NXP 4D IMAGING RADAR READY FOR DEPLOYMENT NOW

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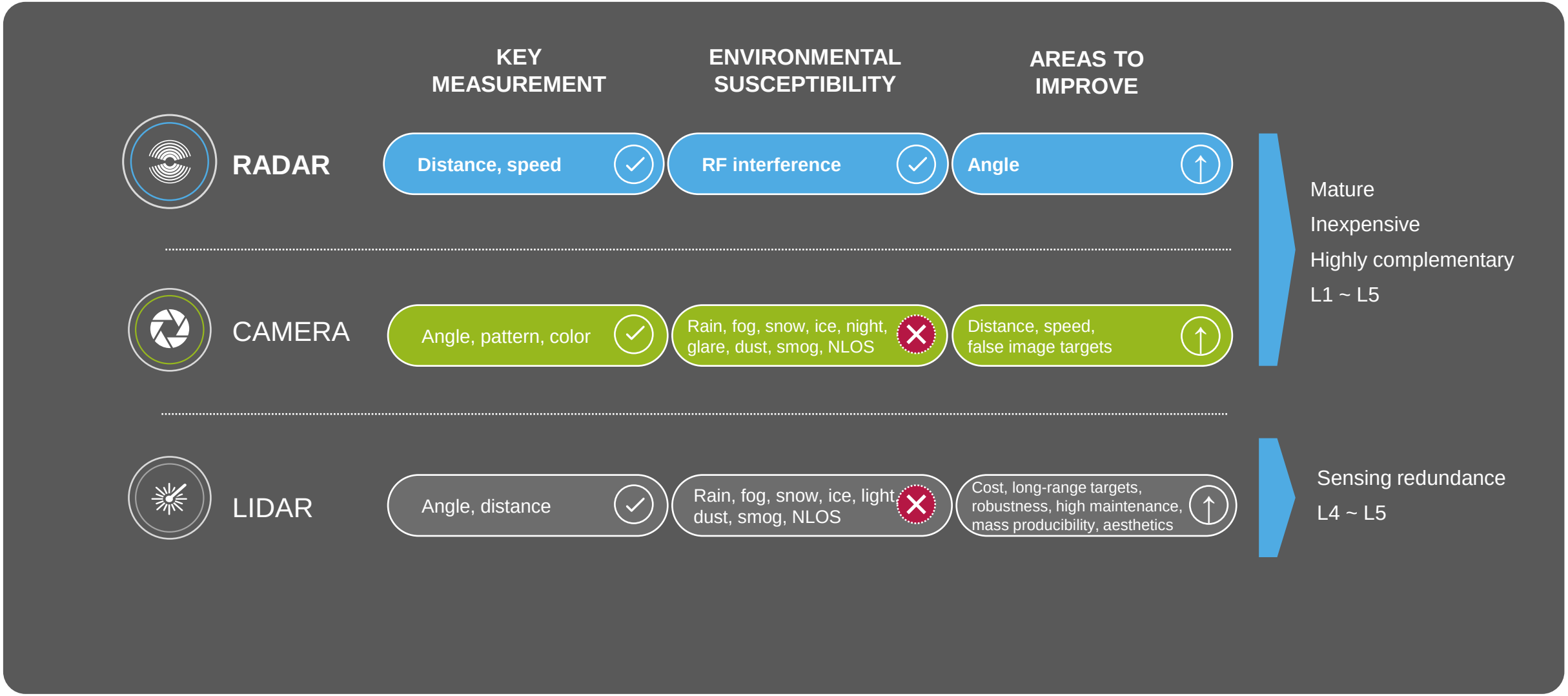
Technical Director - Advanced Radar Solutions

SEPTEMBER 2022

SECURE CONNECTIONS FOR A SMARTER WORLD

ADAS / AD SENSING TECHNOLOGIES

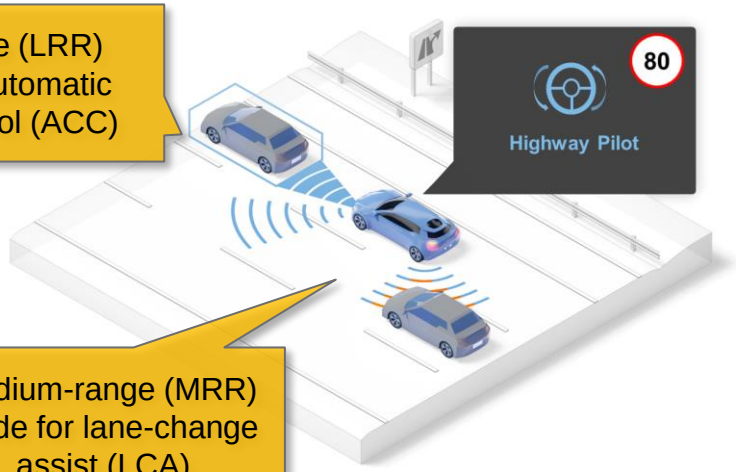


4D HIGH IMAGING RADAR USE CASE EXAMPLES

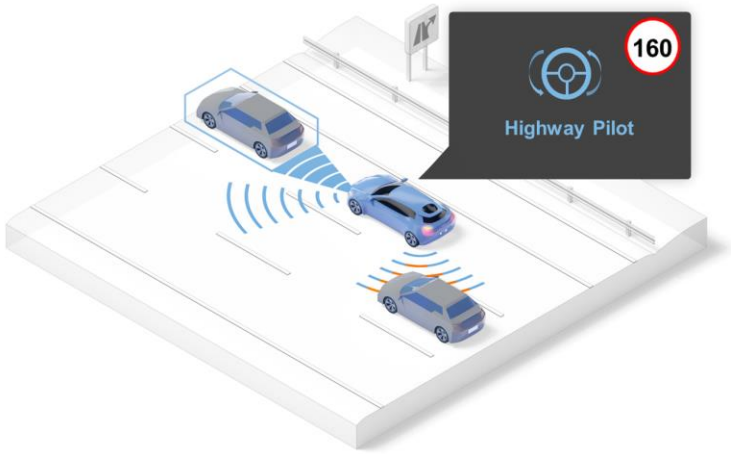
EXTENDING L2+ TO MORE DEMANDING DRIVING SCENARIOS

Highway pilot

Long-range (LRR) mode for automatic cruise control (ACC)

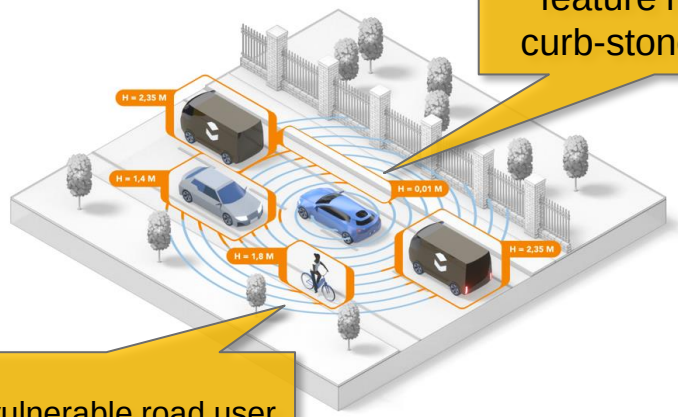


Medium-range (MRR) mode for lane-change assist (LCA)

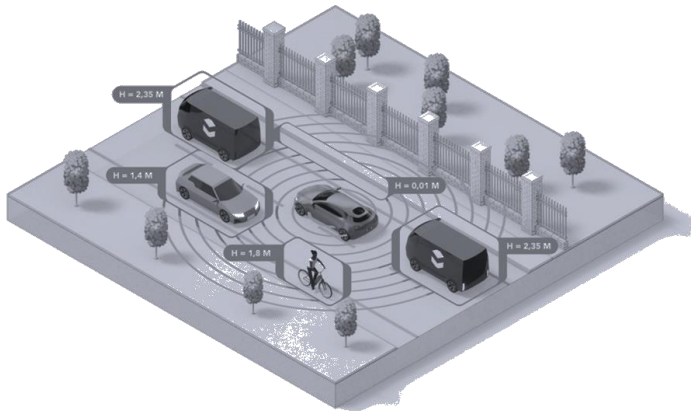


Urban pilot

Very fine feature resolution: curb-stone detection



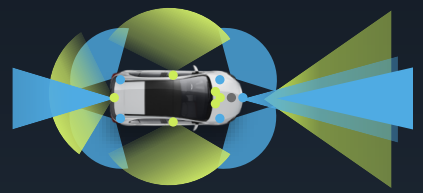
Reliable vulnerable road user detection & classification



4D IMAGING RADAR - BIG TECHNOLOGY LEAP

NXP 4D Imaging Radar spans L2+ to L5

LEVEL 2+
Conditional Automation



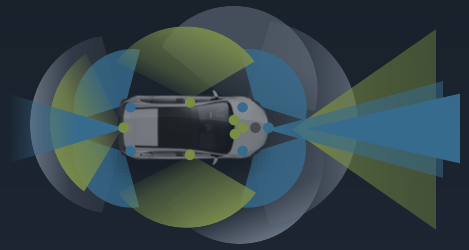
~43%
of cars '30

Higher Automation

Accelerated Growth

RADAR	5+
CAMERA	6-8
LIDAR	0-1

LEVEL 3 TO 5
High/Full Automation



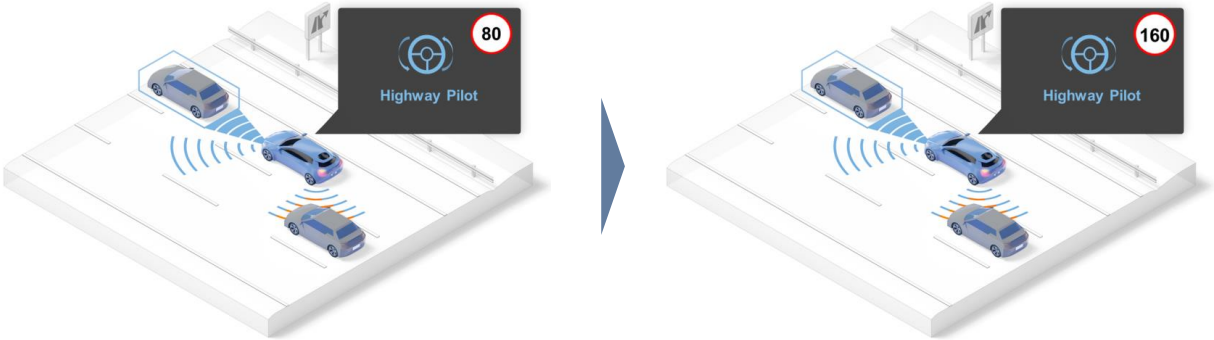
4%
of cars '30

Mobility as a service

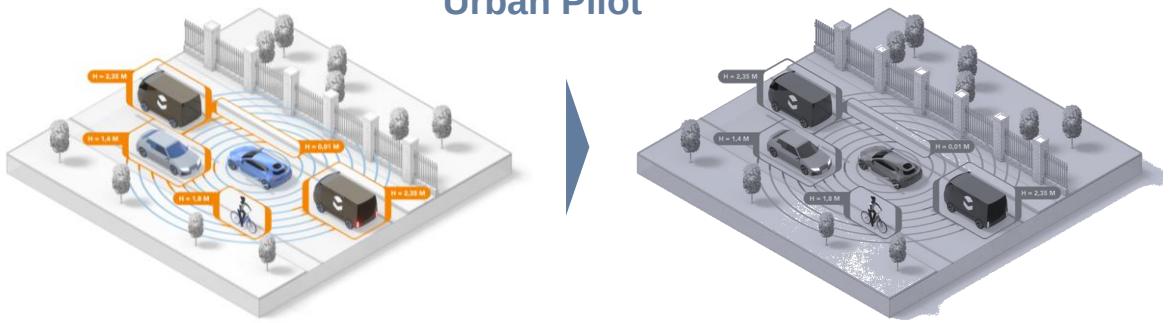
RADAR	6-10
CAMERA	6-8
LIDAR	1-3

- Fine point clouds enables standalone 360° sensing and environmental mapping
- Complement by camera
- Minimizing lidar usage for L2+ ~ L5
- Assuming majority workload for future sensor suites

Highway Pilot

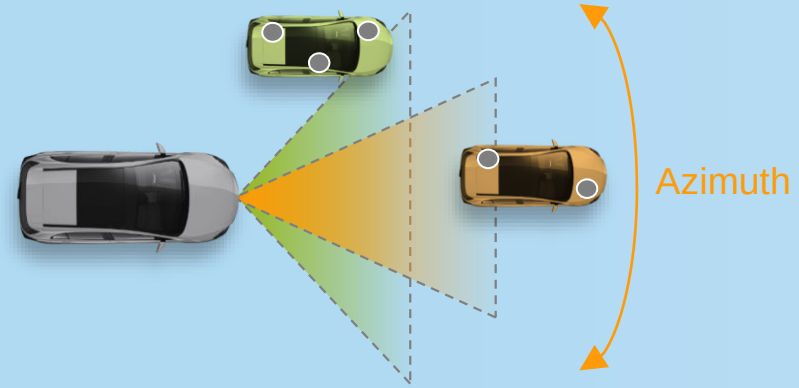


Urban Pilot



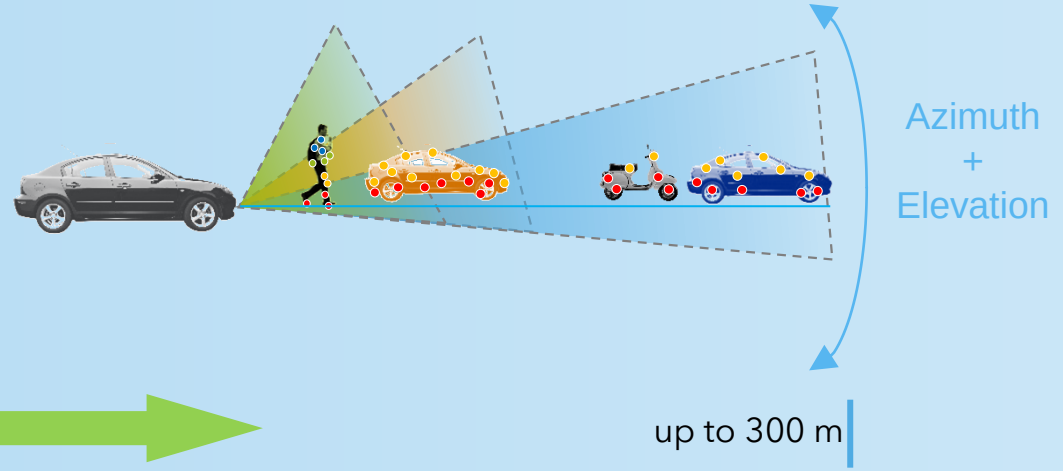
RADAR – FROM CONVENTIONAL TO 4D IMAGING

Conventional Radar



Range | Doppler | Azimuth

4D Imaging Radar



< 1° Resolution | Elevation | Extended Range

Range | Doppler | Azimuth

Weather robustness + 4D high resolution = fundamental sensing technology across all AD levels

IMAGING RADAR MARKET OUTLINE
FAST GROWING LEVEL 2+ DRIVES IMAGING RADAR MARKET DEMAND

Fast growth with advanced corner & front sensors

NXP 4D Imaging Radar spans L2+ to L5

LEVEL 1	LEVEL 2	LEVEL 2+	LEVEL 3 TO 5
Driver Assistance	Partial Automation	Conditional Automation	High/Full Automation
~25% of cars '30	~18% of cars '30	~43% of cars '30	4% of cars '30
RADAR 1-3	RADAR 3-5	RADAR 5+	RADAR 6-10
CAMERA 1-2	CAMERA ≥4	(IMR) (1)	(IMR) (1-4)
LIDAR 0	LIDAR 0	CAMERA 6-8	CAMERA 6-8
		LIDAR 0	LIDAR 1

Vehicle ownership: trending towards higher automation

Mobility as a service

Accelerated Level 2+ growth: 43% market penetration in 2030

Modest growth of full automation but potential for 10+ high performance sensors per vehicle

Imaging radar may eliminate the need of Lidar in L2+

Standalone 360° surround sensing reduces Lidar to 1x only for redundancy

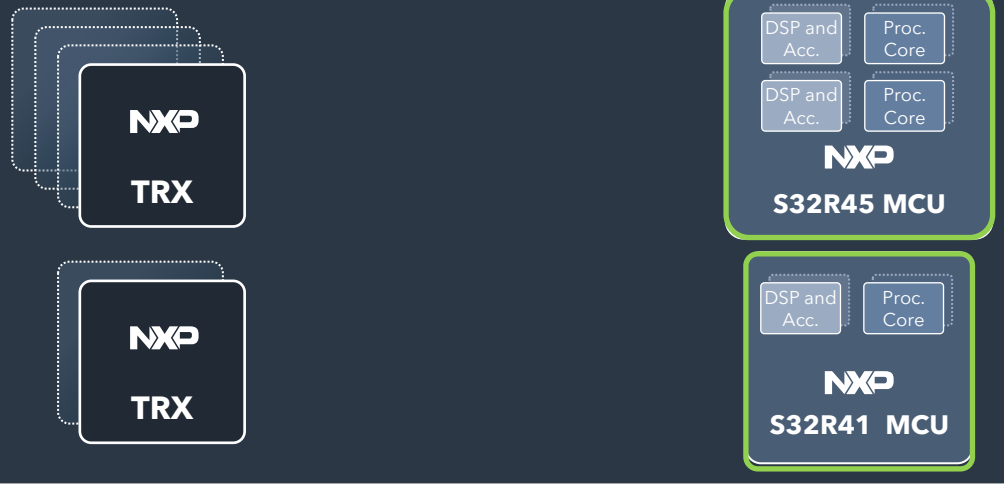
4D IMAGING RADAR BIFURCATION REQUIRES OPTIMIZATION FOR USE CASE

SCALABLE S32R4X ARCHITECTURE: EASY SCALING AND MIGRATION

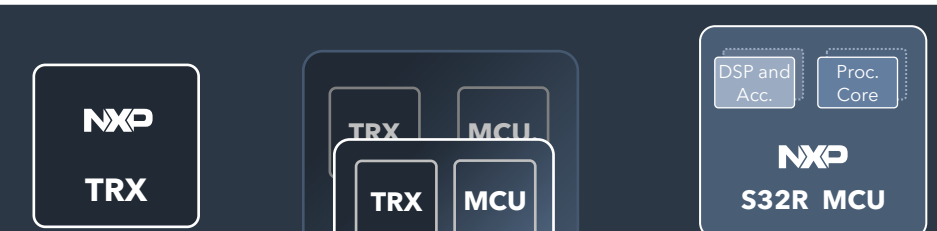
4D Imaging Radar spans L2+ to L5

RADAR PRODUCT FAMILY

IMAGING RADAR 77 GHZ
Highest resolution and performance



LONG-RANGE RADAR 77 GHZ
Front and rear higher performance



CORNER RADAR 77 GHZ
Multiple small modules

NXP 4D IMAGING RADAR

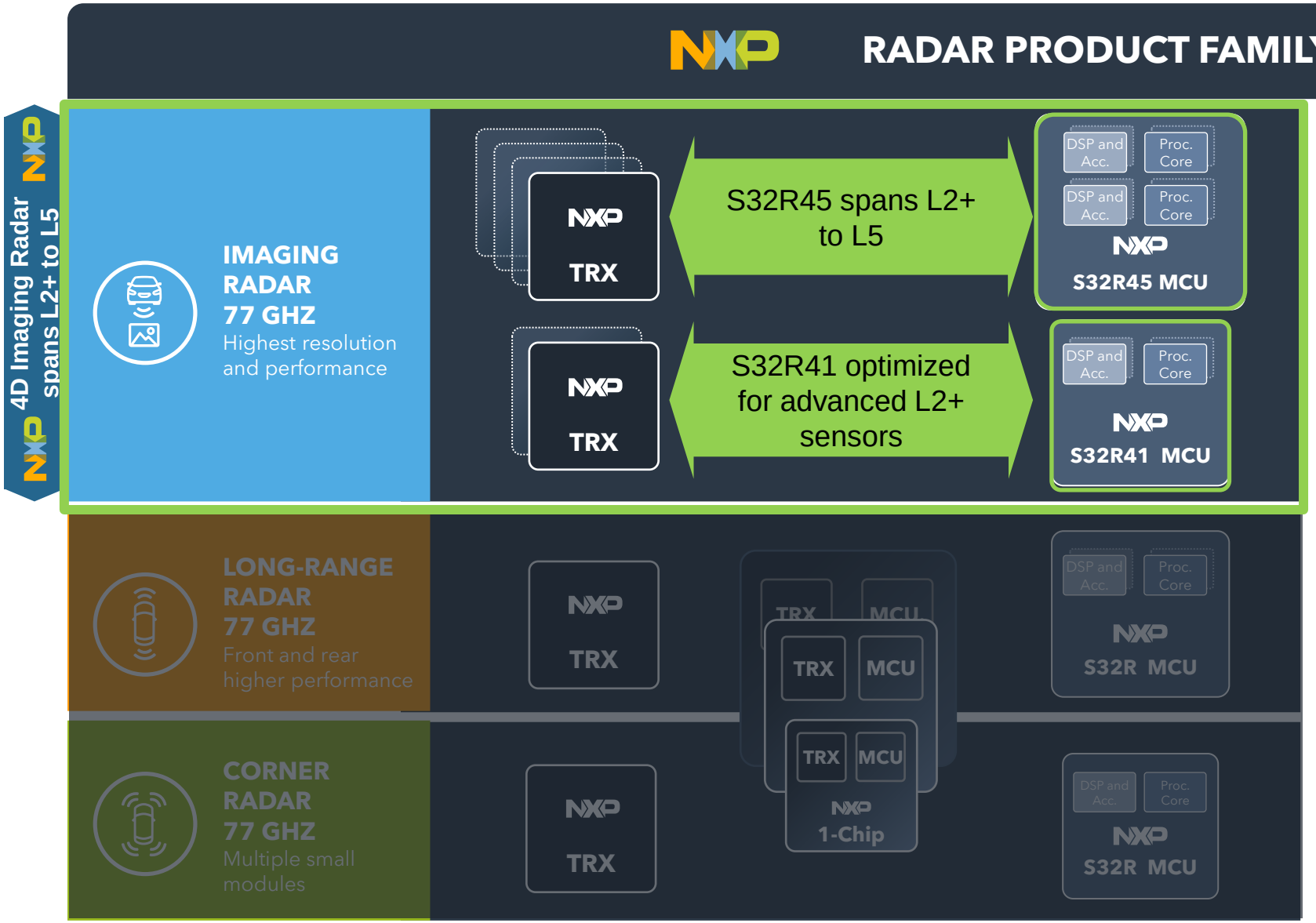
Tailor-made high-performance processors
Delivers fast, powerful and efficient processing

Unparalleled scalability on common architecture
Maximized software reuse for platform development – from advanced corner to 4D imaging radar

Performance boost beyond raw HW capability
Advanced radar processing software unleash the full hardware potential

4D IMAGING RADAR BIFURCATION REQUIRES OPTIMIZATION FOR USE CASE

SCALABLE S32R4X ARCHITECTURE: EASY SCALING AND MIGRATION



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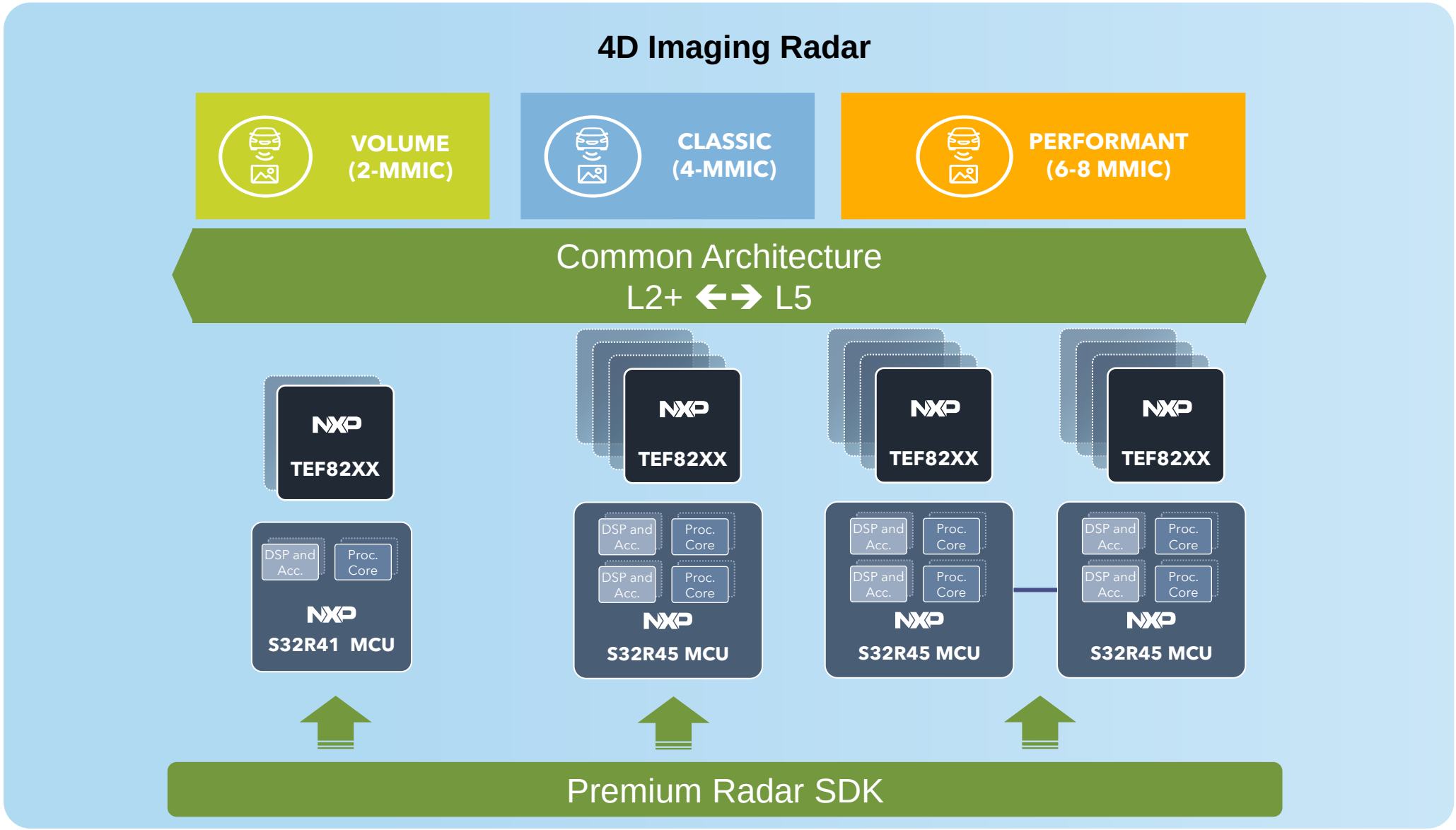
IMAGING RADAR BIFURCATION
VOLUME SEGMENT VS. TOP-PERFORMANT



S32R4X BOOSTING PERFORMANCE WITH 3-IN-1 IMAGING RADAR FOR L2+ THROUGH L5

4D Imaging Radar spans L2+ to L5

IMAGING RADAR 77 GHZ
Highest resolution and performance

LONG-RANGE RADAR 77 GHZ
Front and rear higher performance

CORNER RADAR 77 GHZ
Multiple small modules

NXP 4D IMAGING RADAR

Maximum awareness: concurrent 3-in-1 sensing

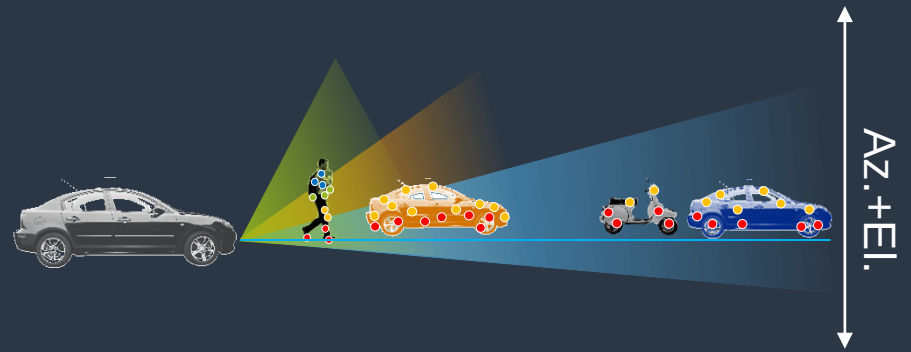
Simultaneous multi-mode scan: wide, mid and far in 4 dimensions

Concurrent use of transmitters plus adv. coding and algorithms

Maximum efficiency for <1° resolution

Up to 192 virtual channels and 12x efficiency gain

Smart and lean design vs. ordinary antenna count scaling



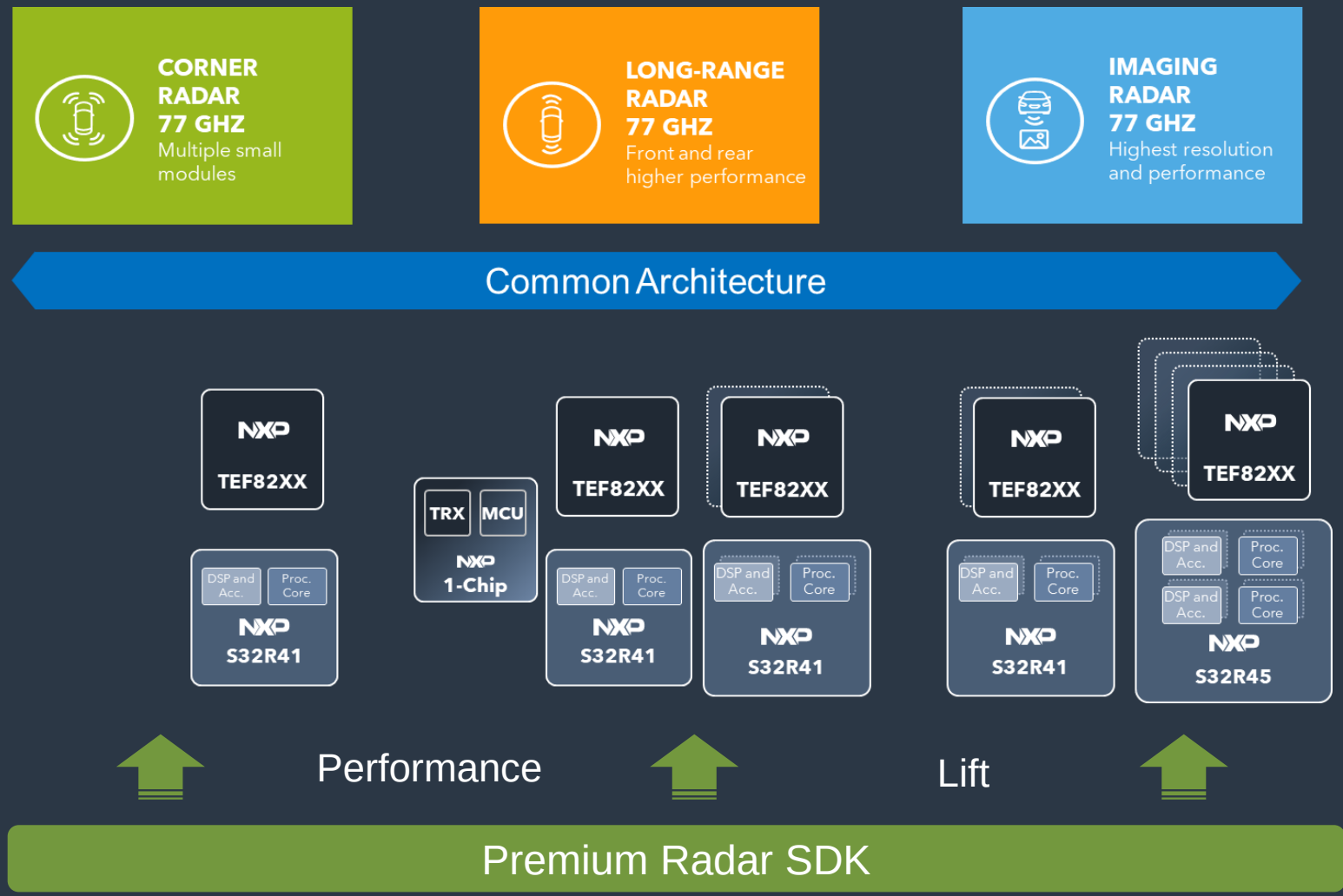
Simultaneous multi-mode sensing up to 300 m

3-in-1	Smart Performance Boost	Algo. Enhancement
Elevation	< 1° Resolution	Extended Range
Range	Doppler	Azimuth

ENABLING MASS ADOPTION OF L2+

NXP PREMIUM RADAR SDK

PERFORMANCE UPLIFT VIA ADVANCED SOFTWARE

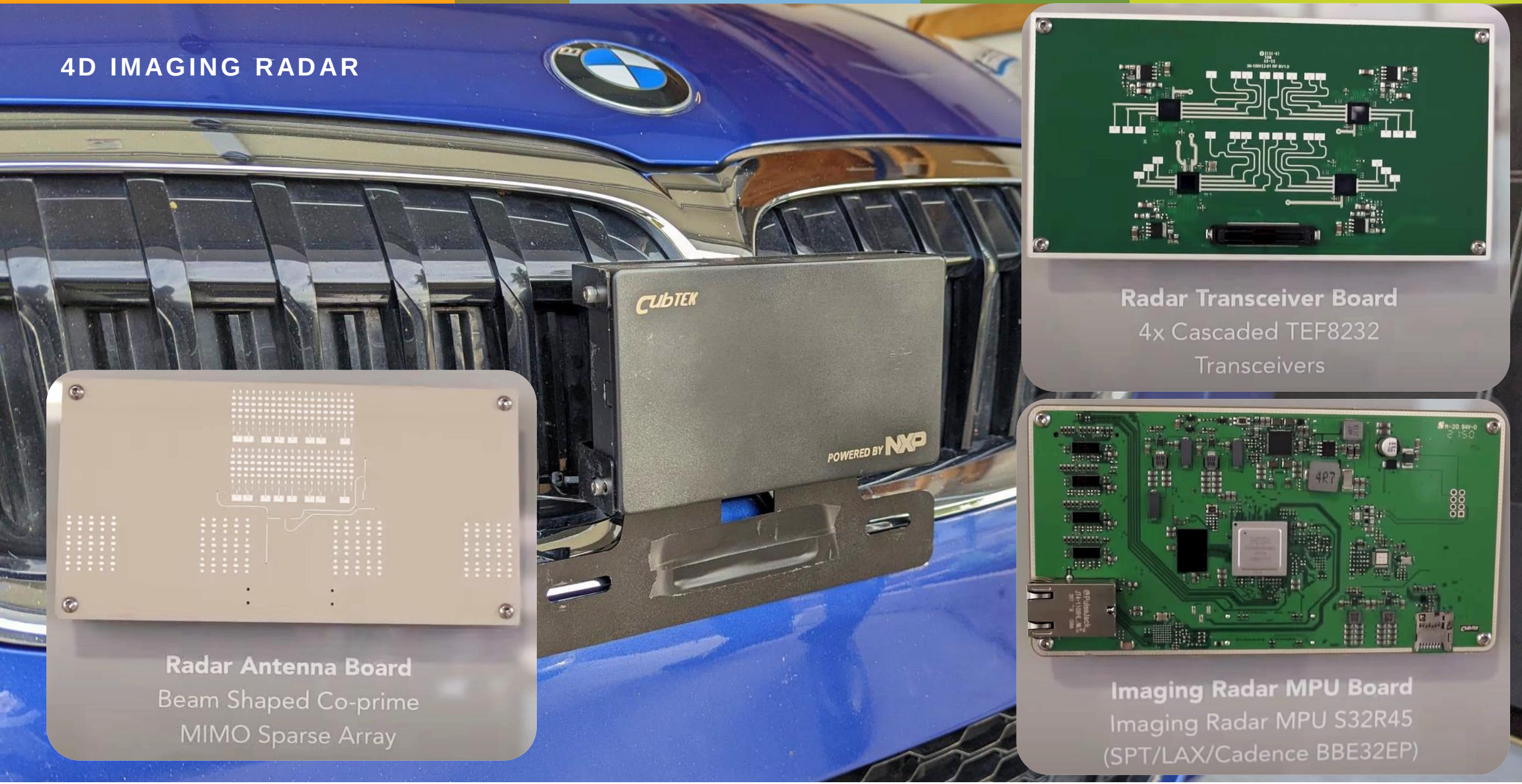


Premium Radar SDK

- Advanced algorithms for
  - Interference mitigation
  - MIMO waveform
  - High angular resolution
  - etc.
- Optimized implementation allowing customer improvement
- Regular releases to expand with new algorithms

Customer evaluation available *NOW*

4D IMAGING RADAR



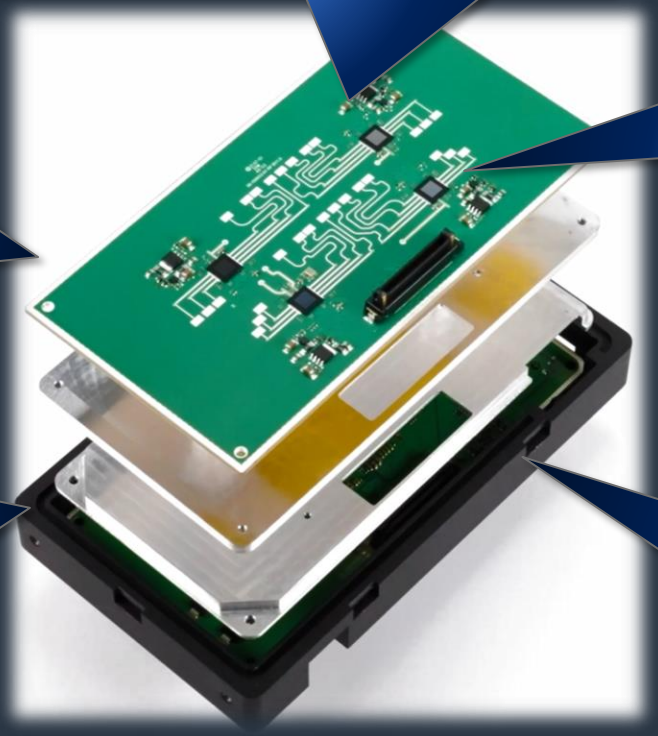
Radar Transceiver Board
4x Cascaded TEF8232
Transceivers

Radar Antenna Board
Beam Shaped Co-prime
MIMO Sparse Array

Imaging Radar MPU Board
Imaging Radar MPU S32R45
(SPT/LAX/Cadence BBE32EP)

NXP4D IMAGING RADAR
APPLYING AN EFFICIENT TOTAL SOLUTION APPROACH

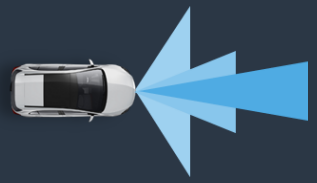
Purpose-made
Radar acceleration:
64x Arm® A53 equivalent



Advanced MIMO waveforms

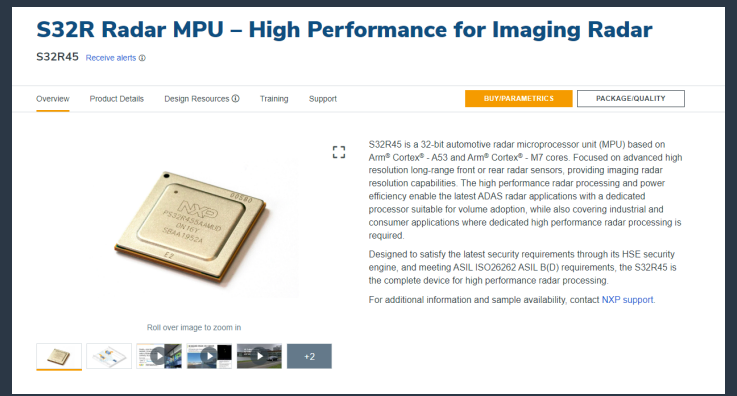
Gen2 RFCMOS:
2x link RF budget

3-in-1 sensor antenna design



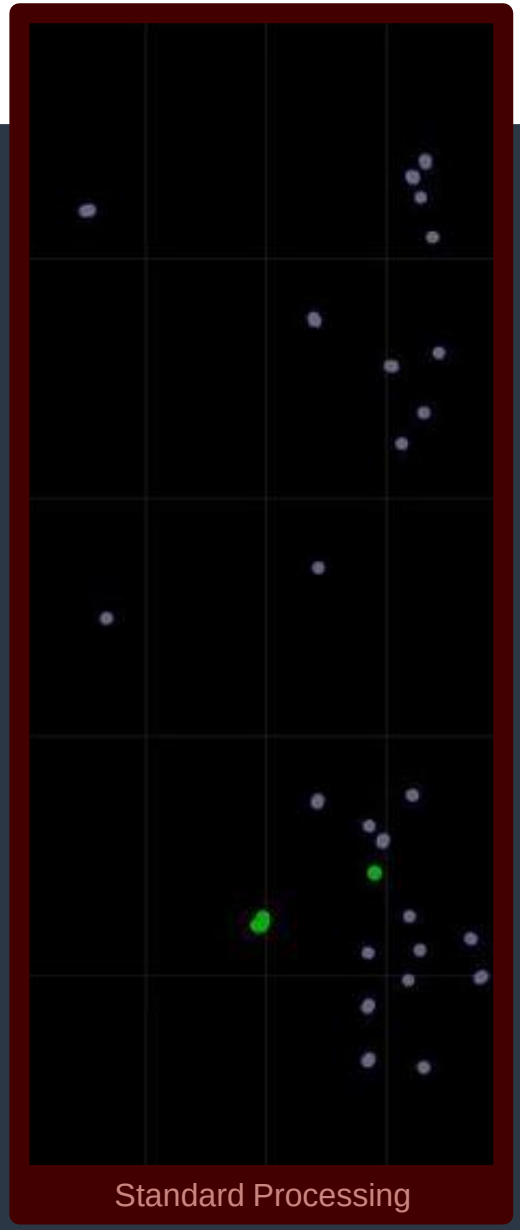
Super-resolution & sparse array algorithms

NXP 4D IMAGING RADAR IS READY TO HIT THE ROAD



STANDARD VS HIGH-RESOLUTION PROCESSING

Hi-Res Processing



Standard Processing

CONVENTIONAL-RADAR VERSUS IMAGING RADAR ANGLE PROCESSING

Conventional ADAS Radar

Array type Uniform Array sometimes with very few holes

Baseline algorithm Beamforming, FFT

Selectively applied algorithm Classic Super Resolution – MUSIC, ESPRIT, DML, etc

Number of targets limited to 2 to 3 per cell

Compute platform on SPT(FFT accelerator) and general-purpose processors

Imaging Radar

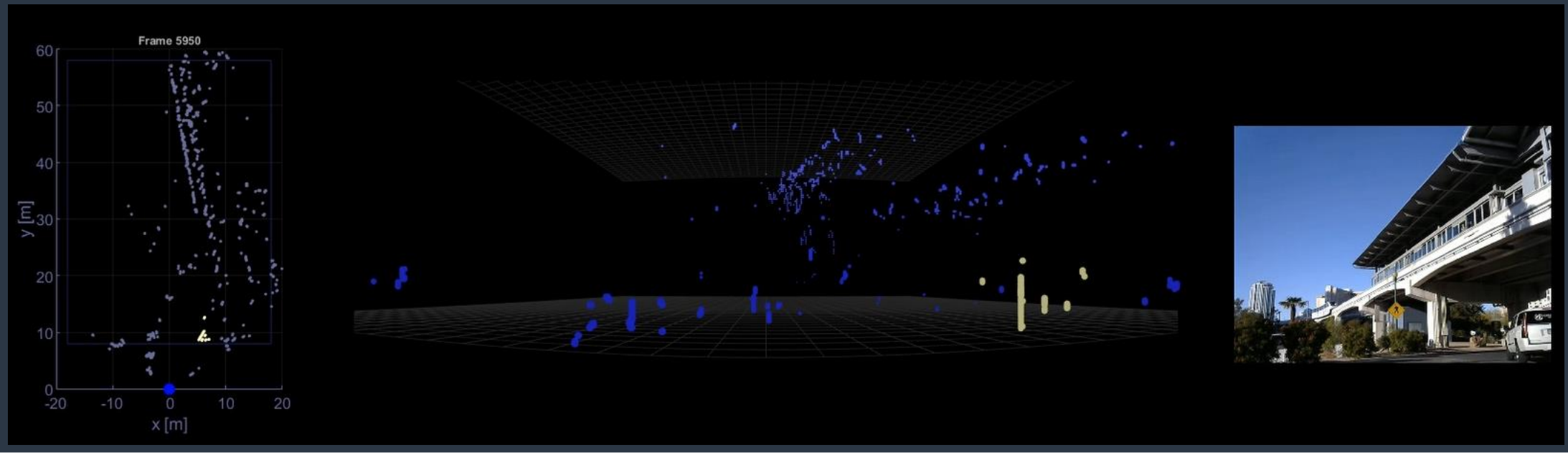
Array type Non-uniform / Sparse array

Baseline algorithms Beamforming, FFT, DFT, Matching Pursuits

Selectively applied algorithm Advanced eigen-space and Bayesian Linear Regression

Number of targets 8 or more

Compute platform on SPT(FFT accelerator), DSP, and Linear Algebra Accelerator



INDOOR PEOPLE WALKING

NXP 4D IMAGING RADAR IS READY TO HIT THE ROAD

- Automotive production Grade 1 solutions from a proven automotive Radar supplier
- Products in the market place now!

NXP Ramps Flagship 4D Imaging Radar Chip to Production, Adds New Product Tailored for Fast-Growing L2+ Market

Jan 4, 2022 9:00 AM PST by NXP Semiconductors Press Release

SHARE

- NXP's flagship S32R45 and new S32R41 processors serve L2+ through L5 autonomy, enabling 4D imaging radar for 360-degree surround sensing
- Based on a common architecture, the S32R radar processors enable software reuse and scalable radar platform development across autonomous driving levels
- At CES, NXP will demonstrate imaging radar with CubTEK and introduce its upcoming radar Tech Day

S32R Radar MPU – High Performance for Imaging Radar

S32R45 Receive alerts

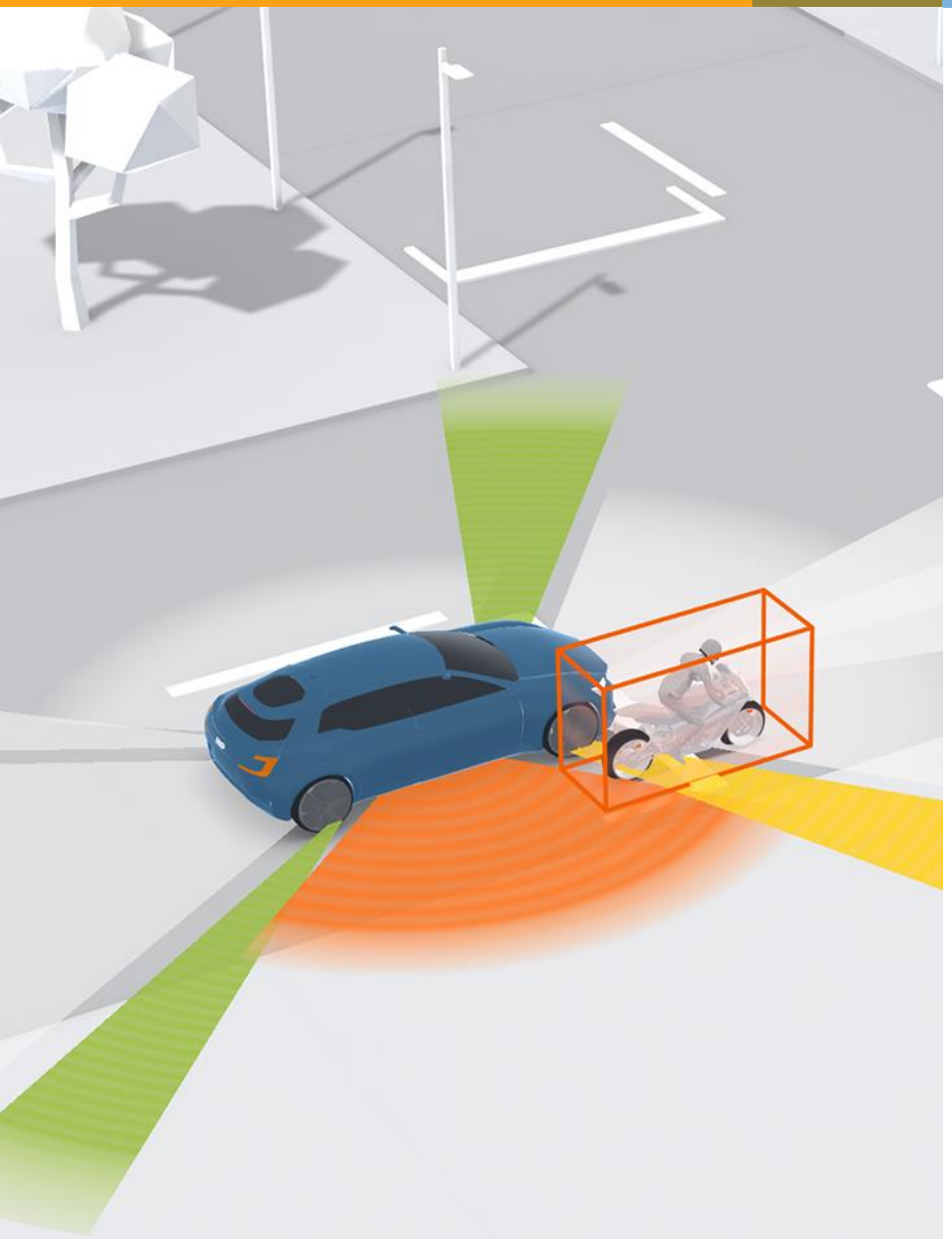
Overview | Product Details | Design Resources | Training | Support | BUY/PARAMETRICS | PACKAGE/QUALITY

Roll over image to zoom in

S32R45 is a 32-bit automotive radar microprocessor unit (MPU) based on Arm® Cortex® - A53 and Arm® Cortex® - M7 cores. Focused on advanced high resolution long-range front or rear radar sensors, providing imaging radar resolution capabilities. The high performance radar processing and power efficiency enable the latest ADAS radar applications with a dedicated processor suitable for volume adoption, while also covering industrial and consumer applications where dedicated high performance radar processing is required.

Designed to satisfy the latest security requirements through its HSE security engine, and meeting ASIL ISO26262 ASIL B(D) requirements, the S32R45 is the complete device for high performance radar processing.

For additional information and sample availability, contact NXP support.



We Recommend the Driving Automation and Radar Training Academy

- Visit additional classes on this topic
  nxp.com/drivingautomationacademy

Q&A

TECHNOLOGY SHOWROOM

JOURNEYS BY DESIRED ENGAGEMENT

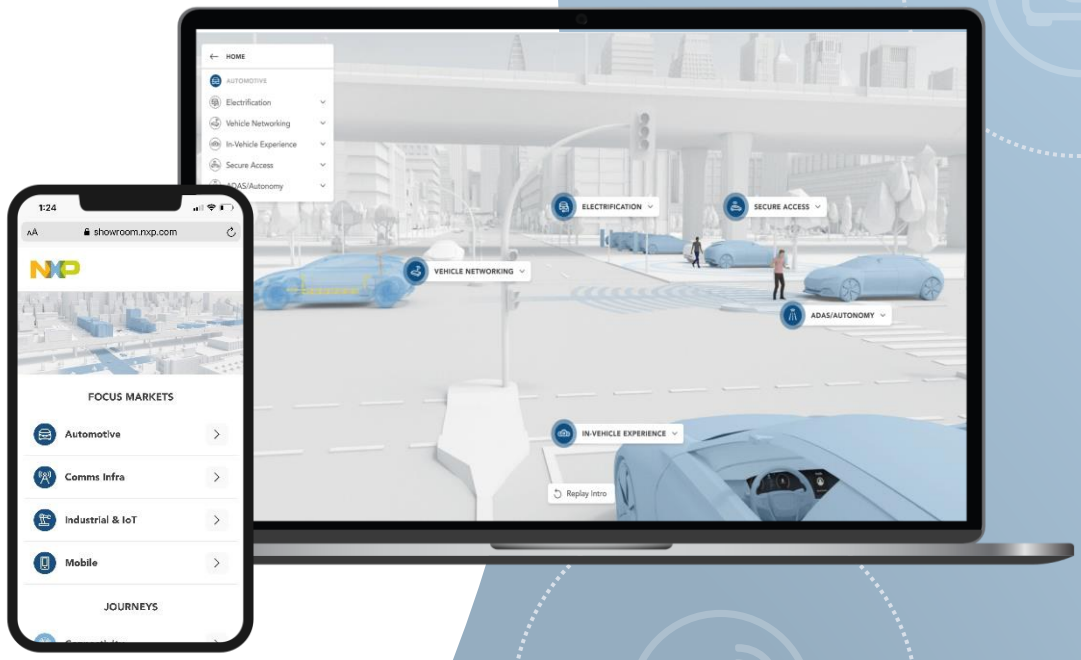
Self-guided tour
Live-streaming at set times
Guided tours

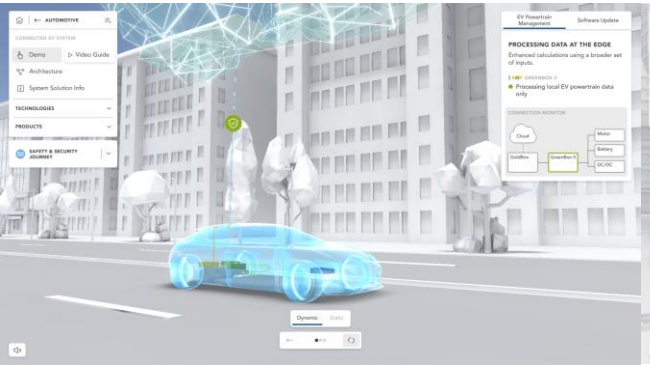
60+ VIRTUAL DEMOS

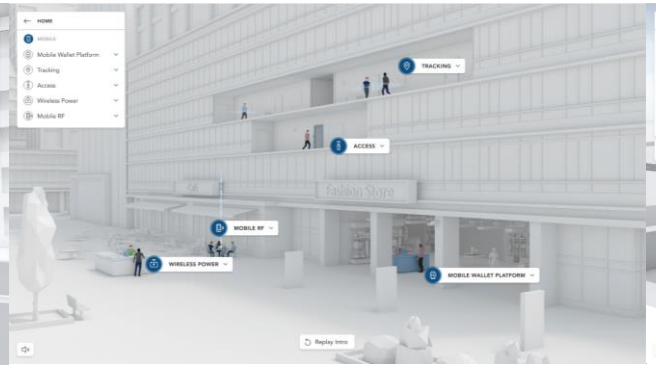
Focus on system solutions
Set up along NXP verticals

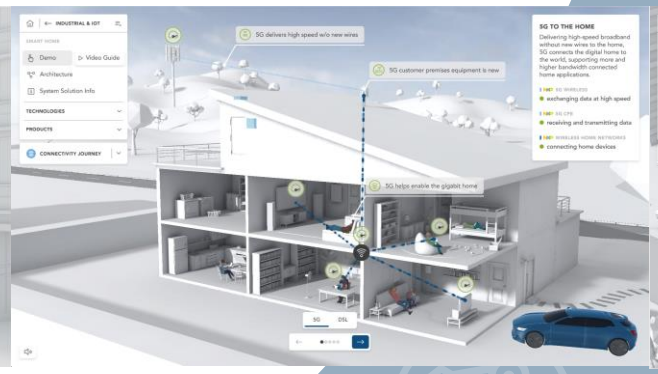
JOURNEYS BY DESIRED FOCUS

Low Power Innovations
Advanced Analog
Connectivity
Edge & AI/ML
Safety & Security









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