A Paravirtualized Android for Next Generation Interactive Automotive Systems

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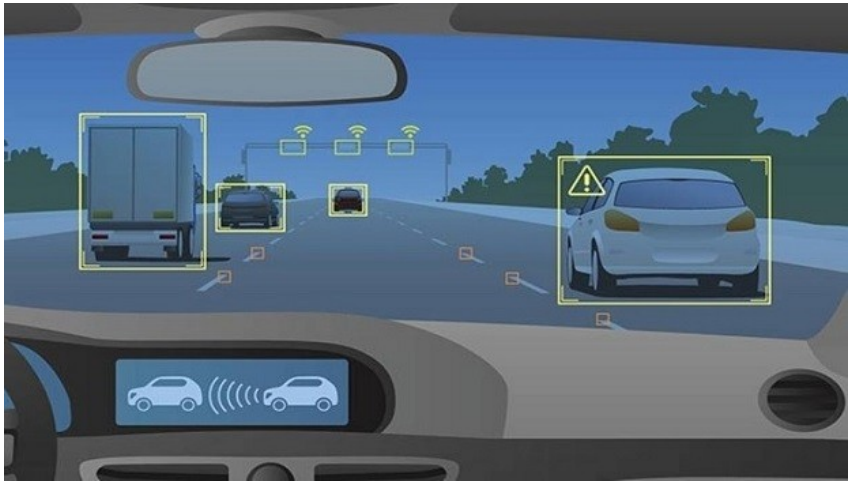
Interactive Automotive Systems

Interactive Automotive Systems

Interactive Automotive Systems + ADAS services

- ADAS Services
  - Lane detection
  - Cruise control
- Control ADAS configurations in real-time



Existing Interactive Automotive Systems

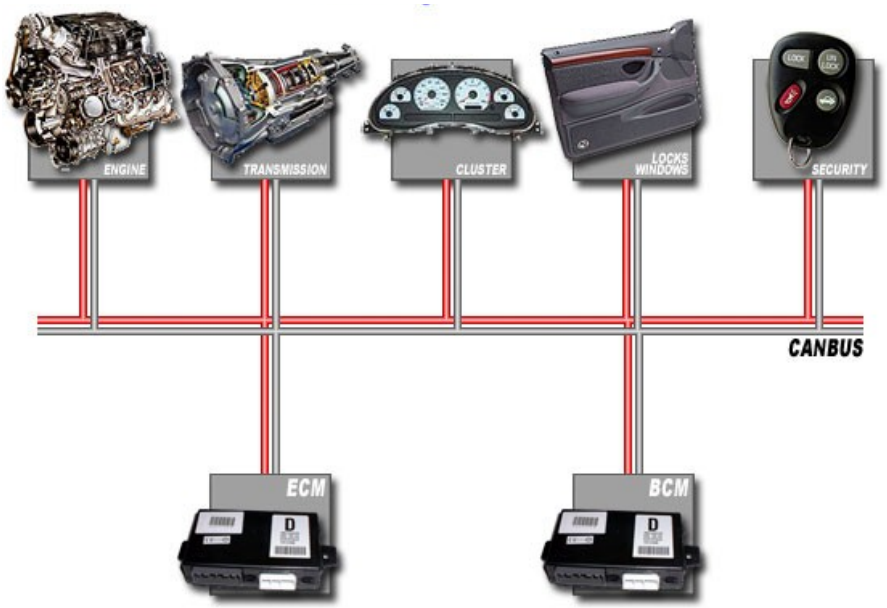
Existing Interactive Automotive Systems

Advantages of Android in Automotive Systems

- Android Automotive OS
  - ~~Android Auto~~
- Running Android natively on a vehicle’s interactive system

Limitations of Existing Automotive Systems

No Real-time I/O



CAN Bus Network

Limitations of Existing Automotive Systems

CYBER NEWS

IVI Systems in Volkswagen, Audi Vulnerable to Remote Hacking

by Milena Dimitrova | May 14, 2018 | 0 Comments Audi, car vulnerability, Volkswagen, vulnerability

Not guarded enough from security attacks

International Conference on Detection of Intrusions and Malware, and Vulnerability Assessment

DIMVA 2017: Detection of Intrusions and Malware, and Vulnerability Assessment pp 185-206 | Cite as

A Stealth, Selective, Link-Layer Denial-of-Service Attack Against Automotive Networks

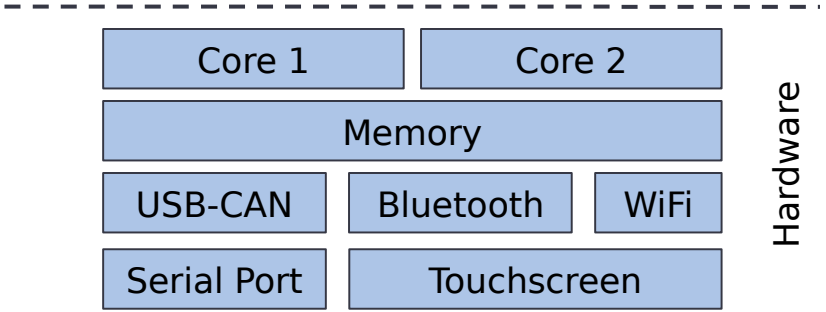
Requirements of a Next Generation Interactive Automotive Systems

- Familiar, straightforward and rich user-interface
- Ability to develop custom apps
- Real-time, predictable and secure I/O
- Minimal hardware complexity

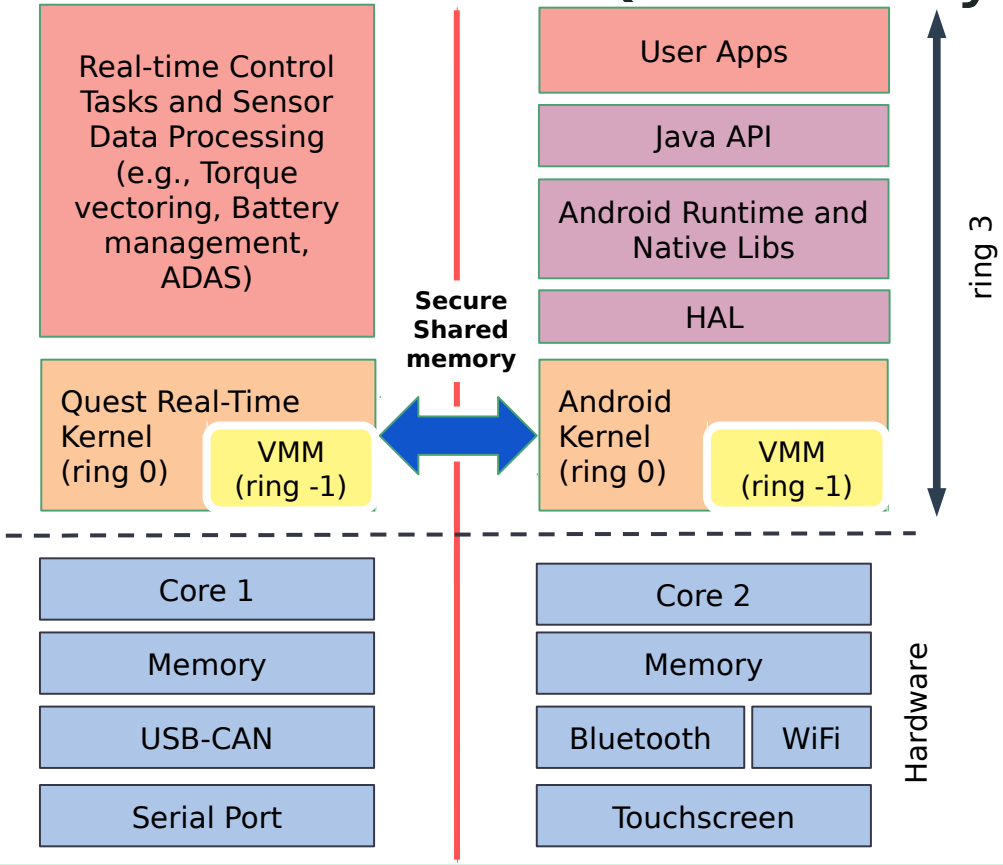
Our Solution:

A Paravirtualized Android in Quest-V Hypervisor

Paravirtualized Android in Quest-V Hypervisor

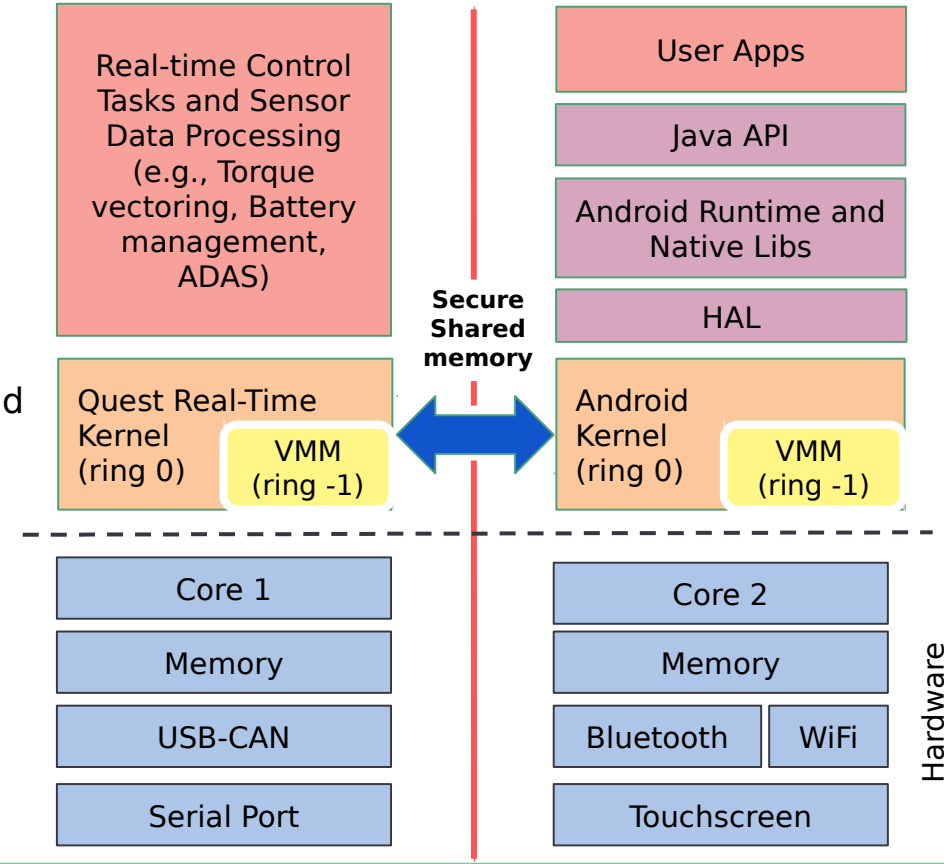


Paravirtualized Android in Quest-V Hypervisor



Advantages of Paravirtualized Android in Quest-V

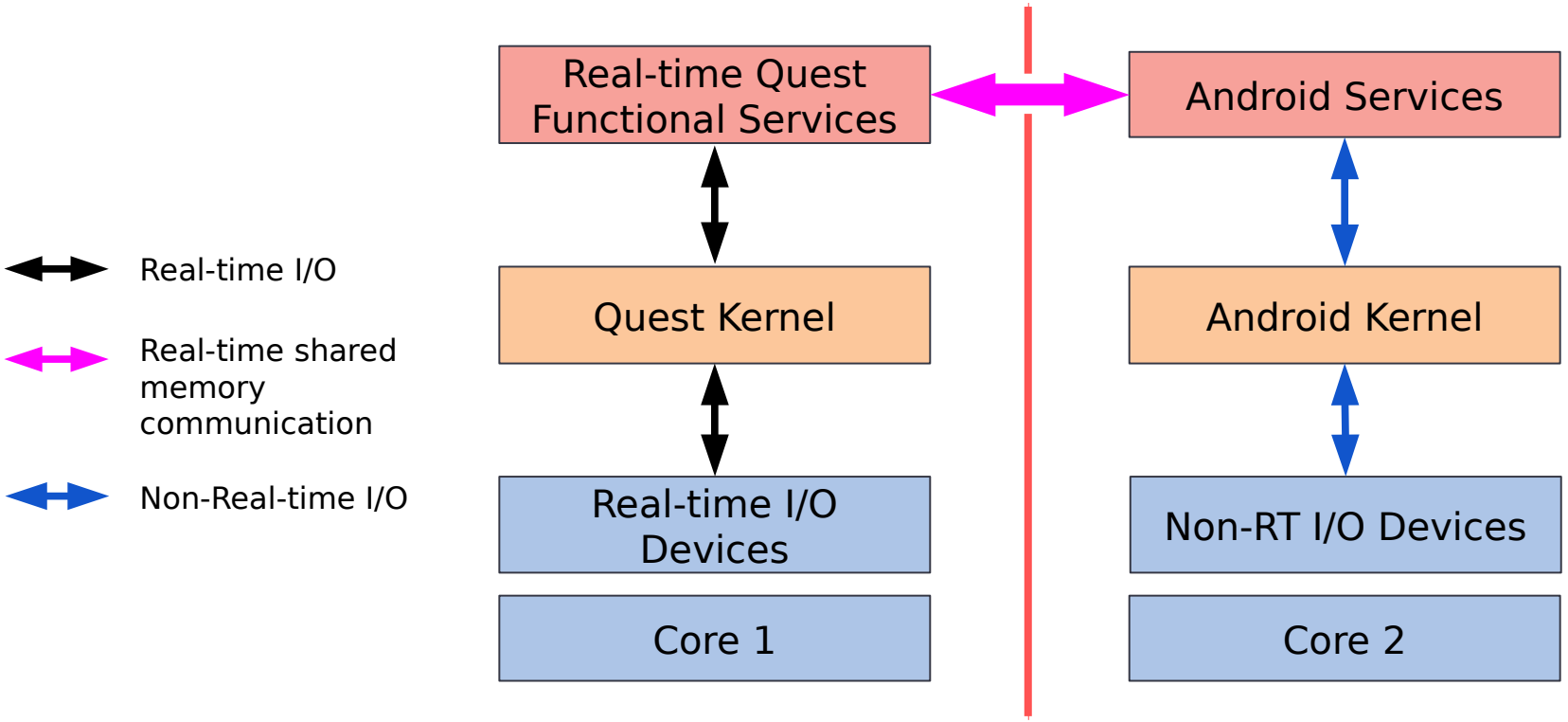
- Real-time and predictable I/O in Quest
- Secure I/O data transfer through shared memory between Android and Quest



- Familiar Android UI
- Large App developer community

A single-board solution

Timing Predictable I/O in Android

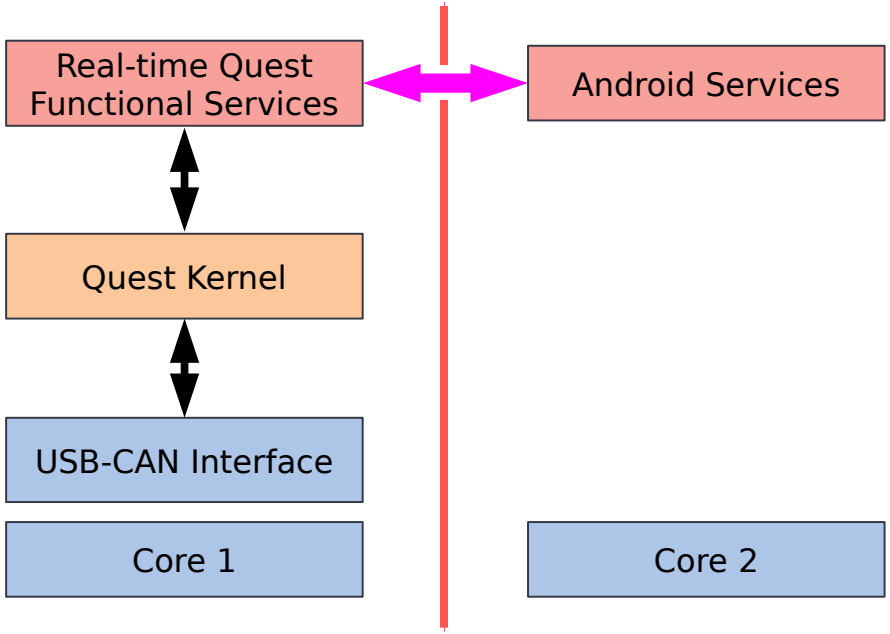


Promising Preliminary Evaluation - Cold Startup Time

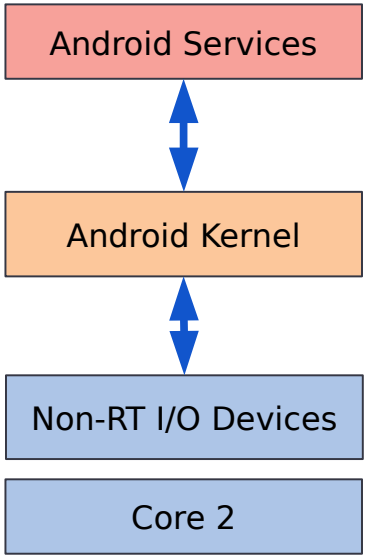
Startup times

	Vanilla Android	Paravirtualized Android in Quest-V
Booting Android	16.6 s	23.7 s
IVI (HVAC) App Startup	49 s	59.2 s

Timing Predictable I/O in Android

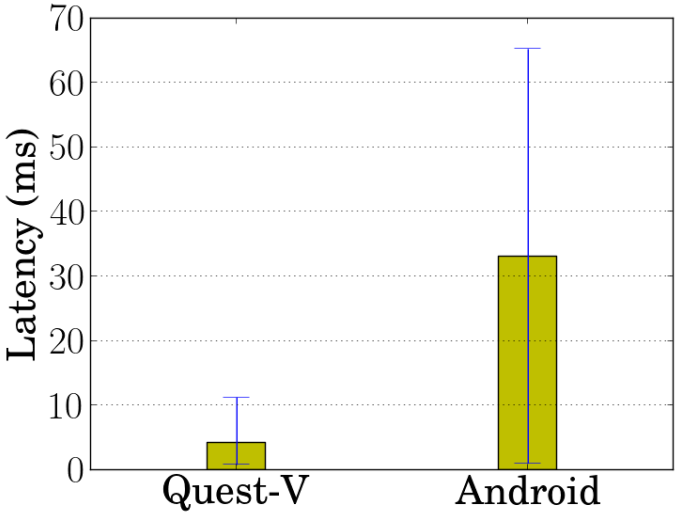


I/O using Paravirtualized Android in **Quest-V**

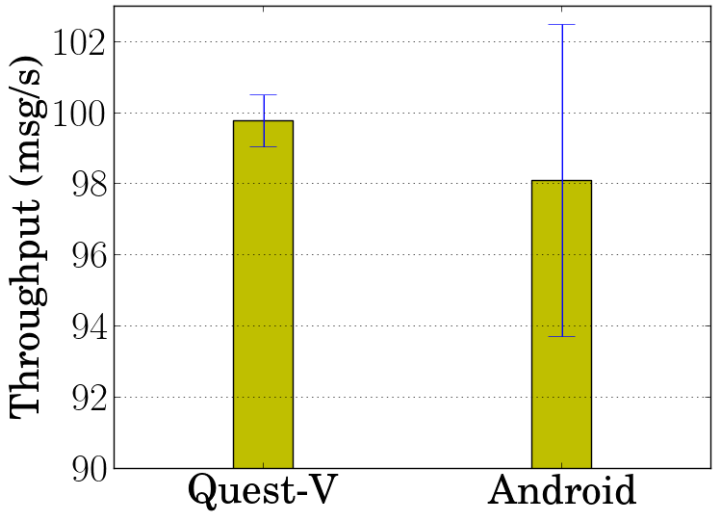


I/O using vanilla **Android**

Promising Preliminary Evaluation - I/O Performance



Synchronous USB-CAN I/O Latency



Synchronous USB-CAN I/O Throughput

Future Work

- Supporting Automotive APIs for Quest-V design
- Communication timing requirements
- Secure communication interface
- Power Management

Thank you!
Questions?