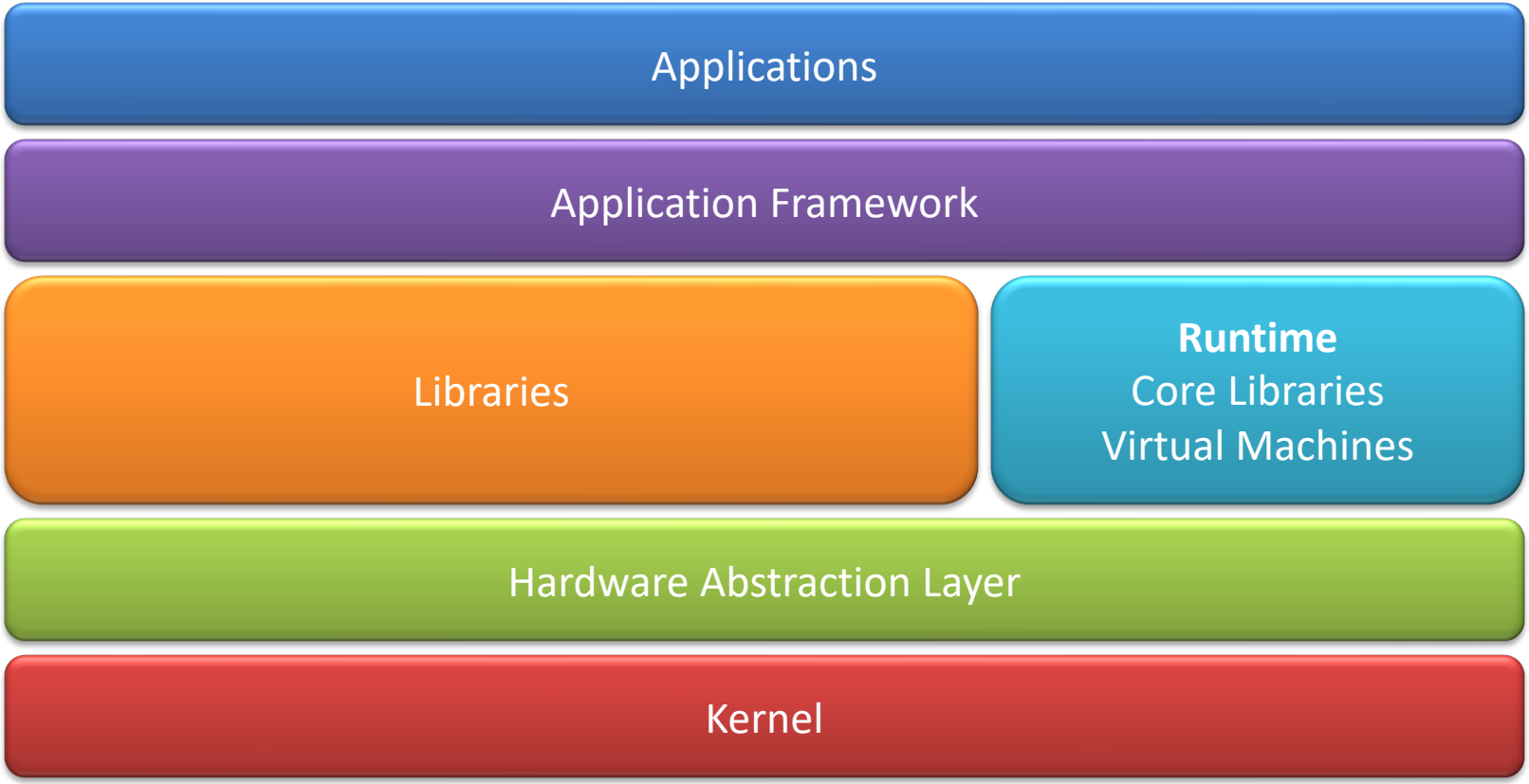
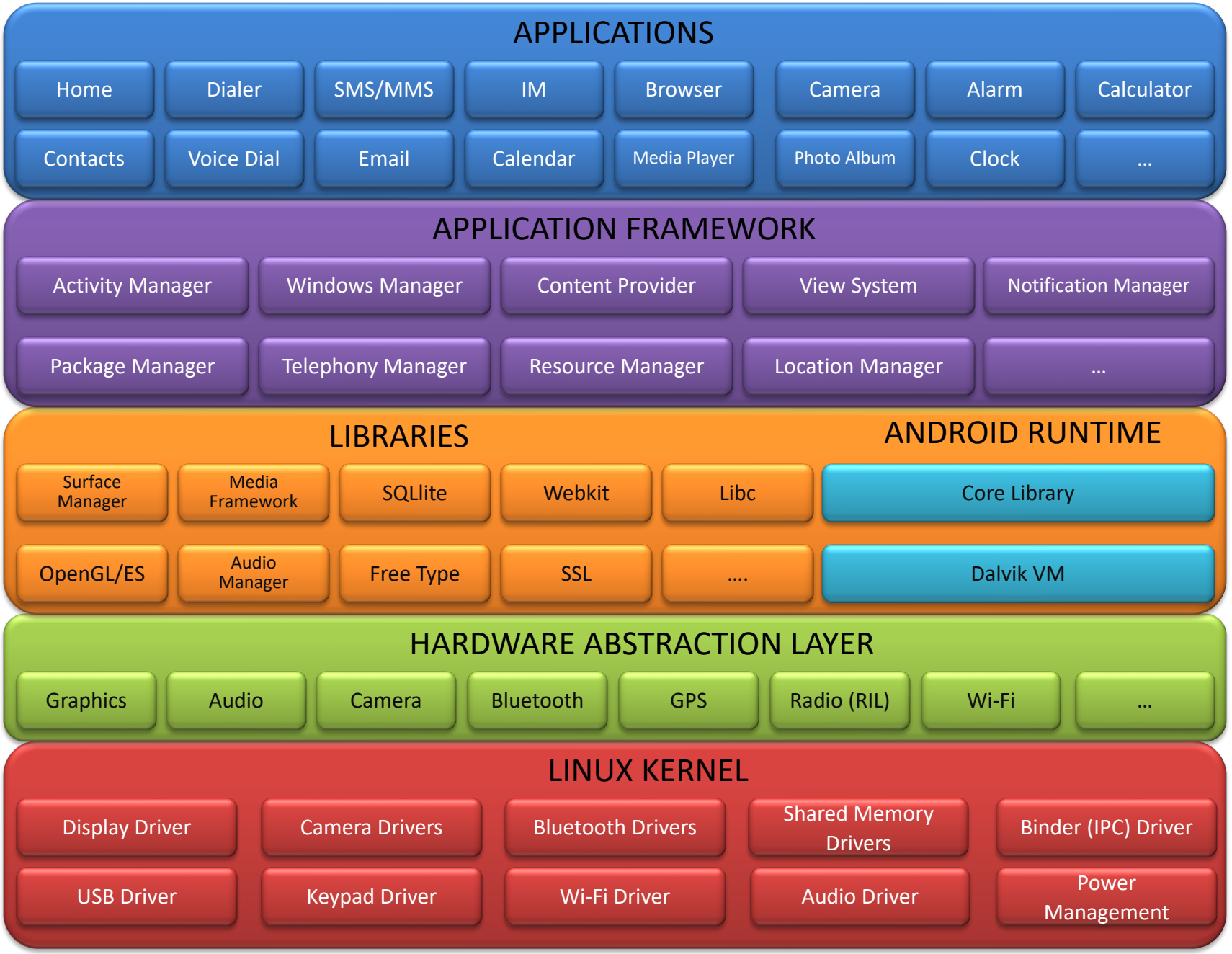
Mobile Computing

Anatomy

Architecture of a Mobile Device



Android Mobile Devices



Linux Kernel in Android

- Uses Linux 2.6 kernel
  - No native windowing system
  - No glibc library support
- Provides basic system functionalities
  - Process management
  - Memory management
  - Device management
    - Camera
    - Keypad
    - Display etc.
- The kernel handles
  - Networking
  - Vast array of device drivers

Hardware Abstraction Layer

- Hardware abstraction layer has the characteristics:
  - The user space C/C++ base layer.
  - Defines an interface between hardware drivers and android library.
  - Separation of Android platform and hardware interface logic.
- Why do you need a user space in Android HAL?
  - Not all components with standard kernel driver interface
  - Kernel driver is the GPL, which will be exposed to all intellectual property rights
  - Android has specific requirements for the hardware driver.

Libraries

- The local library includes:
  - Bionic Libc
    - Custom libc implementation, optimized for embedded.
  - Function Libraries
  - Native Servers
  - Hardware Abstraction Libraries
- Bionic libc:
  - The BSD license
  - The code path is small and fast
  - Very fast and small custom pthread implementation
  - Built in support for a specific Android service important system properties
  - Does not support some POSIX features.
  - GNU Libc (glibc) is not compatible.
  - The Native code must rely on the bionic to compile.

Libraries

- Function Libraries
  - WebKit
    - Based on the open source WebKit browser:
    - In full view rendering
    - Fully support CSS, Javascript, DOM, AJAX
    - Support single and adaptive rendering
  - Media Framework
    - OpenCORE platform on PacketVideo
    - Support the standard video, audio, still-frame format
    - Support hardware / software encoder plug-in
  - SQLite
    - A lightweight transaction data storage
    - The back-end data store of most platform

Libraries

- Native Servers
  - Surface Flinger
    - Provides system wide appearance "combiner", all the appearance of rendering into the frame in buffer equipment.
    - Can be combined with 2D and 3D appearance and multiple application appearance.
    - Can use the OpenGL ES and the 2D hardware accelerator
    - Double buffer system using page-flip.
  - Audio Flinger
    - The output of the audio equipment management
    - Processing of multiple audio flows to the PCM audio output path.
    - Audio routing to each output.

Core Library & VMs

- The core library(Core Libraries)
  - Java Core APIs provides a powerful, but simple and familiar development platform.
    Data structure
  - Tool and Utilities
  - File Access
  - Network Access
  - Graphics
- Dalvik VM
  - A special Java virtual machine (VM) designed to run with limited system resource
  - Memory efficient
  - Register machine vs. Stack machine (modern JVM)
    - fewer instructions, faster execution
  - Running multiple VMs more efficiently
  - DEX: Dalvik Executables
  - Java class files are converted into ".dex" files that Dalvik executes
    - Java byte-code is converted into Dalvik byte-code during this process

Application Framework

- Application Services
  - Activity Manager
    - Manages the lifecycle of applications.
  - Package Manager
    - Maintains information on the available applications on the device.
  - Window Manager
    - Performs window management.
  - Resource Manager
    - Manages the storing of strings and layout files and bitmaps.
  - Content Provider
    - Allows one application to make its data available to another
  - View System
    - Contains the building blocks of the user interface – buttons, text boxes etc.
  - Notification Manager
    - Alerts the user about events: Status bar updates, flashing lights, vibrations etc.
- Hardware Services
  - Telephony Service
    - API's needed to build the phone application and SMS.
  - Location Service
    - Uses GPS and Android Network provider which uses cell tower and wi-fi signals.
  - Bluetooth Service
    - Access Bluetooth
  - WIFI Service
    - Access Wi-Fi
  - USB Service
    - Access USB for various tasks
  - Sensor Service
    - Access sensors