Introduction to Android

Outline

- What is Android?
- Features
  - Android Architecture
  - Linux kernel
  - Native Libraries
  - Android Runtime
  - Application Framework
  - Applications

What is Android

- Android is a software stack for **mobile devices** that includes an operating system, middleware and key applications.
- Android is a **Java-based** operating system that runs on the **Linux** 2.6 kernel.
- The **Android SDK** provides the tools and APIs necessary to begin developing applications on the Android platform using the **Java** programming language.

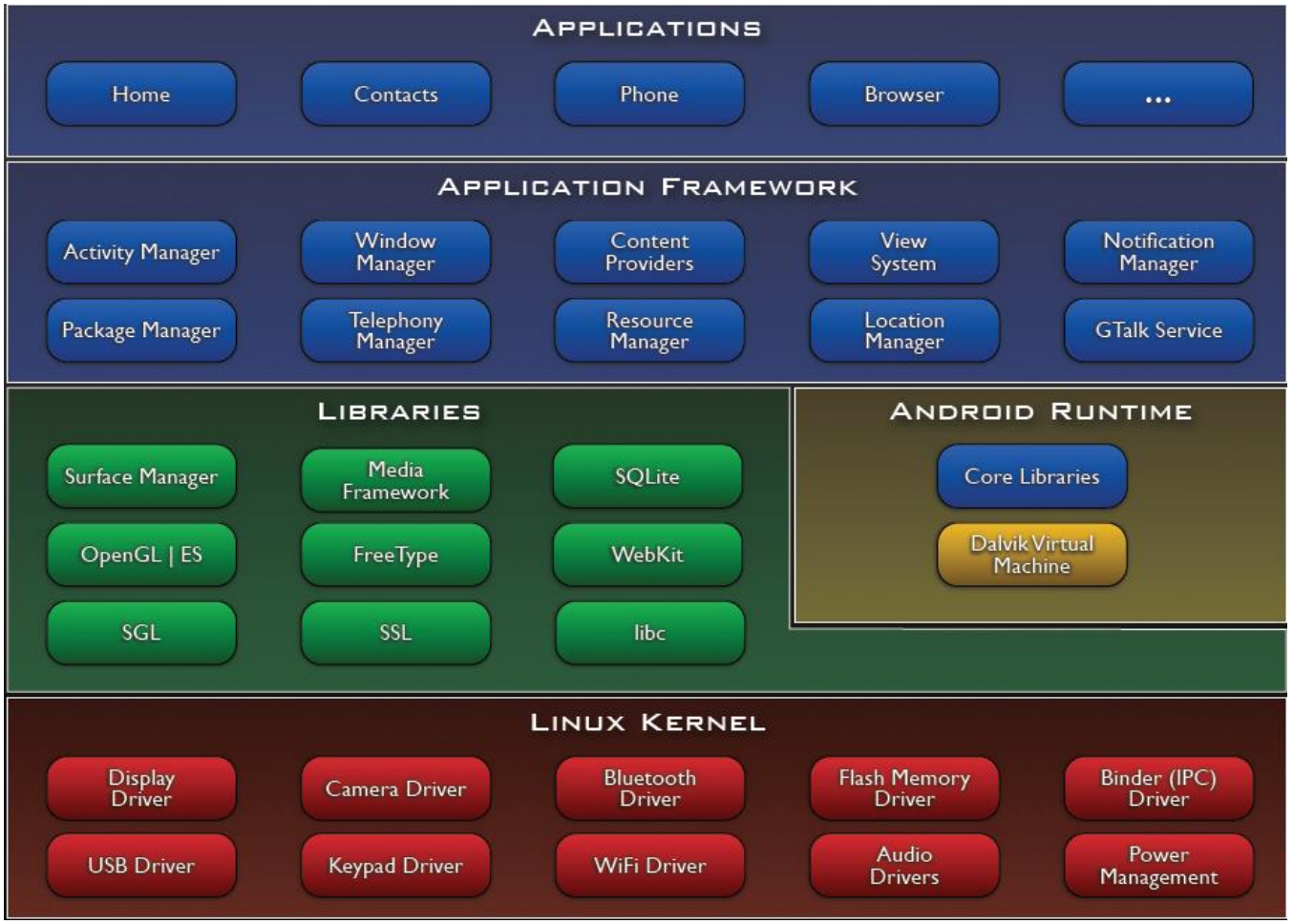
Features

- **Application framework** enabling reuse and replacement of components
- **Dalvik virtual machine** optimized for mobile devices
- **Integrated browser** based on the open source WebKit engine
- **Optimized graphics** powered by a custom 2D graphics library; 3D graphics based on the OpenGL ES 1.0 specification (hardware acceleration optional)
- **SQLite** for structured data storage

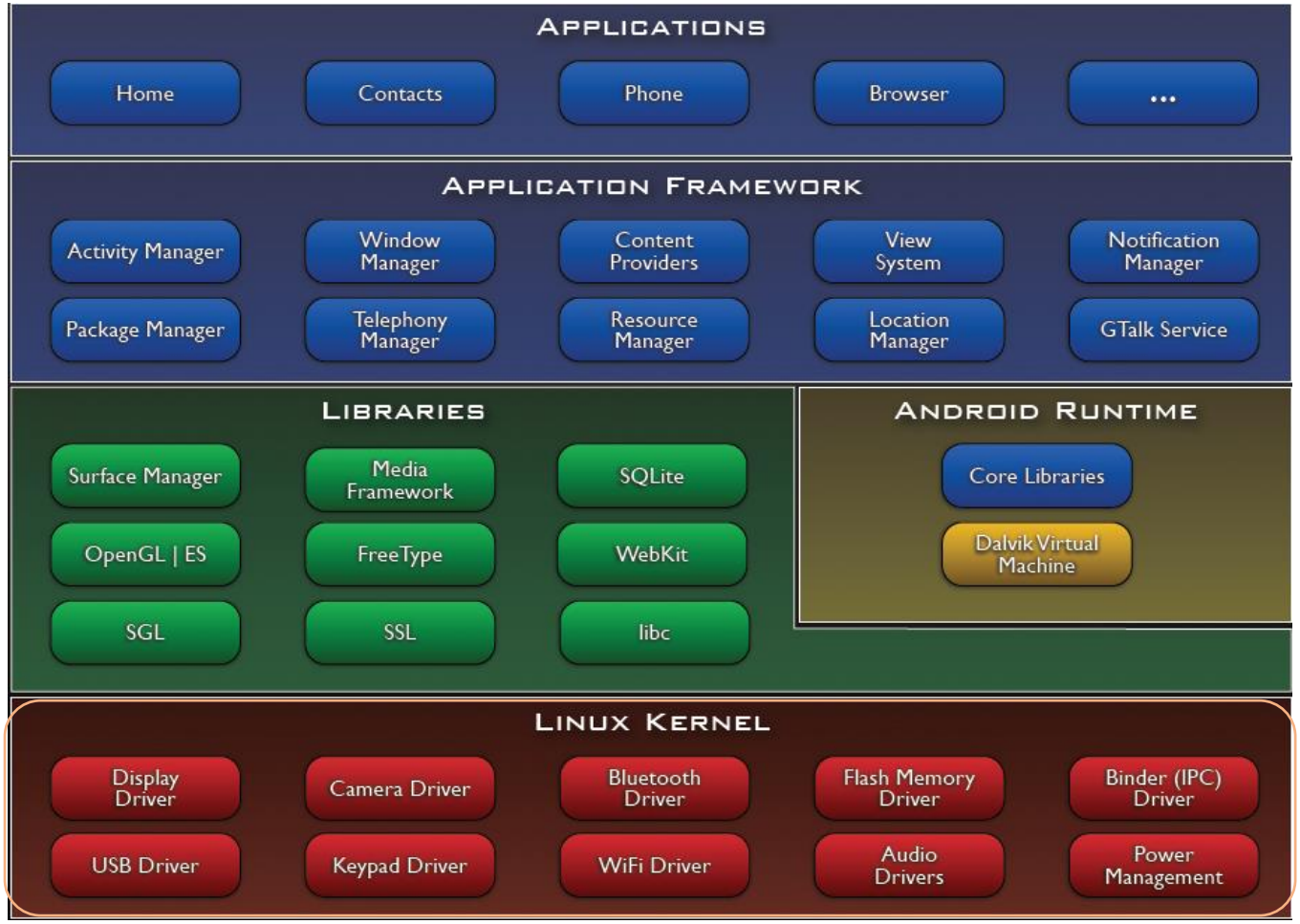
Features(con't)

- **Media support** for common audio, video, and still image formats (MPEG4, H.264, MP3, AAC, AMR, JPG, PNG, GIF)
- **GSM Telephony** (hardware dependent)
- **Bluetooth, EDGE, 3G, and WiFi** (hardware dependent)
- **Camera, GPS, compass, and accelerometer** (hardware dependent)
- **Rich development environment** including a device emulator, tools for debugging, memory and performance profiling, and a plugin for the Eclipse IDE

Android Architecture



Linux Kernel

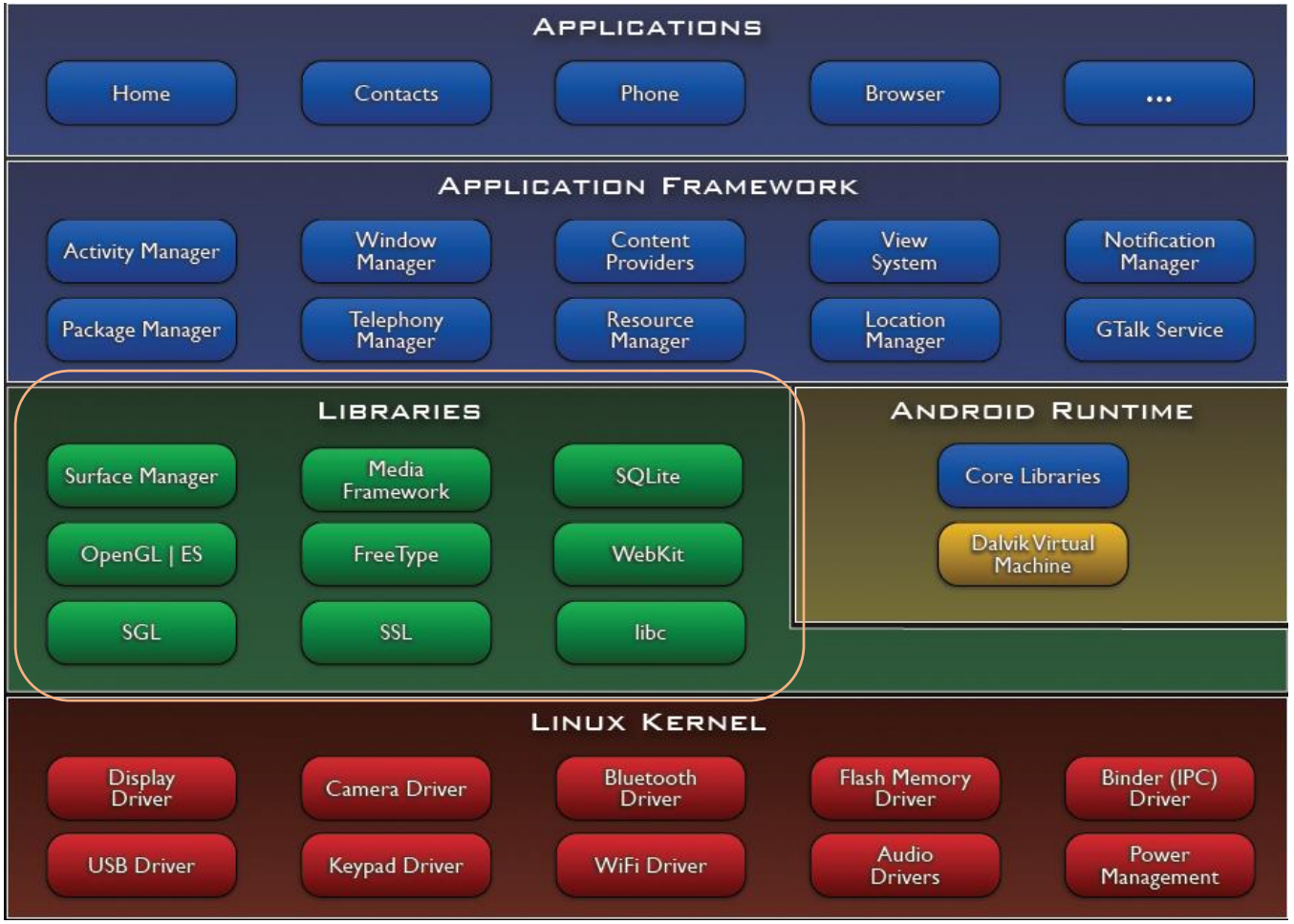


Linux Kernel

- Android is built on the Linux kernel, but Android is not Linux
- Provide core system services such as process, memory, power management, network stack, driver model and security
- Does not include the full set of standard Linux utilities
- The Android kernel source is available today
  - http://git.android.com

We thank cllee for sharing his slides with us

Libraries


Applications
Home
Contacts
Phone
Browser
...
Application Framework
Activity Manager
Window Manager
Content Providers
View System
Notification Manager
Package Manager
Telephony Manager
Resource Manager
Location Manager
GTalk Service
Libraries
Surface Manager
Media Framework
SQLite
OpenGL | ES
FreeType
WebKit
SGL
SSL
libc
Android Runtime
Core Libraries
Dalvik Virtual Machine
Linux Kernel
Display Driver
Camera Driver
Bluetooth Driver
Flash Memory Driver
Binder (IPC) Driver
USB Driver
Keypad Driver
WiFi Driver
Audio Drivers
Power Management

Native Libraries

- Bionic Libc
- Function Libraries
- Native Servers
- Hardware Abstraction Libraries

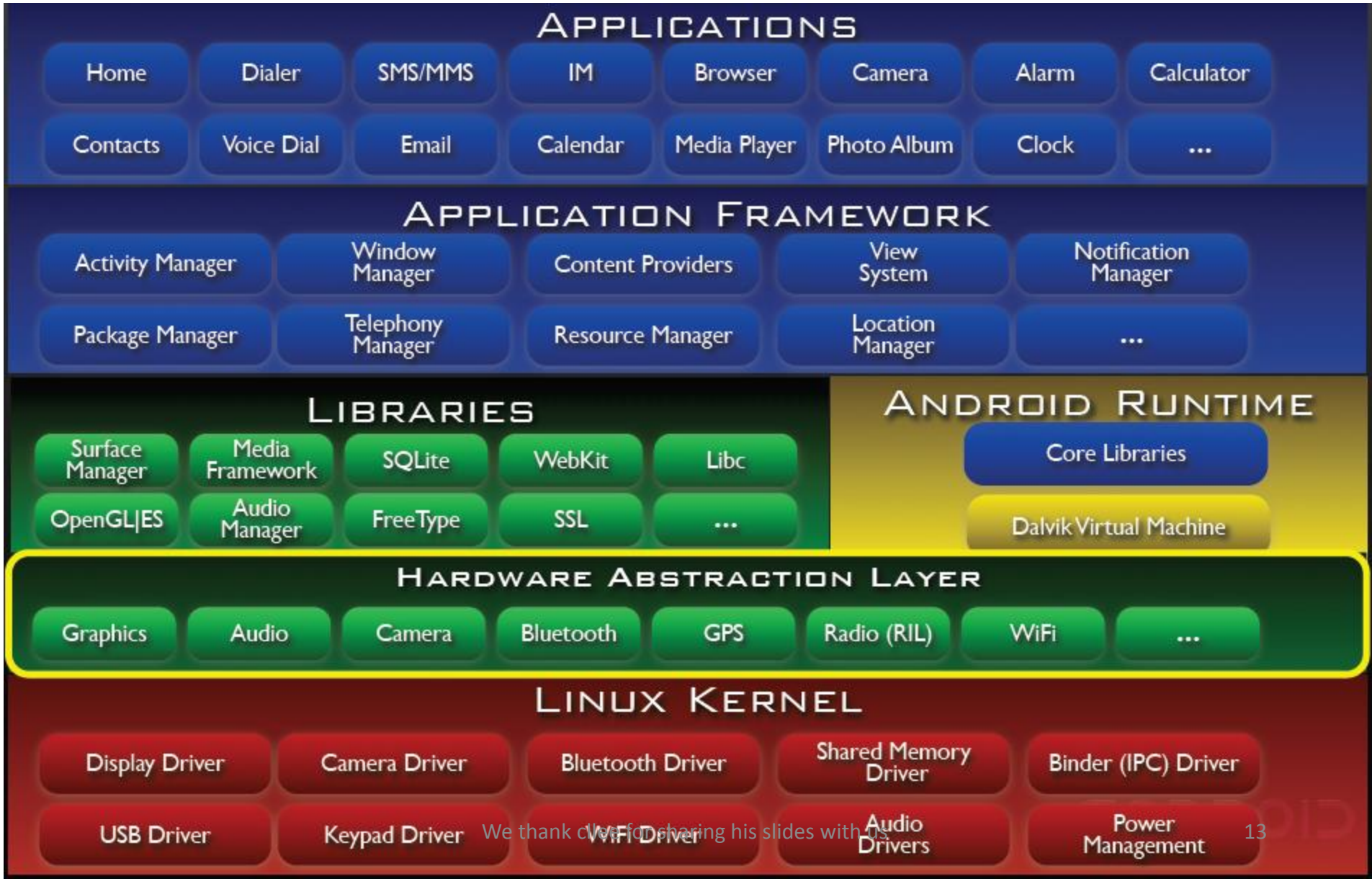
Bionic Libc

- C/C++ library
- Custom libc implementation, optimized for embedded use.
- Not compatible with Gnu Libc (glibc)
- Pros (compare with glibc)
  - Small size and fast code paths
  - Very fast and small custom pthread implementation

Function Libraries

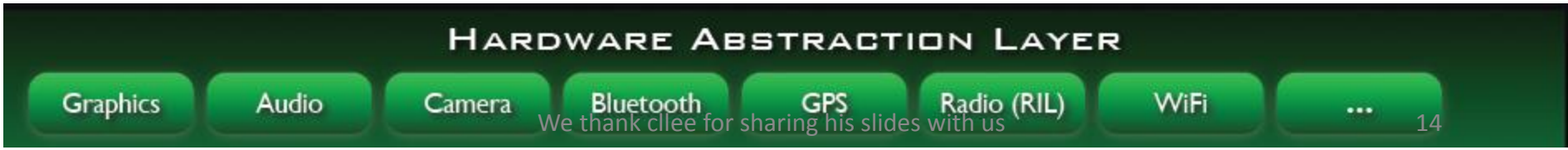
- WebKit
  - Based on open source WebKit browser
  - Full CSS, Javascript, DOM, AJAX support
- Media Framework
  - Based on PacketVideo OpenCORE platform
  - Supports standard video, audio, still-frame formats
- SQLite
  - Light-weight transactional data store
  - Back end for most platform data storage

Hardware Abstraction Libraries

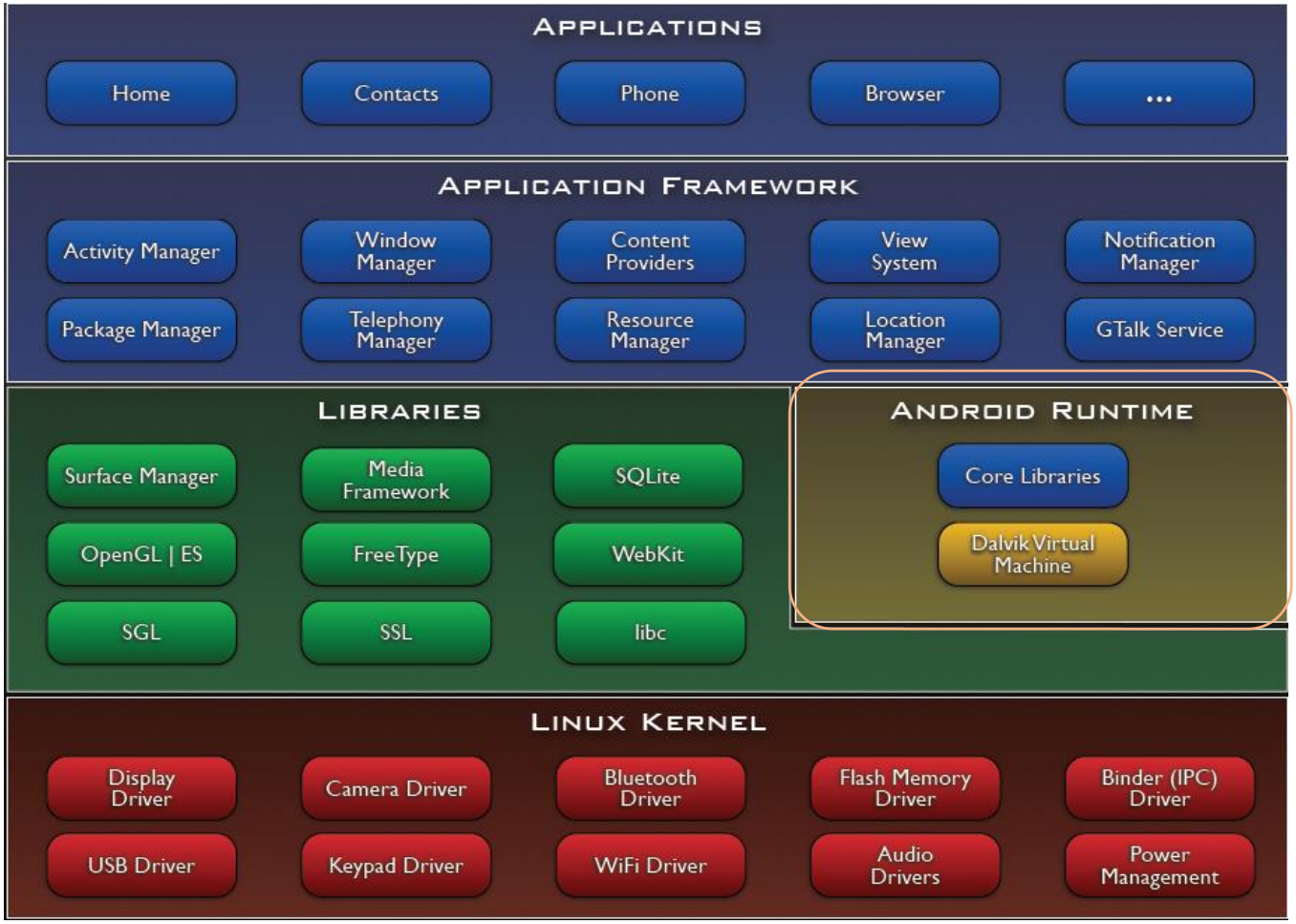


Hardware Abstraction Libraries

- User space C/C++ library layer
- Defines the interface that Android requires hardware "drivers" to implement
- Separates the Android platform logic from the hardware interface
- Why do we need a user-space HAL?
  - Not all components have standardized kernel driver interfaces
  - Kernel drivers are GPL which exposes any proprietary IP
  - Android has specific requirements for hardware drivers

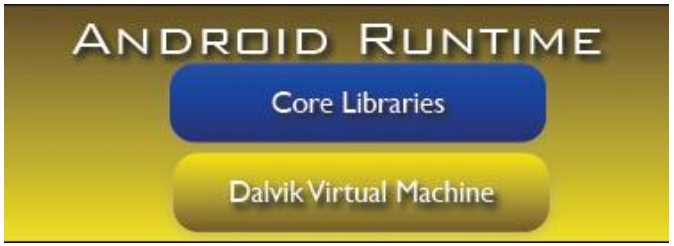


Libraries


Applications
Home
Contacts
Phone
Browser
...
Application Framework
Activity Manager
Window Manager
Content Providers
View System
Notification Manager
Package Manager
Telephony Manager
Resource Manager
Location Manager
GTalk Service
Libraries
Surface Manager
Media Framework
SQLite
OpenGL | ES
FreeType
WebKit
SGL
SSL
libc
Android Runtime
Core Libraries
Dalvik Virtual Machine
Linux Kernel
Display Driver
Camera Driver
Bluetooth Driver
Flash Memory Driver
Binder (IPC) Driver
USB Driver
Keypad Driver
WiFi Driver
Audio Drivers
Power Management

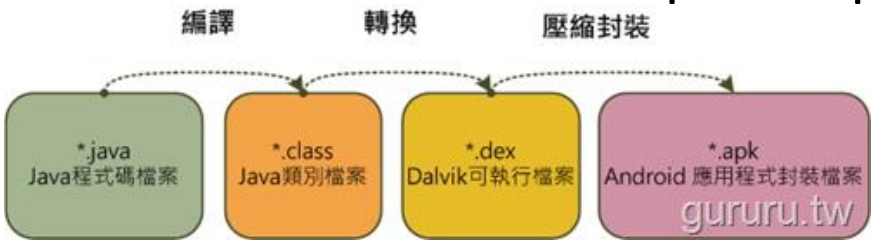
Android Runtime

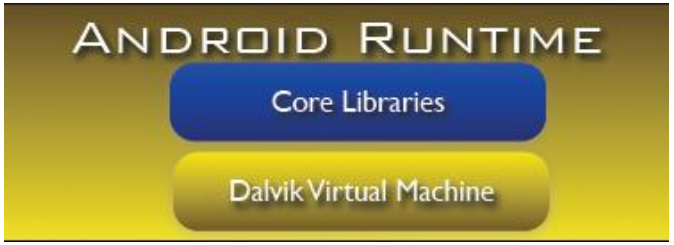
- Application Developed language : Java
- Dalvik Virtual Machine
  - Instruction set : Dalvik Excutable
- Java Standard Library
  - Compile java code to Dalvik Excutable (dex format)



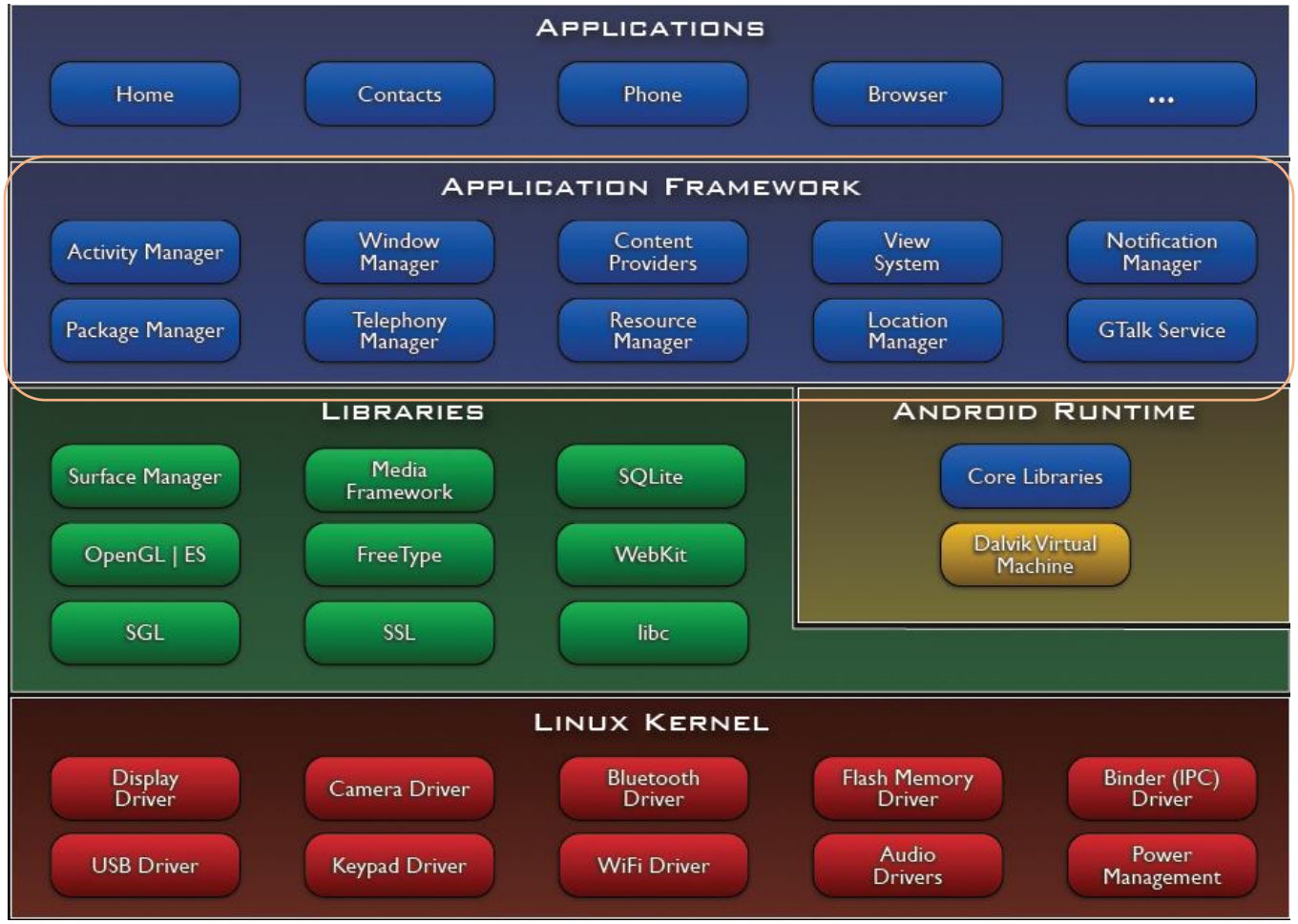
Dalvik Virtual Machine

- Android custom implementation virtual machine
  - Provides application portability and runtime consistency
  - Runs optimized file format (.dex) and Dalvik bytecode
  - Java .class / .jar files converted to .dex at build time
- Designed for embedded environment
  - Supports multiple virtual machine processes per device
  - Highly CPU-optimized bytecode interpreter
  - Efficiently Using runtime memory
- Core Libraries
  - Core APIs for Java language provide a powerful, yet simple and familiar development platform





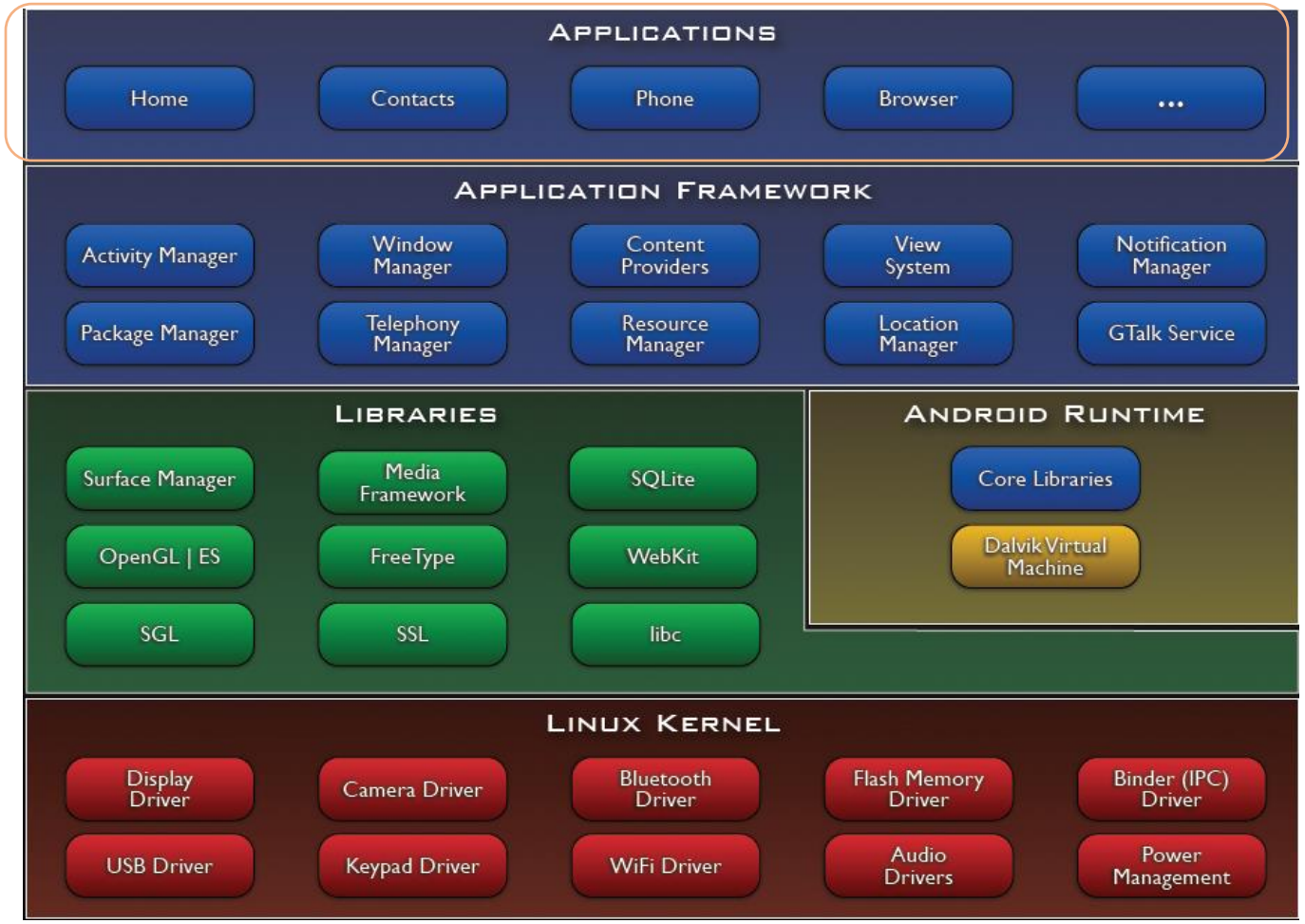
Application Framework



Application Framework

- Activity manager
  - Manage the life cycle of applications
- Content Provider
  - Share data between applications
- Resource Manager
  - Manager non-code resource
- Notification Manager
  - Display custom alerts in the status bar
- Views System
  - A rich and extensible set, which can construct UI

Application Framework



Applications

- Use the powerful and flexible application framework to develop your application
- Written by JAVA programming language