



NXP's 28nm RFCMOS Radar Solutions

深入探讨 28nm RFCMOS 雷达解决方案

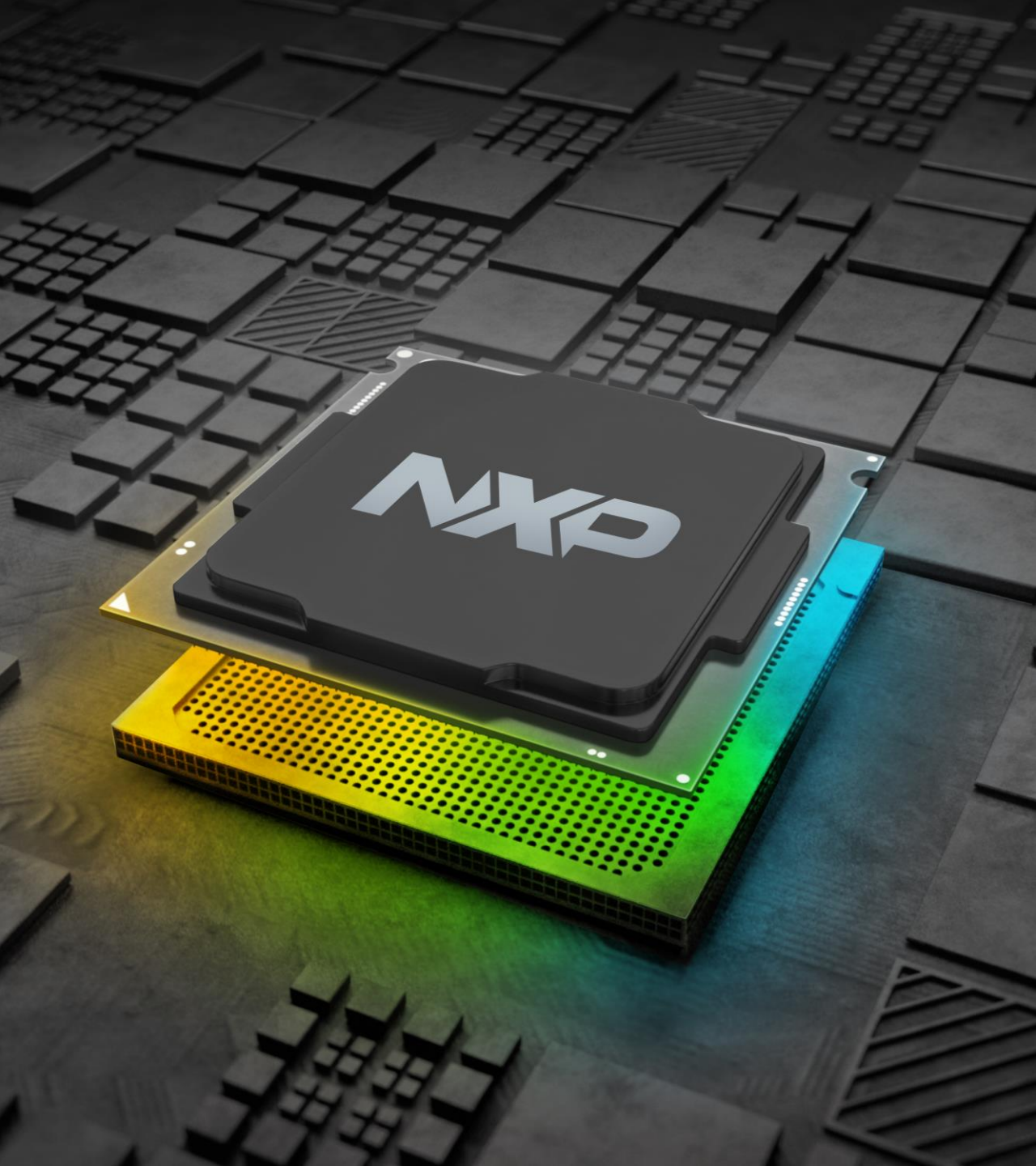
Chang Yang 杨昌

Product Marketing Manager, GC & SAP

产品市场经理

May 2024

| Public | NXP and the NXP logo are trademarks of NXP B.V. All other product or service names are the property of their respective owners. © 2024 NXP B.V.



Agenda

1. Vehicle architectures 车载电子电气架构
2. Radar in different vehicle architectures 不同电子电气架构中的雷达传感器
3. NXP radar solutions portfolio 恩智浦雷达解决方案组合
4. Introduction to NXP's 28nm single-chip solutions 恩智浦 28 纳米单芯片解决方案介绍
5. New antenna technologies (Launcher-in-Package) 新型天线技术
6. Summary 总结

Vehicle architectures

车载电子电气架构

Software defined vehicles
软件定义汽车

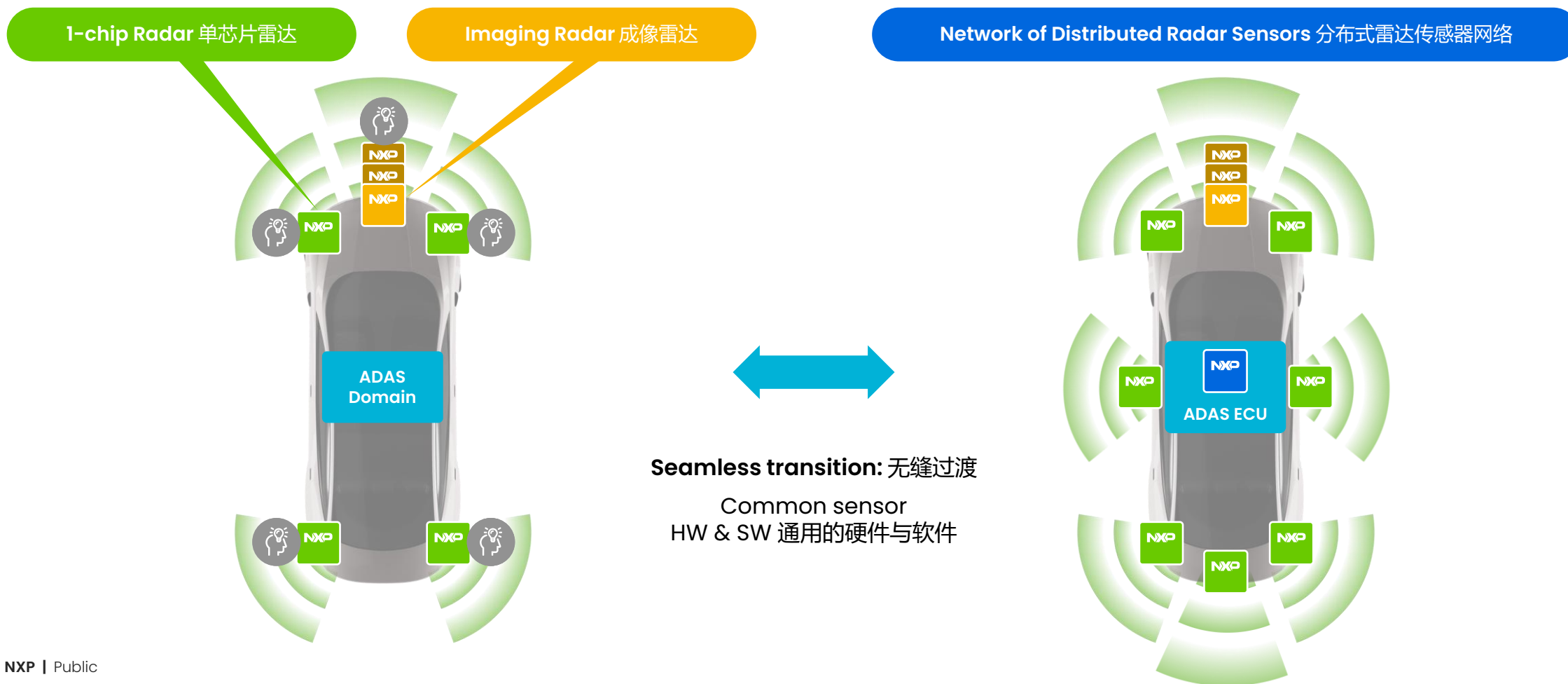


Extended NXP automotive radar platform serves SDV architectures 服务于 SDV 架构的扩展的恩智浦汽车雷达平台

Seamless transition from smart sensors to network of sensors 从智能传感器到传感器网络的无缝过渡

Today: 现在
Smart sensors 智能传感器
(Edge processing) (边缘处理)

Tomorrow: 未来
Streaming sensors 流式传感器
(Distributed processing) (分布式处理)

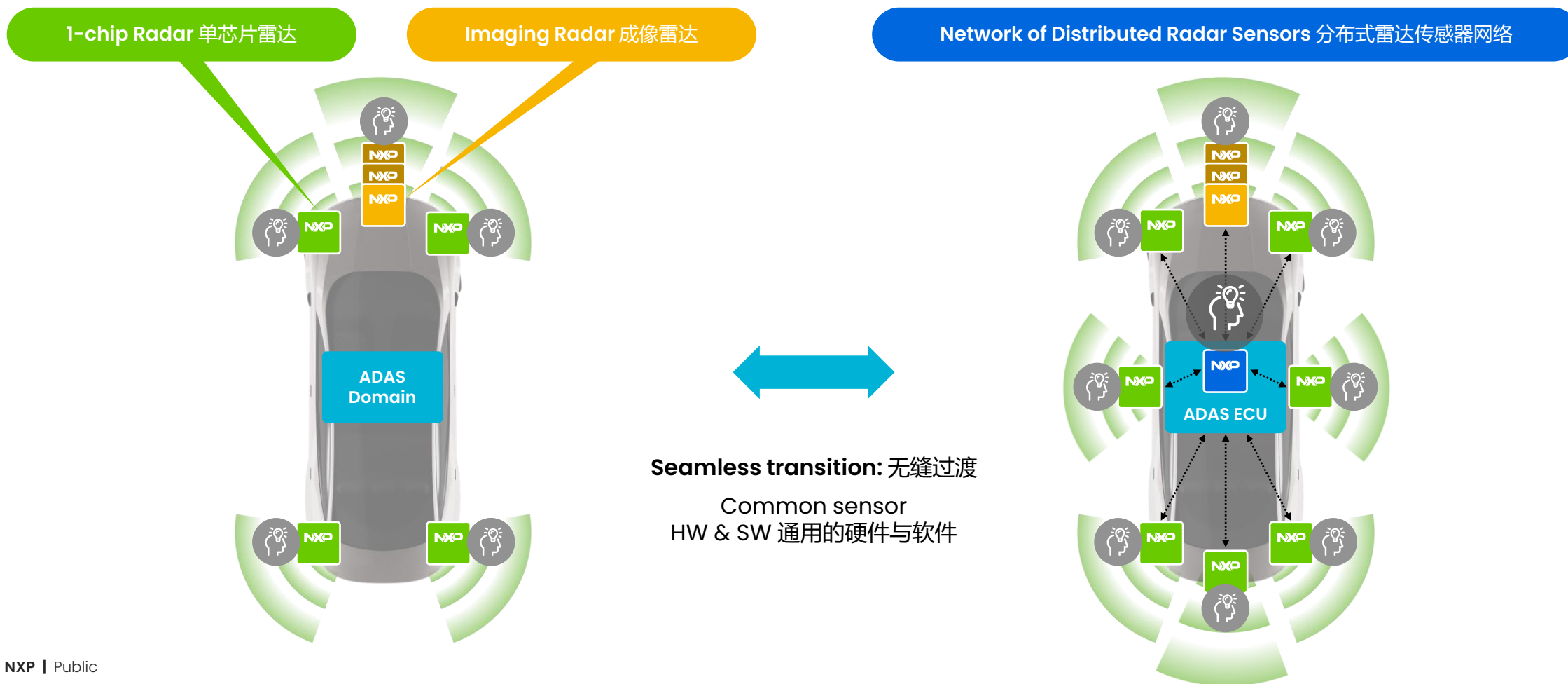


Extended NXP automotive radar platform serves SDV architectures 服务于 SDV 架构的扩展的恩智浦汽车雷达平台

Seamless transition from smart sensors to network of sensors 从智能传感器到传感器网络的无缝过渡

Today:现在
Smart sensors 智能传感器
(Edge processing) (边缘处理)

Tomorrow:未来
Streaming sensors 流式传感器
(Distributed processing) (分布式处理)



Extended NXP automotive radar platform serves SDV architectures 服务于 SDV 架构的扩展的恩智浦汽车雷达平台

Common HW & SW for both smart sensors and network of sensors 服务于智能传感器和传感器网络的通用硬件和软件

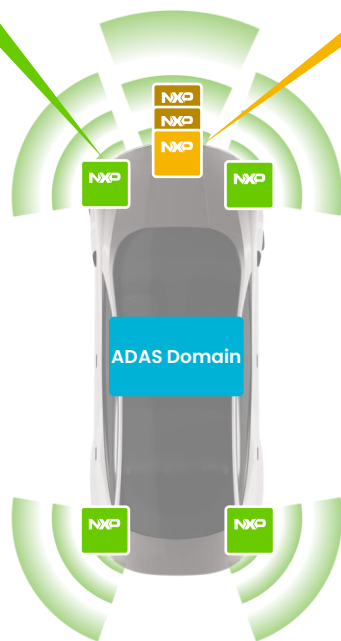


1-chip Radar 单芯片雷达

Imaging Radar 成像雷达

Network of Distributed Radar Sensors 分布式雷达传感器网络

Today:现在
Smart sensors 智能传感器
(Edge processing) (边缘处理)



Seamless transition: 无缝过渡

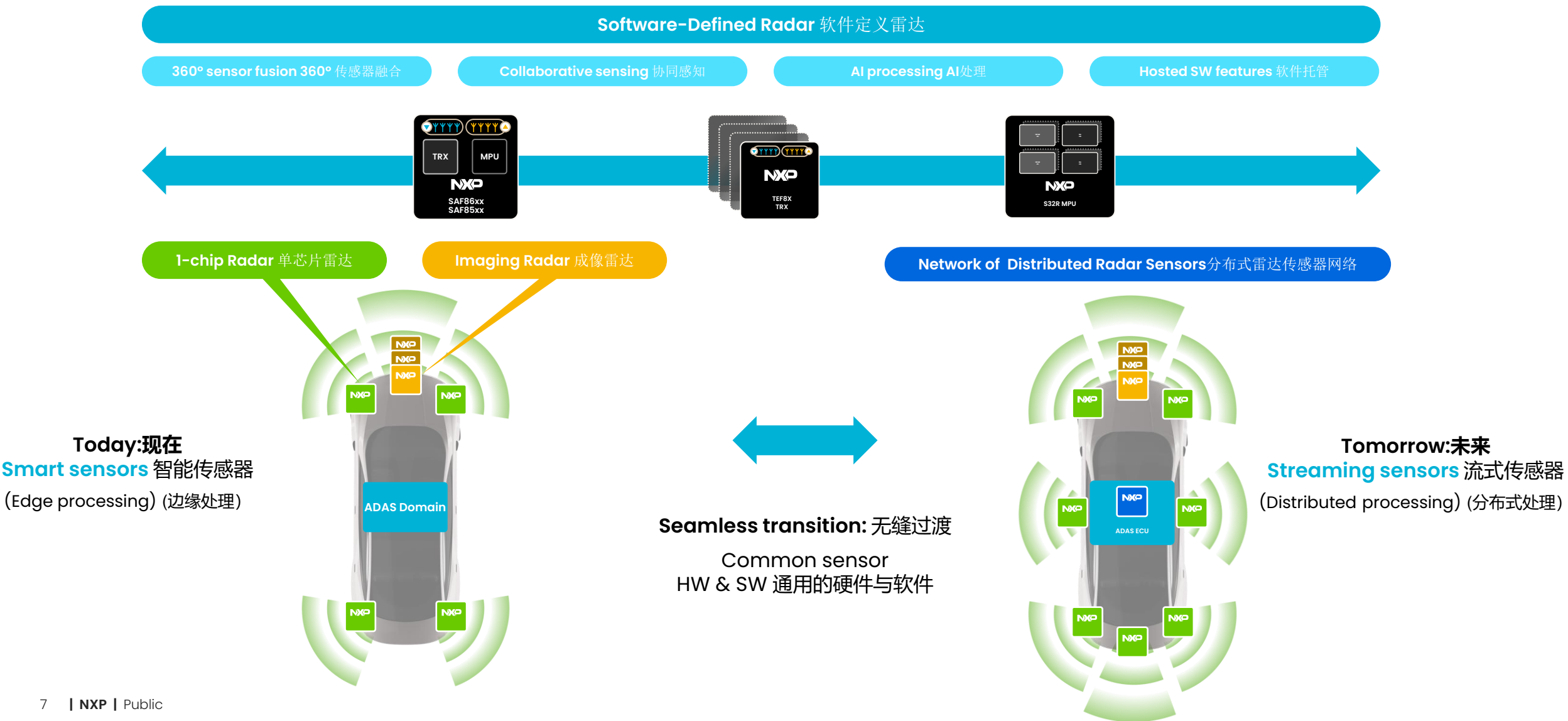
Common sensor
HW & SW 通用的硬件与软件

Tomorrow:未来
Streaming sensors 流式传感器
(Distributed processing) (分布式处理)



NXP automotive radar platform enables software defined radar 恩智浦汽车雷达平台实现软件定义雷达

New sensing capabilities for software-defined vehicles 服务于软件定义汽车的新传感功能



Radar in SW-defined vehicles

软件定义汽车中的 雷达

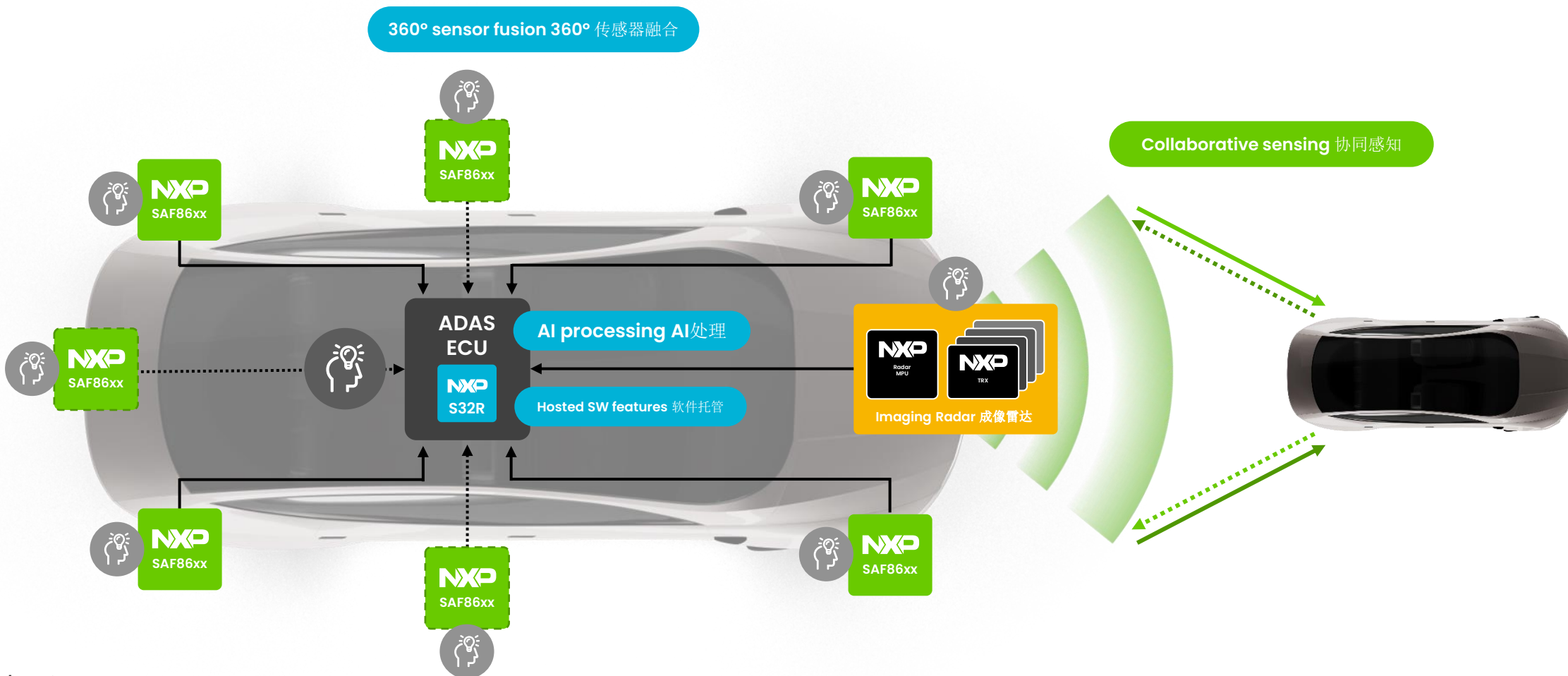
Connected, adaptable & upgradeable
互联, 可调 & 可升级



SAF86xx + S32R system solution for software-defined radar 用于软件定义雷达的 SAF86xx + S32R 系统解决方案

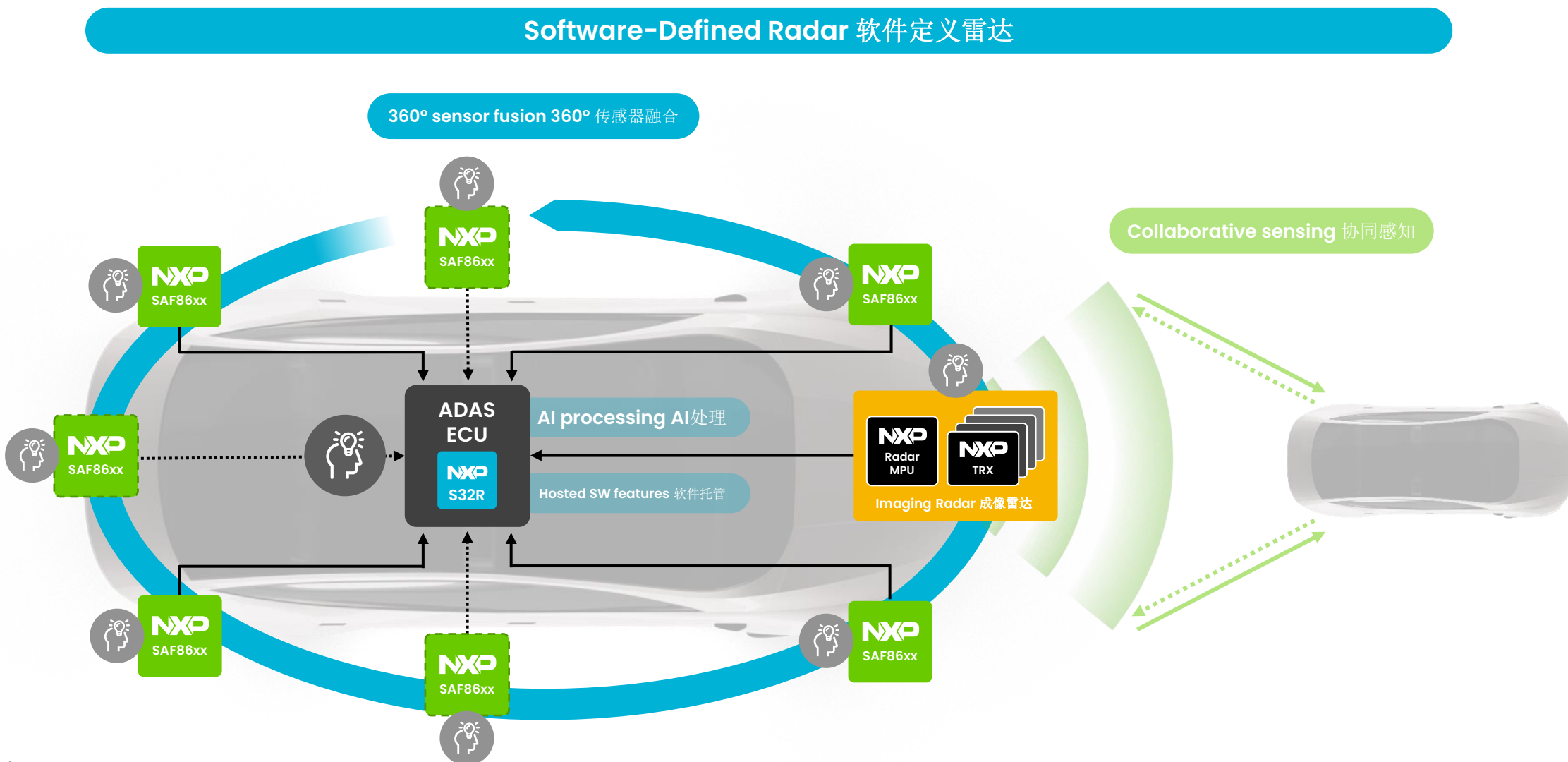
Enabling advanced system features for software-defined vehicles 为软件定义的车辆提供先进的系统功能

Software-Defined Radar 软件定义雷达



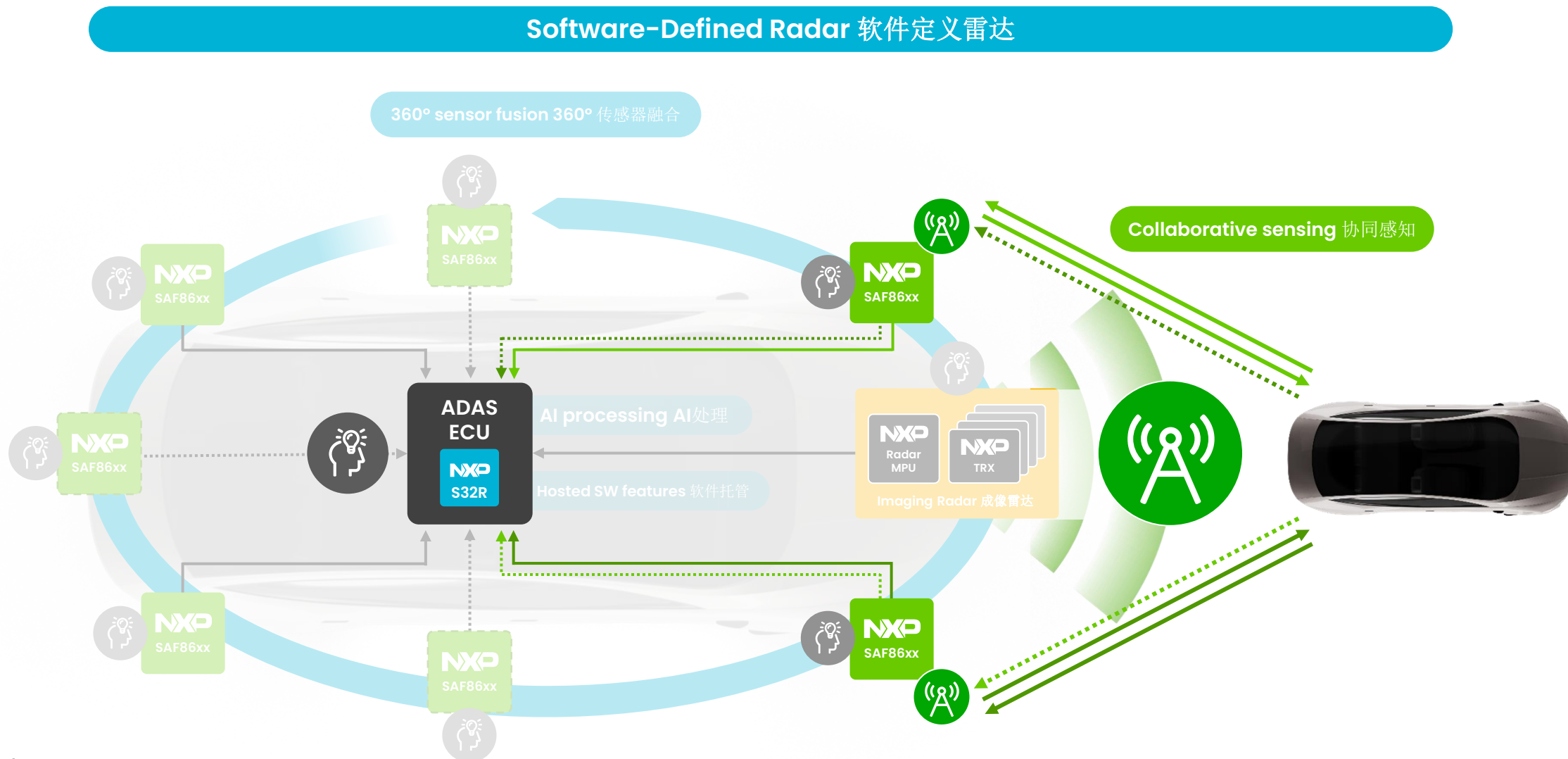
SAF86xx + S32R system solution for software-defined radar 用于软件定义雷达的 SAF86xx + S32R 系统解决方案

Enabling 360° surround sensing 实现360°环视感知



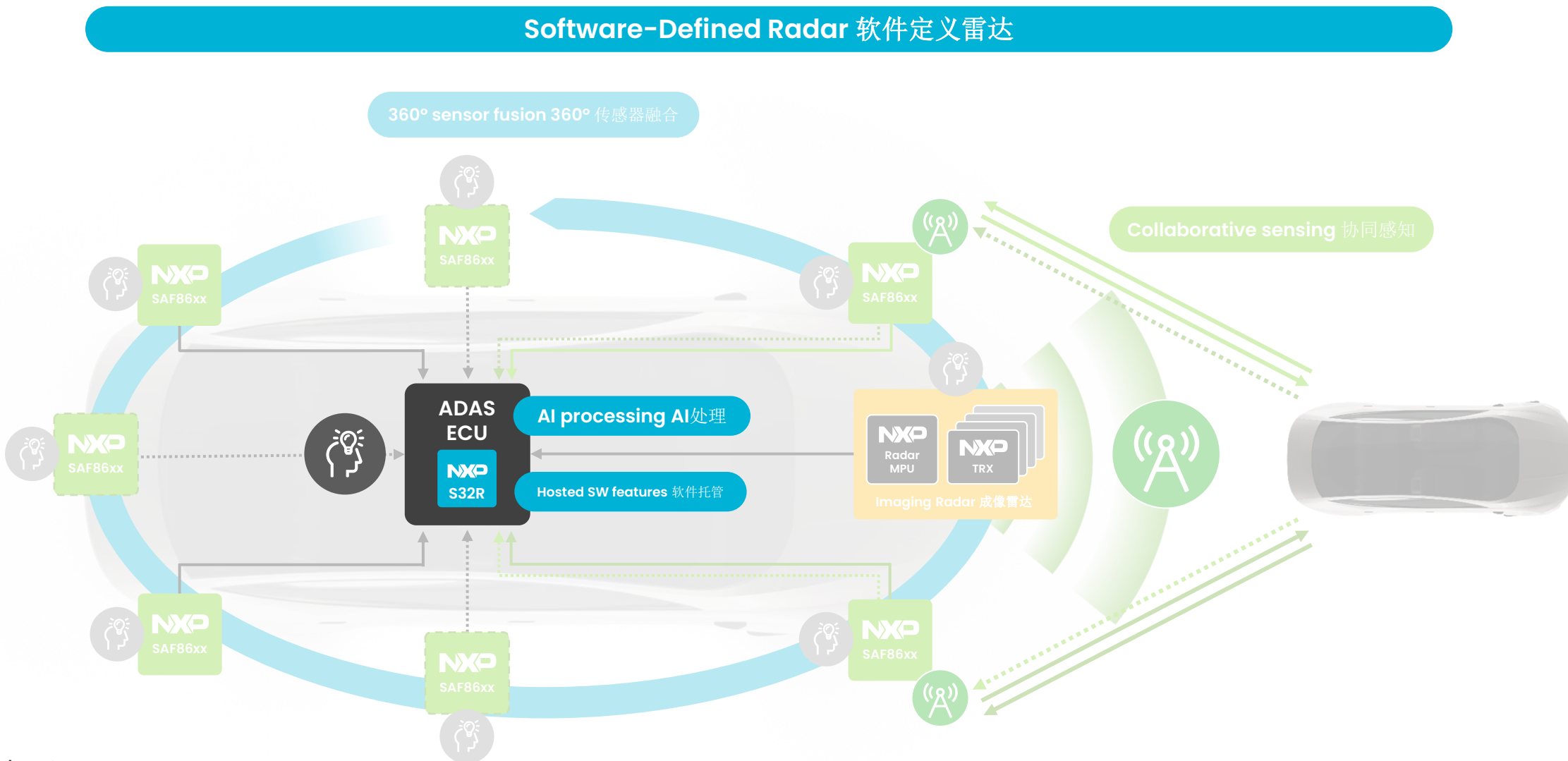
SAF86xx + S32R system solution for software-defined radar 用于软件定义雷达的 SAF86xx + S32R 系统解决方案

Enabling high-resolution collaborative sensing 实现高分辨率协同感知



SAF86xx + S32R system solution for software-defined radar 用于软件定义雷达的 SAF86xx + S32R 系统解决方案

Enabling hosted software features and AI processing 实现软件托管与AI处理



NXP radar solutions portfolio

恩智浦雷达解决方案组合

Scalable, serving all vehicle architectures
可扩展，服务于所有车载电子电气架构



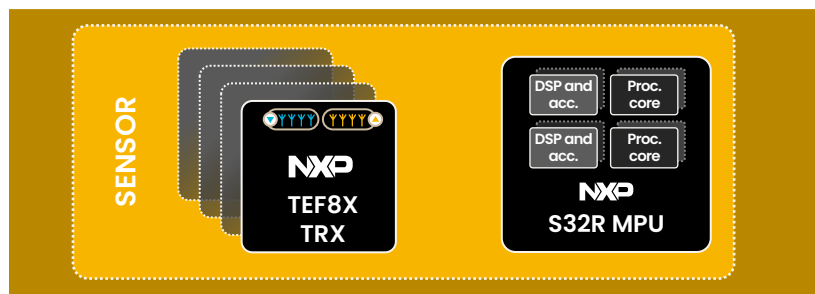
NXP scalable automotive radar platform to date 现有恩智浦可扩展汽车雷达平台

Common architecture for all sensor types 适用于所有传感器类型的通用架构

Today: 现在
Smart sensors 智能传感器

IMAGING RADAR
77 GHz
成像雷达

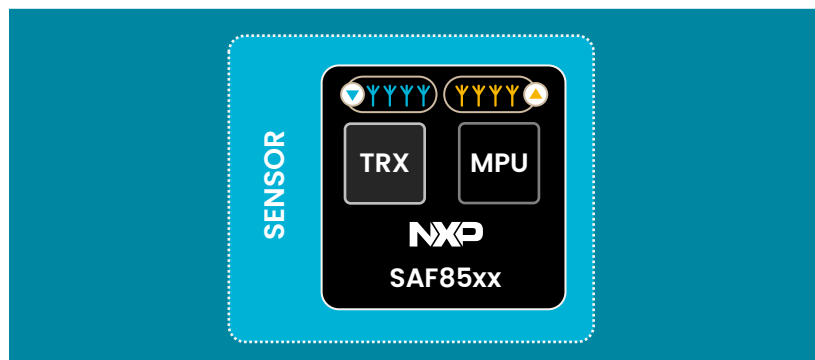
Highest resolution and performance
最高分辨率与性能



High-resolution imaging radar chipsets
高分辨率成像雷达芯片组

LONG-RANGE RADAR
77 GHz
长距离雷达

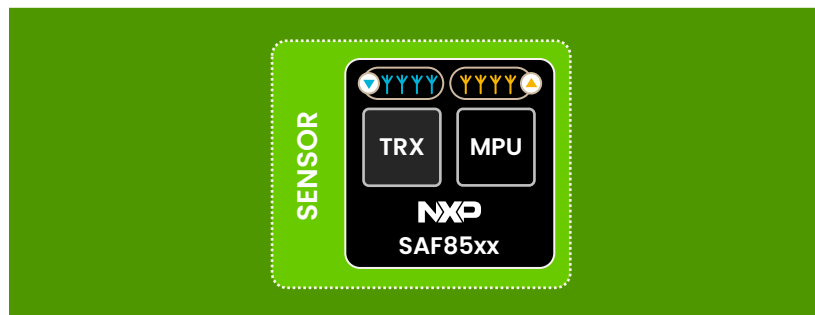
Front and rear higher performance
前向与后向高性能感知



High-performance 28nm 1-chip radar for 360° surround sensing
用于 360° 环视感知的高性能 28nm 单芯片雷达

CORNER RADAR
77 GHz
角雷达

Multiple small modules
多个小尺寸模块



Proven security and functional safety customers can trust
经过验证的加密技术与功能安全性，值得客户信赖

Serves all sensor types:
Corner, front & 4D imaging radar
服务于所有传感器类型：前向，前角后角，4D成像雷达

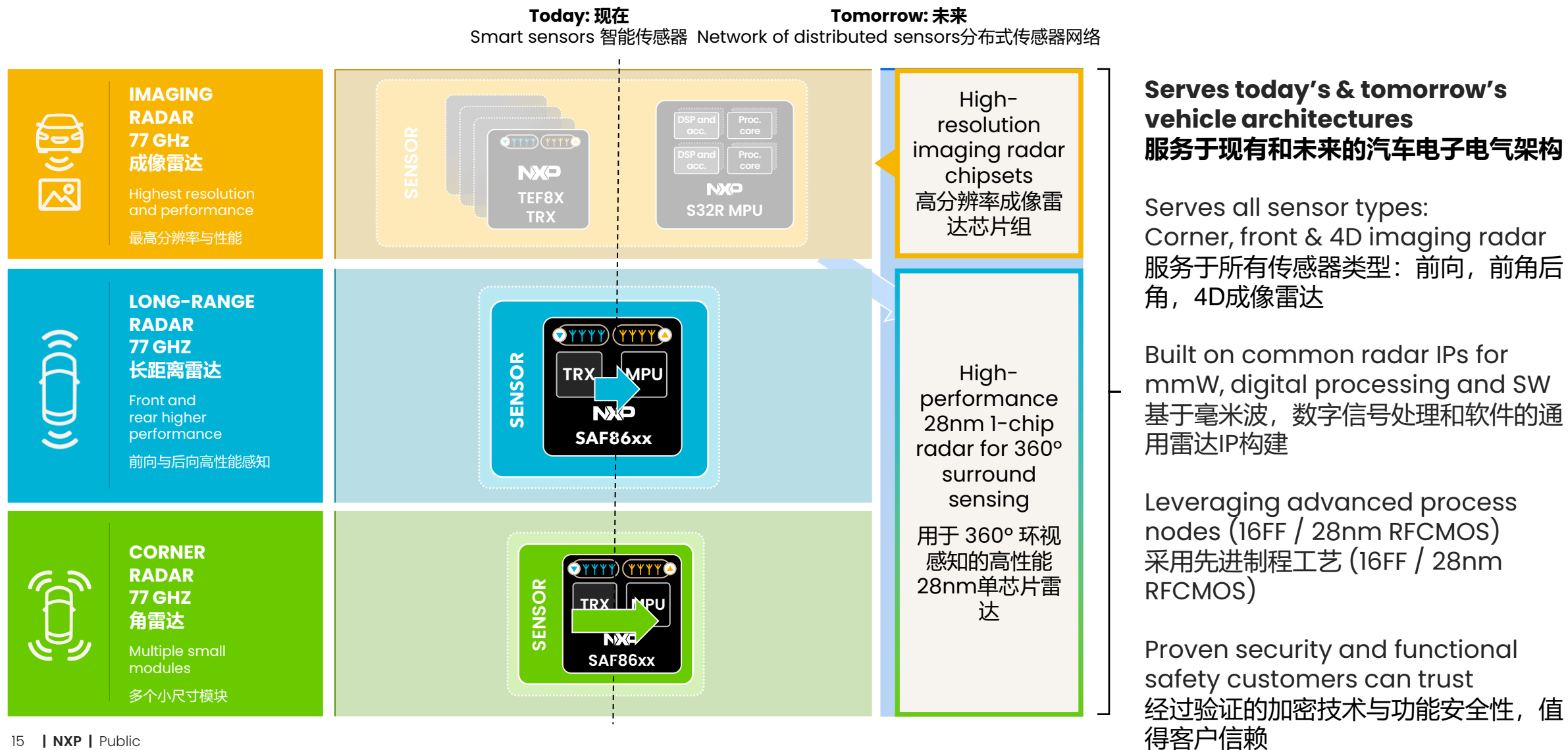
Built on common radar IPs for mmW, digital processing and SW
基于毫米波，数字信号处理和软件的通用雷达IP构建

Leveraging advanced process nodes (16FF / 28nm RFCMOS)
采用先进制程工艺 (16FF / 28nm RFCMOS)

Proven security and functional safety customers can trust
经过验证的加密技术与功能安全性，值得客户信赖

Extended NXP scalable automotive radar platform 恩智浦可扩展汽车雷达平台延伸

Common architecture for all sensor types & new vehicle architectures 适用于所有传感器类型及新型车载电子电气架构的通用架构





Advanced Automotive Radar SoC for Next-Gen ADAS and AD Autonomous Driving Systems 用于下一代 ADAS 和 AD 自动驾驶系统的先进汽车雷达 SoC

Industry-first 28nm RFCMOS radar one-chip 业界首款 28 纳米 RFCMOS 雷达单芯片

enables advanced 4D sensing for safety-critical ADAS use cases and a 30% reduced sensor size vs. previous generation
可实现先进的 4D 感知，用于安全关键型 ADAS 功能，传感器尺寸相较前代可优化30%

Gen3 RFCMOS delivers performance step-up 第 3 代 RFCMOS 技术助力性能阶梯式提升

2x RF performance & + 40% compute power vs. previous generation
相较前代产品，射频性能提高 2 倍，算力提高 40%

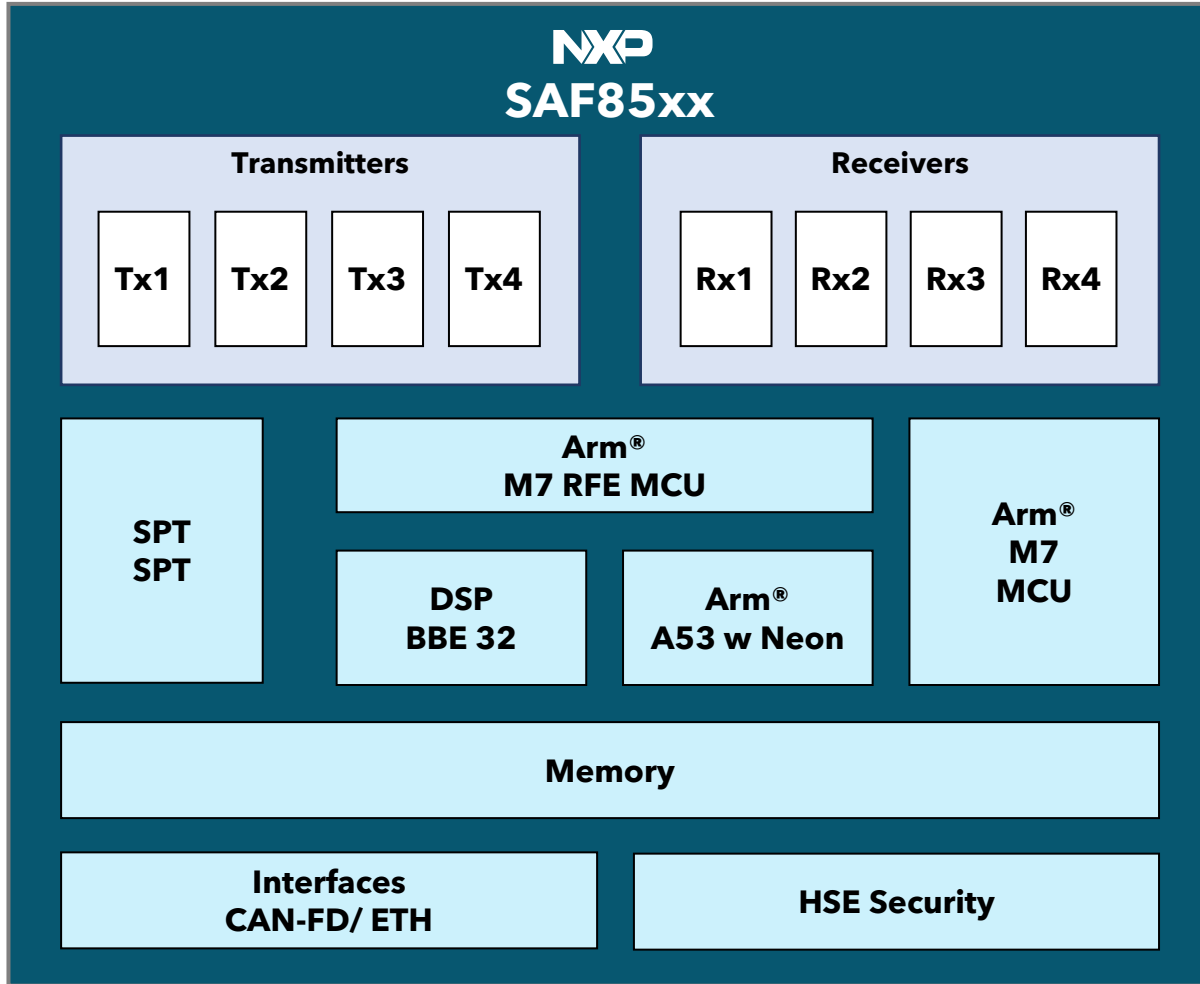
Scalable platform including advanced radar software 可扩展平台包含进阶的雷达软件

support today's & tomorrow's OEM ADAS architectures
支持现有和未来的车厂 ADAS 架构

SAF85xx offers high level of Integration SAF85xx 提供高阶集成度

Powerful 4D radar in a small form factor 外形小巧、性能强大的 4D 雷达

Sampling now
SOP 1Q25



Highly integrated radar SoC 高集成度雷达SoC

Four high performance transmitters & receivers
4个高性能发射器与接收器
Multiple processor cores
多个处理内核
Integrated memory and system interfaces
集成内存与系统接口

Efficient compute for Radar 用于雷达的高效计算

Integrated Radar Accelerator for efficient FFT processing
集成用于高效FFT处理的雷达信号加速器
High performance DSP and Arm cores offers a good mix for radar processing
高性能DSP和Arm内核为雷达信号处理提供强大组合
Arm® core for AUTOSAR® implementation
支持AUTOSAR® 实现的Arm® 内核

Sampling now and supporting design-ins 有样品

PLUTO sensor

SAF85xx based reference design for mainstream radar applications

基于 SAF85xx 的主流雷达应用参考设计

Full NXP system solution

- Radar SoC SAF8544
- Power Supply Solution FS5600 + PF5103
- Automotive Ethernet PHY TJA1120B

Performance

- Operates at 76–81 GHz
- Range of up to 225m@5dBsm RCS
- 140° field of view
- 5 GHz, effective chirp BW up to 4 GHz

Interfaces

- 1 x SGMII Gbit Ethernet 10/100/1000 Mbit/s
- 2 x CAN-FD
- JTAG, I2C, CSI, UART/CAN

Small dimensions

- 60 x 60 x 35mm



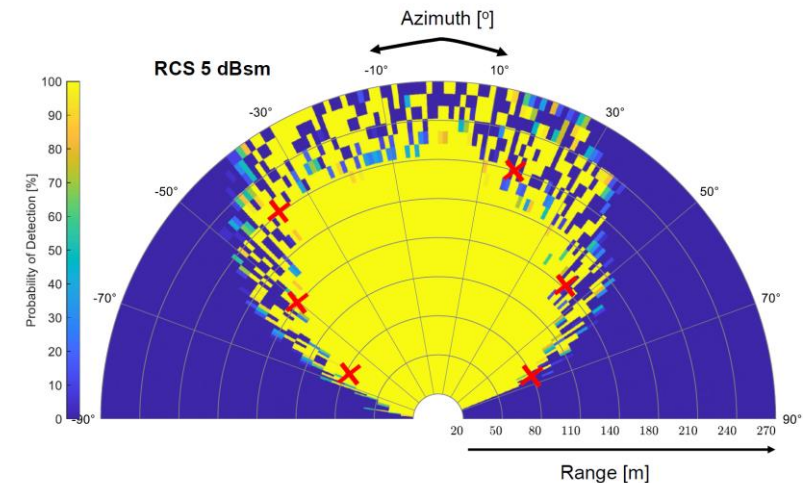
Safe power management



Radar 1-chip



In-vehicle networking



NXP introduces 恩智浦推出

SAF86xx next-gen 28nm radar SoC

Enables new ADAS architectures for
software-defined vehicles
为软件定义的汽车提供全新的 ADAS 架构

Forms network of distributed radar sensors,
together with S32R MPU
与 S32R MPU 一起组成分布式雷达传感器网络

Unleashes powerful software-
defined radar features
释放软件定义雷达的强大功能

Builds on market-leading
28nm RFCMOS radar technology
基于市场领先的 28 nm RFCMOS 技术



Sampling now
SOP 2Q25

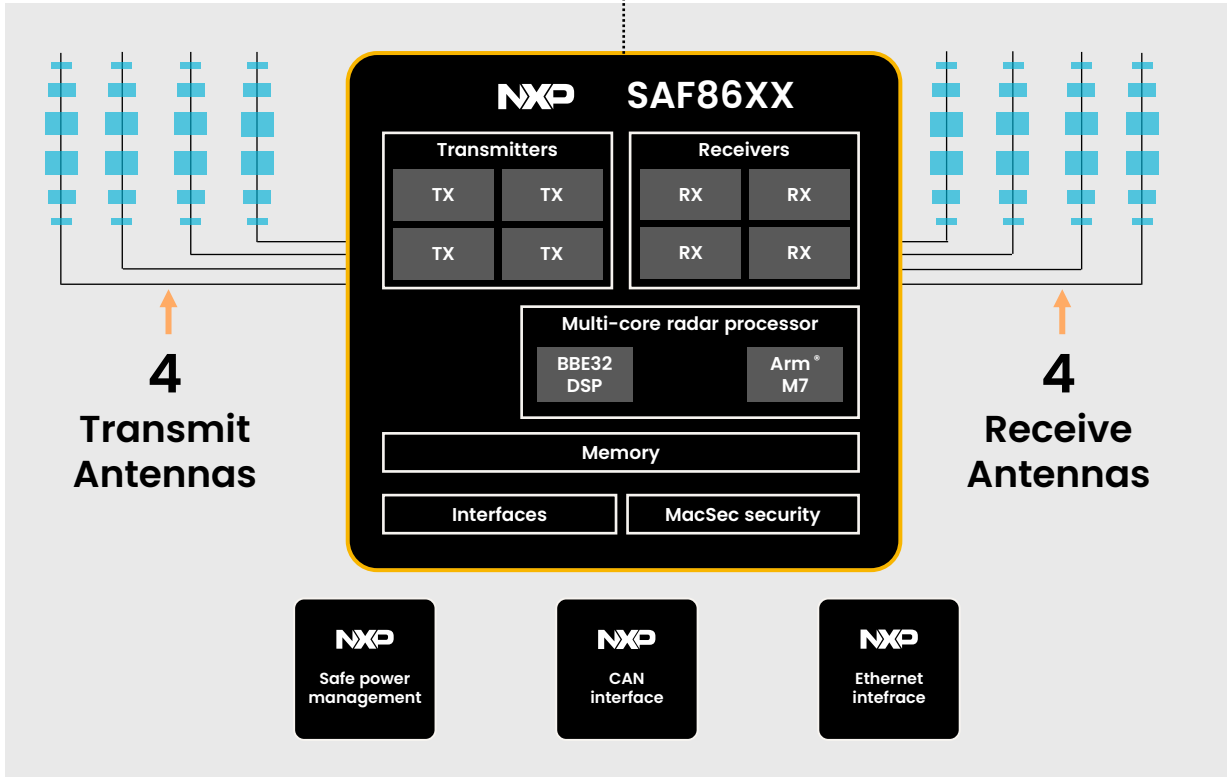


360° corner sensing



4D long range sensing

28nm
Radar 1-chip



NXP 4th gen high performance RFCMOS radar 恩智浦 4 代高性能 RFCMOS 雷达

SAF86xx supporting zonal and centralized architectures
SAF86xx 支持zonal和中央式架构

Superior RF performance enabling up to 300 m range 卓越的射频性能，距离可达 300 米

10% reduced power dissipation versus 1st gen. SoC solution 功耗相较于第一代SoC下降10%

Enabling leaner, higher resolution surround view sensor heads 实现更精简、高分辨率的环视感知

Supporting central & zonal radar post-processing 支持zonal和中央式雷达信号后处理

Streaming pre-processed range FFT over Gigabit Ethernet 通过千兆以太网串流预处理的1D FFT

Latest security supported by HSE and MACsec HW 由 HSE 和 MACsec 硬件支持的最新加密技术

Supporting software defined vehicles 支持软件定义车载架构

New antenna technologies

新型天线技术

Launcher-In-Package



SAF8x + launcher in package with 3D waveguide antenna SAF8x + LIP与 3D 波导天线的组合

Next level in automotive radar sensor performance 汽车雷达传感器性能的下一阶段

Gen2 RFCMOS Radar

NXP
TEF82xx
2022 release

Up to 300m range

Sub-1 degree angular resolution



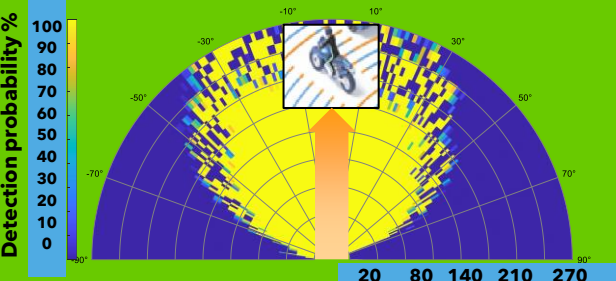
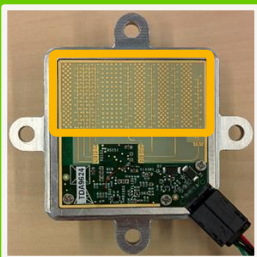
2x
RF
performance
increase

NXP
SAF85xx
SAF86xx

Gen3 RFCMOS Radar (28nm)

Up to **200m detection range** with PCB antenna

Motor cycle target (RCS 5 dBsm)

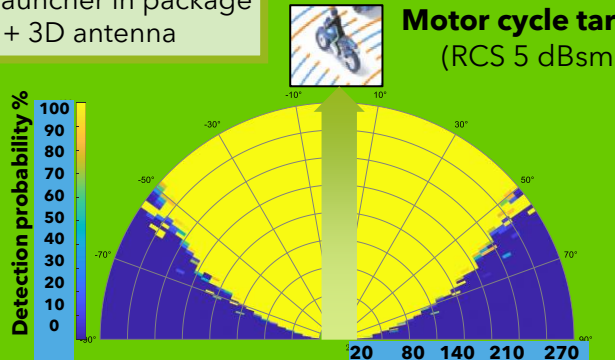

Up to 9 dB
RF link budget
increase at
sensor level

NXP
SAF85xxL
SAF86xxL

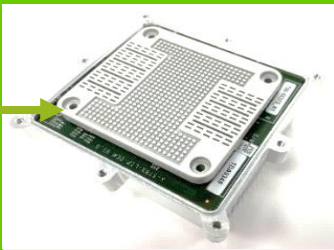
Gen3 RFCMOS Radar + Launcher in Package (LiP)

>300m detection range with launcher in package + 3D antenna

Motor cycle target (RCS 5 dBsm)




3D waveguide antenna
HUBER+SUHNER



Gen2 Racerunner Radar MCU

NXP
S32R29
2021 release

First 16nm Radar MCU



+40%
compute
performance
increase



Take-aways 总结

Fully scalable system solutions for all vehicle architectures

可扩展的系统解决方案，适用于所有车辆架构

Enabling seamless transition to software-defined vehicle architectures

实现向软件定义车辆架构的无缝过渡

Building on market-leading 28nm RFCMOS radar technology

基于市场领先的 28 纳米 RFCMOS 技术

2x performance than previous generations

强大的射频性能

Supporting latest antenna technologies

支持最新天线技术

Tour our immersive all-digital **technology showroom** from anywhere in the world, in just one click.

Journeys | focus

- Automotive
- Industrial & IoT
- Mobile
- Communication Infrastructure
- Smart city
- Smart home

Journeys | engagement

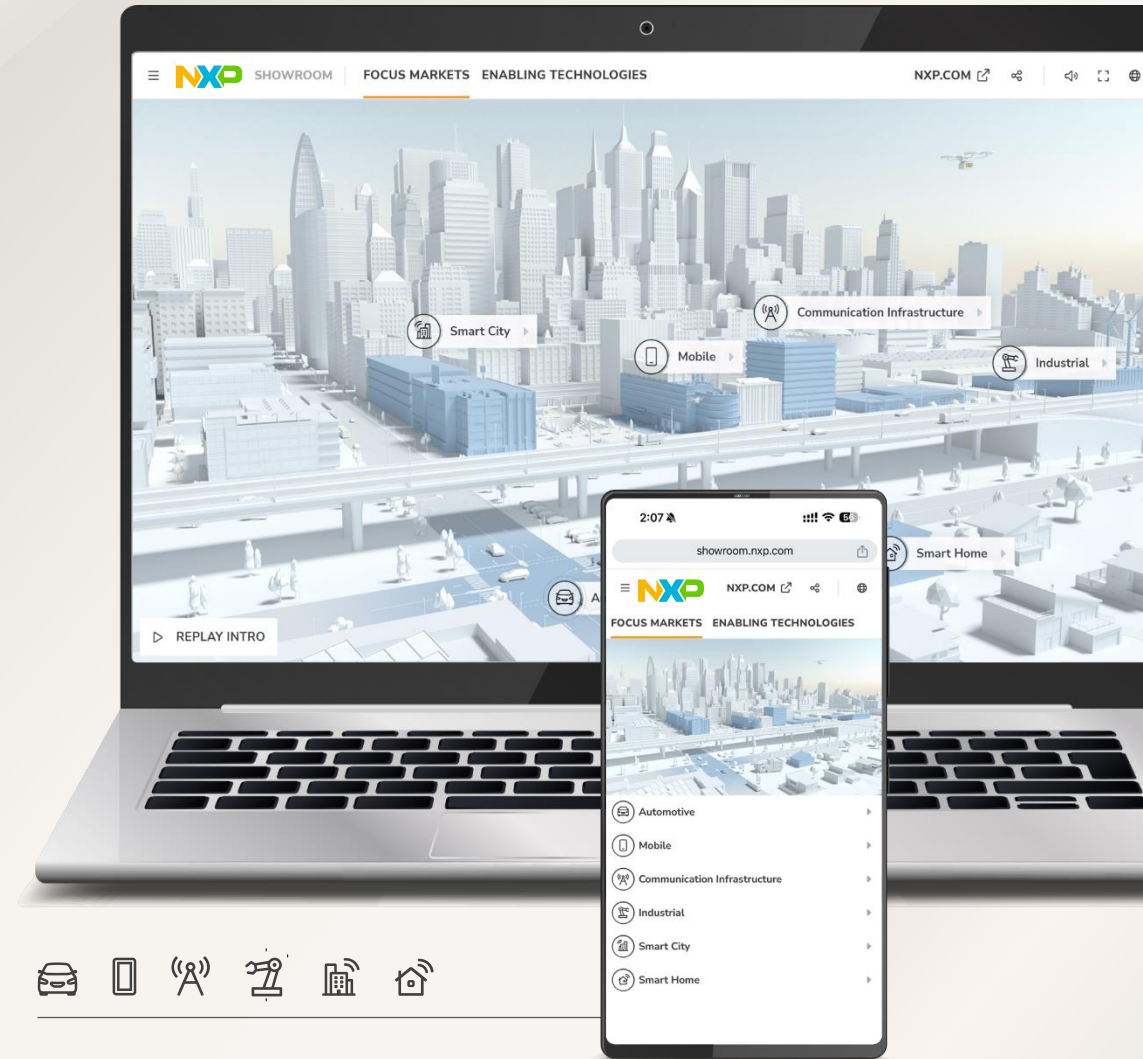
- Self-guided tour
- Live-streaming at set times
- Guided tours

Journeys | enabling technologies

- Edge & AI/ML
- Safety & security
- Connectivity
- Advanced analog
- Sustainability
- Low power innovations

40+ virtual demos

- Focus on system solutions
- Set up along NXP verticals



showroom.nxp.com





**Brighter
Together**

nxp.com/radar

| Public | NXP and the NXP logo are trademarks of NXP B.V. All other product or service names are the property of their respective owners. © 2024 NXP B.V.