Introduction:
Overview of Android Layers

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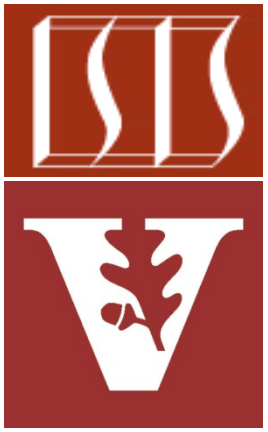

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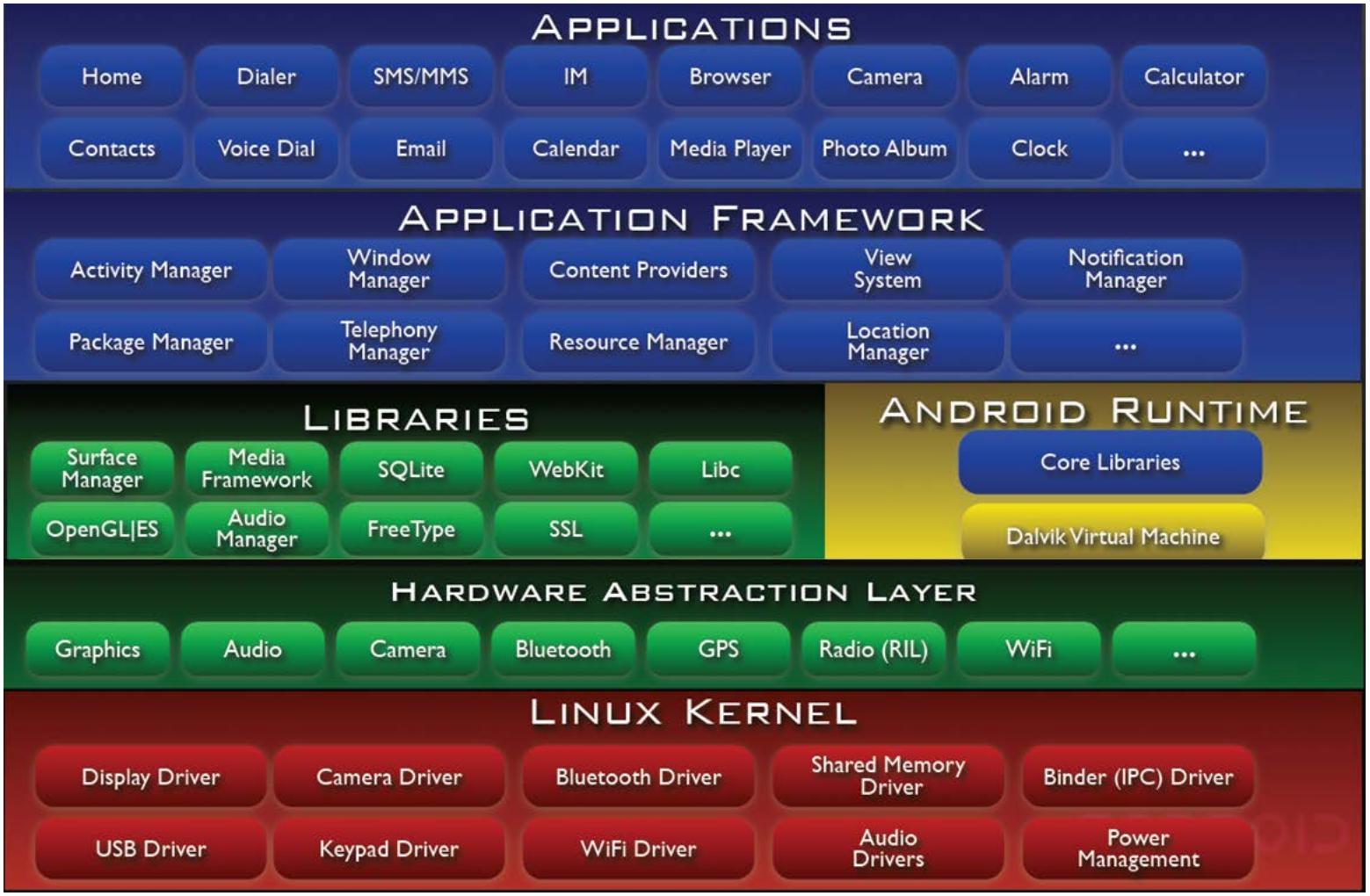
Learning Objectives in this Part of the Module

- Understand the key layers in the Android software architecture



See www.techotopia.com/index.php/An_Overview_of_the_Android_Architecture

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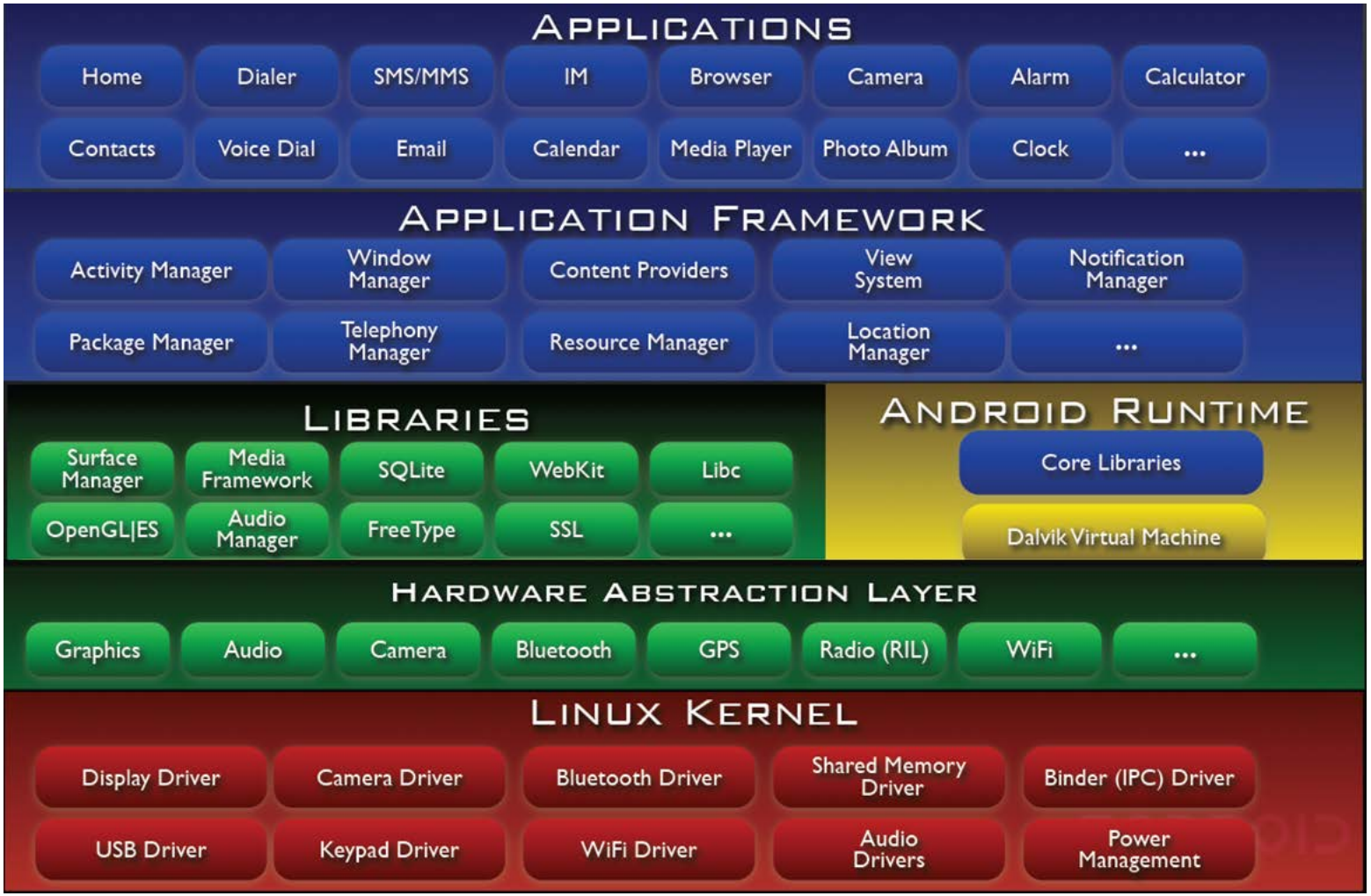
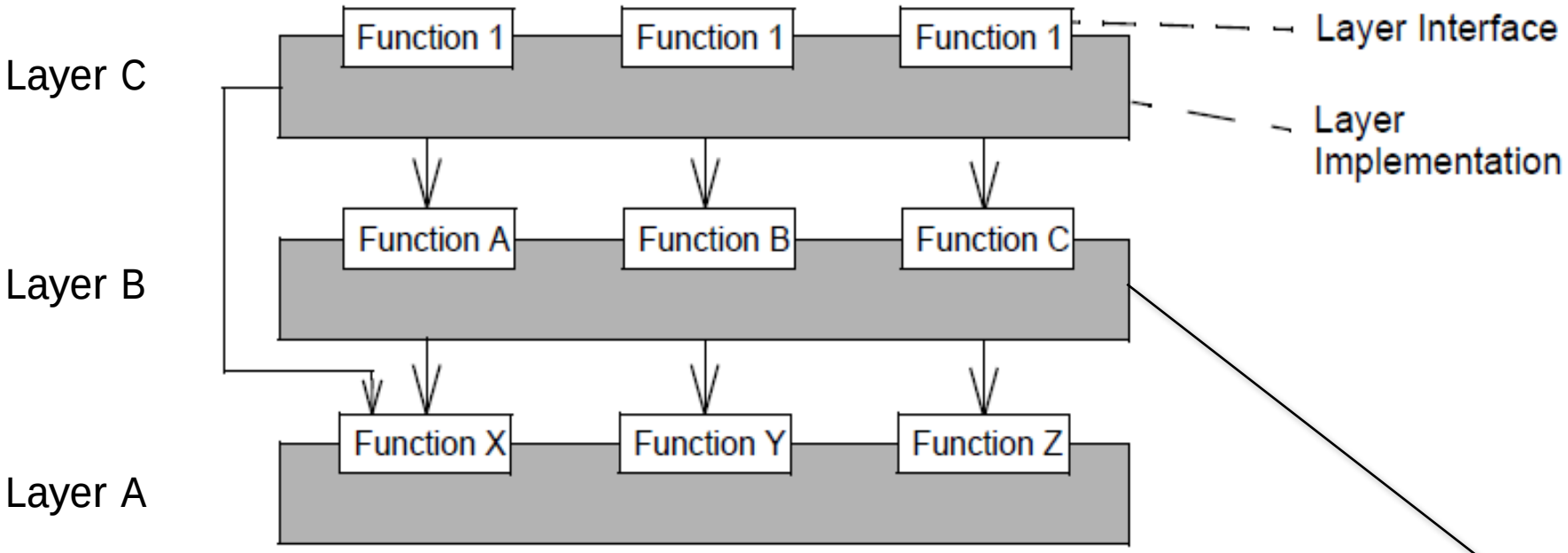


Focus on Android concurrency (& communication) support

Overview of Android Layers

What is Android?

- Android provides a *layered* stack for mobile devices

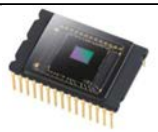


Layering structures software apps & infrastructure by decomposing them into groups of subtasks, with each group residing at a particular level of abstraction

See posa1.blogspot.com/2008/05/layered-architecture-pattern.html

What is Android?

- Android provides a *layered* stack for mobile devices, including
  - Hardware sensors, transceivers, storage, & (multi-core) processors



Hardware components

What is Android?

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  - A variant of the Linux OS




Hardware components

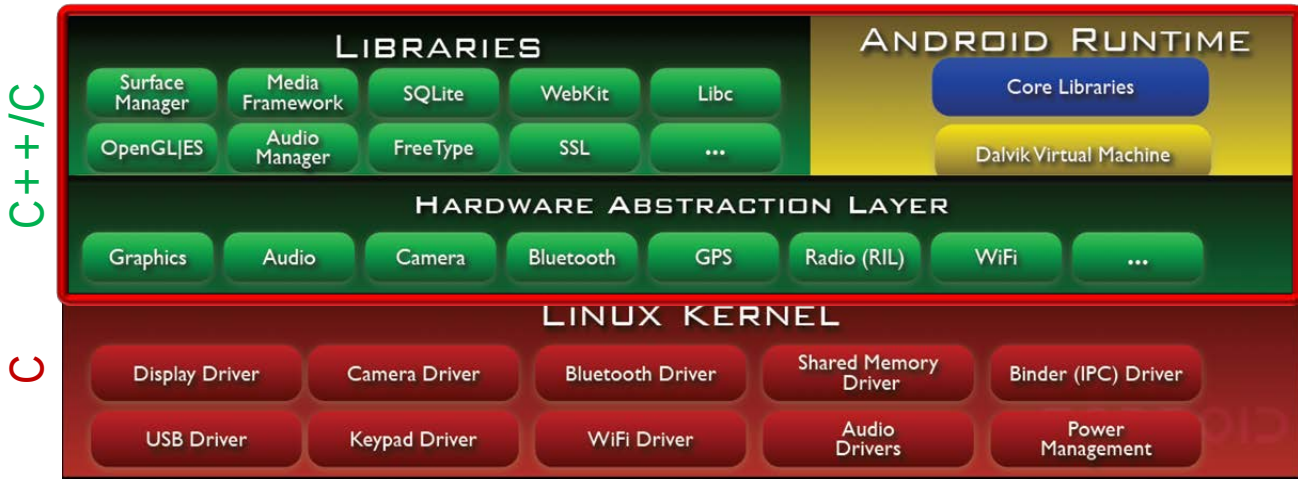
What is Android?

- Android provides a *layered* stack for mobile devices, including
  - Hardware sensors, transceivers, storage, & (multi-core) processors
  - A variant of the Linux OS
    - Optimized for power conservation & local IPC

Hardware components

What is Android?

- Android provides a *layered* stack for mobile devices, including
  - Hardware sensors, transceivers, storage, & (multi-core) processors
  - A variant of the Linux OS
  - Middleware infrastructure



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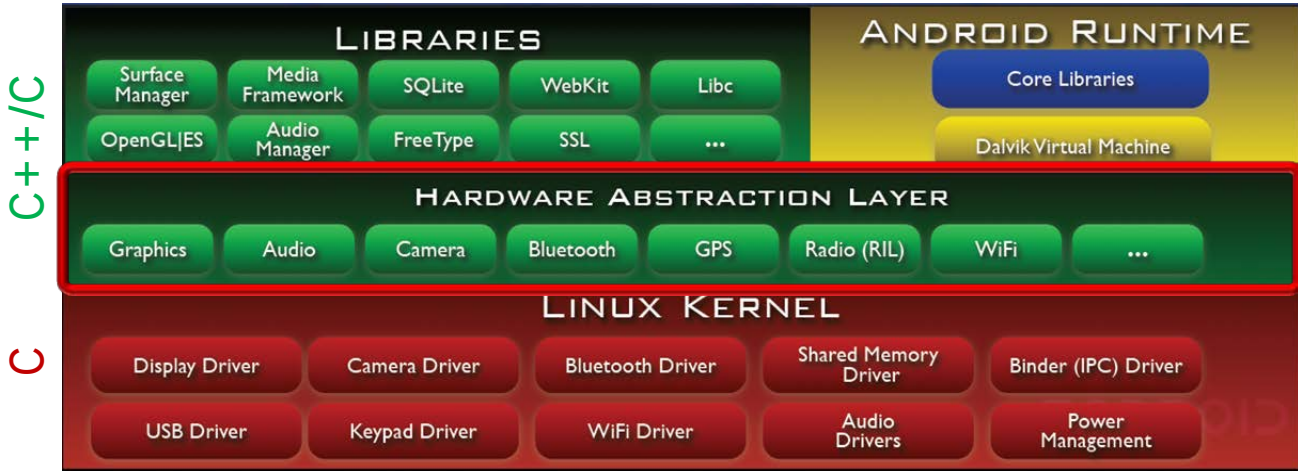
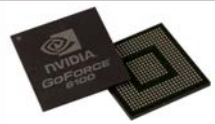
  - Middleware infrastructure
    - A hardware abstraction layer





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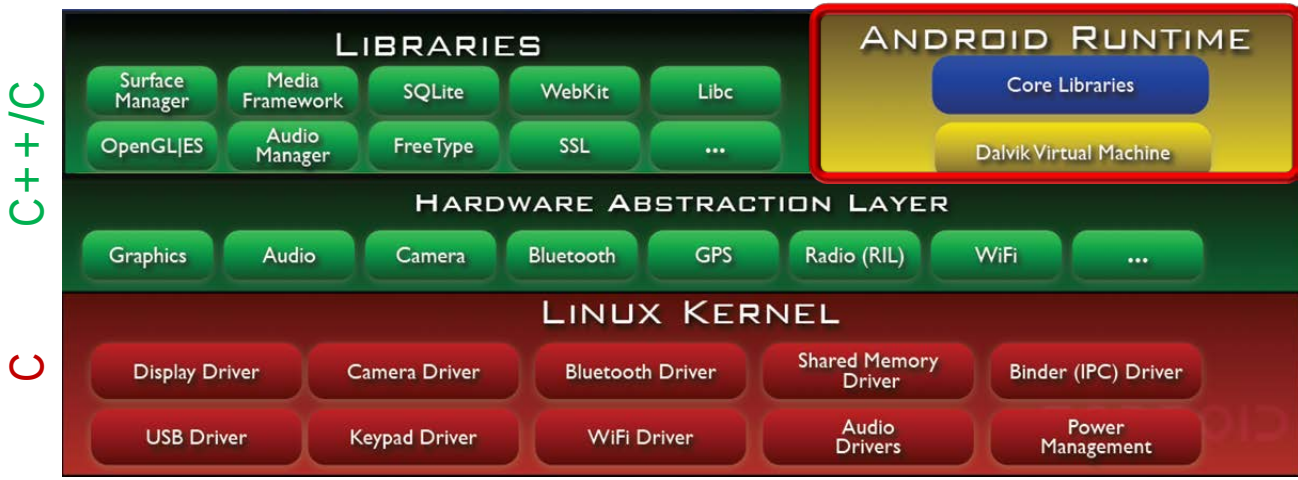
  - A variant of the Linux OS
  - Middleware infrastructure
    - A hardware abstraction layer
    - A Java runtime environment



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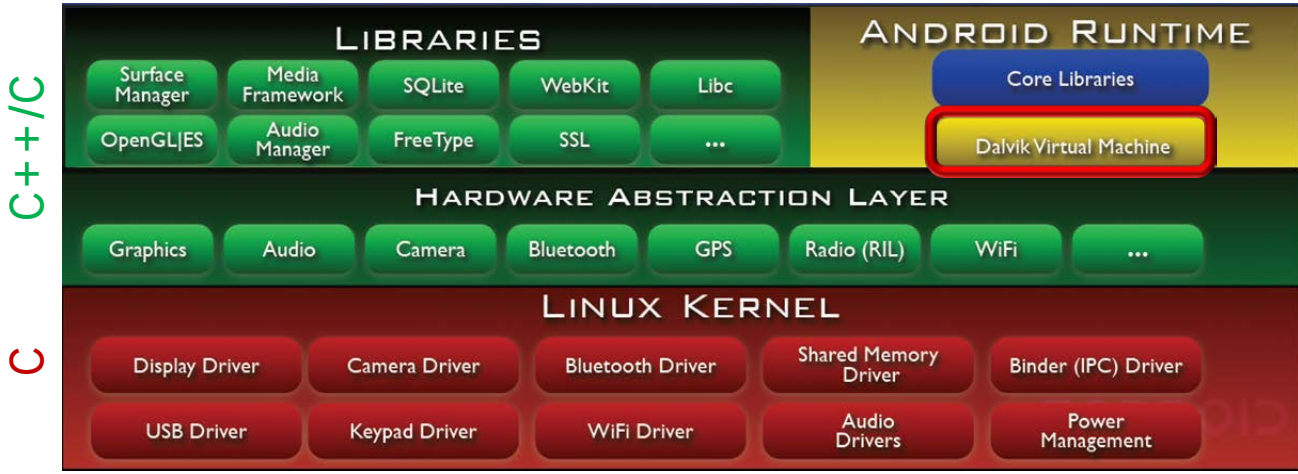
  - Middleware infrastructure
    - A hardware abstraction layer
    - A Java runtime environment
      - An optimized Java Virtual Machine (Dalvik or ART)



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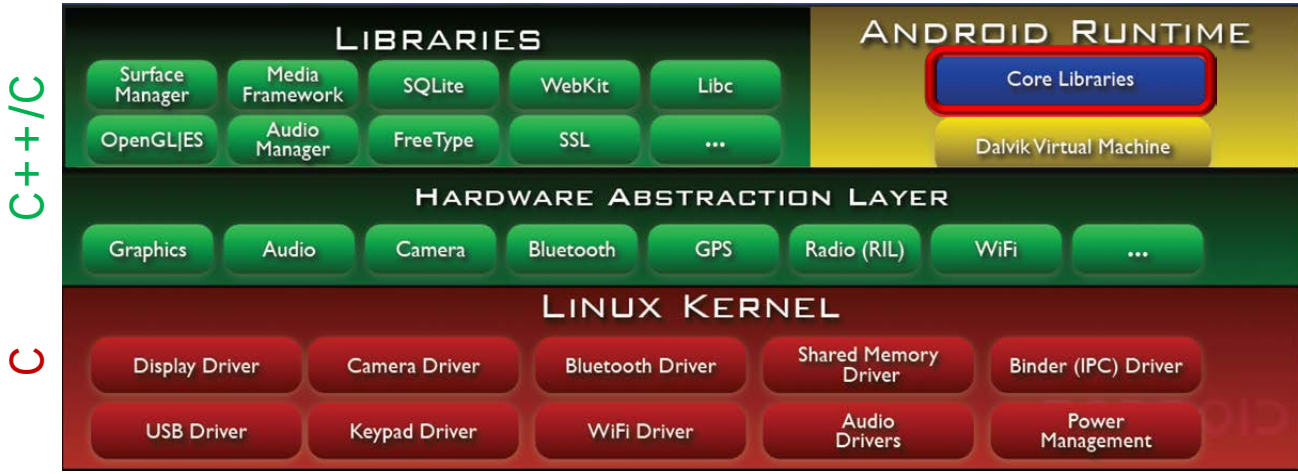
  - Middleware infrastructure
    - A hardware abstraction layer
    - A Java runtime environment
      - An optimized Java Virtual Machine (Dalvik or ART)
      - A subset of core Java libraries



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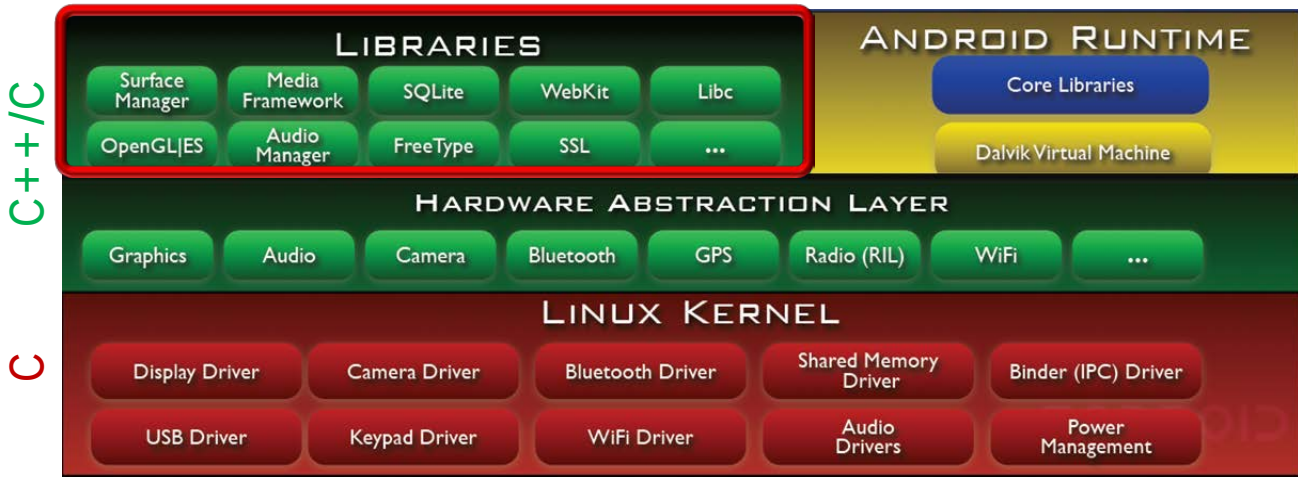
  - A variant of the Linux OS
  - Middleware infrastructure
    - A hardware abstraction layer
    - A Java runtime environment
    - Native C/C++ libraries



Hardware components

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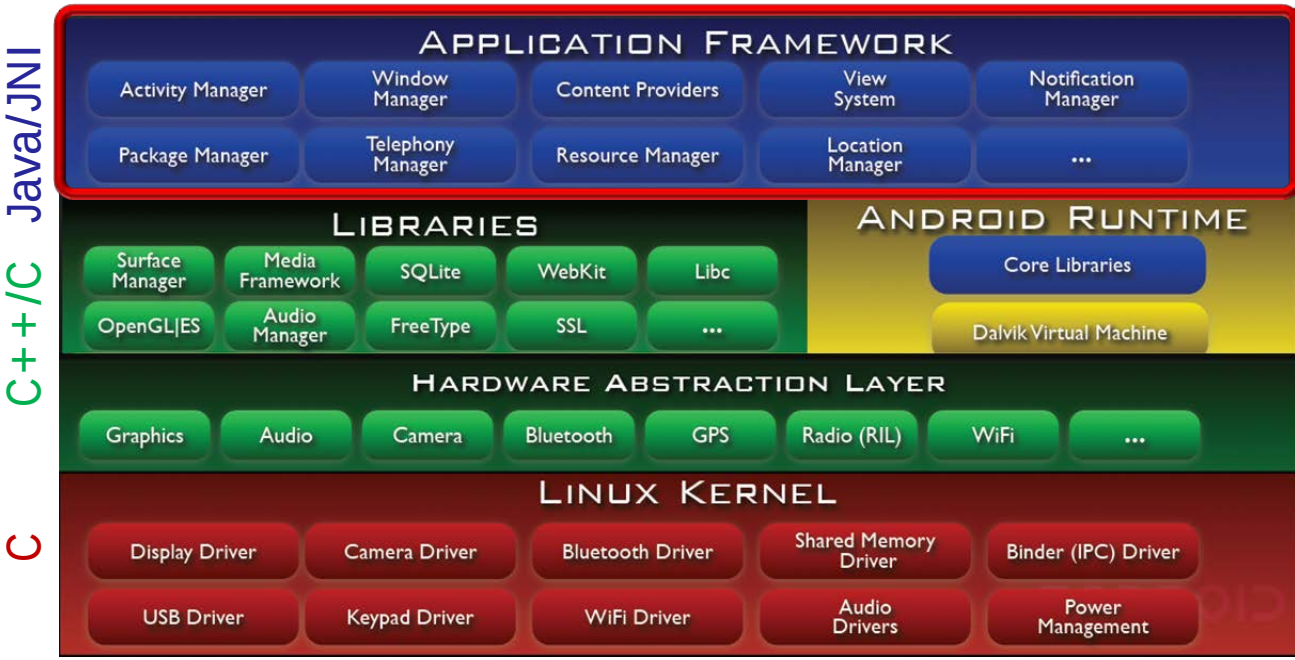
- Android provides a *layered* stack for mobile devices, including
  - Hardware sensors, transceivers, storage, & (multi-core) processors
  - A variant of the Linux OS
  - Middleware infrastructure
  - Middleware frameworks
    - GUIs
    - Telephony services
    - Camera
    - Multimedia
    - App frameworks
    - App Distribution
    - etc.



Hardware components

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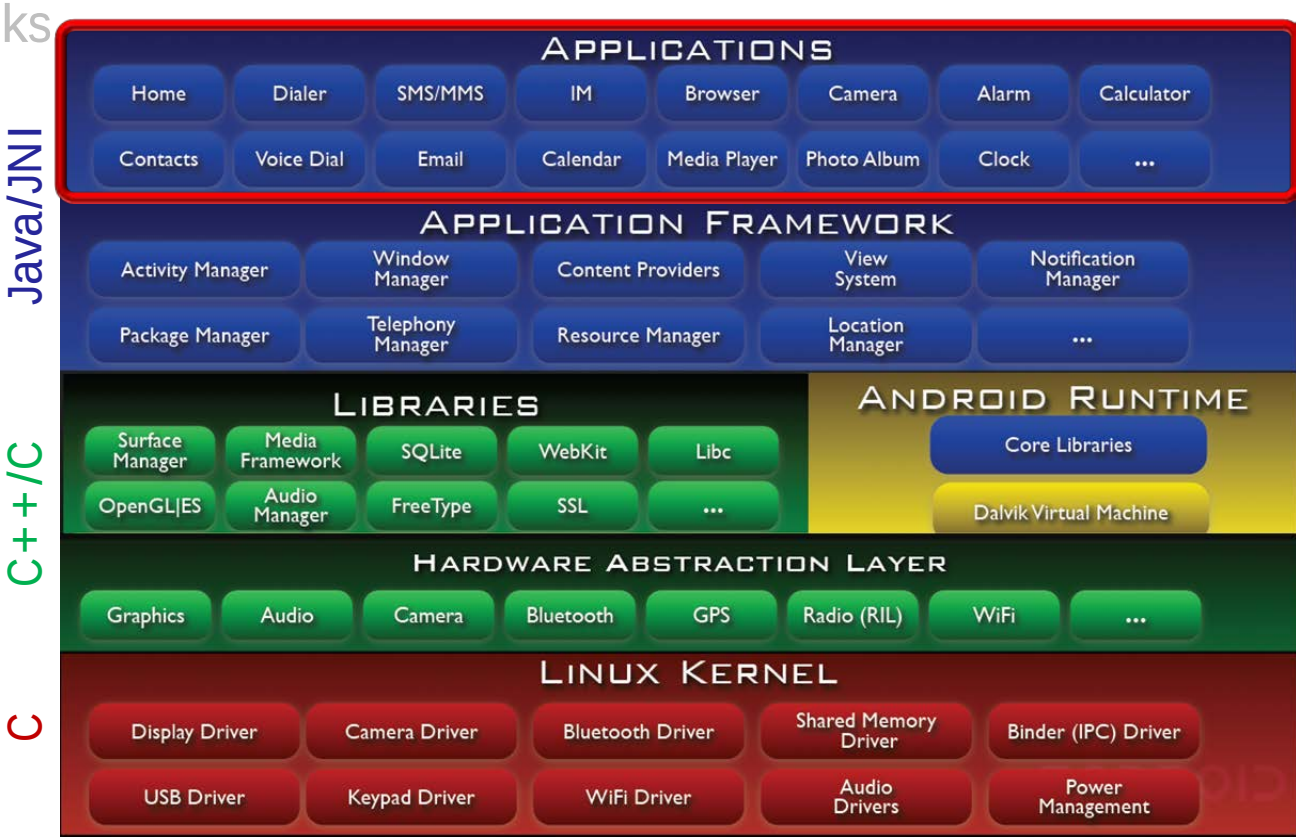
  - A variant of the Linux OS
  - Middleware infrastructure
  - Middleware frameworks
  - Packaged apps



See sites.google.com/site/io/anatomy—physiology-of-an-android

Overview of the Android Linux Kernel

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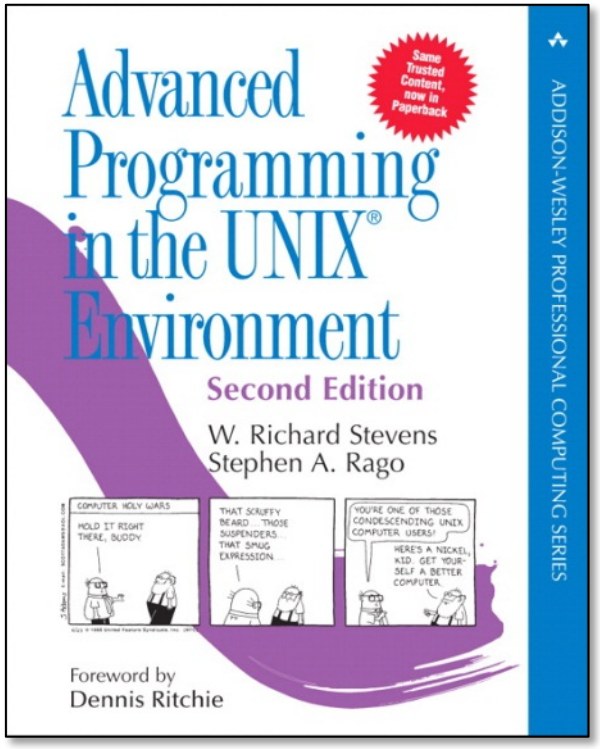
See en.wikipedia.org/wiki/Android_(operating_system)#Linux

Overview of the Android Linux Kernel

- Provides common UNIX mechanisms to manage mobile device resources

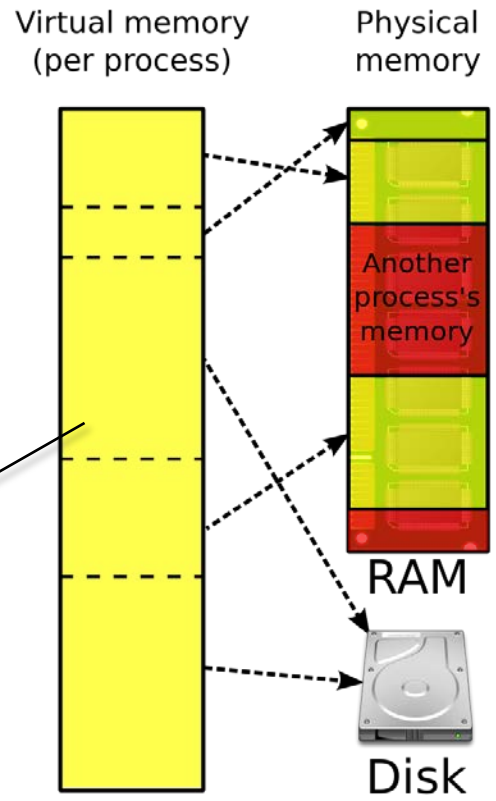


See en.wikipedia.org/wiki/Unix_architecture

Overview of the Android Linux Kernel

- Provides common UNIX mechanisms to manage mobile device resources
  - Virtual memory, process, & thread management

Provides memory isolation to & allows applications to use more memory than may physically be available

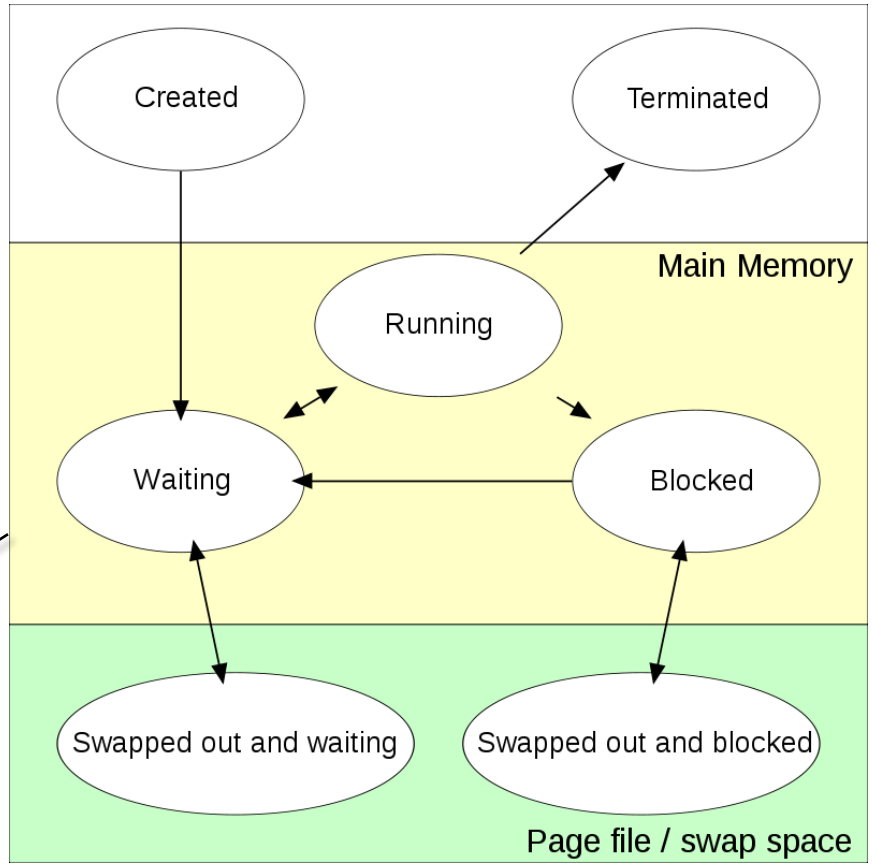


See en.wikipedia.org/wiki/Virtual_memory

Overview of the Android Linux Kernel

- Provides common UNIX mechanisms to manage mobile device resources
  - Virtual memory, process, & thread management

Provide units of resource allocation & protection to ensure that private application data can't be read from or written to by other applications



See en.wikipedia.org/wiki/Process_(computing)

Overview of the Android Linux Kernel

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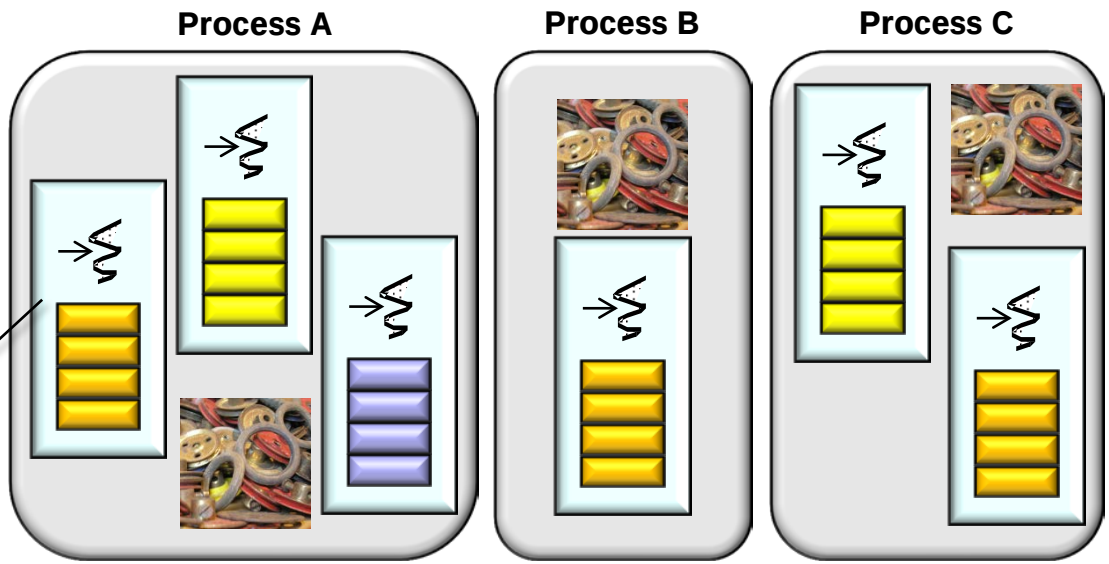
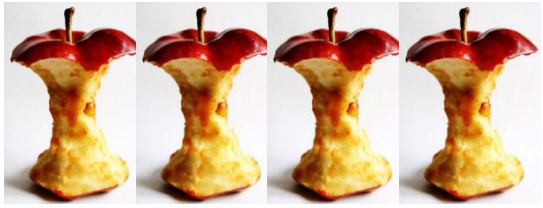


Provide units of execution for instruction streams that run on processor cores

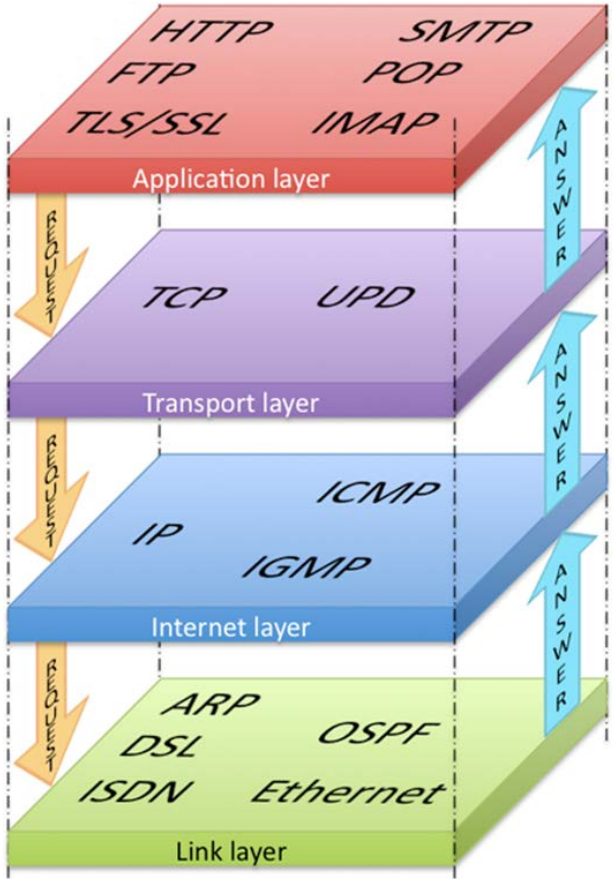


See en.wikipedia.org/wiki/Thread_(computing)

Overview of the Android Linux Kernel

- Provides common UNIX mechanisms to manage mobile device resources
  - Virtual memory, process, & thread management
  - Network & inter-process communication stack

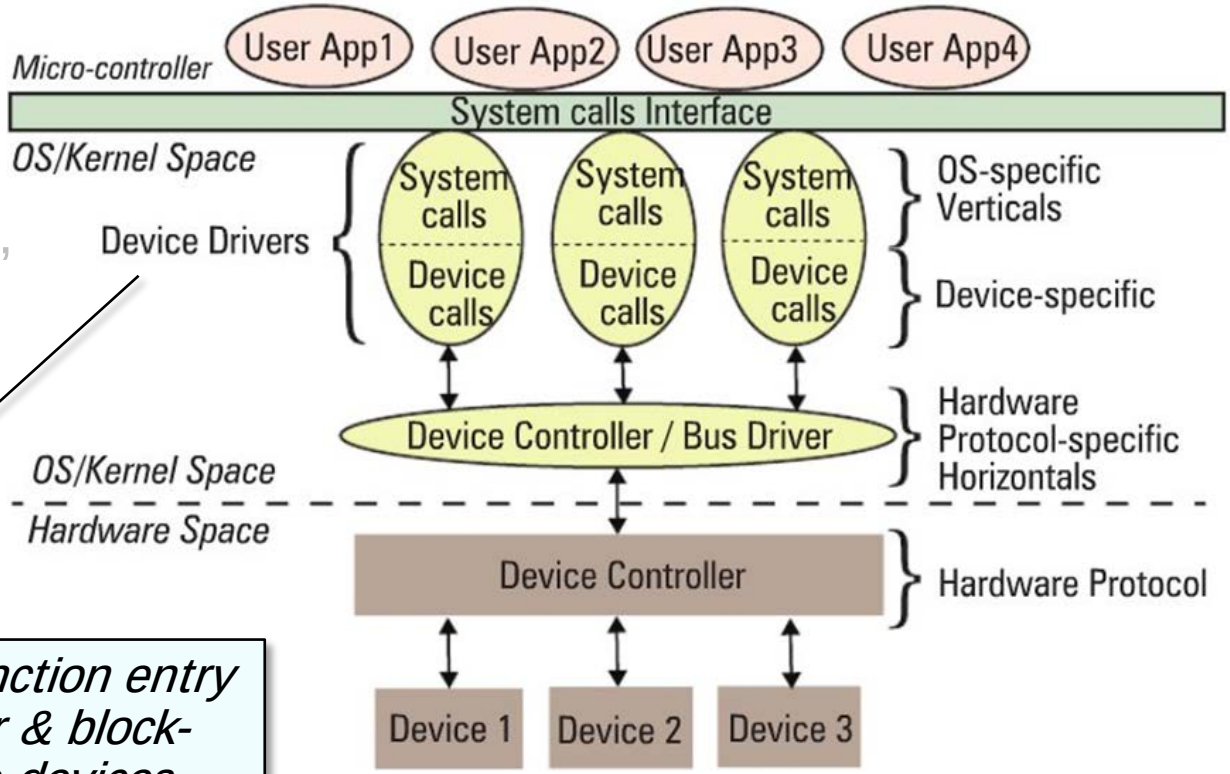
Used by applications & system services to access the Internet



See en.wikipedia.org/wiki/TCP/IP_model

Overview of the Android Linux Kernel

- Provides common UNIX mechanisms to manage mobile device resources
  - Virtual memory, process, & thread management
  - Network & inter-process communication stack
  - Device driver framework



Provides common function entry points for character & block-oriented hardware devices

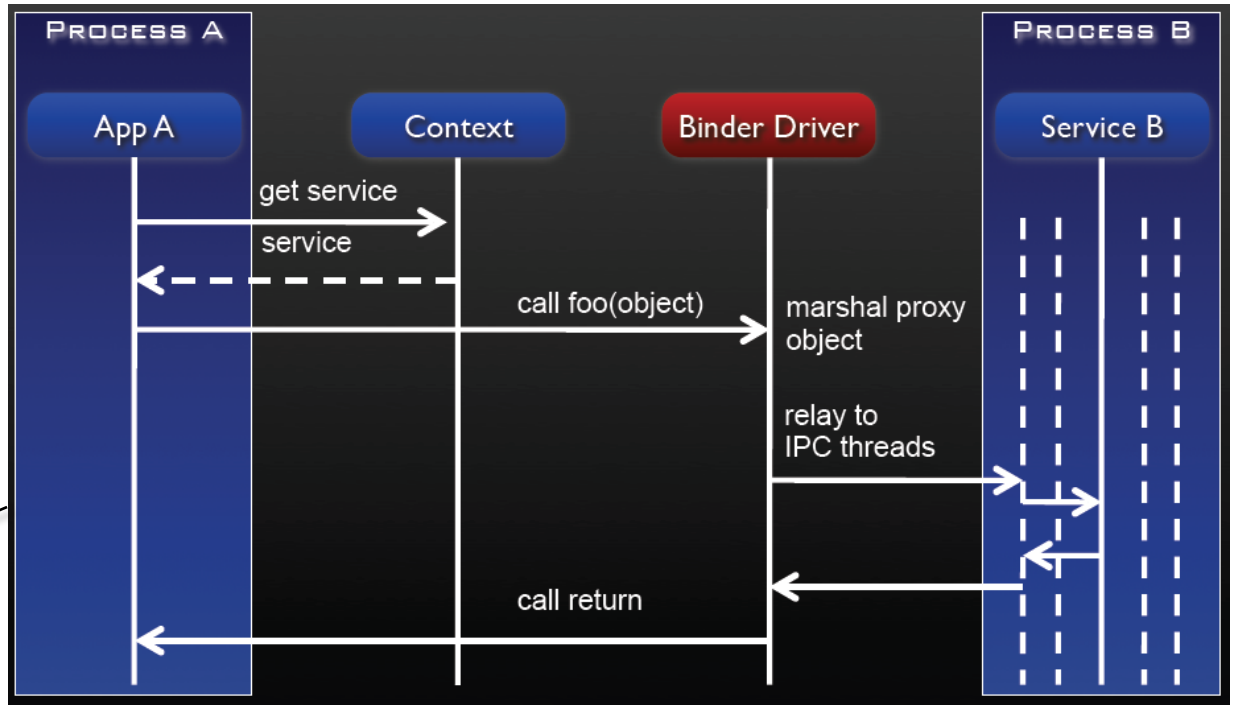
See en.wikipedia.org/wiki/Device_driver

Overview of the Android Linux Kernel

- Provides common UNIX mechanisms to manage mobile device resources
- Provides Android-specific kernel enhancements

Overview of the Android Linux Kernel

- Provides common UNIX mechanisms to manage mobile device resources
- Provides Android-specific kernel enhancements
  - Binder optimized IPC

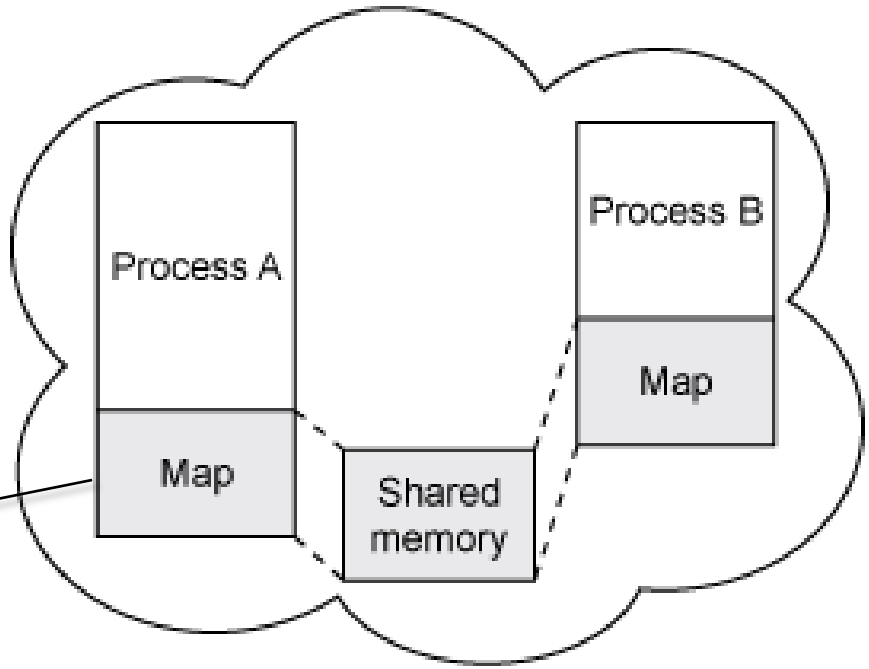


Designed for IPC between processes on an Android device

See elinux.org/Android_Binder

Overview of the Android Linux Kernel

- Provides common UNIX mechanisms to manage mobile device resources
- Provides Android-specific kernel enhancements
  - Binder optimized IPC
  - Android shared memory

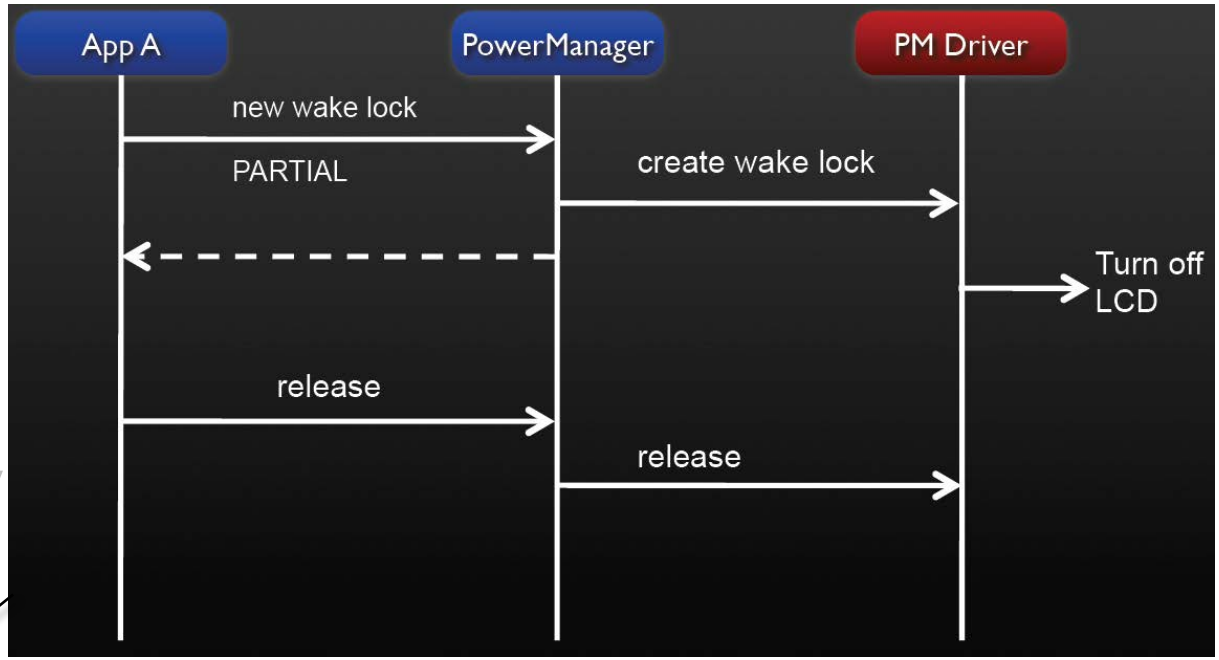


Allows sharing of memory between two or more processes

See elinux.org/Android_Kernel_Features#ashmem

Overview of the Android Linux Kernel

- Provides common UNIX mechanisms to manage mobile device resources
- Provides Android-specific kernel enhancements
  - Binder optimized IPC
  - Android shared memory
  - Power management

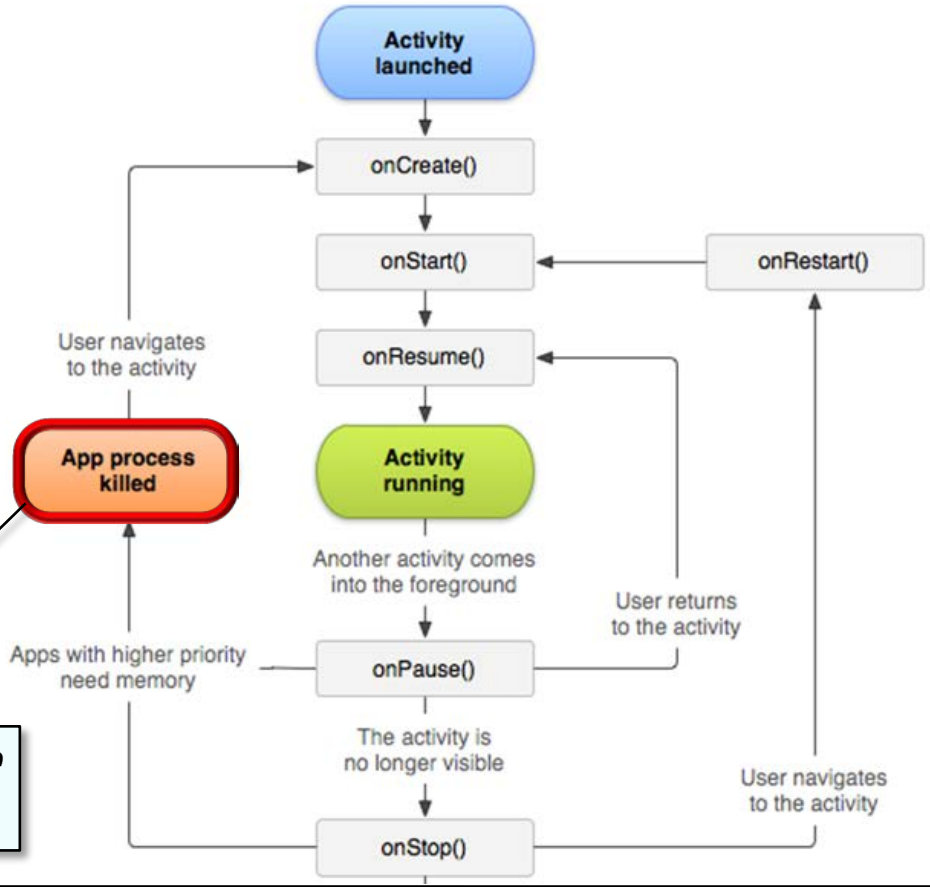


Allows applications to control when the device sleeps vs. wakes

See elinux.org/Android_Power_Management

Overview of the Android Linux Kernel

- Provides common UNIX mechanisms to manage mobile device resources
- Provides Android-specific kernel enhancements
  - Binder optimized IPC
  - Android shared memory
  - Power management
  - Low memory killer



Kills processes as available memory becomes low

See elinux.org/Android_Kernel_Features#oom_handling