SYSGO
EMBEDDING INNOVATIONS

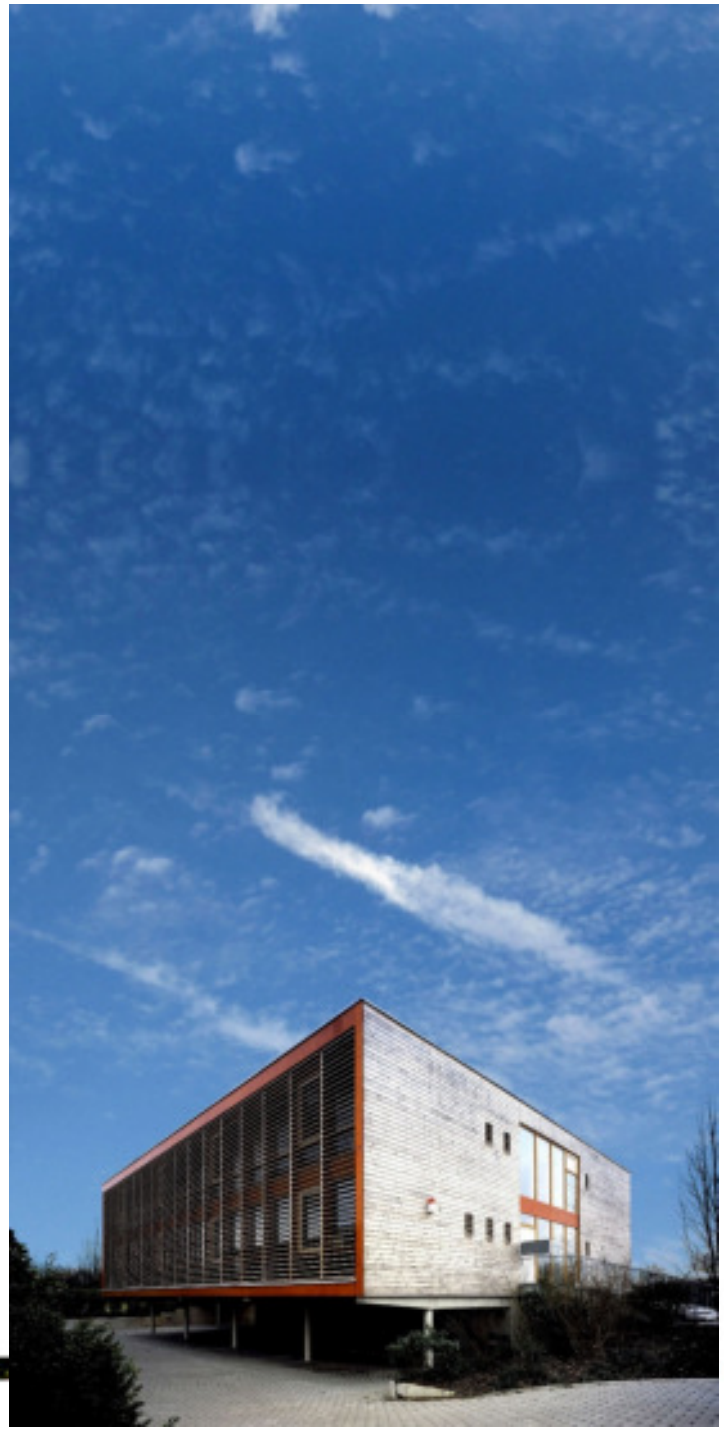
Return of Experience:
“Deploying virtualization in the vehicle”

Genivi AMM, Munich, May 2019

F. Walkembach, VP Marketing & Alliances

Company · Brief Overview

Founded	**1991** **Since 2012 part of the Thales Group**
Local	**Facilities in Germany, France, and Czech Republic**
Global	**Distribution and Support Network including Europe and the Pacific Rim**
PikeOS®	**Certified RTOS and Hypervisor supporting many embedded VMs and Guest OS**
ELinOS®	**Late 90's SYSGO pioneered the use of Linux in the Embedded Market**
Alliances	**JV with Vector on AUTOSAR adaptive**



Agenda

- **Customer use case**
  - Top level requirements
  - Pain points
  - Why using a hypervisor
- **Technical work packages**
  - Guests
  - Hw-virt
  - Boot process
  - Selection of hardware
- **Technical constraints**
  - Boot process
  - BSP creation with Serial and Ethernet driver
  - Training-, Support services
- **Potential issues**

Use cases for a V2X solution

Emergency Vehicle Warning

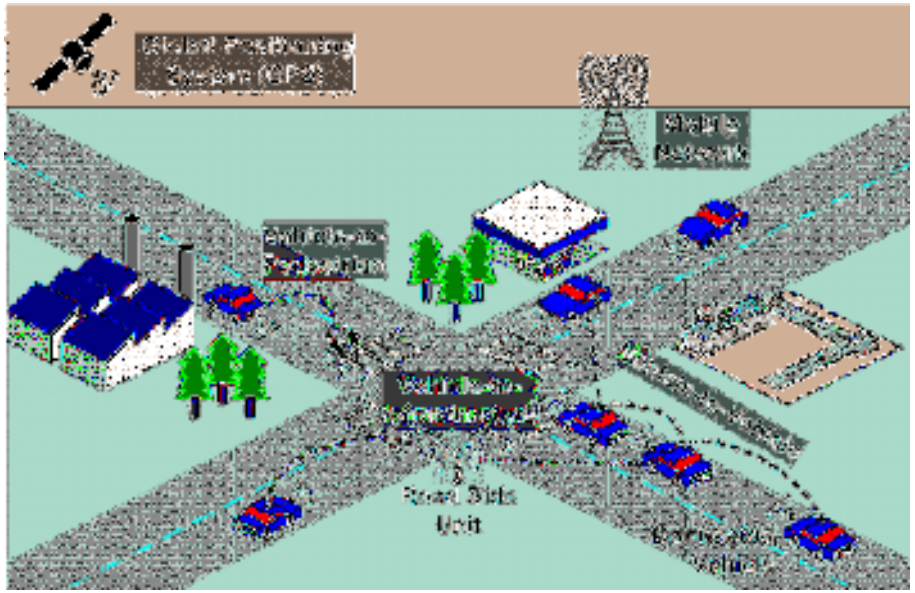
Intersection Movement Assist

Stationary Vehicle Warning

Enhanced Traffic Jam Assist

Top level requirements for a V2X box

- Real time data processing
- Respecting safety considerations with early warning
- Data security & privacy
- Vehicle bus interface
- Network IEEE 802.11p / ITS G5
- GNSS
- Always localized
- Generic ECU requirements
- Generic quality requirements
- Safety certification levels



Acc. To researchgate.net

Unknown certification details at start of project

- **End customer specification not precise at the start of the project**
  - Unknown certification elements
  - Not yet agreed SW architecture
- **But, a flexible approach in using a hypervisor**
  - Elements that require ASIL certification can be added later in the project
  - The customer initially planned using PikeOS native and POSIX but
  - added new Linux partition later
  - Via Linux the need for HW-virt was introduced
  - Adding safety requirements inforce the change of only ONE partition, that go through the certification process

Why did customer prefer using a hypervisor?

- Realtime capabilities (Mix of lower and higher RT capabilities)
  - Configurable Time Schemes, WCET guaranties, handling different levels of RT
- Strong separation
- Certifiable at a later stage of the project
- Small footprint
- Flexible enhancement of other guests
- Embracing OpenSource
- Use of legacy code in VM
- Secure Boot, secure Update
- Reduction of time to market
  - Building a prototype in Linux guest for V2X quickly
  - Critical blocks can be moved to PikeOS native or POSIX
  - Limited effort for creation of a POC and
  - preparing the final architecture in parallel

Top work packages

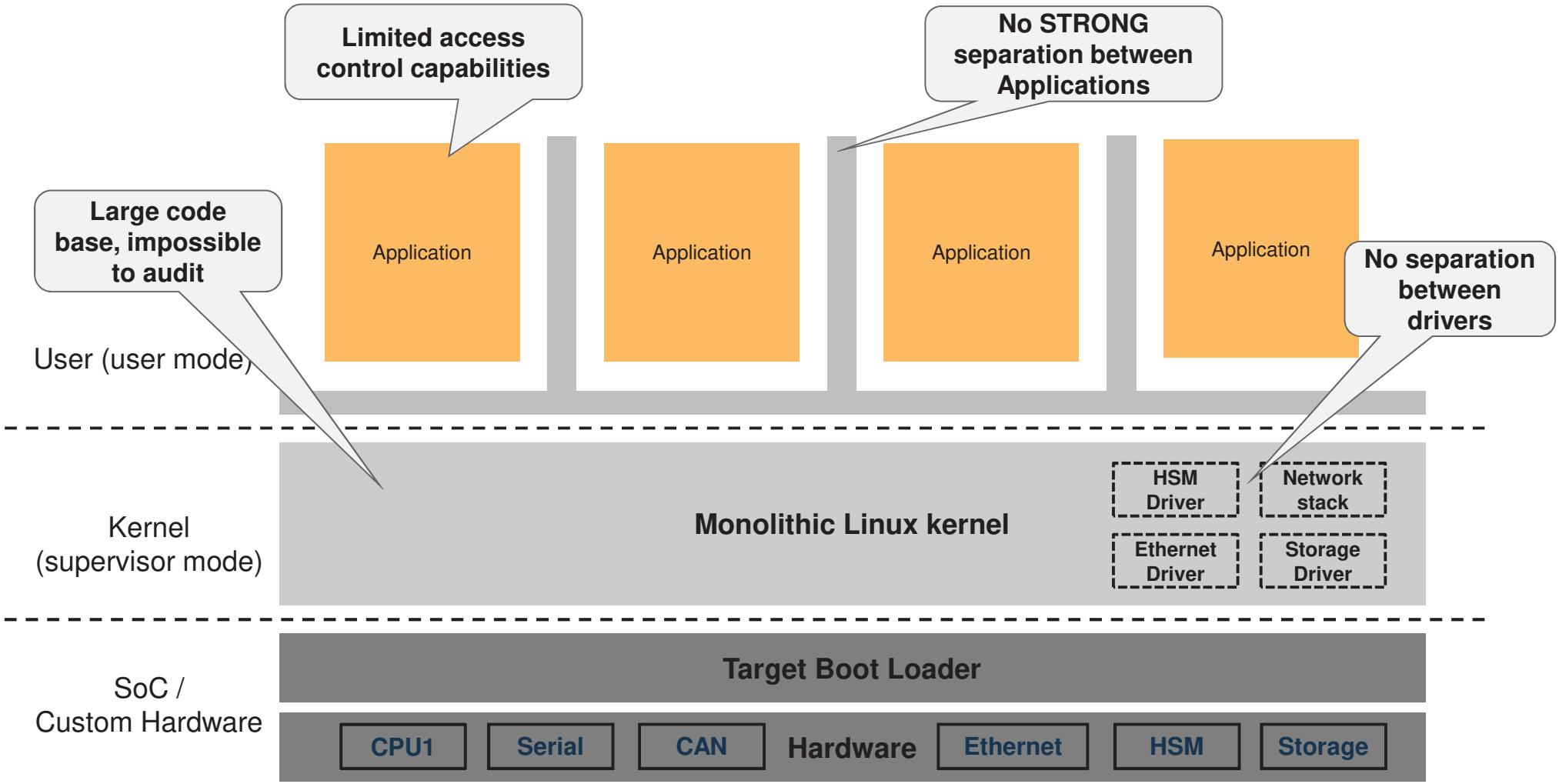
- **Creation of BSP**
  - Adjust RAM physical addresses
  - Adapt GPIO settings
  - Integrate interrupt controller
  - Integrate timer
  - Support HW virtualization
  - Support PAE
  - Testing within SYSGO test framework
- **Development of drivers**
  - Serial and Ethernet
- **Configure and set up partitions**
  - Based on use cases
  - Boot time optimisation

Security approach with certified crypto

- **Security by separation with Independent Common Criteria Assessment**
- **Enables SW architecture design with dedicated partitions allocated to sensitive functions**
  - Controlled information flow
  - Privilege allocation per partition
  - Enable OTA for single component (when vulnerabilities are discovered)
- **Enables Secure Sharing of Resources**
  - Secure storage, Crypto Algorithm
- **Multi-level Containerisation**
  - Strong hypervisor based separation
  - Optional docker containers in a partition
- **Mono-directional communication flow**

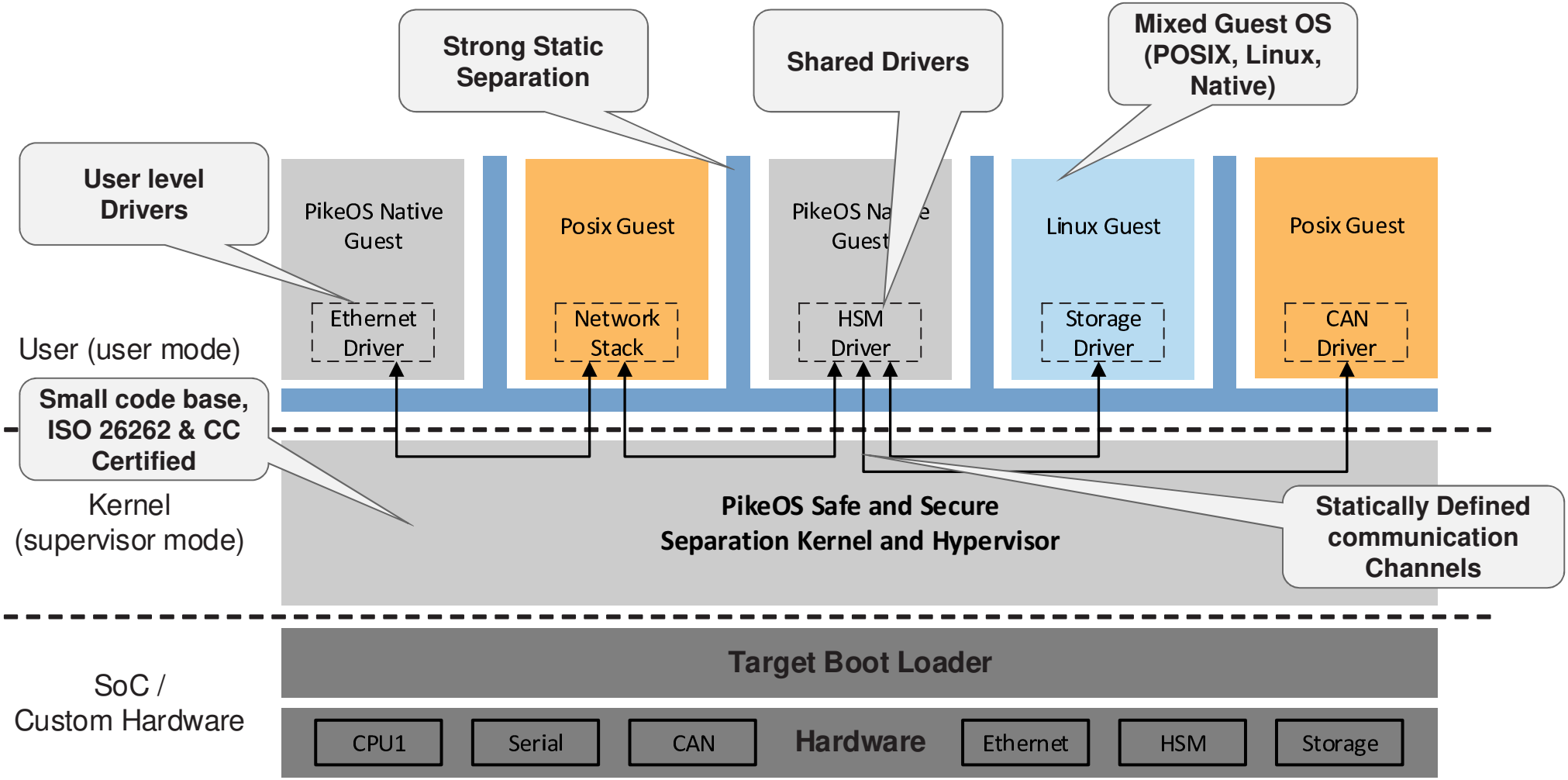
Introduction

Traditional approach

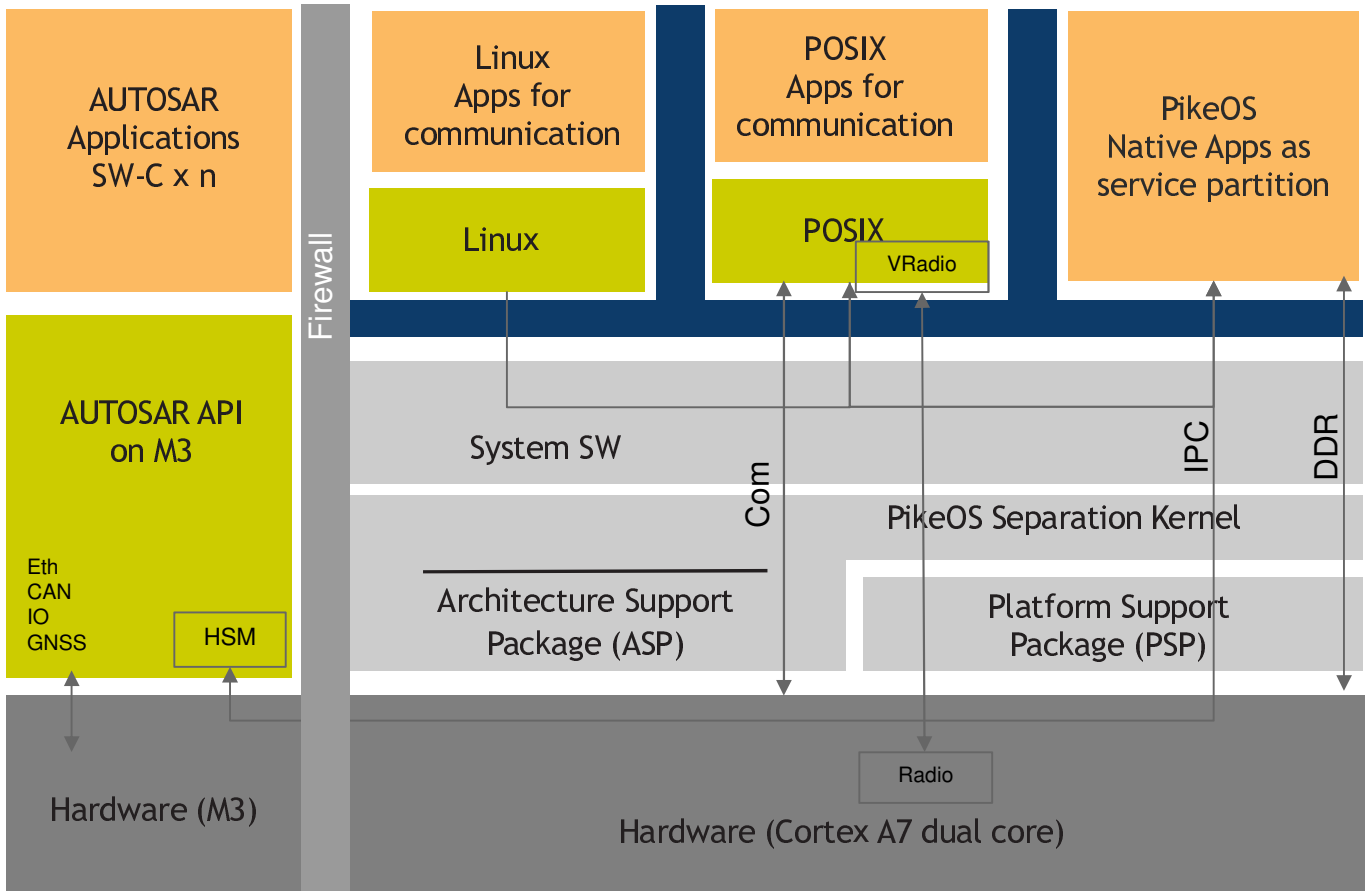


Introduction

Security by separation



Selected Architecture for V2X



Advantage:

- Real time
- Flexible
- Security with certified crypto algorithms
- Managed boot process

Potential issues

- **Performances (Latency)**
  - The more partitions are created the safer the system will be
  - Each partition adds latency in the data flow
- **Resource sharing design**
  - Using an hypervisor adds flexibility and enables late design decisions within an exception
  - Resource sharing control is defined by dedicated driver
  - Specification need to be ready at a very early stage
- **SOC Core allocation**
  - Time Partitioning Allocation
  - Interferences will exist

SYSGO
EMBEDDING INNOVATIONS

Thank you for your attention!

More information on www.sysgo.com