



Evaluating Android OS for Embedded Real-Time Systems

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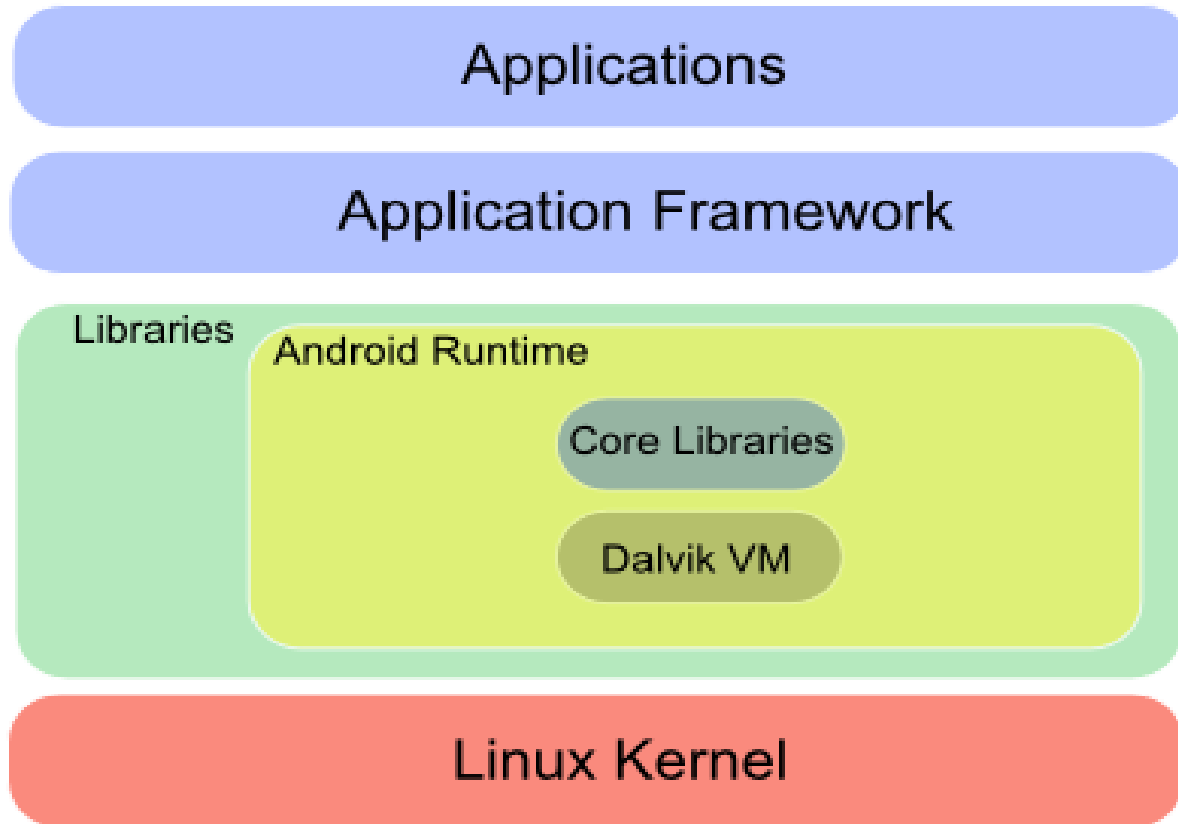
Agenda

- Context
- What is Android?
- Dalvik Virtual Machine
- Linux Kernel
- Possible Directions
- Conclusion

Context

- Increasing relevance of Android in the mobile industry
- Open-source platform
 - Linux kernel based architecture
- Possibly a target to ERTS
- The paper presents the evaluation of the platform for ERTS with the objective of discussing potential ERTS support in Android

What is Android?



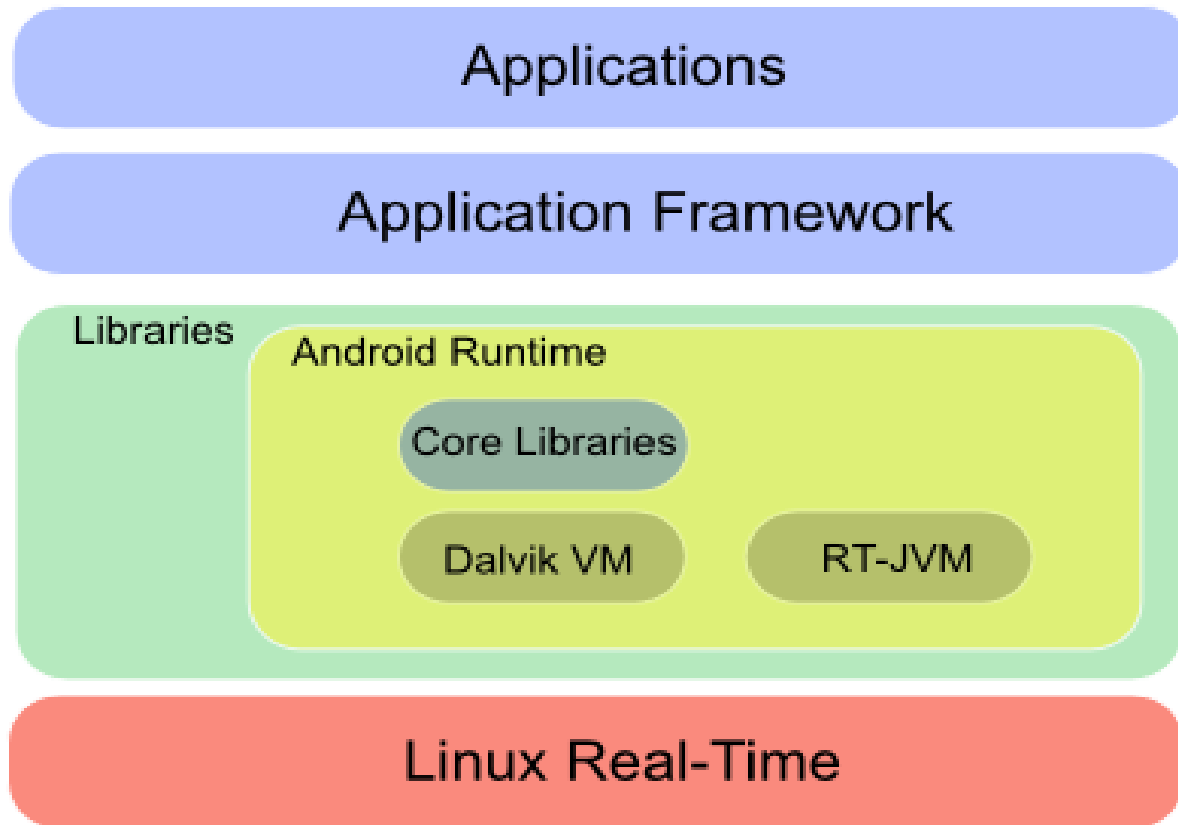
Dalvik Virtual Machine

- Multiple independent processes, each one with its own address space and memory
- Implements the Java Concurrency Model
 - Shared Objects and Monitors
- Follows pthread model, separated by groups
 - VM Threads and Application Threads
- Garbage Collector presents the “Stop the world behavior”
 - Separated Instances that collect independently
- Scheduling and Interrupt Handling are delegated to the Linux Kernel

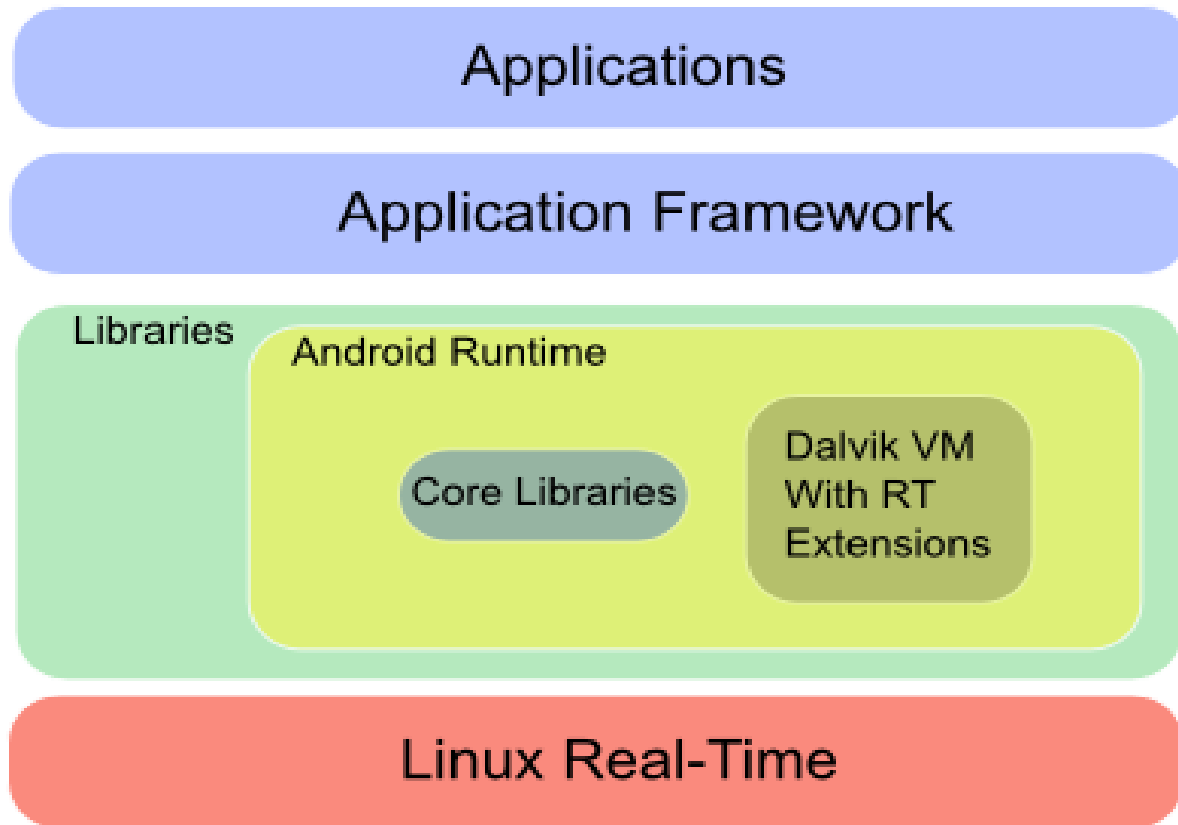
Linux Kernel

- Version 2.6.XX
- Core scheduler is periodic and preemptive based on scheduling classes' priority
 - Android uses the CFS by default
- Own implementation of libc – Bionic
 - Process-Shared Mutexes and Condition Variables are not supported
 - Thread Mutexes and Condition Variables are limitedly supported
- Interrupt Handling/Resource Management are not timely bounded

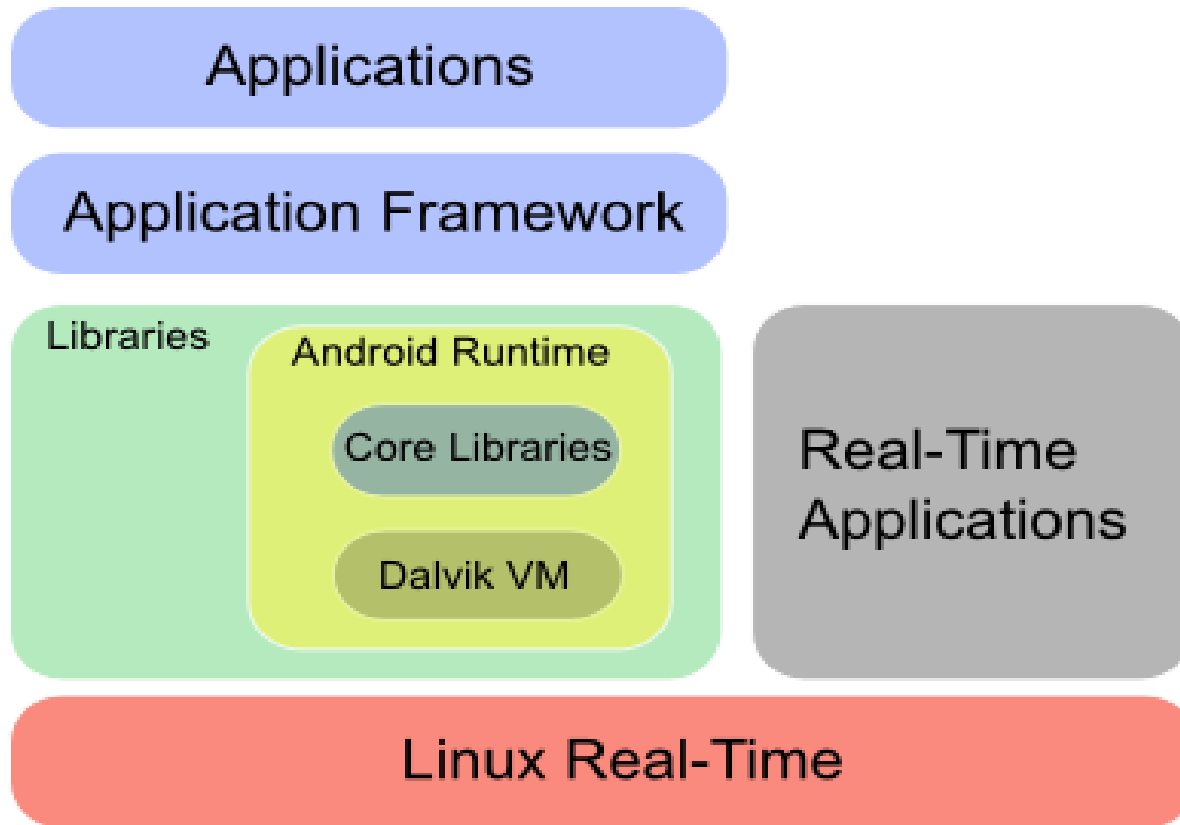
Possible Directions - I



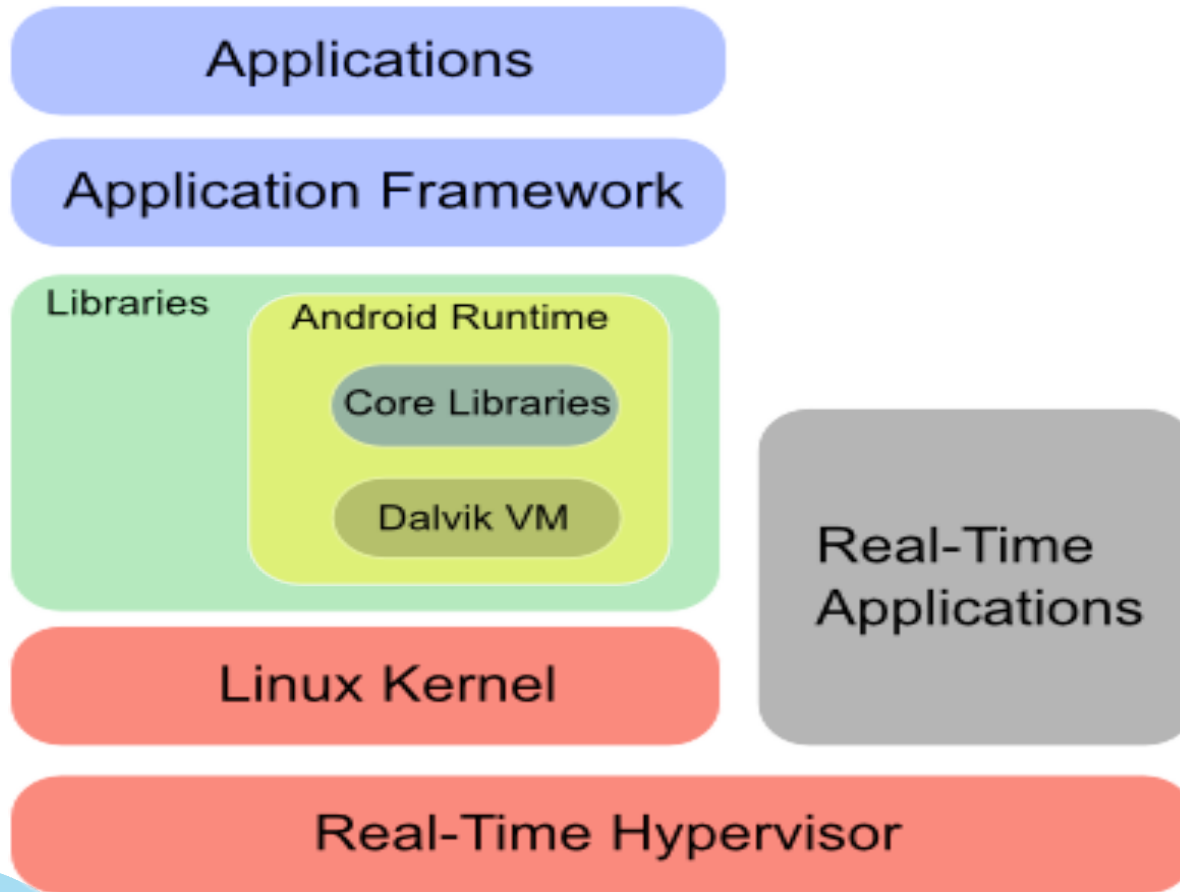
Possible Directions - II



Possible Directions - III



Possible Directions - IV



Chosen Direction & Challenges

- The first proposed direction is considered the one that causes less impact in the system as a whole
 - Android apps and QoS apps can coexist
- Scheduling operations at OS level
 - Handle each VM with the correct priority is a must
- Memory Management
 - Mechanisms to address system resource saving
- Synchronisation Mechanisms (If necessary)
 - Communication between each VM's threads

Conclusion

- Potential target for ERT environments
 - Industry would benefit from it
- The evaluation performed shows that determinism is not possible out of the box
- Each of the four directions enables the possibility of incorporating determinism into the platform in its own way
- Whichever the chosen direction, work must be conducted at different layers of the architecture

Thank You!

Questions?

