APPLICATION BRIEF: AUTOMOTIVE HIGH-PERFORMANCE COMPUTE
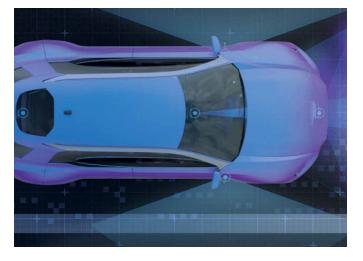
KEY APPLICATIONS

- Autonomous vehicle and ADAS processing
- Central computing for zonal architecture
- Multi-modal sensor fusion and perception processing
- Automotive applications based on artificial intelligence (AI) and machine learning (ML)
- Multiservice domain computing
- Automotive safety architecture development and exploration
- Automotive networking and gateway solutions
- General-purpose high-performance compute

NXP'S SOLUTION FOR AUTOMOTIVE HIGH-PERFORMANCE COMPUTE

- BlueBox development platform series provides compute performance, functional safety and automotive reliability for engineers to develop self-driving cars

NXP SAFE AUTOMOTIVE HIGH-PERFORMANCE COMPUTE: LEVERAGING SOLUTIONS TO MAXIMIZE SAFETY

In the ongoing evolution toward fully autonomous vehicles, centralized compute architectures will govern the intelligence and real-time decision-making required for AI-enabled vehicles to ensure the highest levels of passenger and pedestrian safety. These vehicle "nerve centers" must be built from the ground up to meet stringent safety requirements, from development to validation to deployment. Safety cannot be addressed as an afterthought in late-stage design cycles with retrofits to general-purpose processors and components originally targeted for consumer devices and cloud datacenter environments. True automotive-grade safety conformance must be engrained in the solution DNA from day one.

This effort requires a coalition of proven automotive hardware and software technology leaders working in concert to help ensure seamless integration at every level of the automotive compute architecture and the attendant supply chain. Automotive OEMs and Tier 1 suppliers are counting on this growing ecosystem of technology providers to converge on a common framework. This framework prioritizes safety above all else, while simultaneously minimizing development complexities and costs to help speed their time-to-market on L2+ and above vehicle autonomy and to innovate in new EE architectures.

A FLEXIBLE, SCALABLE DEVELOPMENT PATH

NXP's automotive high-performance compute initiative is harnessing these efforts into a unified framework that ADAS and new EE architectures system designers can trust for ASIL-grade quality and reliability, even as their designs evolve. They need a clear, consistent development path from L2 onward, leveraging scalable processing capacity and software resources that are proven compatible and will help to preclude major system redesigns in the years ahead. With the new EE architectures, NXP sees some cross-domain compute consolidation which can be addressed with the BlueBox3.

Software openness and code portability are key to this effort. System designers shouldn't be locked into "black box" systems or proprietary development platforms that can restrict their design freedoms and/or limit their feature differentiation. With open, standards-based programming languages and development tools, designers are afforded the flexibility they need to meet their ambitious design goals with greater workflow agility and lower development costs.

With a decades-long heritage and established expertise in automotive applications, NXP is leading the effort to enable precisely orchestrated automotive high-performance safety and compute capabilities that leverage a precisely orchestrated partner ecosystem. Safe automotive high-performance compute unites a wide range of development, testing and validation efficiencies with a shared vision for the future of automotive safety. It's designed to encompass vehicle management, diagnostics and feature-specific services and functions—all accessing a central gateway and elegantly serviced via a single, scalable platform.

THE AUTOMOTIVE HIGH-PERFORMANCE COMPUTE ECOSYSTEM

Central Processing Hub

NXP's BlueBox development platform integrates ASIL-ready automotive-grade NXP processors to enable optimized performance-per-watt and thermal profiles that are harder to meet with power-hungry, general-purpose processor cores. It houses the central compute and connectivity to accommodate vision, radar and LiDAR signal paths. The NXP BlueBox platform delivers the performance required to analyze driving environments—in the lab and on the road—to assess risk factors and govern the vehicle's behavior. www.nxp.com/bluebox

Massive Processing Acceleration

NXP and Kalray are collaborating to deliver on a common hardware and software platform for safe, reliable and scalable autonomous driving solutions. These solutions encompass the near-term delivery of L2+ and full automation in the long-term. Within the NXP BlueBox Platform and integrated in the Software Development Environment, Kalray MPPA® (Massively Parallel Processor Array) intelligently accelerate the perception and modeling required for the next steps in the automated driving roadmap.

Kalray's MPPA® Intelligent Processors ease the development of safe and ready-to-certify solutions, thanks to its deterministic architecture and its ability to isolate execution domains and guarantee freedom from interference together with its compliance with the ISO 26262 standard.

MPPA® processors are not only capable of executing AI algorithms but can also simultaneously execute a wide set of different processing such as mathematical algorithms, signal processing and networking software stacks with different levels of criticality on the same chip. This heterogenous multi-processing capability is also a critical requirement for autonomous vehicles, and is a unique capability of Kalray's Coolidge™, 3rd generation of MPPA® processor. www.kalrayinc.com

Certifiable Motion Control and Pathfinding

Embotech specializes in motion planning for autonomous driving. Its success lies in the safe execution of sophisticated decision-making algorithms that ultimately send steering, accelerating and braking commands to the vehicle. Embotech's software runs on the powerful NXP LX2160A to enable high performance automated driving. Additionally, in the event of a system malfunction, the software runs the firm's backup motion planner concurrently on the safe and redundant NXP S32G. This safety backup is an essential step towards achieving ASIL B functional safety certification, which Embotech aims to achieve by the end of 2021. BlueBox3.0 is an ideal platform for safe and certifiable autonomous driving collaboration. For more information visit: https://www.embotech.com/products/prodriver/overview/

Safety-Certified Real-Time Operating System (RTOS)

Green Hills Software and NXP have collaborated to enable engineers to build mixed-criticality software forhighly automatedvehicle systems running on theBlueBoxAutonomous Driving Development Platform from NXP. The combined solution is powered by the ASIL-D INTEGRITY® real-time operating system and provides a trusted software foundation to bridge development programs to production readiness. Critical applications such as path planning, health monitoring and DDS communications run side-by-side with less critical frameworks such as Linux, all on the same processor. Advanced development tools from Green Hills help speed debugging and deployment on the heterogenous multicore system. www.ghs.com

Precision Traffic and Sensor Simulation

dSPACE's data-driven development toolchain empowers safe autonomous driving. Thephysics-basedASM Traffic solution supports the creation of complex road networks, whereby designers can define sophisticated traffic scenarios on virtual roads among static and movable objects, like traffic signs and pedestrians.Additionally,physical sensors – radar, lidar and camera – can be simulated for both Software-In-the-Loop (SIL) and Hardware-In the-Loop (HIL) testing of complex Autonomous Driving and ADAS systems.dSPACEsupports all raw data sensor interfaces incl. SerDes and MIPI CSI-2ˢᴹ. www.dspace.com

Open-Source Software Development

Deploying safe, autonomous vehicles at scale is a colossal undertaking that requires strong synergies between corporate development, government entities and academic research. It also requires a vastly expanded ecosystem for autonomous vehicle technologies. Organizations such as the non-profit Autoware Foundation are closing these gaps by initiating, growing and funding open-source projects that enable self-driving mobility. Open-sourced software stack contributions from members are fully open to everyone, and the group is developing software that is vendor-agnostic to any SOC, enabling an easier way to compare and contrast vendor offerings. www.autoware.org

Memory and automotive experts delivering optimized memory products for automotive applications

At the heart of BlueBox 3.0 is a powerful combination of leading memory and storage technologies fueling the platform's advanced automotive high-performance computing. These include Micron Technology's high-speed NOR flash, e.MMC flash, NVMe SSDs, DDR4 and LPDDR4x DRAM, which work in concert to drive NXP's Layerscape LX2160A's and S32G's processors. These gains enhance the intelligence and connectivity possible for next-generation vehicle architectures and ADAS systems. Micron's memory and storage is critical for managing the vast amounts of automotive data generated by smart radars, sensors and cameras — enabling scalable semi-autonomous and autonomous applications.

Micron's broad portfolio of volatile and nonvolatile memory products are rigorously tested and optimized for automotive applications to ensure they can function in extreme environments. Micron automotive memory and storage solutions offer the increased reliability, fast boot times, high bandwidth, low power and small footprint required by today's compute-intensive automotive applications.

Micron has 30 years of automotive expertise, innovation, and engineering experience and is the market share leader, supplying its automotive memory and storage to all leading automotive manufacturers. Micron is one of the first memory solutions providers to earn International Automotive Task Force (IATF) 16949:2016 quality certification, a clear reflection of Micron's relentless commitment to quality. For more information on Micron Technology's automotive memory solutions, visit: https://www.micron.com/solutions/automotive.

eProsima, delivers high-perfomance middleware for real-time critical systems

eProsima is focused on high-performance middleware. Its main product, eProsima Fast DDS, is a high-performance middleware for real-time and critical systems. It powers the communications between the different components of the BlueBox 3.0. NXP and eProsima joined forces to create a strikingly fast PCIe® transport for eProsima Fast DDS, to get the most of the BlueBox hardware. Tens of thousands of developers use eProsima to create real-time high-performance distributed systems for critical applications in sectors such as defense, robotics, and automotive. Learn more about eProsima at https://www.eprosima.com/ and eProsima Fast DDS at https://www.eprosima.com/index.php/products-all/eprosima-fast-dds.

EDGE CASE RESEARCH

NXP's latest version of Bluebox, includes the live safety case architecture developed by Edge Case Research. The Edge Case state-of-the-art software is a standards-based validation platform to track metrics and provide insights to inform safe deployment decisions. Our partnership is a step forward in accelerating the future of highly automated vehicles safely. www.edge-case-research.com

INTEMPORA
MULTISENSOR SOFTWARE SOLUTIONS
A dSPACE COMPANY

Intempora, addressing the full breadth of autonomous development through software

Intempora's software can address all stages of the development process for autonomous driving from prototyping to testing and validation. RTMaps (Real-Time Multisensor applications), a component-based development and execution environment, allows developers to easily develop and deploy algorithms for autonomous driving that respond promptly and precisely to the perceived environment with real or simulated data. As a versatile and powerful framework, RTMaps can take advantage of the hardware acceleration and the full processing capabilities offered by the BlueBox. Learn more at https://intempora.com.

rti Your systems.
Working as one.

Enabling advanced zonal E/E architectures with connectivity software

RTI has integrated the power and functionality of its DDS-based Connext Drive® connectivity software with NXP's BlueBox 3.0. Connext Drive is the standard-based software framework that manages complex data distribution for real-time connectivity in the autonomous systems used globally in vehicle production environments. By running Connext Drive natively through S32G vehicle network processors, RTI and NXP are enabling a next-generation zonal E/E architecture through a real-time, scalable and safety-certifiable platform that connects the entire system from safety domain to backend.

In addition, RTI and NXP are working to integrate Connext Drive with time-sensitive networking (TSN) on the S32G network processor and SJA1110 network switch. This aims to provide highly-reliable and predictable delivery, time synchronization and bandwidth allocation for TSN applications while expanding functionality through redundancy, reliability, monitoring, content-based filtering, and much more. www.RTI.com

TERAKI™

Teraki provides high-accuracy edge-AI software

Teraki's edge-AI software delivers higher accuracy to customers' AI-models. It does so by intelligently pre-processing and selecting relevant information from sensor data to train and run AI-models efficiently in the car. The lightweight footprint allows to run it in real-time on low-powered production hardware. AI-models are trained 10x-20x faster and - more importantly - achieve 10%-30% higher accuracy essential for better sensor fusion, ADAS, AD and increased safety. https://www.teraki.com/gallery/flyers/

MicroSys

MicroSys provides a broad product portfolio beginning from Systems on Module up to full turnkey systems. NXPs Arm™ based CPUs and controllers are the foundation of MicroSys miriac™ branded modules and system level products. For example, the S32™ portfolio with its heterogenous configuration of microprocessors and controllers is integrated, including the NXPs S32V processor for vision applications and the S32G for next-gen gateways in vehicle applications. This processor is the core of the miriac™ MPX-S32G274A SoM, that is a component of NXPs BlueBox 3.0.

Furthermore, the modular concept around the broad modules' collection enables a short-term and lowest risk development of products that target segments in automation, avionics, automotive, medical, railways & transportation, construction, and defense market respect for effectual norms (ISO13849, ISO26262, IEC61508, DO-160, EN50155, ISO13485) and requirements (extended temperature, rugged design). For more information visit: https://microsys.de/produkte/system-on-modules/armr-automotive/miriactm-mpx-s32g274a.html?L=1.

PROVE & RUN

OEMs are currently primarily focused on demonstrating the ADAS functionality as well as validating the new EE architectures like zonal architecture - they will soon raise the issues around certification and security - and ProvenRun (www.provenrun.com) will be able to answer to those issues with their secure TEE ProvenCore.

www.nxp.com/bluebox