applications

Cloud Service Providers

Containerized Multi ML Model / Inference Engines

Containerized Analytics/Storage

Communication – RSTP, REST, SOAP

Security – PSA, PARSEC

V4L2

OpenCV

BL

AS

ACL

Arm NN, TVM

Vulkan

MLA Runtime

Container Run times – K3S

OS (Linux)

Firmware (UEFI, U-Boot, TF)
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.