Overview of Android: The Hardware Layer

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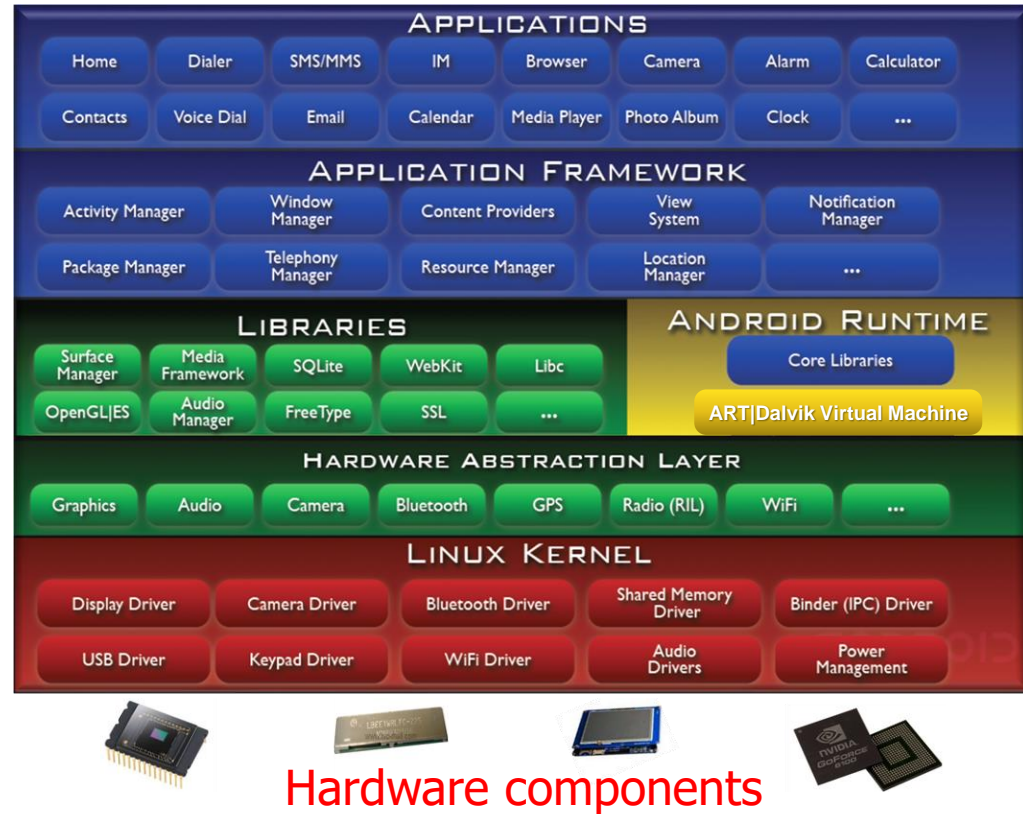
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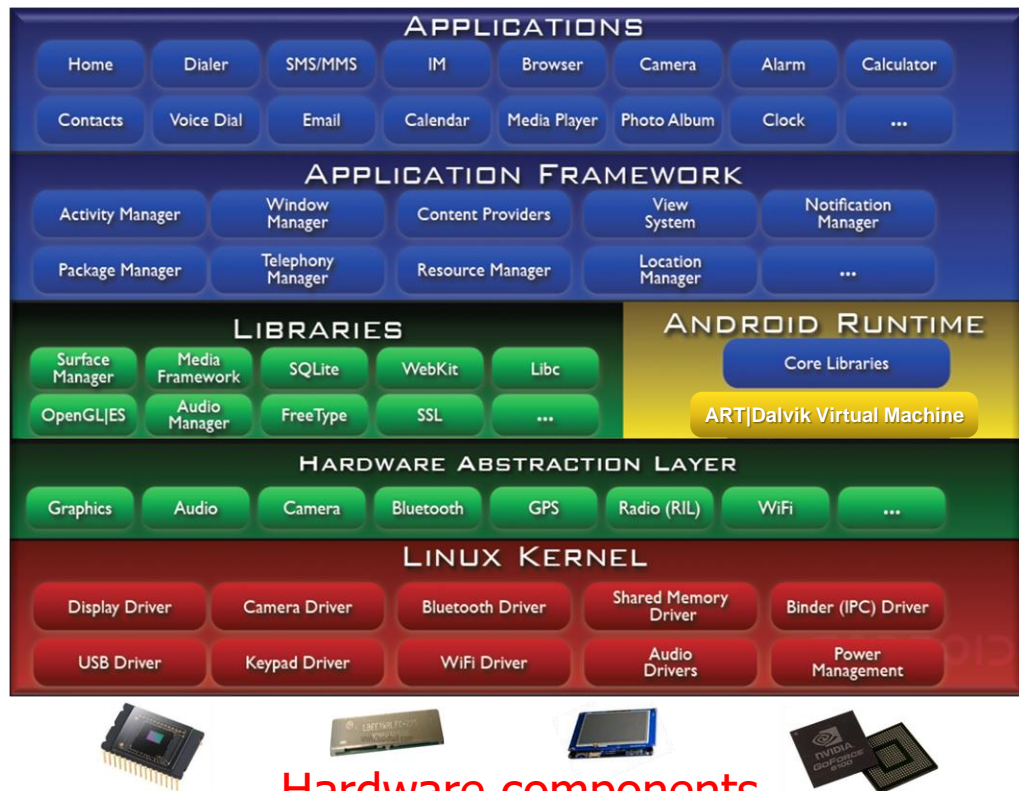
Learning Objectives in this Part of the Lesson

- Understand common hardware elements in Android
  - e.g., sensors, transceivers, storage, & processors

Hardware components

Overview of Android Hardware

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements

Hardware components
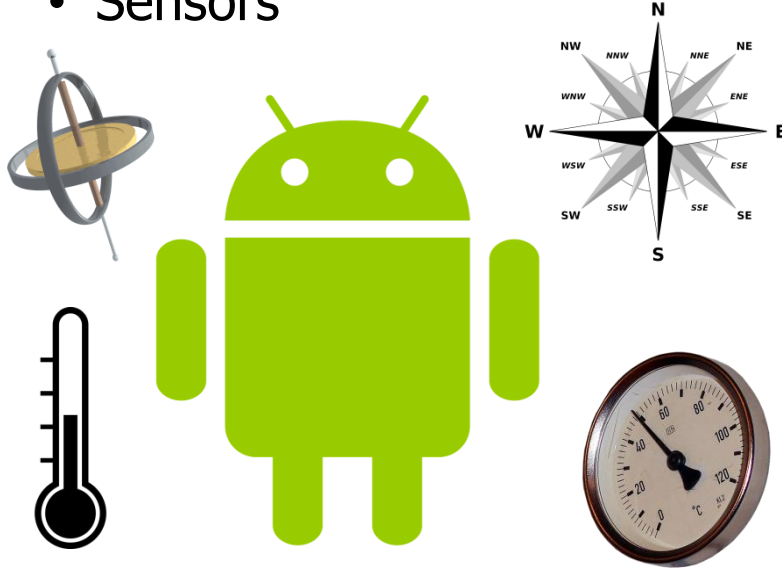
- Android devices are built upon a range of hardware elements, e.g.

  - Sensors

Sensors detect events or changes in the environment

Hardware components

See developer.android.com/guide/topics/sensors/sensors_overview.html

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.

  - Sensors, e.g.

    - Motion sensors measure acceleration forces & rotation

      - e.g., accelerometers & gyroscopes

Hardware components

See developer.android.com/guide/topics/sensors/sensors_motion.html

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.

  - Sensors, e.g.

    - Motion sensors measure acceleration forces & rotation

    - Environment sensors measure temperature, pressure, & humidity

      - e.g., thermometers & barometers

Hardware components

See hdeveloper.android.com/guide/topics/sensors/sensors_environment.html

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.

  - Sensors, e.g.

    - Motion sensors measure acceleration forces & rotation

    - Environment sensors measure temperature, pressure, & humidity

    - Position sensors measure the physical position of a device

      - e.g., magnetometers

Hardware components

See developer.android.com/guide/topics/sensors/sensors_position.html

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.
  - Sensors
  - Transceivers

A transceiver comprises both a transmitter & a receiver

Hardware components

See en.wikipedia.org/wiki/Transceiver
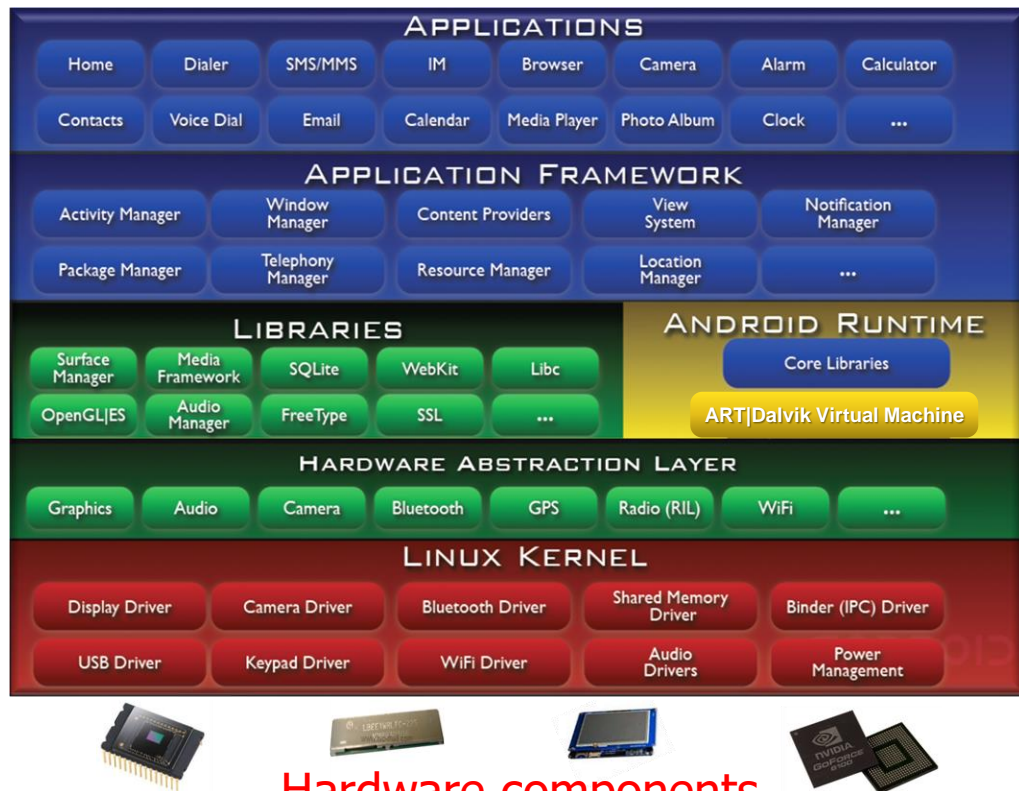
Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.
  - Sensors

  - Transceivers, e.g.
    - Cellular radio
      - Make & receive calls over a radio frequency link

Hardware components

- Android devices are built upon a range of hardware elements, e.g.
  - Sensors
  - Transceivers, e.g.
    - Cellular radio
    - WiFi
      - Provides a wireless local area network

APPLICATIONS

| Home | Dialer | SMS/MMS | IM | Browser | Camera | Alarm | Calculator |
| Contacts | Voice Dial | Email | Calendar | Media Player | Photo Album | Clock | ... |

APPLICATION FRAMEWORK

| Activity Manager | Window Manager | Content Providers | View System | Notification Manager |
| Package Manager | Telephony Manager | Resource Manager | Location Manager | ... |

LIBRARIES | **ANDROID RUNTIME**

| Surface Manager | Media Framework | SQLite | WebKit | Libc | Core Libraries |
| OpenGL|ES | Audio Manager | FreeType | SSL | ... | ART|Dalvik Virtual Machine |

HARDWARE ABSTRACTION LAYER

| Graphics | Audio | Camera | Bluetooth | GPS | Radio (RIL) | WiFi | ... |

LINUX KERNEL

| Display Driver | Camera Driver | Bluetooth Driver | Shared Memory Driver | Binder (IPC) Driver |
| USB Driver | Keypad Driver | WiFi Driver | Audio Drivers | Power Management |

Hardware components

See en.wikipedia.org/wiki/Wi-Fi

Overview of Android Layers: Hardware

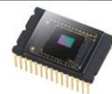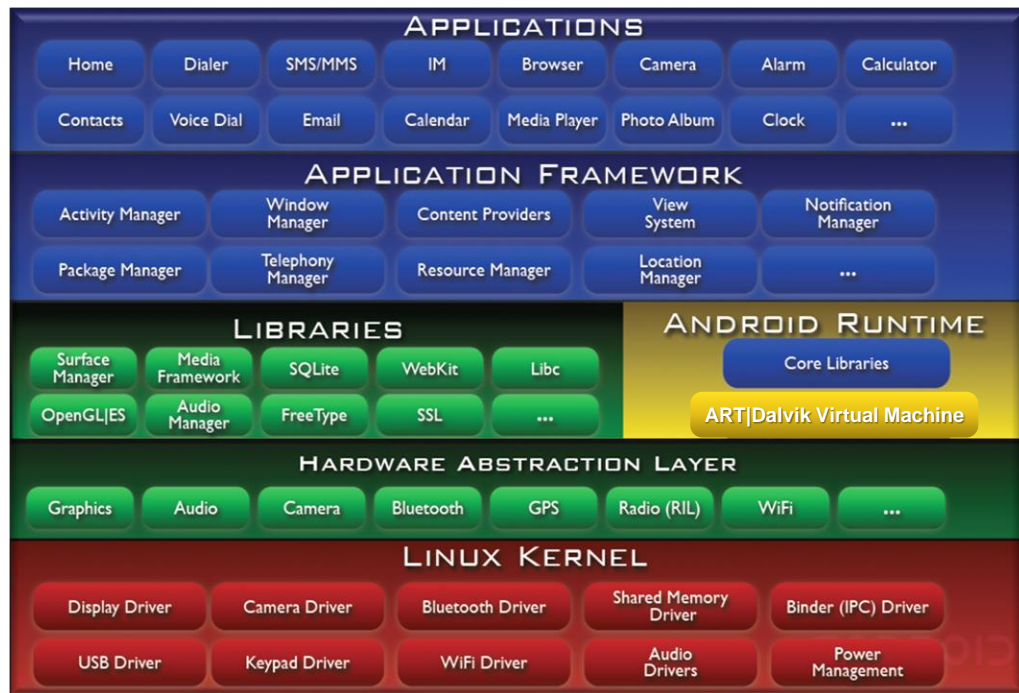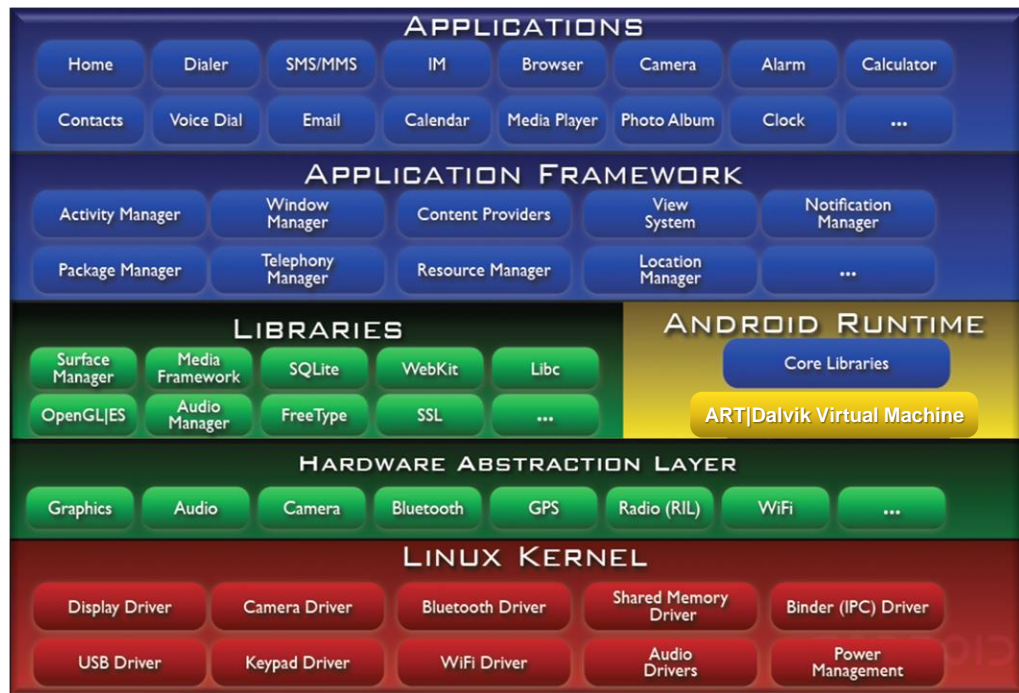- Android devices are built upon a range of hardware elements, e.g.
  - Sensors
  - Transceivers, e.g.
    - Cellular radio
    - WiFi
    - Bluetooth
      - Exchange data over short distances in a "personal area network"

Hardware components

See en.wikipedia.org/wiki/Bluetooth

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.
  - Sensors
  - Transceivers, e.g.
    - Cellular radio
    - WiFi
    - Bluetooth
    - Near-field communication (NFC)
      - Enable 2 electronic devices to communicate by placing them within 2 inches

Hardware components

See en.wikipedia.org/wiki/Near_field_communication

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.
  - Sensors
  - Transceivers
  - Storage

Storage is used to retain digital data

Hardware components

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.
  - Sensors
  - Transceivers

  - Storage, e.g.
    - Random access memory (RAM)
   - Allows read/write access to data in ~same amount of time irrespective of location

Hardware components

See en.wikipedia.org/wiki/Random-access_memory

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.

  - Sensors

  - Transceivers

  - Storage, e.g.

    - Random access memory (RAM)

    - Flash memory

      - Non-volatile memory that can be electrically erased & reprogrammed
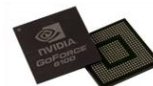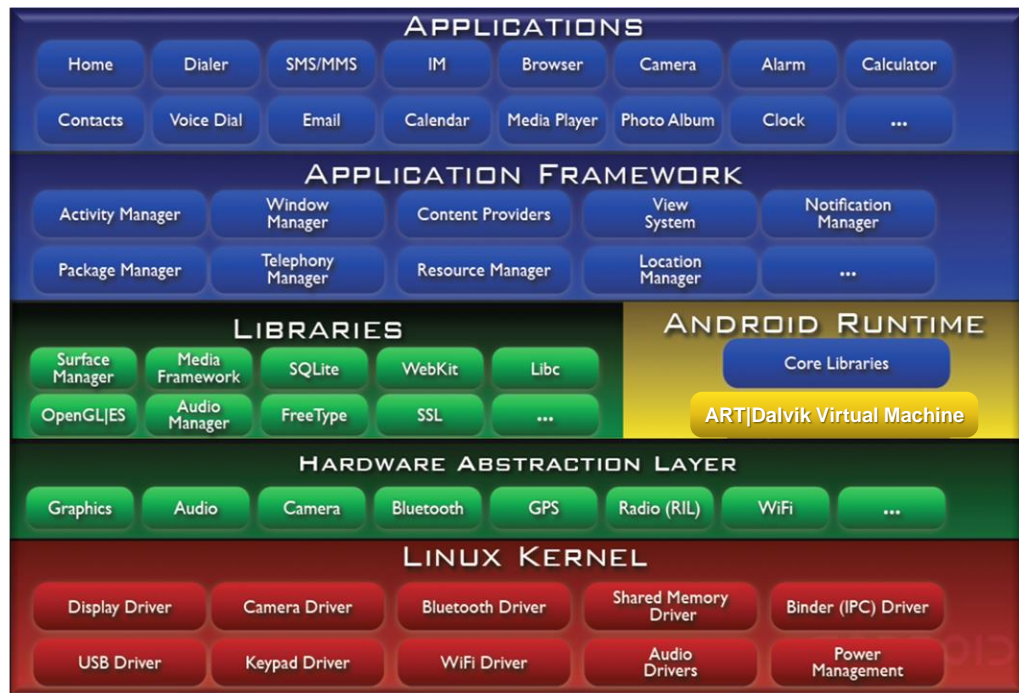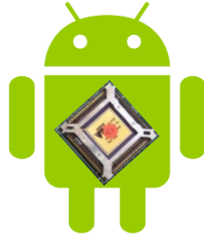

Hardware components

See en.wikipedia.org/wiki/Flash_memory

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.

  - Sensors
  - Transceivers
  - Storage

  - Processors

Processors perform computer program instructions

Hardware components

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.

  - Sensors

  - Transceivers

  - Storage

  - Processors, e.g.,

    - Central processing units

      - Basic arithmetic, logical, control, & I/O operations

Hardware components

See en.wikipedia.org/wiki/Central_processing_unit

- Android devices are built upon a range of hardware elements, e.g.
  - Sensors
  - Transceivers
  - Storage

  - Processors, e.g.,
    - Central processing units
      - Basic arithmetic, logical, control, & I/O operations
    - Increasingly multi-core

Hardware components

See www.androidauthority.com/fact-or-fiction-android-apps-only-use-one-cpu-core-610352

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.
  - Sensors
  - Transceivers
  - Storage
  - Processors, e.g.,
    - Central processing units
    - Graphics processing units
      - More efficient than CPUs for processing of large blocks of data in parallel

Hardware components

See en.wikipedia.org/wiki/Graphics_processing_unit

Overview of Android Layers: Hardware

- Android devices are built upon a range of hardware elements, e.g.

  - Sensors

  - Transceivers

  - Storage

  - Processors, e.g.,

    - Central processing units

    - Graphics processing units

    - Digital signal processors

      - Efficiently measure, filter & compress continuous analog signals

Hardware components

See en.wikipedia.org/wiki/Digital_signal_processor

End of the Overview of Android: The Hardware Layer