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Mobile Virtualization using the Xen Technologies

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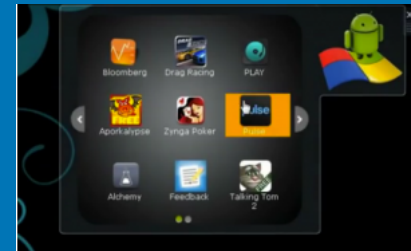
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Agenda

- Mobile Virtualization
- PC/Server vs. Mobile device virtualization
- Example: Android™ Virtualization
- Advantages of Xen Technologies and Opportunities
- Xen-Based Android* Architecture
- Innovation/Research Required for Xen Mobile Virtualization

What's Mobile Virtualization?

- Virtualization of mobile platforms
 - E.g. Android as a guest on laptop, desktop, cloud...
 - BlueStacks*, Android Emulator
- Virtualization on mobile platforms
 - E.g. Android as the host such as smartphone, tablet
 - Red Bend*, Mobile Virtual Platform* (VMware*), Motorola Atrix 4G*
- Combination
 - E.g. Android guest on Android host

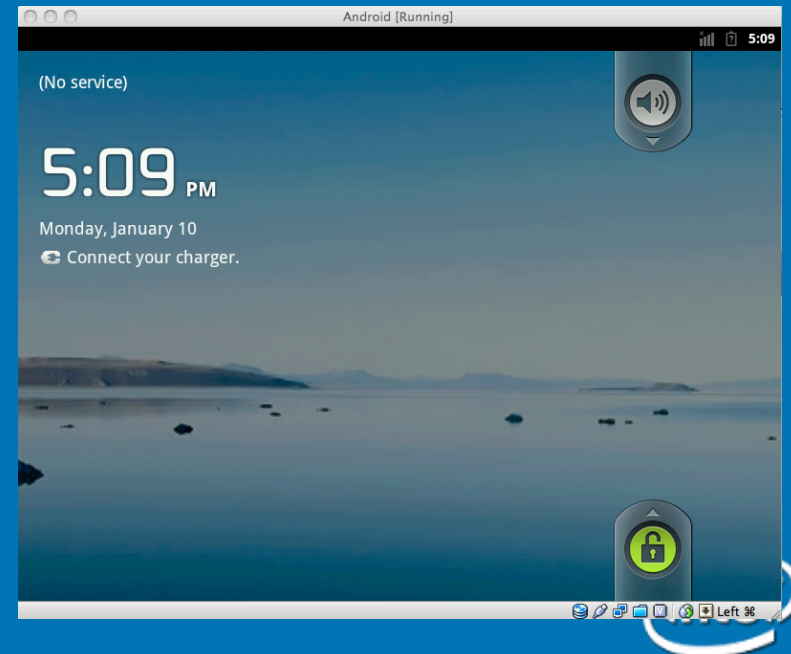


Why Mobile Virtualization?

- Many devices and many reasons
 - Dual personality (business, personal)
 - Multiple OS (e.g. Android + Windows*)
 - Security enhancements
 - “Secure Xen on ARM” (Samsung*)
 - Reusing existing software stacks
- Potential drawbacks
 - Virtualization overhead affecting performance and power, higher latency
 - Extra efforts to rebase, certify
 - More complex

PC/Server vs. Mobile Device Virtualization

- Typical VMMs virtualize PC/servers
 - No mobile devices support, such as GPS, accelerometer, gyroscope, touch screen, telephony, etc.
 - No skin support.
 - Qemu has some mobile devices support



Example: Android Virtualization

- Android Emulator in Android SDK
 - Android-specific modifications to qemu
 - Framebuffer, sound, tty, serial, MMC, NAND, etc.
 - Software emulation for ARM and x86
 - Emulator with hardware-assist (e.g. Intel® VT) for x86
 - KVM on Linux* today (about 10x faster). Available since SDK Tools Revision 12**.
 - Porting to Xen should be easy
 - GLES H/W acceleration(via qemu_pipe)
- Android Guest
 - Linux (“Goldfish” kernel) + PV devices

** : <http://developer.android.com/sdk/tools-notes.html>

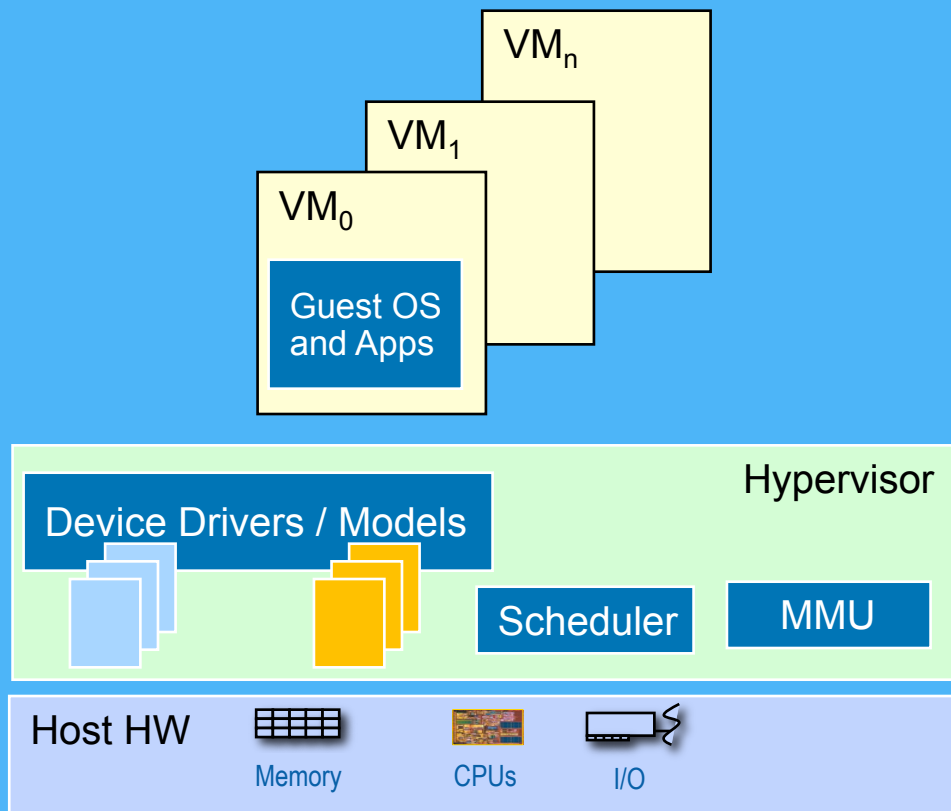
Opportunities for Xen

- Goldfish kernel
 - 32-bit UP HVM Linux kernel (2.6.29 as of today)
 - Works well for SDK environment, Save/Restore feature.
 - Can be very expensive on mobile devices
- Xen PV
 - **PVOPS kernel**: lower virtualization overhead and/or eliminate need for hardware-assisted virtualization
 - **No qemu**: frontends for mobile devices to avoid dependency on qemu
- Live migration
 - Example: Between laptop and cloud

Hypervisor Architecture Considerations

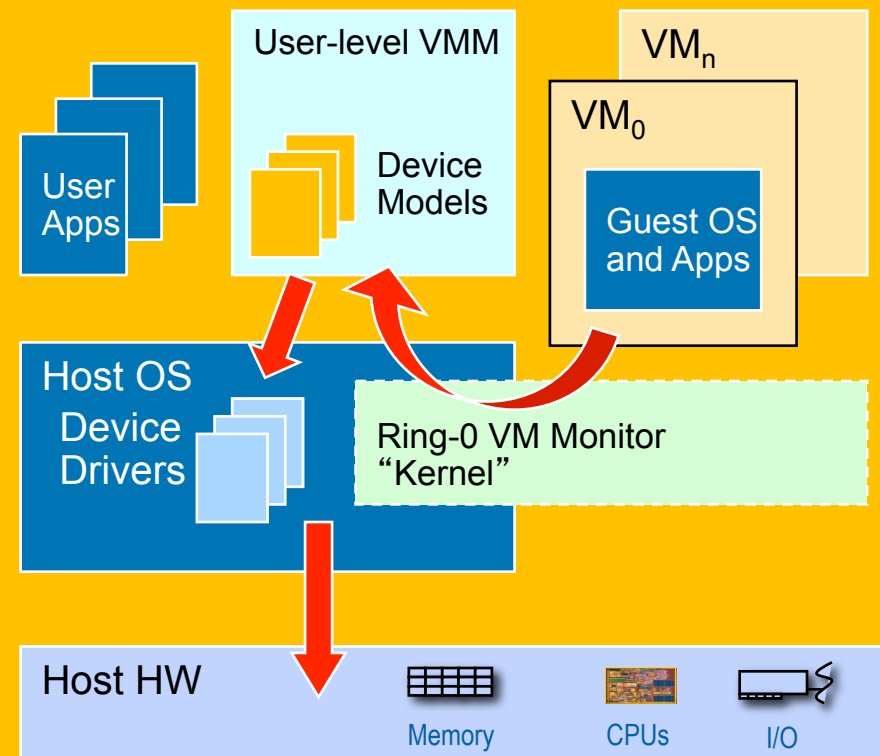
Type 1: Bare metal Hypervisor

A pure Hypervisor that runs directly on the hardware and hosts Guest OS's.



Type 2: OS 'Hosted'

A Hypervisor that runs within a Host OS and hosts Guest OS's inside of it, using the host OS services to provide the virtual environment.

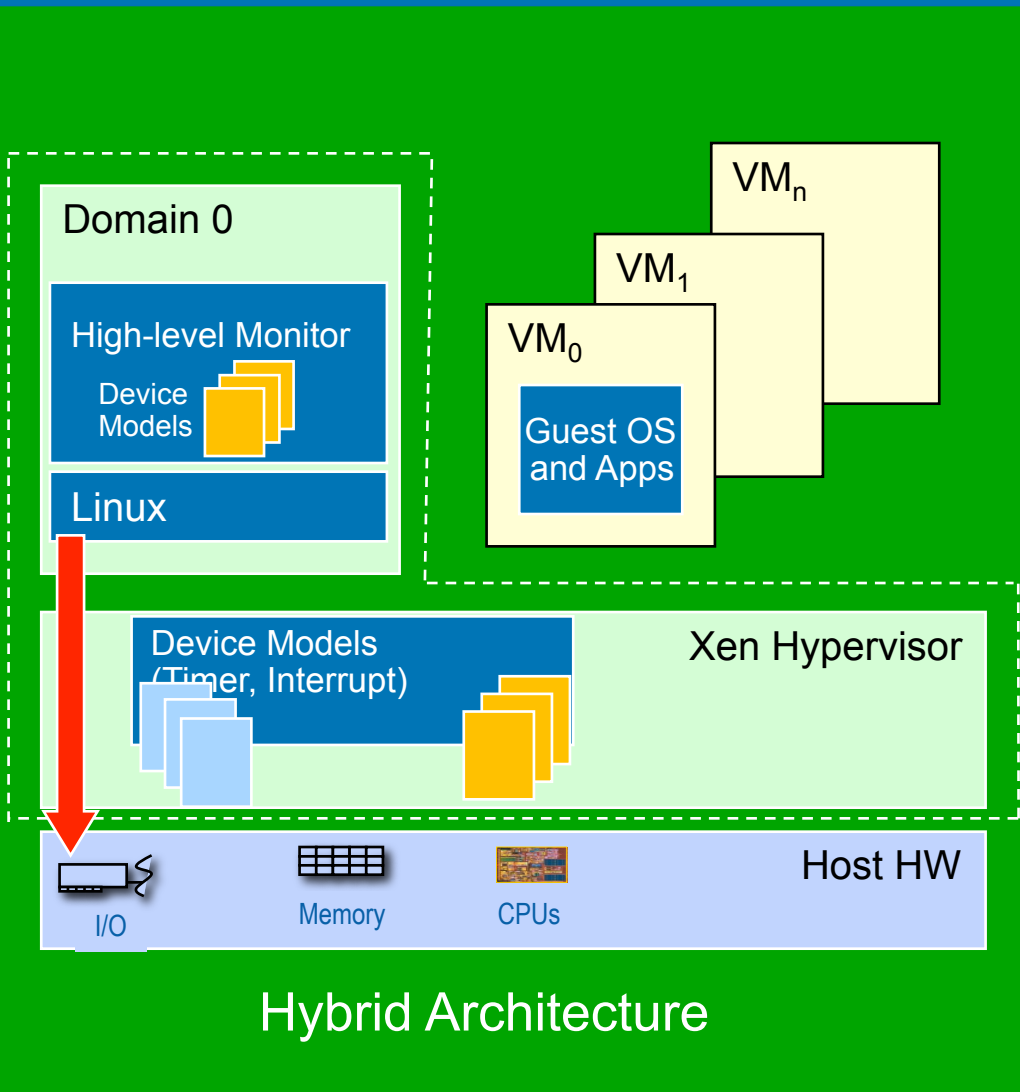


Provides partition isolation + reliability, higher security

Low cost, no additional drivers

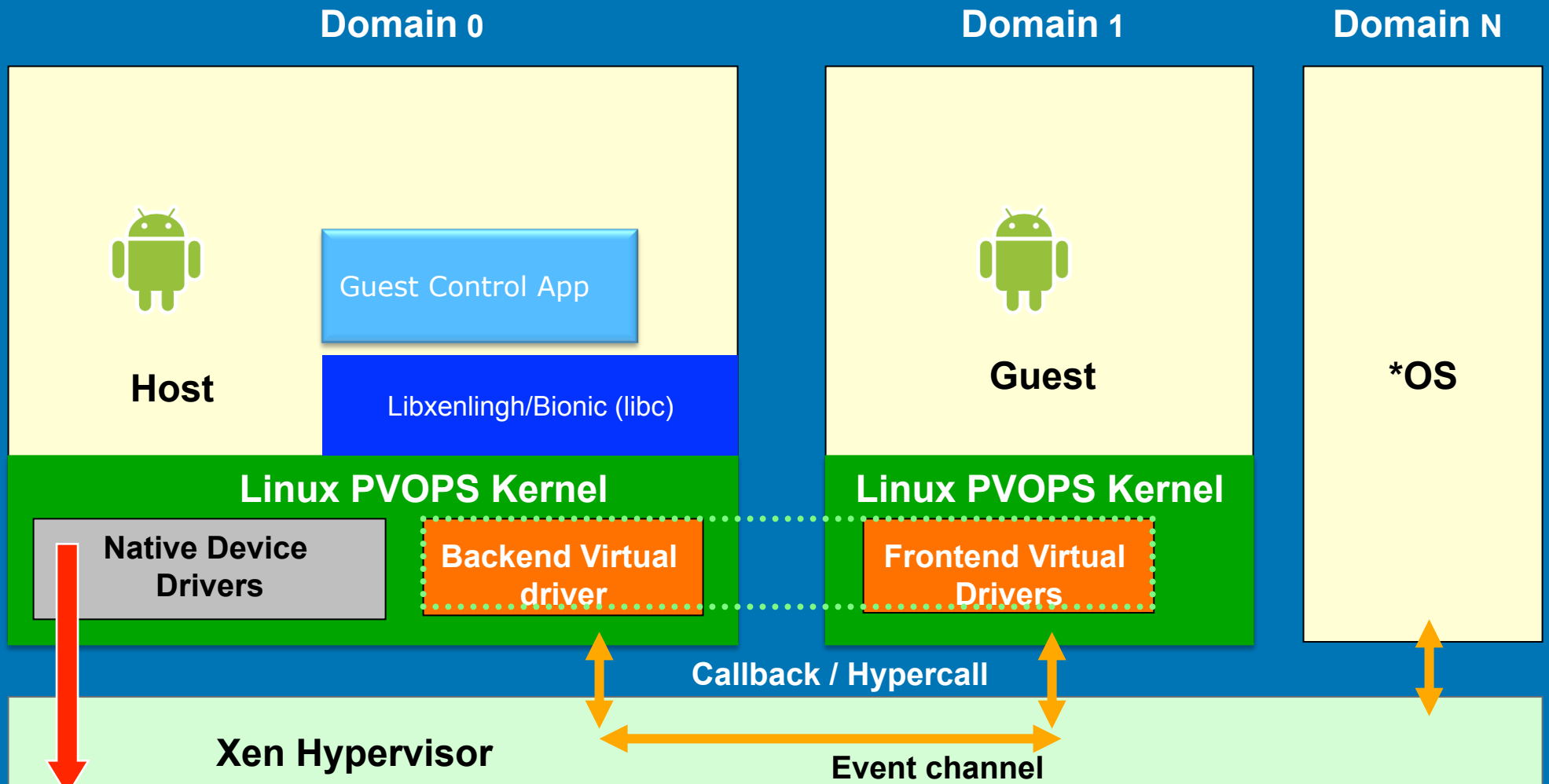


More Opportunities – Architectural Advantage of Xen



- Thin hypervisor
 - Open source
 - Proprietary code in guests
- Use Linux in upstream
 - Take full advantage of PV
 - PV on HVM
 - No additional device drivers (Linux 3.x dom0)
- Use hardware assistance for unmodified guests

Xen-Based Android w/o HVM

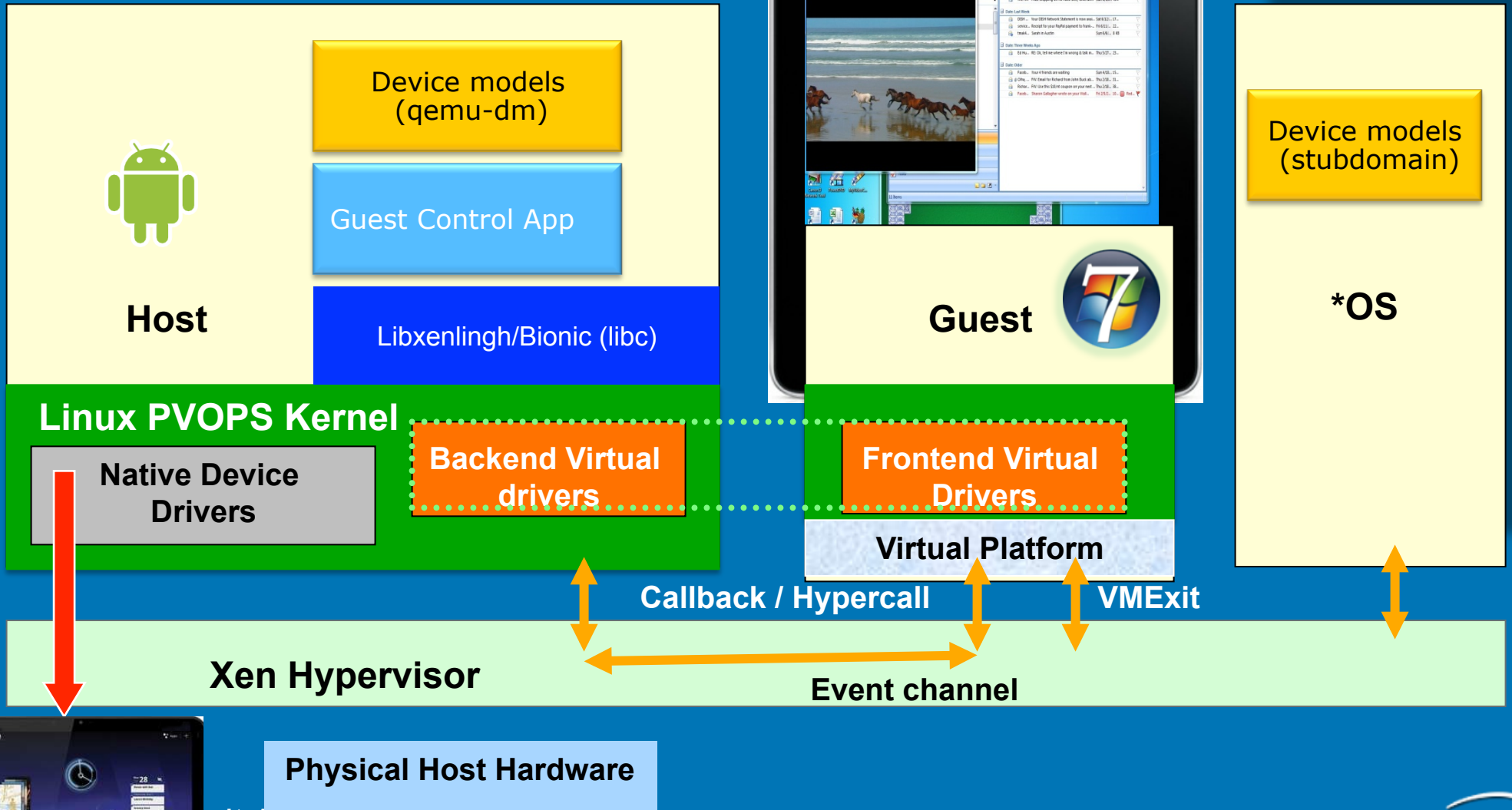


Physical Host Hardware
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Xen-Based Android w/ HVM

Domain 0

Domain N



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Innovation/Research Required for Xen Mobile Virtualization

- Power management
 - Optimized for mobile devices
- Realtime
 - RTOS guests support
- Security
- Mobile device virtualization

Conclusion

- Mobile virtualization will be more important
- Xen has unique advantages there
 - Thin hypervisor, driving innovations for virtualization
 - Keeping PVOPS for dom0 in Linux upstream is key
- Proposed Xen-based Android system
- Let's get started!