ACRN Open Source Roadmap 2019

Intel Open Source Technology Center

WW30’19

ACRN Open Source Roadmap in 2019

	*Feature and dates for reference only and subject to change without notices			
Area	**V1.0@Q1'19**	**Q2'19**	**Q3'19**	**Q4'19**
HW	• APL NUC (UEFI) • KBL NUC (UEFI) • APL UP2 (SBL)	• APL NUC (UEFI) • KBL NUC (UEFI) • APL UP2 (SBL)	• APL NUC (UEFI) • KBL NUC (UEFI) • APL UP2 (SBL)	• APL NUC (UEFI) • KBL NUC (UEFI) • APL UP2 (SBL)
Hypervisor	• Power Management (S3/S5) • ACRN partition mode • Local APIC passthrough • Real-Time VM support	• VxWorks as Guest • Zephyr as Guest • ACRN Real-Time baseline • ACRN Hybrid mode • OVMF for Clear Linux Guest support • IOMMU interrupt remapping • VM Configuration Unify	• Real-Time for Preempt-RT Linux • Real-Time for Pseudo Locking • Real-Time profiling tool • Real-Time Performance optimization • Kata Container support • OVMF GOP driver for GVT-g • Multiple IOAPIC support • Windows as Guest	• Zephyr as Safety OS • CPU sharing • Docker support based on Kata Containers • Kubernetes support based on Kata Containers • ARM Support
I/O virtualization	• GPIO virtualization • QoS – Support RunC • TPM2.0 Sharing (Security)	• HPET Virtualization • Open vSwitch • I2C virtualization	• USB hub virtualization • GVT-g for Windows as Guest	

2019 ACRN Roadmap Feature Description

ACRN partition mode: Guest VM is created and launched from hypervisor with partitioned hardware resource (CPU, Memory, pass-through devices etc.)
Local APIC pass-through: To pass-through most of local APIC MSRs to Guest VM and deliver IRQ to Guest VM directly without needing vmexit.
Real-Time VM support: To support the Real-Time VM's power lifecycle (e.g. boot/reboot/poweroff), need to complete LAPIC passthru, ioreq completion polling, and virtio-PMD.
QoS – Support RunC: Run ACRN DM Device Model (`acrn-dm`) inside a container (runc) to guarantee the QoS for the VM's I/O.
TPM2.0 Sharing: Trusted Platform Module 2.0 virtualization on ACRN.
Real-time baseline: basic real-time support, it provides the baseline for future real-time enhancement and performance tuning.
OVMF for Clear Linux support: Open Virtual Machine Firmware (OVMF) will be used as virtual VM bootloader on ACRN. OVMF will boot ClearLinux as a User OS (UOS)
IOMMU interrupt remapping: Enable IOMMU interrupt remapping for pass-through devices to ensure they only send their interrupts to the processor they are supposed to, even if the device is misbehaving.
ACRN Hybrid mode: ACRN hypervisor can create and launch pre-defined guest(s) and the Service VM with partitioned hardware resource. The Service VM can create & launch additional User VM through its Device Model (DM). Two types of Guests can co-exist, pre-defined guest(s) and those managed by the Service VM (acrn-dm)
VM Configuration unification: Both hypervisor & DM can launch Guests with same VM configuration structure, and an offline tool will be used to create VM configuration structure info for hypervisor-launched Guests, similarly DM will create VM configuration structure info for the guests which it launches.
HPET Virtualization: Add HPET virtualization in ACRN-DM, prepare for removing legacy device.
Open vSwitch: Enable Open vSwitch kernel module in SOS as a bridge , to which NICs inside VMs are connected.
Real-Time for PPREEMPT_RT Linux: PREEMPT_RT Linux will run as ACRN RT VM guest, with soft real-time performance.
Real-Time for Pseudo Locking: The RT VM guest can lock the real-time critical data or instructions into the cache by leveraging the Intel CAT technology.
Kata Containers support: enable Kata containers on ACRN.
OVMF GOP driver for GVT-g: OVMF GOP doesn't support GVT-g, this feature is to support GVT-g in OVMF GOP, so we can use OVMF console with GVT-g.
Real-Time profiling tool: Real-Time profiling tool will help the developers to tune the Real-Time performance.
Real-Time Perf optimization: Hypervisor and operating system level Real-Time performance will be optimized
Multiple IOAPIC support: some platforms (such the Denverton Atom family) have multiple physical IOAPICs, ACRN will be extended to support this.
CPU sharing: Enable scheduler in hypervisor to share physical CPU resource between all SOS & UOS vCPUs
Docker support based on Kata Containers: Make Kata/ACRN work with Docker
Zephyr as Safety OS: Zephyr will be used as safety OS which will perform the system functional safety related tasks
Kubernetes support: Make Kata/ACRN work with Kubenetes.
GVT-g for WaaG: GVT-g support Windows as Guest on ACRN
ARM support on ACRN: ACRN can run well on Intel x86, but ACRN on ARM platform is support next goal.

GVT-g Gen11 support: GVT-g support for Intel GPU device on Ice Lake platform [Updated in July'19: move to 2020 timeframe]
SR-IOV for sharing mode: To support passing through virtual function of SR-IOV device in sharing mode. [Updated in July'19: removed]
Device PI (posted interrupt): VT-d posted interrupt allows the PCI device interrupt to be injected to the Guest without hypervisor participation. [Updated in July'19: move to 2020 timeframe]

ACRN Look Ahead in 2019

2019 will be an exciting year for project ACRN. Several big things are planned:

- By early Q2, we'll welcome **ACRN v1.0** and provide a stable software reference for Software-Defined-Cockpit (SDC) usage on Intel Apollo Lake platforms.
- **Real-Time OS will be supported,** opening use of ACRN in industrial scenarios needing low latency, and fast, predictable responsiveness. Initial support is for VxWorks ~~and Zephyr OS~~ as Real-Time guest OSes in Q2, and PREEMPT-RT Linux in Q3.
- A new **ACRN Hybrid Mode** will be completed in Q2, giving ACRN the ability to run mixed-criticality workloads. For example, running a Real-Time Guest OS with a time sensitive application and dedicated hardware resources assigned, together with a normal priority Guest VMs running with Service VM and sharing the remaining hardware devices.
- **Windows as Guest (WaaG)** will be officially supported in Q4, but you will see incremental features merged before that. For example, we'll soon introduce a virtual boot loader, OVMF, that enables UEFI support for Virtual Machines required for supporting WaaG.
- **Kata Containers** will be supported in Q3. Kata Containers is an open source project and community working to build a standard implementation of lightweight Virtual Machines (VMs) that feel and perform like containers, but provide the workload isolation and security advantages of VMs.
- More **I/O device virtualization** will be implemented to enrich ACRN's IoT device hypervisor capability, including GPIO virtualization in Q1, I2C virtualization in Q2 and Intel GPU Gen11 support in Q4.
- **CPU sharing** will be a big thing for ACRN. Typically used for embedded systems, a partitioned CPU will be assigned to a Guest VM to benefit the isolation and fast response from hardware. There's also a requirement for non-critical usage for sharing CPU cores among multiple VMs to better support Kata container.
- **Functional Safety (FuSa) certification process** will be applied to ACRN core feature development, and ultimately help ACRN be deployed in industrial or automotive (Soft-Defined-Cockpit) uses.

*More details can be found in "ACRN Open Source Roadmap 2019"