Innovation and Investment for the Future

QNX® SDP 8.0 and QNX Cloud Enablement

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Agenda

(1) **Notable Industry Trends**

(2) **QNX Software Development Platform (SDP) 8.0**

(3) **QNX Cloud Enablement**

(4) **QNX Strategic Roadmap Investments**

Notable Industry Trends

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

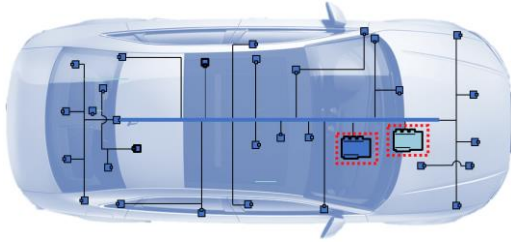**SOCs with 8 or more cores** from top silicon vendors

Automotive and IoT – established and new domains

Complexity Shifting From Hardware and Networks to Software

Vehicle-wide Foundational Software Essential to Enabling Innovation, Differentiation, and Value
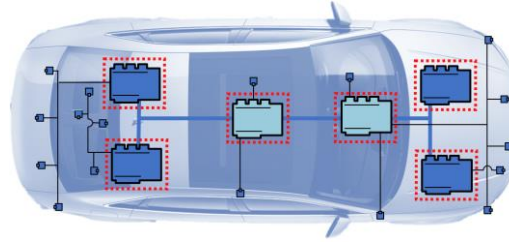
Distributed
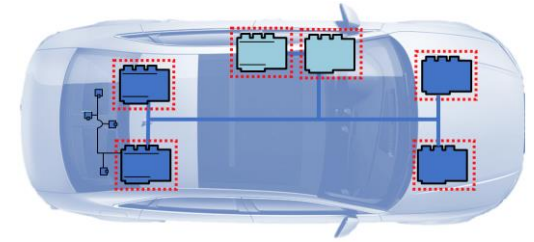*Many fixed functions – discrete ECUs*

Domain – Centralized
Reduction in fixed function ECUs

Vehicle – Centralized
High performance centralized compute domains with zonal architecture

Complexity

Software		Hardware / Network

Complexity

Software		Hardware / Network

Complexity

Software		Hardware / Network

- Limited opportunity for consolidation of features and functionality
- Separate discrete safety ECUs across multiple networks (no mixed criticality)

- Consolidation of complimentary vehicle features
- Emergence of mixed critical ECUs
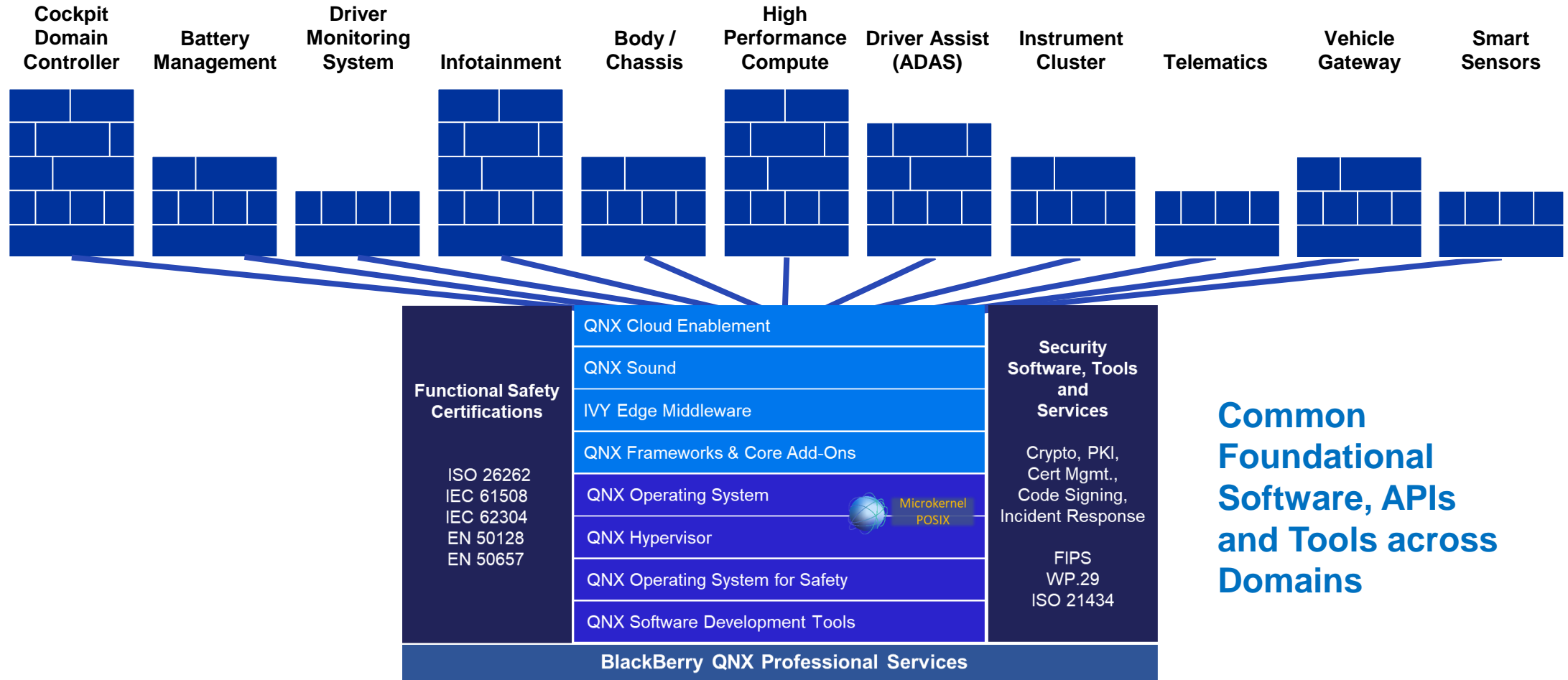- Increase in software complexity across new domains

- High performance and low-latency communications
- Multiple mixed critical environments
- **Critical need for managed software complexity**

SDVs: Vehicle-wide Foundational Software *Essential* to Enabling Innovation, Differentiation, and Value

BlackBerry QNX

Cross-Domain Common Foundational Software

Decades of Proven Foundational Software for Automotive

Cockpit Domain Controller · Battery Management · Driver Monitoring System · Infotainment · Body / Chassis · High Performance Compute · Driver Assist (ADAS) · Instrument Cluster · Telematics · Vehicle Gateway · Smart Sensors

Functional Safety Certifications

ISO 26262
IEC 61508
IEC 62304
EN 50128
EN 50657

QNX Cloud Enablement
QNX Sound
IVY Edge Middleware
QNX Frameworks & Core Add-Ons
QNX Operating System · Microkernel POSIX
QNX Hypervisor
QNX Operating System for Safety
QNX Software Development Tools

Security Software, Tools and Services

Crypto, PKI, Cert Mgmt., Code Signing, Incident Response

FIPS
WP.29
ISO 21434

BlackBerry QNX Professional Services

Common Foundational Software, APIs and Tools across Domains

QNX Software Development Platform (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 release with our next-generation microkernel
- Our most performant OS ever with providing the ultimate in scalability for next-generation SoCs
- Scalable from fixed-function to high-performance compute systems
- 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
- Commercially released and production ready

QNX SDP 8: Technology and Innovation

Performance
Scalability
Low latency
Realtime

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 High Performance Compute

State-of-art tooling
Supports advanced tools for developer productivity tools.

Unparalleled safety and security
Offers industry-leading functional safety and cybersecure design, tools and services

QNX SDP 8: Core Components

QNX Operating System

Full featured Realtime OS

Next-generation Microkernel

Scales from 2 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

CI/CD Build servers

QNX Dev Ops

Centralized installation

Secure delivery

Proactive updates

GPL (and other) license compliance management

CI/CD pipeline integration

Cloud Enablement

QNX SDP 8.0

Highlights

New advanced OS Microkernel
(patented, performance, scalability, realtime)

Microkernel architecture with
security- and safety-by-design

High performance networking
(Highly optimized FreeBSD-based stack)

Advanced Tool Support for GCC 12
(ARMv8, ARMv9, x86-64)

Virtualization host extensions
(Higher performance virtualization)

Support for C++17 and C++20

High-performance memory allocator
(Includes safety certification design)

Full 64-bit architecture support
(ARMv8, ARMv9, x86-64 and Cloud enablement)
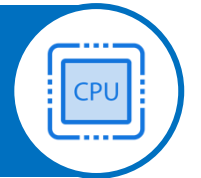
QNX SDP 8: Future-Proof Microkernel

Maximizes silicon advancements with a new microkernel design

PATH MANAGER

NEUTRINO EXECUTIVE

PROCESS MANAGER

THREAD EXECUTIVE

MEMORY MANAGER

QNX

MICROKERNEL

Patent-pending QNX 8 kernel technologies

- **New QNX 8 Microkernel with ultimate granularity for real-time performance, scalability and determinism**
  - New thread executive is dedicated to scheduling threads and supports configurable core clusters
  - Neutrino handles the remaining kernel tasks
  - Adding cores does not degrade performance

- **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.
  - Based on decades of proven reliability and safety certifications

QNX SDP 8: Seamless Scalability

Scale without compromise from entry-level processors to High-Performance silicon

QNX 8 OS builds on trusted microkernel benefits

- Process isolation provides inherent safety and security.
- 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 8 Kernel
Scales linearly with # of cores
Message Passing Scalability**
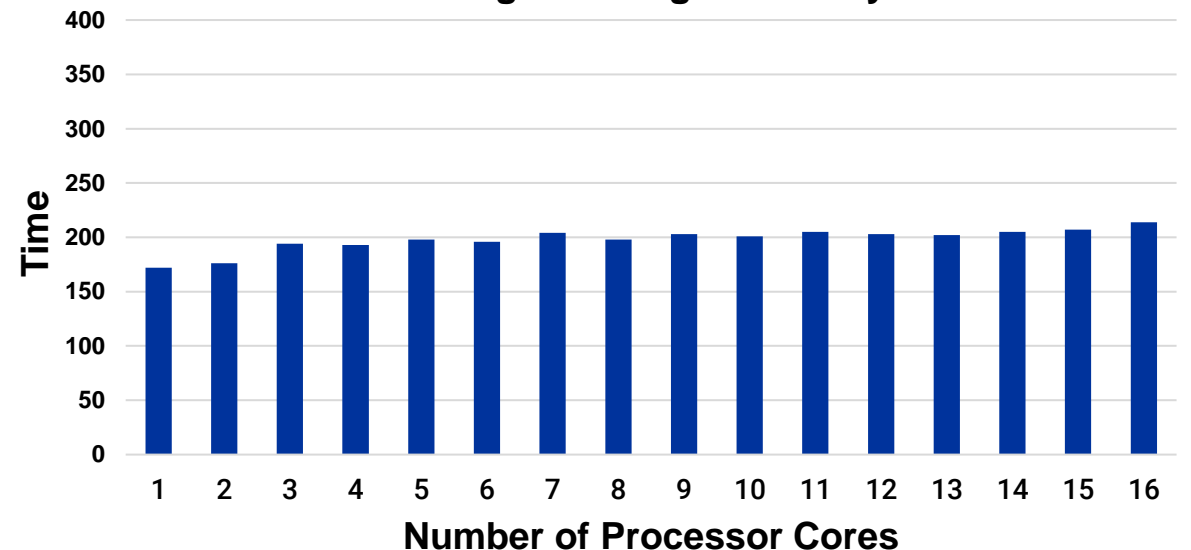
- Tested using configurations from 1 core to 16 cores on ARMv8 hardware
- Messages between a client / server pair of processes on each core in parallel.

QNX SDP 8: High Performance Silicon + Board Integration

QNX SDP 8 Silicon and Board vendor commitment

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

and more …
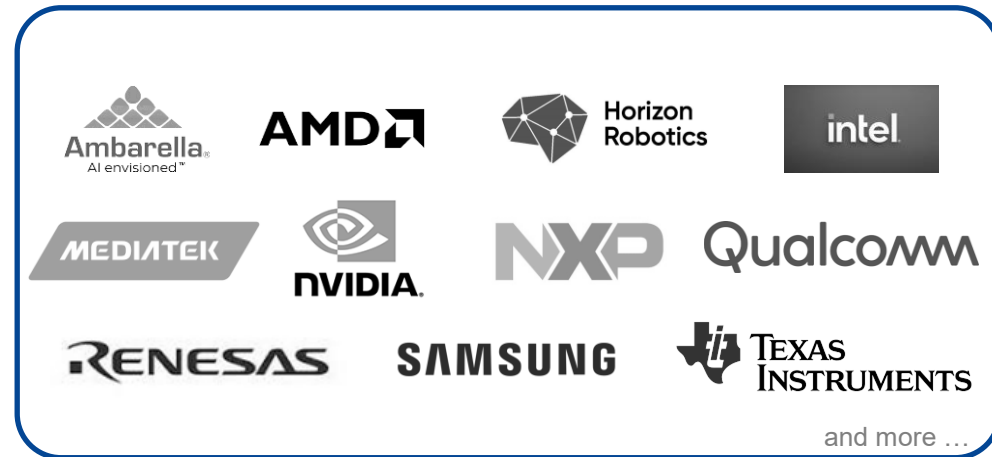
Hardware board vendor support to maximize integration and reduce customer time to production across IoT markets

and more …

QNX SDP 8 Security Features

QNX OS - Security Features

- POSIX permissions model and Access Control Lists (ACL)
- Random service generator
- Fortified system functions
- Secure process launcher
- QNX Trusted Disk (QTD)
- QNX generic crypto device driver
- Process manager abilities

- Address space layout randomization (ASLR)
- QNX crypto library
- Pathtrust
- Security policies for generator and compiler
- SMMU manager
- QNX binary security check tool
- Mkshadow utility

QNX SDP 8: Advanced Development Tools

Supports standards-based developer productivity tools

QNX ® Toolkit for Visual Studio 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 Development Environment Support

Host Operating Systems

Virtual Target Environments

Cloud Enablement

QNX Momentics IDE

The QNX Momentics IDE is the integrated development environment provided with QNX SDP 8 and provides continuity with previous QNX releases.

- Based on the popular open-source Eclipse IDE

- Supports C and C++

- Supports multi-core debugging and development

- Integrated source control (Git, SVN, etc)

- System builder tool

- Target system information

- Application profiler

- System profiler

- Memory analysis

- Code coverage

Microsoft Visual Studio Code

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

- Thousands of third-party extensions

- Advanced Git integration; 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
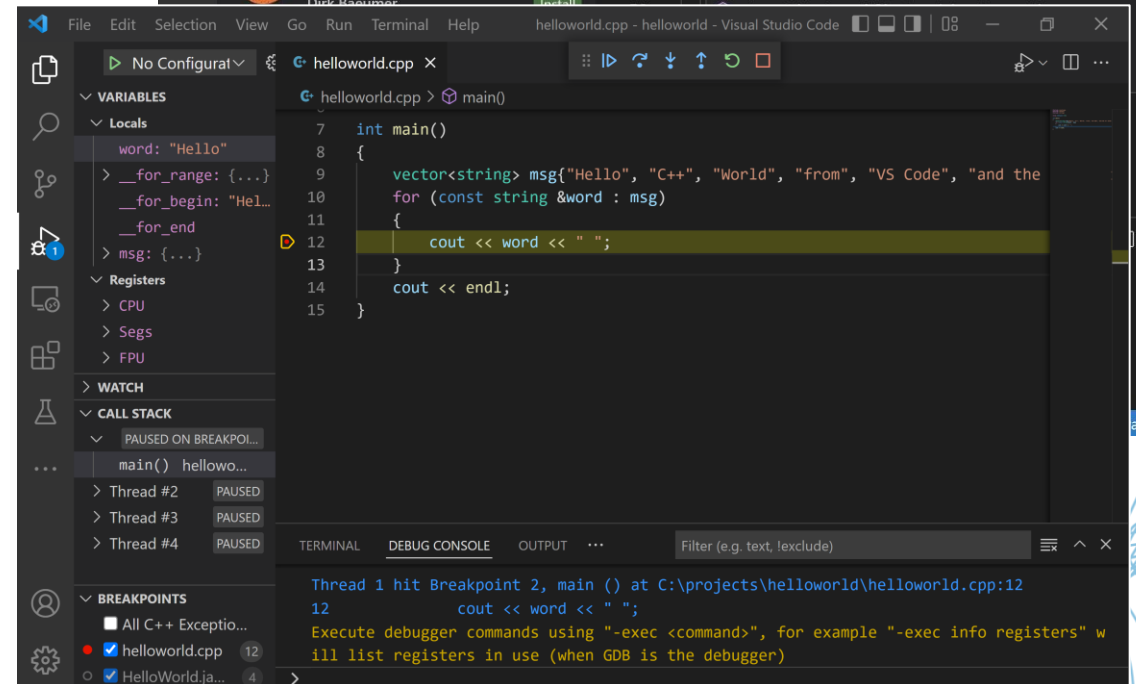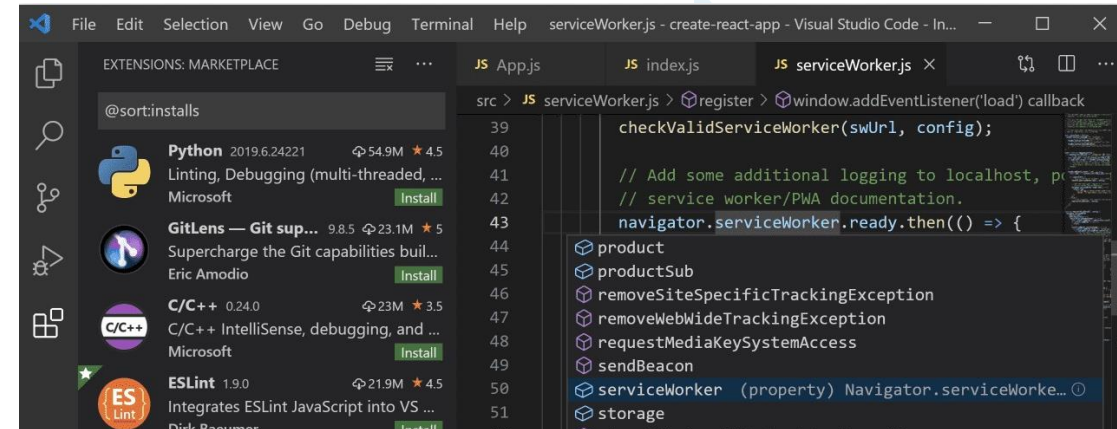
QNX Foundational Software:
Unified Code Base, Tools and Target System Software

Safety Certification

QNX OS for Safety	QNX Hypervisor for Safety	QNX Containers for Safety
QNX Software Development Platform (QNX SDP) OS, Tools, Hardware Support	**QNX Hypervisor**	**QNX Containers**

Virtualization Products

Developer ecosystem leverage

Common Host Dev Tools
QNX CI/CD build servers
POSIX / common APIs
Documentation / artifacts
QNX Software Center

Shared code base

Security updates
Safety updates
Optimizations
Roadmap leverage
New features

QNX SDP 8: Product Portfolio Timeline

QNX SDP 8.0 Core Product Portfolio

QNX SDP 8.0.2
Commercial
Release

QNX SDP 8.0.x
Maintenance releases

QNX SDP 8.0
Commercial
Release

QNX SDP 8.0.1
Commercial
Release

QNX OS for Safety 8.0
Early Access

Dec '23

Jul '24

Dec '24

2025+

QNX Hypervisor 8.0
Early Access

QNX Containers 1.x
Early Access

QNX Hypervisor 8.0
Commercial
Release

QNX OS for Safety 8.0
Commercial
Release

QNX Containers 1.x
Commercial
Release

QNX Hypervisor for Safety 8.0
Commercial
Release

Trusted and Proven Product Platform Strategy

Plan of Intent

QNX Cloud Enablement

Cloud Market Influences in Automotive

HYPERSCALER INVESTMENTS

From IT to In-Vehicle technology, Hyperscalers are investing.

Google: Android Automotive OS, Google Automotive Services, SDV…
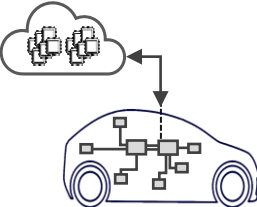
AWS Automotive: Virtual Engineering Workbench, *IVI* OS, Cloud Services, Fleetwise, IVY…

Microsoft Automotive: Reference architectures, Tools / Services, Copilot, …

All are QNX partners

VIRTUALIZATION & EMULATION

OEMs looking to leverage cloud scale and velocity to "shift left". Ecosystem players developing cloud-ready emulation and tools enabling cloud / ECU parity.

- Virtual ECUs in the cloud: Corellium, ASTC, Synopsys, Siemens and others with emerging cloud virtual hardware and development tools.

- Qualcomm + AWS Snapdragon Virtual Platforms

VEHICLE DATA VALUE CAPTURE

OEMs to monetize and cost-optimize features and services through new development and deployment paradigms using cloud-based tools, connectivity and software updates.

- Example connect services free, freemium, fee-based: Ford Fordpass, Audi Connect, NisssanConnect, BMW ConnectedDrive, Hyundai Bluelink, VW myVW, …
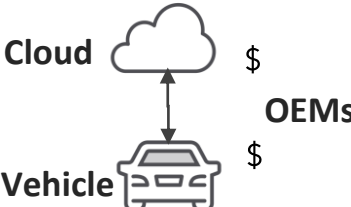
STANDARDS AND REGULATION

Global vehicle standards and regulations demand ongoing safety and cybersecurity management of vehicle software over the full life cycle of the vehicle driving vehicle connectivity.

- Automotive Cybersecurity: New WP.29 R155/R156 and ISO 21434 regulations and standards

- Automotive Safety – ISO 26262

CONSORTIUM ACTIVITIES

Eclipse SDV, SOAFEE, Covesa, FEDERATE consortiums embracing cloud integration with Amazon and Microsoft participation to enable cloud integrated development and vehicle software activities.
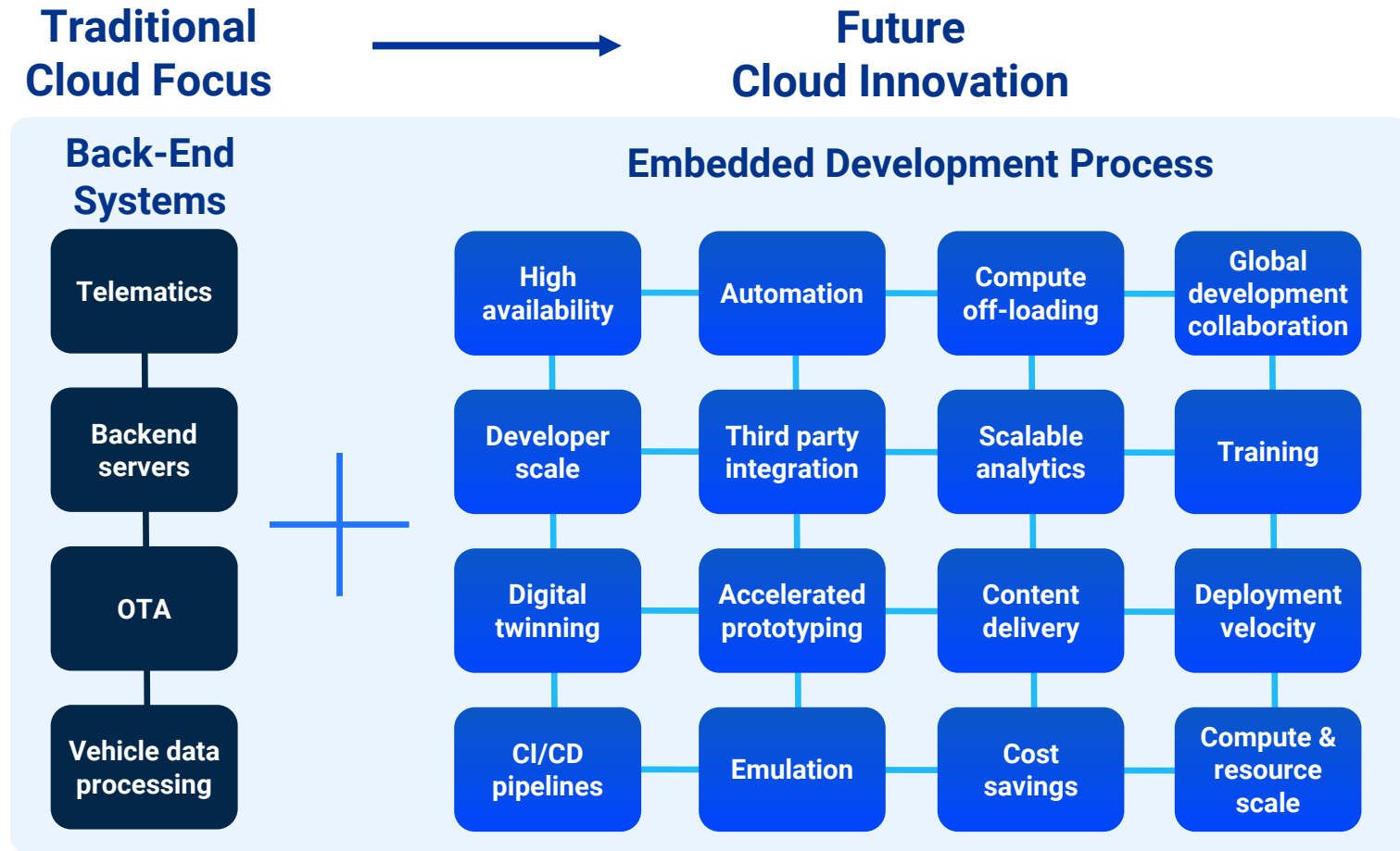
- Development process automation

- Vehicle data and connectivity & services

Note: Not production ready

Cloud-First Embedded Development to Accelerate Customer Innovation

QNX Cloud-Enabled Products and Partner Integrations

Traditional Cloud Focus → **Future Cloud Innovation**

Back-End Systems

- Telematics
- Backend servers
- OTA
- Vehicle data processing

+

Embedded Development Process

High availability	Automation	Compute off-loading	Global development collaboration
Developer scale	Third party integration	Scalable analytics	Training
Digital twinning	Accelerated prototyping	Content delivery	Deployment velocity
CI/CD pipelines	Emulation	Cost savings	Compute & resource scale

Blurring the Line Between Physical and Digital to Deliver Scale, Velocity, and Ecosystem Collaboration Opportunities

"… enabling the delivery of infotainment tech to customers 100 times faster than previous processes"

– Global Automaker

"… taking what used to take months to be achieved down to 24 hours in some cases"

– Global Automaker
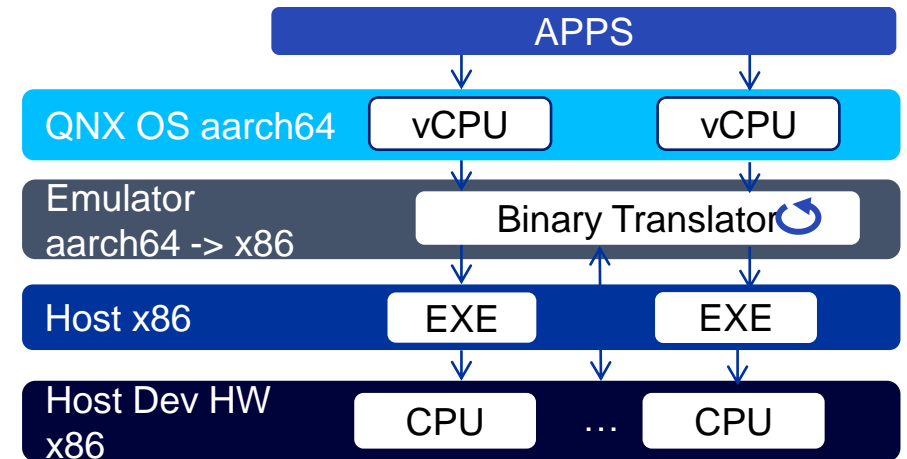
Embedded Software Development Challenges

Limited Hardware Access

- Programs seek to reserve target system hardware from a shared or reserved pool of hardware that is often part of an engineering lab infrastructure that require specialized tools and setup

- Not scalable as it does not have high availability for use across teams, programs and the ecosystem as the number of target system hardware units are limited and can require complex setup.
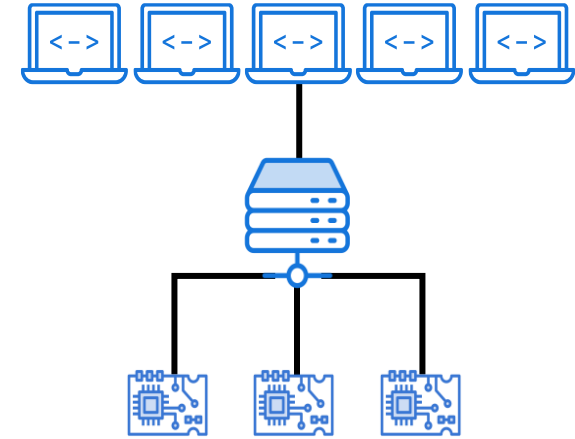
Cross Platform Emulation

- Developer uses an emulator to imitate features of the target hardware, mimicking the SoC behaviors, because their developer machine hardware does not match the architecture of the target hardware.

- Developer must deal with slower running software and potential differences in execution due to binary translation of the Instruction Set of the emulated Target Hardware CPU.

APPS		
QNX OS aarch64	vCPU	vCPU
Emulator aarch64 -> x86	Binary Translator	
Host x86	EXE	EXE
Host Dev HW x86	CPU	... CPU

Solution: QNX OS in the Cloud

1. What is it?

Cloud-enabled versions of the **QNX Neutrino RTOS and QNX OS for Safety** running natively on AWS Graviton Cloud
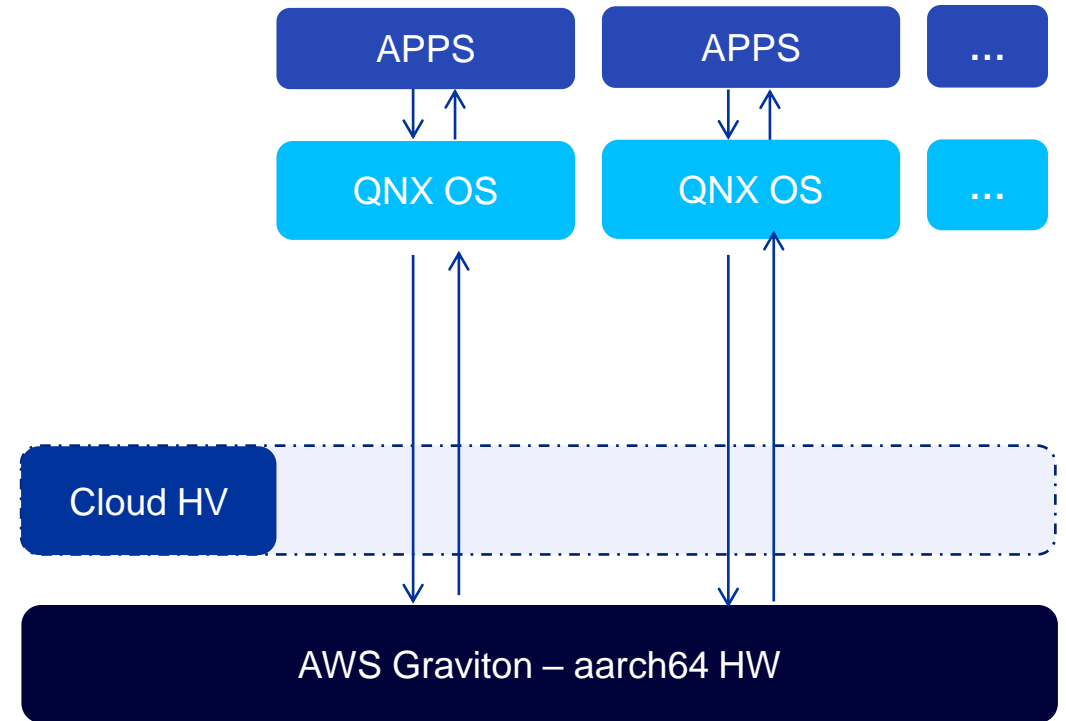
4. How?

QNX Neutrino RTOS and **QNX OS for Safety** deployed on an Amazon Machine Image (AMI) on aarch64 Graviton hardware

2. Advantages?

Run with **binary parity** for aarch64 executables on aarch64 hardware without binary translation or performance overhead
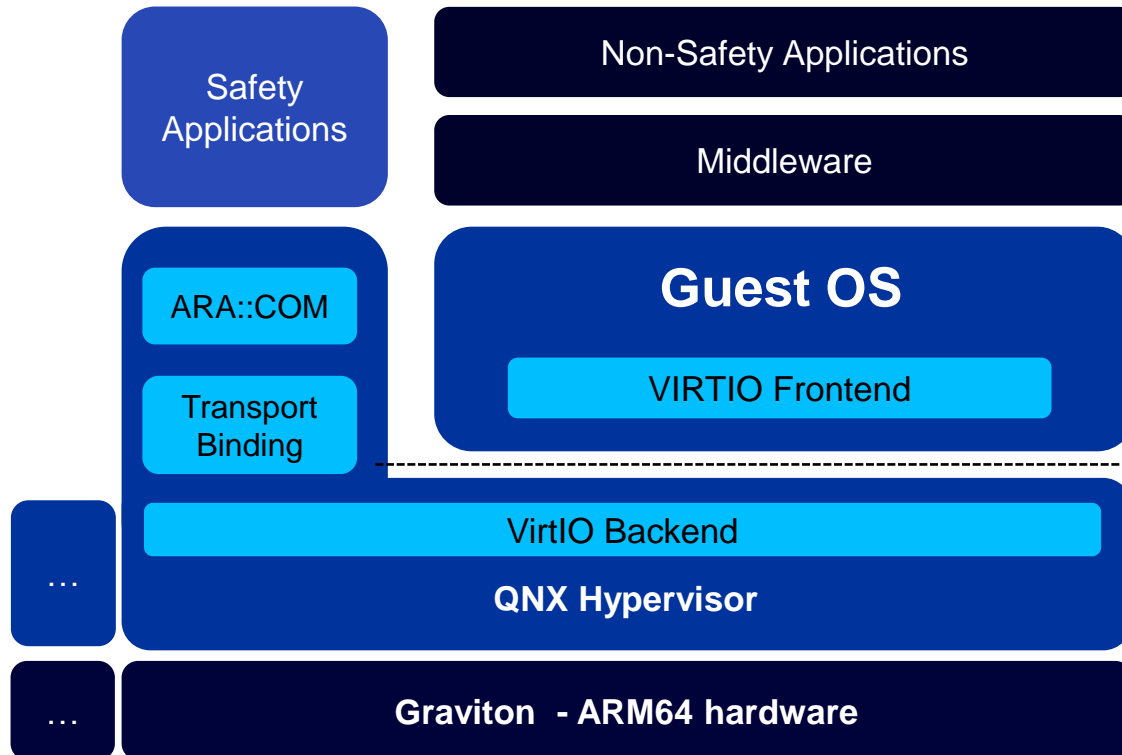
3. Why?

To provide an alternative that reduces the drawbacks with instruction set emulators and limited target system hardware availability

APPS | APPS | ...
QNX OS | QNX OS | ...
Cloud HV
AWS Graviton – aarch64 HW

Solution: QNX Hypervisor in the Cloud

Safety Applications

Non-Safety Applications

Middleware

ARA::COM

Transport Binding

Guest OS

VIRTIO Frontend

...

VirtIO Backend

QNX Hypervisor

...

Graviton - ARM64 hardware

- QNX Hypervisor in the cloud enables development and testing for mixed-criticality and safety applications

- Industry standard VIRTIO for device sharing between guest VM and hypervisor providing Interface Parity between the cloud and target hardware

- Developers can easily share cloud targets and work on their respective domains

- Cloud / Target hardware binary parity

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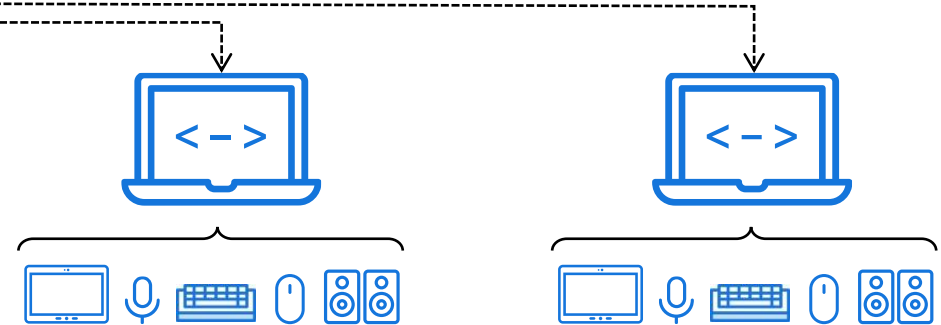
QNX Software on AWS Marketplace

aws marketplace

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BlackBerry QNX

About BlackBerry QNX

BlackBerry QNX is a trusted supplier of commercial operating systems, hypervisors, development tools, support and services, all purpose-built for the world's most critical embedded systems. Blackberry QNX helps customers streamline their development efforts to more efficiently launch safe, secure and reliable systems. Our technology is trusted in more than 215 million vehicles and is deployed in embedded systems around the world across a range of industries including aerospace and defense, automotive, commercial vehicles, heavy machinery, industrial controls, medical, rail and robotics.

QNX Neutrino RTOS 7.1

By **BlackBerry QNX** | Ver QNX Neutrino RTOS 7.1 Build 209

★★★★★ 1 AWS review

Starting from **$0.37/hr** or from **$2,917.00/yr** (10% savings) for software + AWS usage fees

QNX® Neutrino® Real-Time Operating System (RTOS) is the industry-leading RTOS for developing mission-critical embedded systems software for industries including automotive, robotics, medical devices, industrial controls, and aerospace & defense. The microkernel architecture provides an extensible o…

QNX Hypervisor 2.2

By **BlackBerry QNX** | Ver QNX Hypervisor 2.2 Build 207 2024.06.19

Starting from **$1.50/hr** or from **$11,826.00/yr** (10% savings) for software + AWS usage fees

QNX® Hypervisor 2.2 lets you consolidate multiple systems with diverse OSs and different reliability and security requirements onto a single System on a Chip (SoC). You can, for example, build a safety-critical system certified to standards such as IEC 61508 and ISO 26262 that includes one or more…

QNX OS for Safety 2.2.3

By **BlackBerry QNX** | Ver QNX OS for Safety 2.2.3 Build 54

Starting from **$0.45/hr** or from **$3,547.00/yr** (10% savings) for software + AWS usage fees

QNX® OS for Safety 2.2 is the safety-certified variant of the QNX Neutrino Real Time Operating System (RTOS) - the industry-leading RTOS for developing mission-critical embedded systems software for industries including automotive, robotics, medical devices, industrial controls, and aerospace &…
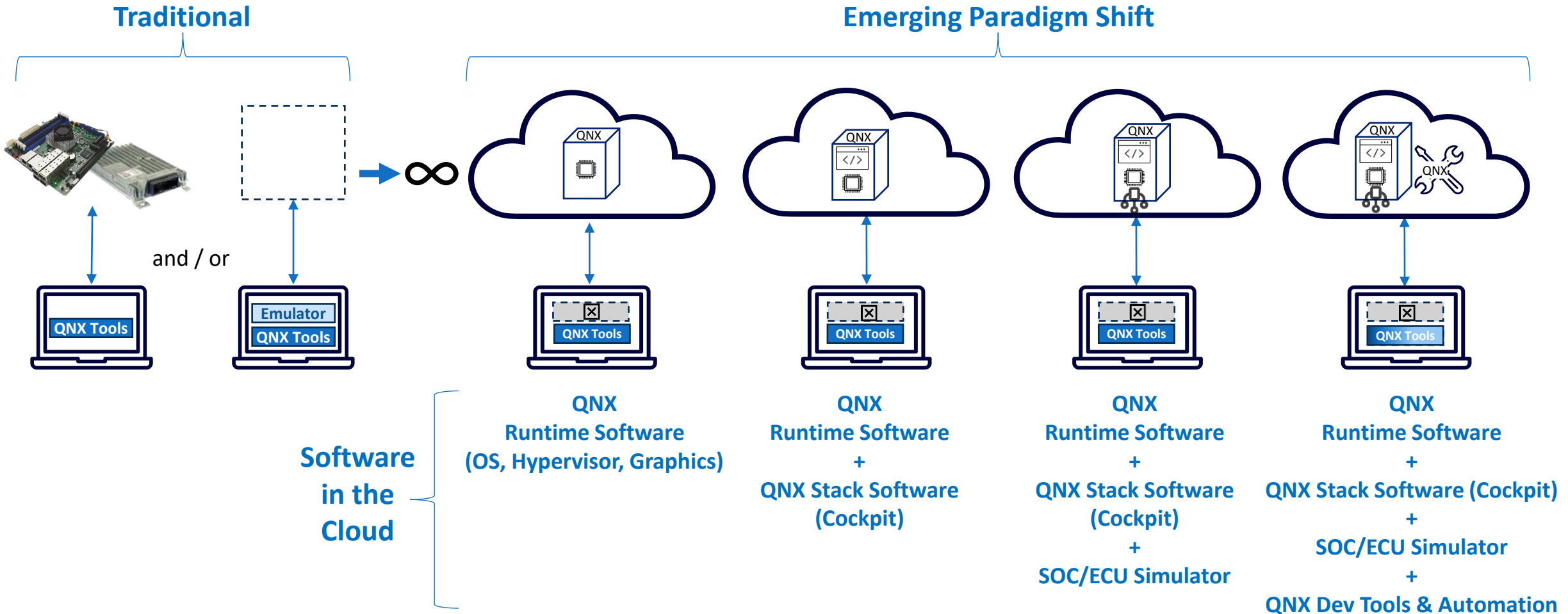
QNX OS 8.0

By **BlackBerry QNX** | Ver QNX OS 8.0 AMI -b5

17 external reviews

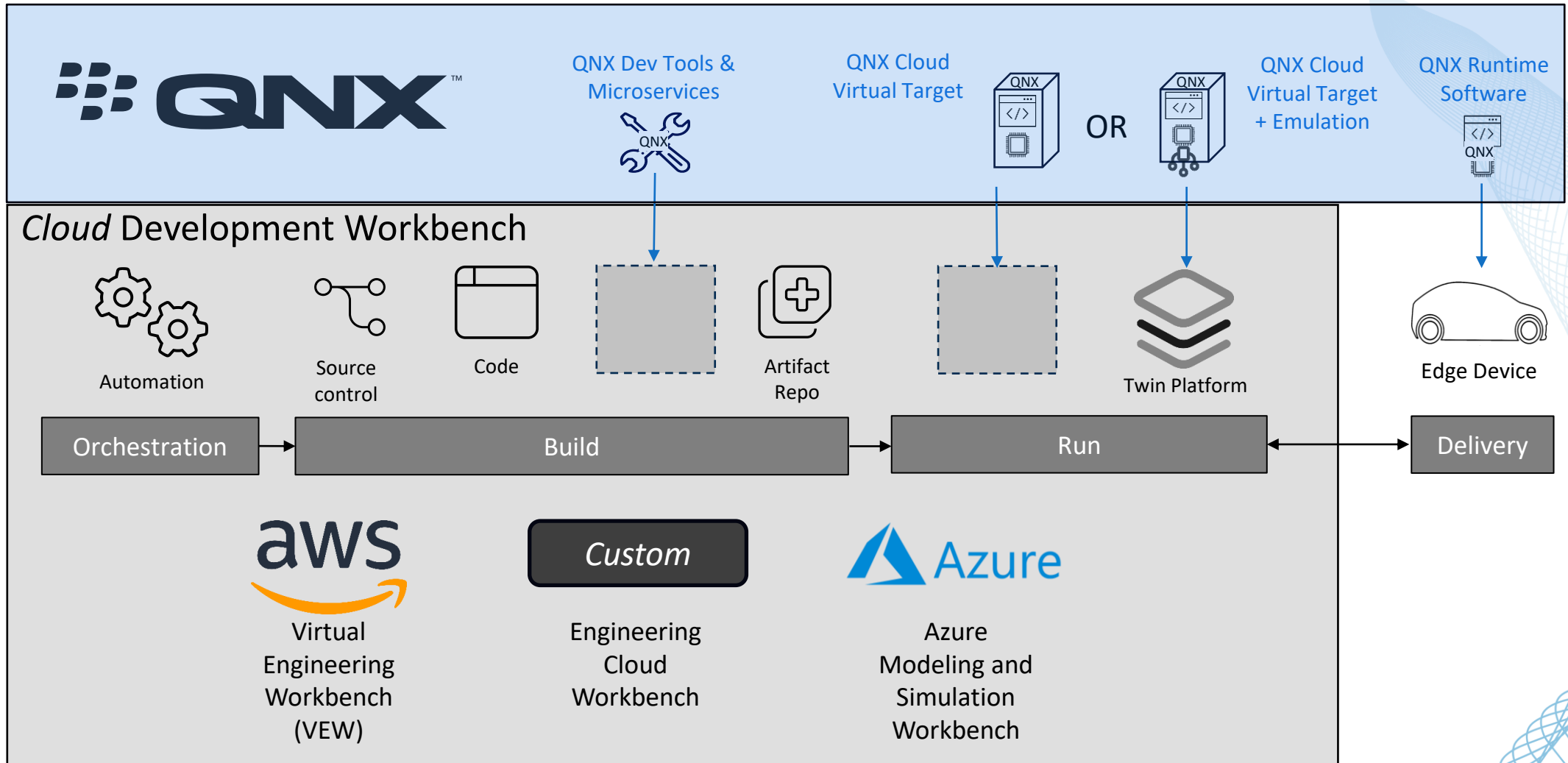Starting from **$0.43/hr** or from **$3,355.00/yr** (up to 11% savings) for software + AWS usage fees

The QNX® OS is the foundation for developing software for high-performance Systems-on-Chip (SoCs) and those embedded systems that run critical, real-time compute-intensive software such as Advanced Driver Assist (ADAS) systems or industrial robots. QNX OS 8.0 features a real-time operating system…

Embedded Development Paradigm Shift

Traditional

Emerging Paradigm Shift

and / or

QNX Tools

Emulator
QNX Tools

Software in the Cloud

QNX Tools

QNX Tools

QNX Tools

QNX Tools

**QNX
Runtime Software
(OS, Hypervisor, Graphics)**

**QNX
Runtime Software
+
QNX Stack Software
(Cockpit)**

**QNX
Runtime Software
+
QNX Stack Software
(Cockpit)
+
SOC/ECU Simulator**

**QNX
Runtime Software
+
QNX Stack Software (Cockpit)
+
SOC/ECU Simulator
+
QNX Dev Tools & Automation**

BlackBerry | QNX

QNX Development Platform Integration Strategy

Virtual ECU:
QNX-Based Software Stack in the Cloud

Customer and Partner Quotes

"… taking what used to take months to be achieved down to 24 hours in some cases"

"… enabling the delivery of infotainment tech to customers 100 times faster than previous processes"

"… With our virtual cockpit, we're revolutionizing not just our approach, but also that of our suppliers and partners in the industry"

"Building on our multi-year partnership, Stellantis is using Amazon Web Services (AWS) computing power and BlackBerry technology for its virtual cockpit that can create and test new versions of car controls and systems in as little as 24 hours instead of months. Get ready for a more connected ride ahead!"

– Adam Selipsky, Former AWS CEO (LinkedIn 2024)

Digital Cockpit ECU

Digital Cockpit in the Cloud

QNX Strategic Roadmap Investments

Enabling Innovation at Scale in 2024 and Beyond

Building on Our Reputation for Performance, Safety, Security, and Reliability

Innovation at the Edge

QNX 8.0 Portfolio Expansion

- Develop high-value add-on products, e.g., containers, virtualization extensions, complex scheduling support

- Commercial release of Hypervisor 8.0 across multiple silicon vendors

- Provide pre-integrated platforms and domain solutions with partners

- Next-generation high-performance silicon and board support

Software-defined audio products

Microcontroller and RISC-V review

Innovation in Safety and Security

Safety Enhancements

- Provide QNX 8 safety OS, QNX 8 safety Hypervisor and certified Containers

- Expand safety certified software portfolio and professional services

- Release qualification toolkit for C++ for automotive and general embedded

Security Upgrades

- Deliver a Software Bill-Of-Materials and ISO 21434 compliance service

- Introduce monitoring and audit framework for intrusion and anomaly detection

Reduce Developer Friction

QNX Everywhere

- Launch program to significantly expand QNX developer community

Open-Source Project Support

- More open-source projects ported, optimized, and maintained

Cloud Enablement

- Cloud-first tooling strategy

- Cloud product enablement: QNX 8 OS, safety products, virtualization, platforms

- Virtual ECU enablement

- New cloud support and collaborations

Building on Our Reputation for Performance, Safety, Security, and Reliability

Thank You