ACRN

A Big Little Hypervisor for IoT Development

February 2018

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PROJECT OVERVIEW

Current State of Affairs – IoT Development

IoT device devices requires support for a myriad of HW resources on one platform:

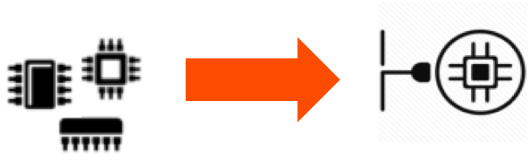
Ex: Camera, Audio, Graphics, Networking, etc.

Needs to be able to support and run multiple operating systems simultaneously

Ex: Linux, Android, Windows, RTOS etc.

Needs to be able to support and run multiple SW tools and applications depending on the IoT device's usage model

Need a way to consolidate ECUs and SW technology investment to lower total BOM costs for IoT devices productization



Virtualization is Key

Current
Data Center Hypervisors

- Too large for embedded IoT development
- No safety-critical workload considerations
- Requires too much overhead for embedded development

Current
Embedded Hypervisors

- Highly dependent on closed source proprietary solutions
- Expensive
- Makes product longevity difficult
- Hard partition, no ability to share resources

No Open Source Hypervisor solution currently exists that is **optimized for embedded IoT** development

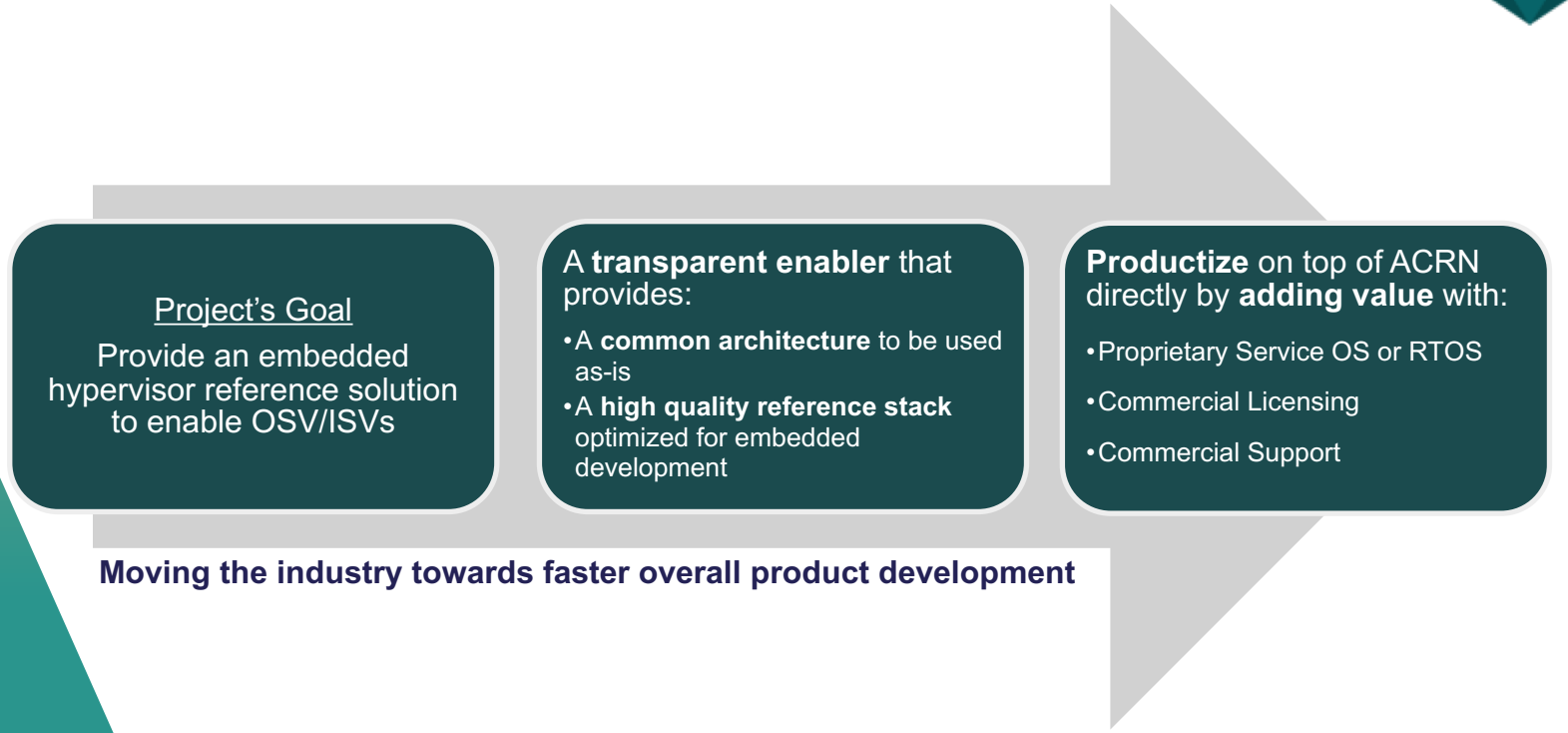
ACRN™ is a flexible, lightweight reference hypervisor, built with real-time and safety-criticality in mind, optimized to streamline embedded development through an open source platform

Project ACRN™ Pillars

ACRN™ is a flexible, lightweight reference hypervisor, built with real-time and safety-criticality in mind, optimized to streamline embedded development through an open source platform

Small footprint	Built with Real Time in Mind	Built for Embedded IoT	Safety Criticality	Adaptability	Truly Open Source
• Optimized for resource constrained devices • Few lines of code: Approx. only 27,000 vs. <156K for datacenter-centric hypervisors	• Low latency • Enables faster boot time • Improves overall responsiveness with hardware communication	• Virtualization beyond the “basics” • Virtualization of Embedded IoT dev functions included • Rich set of I/O mediators to share devices across multiple VMs	• Safety critical workloads have priority • Isolates safety critical workloads • Project is built with safety critical workload considerations in mind	• Multi-OS support for guest operating systems like Linux and Android • Applicable across many use cases	• Scalable support • Significant R&D and development cost savings • Code transparency • SW development with industry leaders • Permissive BSD licensing

ACRN™ & OSV/ISV Vendors



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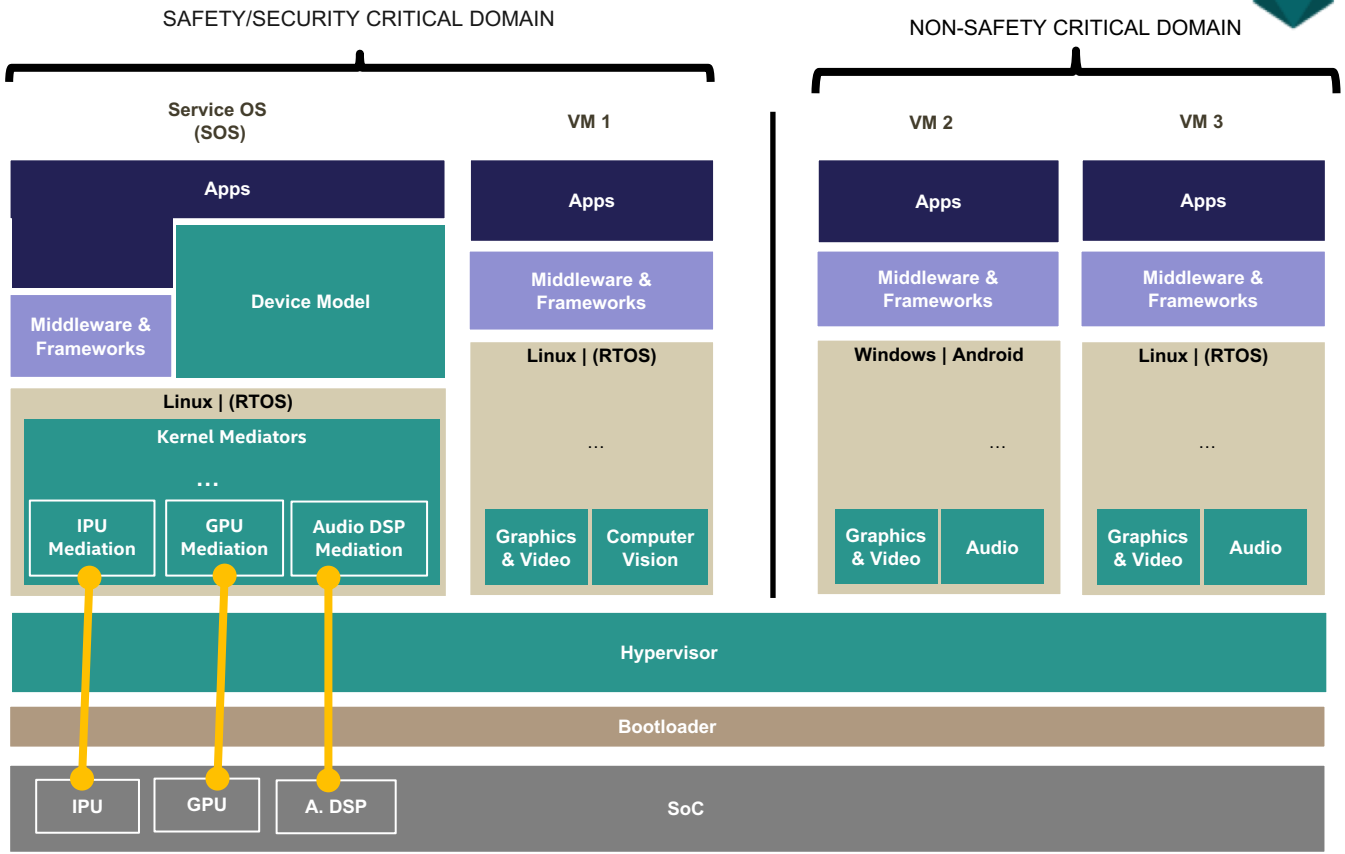
TECHNCIAL OVERVIEW

ACRN™ Reference Stack

- Hypervisor sits right on top of bootloader for **fast booting** capabilities.
- **Partitioning of resources** to ensure safety-critical and non-safety critical domains are able to coexist on one SoC.
- **Rich IO mediators** that allow for the Service OS to communicate directly to SoC ensuring low latency for safety critical elements
- Allows for **multiple operating systems** to be supported by one SoC through efficient virtualization



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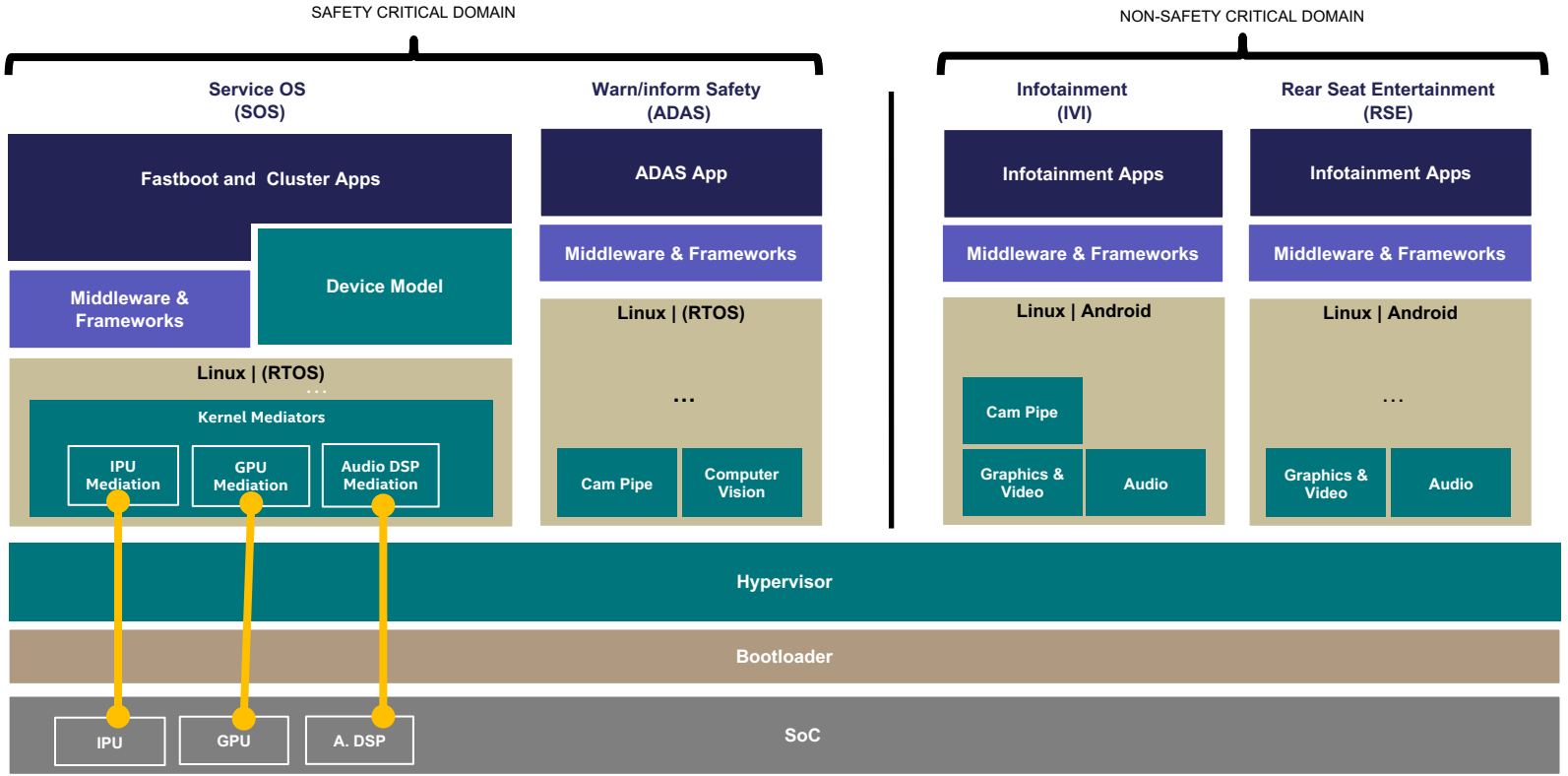
ACRN™ Usage: Automotive Example



Current Project Status

Code

- Support for hypervisor and device model included
- Support for Storage, Network and Console Mediators
- Integration with a Linux-derivative Service OS in progress
- Currently supporting the Intel Apollo Lake NUC platforms
- Project code will be posted on public GitHub on March 13th, 2018

Documentation

- All project documentation including release notes, API documentation and all other documentation related to the code will available on project GitHub by March 13th, 2018
- Other documentation planned include, a Getting Started Guide to familiarize the developer with the project
- A Contribution guide to encourage code contributions to the project, etc.

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CI

- Currently utilizing Intel CI processes to open source the project.
- Planned collaboration with the open source community on input for CI infrastructure for the project to a neutral host site

On the Horizon

- Mediator Support for Audio, IPU, GFx, CSE, TSN etc. planned for expanded embedded IoT use cases of the project
- Create a process to address functional safety (FuSa) and security requirements together with the project community
- Hardware platform support to create a hardware agonistic project

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GOVERNANCE

Governance Ethos

Community Involved

- Encourage and welcome participation in the project

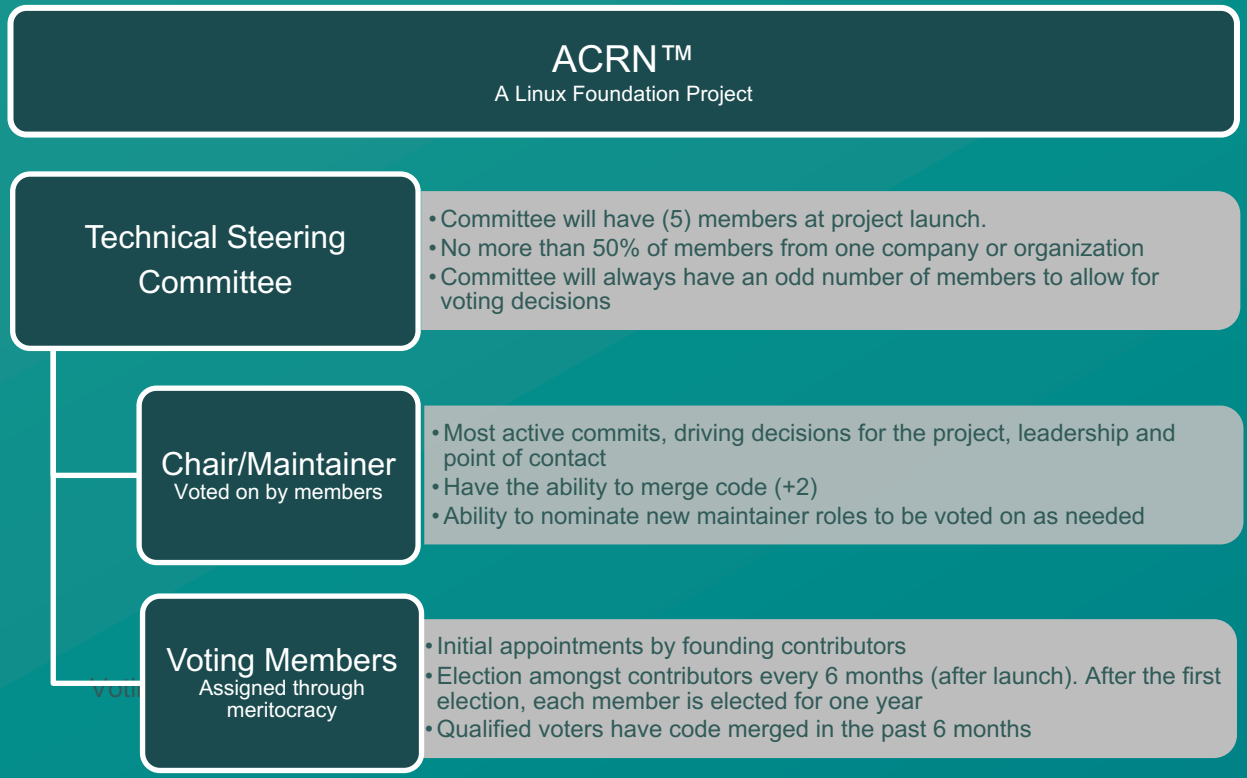
Transparency

- Committed to working transparently in the open to encourage the open source community's involvement

Code > Currency

- The project is committed to a true open governance where code contributions is the main objective

Governance: Technical Steering Committee



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Project ACRN™

For Embedded Developers

- Build complex embedded systems requiring various levels of safety-criticality
- Resource sharing allows for maximizing potential of resource-constrained devices while ensuring safety critical workloads are given priority to platform hardware
- Open source code allows for developmental cost savings as transparent code ensures code compatibility, flexibility in vendor selection as well as helping to ensure longevity of product lifecycle while reducing support and maintenance costs of the product's life.
- Small footprint, lightweight code base to ensure inclusion of only necessary code optimized for embedded development. No superfluous code.

Call to Action

Endorse us!

If you support the ACRN project and feel that this is the right thing for the embedded ecosystem.

No sponsorship dollars required

Add your **company's name**, **logo** and a **quote** to our project announcement press release on **March 12th, 2018**

Contribute code!

Make a difference to the project by committing code, help us become a better project.

Join in and participate in the project to become a member of the Technical Steering Committee

Project Opening Plan

Q1	Q2	Q3
ELC North America March 12-14		**July XX, 2018**
• Keynote on March 13th announce project with at least 1 automotive partner and endorsements from early adopters • Project will be hosted by Linux Foundation. Press release by Linux Foundation to announce project • Demo and Session at conference with project • Open source project via GitHub • Neutral, open source project name • Website	Continue to build Project momentum	• Beta features of project are available • Press release to announce the partners that signed on to the project and to announce the β features release of the project • Fully formalize TSC with voting members via meritocracy

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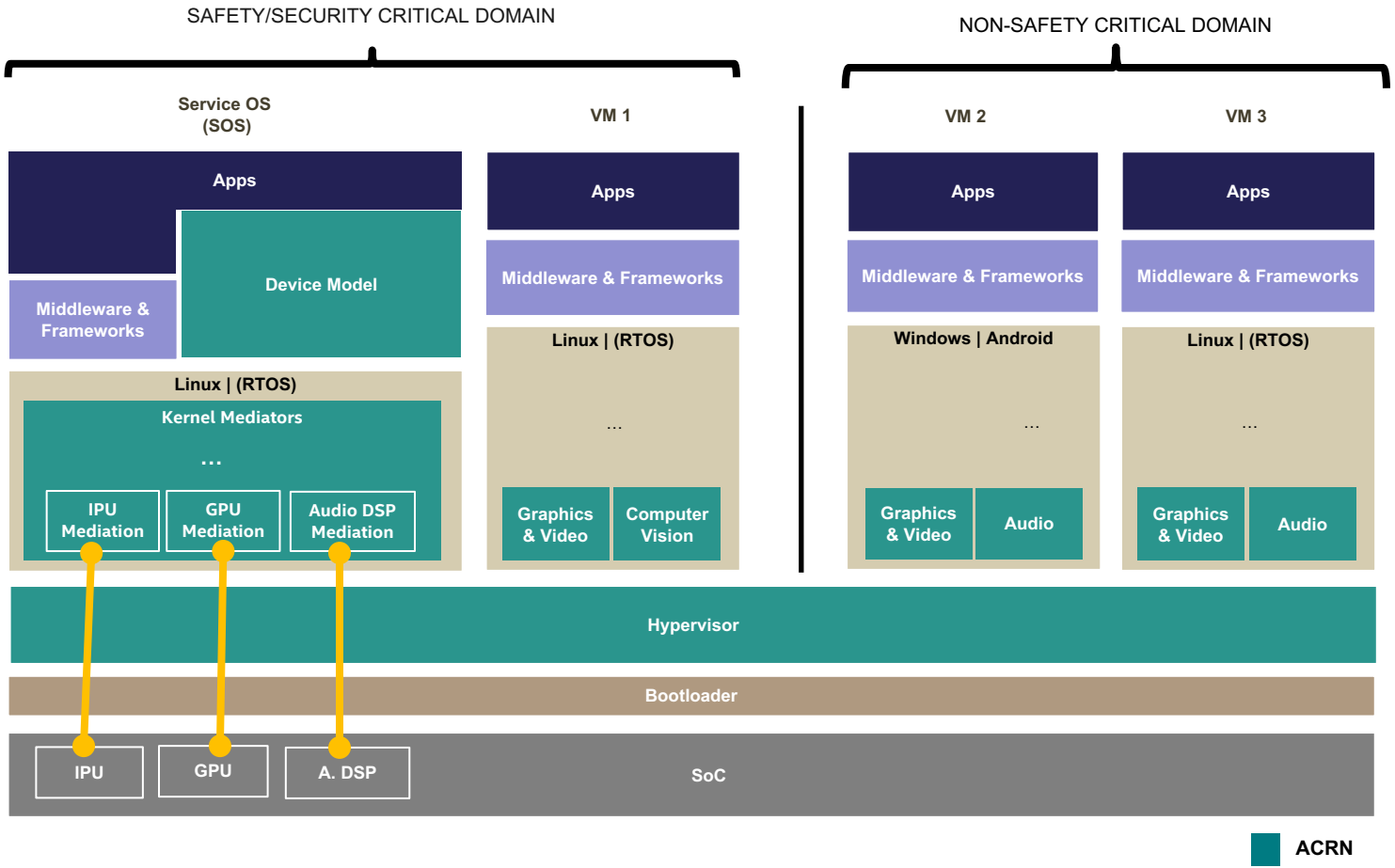
SAFETY/SECURITY CRITICAL DOMAIN
NON-SAFETY CRITICAL DOMAIN
Service OS (SOS)
VM 1
VM 2
VM 3
Apps
Apps
Apps
Apps
Device Model
Middleware & Frameworks
Middleware & Frameworks
Middleware & Frameworks
Middleware & Frameworks
Linux | (RTOS)
Kernel Mediators
...
IPU Mediation
GPU Mediation
Audio DSP Mediation
Linux | (RTOS)
...
Graphics & Video
Computer Vision
Windows | Android
...
Graphics & Video
Audio
Linux | (RTOS)
...
Graphics & Video
Audio
Hypervisor
Bootloader
IPU
GPU
A. DSP
SoC
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