



# The Automotive Virtual Platform

COQOS Hypervisor SDK is a modular software kit for developing cockpit controllers, rear-seat entertainment solutions, telematics systems and domain controller. It is based on a type-1 hypervisor especially fitting to automotive applications. TÜV SÜD has confirmed that the hypervisor complies to ISO 26262:2018 ASIL-B. Its architecture makes it possible to run several separated virtual machines (VMs) on a single processor, integrating real-time operating systems, open source systems like Linux or Android and AUTOSAR (both Classic and Adaptive). This is proven by multiple mass production projects with COQOS Hypervisor SDK.

### Target Automotive ECU

- Cockpit controller
- Rear-seat entertainment
- Telematics systems
- Gateway
- Domain controller

### Main Features

- Safe partitioning of the processor
- Freedom from interference between VM's
- Linux and Android
- Additional security features
- Multiple operating systems on a singlecore or multicore CPU
- VIRTIO based virtualization
- Virtualized GPU
- Support of hardware virtualization
- Fast-boot features
- Power management

### Properties

ASIL-B certified hypervisor designed for safety- and security-critical applications

Full VIRTIO support avoids hypervisor vendor lock-in. This minimizes development, integration efforts and time to market

Managed boot and fast boot technology ensure quick availability of critical functionality

Virtualized Linux and Android guest operating systems make the power of open source solutions available to automotive systems

VIRTIO device sharing makes it possible to share hardware resources between VMs

COQOS Hypervisor SDK comes with a set of out-of-the-box configurations

Ready for virtualization of Adaptive AUTOSAR.

### Benefits

Cockpit Controller combines mixed criticality functions (safety and non-safety relevant) within a single system

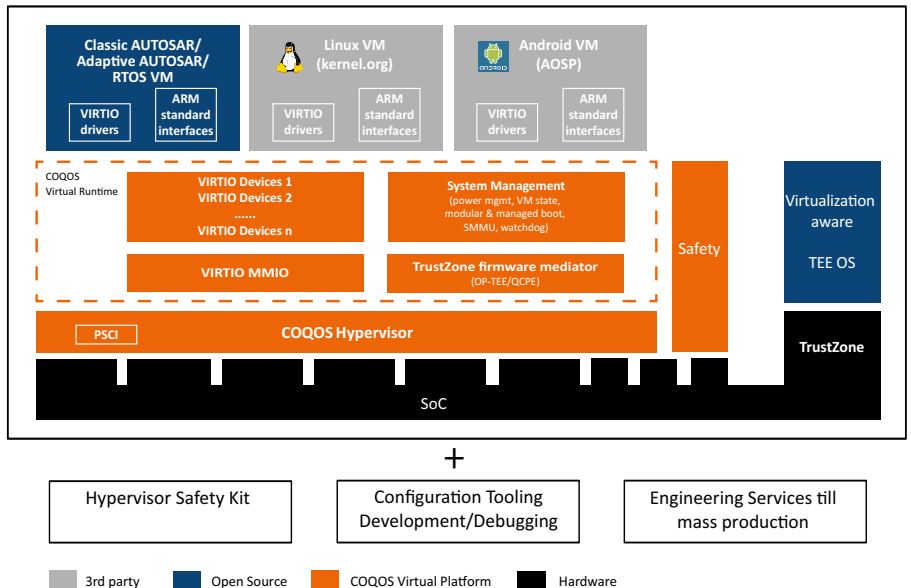
Type-1 hypervisor takes full advantage of the SoC hardware features and runs with very low performance overhead

Hypervisor running directly on the hardware generates virtual machines. The partitioning function protects from outside attacks against guest operating systems

Individual VM's could be updated without impacting functionality of other VM's

Reduces hardware cost by migrating from multi-chip solutions to a single, highly integrated system on chip

Using standards minimizes development costs for the customers.



## Supported target processor architectures

- ARMv8-A

## Reference SoCs

- Renesas R-Car H3/M3
- NXP i.MX 8
- Qualcomm Snapdragon™ S8155

## Supported SoCs

- NXP S32G
- TI J7
- Samsung Exynos
- Any other SoC could be supported based on customer project.

## COQOS Hypervisor

- The type-1 hypervisor runs directly on the host's hardware to control the hardware and to manage guest operating systems
- It supports hardware virtualization
- Resource visibility is based on static configuration
- Lean codebase limits exposure of attack surface and helps to develop safe and secure system.

## ISO 26262

TÜV SÜD has confirmed the compliance of OpenSynergy's COQOS Hypervisor to ISO 26262:2018 ASIL-B. It is the first hypervisor that has been certified to the second version of the ISO 26262 standard.

## VIRTIO Devices

OpenSynergy supports a wide range of virtualized devices. OpenSynergy is continuously contributing to standardization and open source. Few VIRTIO devices are listed below:

- VIRTIO-block device for using mass storage
- VIRTIO-rng for Random Number Generator
- VIRTIO-gpu enabling graphical output of VMs with different requirements on one or multiple displays (Shared Display) and for paravirtualization of 3D GPU (Shared GPU)
- VIRTIO-input to share input e.g. for touch
- VIRTIO-scmi to share platform clocks and regulators for seamless pass-through.

## Inter-X Communication Framework (IXCF)

IXCF transfers data between VMs. It consist of:

- VIRTIO Network (VIRITO-net) for paravirtual ethernet + Virtual Character Driver (VCHAR)
- VIRTIO over MMIO.

## Modular and managed boot

- Bootsystem image is split to smaller HV and VM images
- It allows to change the boot sequence of the different Virtual Machines (VMs)
- It allows shutdown and restart of a single Virtual Machine.

## Power management

COQOS Hypervisor SDK supports the Arm PSCI specification. It supports all mandatory PSCI calls and in addition the PSCI calls used by current Linux (4.20 kernel) and Android (P).

## COQOS State Manager

This quality management component:

- has interfaces with the hardware watchdog, which is a key element in the safety concept
- can be used to implement a system supervisor to monitor that the other VMs are still alive or a system state manager to manage state of the system
- is highly customizable.
- States, transitions and transition guards can be configured through standard SCXML files.

## Android, Linux and RTOS

COQOS Hypervisor SDK supports the following guest operating systems:

- Latest Linux versions (following roadmap of chipset vendors)
- Latest Android versions (following roadmap of chipset vendors)
- OpenSynergy supports out-of-box usage of FreeRTOS.

However, based on customer needs, any RTOS could be supported. Please contact OpenSynergy for more info.

## In addition available

### Adaptive AUTOSAR

In case customers wish to use Adaptive AUTOSAR, a pre-integrated example use-case is available:

- Integration of commercial Adaptive Platform stacks (Vector Adaptive Microsar, ETAS RTA-VRTE);
- VIRTIO devices for Ethernet and EMMC.

## Development Environment

### Host support

COQOS Hypervisor SDK development tools are designed for use on Linux Ubuntu 16.04. Support is also available for other Linux distributions.

### Hypervisor Configuration

COQOS configuration tooling generates the hypervisor configuration from a model described in XML.

### Build and Integrate

Supports the seamless integration of Yocto based Board Support Packages (BSP).

### Test and Debug

- Dedicated UART channel to monitor hypervisor
- Individual guest VM debugging
- Periscope: multiple bidirectional communication channels over a single physical serial link.

### Adaptive AUTOSAR

OpenSynergy has developed a performance measurement framework to test any Adaptive AUTOSAR Stack: Communication, Persistency, Execution Management, Time Synchronization, Identity Access Management, Update Configuration Management; The tool is not part of the SDK, but an additionally offered service by OpenSynergy.

## Support

COQOS Hypervisor SDK comes with standard support and access to updates of the product. In addition, OpenSynergy's Professional Services are available to port COQOS Hypervisor SDK to your hardware or to help in configuration or integration tasks.

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