QNX Software Development Platform (SDP) 8.0

Next Generation Performance and Scalability without compromising Safety, Security and Reliability

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Agenda

1. Notable Industry Trends
2. Strategic Roadmap Investments and Product Portfolio Highlights
3. QNX Software Development Platform 8.0

Trends Driving More Powerful Embedded System Software

Important IoT market trends

Increased **software-defined systems** across many industries

Mixed critically systems from increased module consolidation

More CPU needs and **intelligence blending** between cloud and edge

Increased **safety and security** requirements and regulation

High performance computing due to higher functionality expectations

SOCs with 8 or more cores from top silicon vendors

AUTOMOTIVE AND IOT – ESTABLISHED AND NEW DOMAINS

Beware of the Challenges Ahead!

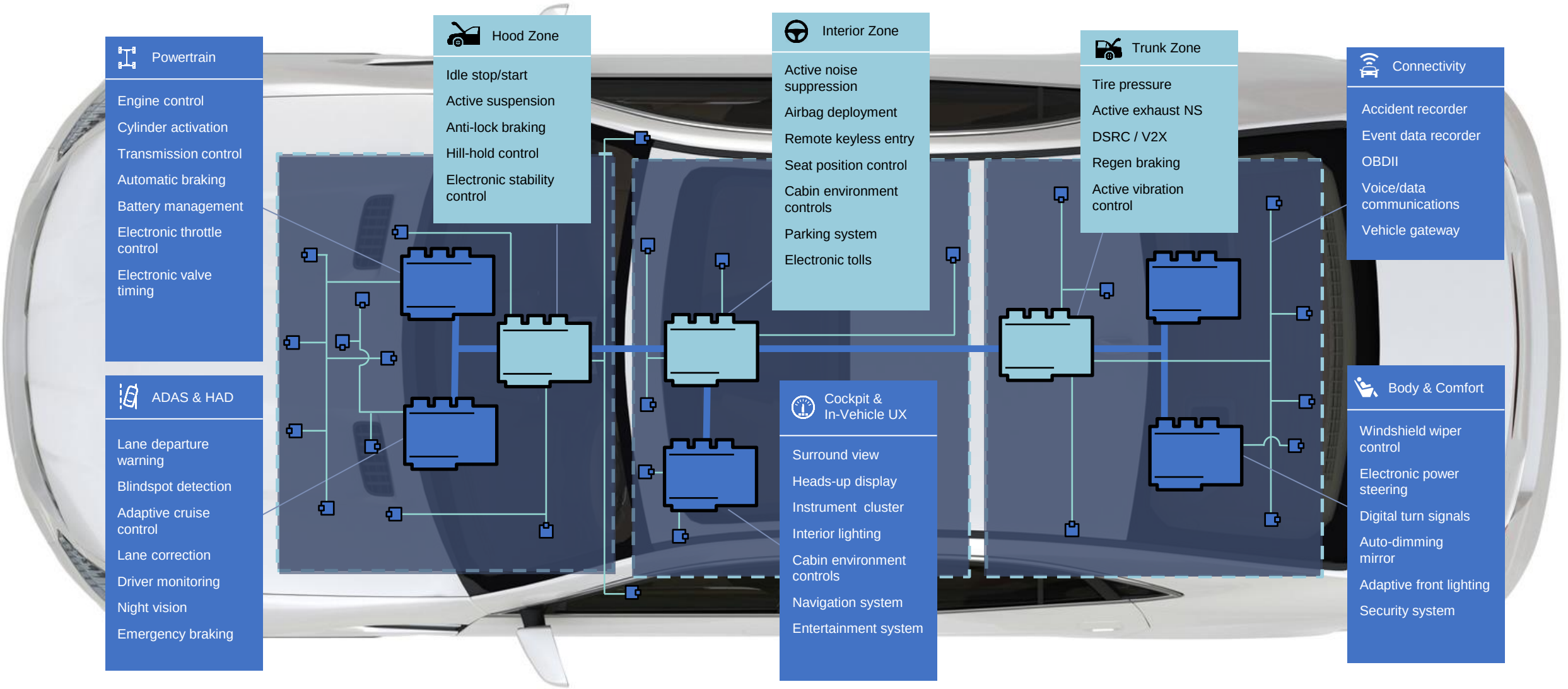
Scale

Complexity

Safety and Security

Cloud

SDV Needs To Address These Challenges



Powertrain
- Engine control
- Cylinder activation
- Transmission control
- Automatic braking
- Battery management
- Electronic throttle control
- Electronic valve timing

ADAS & HAD
- Lane departure warning
- Blindspot detection
- Adaptive cruise control
- Lane correction
- Driver monitoring
- Night vision
- Emergency braking

Hood Zone
- Idle stop/start
- Active suspension
- Anti-lock braking
- Hill-hold control
- Electronic stability control

Interior Zone
- Active noise suppression
- Airbag deployment
- Remote keyless entry
- Seat position control
- Cabin environment controls
- Parking system
- Electronic tolls

Cockpit & In-Vehicle UX
- Surround view
- Heads-up display
- Instrument cluster
- Interior lighting
- Cabin environment controls
- Navigation system
- Entertainment system

Trunk Zone
- Tire pressure
- Active exhaust NS
- DSRC / V2X
- Regen braking
- Active vibration control

Connectivity
- Accident recorder
- Event data recorder
- OBDII
- Voice/data communications
- Vehicle gateway

Body & Comfort
- Windshield wiper control
- Electronic power steering
- Digital turn signals
- Auto-dimming mirror
- Adaptive front lighting
- Security system

SCALE, COMPLEXITY, SAFETY AND SECURITY, CLOUD

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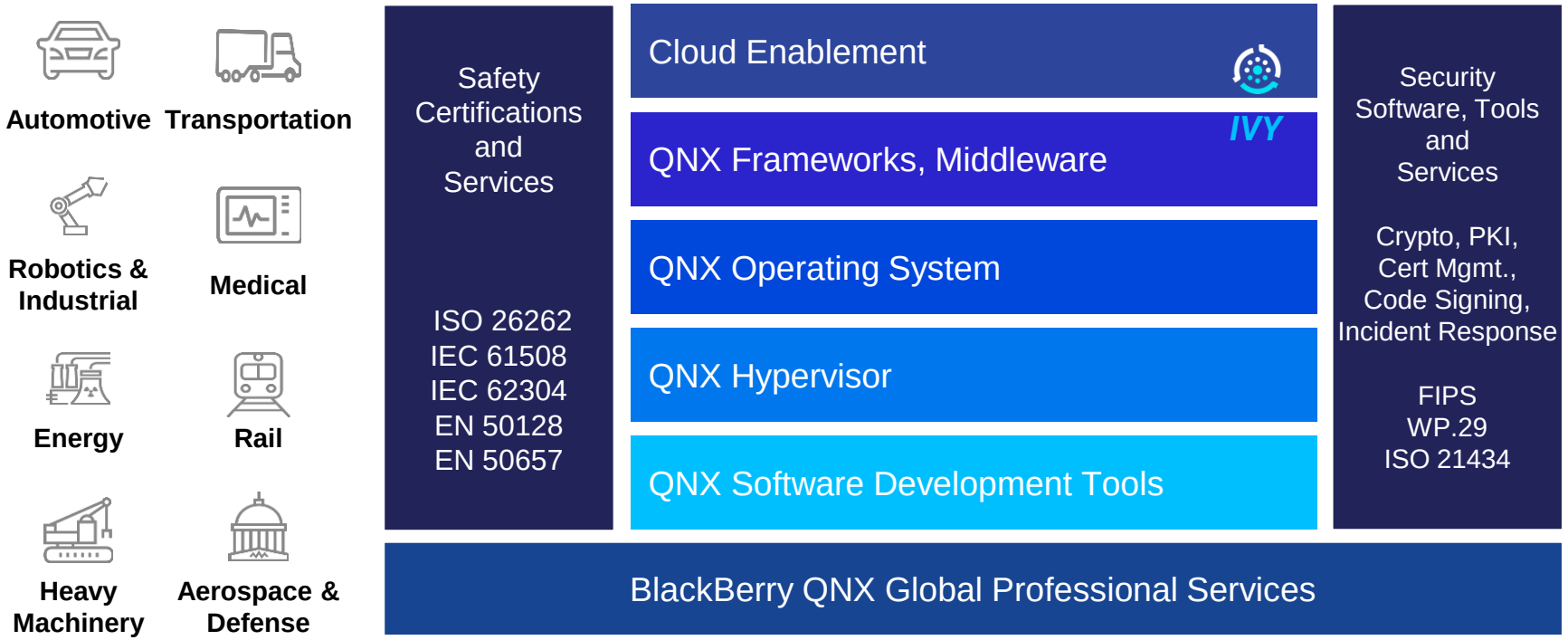
Strategic Roadmap Investments and Progress Highlights

	Innovation at the edge	Safety and security innovation	Reduced developer friction
2022	• QNX SDP 8 OS and Tools Early Access release • Virtualization Frameworks product release – Google press release, Virtio standards contribution • Performance Optimization team created – Local socket prototypes, heap allocation, benchmark frameworks and system-wide performance optimizations	• Industry first Safety certified QNX virtualization frameworks release • Multiple QNX OS for Safety releases • ISO 26262 ASILD D certified C++ library • TI/QNX Academy for Functional Safety • Increased security analysis and incident response team	• Cloud enablement – QNX OS and Safety OS in the cloud • Open-Source team created • RUST support upstreamed to community • Augmented board vendor engagement for QNX board support packages
2023+	• **QNX SDP 8.0 commercial release** • **Workload orchestration strategy defined** • **QNX 8-based Hypervisor early access** • **Software stack augmentation (e.g. Containers, VIRTIO, QNX Audio/Acoustics...)** • **CPU support – RISC-V and MCU investigation**	• **Safety certified filesystem** • **Safety certified crypto** • **Safety qualified RUST tools** • **ISO 26262 ASIL D Qualification kit for C++ headers/templates** • **ISO 21434 assessment and certification**	• **Expand cloud-enabled edge portfolio products and CI/CD tools offering** • **Online/on-demand training** • **Key Open-Source projects ported, optimized and maintained** • **Enable a global QNX ecosystem with easier access to QNX technology**

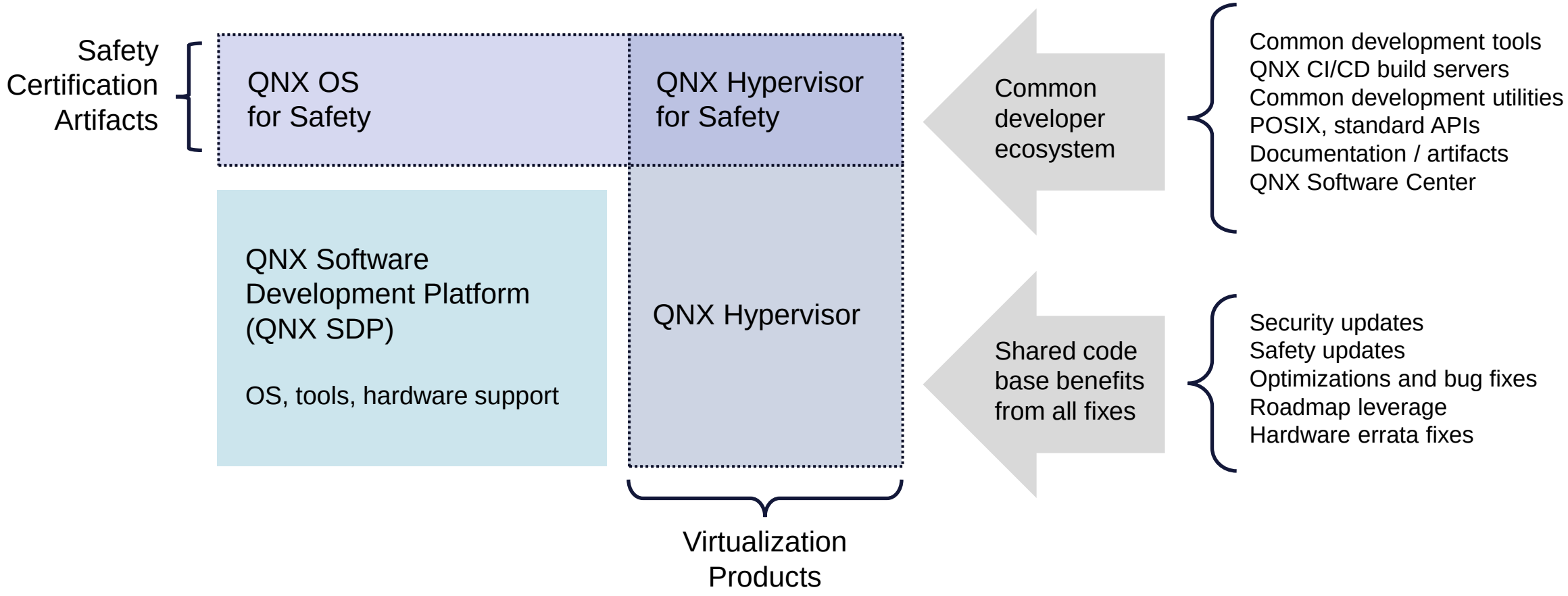
Leaders in Foundational Software for the Intelligent Edge

Comprehensive Foundational Software Development Platform for **Safe** and **Secure** Embedded Systems requiring the highest **Performance** and **Reliability**



QNX Product Platform Strategy

Unified Code Base, APIs and Tools including Safety Certified Products



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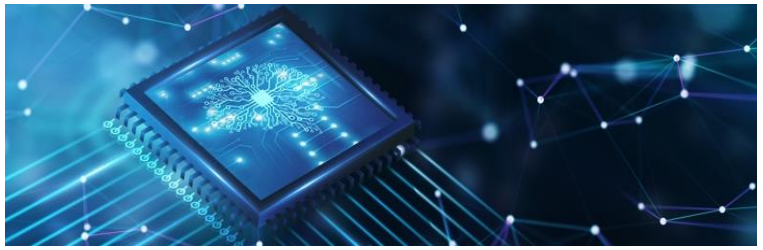
QNX SDP 8.0

QNX SDP 8.0

Foundational Software for High-Performance Critical IoT Devices



QNX Software Development Platform 8.0	QNX 8 OS and Development Tools QNX OS for Safety	QNX Hypervisor QNX Hypervisor for Safety

- Major QNX SDP release with our next-generation microkernel
- Our most performant OS ever with providing the ultimate in scalability for next-generation SoCs and high-performance compute
- Baseline for future QNX Hypervisor, QNX OS For Safety and QNX Hypervisor for safety products
- New Development Tools including Visual Studio Code IDE, command line tools and CI/CD build tools
- Early access available now and commercial release in December 2023

Major Silicon Partners (partial list)

AMD intel NVIDIA NXP Qualcomm RENESAS SAMSUNG Texas Instruments

QNX SDP 8: Technology and Innovation

Performance
Scalability
Low latency

Future-proof architecture

Maximizes silicon advancements with a new microkernel design.

Unprecedented performance

Maintains consistent and blazing-fast real-time performance regardless of load.

Seamless scalability

Scale without compromise from entry-level processors to HPC manycore designs.

State-of-art tooling

Supports best-of-breed and uniquely innovative developer productivity tools.

Unparalleled safety and security

Offers industry-leading functional safety and cybersecure design, tools, services, and ecosystem.

QNX SDP 8: Core Components

QNX Operating System

Full featured Realtime OS

Next-generation Microkernel

Scales from 1 to 64 CPU cores

High performance networking

New filesystems

Advanced toolchain

QNX Screen and graphics

QNX Tool Suite

QNX Momentics IDE

QNX Toolkit for Microsoft Visual Studio Code

QNX Command Line Tools

C, C++, Python, RUST*

Cloud target support

QNX Dev Ops

Centralized installation

Secure delivery

Proactive updates

GPL (and other) license compliance management

CI/CD pipeline integration

Cloud Enablement

* Post QNX SDP 8 release availability

QNX SDP 8.0

Highlights

- New advanced OS Microkernel
  (patented, performance, scalability, realtime)
- High performance networking
  (Optimized FreeBSD stack)
- Virtualization host extensions
  (Higher performance virtualization)
- High-performance memory allocator
  (Includes safety certification design)
- Microkernel architecture with security- and safety-by-design
- Advanced Tool Support for GCC 12
  (ARMv8, ARMv9, x86-64)
- Support for C++17 and C++20
  (ARMv8, ARMv9, x86-64)
- Full 64-bit architecture support
  (ARM, X86 and Cloud enablement)

QNX SDP 8 Future-Proof Microkernel

Maximizes silicon advancements with a new microkernel design

Patent-pending QNX 8 kernel technologies

- **New QNX 8 Microkernel with ultimate granularity for real-time performance, scalability and determinism**
  - A new thread executive is dedicated to scheduling threads and Neutrino handles the remaining kernel tasks.
  - Adding cores does not degrade performance.
  - New thread executive with configurable core cluster support
- **QNX 8 Microkernel Architecture is unique**
  - Enables far more parallelism than existing microkernels or monolithic kernels.
  - Execution of context switching is very fine-grained with no kernel locks required.
  - Retains decades of proven in-field reliability and safety certification design

QNX SDP 8: Seamless Scalability

Scale without compromise from entry-level processors to HPC manycore designs.

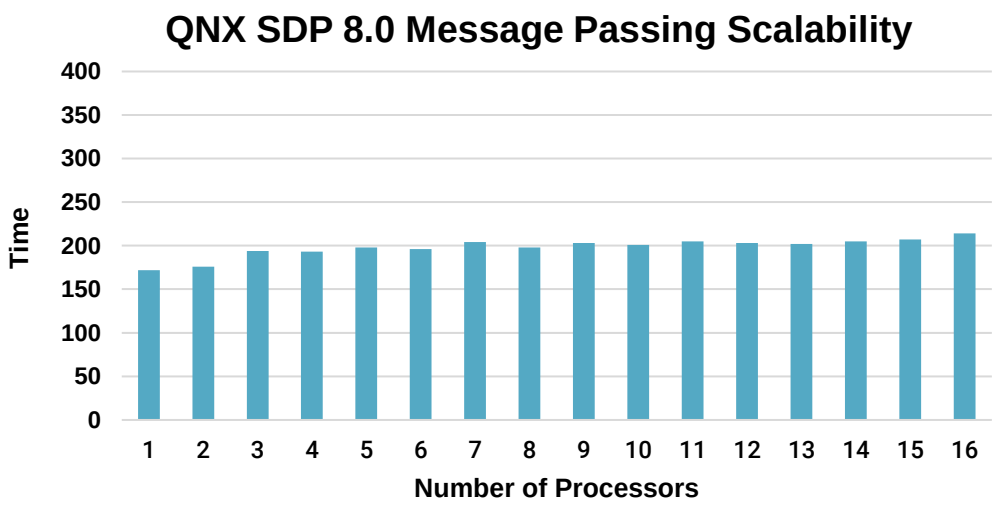
QNX 8 OS builds on microkernel benefits

- Process isolation provides inherent safety and security.
- Benefit of QNX's proven in-field reliability and certification experience.
- Modular design offers extremely fast boot, application-like driver development, and easy fail-over redundancy.

QNX 8 OS scales with CPU cores

- Unique architecture enables better parallelism than any existing kernel designs (monolithic or microkernel).
- Highly optimized thread scheduling.
- Fine-grained context switching and preemptible scheduling provides extremely low latency.

QNX Kernel Call Execution Benchmark



- Tested using configurations from 1 core to 16 cores.
- Messages between a pair of client and server processes on each core in parallel.
- Testing using QNX 8 on a 16 core armv8 hardware platform

QNX SDP 8: High Performance Silicon + Board Integration

Global relationships

Close partnership with key silicon vendors ensuring maximum performance and scalability for next-generation silicon.

Key board vendor support to maximize integration and reduce customer time to production across IoT markets.

QNX SDP 8: Advanced Development Tools

Supports best-of-breed and innovative developer productivity tools.

QNX® Toolkit for VS Code

Visual Studio Code is a full featured Integrated Development Environment (IDE) made by Microsoft and includes frameworks for editing, debugging, syntax highlighting, intelligent code completion, embedded Git and QNX extensions and 3rd party extensions.

QNX® Momentics® IDE

QNX Momentics customized Eclipse-based IDE for software development, source management, debugging and performance optimizations with a huge variety of built-in tools, QNX plugins and 3rd party plugins.

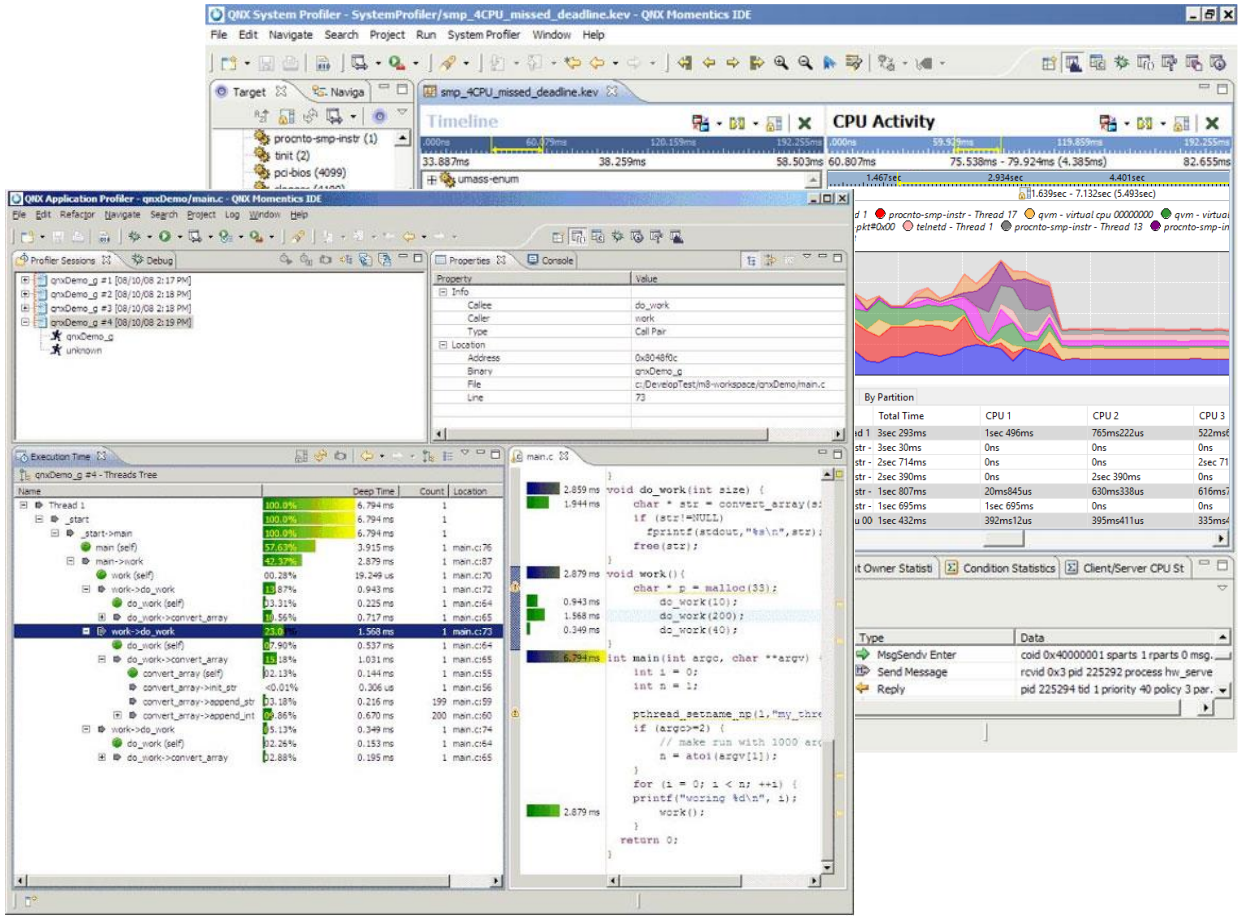
Command-line Tools

Completed set of modern GCC-based command-line tools optimized and supported by QNX for fast and direct task execution and automation in software development, debugging, performance analysis, and optimization.

QNX SDP 8: QNX Momentics IDE

QNX Momentics to facilitate migration and will continue to be supported and maintained

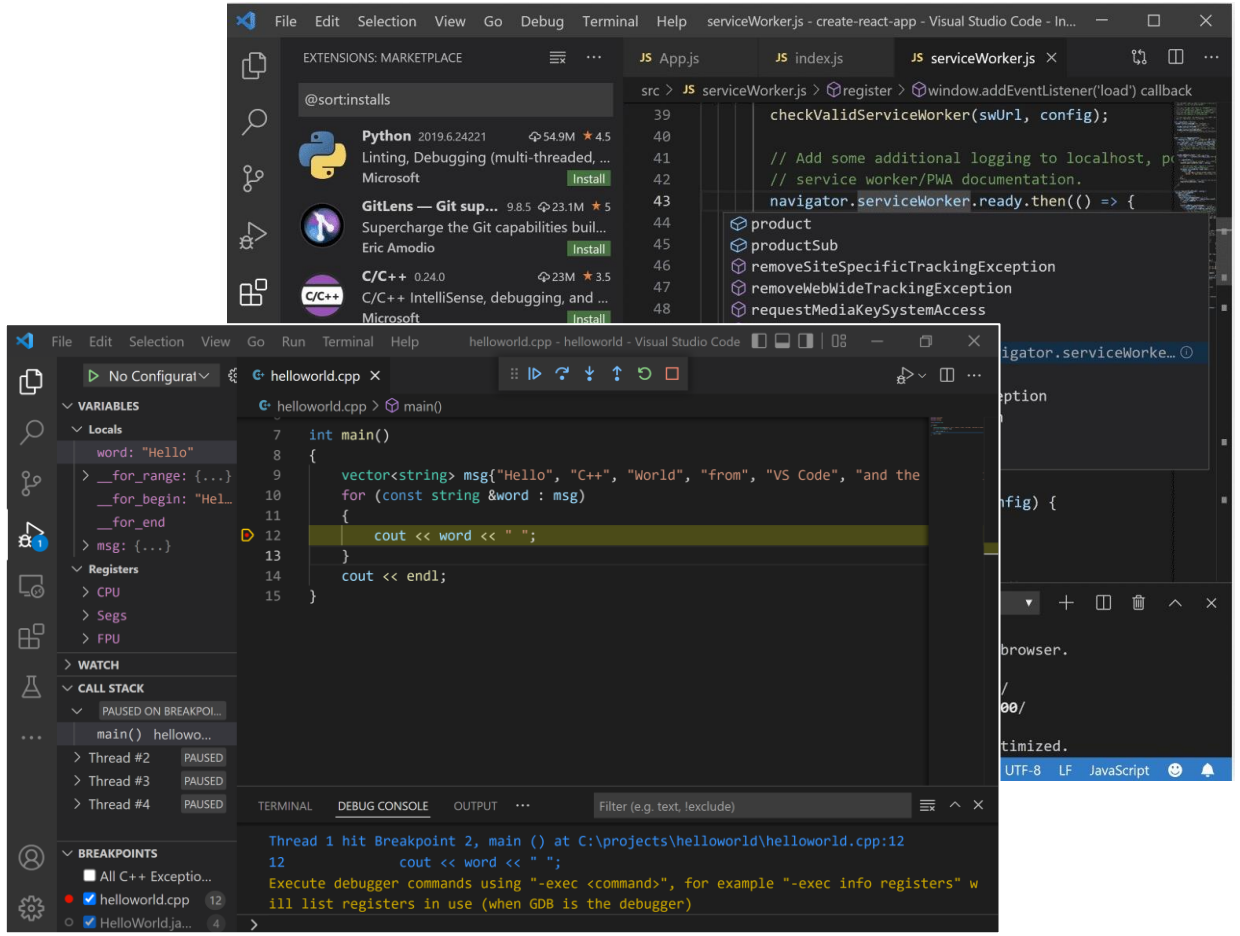
- Based on the open-source Eclipse IDE
- Supports C and C++
- Supports multi-core debugging and development
- Integrated source control (Git, SVN …)
- System builder tool
- Target system information
- Application profiler
- System profiler
- Memory analysis
- Code coverage



QNX SDP 8: Microsoft Visual Studio Code

VS Code is a popular code editor optimized for developing and debugging modern applications:

- Thousands of third-party extensions
- Advanced Git integration with cloud and container workflows
- Intellisense smart code completion and dynamic syntax error highlighting
- Support for all major languages, HTML/CSS, JSON, and markdown



QNX SDP 8 includes the QNX Toolkit extension (available on the VS Code marketplace) to add QNX-specific functionality, such as:

- QNX System Information
- QNX System Profiler
- QNX Target Management

QNX SDP 8: Product Portfolio Timeline

Plan of Intent

QNX SDP 8.0 Core Product Portfolio

Trusted and Proven Product Platform Strategy

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Thank You

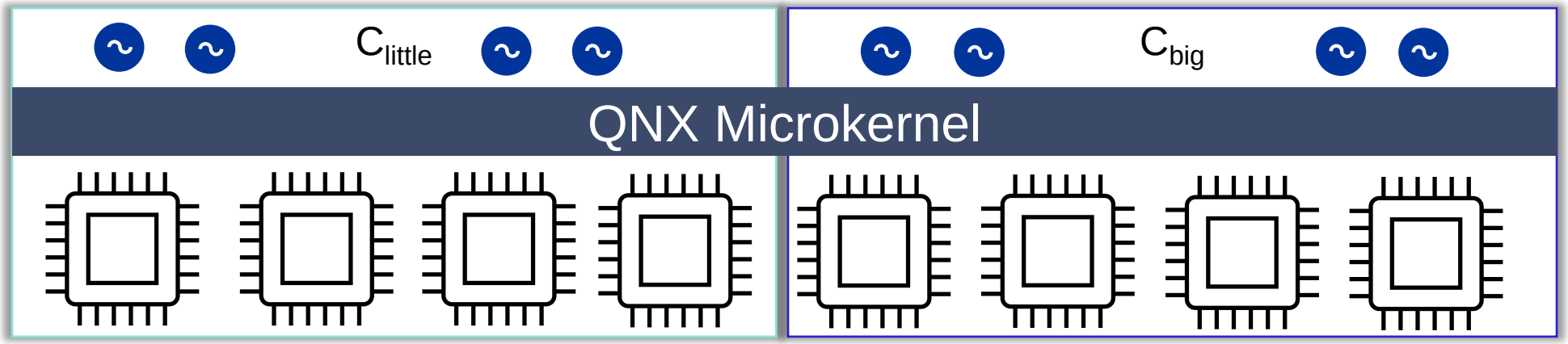
Configurable Clusters

- By default, the QNX OS kernel places all cores in two clusters:

  C_{all} – Cluster of all processors
  C_{self} – Cluster for each processor

- The system integrator can create additional custom clusters such as:

  C_{little} – low energy use cores
  C_{big} – high performance cores
  C_n – any configuration



QNX SDP 8: Command-Line Tools

Industry standard tooling

Toolchain

- GNU Compiler Collection 12
- GDB 12 Debugger
- Command Line Utils

Programming languages

2017

2020

2011 Standard

Version 3

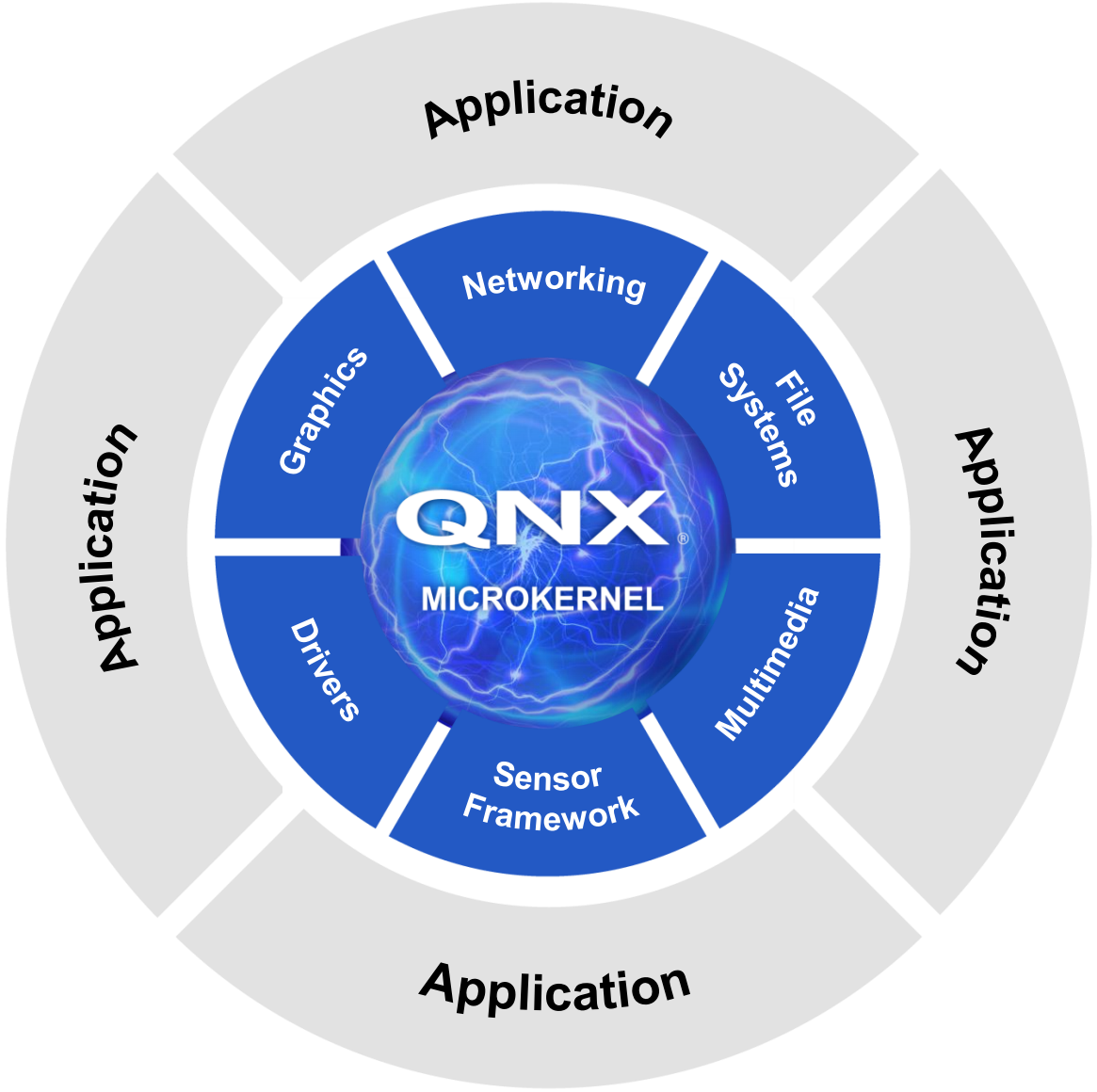
Post QNX SDP 8 release availability

QNX OS – Host Tools

QNX Microkernel

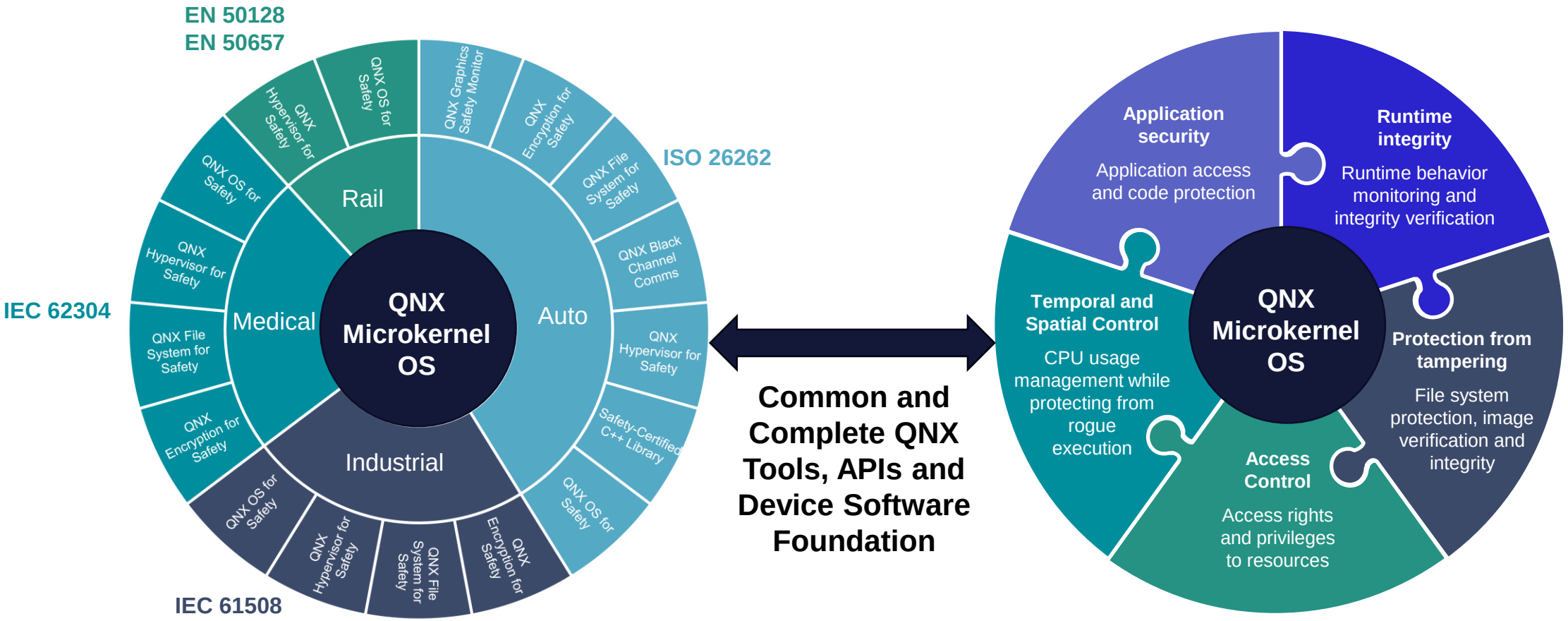
A Trusted and Proven Microkernel Architecture

- Functional partitioning and isolation of system functions for high reliability
- Real-time scheduling of CPU and resources
- Compatible with standard tools, libraries, frameworks
- Architecture that incorporates security- and safety-by-design
- Pre-certified for streamlined system certifications



Unparalleled Safety and Security Software Foundation

Offers industry-leading functional safety and cybersecure design, tools, services, and ecosystem.



QNX SDP Runtime Safety

QNX SDP Runtime Safety

QNX SDP 8: High Performance Silicon Integration

Global relationships

QNX OS was developed in partnership with silicon vendors on their next-generation high performance compute (HPC) platforms to maximize integration and reduce customer time to production.

QNX SDP 8: Embedded Board Support

Global relationships

Major roadmap investments and close collaboration to ensure broad and ongoing support for embedded board vendors to enable multiple IoT market segments.