



CEVA TECHNOLOGY
SYMPOSIUM SERIES

CEVA Automotive

A path towards autonomous driving

Jeff VanWashenova – Director
Automotive Segment Marketing

www.ceva-dsp.com



Paving the way – ADAS to Autonomous

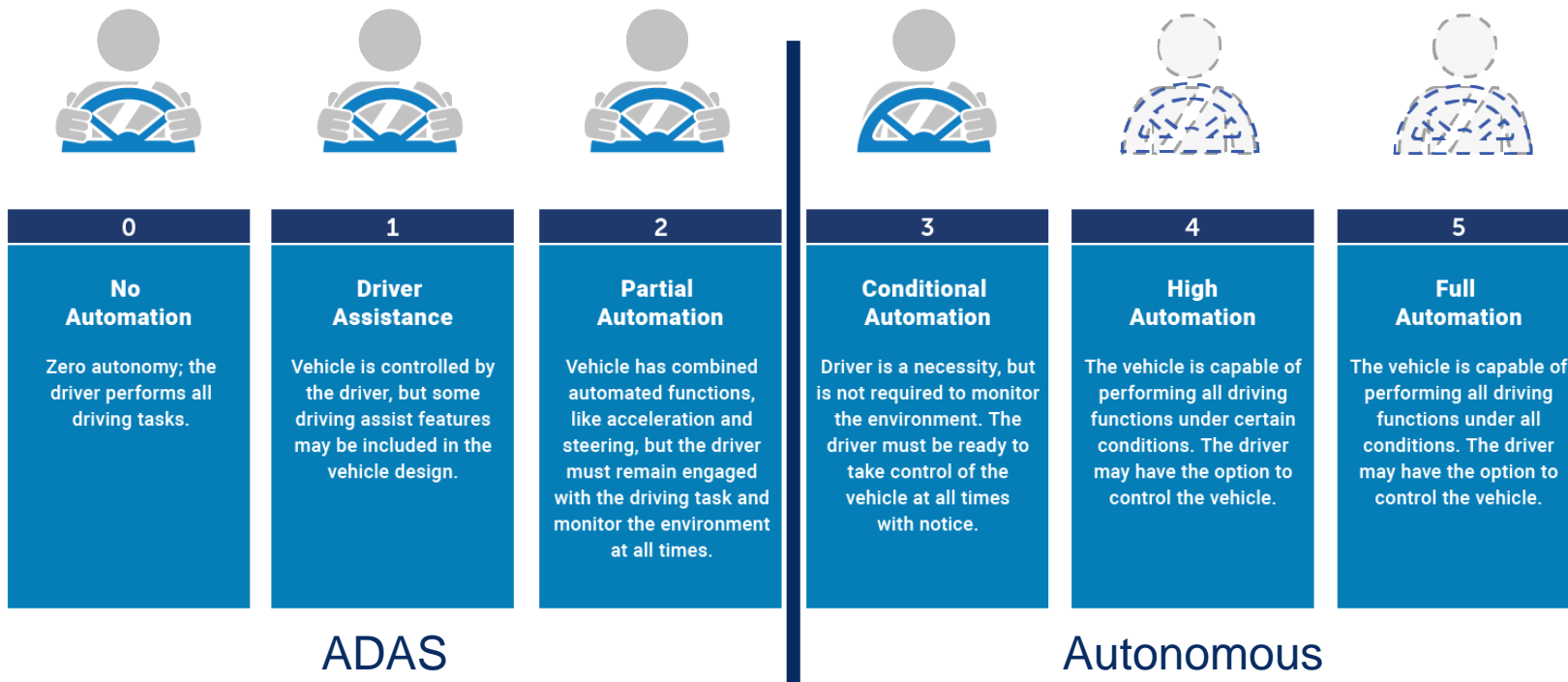
- ▶ Safety
 - ▶ Reduce Traffic Fatalities by 90%
 - ▶ Millions of lives globally
- ▶ Mobility
 - ▶ Social – Elderly
 - ▶ Free Time/Productivity
- ▶ Economic (\$5.6 T)
 - ▶ Fuel Cost
 - ▶ Productivity Gains
 - ▶ Accident Cost



Autonomous Driving Levels

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

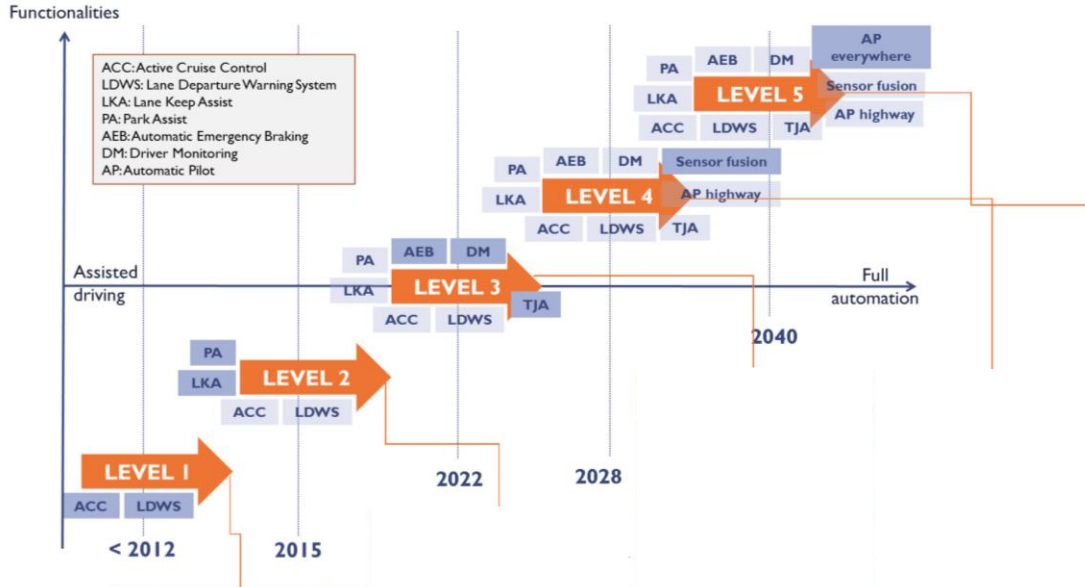
Full Automation



CEVA Automotive: Paving the way for autonomous Driving



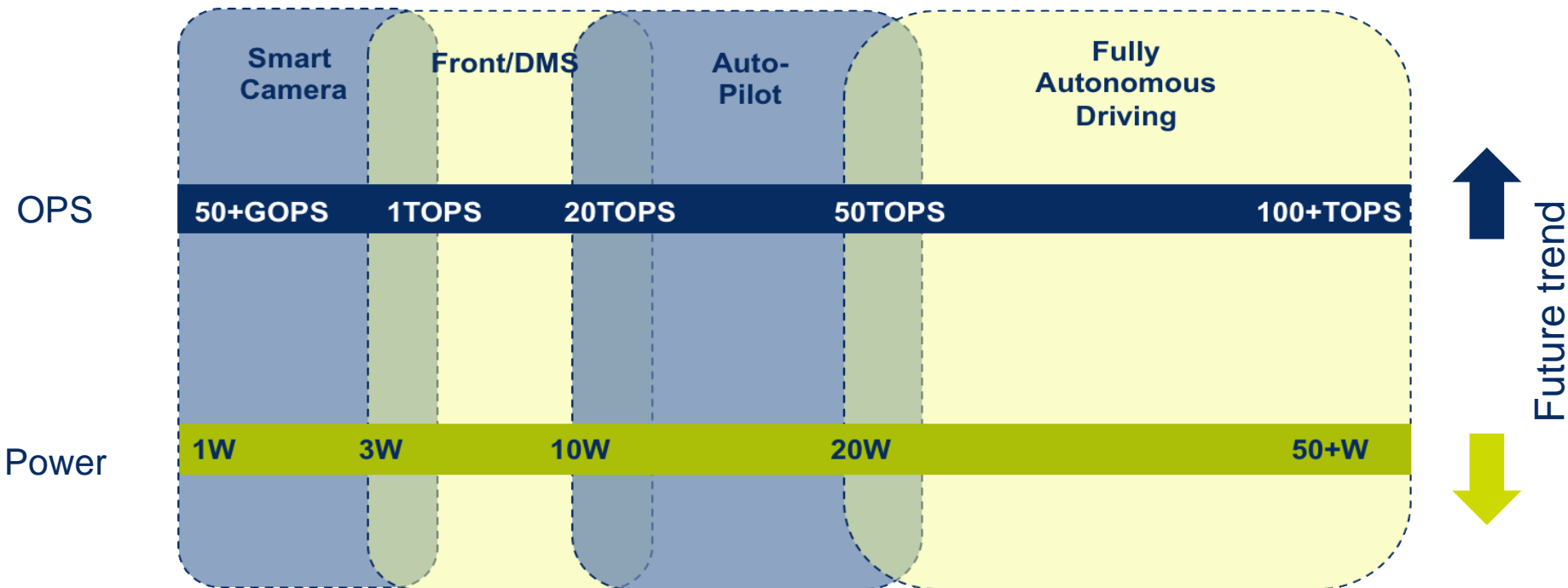
ADAS to Autonomy



Automotive DNN Performance Requirements



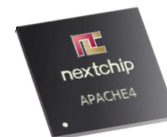
← Scalable NN coprocessor →



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

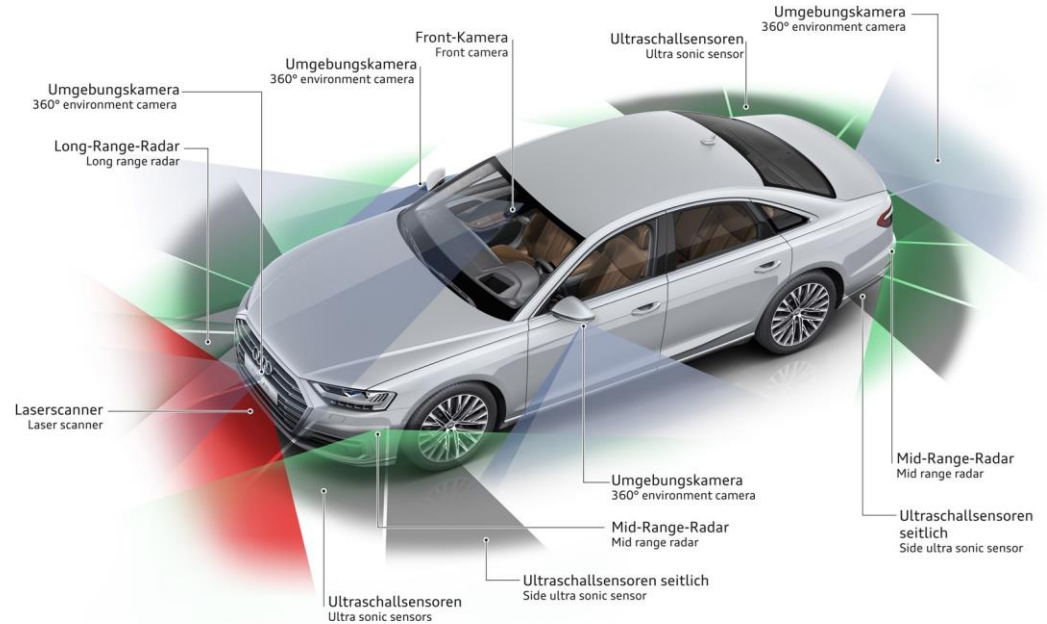


- ▶ First step towards automated driving
- ▶ Multiple Sensor inputs
 - ▶ Camera: 4+ (Driver Monitoring)
 - ▶ LiDar: 1-2
 - ▶ Radar: 4+
- ▶ Algorithms – Need both CV/CNN
 - ▶ Computer Vision
 - ▶ HOG, SVM, Optical Flow
 - ▶ Image Warp
 - ▶ CNN
 - ▶ Object Detection
 - ▶ Segmentation
 - ▶ Free Space
-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



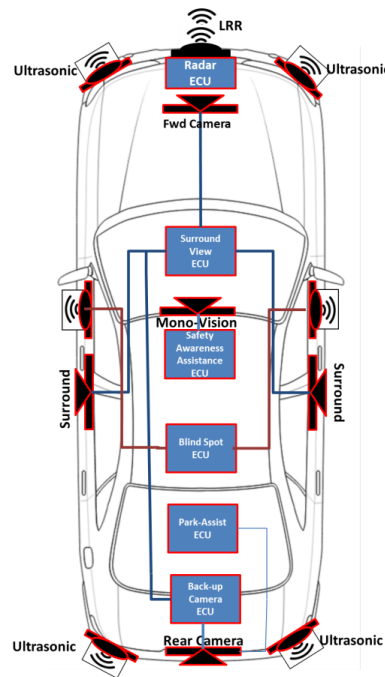
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Edge or Central – How about both?

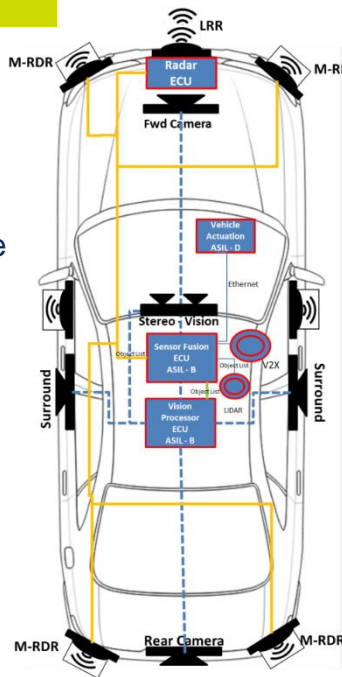
Distributed



Modular

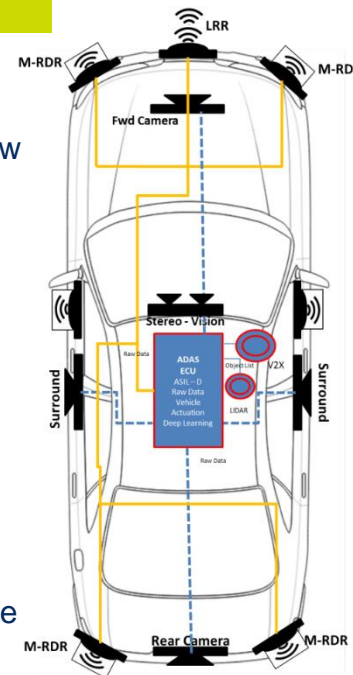
- ▶ Pros
 - ▶ Scalability
 - ▶ Less Data
 - ▶ Add a box - Feature
- ▶ Cons
 - ▶ More Expensive Sensors
 - ▶ Synchronization

Centralized



Hybrid

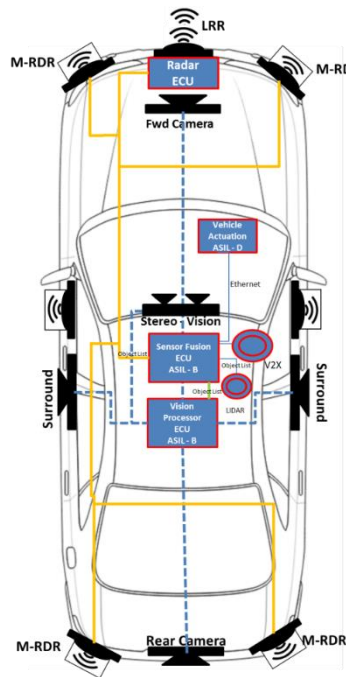
- ▶ Pros
 - ▶ Clear picture w/ Raw Data – True Model
 - ▶ Cheaper Sensors
 - ▶ Latency
- ▶ Cons
 - ▶ Expensive Central Unit
 - ▶ Power
 - ▶ Data Bandwidth
 - ▶ Single unit of Failure



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

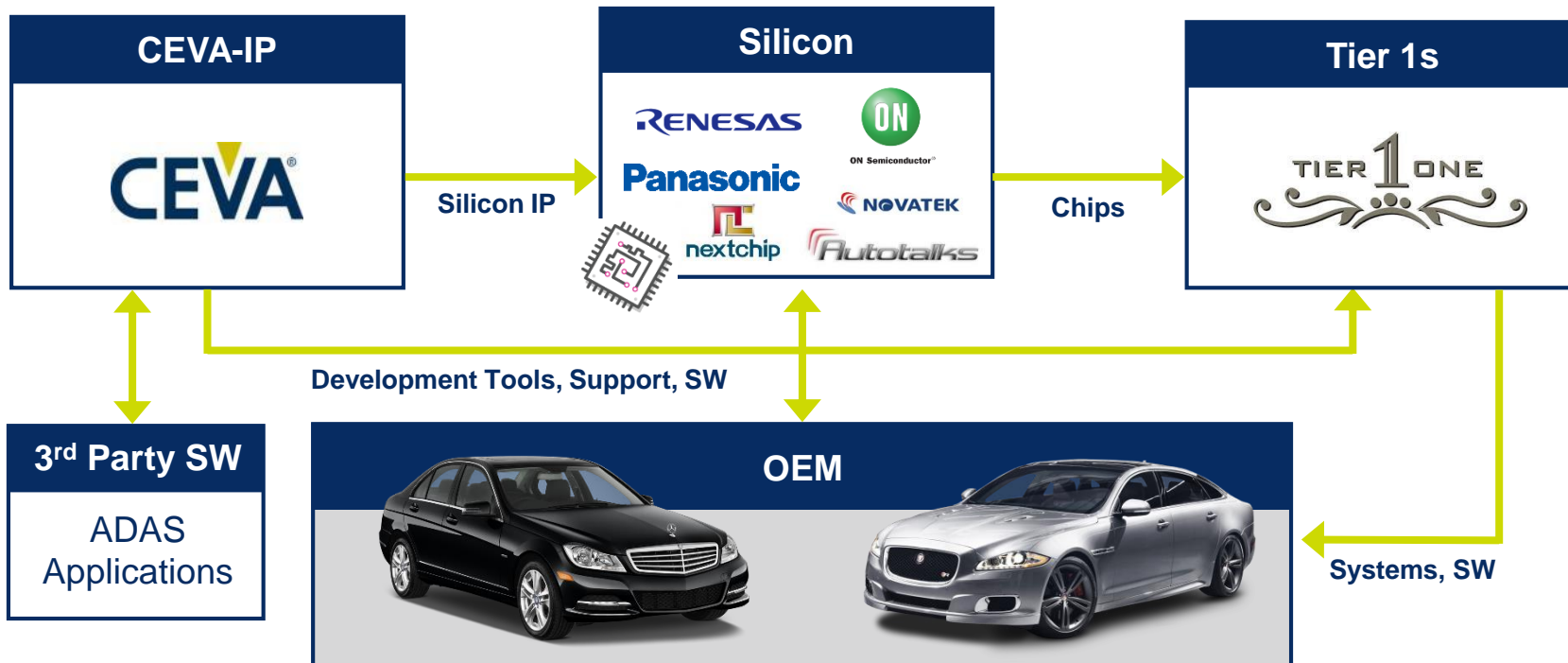


**Paves the way to
Autonomous Driving**

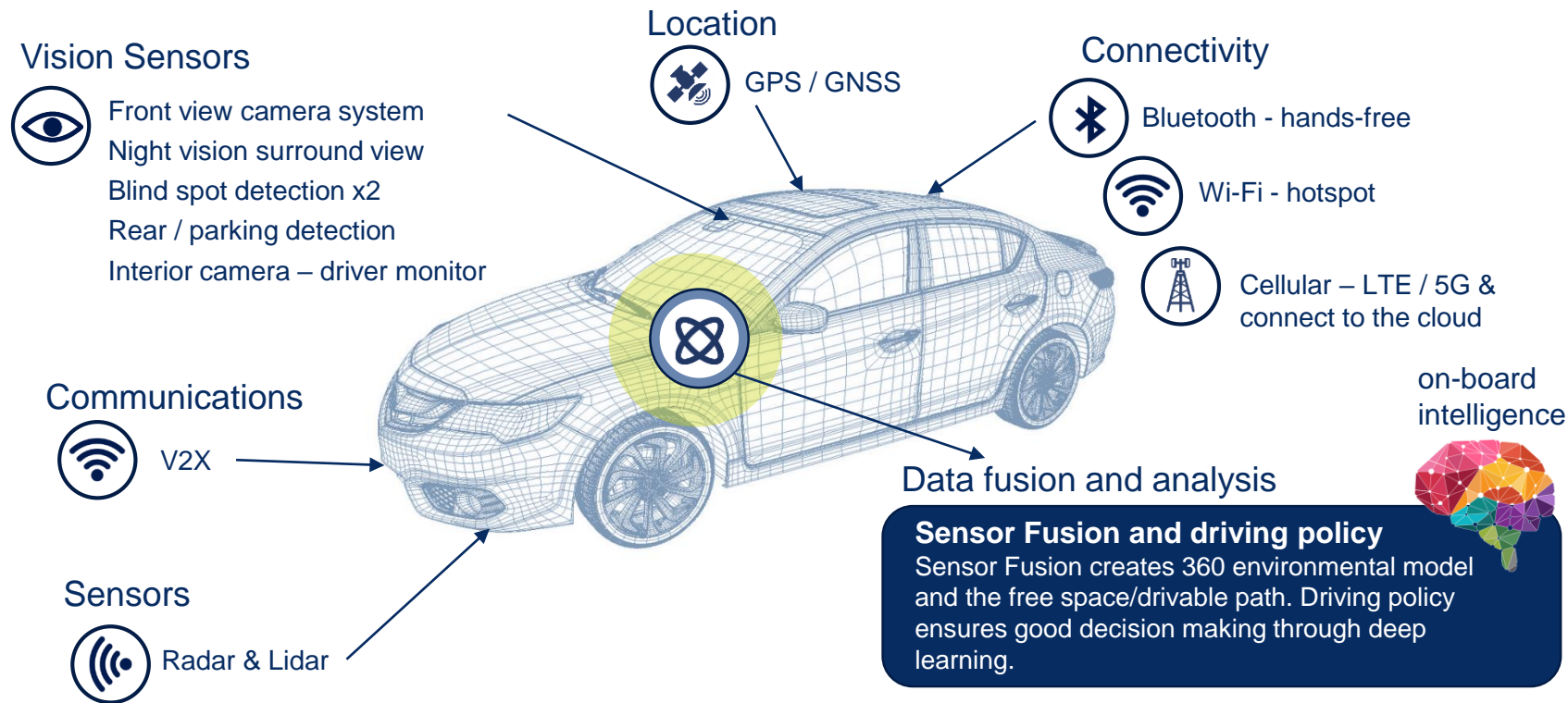
CEVA Automotive Value Chain



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



CEVA Potential in Automotive



CEVA: Foundation for Autonomous



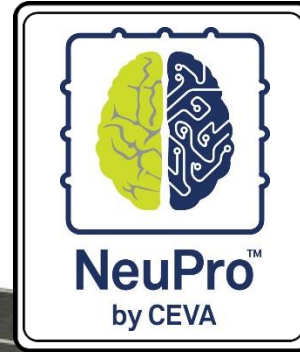
Industry leading
Computer Vision
IP
With ISO26262



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



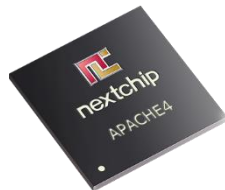
Automotive CEVA Silicon



CEVA AEC-Q100 Silicon Public Announcements



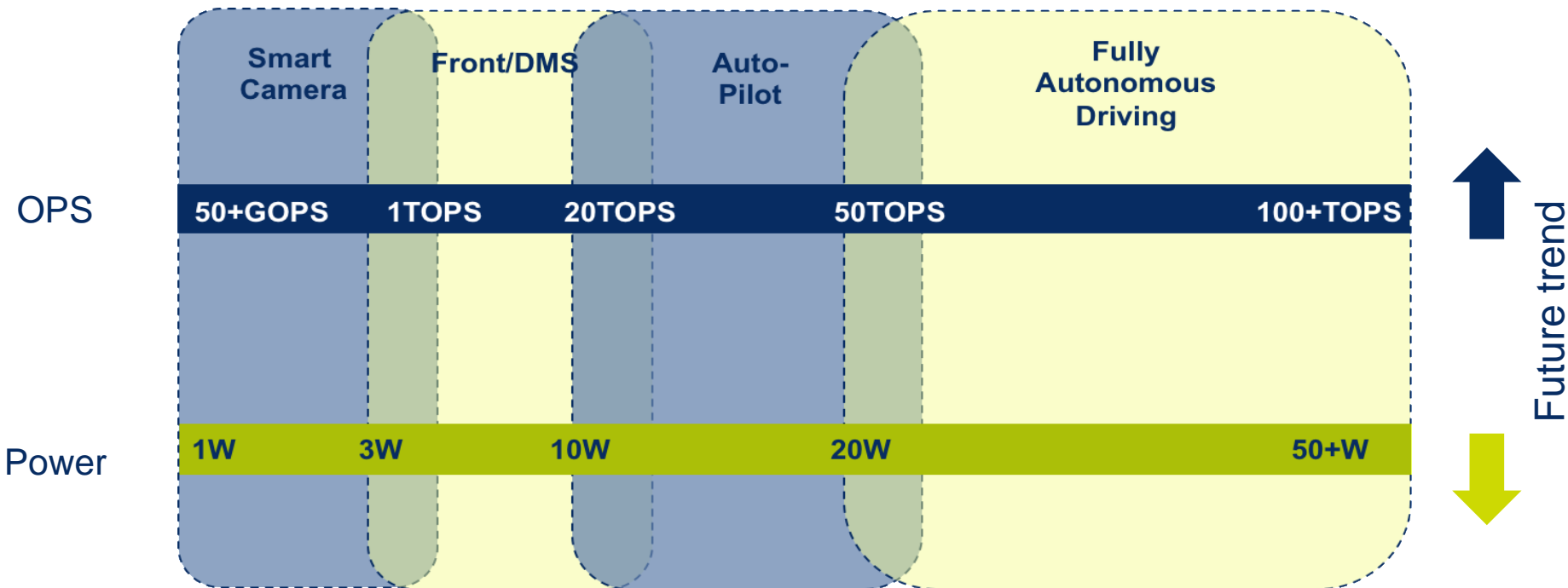
- ▶ On Semiconductor – Utilization of CEVA XM4 core in vision sensor products used in ADAS



- ▶ 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

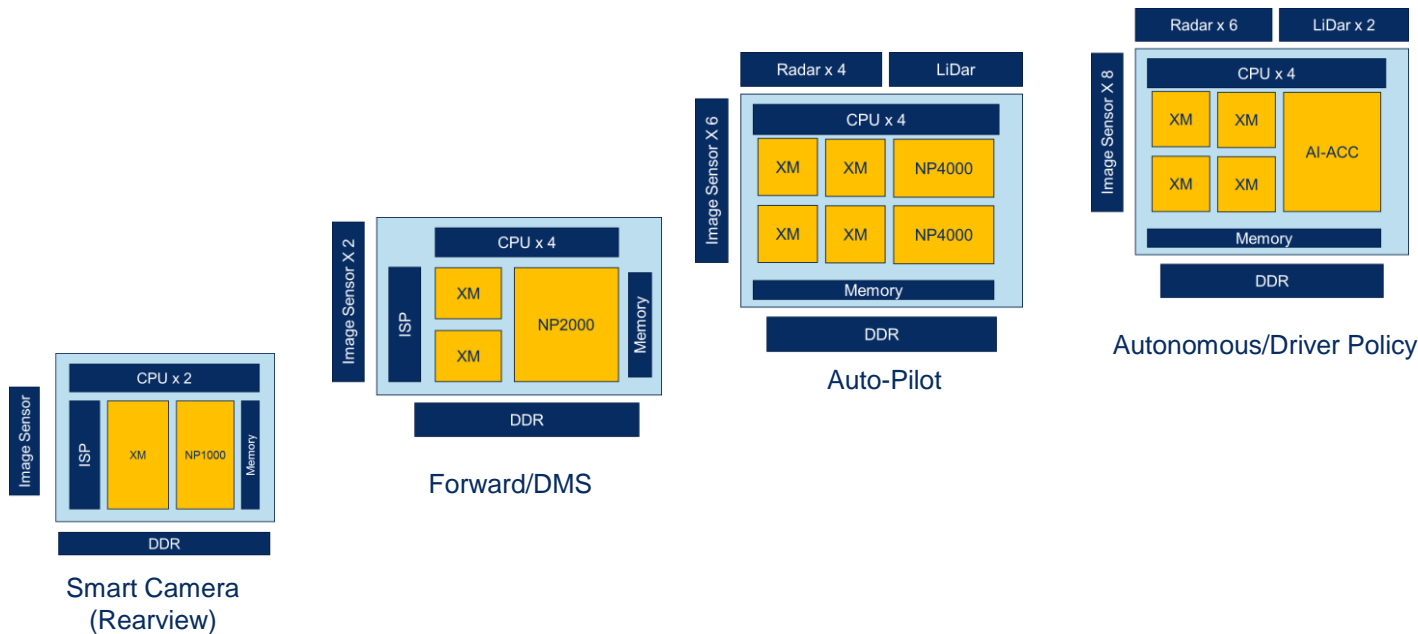
50+GOPS

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



Jeff VanWashenova

jeff.vanwashenova@ceva-dsp.com

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