Workload Consolidation with ACRN™ Hypervisor

James Wu, Director of IOT Hypervisor
Yogesh Marathe, Product Manager from Google OS Division
Intel System Software Product Group

Agenda

- ACRN Based Reference Stack for Workload Consolidation
- ACRN Update: 1.0 Release and 2.0 Roadmap
- Introduction of Celadon – Open Source Android Stack for IA

Overview of Workload Consolidation

Modern OS -> Multiple App/Process

Linux Container -> Multiple Linux based System

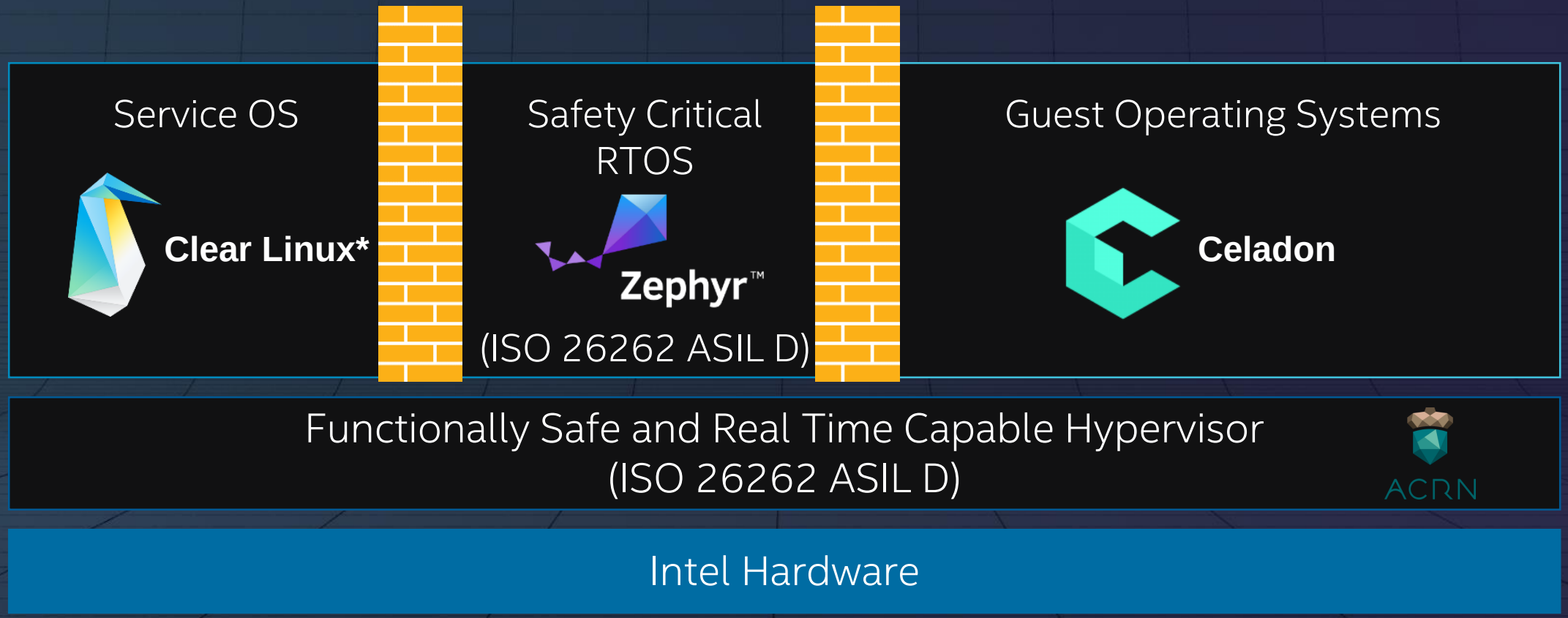
Kata Container -> Hardware Backed Security

KVM, XEN -> Different OS

Why ACRN ->

- Heterogeneous Workload Consolidation
  - Functional Safe World and Non-Safe World
  - Hard Real Time and Rich Graphics

Open Source Fusion Stack from Intel



Core Components of Intel Reference Stack

Clear Linux* OS is an open source, rolling release Linux distribution optimized for performance and security, from the Cloud to the Edge, designed for customization, and manageability

The Zephyr™ Project is a scalable real-time operating system (RTOS) supporting multiple hardware architectures, optimized for resource constrained devices, and built with safety and security in mind

Celadon is an open source Android* software reference stack for Intel architecture. It builds upon a vanilla Android stack and incorporates open sourced components that are optimized for the hardware

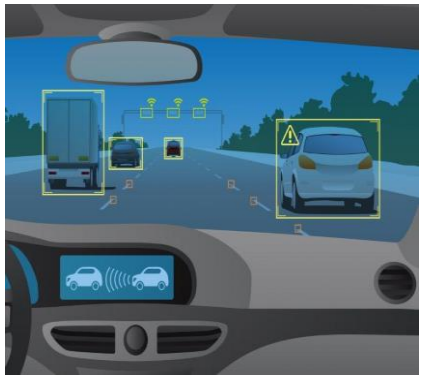
ACRN™ is a flexible, lightweight reference hypervisor, built with real-time and safety-criticality in mind, optimized to streamline embedded development through an open source platform

Usage Example – In-Vehicle Experience

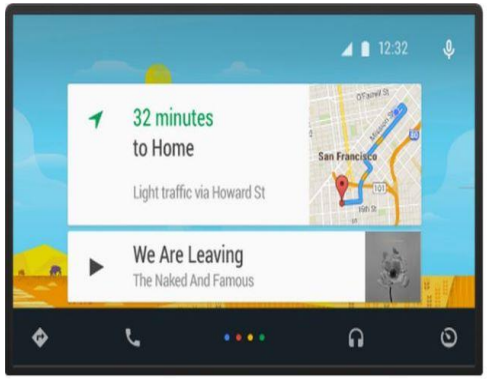
Safety OS

Cluster

ADAS Info



Infotainment (IVI)



ACRN Hypervisor

Bootloader

SoC

Neusoft Automotive C4-Alfus Pro System

Cluster

- Traditional Cluster
- Safety Alert

IVI – Up Screen

- Focus on display to driver
- ADAS Display

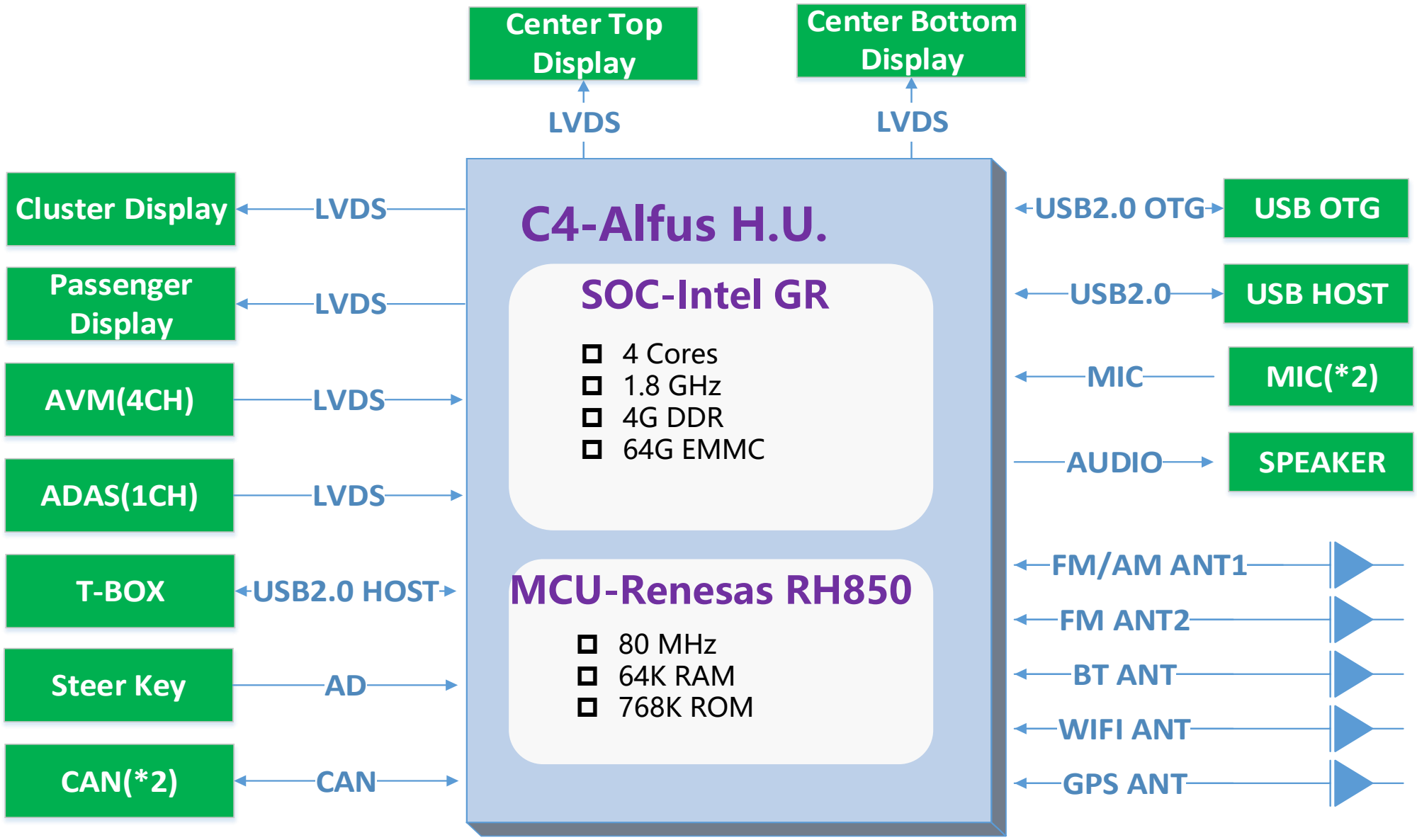
IVI – Bottom Screen

- Focus on operation
- Voice control

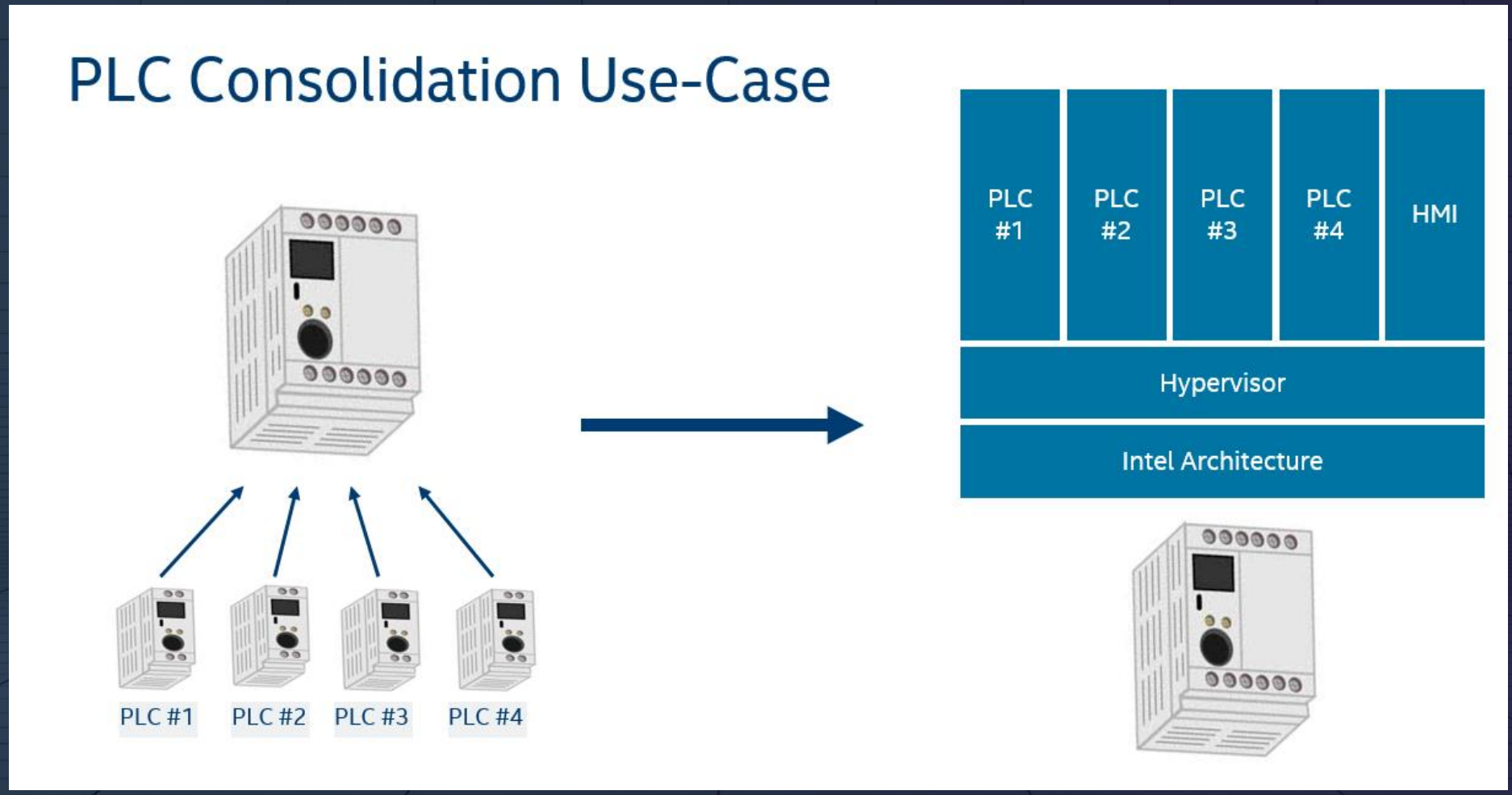
Passenger Screen (option)

- Assist driver on complex operation
- Entertainment

Neusoft C4-Alfus Pro Hardware Architecture



Usage Example – Industry



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Introduction

ACRN™ is a flexible, open-source, lightweight hypervisor - intended to enable consolidation of heterogeneous workloads, and to streamline IoT edge development.

- A Linux Foundation Project Launched in March 2018
- Version 1.0 released in May 2019

https://projectacrn.org

ACRN Value Proposition

Small Footprint

- Optimized for IOT class solutions
- Significantly smaller footprint than cloud/data center targeted hypervisors

Functional Safety and Hard Real time

- Heterogeneous Workload Consolidation
- Real time & HMI
- Functional Safety & Unsafe

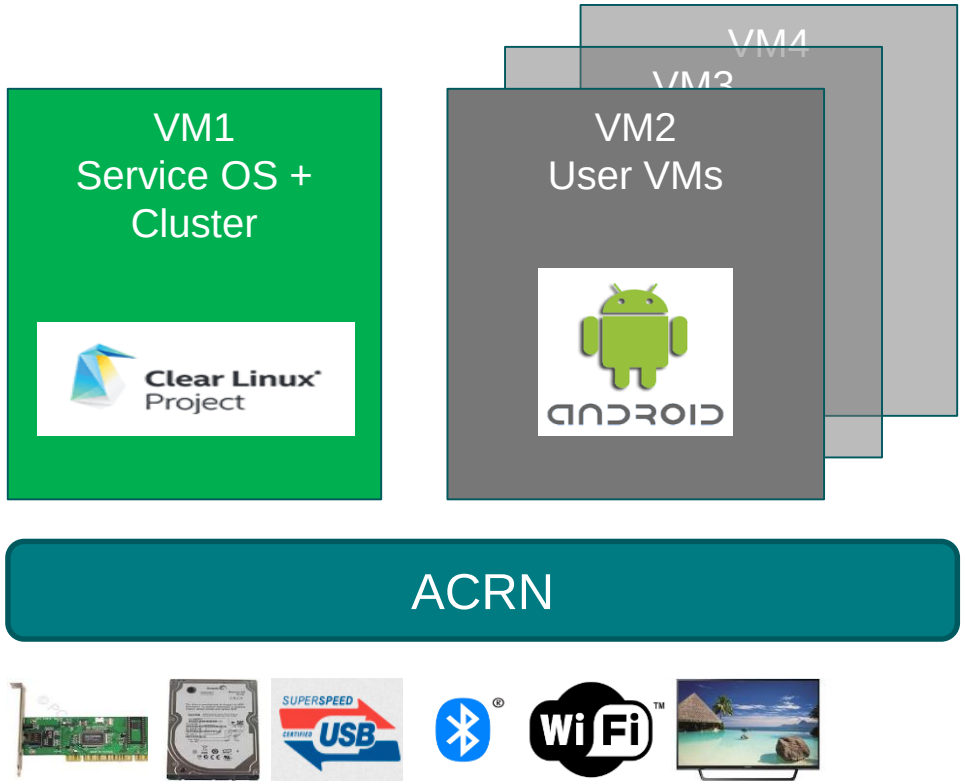
Open-source with Flexible Licensing

- BSD license enables proprietary Guest OS
- True Open source with a vibrant Community

ACRN reduces system deployment complexity, enables heterogeneous architectures, and provide TCO advantages

ACRN 1.0

Main Usage: In-Vehicle Experience



Ready for Production

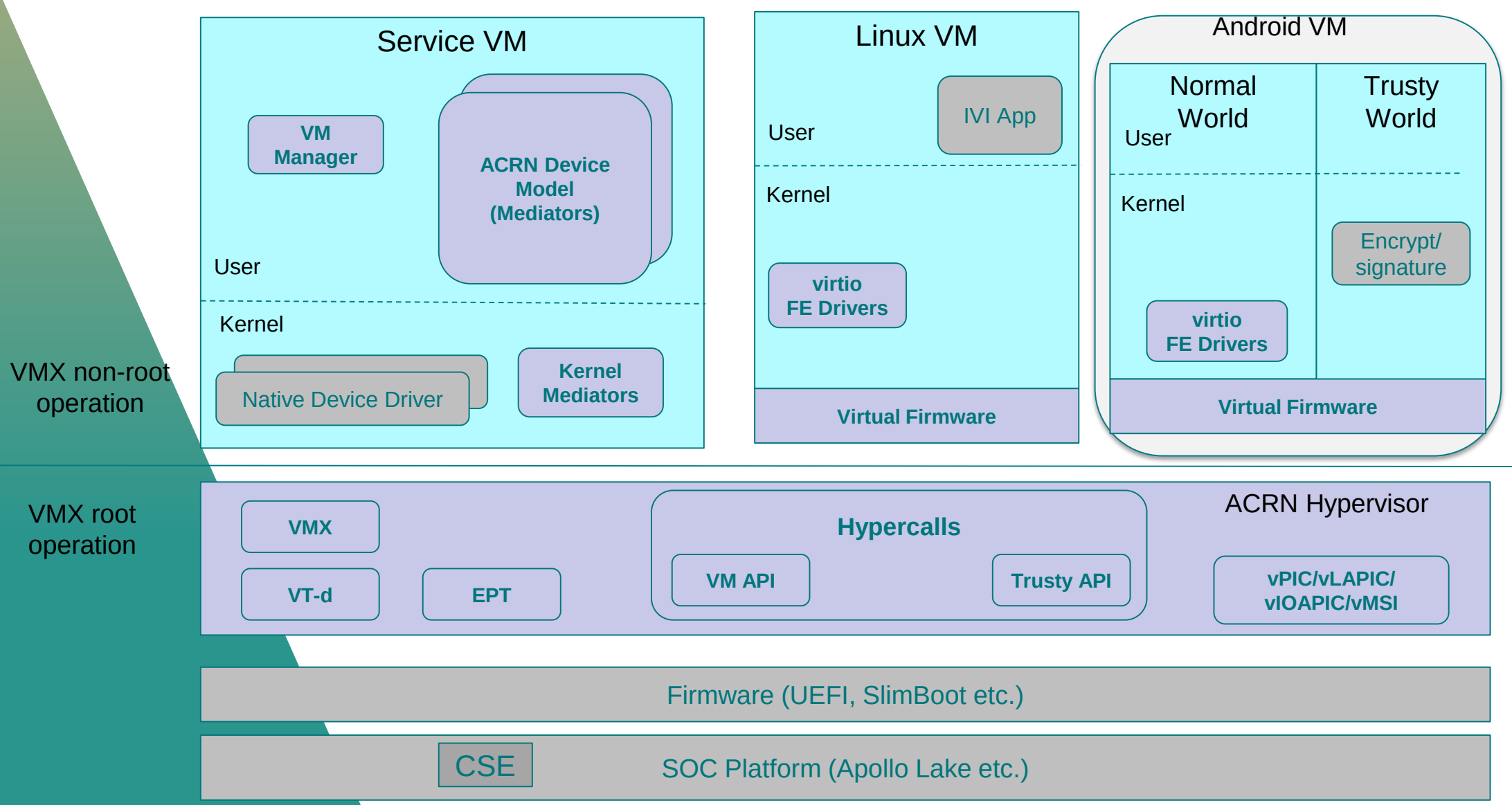
- Fast Boot and Performance KPI
- 100% CTS Pass for Android Guest

Key Features

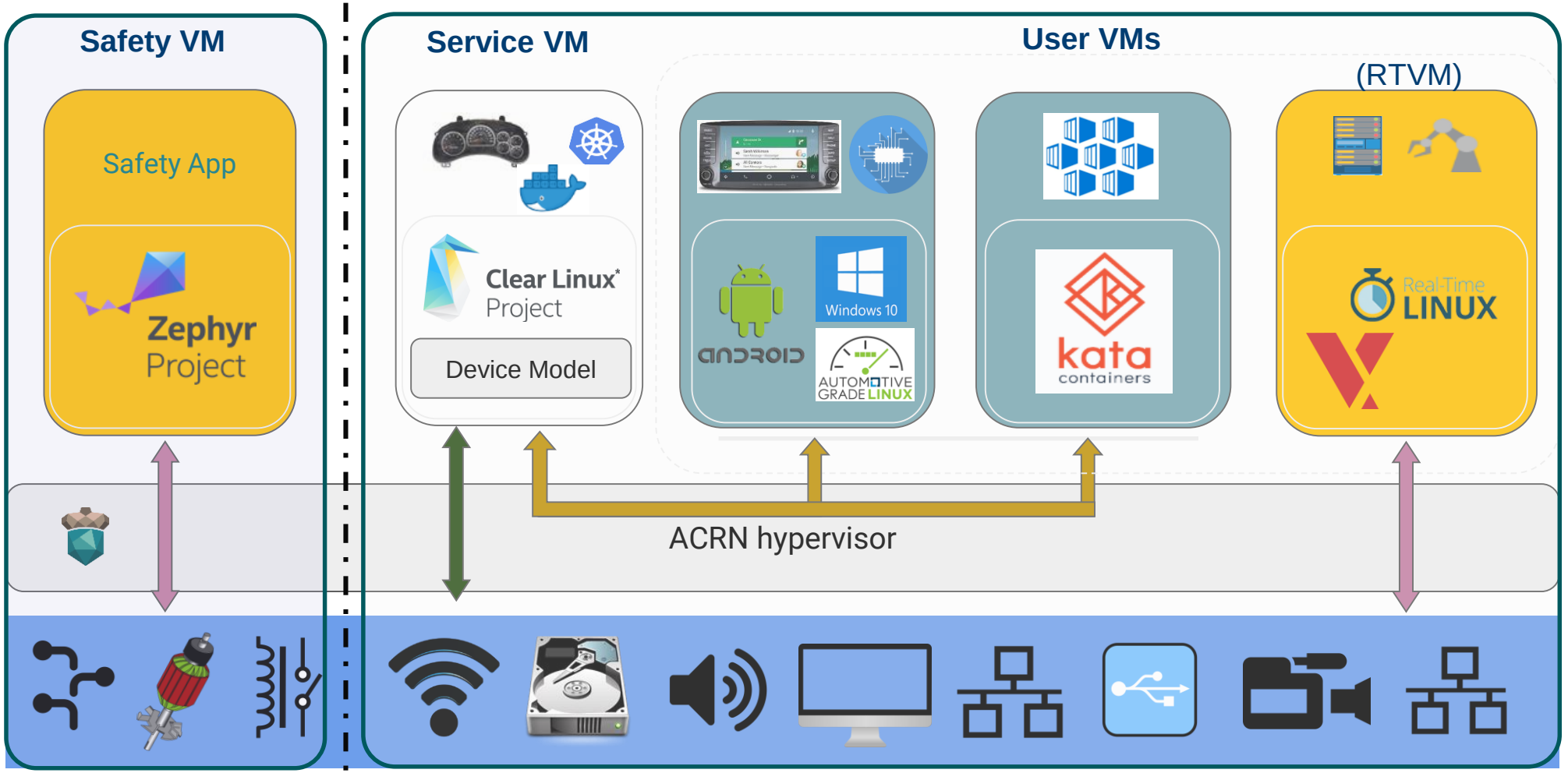
- Safety and Security Isolation (Cluster + IVI)
- Extensive Sharing Capabilities
- Multiple OS Support
- MISRA-C Compliance

Released in May 2019 @github.com/projectacrn/

Architecture Overview



Looking Forward – ACRN 2.0



Hybrid-Mode

- Partition + Shared

VM Type

- Safety VM
- Real-time VM

Kata Container & CPU sharing

More OS Support:

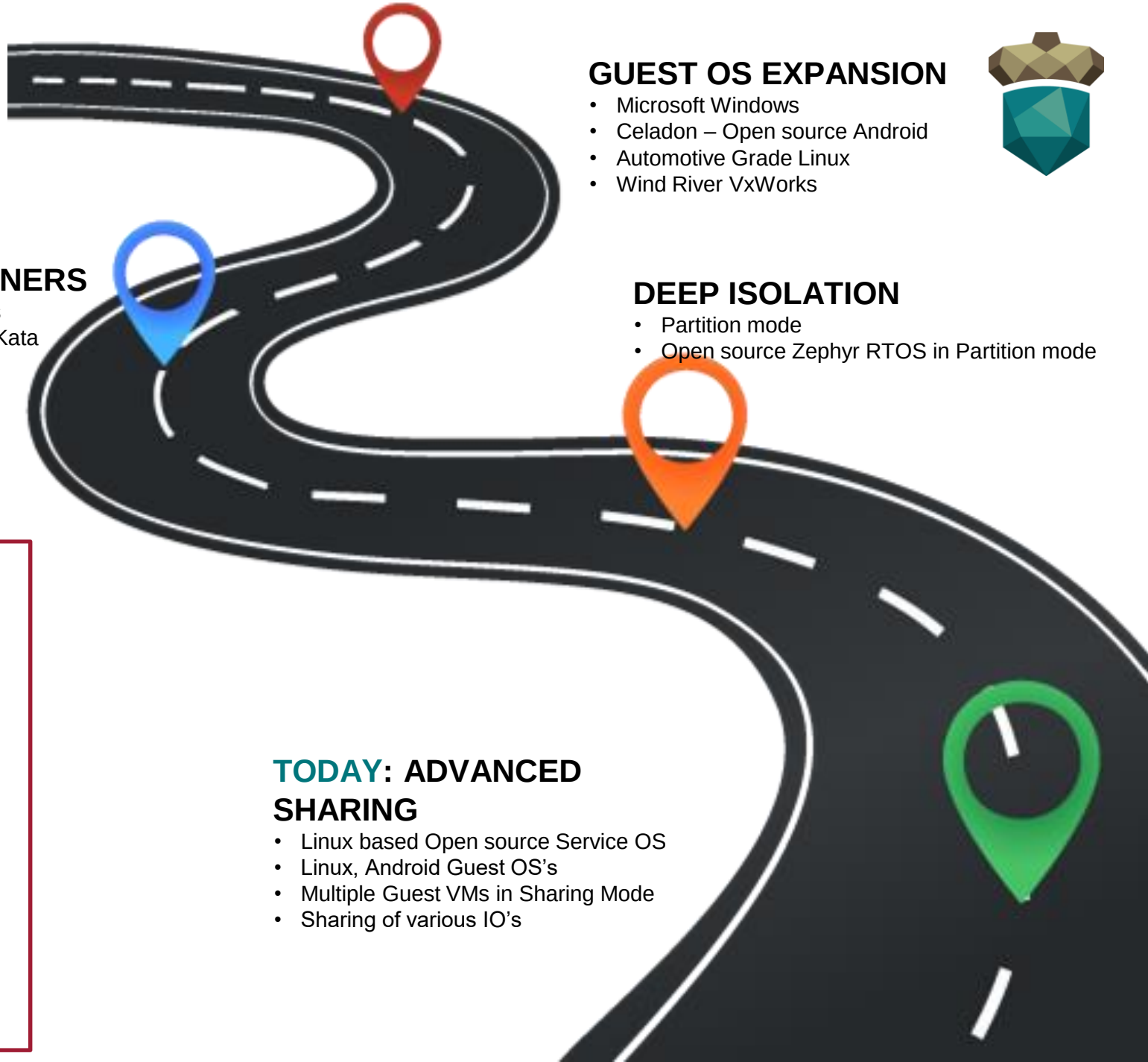
- Zephyr, VxWorks, RT-Linux, Windows

FUSA Certification

THE LINUX FOUNDATION

Roadmap (2019-20)

Updated Q2-2019



GUEST OS EXPANSION

- Microsoft Windows
- Celadon – Open source Android
- Automotive Grade Linux
- Wind River VxWorks

SECURE CONTAINERS

- Kata Containers as VMs
- Kubernetes support for Kata

DEEP ISOLATION

- Partition mode
- Open source Zephyr RTOS in Partition mode

TODAY: ADVANCED SHARING

- Linux based Open source Service OS
- Linux, Android Guest OS's
- Multiple Guest VMs in Sharing Mode
- Sharing of various IO's

Foundational Characteristics

- Heterogeneous Workloads consolidation
- Small Footprint (sub-50K lines)
- Open-source with a flexible licensing (BSD)
- Shared & Partitioned frameworks
- Beyond-Compute (IOs, Accelerators, Graphics/Media sharing)
- Designed for IOT market (Industrial, Automotive and beyond)

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Celadon

an Android open source platform*
for Intel® architecture.

SMART CITIES

AUTOMOTIVE

RETAIL

SMART HOME

Android* on IA that just works

CELADON

an Android open source platform*
for Intel® architecture.

ACCELERATE DEVELOPMENT

open platform enablement
speeds build time
lowering time to market

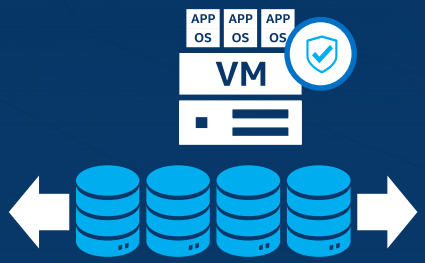
DEVELOP ON LATEST ANDROID* RELEASES

IMPROVE EFFICIENCY

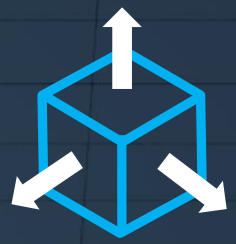
LEVERAGE INTEL® HARDWARE ACCELERATION

SCALE RELIABLY

SHIFT & EVOLVE DEPLOYMENTS



ACCELERATE DEVELOPMENT WITH CELADON



IA Ready

open platform enabling extends adaptability, **helping developers speed Time to Market (TTM) across a variety of segments**

Optimized

supports a wide range of hardware components enhanced for Intel® architecture making it **easy for rapid prototyping and building new applications**

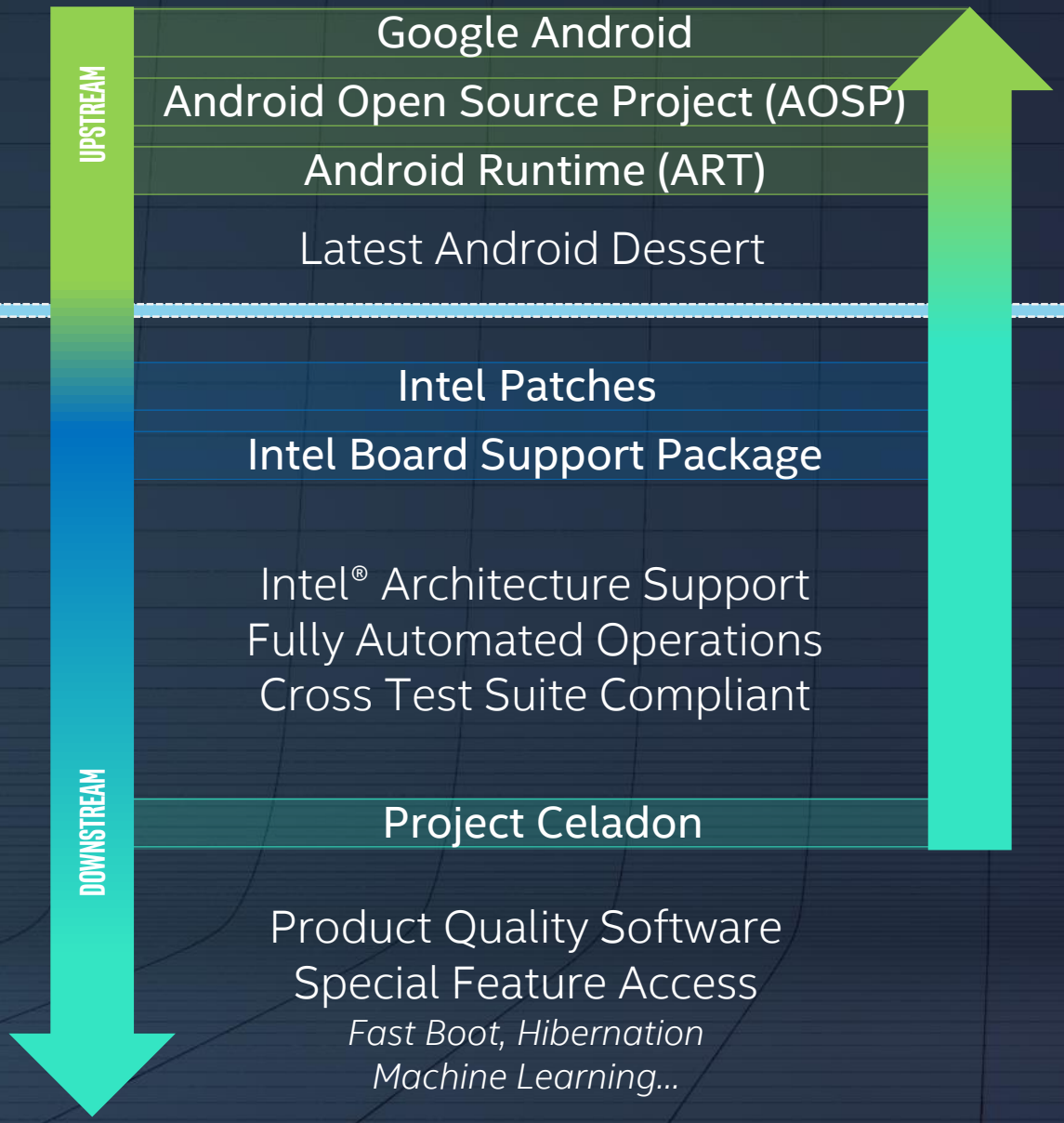
Verified

full compatibility is **verified using the Android* Compatibility Test Suite (CTS),** ensuring consistent experiences across application and hardware environments

Refreshed

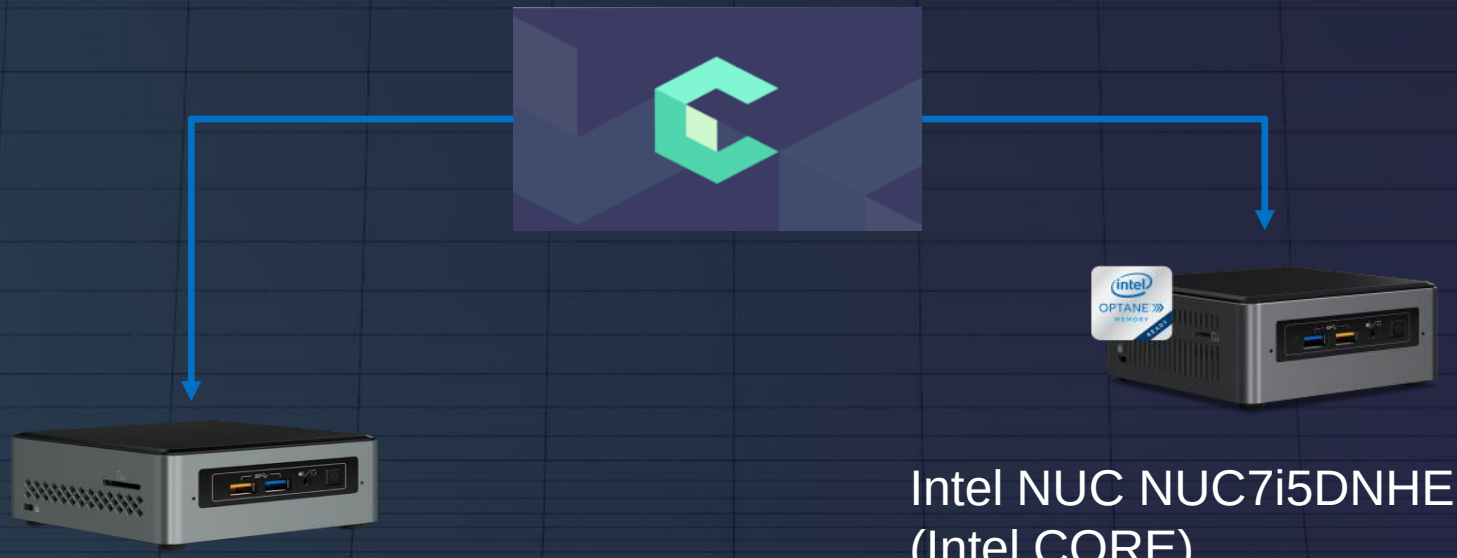
continued upgrades & security mitigations provide opportunities to realize and scale new features when developing on the latest Android* dessert

PROJECT CELADON DELIVERY MODEL



open platform enabling
helps developers speed Time to Market (TTM) across a variety of segments

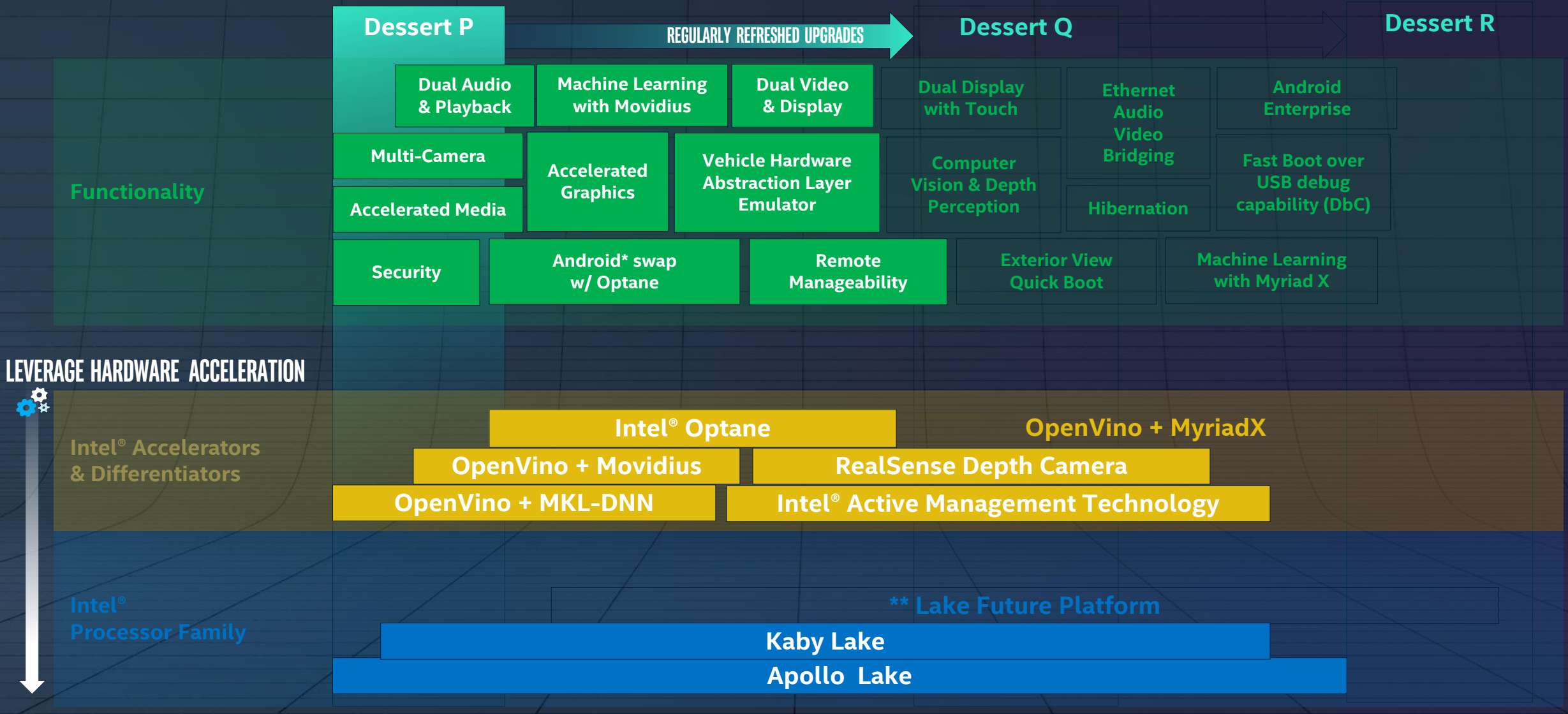
Celadon Demos



Intel NUC NUC6CAYH
(Intel ATOM)

Intel NUC NUC7i5DNHE
(Intel CORE)

IMPROVE EFFICIENCY WITH INTEL® HARDWARE



SCALE RELIABLY ACROSS NEW MARKETS

RETAIL

Personalized Shopping Experiences

Inventory Management

Precision Marketing

In-store Path to Purchase

AUTOMOTIVE

In-Vehicle Infotainment

Enhanced Diagnostics

Maintenance & Safety

Vehicular Interaction

EDGE

Advanced Analytics

Workload Consolidation

Security & Manageability

SMART CITIES

Safety & Security

Resident Engagement

Smart Parking

Traffic Flow Monitoring

CLOUD GAMING

High Performance Gaming

Social Identity Mapping

AI & Graphics

Interactive Lobby

PROJECT CELADON + DEVELOPER COMMUNITY ENABLES INNOVATION

CELADON USE CASES

CELADON RETAIL USAGE CASE
DIGITAL SIGNAGE

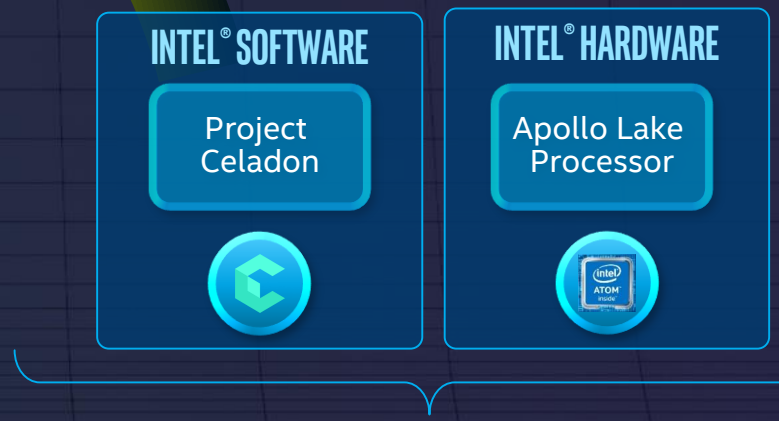
CHALLENGES

Providing flexible Android* OS implementations
on performant hardware

Bringing lower cost devices
to large digital signage applications
at rapid speeds

Providing security & support
to innovative visual messaging

SOLUTION



LEVERAGE INTEL HARDWARE

"Project Celadon allowed us to focus on building our portion of a solution for our customers. Previously, I would have needed a significant budget for BSP and other hardware related tasks before even being close to building a product."

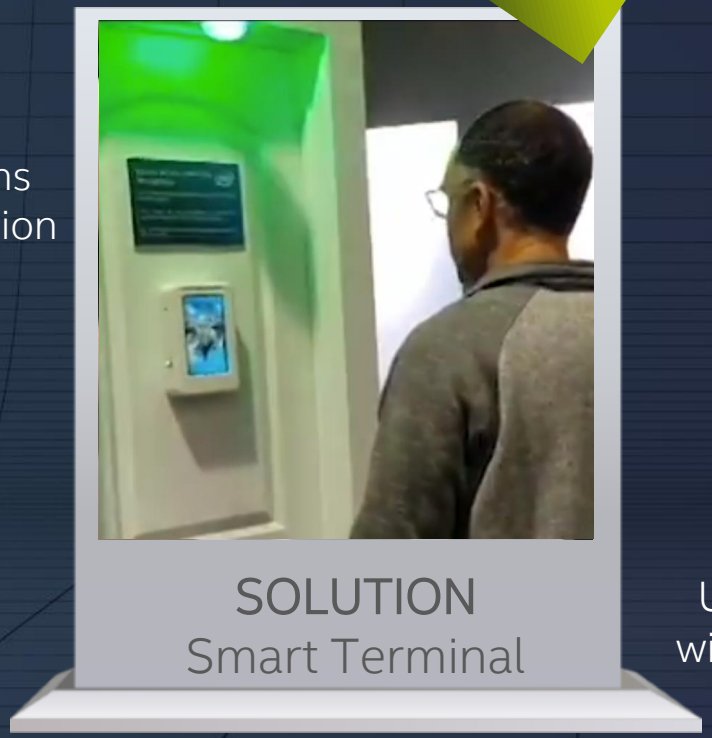
- Customer Testimonial

CELADON RETAIL USAGE CASE
SMART TERMINAL

CHALLENGE

Rapid Segment Scaling

Quickly develop IoT applications for security & facial authentication at smart terminals



SOLUTION
Smart Terminal

SOLUTION

ACCELERATE DEVELOPMENT

Using AI and wireless technology, achieve real time security with 99.8% accuracy in face recognition with Project Celadon

CELADON AUTOMOTIVE USAGE CASE
IN-VEHICLE INFOTAINMENT

CHALLENGE

Innovative Automotive Applications

SOLUTION

INTEL® HARDWARE

- Atom A3900 Processor

INTEL® SOFTWARE

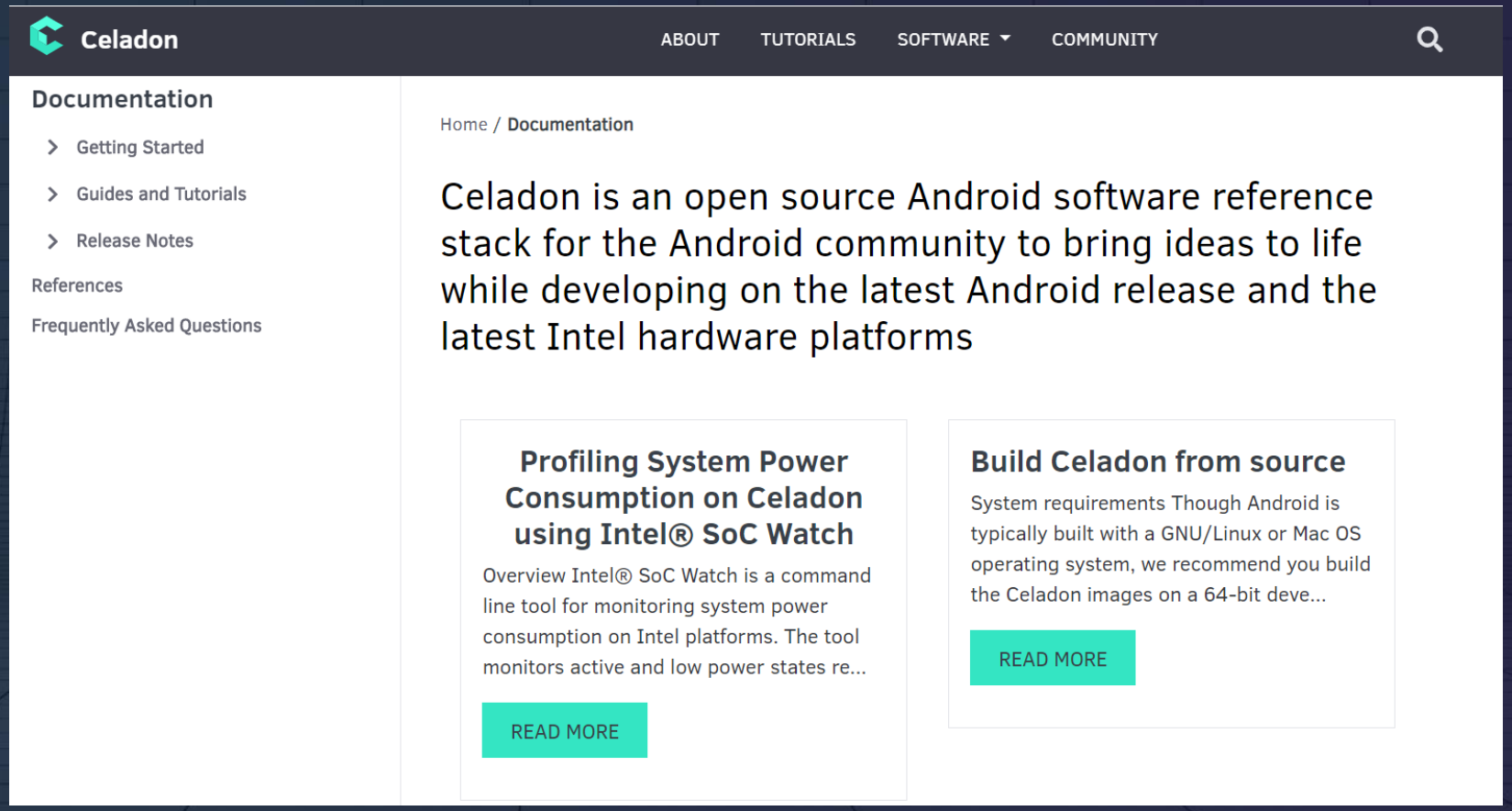
- Project Celadon
- Gordon Ridge Dev Kit

SHIFT & EVOLVE DEPLOYMENTS

Tier1s and Car OEMs can start their product development with Celadon on a standard Intel NUC HW platform, then shift the SW stack to Intel's Automotive Platform, Gordon Ridge MRB developer kit.

HOW DO I CONTRIBUTE TO THE CELADON COMMUNITY?

Visit our Guides and Tutorials https://01.org/projectceladon/documentation



CONTACT US

Learn More

https://01.org/projectceladon

https://github.com/projectceladon

FAQ

Win Customers

Determine if Android* on Intel architecture is a good fit for your customers

Suggest Project Celadon for customer product POC use

Stay Connected

Join the mailing list to stay inform on community discussions

https://lists.01.org/mailman/listinfo/celadon

THANK YOU!