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GUARDKNOX CAPABILITIES

THE CYBERTECH SUPPLIER

GuardKnox is the world's first Cybertech Tier supplier providing optimized and cybersecure high-performance computing platforms. With roots and extensive experience in secure avionics, defense aviation, and embedded systems, GuardKnox is navigating the steep learning curve for the development of ficutting-edge platforms and architecture design for the automotive industry.

GuardKnox's expertise and inherent flexibility facilitates a variety of implementations including full hardware and software solutions, software only (integrated into existing hardware) or built-to-spec. Empowering Tier 1s, OEM's, and other mobility players across the automotive ecosystem with the freedom to evolve to cost-effectively meet the challenges of rapid change and capability deployment



GuardKnox's solutions empower the auto industry with the **FREEDOM TO EVOLVE** to meet the changing needs of connected vehicles safely and securely



GUARDKNOX PRODUCTS

DOMAIN CONTROLLER PLATFORM

Uniform HW and SW ECU platform for domain controller E/E architectures. Including but not limited to Gateway Domain Controller, IVI Domain Controller and Body Domain Controller

VEHICLE SERVER ECU

Multi-domain ECU for Zonal backbone applications with heterogeneous resources (CPU, MCU, GPU, communication acceleration and FPGA). Coupled with GuardKnox Secure SOA stack to provide both HW and SW infrastructure for safe and secure multi-domain and mixed criticality operation

DOMAIN ON A CHIP

Complete domain on a chip, including all necessary communication infrastructure and application processing capabilities. Provides a cost effective, power efficient and flexible solution for single domain applications with emphasis on a multitude of interfaces and management applications

SECURE SERVICE-ORIENTED ARCHIECTURE (SOA) MODULAR STACK

Fully modular patented SOA stack which includes: BSP, separation kernel, hypervisor, optimized and secure partition and kernel configuration, host OSs (e.g. Linux, Android, AUTOSAR etc.), management infrastructure, software deployment infrastructure including OTA, network level service discovery, security infrastructure and container engine support.

AFTERMARKET TAILORED SOLUTIONS

Fleet management logistics, telematics, dealer fleet management, insurance and UBI, mobile device integration, ride sharing, security and anti-theft

ZONAL GATEWAY ON A CHIP

Cost-effective hardware solution for highperformance routing on a single chip design. Based on low cost FPGA containing the GuardKnox proprietary High-Performance Communication Engine.

BUILT TO SPEC

A customized and tailor-made solution adapted to meet each customer's individual requirements and needs.

FREEDOM TO EVOLVE

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GUARDKNOX EXPERT ENGINEERING

DESIGNED WITH THE FUTURE IN MIND

GuardKnox's Platform functions as a Domain Controller or as a high-performance computing platform ECU, which provides a secure endpoint for data processing and storage and also supports secure cloud communication.

Safety and non-safety critical services and applications are hosted on a single system-on-chip (SoC) with secure separation, partitioning, and access control. This ensures that no vulnerability can be used as a stepping stone to penetrate safety critical systems.

Partitions provide the capability to run multiple operating systems in parallel, while supporting real-time OTA updating of all services and micro-services running on the platform. Creating the ability to implement a modular design

COLLABORATION IN SPECIFIYING, DESIGNING AND IMPLEMENTING CURRENT AND NEXT-GEN <u>ZONAL</u> <u>E/E ARCHITECTURES</u>

ADVANCED SERIES SOFTWARE DEVELOPMENT

Dedicated series software solution on all layers of • the software stack and within multiple domains

- High-performance communication processing, with integrated security
- Modular software stack solutions
- Hypervisor based and application rich compute environments
- Telematics
- Integration with extra-vehicle devices (e.g. mobile devices, EV charging)
- Cyber security applications
- Ethernet communication

ADVANCED PRE-DEVELOPMENT CAPABILITIES

Customer specific solutions leveraging GuardKnox's advanced technical know-how and product innovation

- ECU Hardware Architecture Engineering & Design: advanced and innovative high-performance architecture design for highly consolidated & cost-effective ECUs. Including ECUs with multi-type resource requirements containing multiple application domains with high performance-to-cost and performance-to-power requirements.
 - **Flexible and Modular Software Stack:** Hypervisor designed with a complete & customizable software stack designed to isolate security and safety critical systems. Flexibility and support for SOA and component modularity allows decoupled design, testing, regression and integration of software components; Optimization of SW stack configuration, application deployment and load balancing; Cross-network unified communication and software deployment solutions.
 - Intelligent High-Performance Network Backbone for Zonal E/E Architectures – Fault tolerant and redundant Ethernet based ring network designs with high bandwidth communication & fiber-based interconnections. Specialization in unified distributed communication (e.g. DDS) and service discovery solutions. Core capabilities include Ethernet topology design, routing protocol, hardware design and optimization, and security in Ethernet network designs.
- Security Engineering System security engineering providing design, analysis and solution. Supporting hardware architecture, software architecture, integration, complete ECU, and network wide scope

FREEDOM TO EVOLVE

CYBERSECURITY HOUSED WITHIN PATENTED ARCHITECTURE

GUARDKNOX SECURE SERVICES-ORIENTED ARCHITECTURE (SOA)

SOA enables GuardKnox's solutions and platforms to allow unified communication as well as access control and service level partitioning. SOA allows for multiple partitions hosting independent services and service/application managers with access control both on application/service level as well as on the hardware level. The unified communication infrastructure allows for distributed unified communication with centralized policy over different hardware interfaces.

SOA utilizes a separation kernel for abstraction and concealment of communications across platforms – allowing for simplified and transparent interfaces to service providers. SOA also enables strong separation between services and applications on the virtual level. Additional capabilities include but are not limited to: separation via hypervisor, several computing zones, virtual ethernet, virtual CAN, network management, virtual ECUs, AUTOSAR classic and much more.

LOCKDOWN CORE™ FOR DETERMINISTIC CYBERSECURITY PROTECTION

GuardKnox's patented Communication Lockdown[™] Methodology is a formal, verifiable and certifiable security methodology that verifies all communication according to strict state machine-based model built by GuardKnox from CANDBs and function specification documents which are readily available from OEMs. The methodology verifies all data and communications on three layers (routing, content and context), including locking down any open fields or bits. The model can be certified for safety up to ASIL D and can adhere and comply to ISO26262, ISO15408, the upcoming ISO 21434 and GDPR.

Full hardware level separation is achieved between all physical interfaces in all of GuardKnox's solutions. This leads to a dedicated communication path for each interface prior to reaching any software. Initial verification of data can be implemented in hardware. Only after verifying hardware can data be passed to the software stack

running on the CPU, providing an efficient and high-performance infrastructure for hardware level security analysis for communication. Moreover, by providing hardware level separation, attacks can't spread and ensure that no one vulnerability is used as a stepping stone to penetrate safety-critical systems.

- <u>Patent 1- 9,899,563</u>: GuardKnox Lockdown Methodology & its implementation within a vehicle
- <u>Patent 2-10,009,350</u>: GuardKnox secure hardware architecture and the physical separation between vehicle networks, including Lockdown implementation in hardware
- <u>Patent 3 10,055,260</u>: Service-Oriented Architecture (SOA) for vehicle ECUs, including Secure SOA and efficient implementation of in-vehicle SOA
- <u>Patent 4 #10129259</u> Granted: Distributed Lockdown architecture within a vehicle, enabling multiple Lockdown devices to work together
- <u>Patent 5- # 10,191,777</u>: Distributed SOA to enable services not solely related to a single ECU within a vehicle
- <u>Patent 6 #10,776,169:</u> Centralized services ECU based on Service-Oriented Architecture and methods of use thereof

A flexible and scalable hardware architecture enables consolidation of E/E architectures into Zonal architectures with an ethernet backbone based realtime communication and network management.

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FREEDOM TO EVOLVE