



智能驾驶员与环景视频监测系统 系统技术实作及应用

AI-based Driver and Surround View Monitoring System:
Implementation and Application

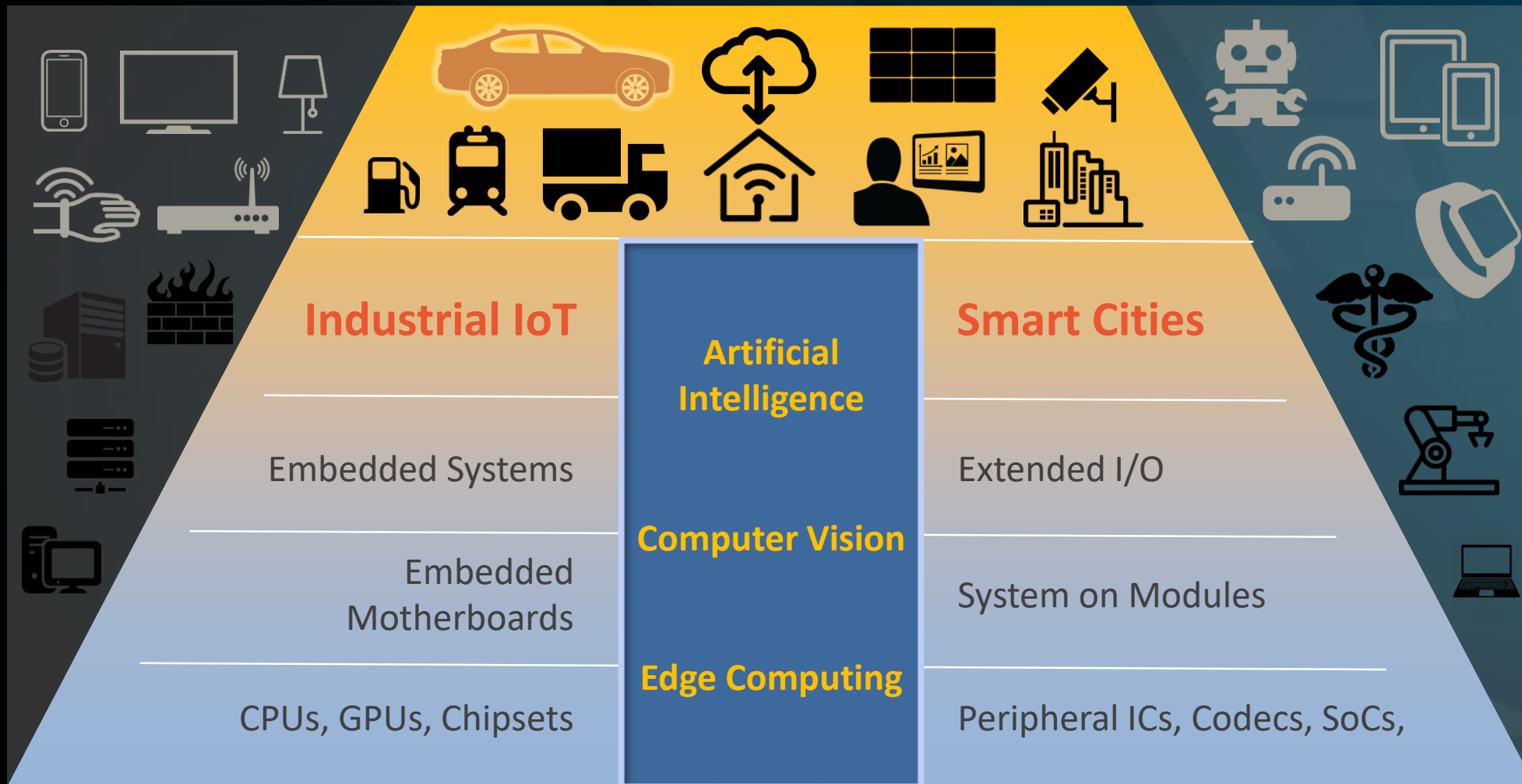
2019 April 3rd



转型之路



VIA at a Glance



Edge AI for Transportation



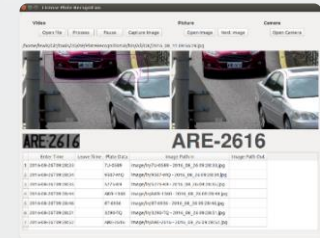
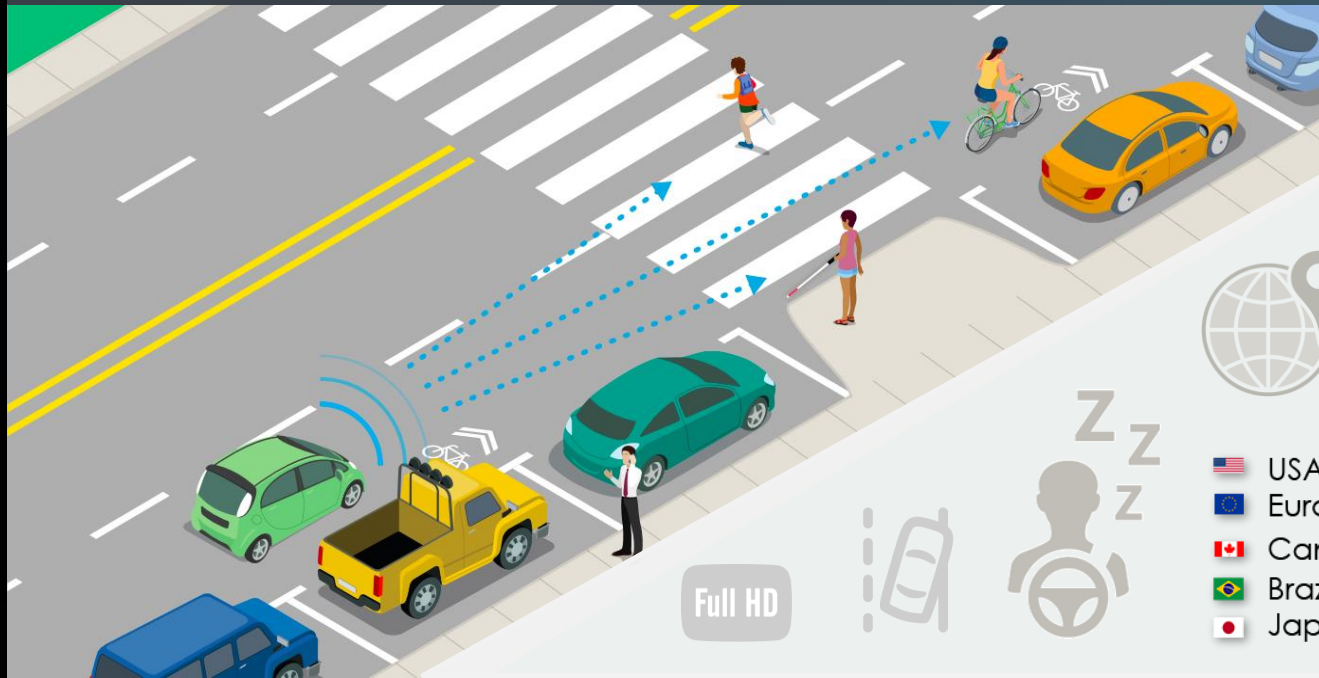
Passenger Info Display



Ticketing and Metering



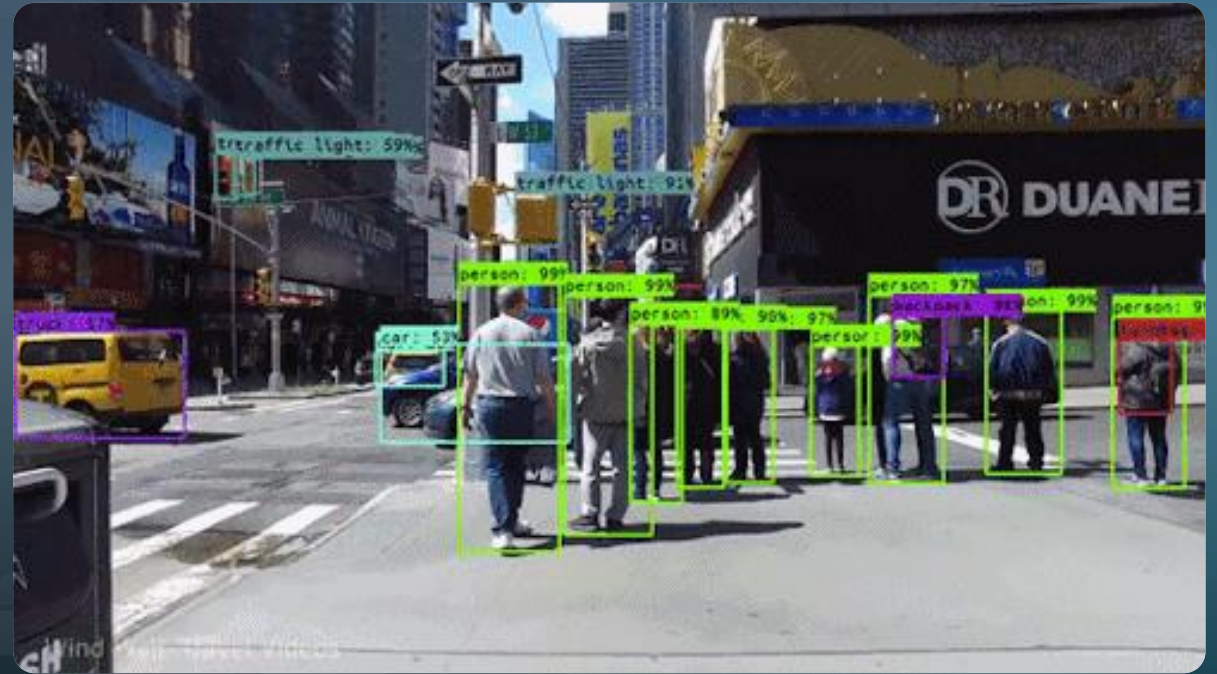
Surveillance/Monitoring



- | | | | |
|--------|-----------|--------------|---------------|
| USA | China | Saudi Arabia | Argentina |
| Europe | Australia | India | New Zealand |
| Canada | Mexico | South Korea | Great Britain |
| Brazil | UAE | Thailand | South Africa |
| Japan | Indonesia | | |



Technology helps the autonomous driving system sense road conditions

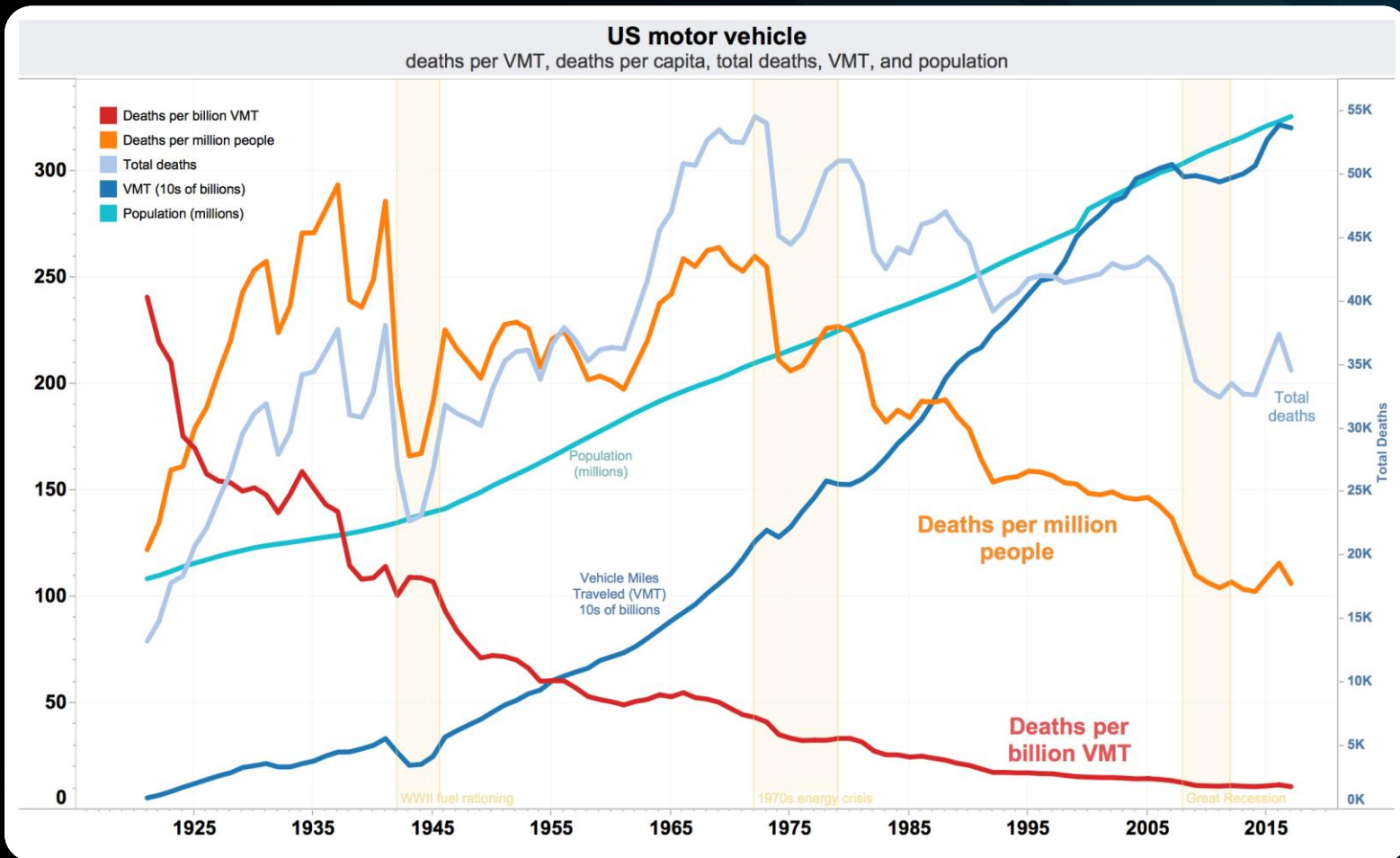


However, numerous hurdles must still be overcome...

Road Safety is Everything



What has been done isn't enough for Road Safety

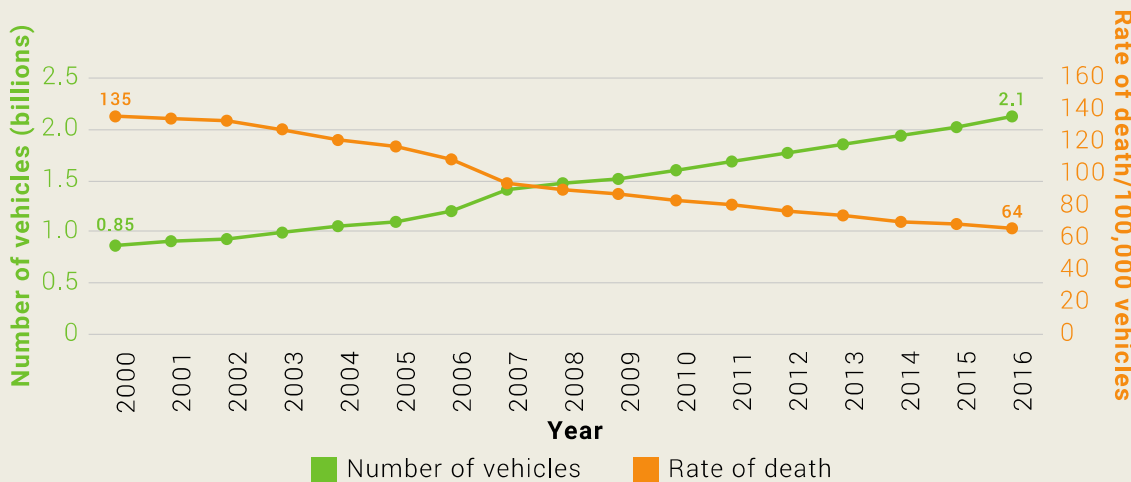
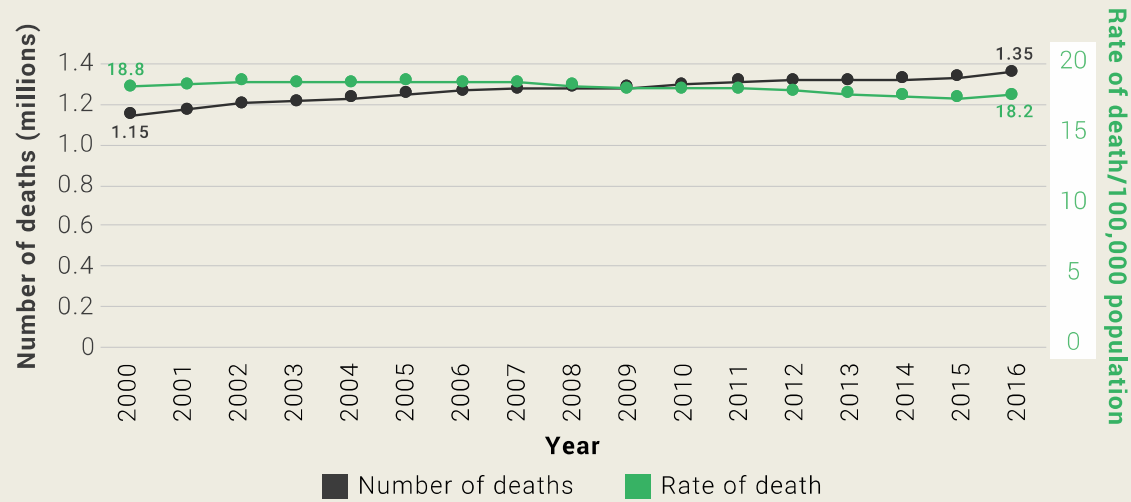


In 2016, nearly 37k people were killed in road traffic accident in US.



Data Source: NHTSA Crash Stats
Chart: Dennis Bratland

Insufficient Progress is Being Made



- 1.35** million deaths each year
- 8th** leading cause of deaths for people of all ages
- #1** cause of deaths for children and young adults 5-29 years of age
- 3** times higher death rates in low-income countries than in high-income countries

Edge AI Addresses The Needs of Safety



Driver Monitoring System Design



Surround View Monitoring System



Applying Sensor Fusion



Implementation and Application

Driver Monitoring System

Driver Behavior Analyzing

- ▶ Fatigue: yawning, eyes closed, nodding...
- ▶ Distraction: talking, texting, drinking, smoking, etc.

Camera-based Driver Monitoring

- ▶ Driver Face: eye gaze, face pose,...
- ▶ Driver Posture: visual elements such as driver's head and hands.



C0: Safe Driving



C1: Text Right



C2: Phone Right



C3: Text Left



C4: Phone Left



C5: Adjusting Radio



C6: Drinking



C7: Reaching Behind



C8: Hair or Makeup

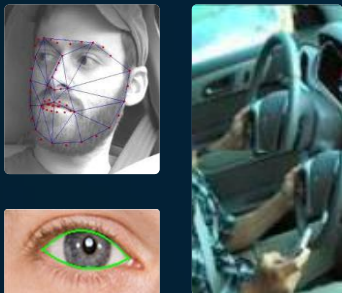


C9: Talking to Passenger

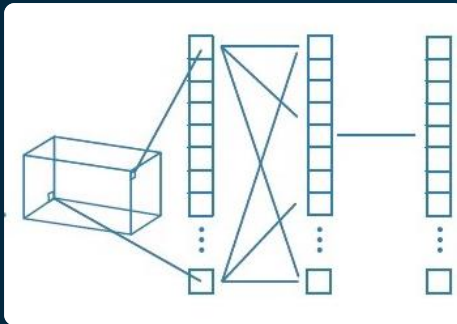
How Driver Monitoring System works



Image Inputs



Face and other key parts detection and extraction



Deep CNN classification of distracted driver behavior : smoking, drinking, yawning...



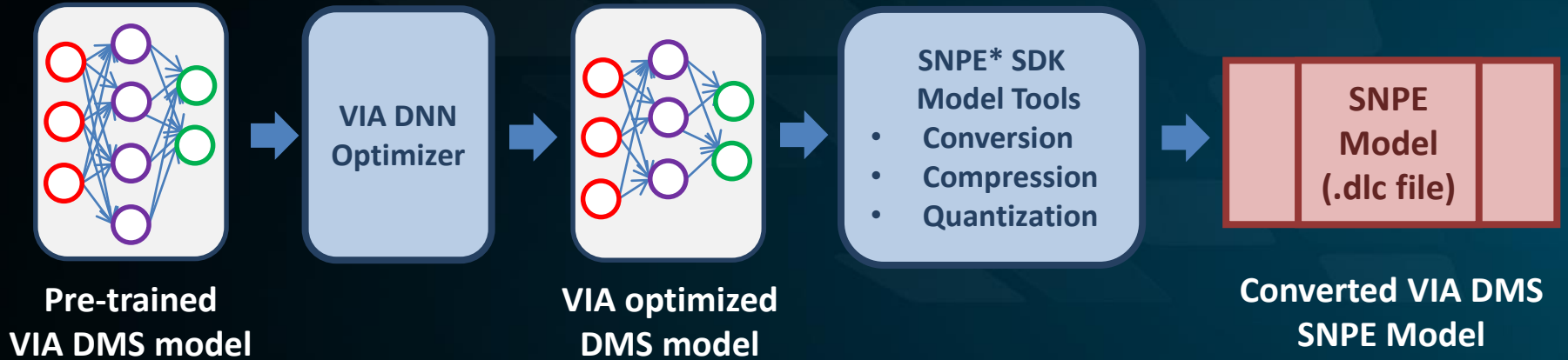
Safe driving



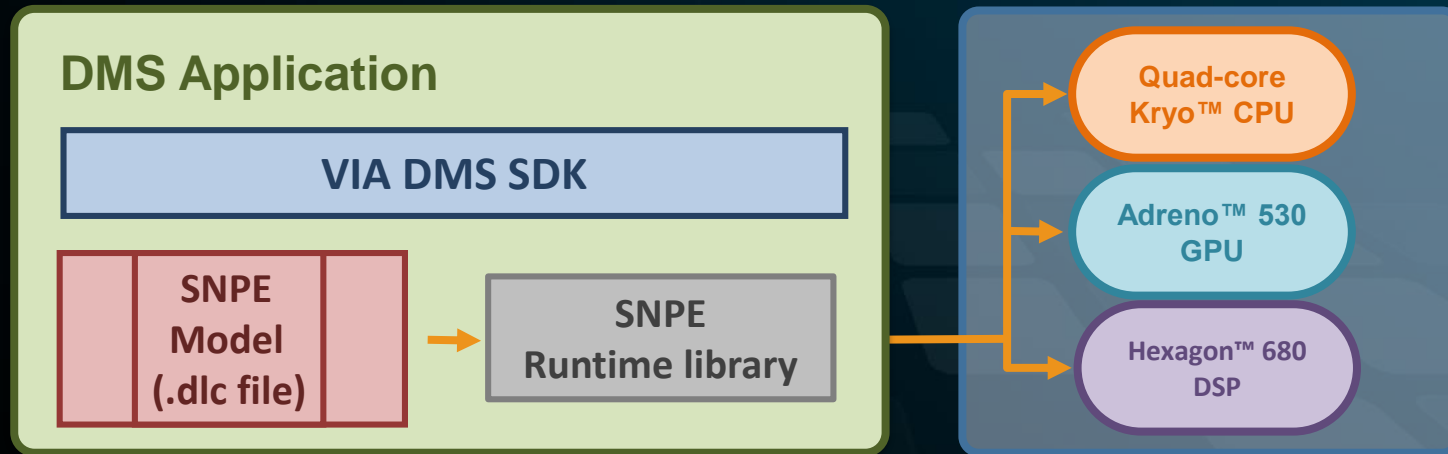
Distraction

Developing and Implementing DMS -using Qualcomm platform as an example

Off-line on
Linux Workstation



Runtime on VIA
Embedded Platform



* SNPE: Qualcomm® Snapdragon Neural Processing Engine

Surround View Monitoring System

ADAS will be deployed as standard and mandatory features, not only for premium models.



Every car deserves a decent Surround View System—well-functioning, easy-to-use and affordable

Parking Guidance



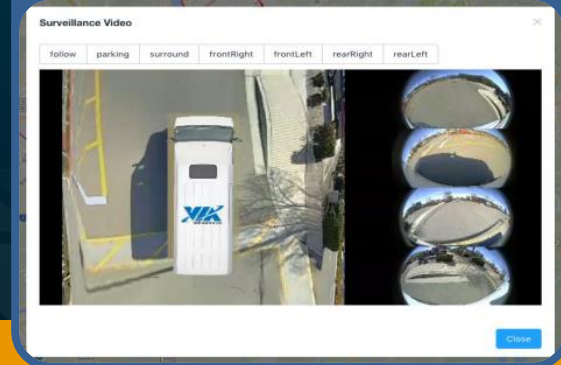
Driving Assist



Automated Object Detection

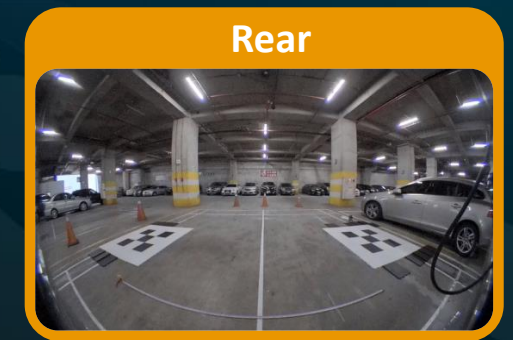
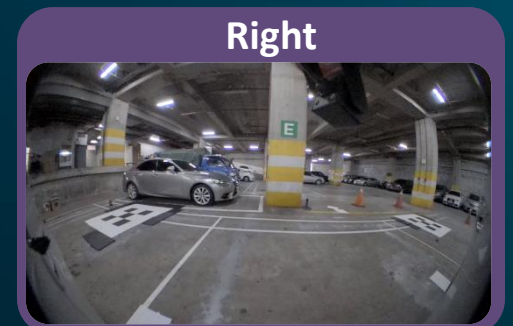
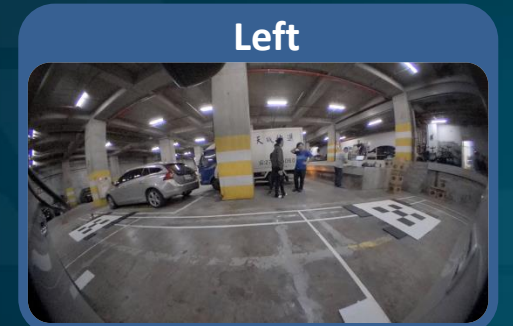
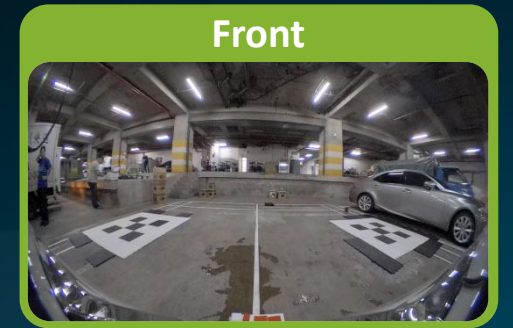
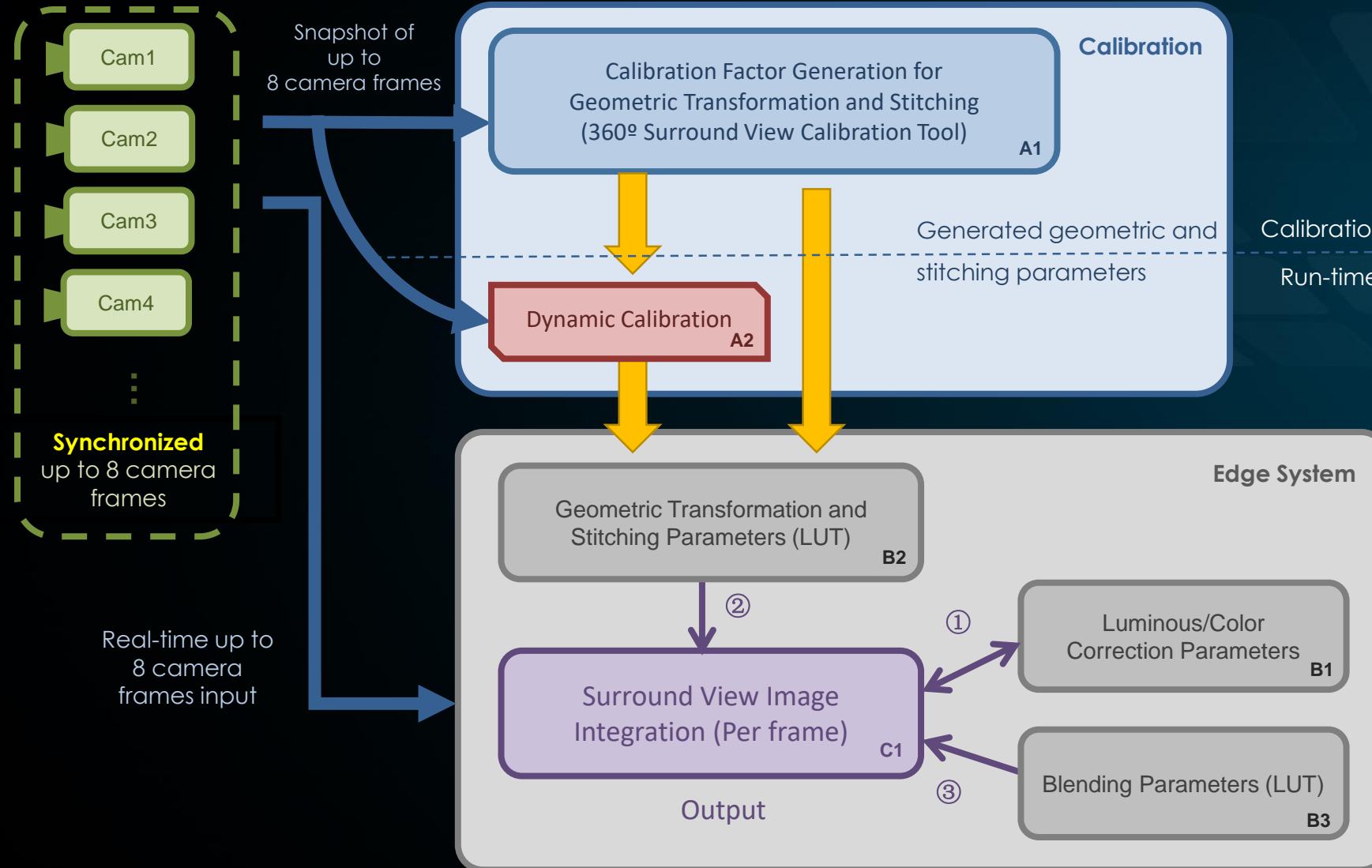


Real-time Remote Monitoring



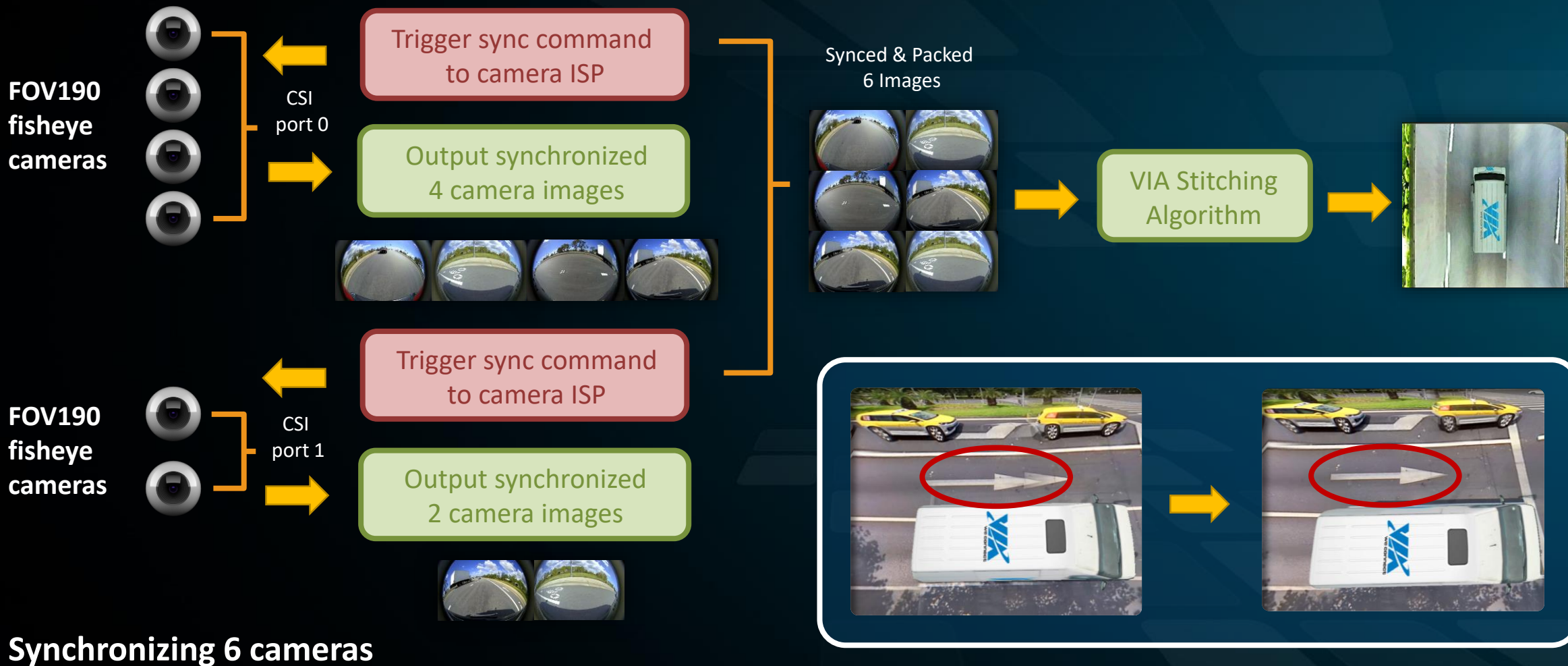
Eliminate the blind spots to increase driving safety

SVM System Architecture



Multi-Camera Video Synchronization

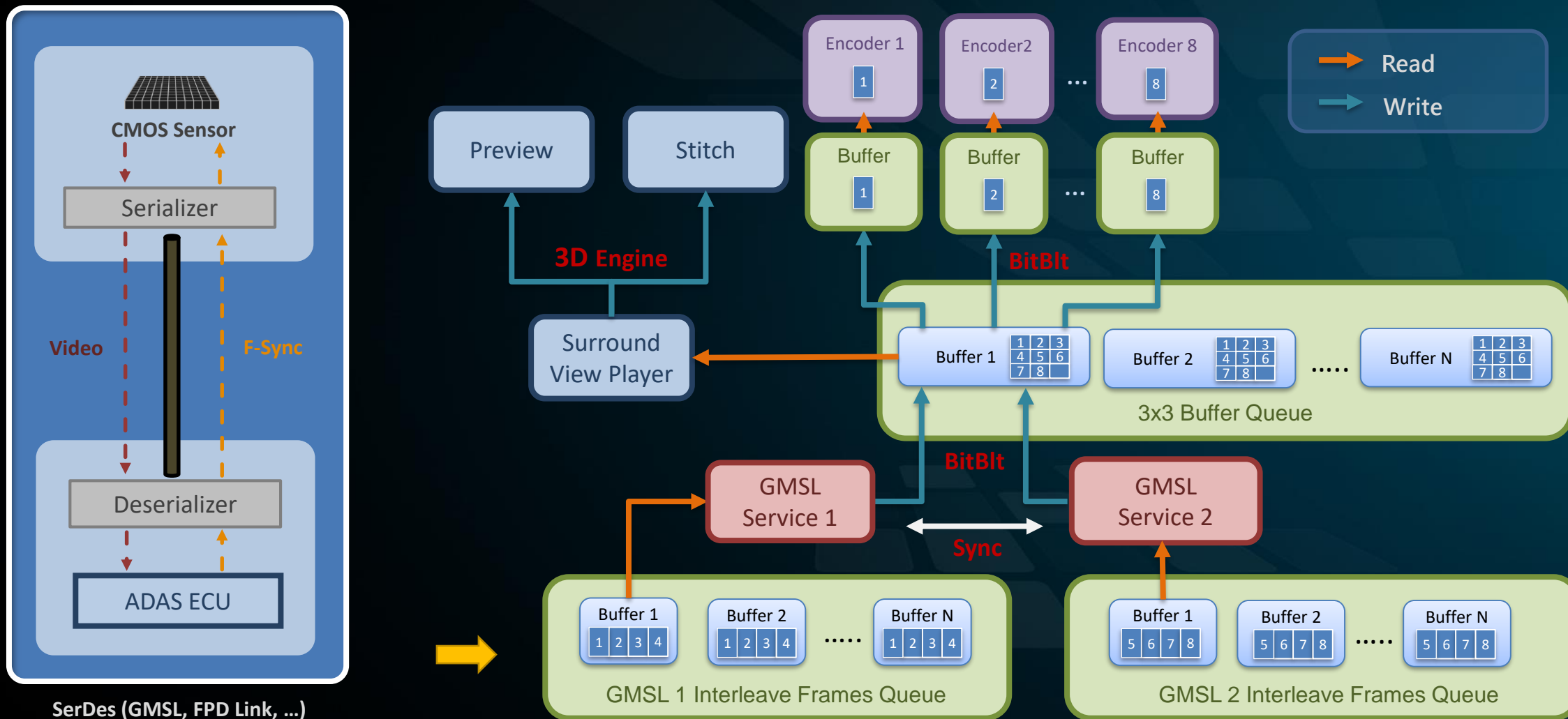
- resolves vehicle size and at-speed stitching issues



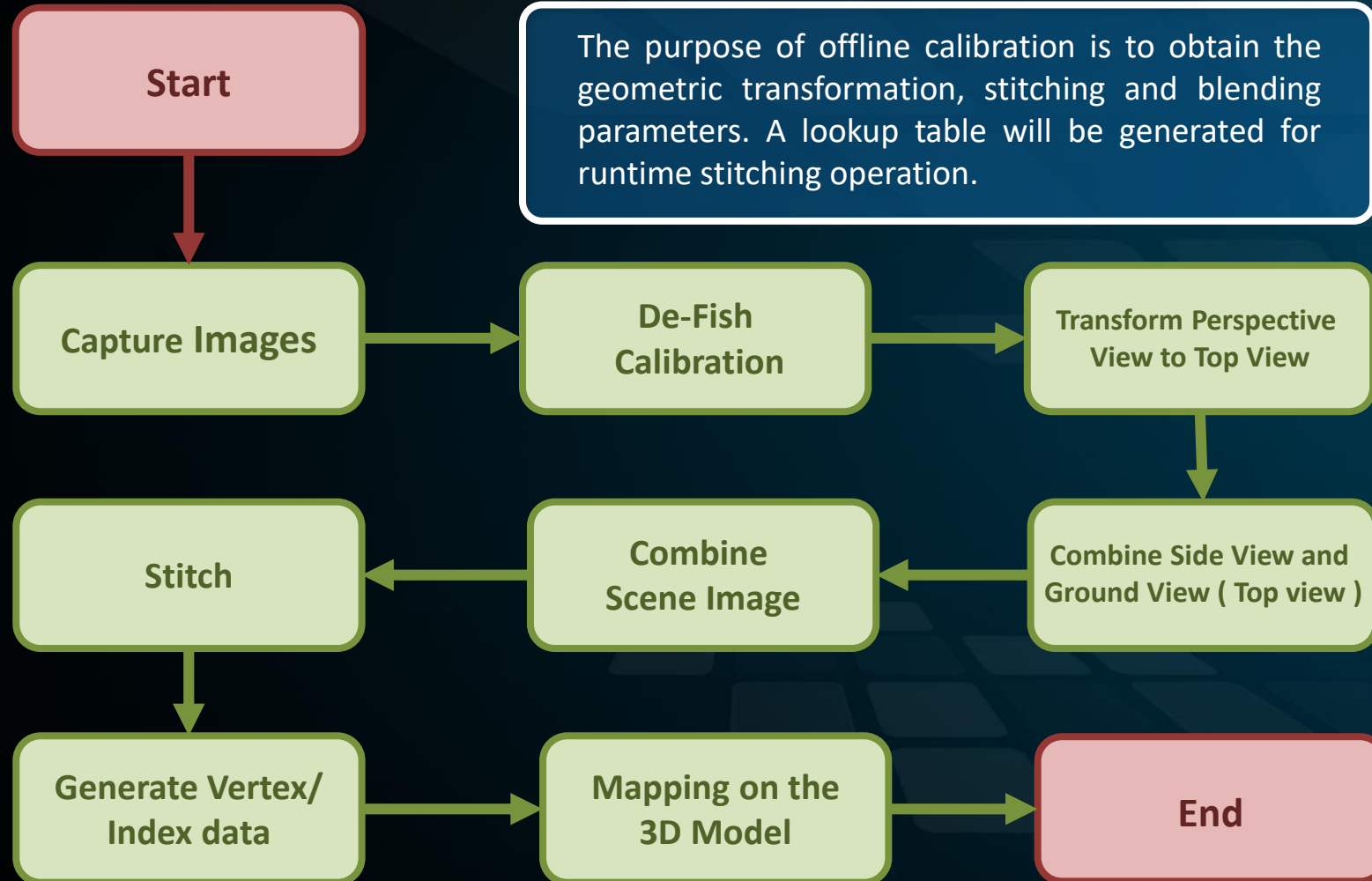
Synchronizing 6 cameras

Multi-Camera Video Synchronization

- buffer design in driver (8 cameras)



SVM Camera Calibration Flow



➤ Mapping 2D Images Onto the 3D Model



3D surround view scene with front camera image

Fisheye lens



2D image

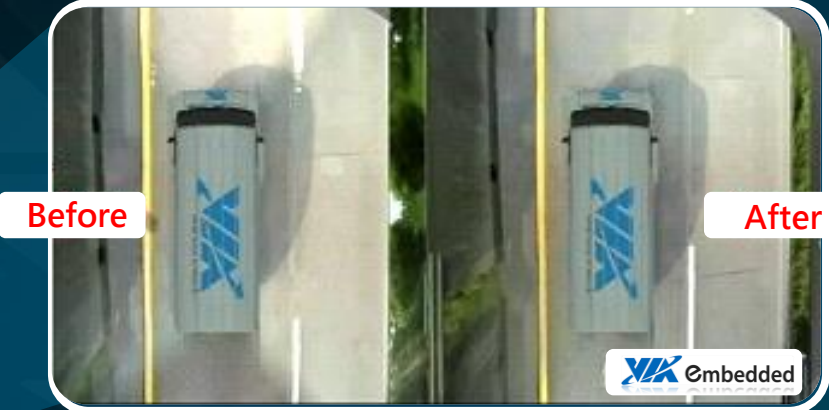
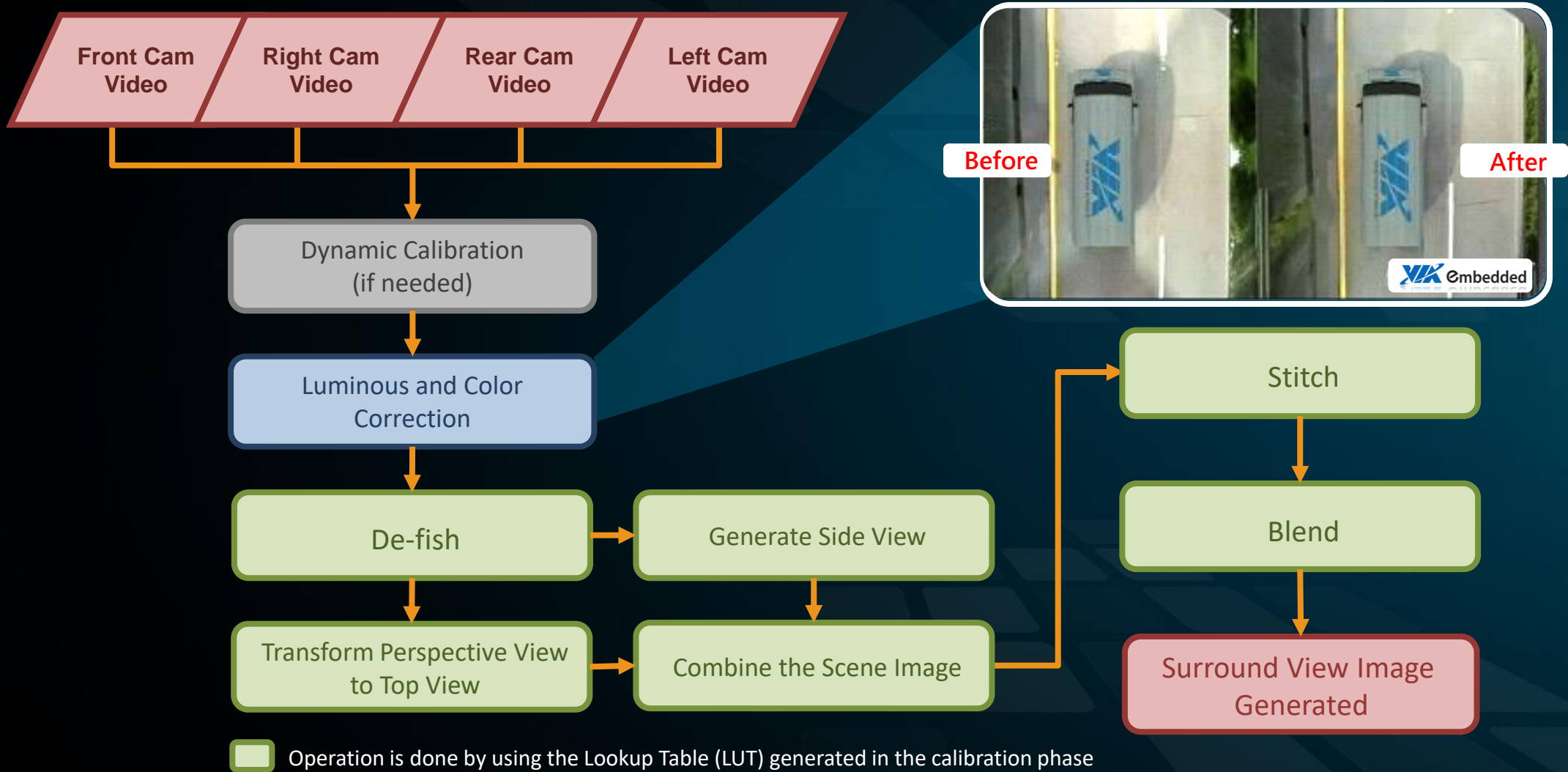
Mapping area

Side plane

Ground plane

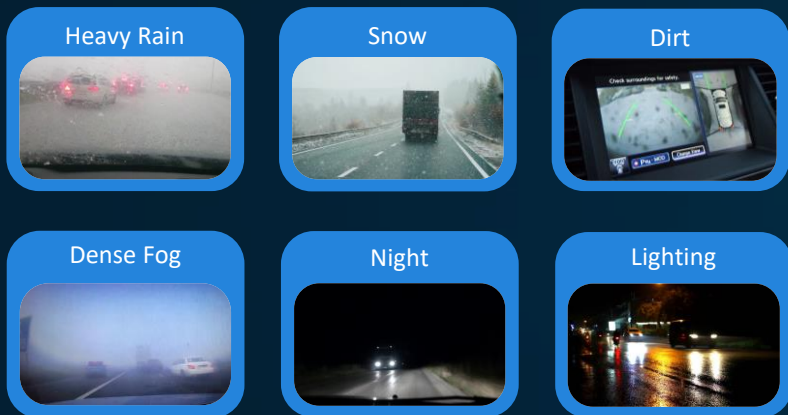
2D front camera image maps to 3D model – ground plane and side plane

SVM Runtime Operation Flow

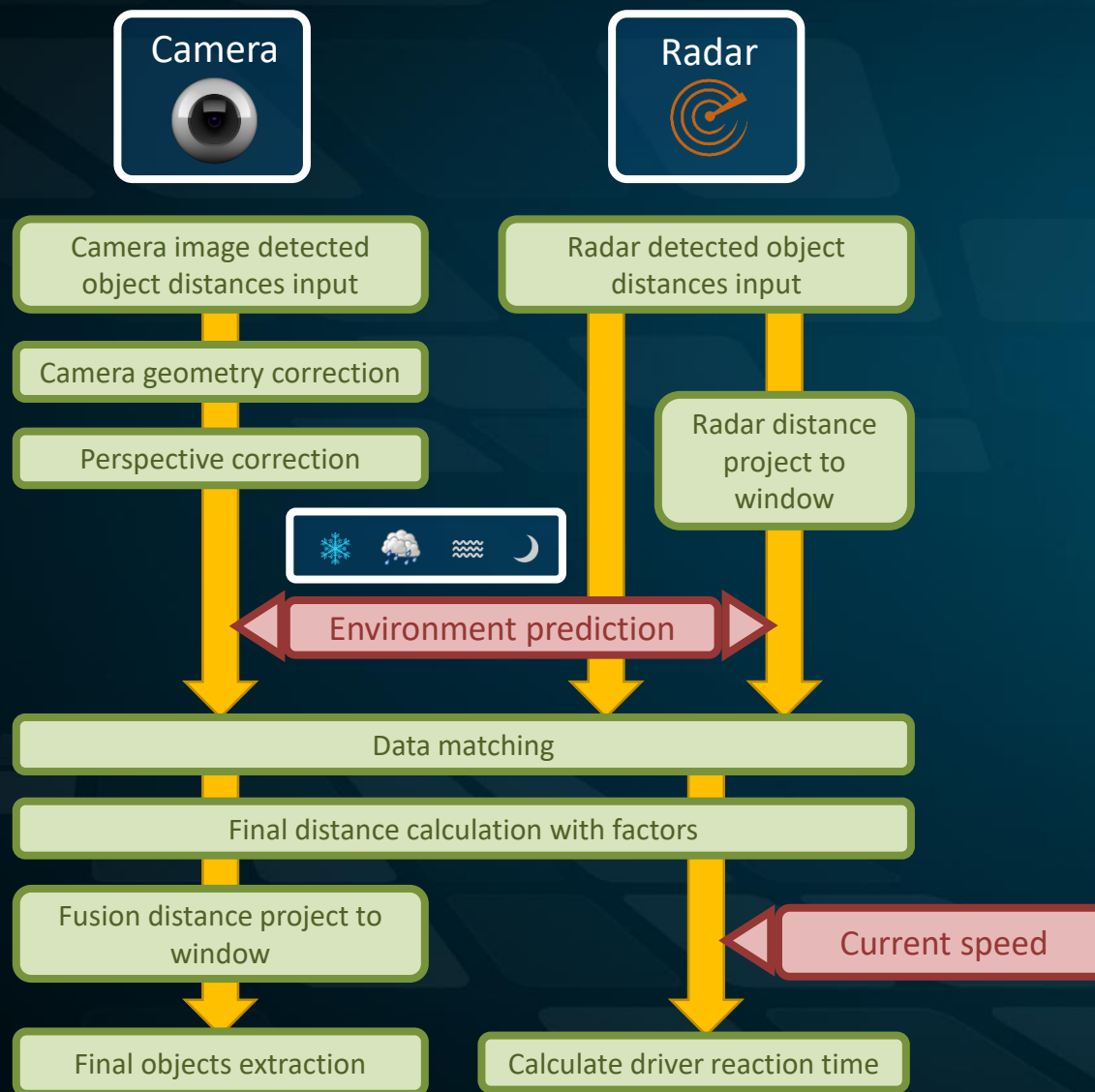


➤ Sensor Fusion Operation Flow

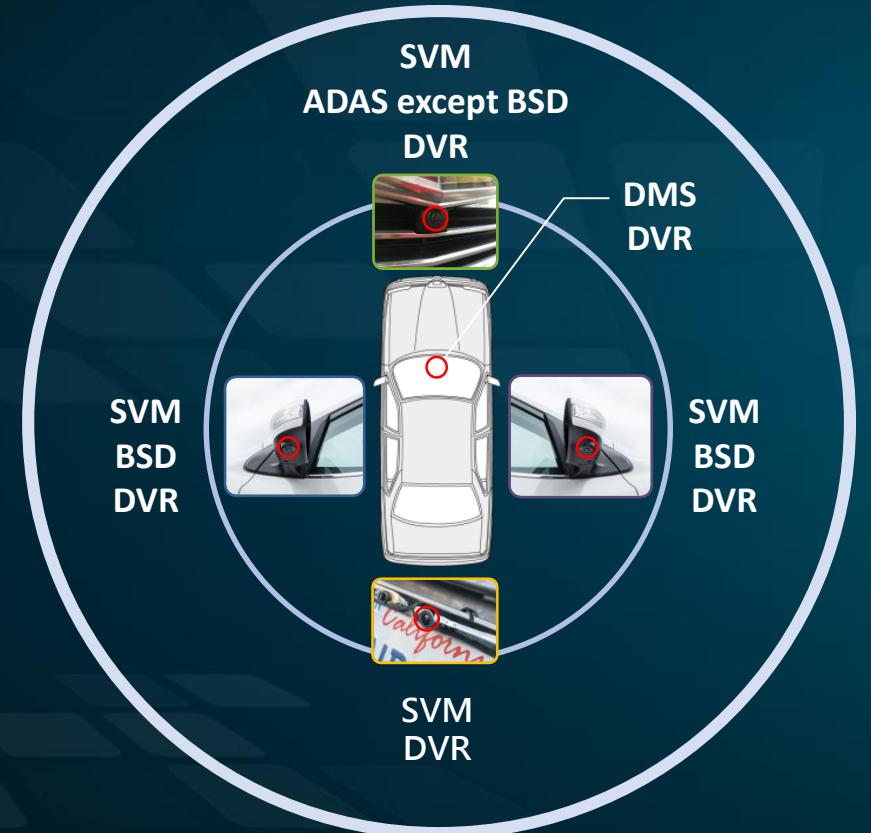
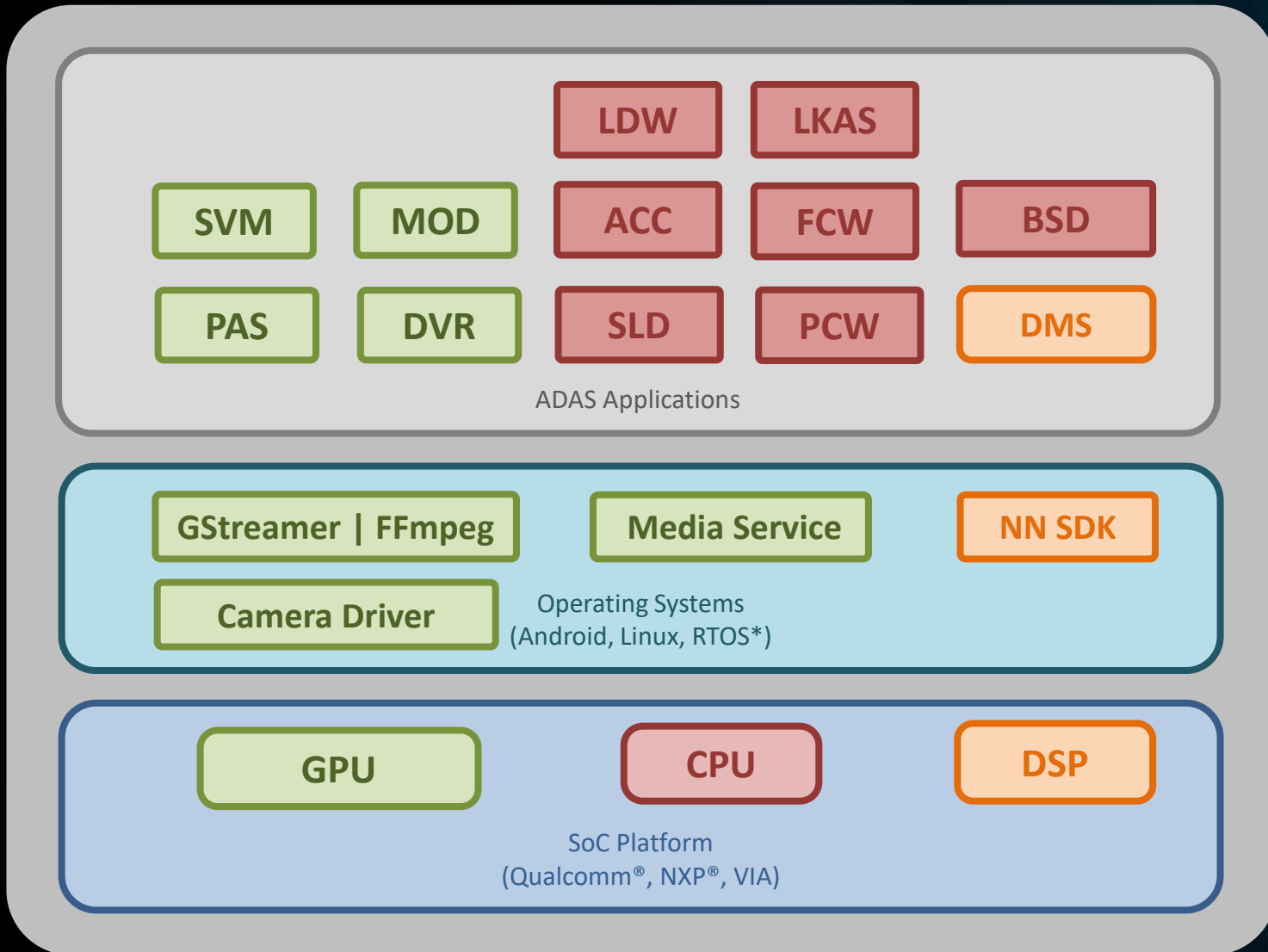
Environment condition could impact the precision of vision based ADAS seriously



By integrating with different range of Radar, LiDAR, ultrasound and other sensors ADAS function can be accomplished more efficiently.



Optimizing ADAS Features on the Edge



CSI #0 (4)
SVM
PAS, MOD
DVR

CSI #1 (3)
FCW, LDW
PD, SLD
BSD, DVR

CSI #2 (1-2)
DMS
DVR



The AI-Enabled Hardware Platforms

Drive Recorder



License Plate Recognition



ADAS | DMS | NVR | SVM



Mobile360 D710



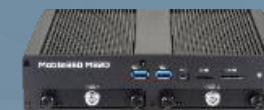
Arm Cortex A72 x4 + Cortex A53 x4

Mobile360 L900



2.0GHz Nvidia Jetson TX2

Mobile360 M820*



2.3GHz Quad Core Kryo + Adreno 530

* Auto-grade edition coming soon



VIA Mobile360 Specs Comparison

	VIA Mobile360 L900	VIA Mobile360 M820	VIA Mobile360 D710
车道侦测 (LDWS)	多车道侦测	多车道侦测	多车道侦测
前车侦测种类 (FCWS)	一般房车、卡车、巴士、骑士、警车、消防车、救护车	一般房车、卡车、巴士、骑士、警车、消防车、救护车	一般房车、卡车、巴士、骑士、警车、消防车、救护车
限速识别 (SLD)	●	●	●
云端系统整合 (Cloud)	●	●	●
倒车动态物体、行人侦测	●	●	●
驾驶员监测 (DMS)	●	●	●
驾驶行为评分 (Scorecard)	●	●	●
行车记录仪 (DVR)	●	●	●
车辆轨迹回传 (GPS Tracker)	●	●	●
3D环视/停车辅助 (SVM/PAS)	●	●	○
盲区两侧来车侦测 (BSD)	●	●	○
开门警示 (DOW)	●	●	○
多国车牌识别 (ALPR)	●	○	○

Application: All-in-One Drive Recorder



Digital Video Recorder (DVR)



Driver Monitoring System (DMS)



ADAS

- Arm Cortex A72 x4 + Cortex A53 x4
- Dual 1080p front/driver cameras
- G-sensor + Gyroscope
- Wi-Fi/BT
- LTE
- CAN Bus

- GPS
- 8-32V DC input
- Vehicle Data Logger
- Digital Video Recorder
- Driver Monitoring System
- ADAS (FCW, LDW, PD, SLD, ...)

Application: Delivery Robots





Thank You

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