Mobile Computing Meets Research Data

Engineer Bainomugisha

Pilot Research Data Center Workshop
Mombasa/Kenya

Software Languages Lab.
Department of Computer Science
Vrije Universiteit Brussel, Belgium

Department of Computer Science
School of Computing & IT
Makerere University

Mobile Computing

2000-2005

2007-todate

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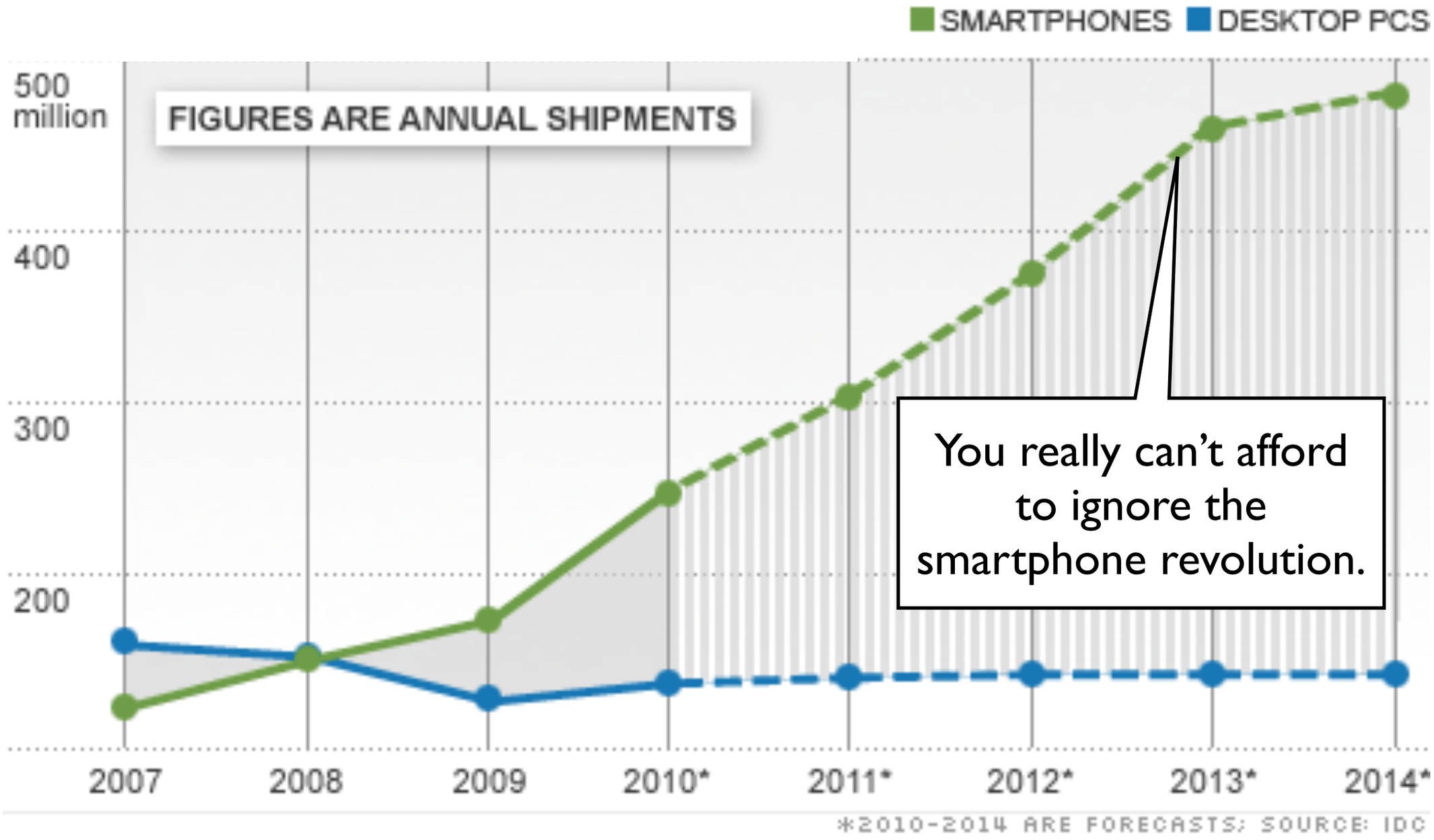
Smartphones Shipments vs PCs



Source: International Data Corporation (IDC).

Mobile Devices Come With Cheap Powerful Sensors

- Microphone
- Camera
- Network connectivity
- Accelerometer
- GPS
- Compass
- Proximity

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Noise level monitoring, Activity (conversation, driving)

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Physical movements: running, walking, driving, standing, ...

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User's location

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+

Identify where a physical activity occurs,
Mode of transport, ...

Mobile Devices as Sensors for Contextual Data

What time you wake up

Where you are now
(bar, home, hospital, meeting room)

Current temperature

Where is your home

Where you work

The people you interact with

Where you go for lunch

Mobile Devices as Sensors for Contextual Data

Data Aggregation

How diseases might spread

How people interact

How quickly traffic is moving

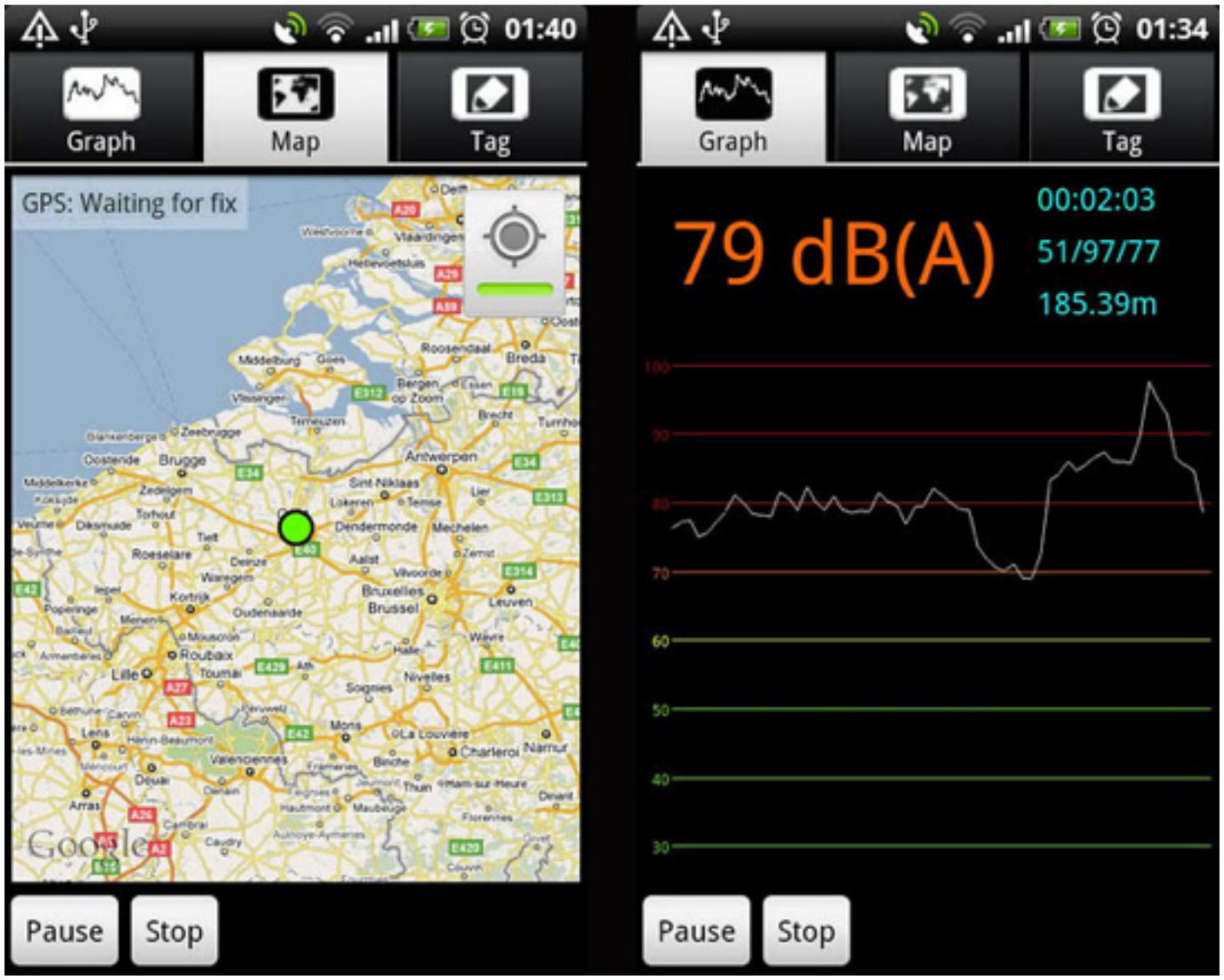
Mobile Devices Enable Participatory Data Collection

"Outbreaks Near Me"
http://www.healthmap.org/en/

- Citizen science: Mobile phones + People = Data collection about interesting aspects e.g., health, culture, environment, ...
- Enabled by: >6 Billion Mobile Phones & >7 Billion People
- Resource sharing possible: Not limited to high-end devices

Near Realtime Data Collection & Information Dissemination

Example 1: Environmental monitoring - using sensors to collect data about noise level, temperature, humidity, e.t.c.



NoiseTube - VUB Brussels

http://www.brussense.be/

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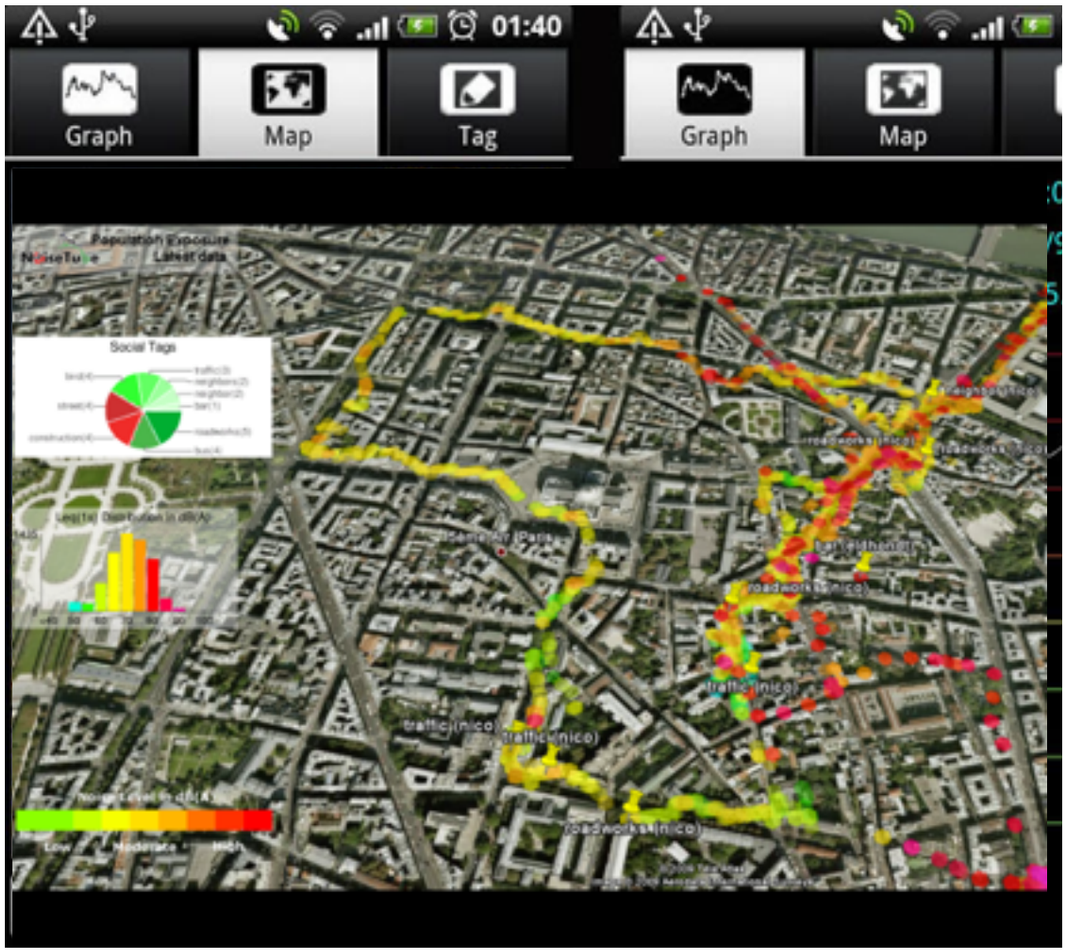

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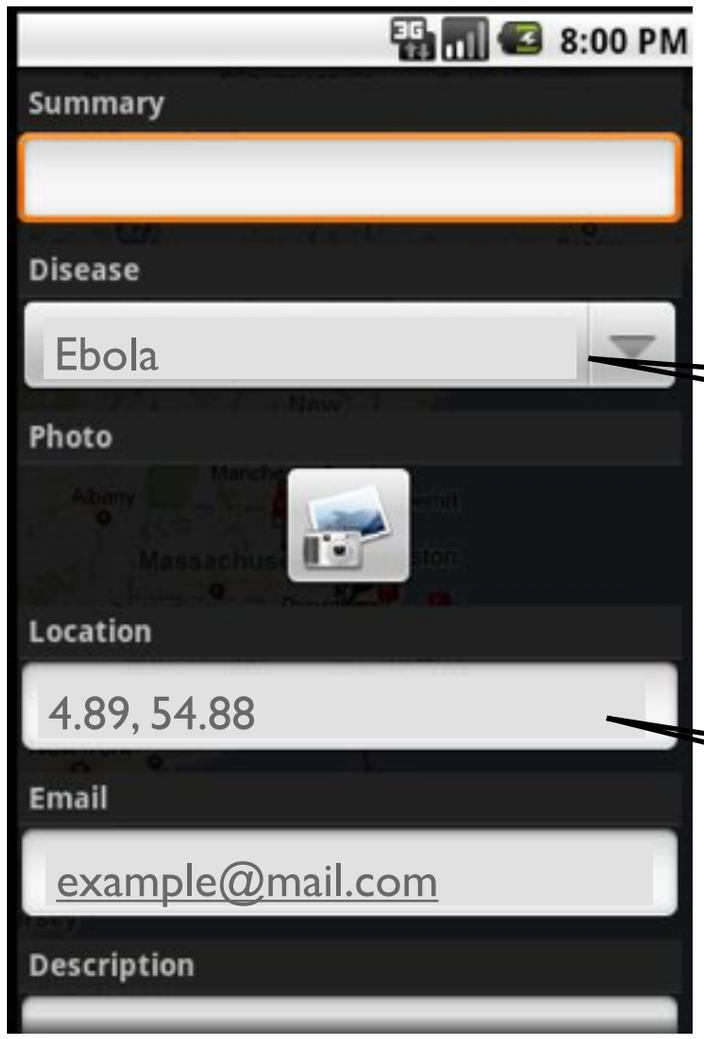
Near Realtime Data Collection & Information Dissemination

Example 2: Health care: near realtime reporting & tracking of disease outbreaks, people movements, monitoring public health threats e.t.c.



"Outbreaks Near Me" app -MIT Media Lab

http://web.mit.edu/press/2009/outbreaks-app.html

Manual Data Collection

Automatic Tagging

Near Realtime Data Collection & Information Dissemination

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Measles

Ebola

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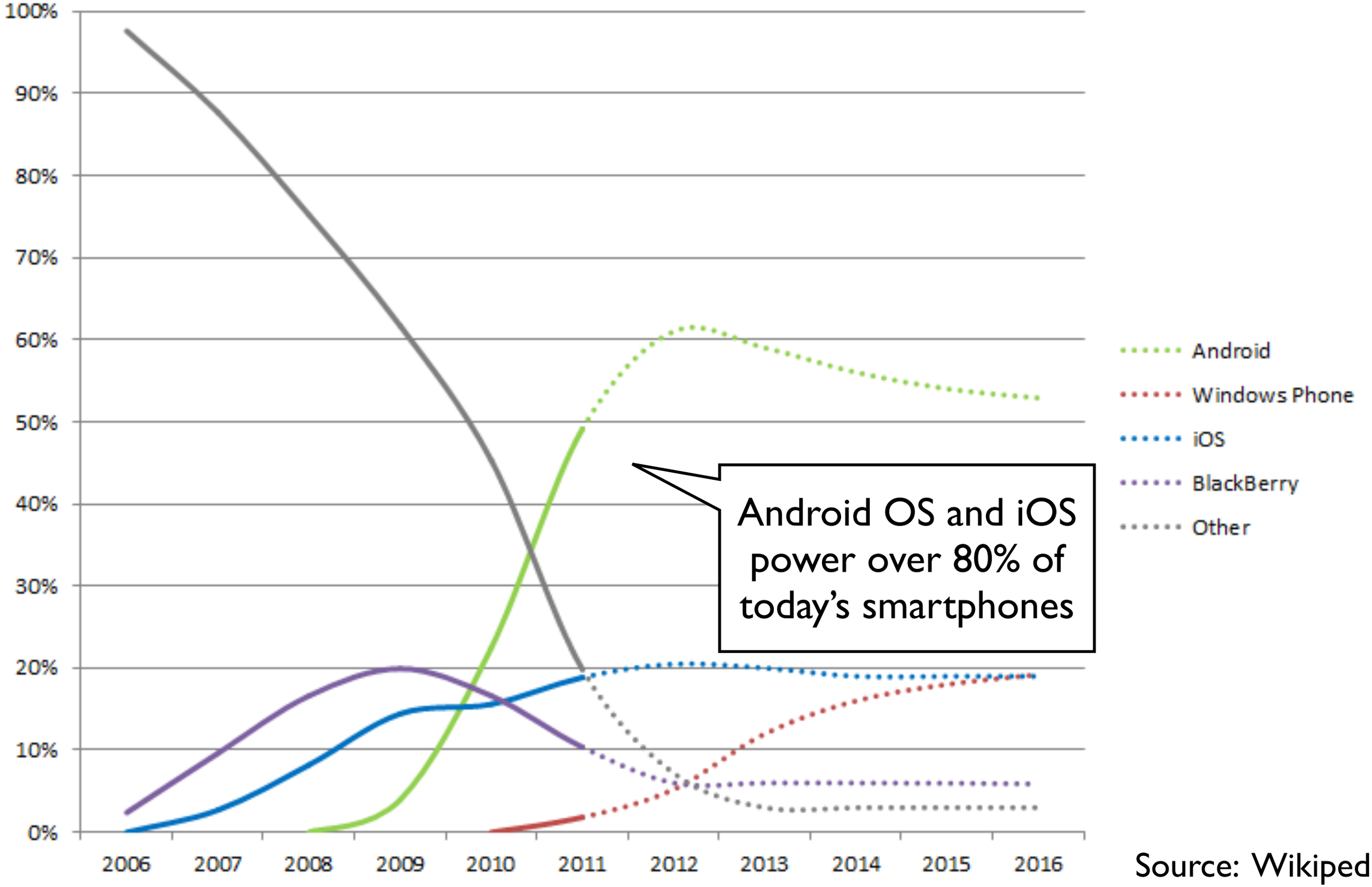
Developing Software for Mobile Devices

Then Vs Now

2000-2005

2007-todate

World-Wide Smartphone market share outlook (%)



Source: Wikipedia + International Data Corporation

What is Android OS?

http://developer.android.com

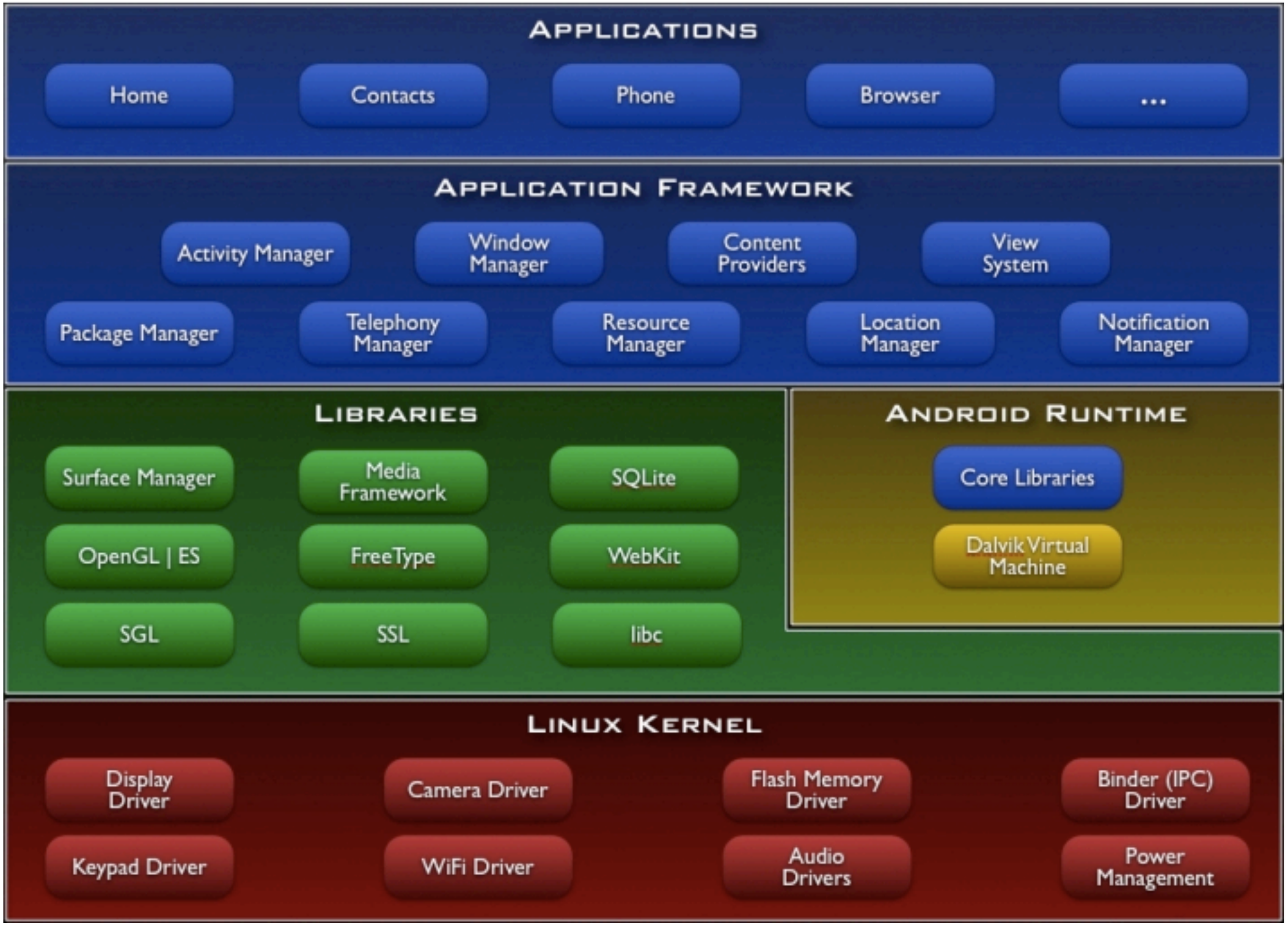
Linux-based mobile operating system developed by Google:

- Runs on smartphones and tablets
- It is Open Source
- Application development mostly done in Java programming language

Provides Frameworks to Enable Access to Sensors

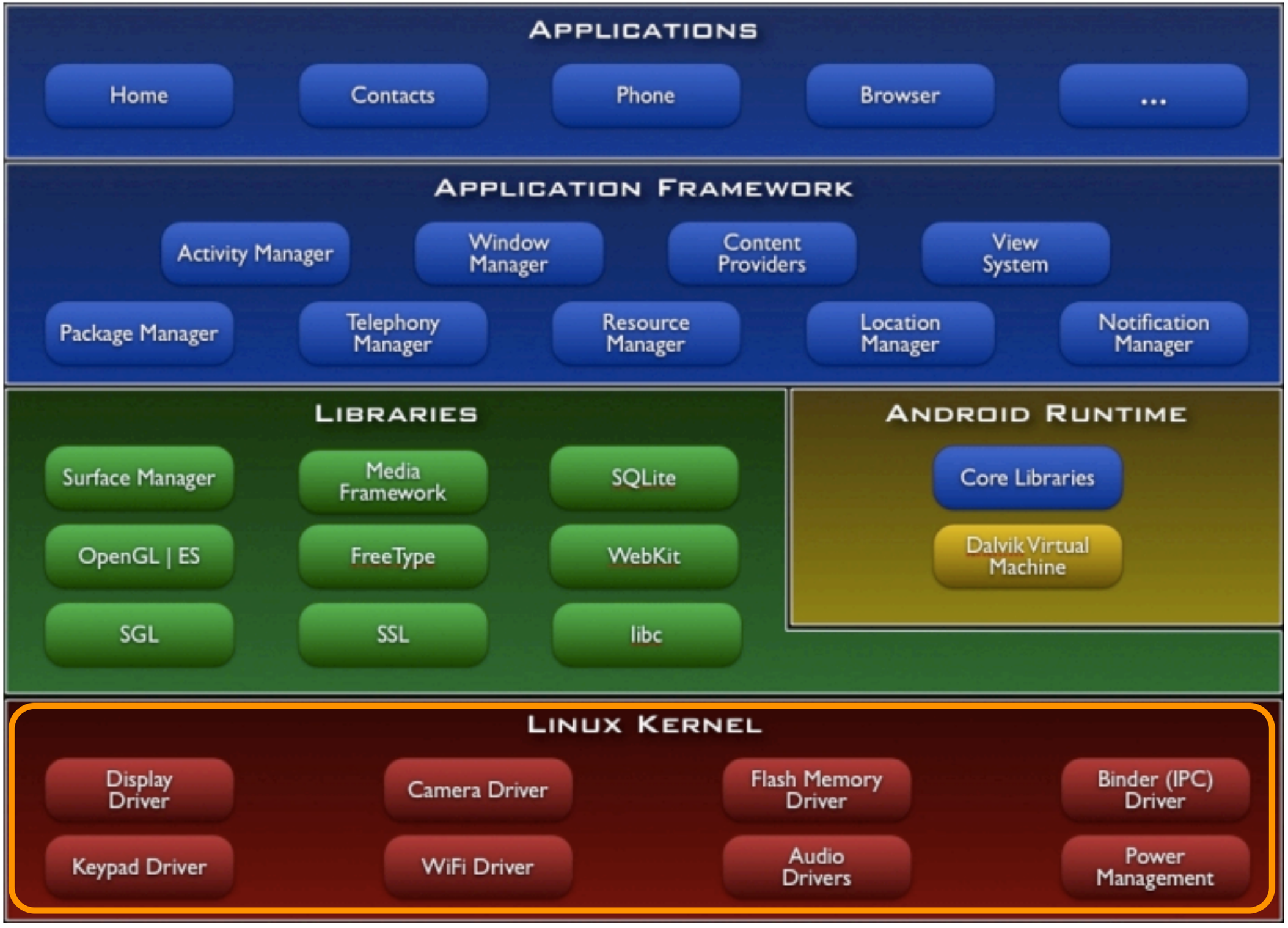
- Microphone
- Camera
- Network connectivity
- Accelerometer
- GPS
- Compass
- Proximity

The Android Software Stack



[1] http://developer.android.com/guide/basics/what-is-android.html

The Android Software Stack



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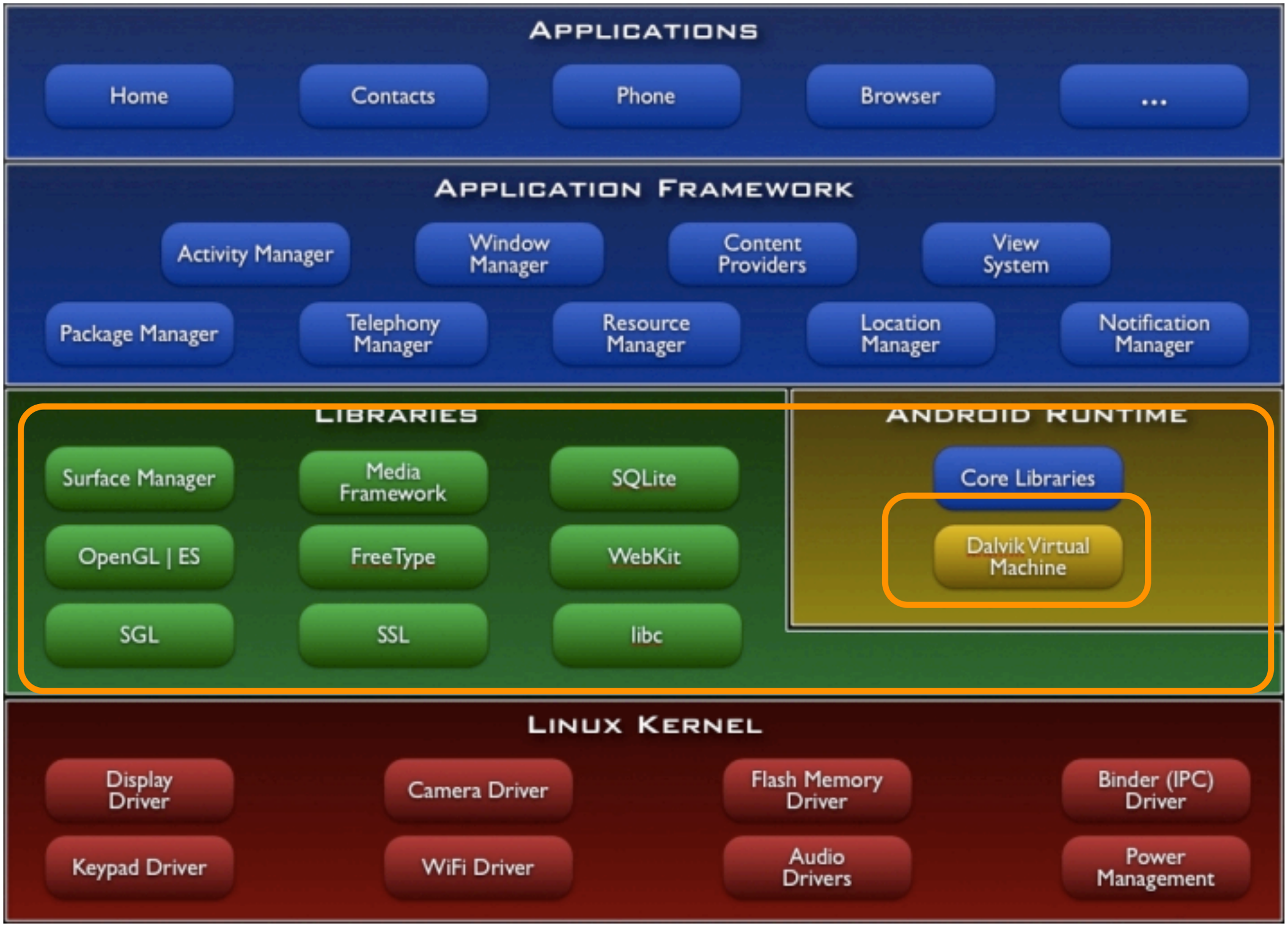

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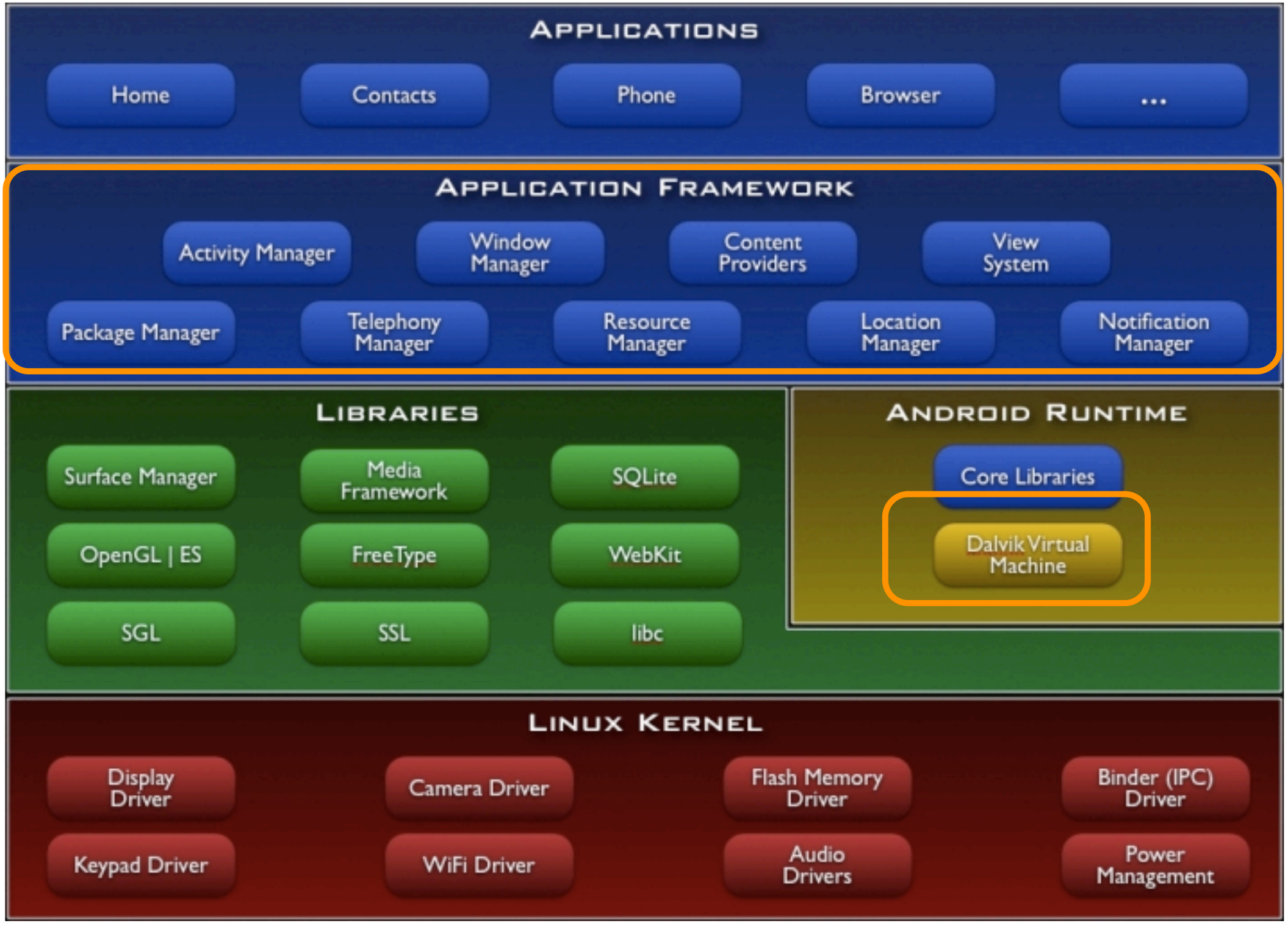

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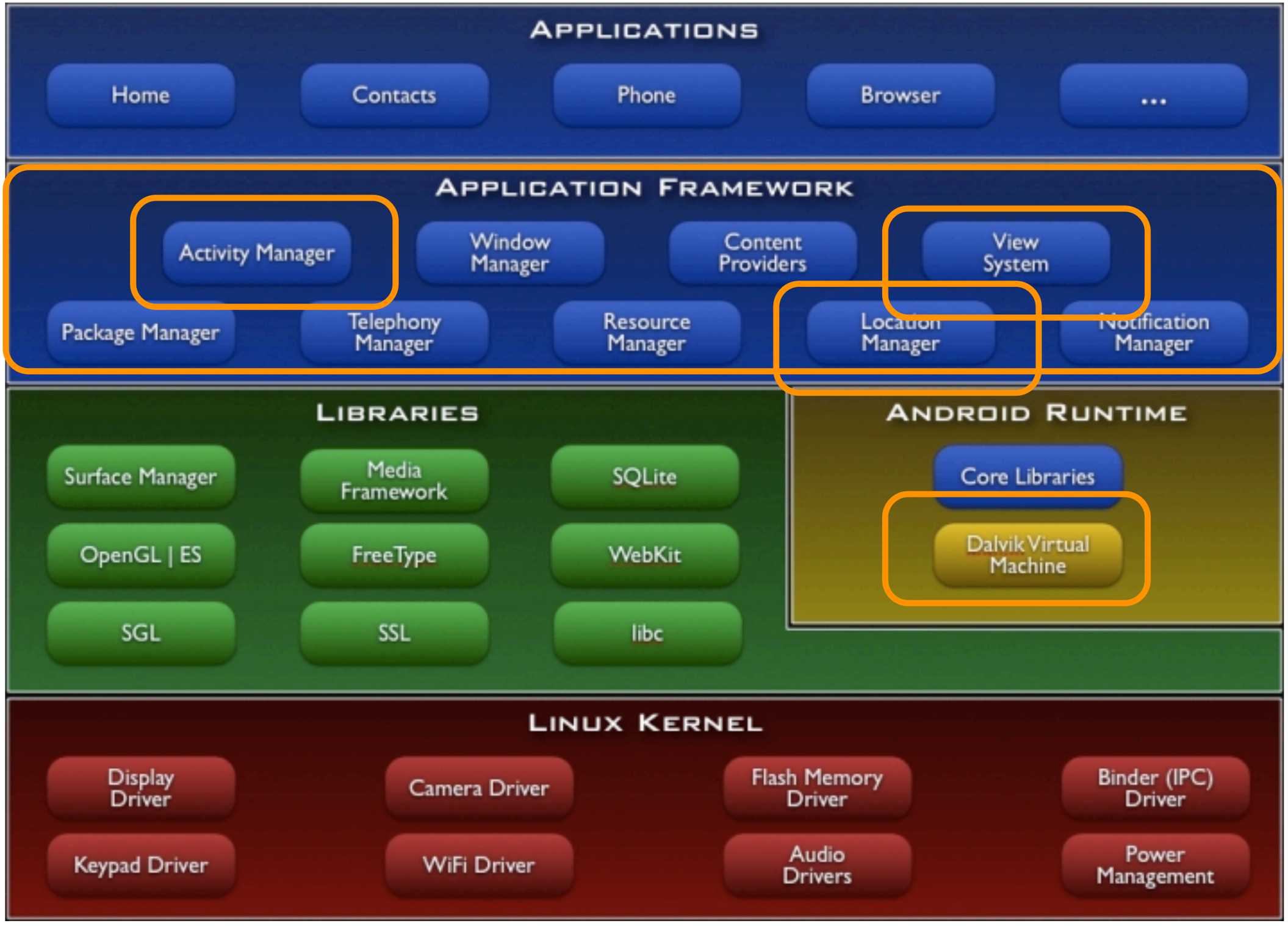

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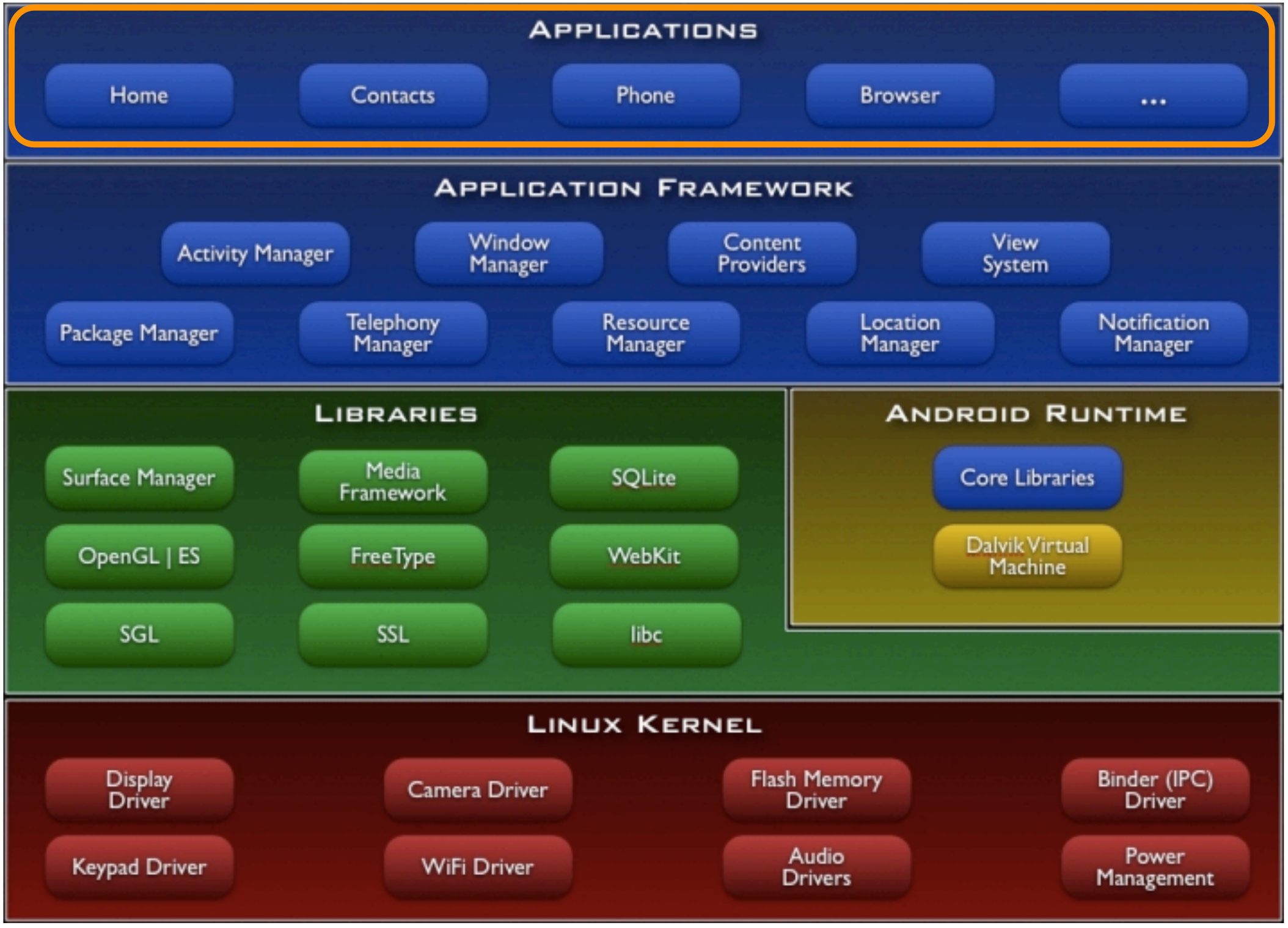

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When Mobile Computing Meets Research Data

Opportunities:

- > 6 Billion mobile phones & > 7 Billion people
- Hardware capabilities (sensors, multitouch screens, connectivity...)
- Participatory data collection (citizen science)
- Near realtime data collection & information dissemination
- Advanced application frameworks

Challenges:

- Privacy
- Data costs
- ...

Part II: iOS Platform

What is iOS?

Apple's mobile operating system that runs on iPhone, iPad and iPod touch devices.

Built for multi-touch interactions: responds to gestures (e.g., swiping, pinching, and tapping).

What is iOS?

Sensors enable building “intelligent” apps (e.g., location-aware apps)

GPS

Compass

Accelerometer

Camera

Comes with a Number of Built-in Apps

Users cannot remove built-in apps.

Photos, Calendar, Mail, SMS, Music, Maps, ...

Software Development Tools for the iOS

The iOS Software Development Kit (SDK) contains the tools needed to develop native apps.

Xcode is the development environment.

Freely available for download from Apple's developer portal

developer.apple.com

iOS Technologies are Packaged as Frameworks

Maps

Media Player

Address Book

Games

Passbook Kit

Core Location

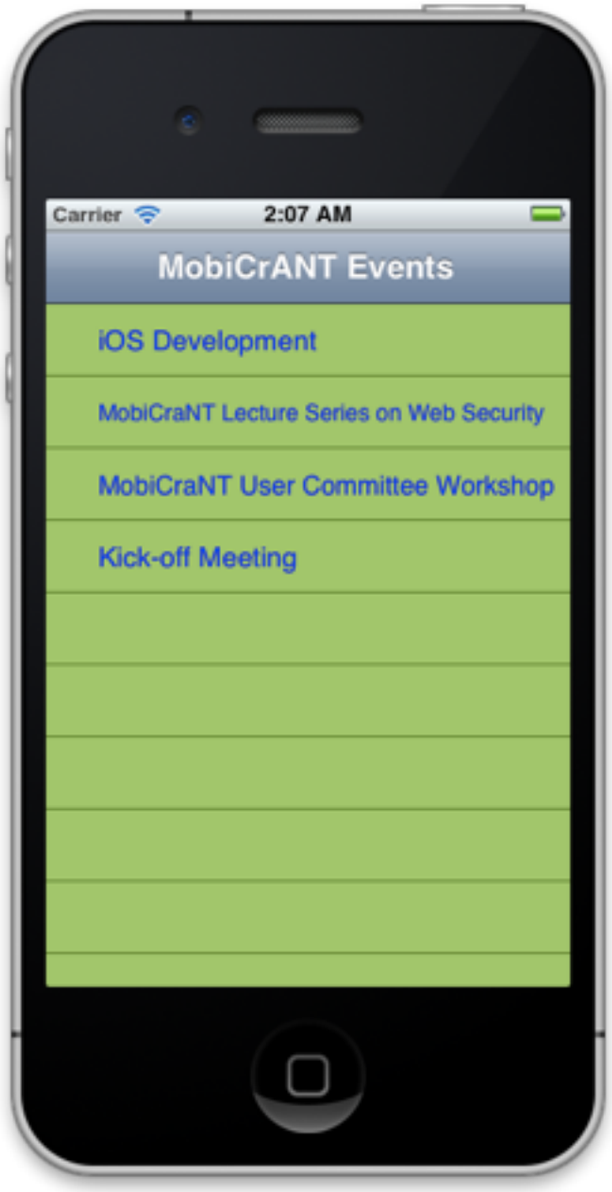
Image Kit

Facebook

UI Kit

Two Kinds of iOS Apps

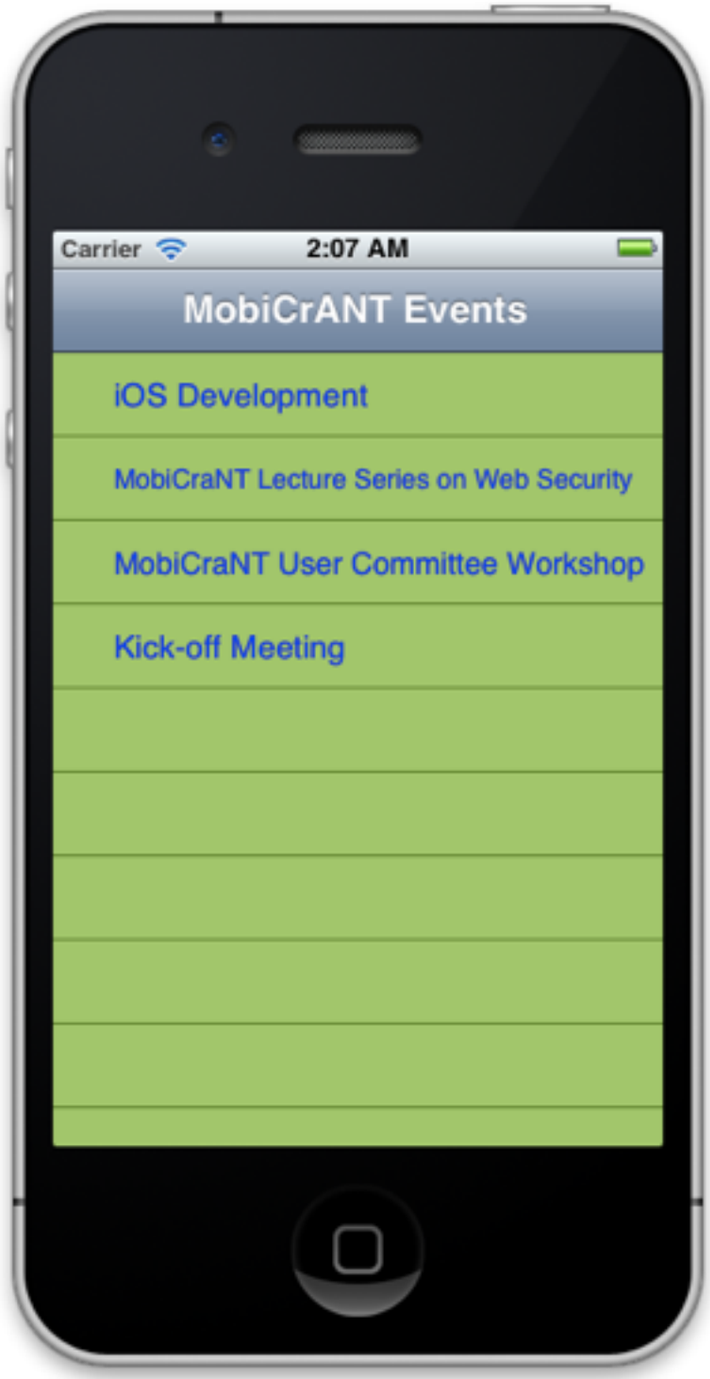
Native iOS apps



Web apps

Two Kinds of iOS Apps

Native iOS apps



- Resemble the built-in apps.
- Are built using Objective-C programming language .
- Have access to the device's hardware capabilities (e.g., GPS).
- Distributed via app store.

Two Kinds of iOS Apps

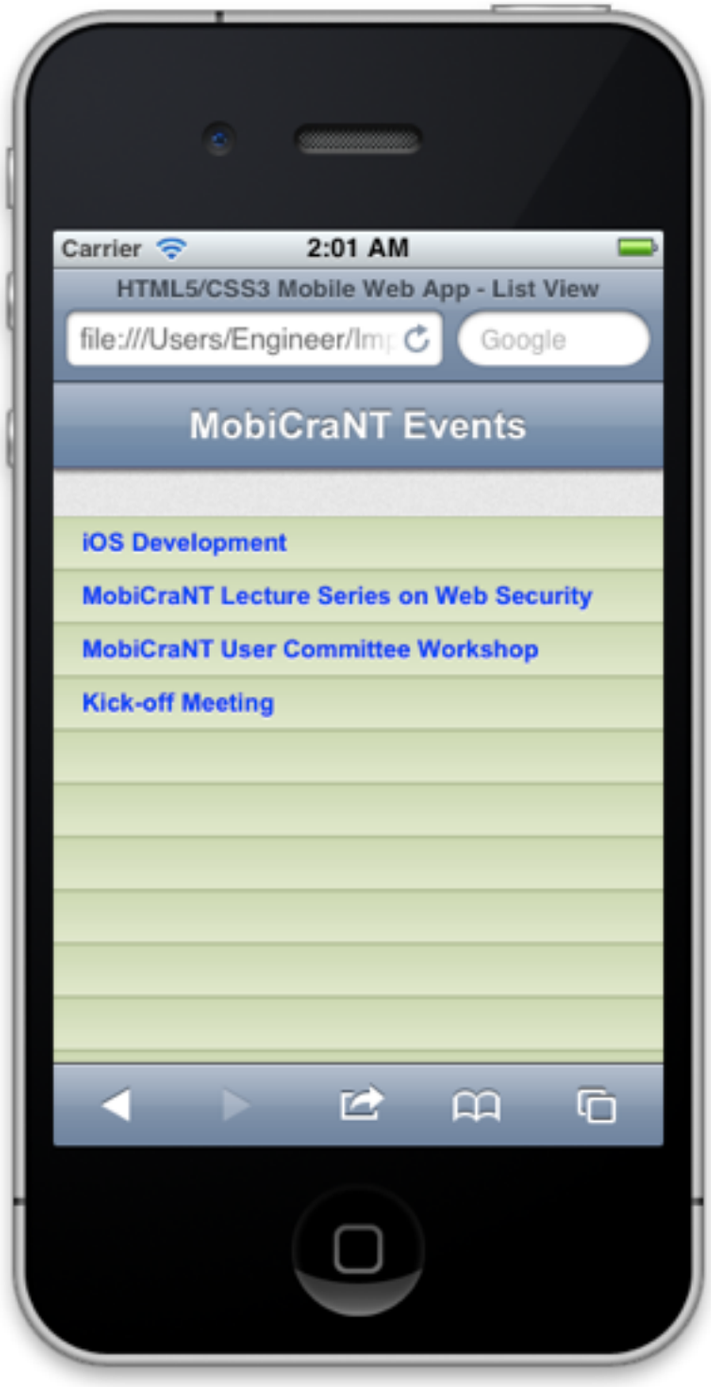
Native iOS apps

- Resemble the built-in apps.
- Are built using Objective-C programming language .
- Have access to the device's hardware capabilities (e.g., GPS).
- Distributed via app store.

Installed on the device like a built-in app.

Two Kinds of iOS Apps

Web apps

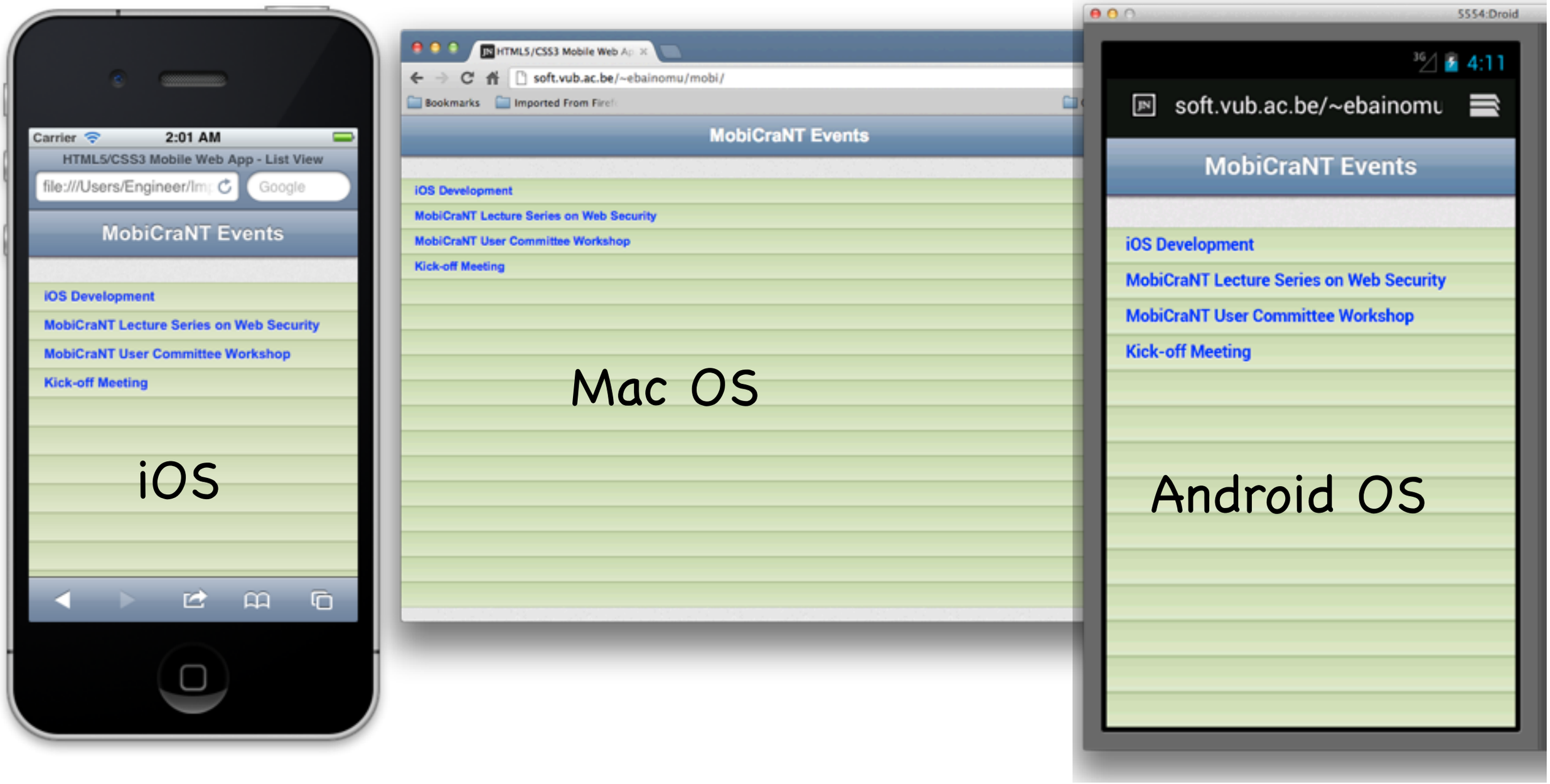


- Run inside a web browser
- Are built using HTML, CSS, HTML5, and JavaScript.
- Limited access to the device's hardware capabilities (e.g., GPS).
- Run slower than native apps.

Two Kinds of iOS Apps

Web apps

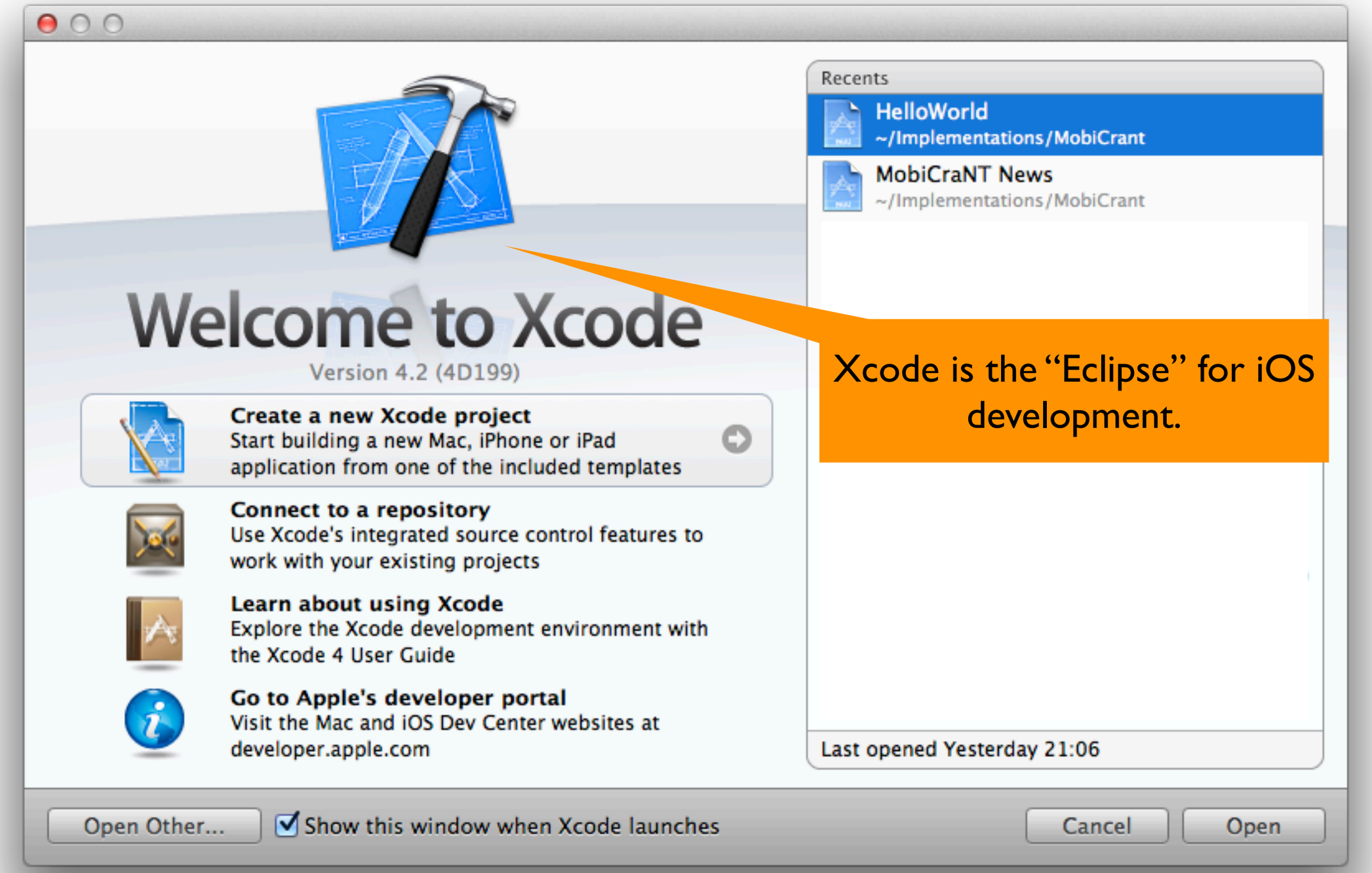
“Write once, run anywhere (WORA)”



Objective-C Programming Language

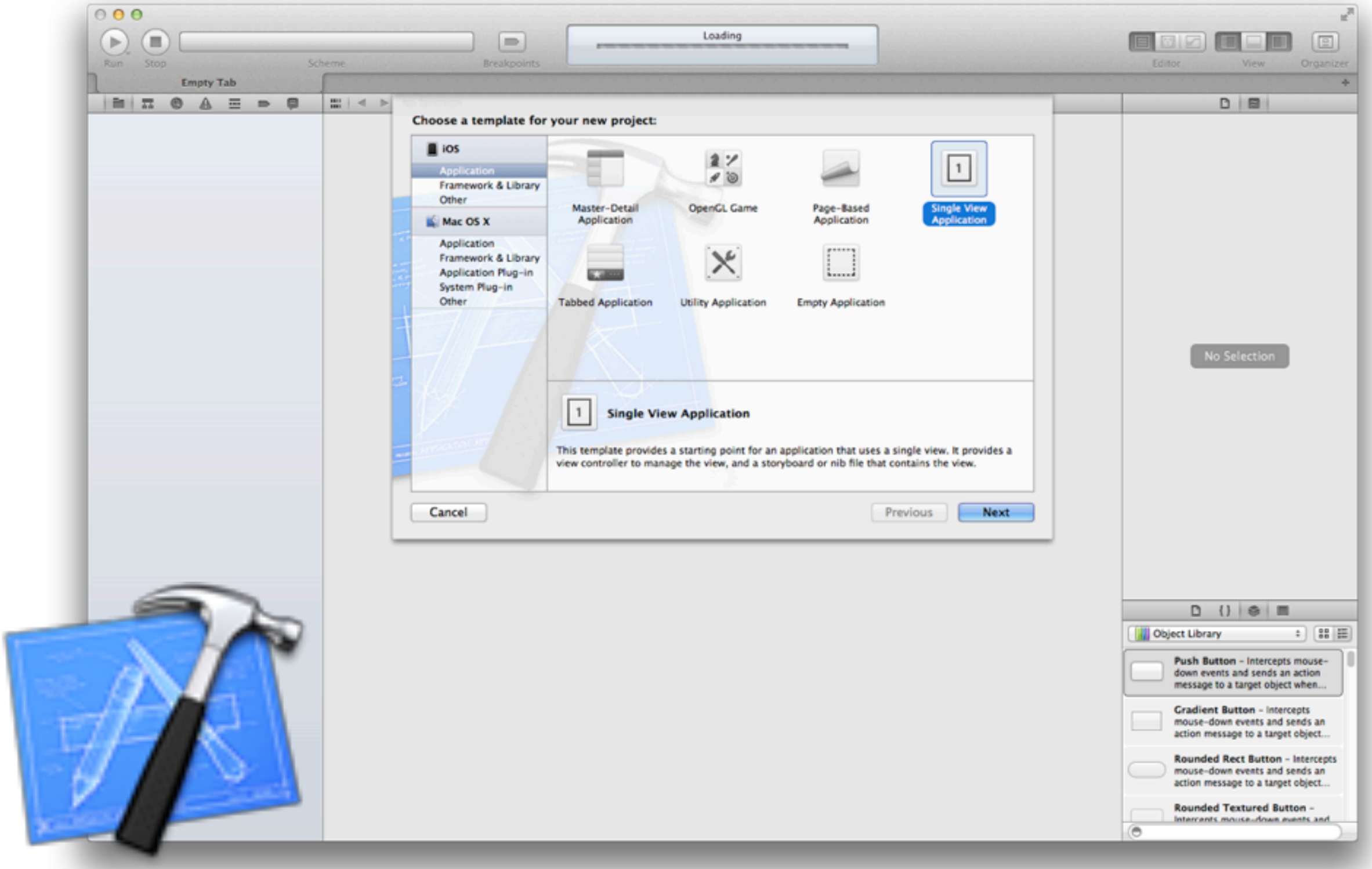
- Object-oriented programming language.
- Easy to learn— if you have experience with other O-O languages such as Java or C++.
- Objective-C is a superset of C.
- Simple, small, powerful.

Getting Started with iOS Development



Xcode is the "Eclipse" for iOS development.

Getting Started with iOS Development



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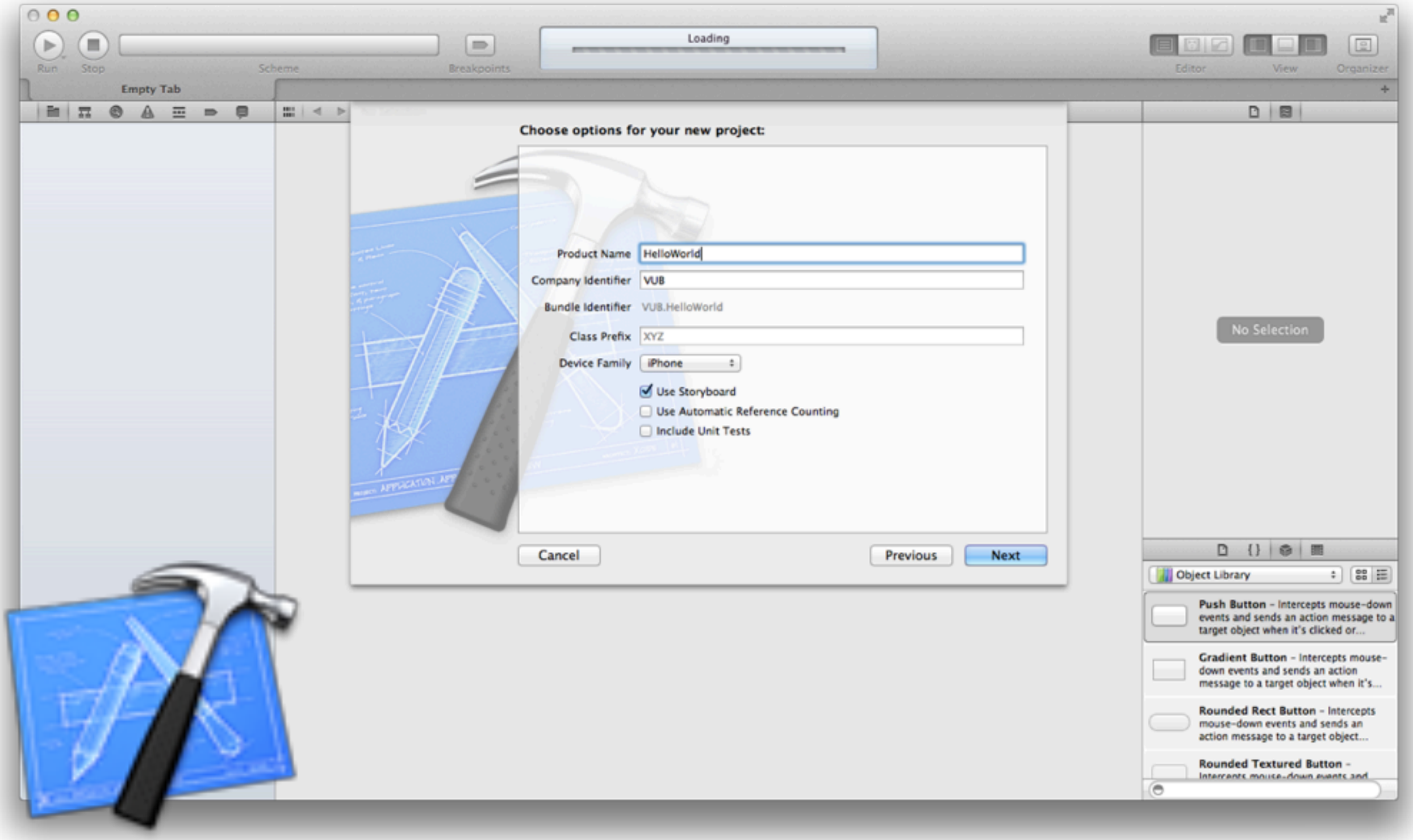

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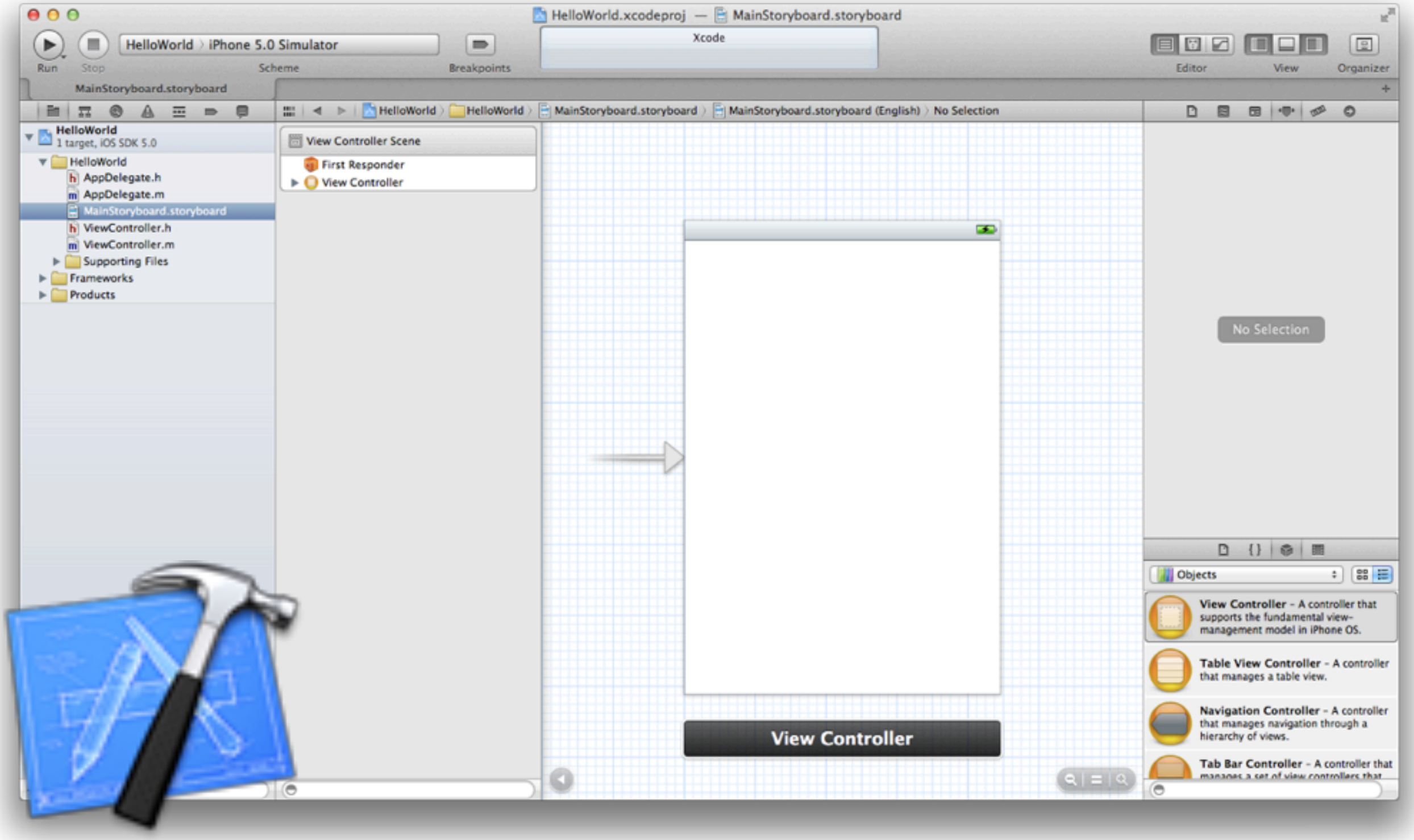

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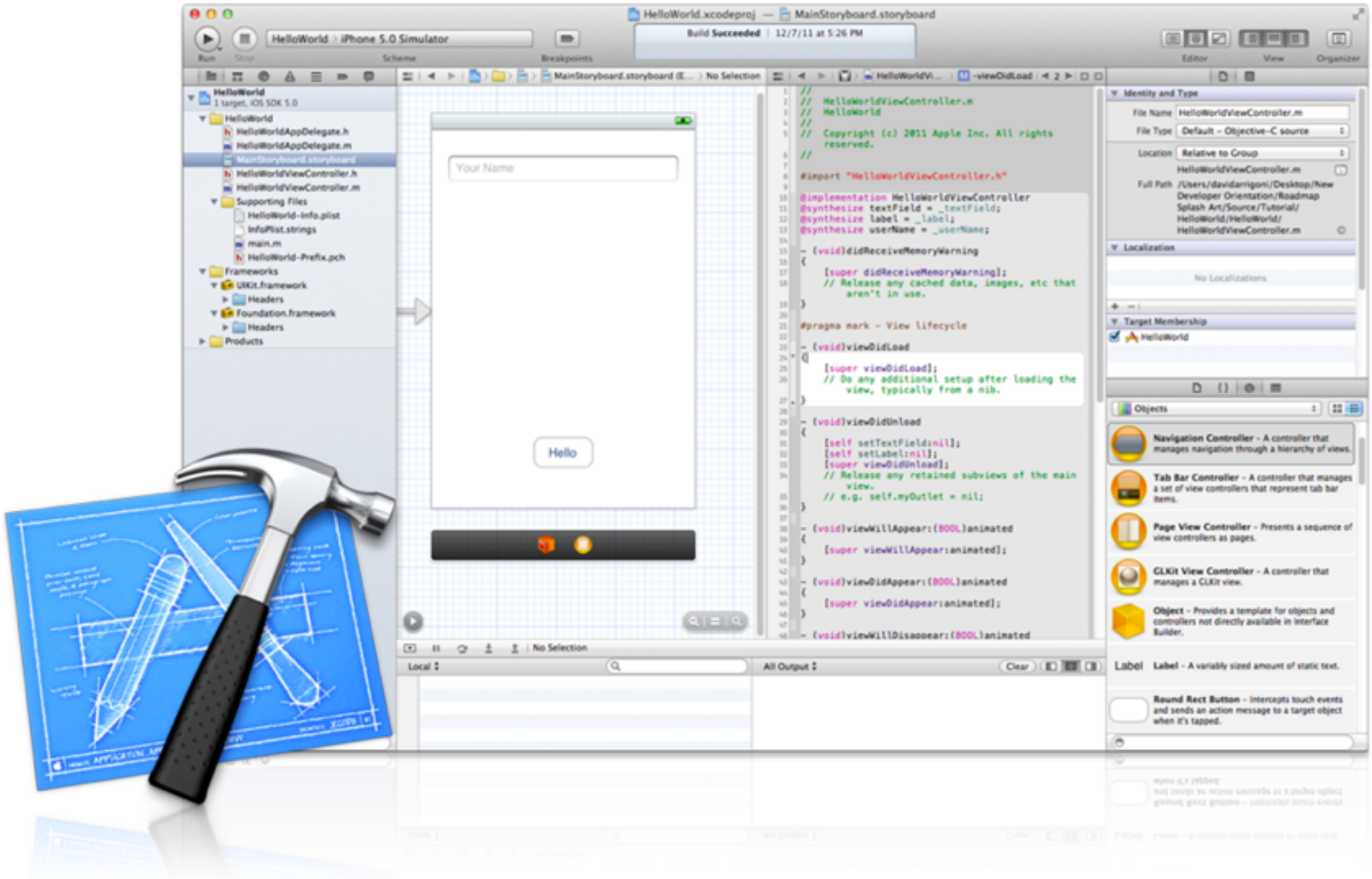

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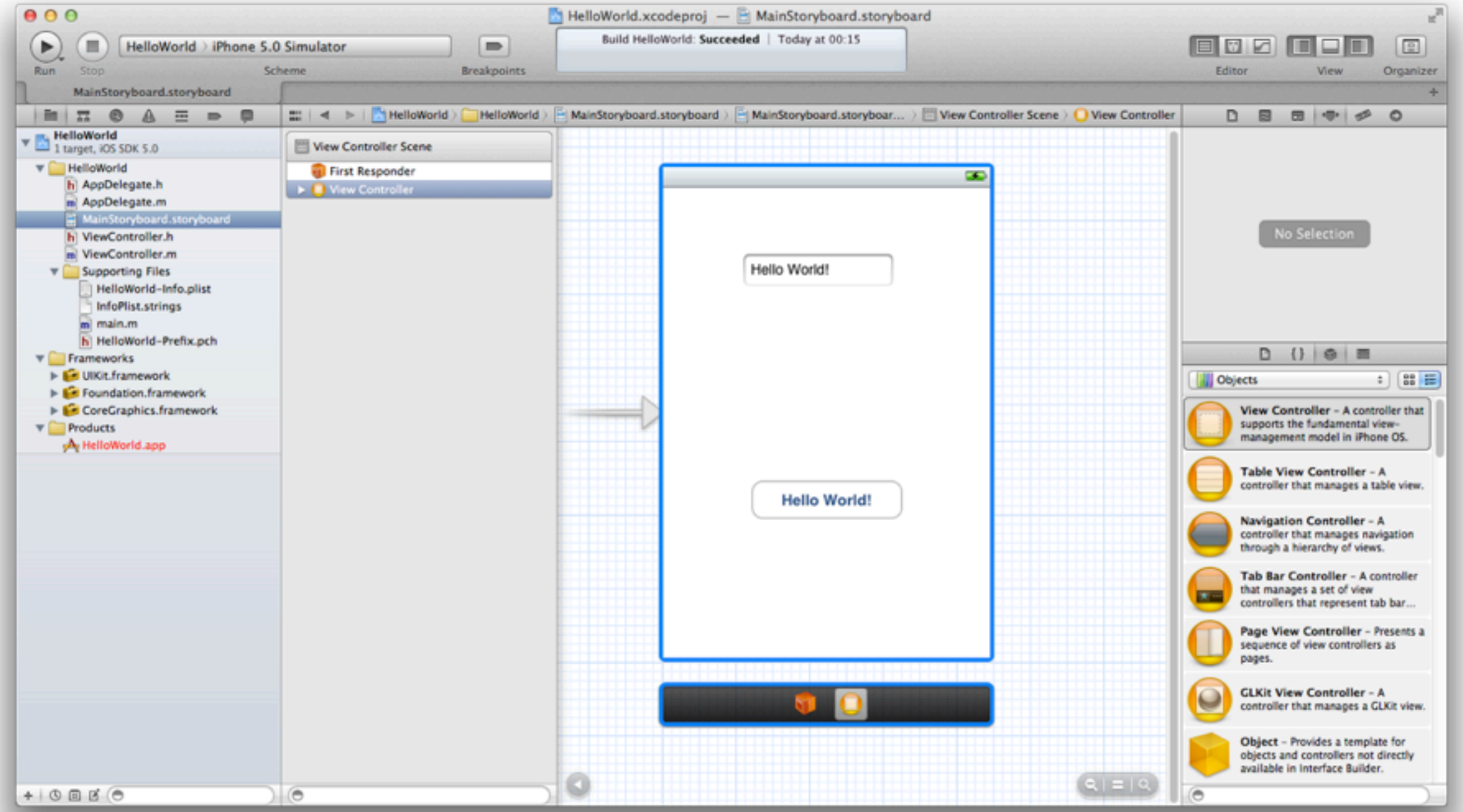

Where to Start

Learn Objective-C

http://developer.apple.com/library/mac/navigation/

iOS Developer Library

+

Sample Code

http://developer.apple.com/library/ios/

Note: Xcode requires a Mac.