



CEVA TECHNOLOGY  
SYMPOSIUM SERIES

# CEVA Automotive

## A path towards autonomous driving

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# Paving the way – ADAS to Autonomous

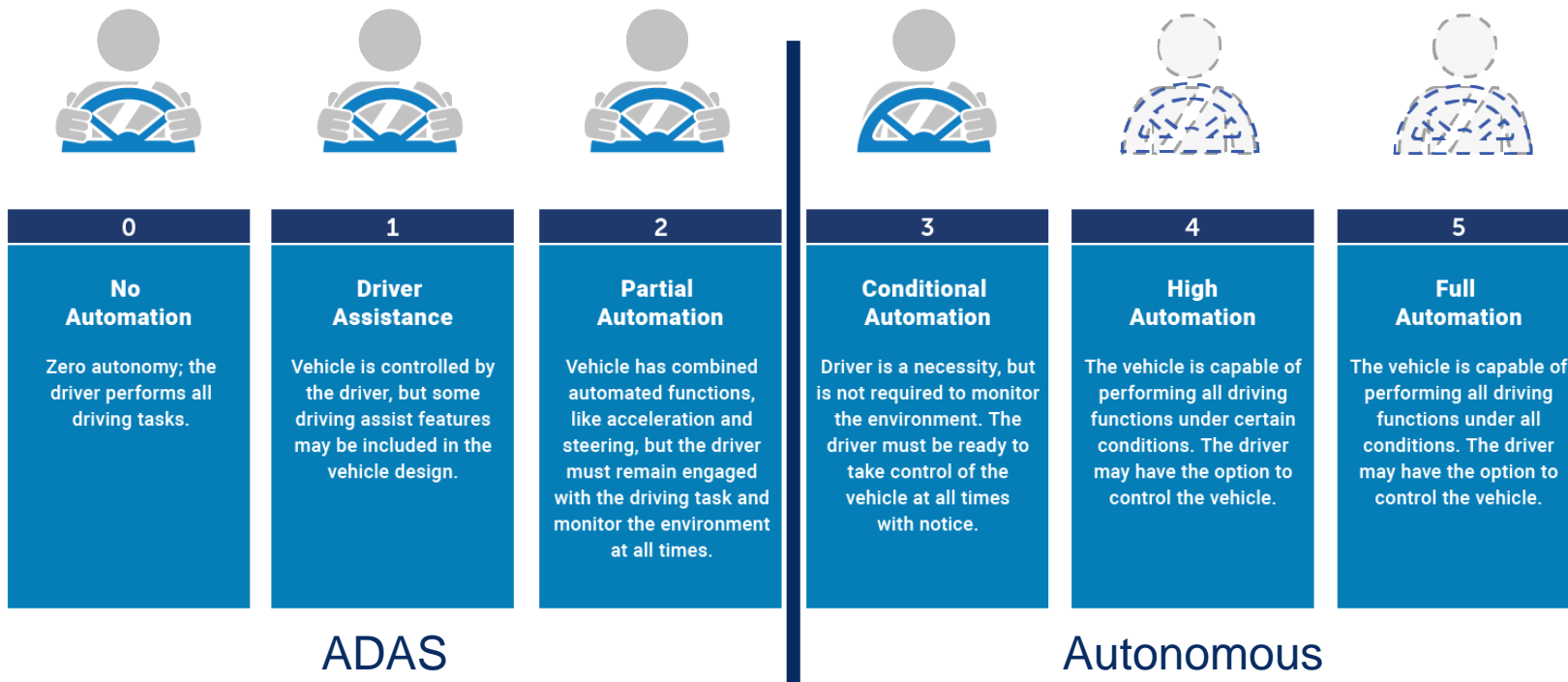
- ▶ Safety
  - ▶ Reduce Traffic Fatalities by 90%
  - ▶ Millions of lives globally
- ▶ Mobility
  - ▶ Social – Elderly
  - ▶ Free Time/Productivity
- ▶ Economic (\$5.6 T)
  - ▶ Fuel Cost
  - ▶ Productivity Gains
  - ▶ Accident Cost



# Autonomous Driving Levels

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

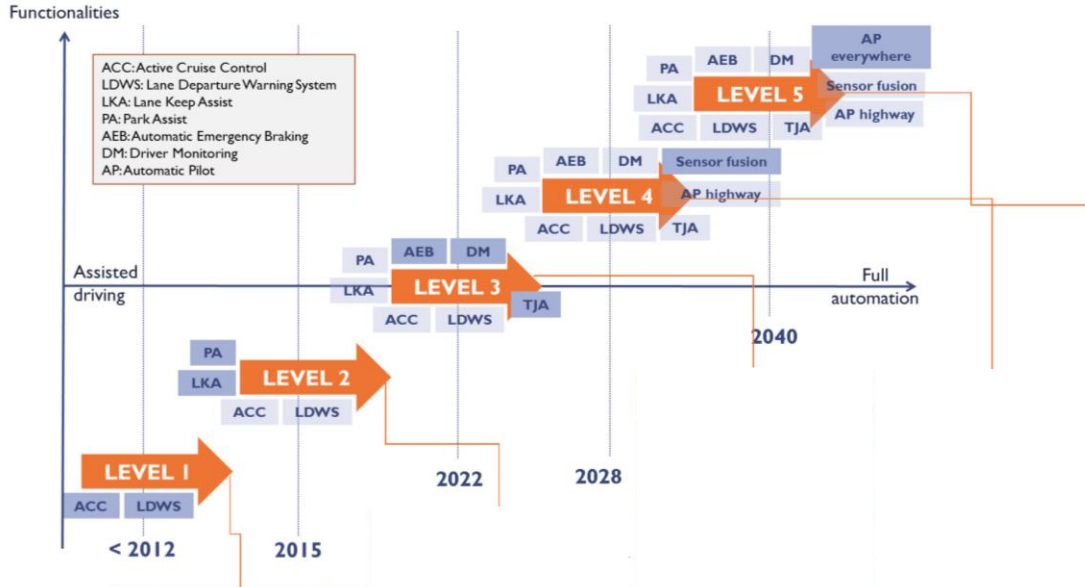
Full Automation



# CEVA Automotive: Paving the way for autonomous Driving



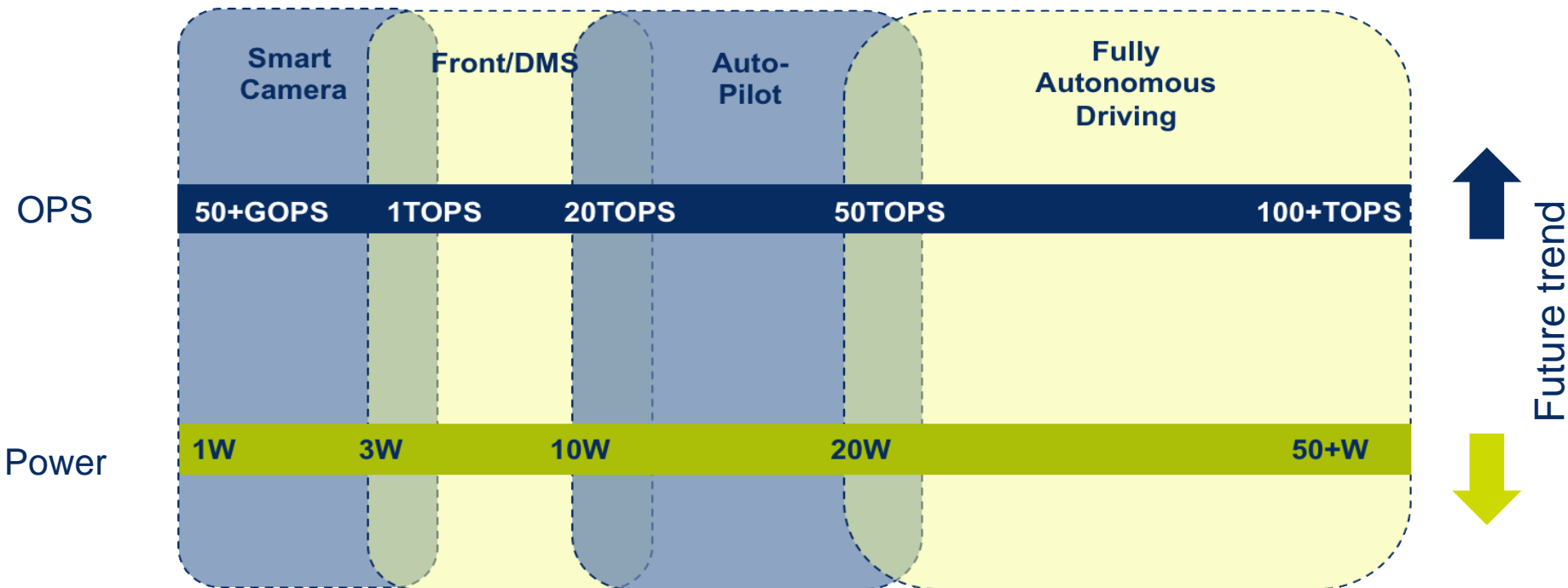
# ADAS to Autonomy



# Automotive DNN Performance Requirements



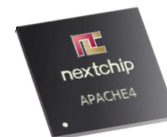
← Scalable NN coprocessor →



Performance and power efficiency are expected to increase up to 10x over next 5 years!

# Smart Rearview Camera - Overview

- ▶ NCAP Requires all vehicles to have rear cameras installed (US/Europe)
- ▶ Need strong ISP for quality imaging
- ▶ Algorithms
  - ▶ Computer Vision
    - ▶ HOG, SVM, Optical Flow
    - ▶ Image Warp
  - ▶ CNN
    - ▶ Object Detection
    - ▶ Segmentation
      - ▶ Free Space
- ▶ Targets
  - ▶ 15– 30 fps
  - ▶ 1 – 2 MP
  - ▶ Power: Low (1 – 2 W)



See NextChip

# Auto-Pilot System Overview



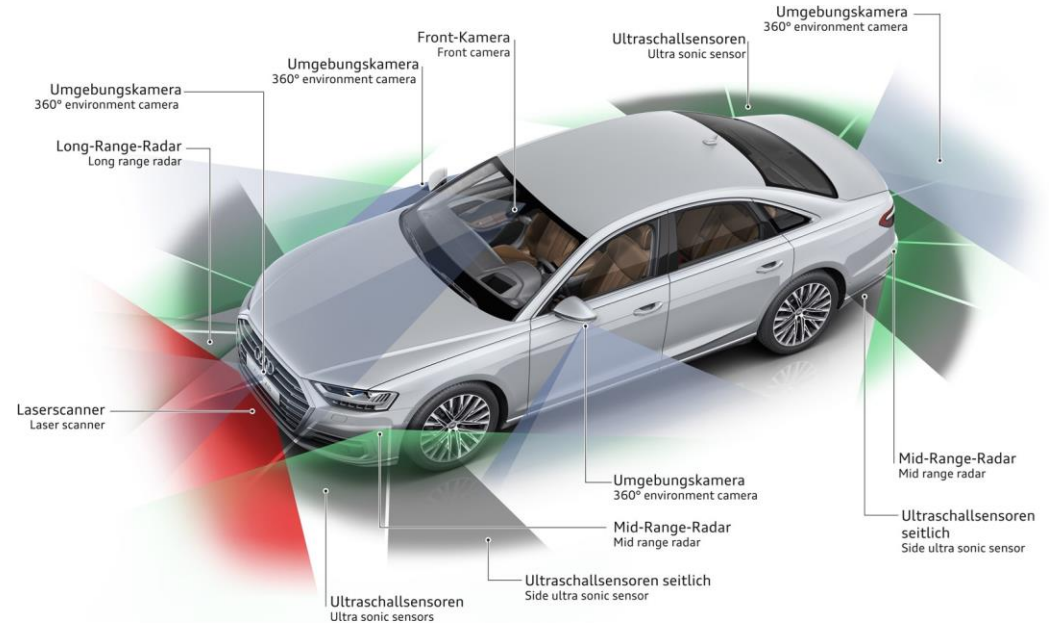
- ▶ First step towards automated driving
- ▶ Multiple Sensor inputs
  - ▶ Camera: 4+ (Driver Monitoring)
  - ▶ LiDar: 1-2
  - ▶ Radar: 4+
- ▶ Algorithms – Need both CV/CNN
  - ▶ Computer Vision
    - ▶ HOG, SVM, Optical Flow
    - ▶ Image Warp
  - ▶ CNN
    - ▶ Object Detection
    - ▶ Segmentation
      - ▶ Free Space
- ▶ Sensor Fusion
- ▶ Targets
  - ▶ 30 - 60 fps
  - ▶ 2 – 8 MP
  - ▶ Power: Low (10 – 20 W)





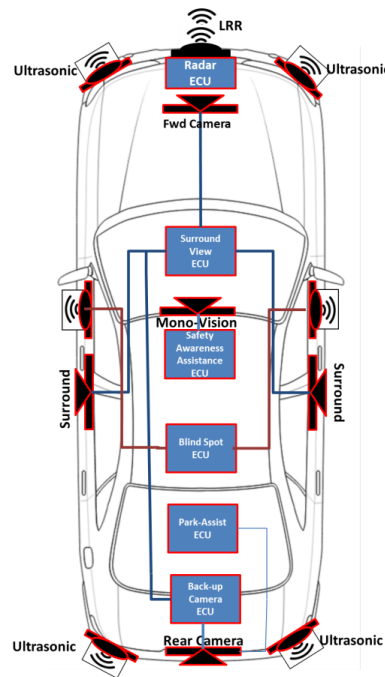
# Auto-Pilot System Overview

- ▶ First step towards automated driving
- ▶ Multiple Sensor inputs
  - ▶ Camera: 4+ (Driver Monitoring)
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# Edge or Central – How about both?

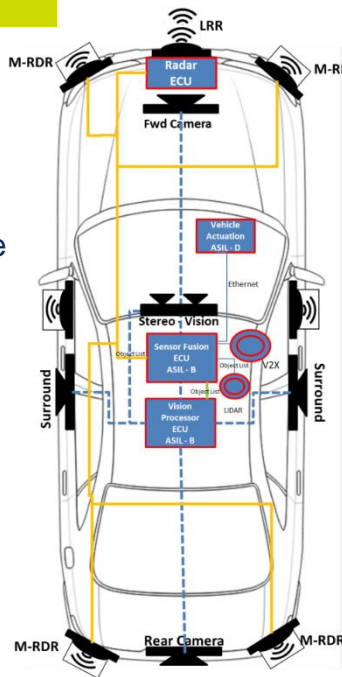
## Distributed



**Modular**

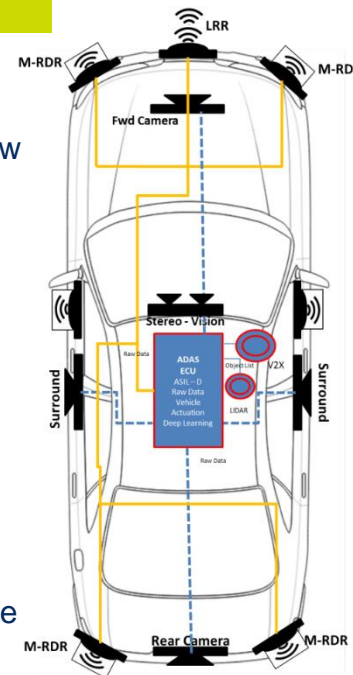
- ▶ Pros
  - ▶ Scalability
  - ▶ Less Data
  - ▶ Add a box - Feature
- ▶ Cons
  - ▶ More Expensive Sensors
  - ▶ Synchronization

## Centralized



**Hybrid**

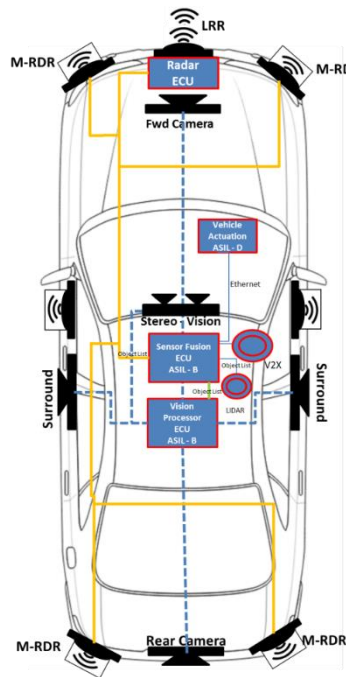
- ▶ Pros
  - ▶ Clear picture w/ Raw Data – True Model
  - ▶ Cheaper Sensors
  - ▶ Latency
- ▶ Cons
  - ▶ Expensive Central Unit
  - ▶ Power
  - ▶ Data Bandwidth
  - ▶ Single unit of Failure



**Centralized**

# Edge or Central – How about both?

## Hybrid



- ▶ Pros
  - ▶ Fail-Safe - Reliability
  - ▶ Smart Sensors
  - ▶ Less Data
  - ▶ Reduced Power
- ▶ Cons
  - ▶ Latency
  - ▶ Synchronization
  - ▶ Sensor Cost

Hybrid

Centralized

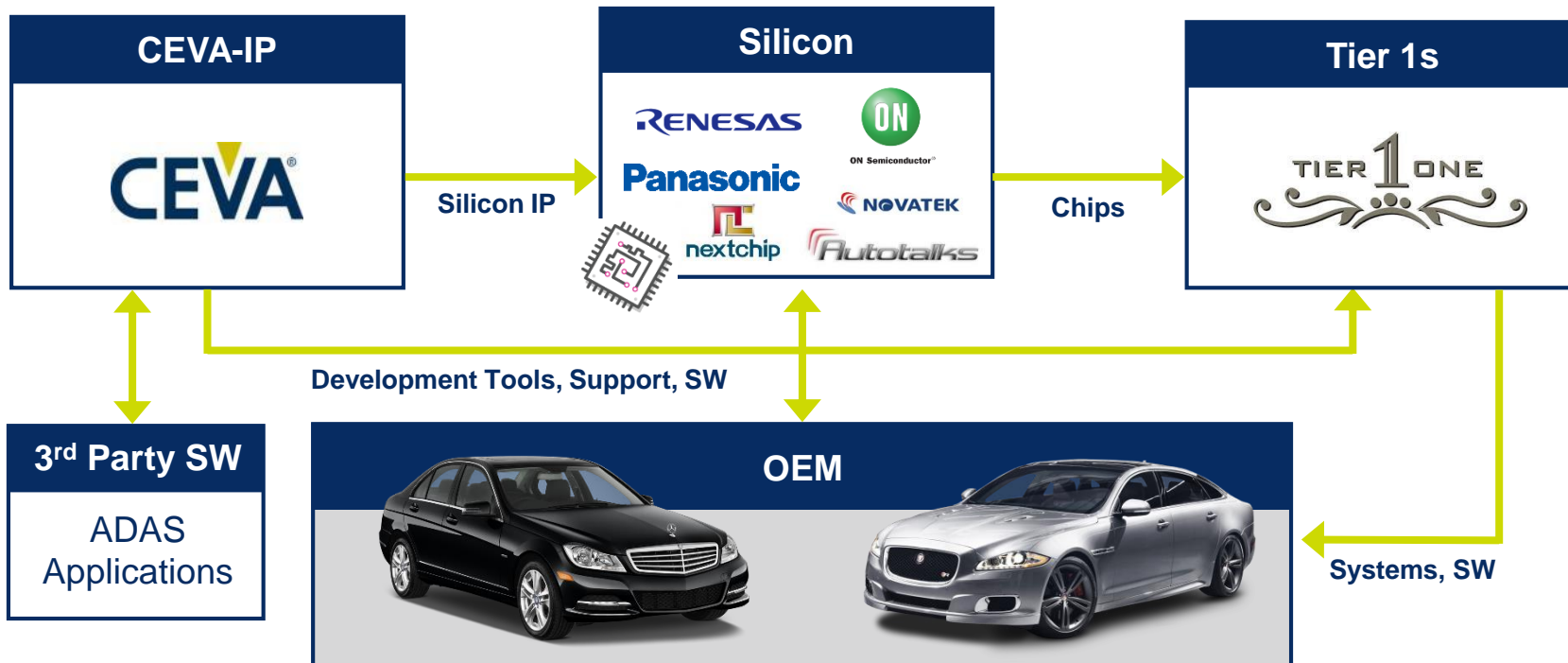


**Paves the way to  
Autonomous Driving**

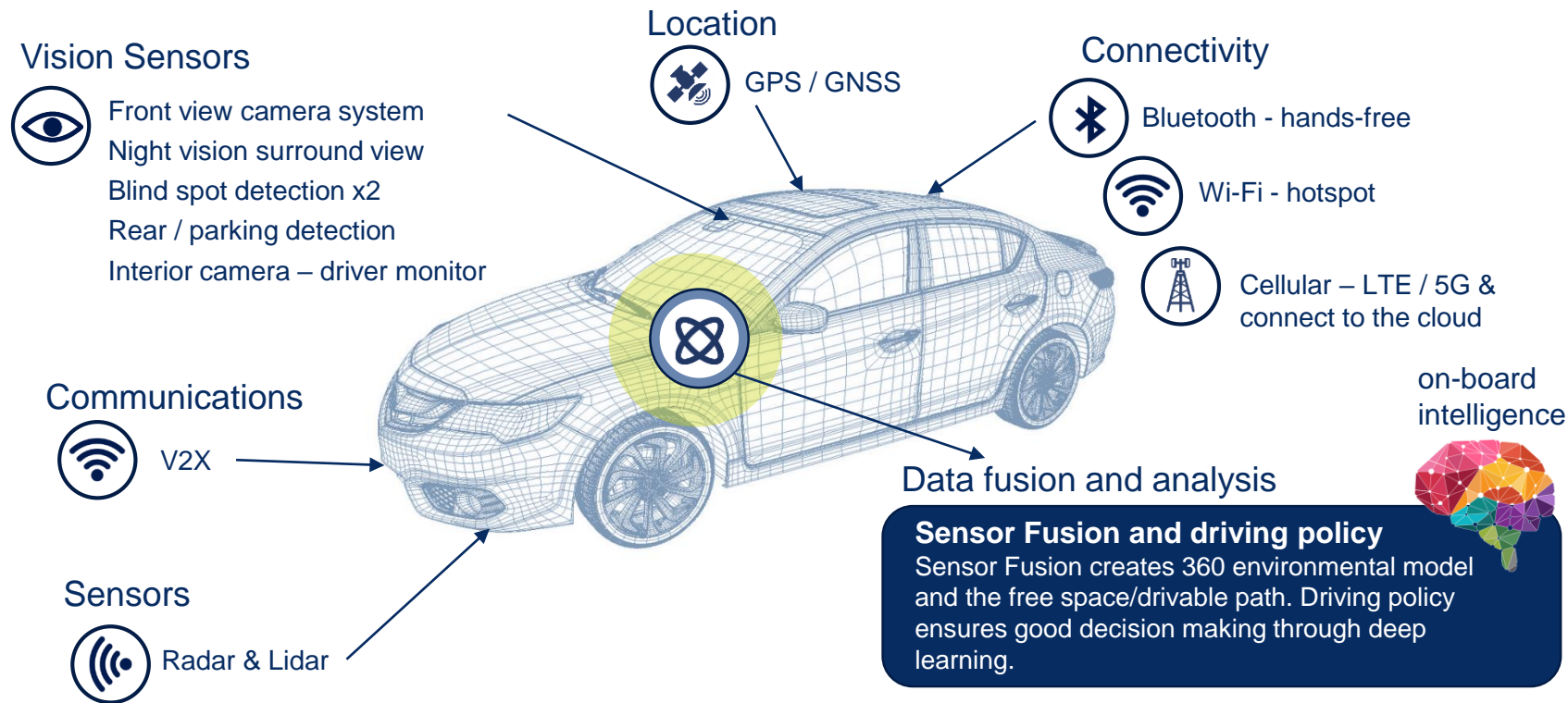
# CEVA Automotive Value Chain



Providing hardware, software, tools and support from license to deployment



# CEVA Potential in Automotive



# CEVA: Foundation for Autonomous



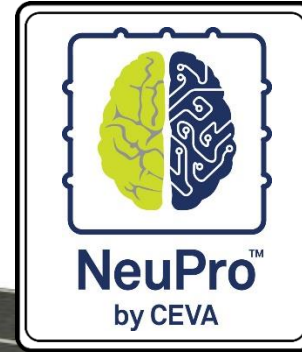
Industry leading  
Computer Vision  
IP  
With ISO26262



Award Winning  
CEVA Deep Neural  
Network Compiler



Leading ADAS silicon  
solution providers and  
leader is sensor vision  
processing



Dedicated AI  
processor Roadmap  
To handle next  
generation use cases



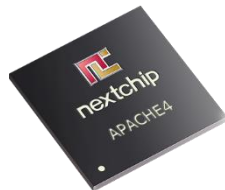
# Automotive CEVA Silicon



## CEVA AEC-Q100 Silicon Public Announcements



- ▶ On Semiconductor – Utilization of CEVA XM4 core in vision sensor products used in ADAS



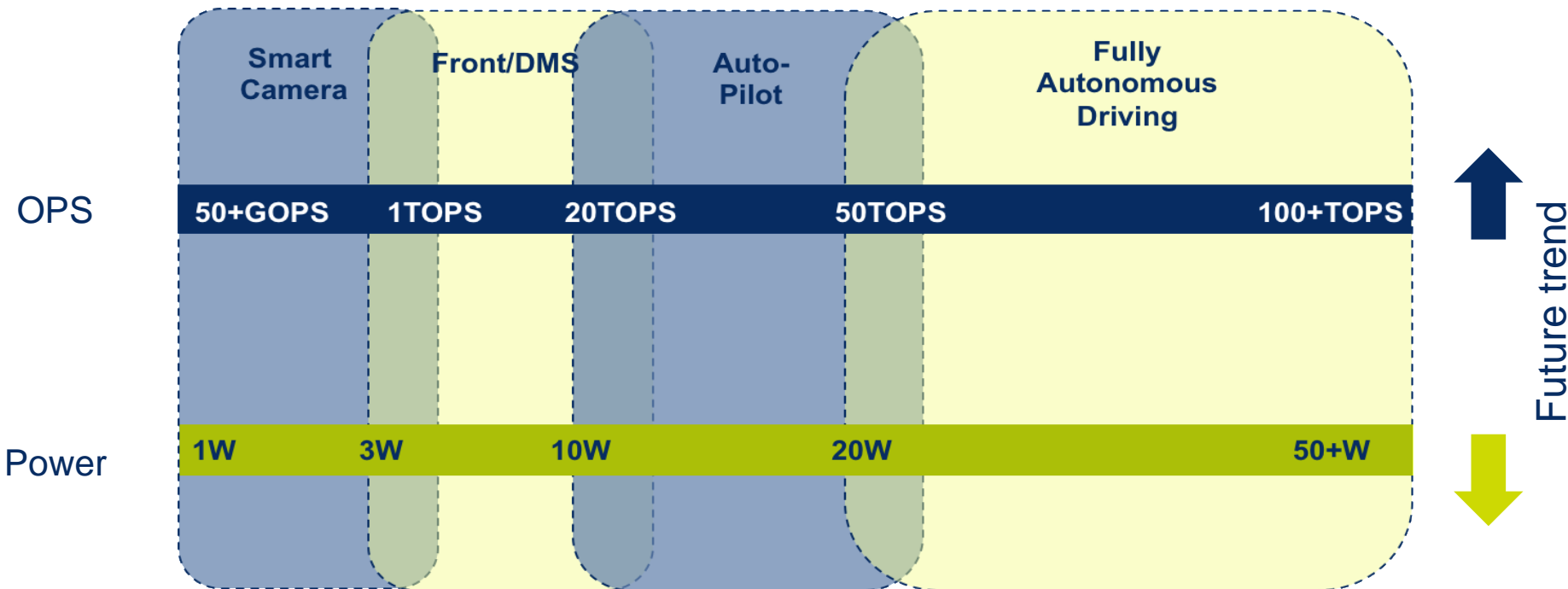
- ▶ NextChip – Utilization of CEVA XM4 in Apache4
- ▶ ADAS Solutions from: Rockchip, Novatek, Sigmastar

NeuPro Coming in 2019



# Automotive DNN Performance Requirements

← Scalable NN coprocessor →



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# Solutions to scale the levels of Autonomy

... And handle both edge and central

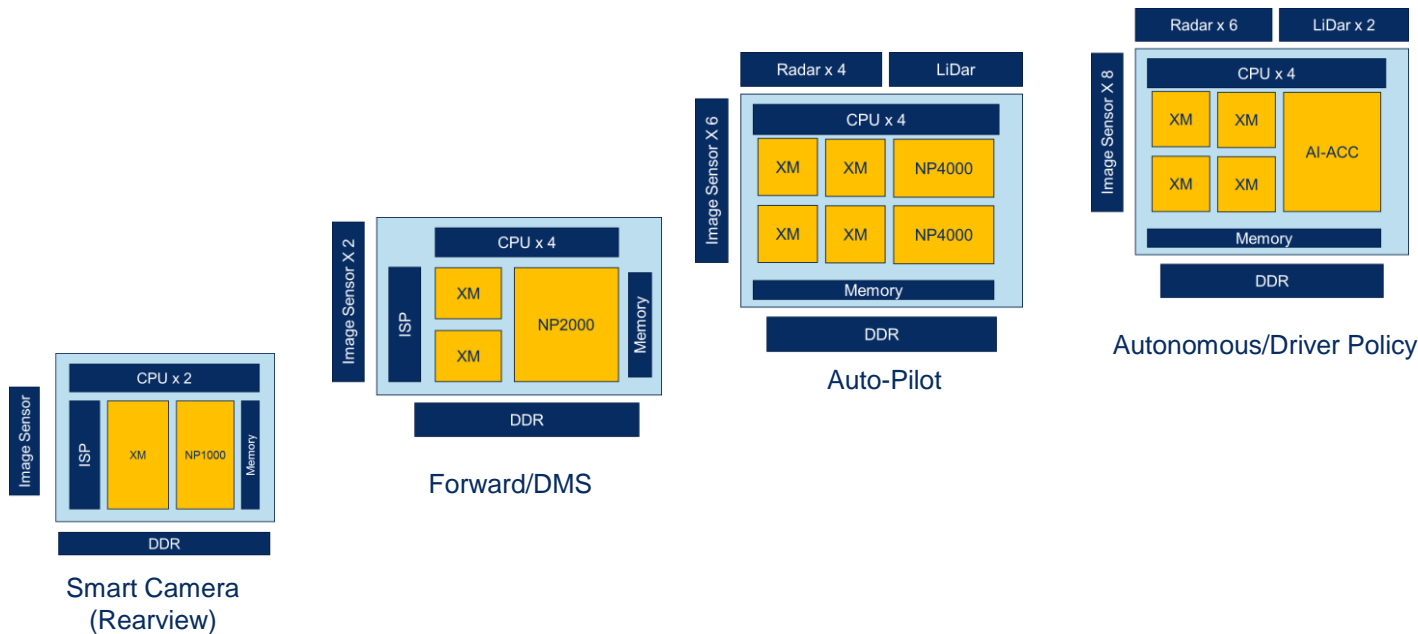
50+GOPS

1TOPS

20TOPS

50TOPS

100+TOPS



# CEVA: Paving the way



- ▶ ADAS to Autonomous
  - ▶ Saves Lives, Increases Mobility, and provides economic benefit
- ▶ Sensors growing on path to autonomous
  - ▶ Need Efficient, cost effective, and scalable solutions
- ▶ AI emerging as leading algorithm for ADAS/Autonomous
  - ▶ Computer Vision still needed in Systems
- ▶ CEVA has the solutions to deliver for next generation ADAS/Autonomous Systems
  - ▶ XM – Computer Vision
  - ▶ CEVA NeuPro - AI

# Thank You



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