# MOBILE DEVELOPMENT

David Stern

# OBJECTIVES

- Different types of mobile applications and tools for development
- Developing mobile software – application development process
- Interfacing with the cloud
- Mobile vs Embedded applications

# MOBILE VS DESKTOP

## Mobile

- Touch controlled
- Size constraints
  - Battery
  - Processor
  - Screen
- Limited on languages that can be used
- Cell phones and infotainment systems

## Desktop

- Uses peripherals
- No hardware restrictions
- Large choice of languages
- Towers

# ANDROID OS VS IOS

Android

- Free to everyone
- More development freedom
- Android Studio
  - Run on all OS, including Mac
- C, C++, XML, Java, and Kotlin
- Needs to support everything

iOS

- Closed ecosystem
- Strict development rules
- XCode
  - Only on Mac
- Objective C, Swift, SwiftUI
- Fewer, exclusive devices

# ANDROID OPERATING SYSTEM

Created in 2008

Mobile operating system

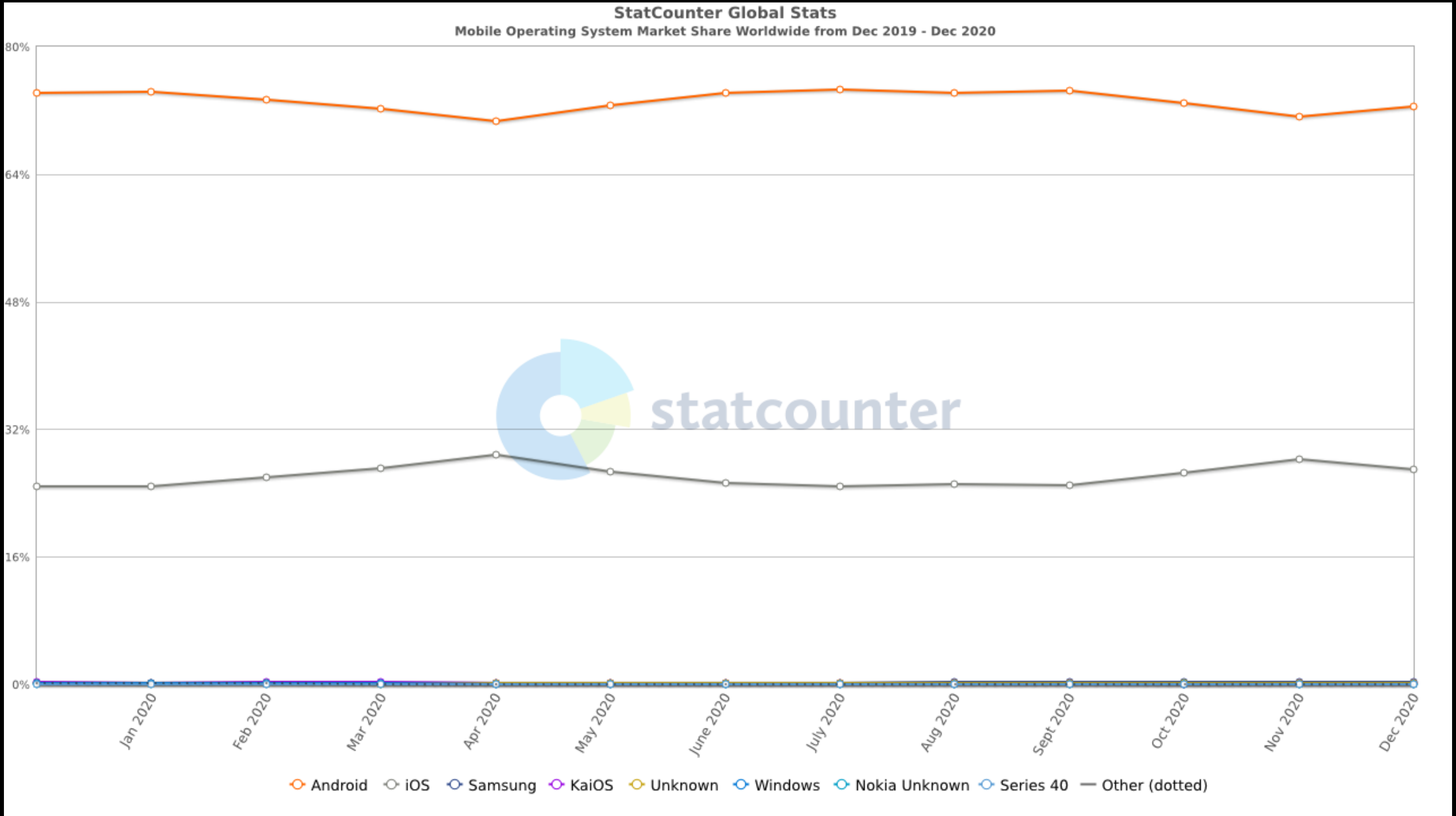
- Phones
- Tablets
- Watches
- (New) Automotive

Free and open-source software

Used in cars – Google's Open Automotive Alliance

- Audi, GM, Honda, Hyundai, Bentley, Chevrolet, **Chrysler**, Ford, Mazda, and many more
- https://www.openautoalliance.net/#press

# ANDROID OS VS IOS MARKET SHARE



# TYPES OF MOBILE APPLICATIONS

# WEB VS NATIVE

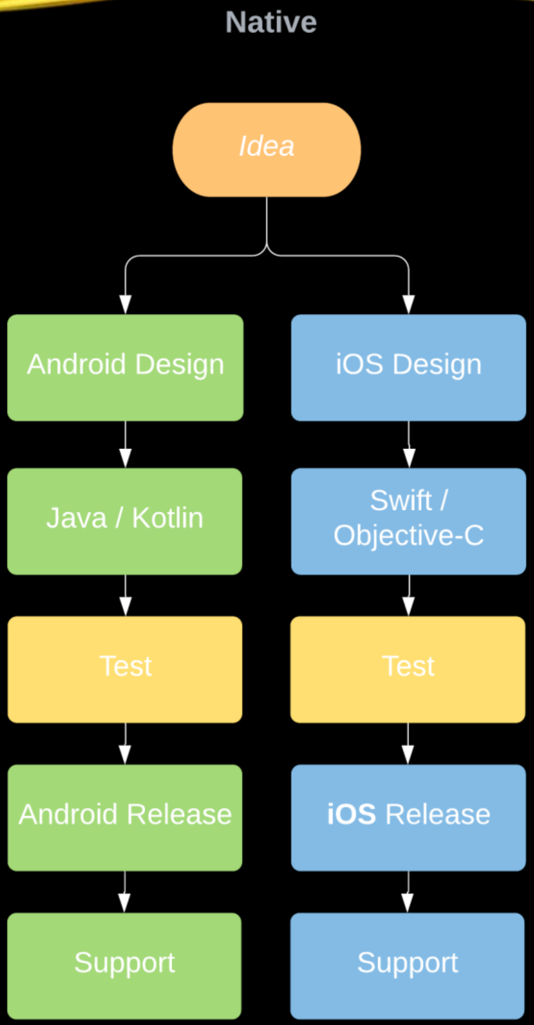
## Web Apps

- Run on the web and are stored on remote servers
- Accessed with an active network connection through a browser
- Low cost, easy maintenance, cross platform compatibility

## Native Apps

- Mobile app developed to work on a specific platform or operating system
- Using Android Studio and Java/Kotlin for Android, or XCode and Swift for iOS
- Best performance and functionality
- Most expensive

# NATIVE APP DEVELOPMENT



# ANDROID - DEVELOPMENT TOOLS

Java Development Kit (JDK)

Android Studio – Official Android IDE

Android Software Development Kit (SDK)

Used to build Java programs

Contains a Java compiler

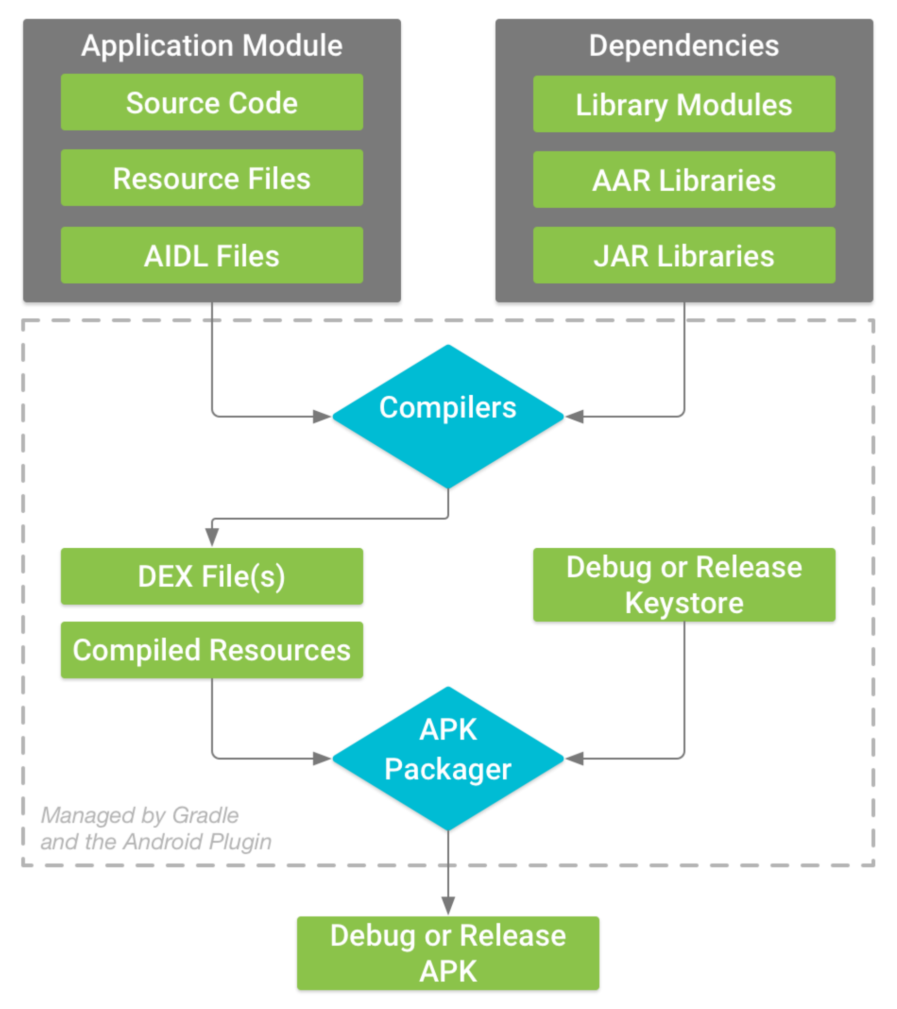
Needs to be installed to use Android Studio

Android Software Development Kit

Installed by Android Studio

The “toolbox” of everything needed to create Android applications

# BUILD PROCESS



# MOBILE APPLICATION DEVELOPMENT

## Hybrid Apps

A blend of web apps and native apps

Code written in web development languages (HMTL, CSS, JavaScript) is embedded into a native app

Lower performance, but good pilot solution

HYBRID APP
NATIVE APP
WEB APP
HTML
HTML

https://siliconithub.com/native-vs-hybrid-app/

# CROSS PLATFORM MOBILE APPLICATION DEVELOPMENT

Hybrid App

- Run on the web and are stored on remote servers
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Native Apps

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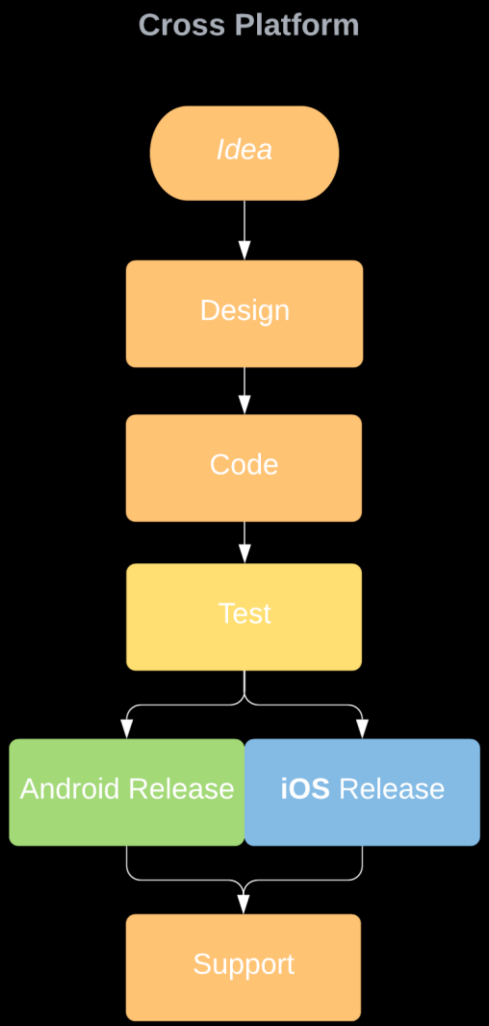
# CROSS PLATFORM APP DEVELOPMENT



Cross Platform

*Idea*

Design

Code

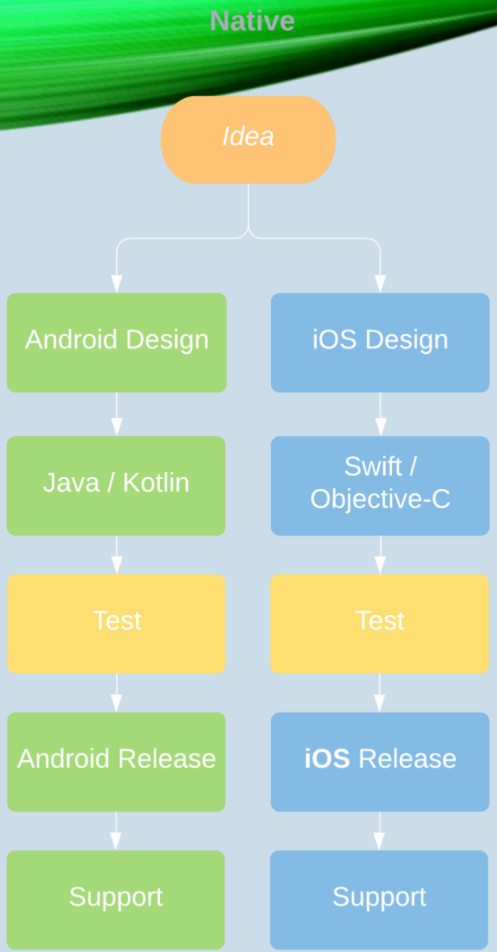
Test

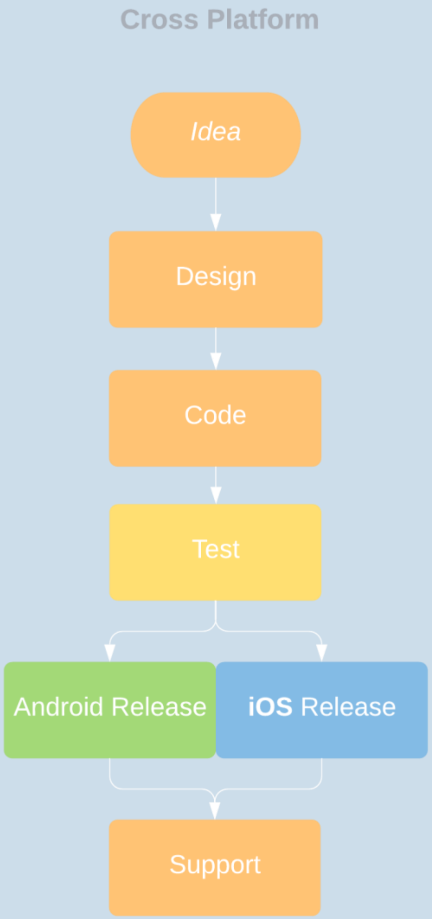
Android Release

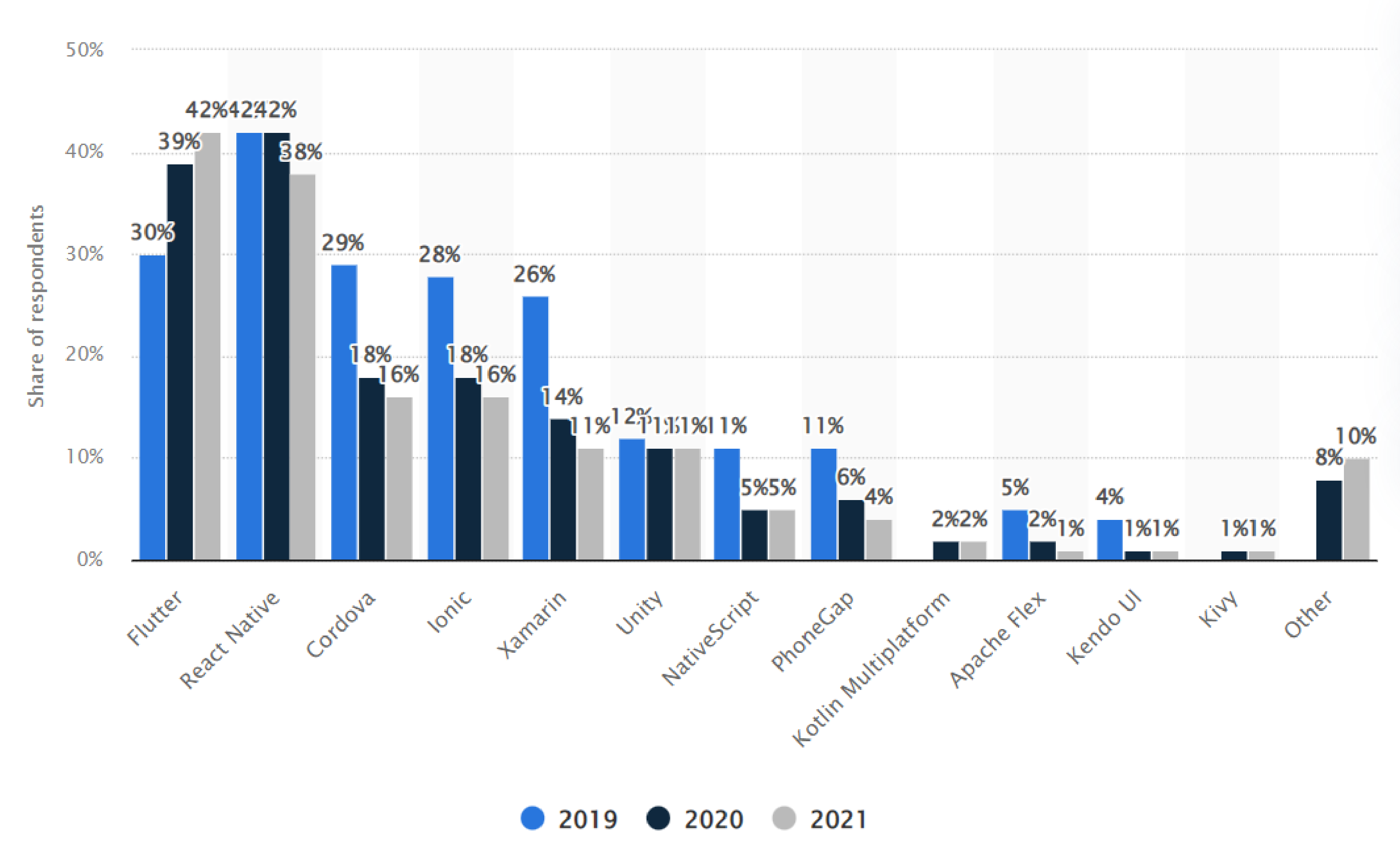
iOS Release

Support

# NATIVE VS CROSS-PLATFORM



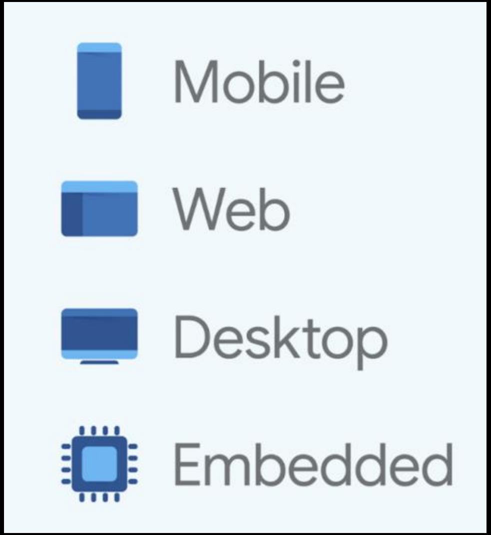




https://www.statista.com/statistics/869224/worldwide-software-developer-working-hours/

# FLUTTER

Multiplatform



Mobile

Web

Desktop

Embedded

Toyota Infotainment
(Embedded Example)

Dart

# FLUTTER

Google announced Flutter 1.0 is available for cross-platform development on December 4, 2018

Completely free

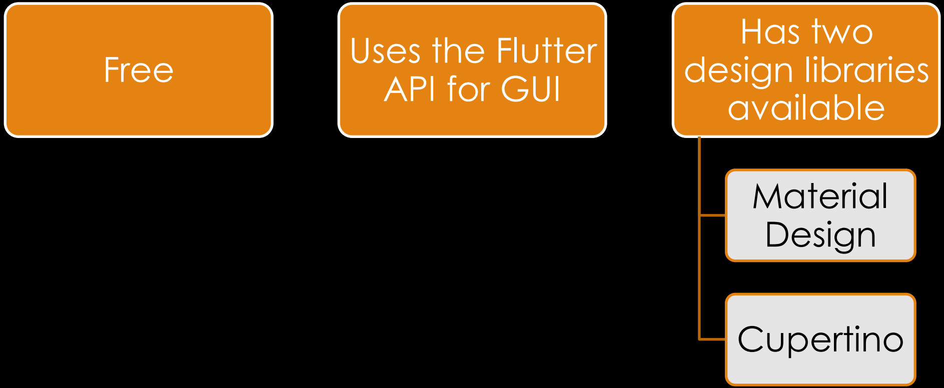
An API for creating applications

- https://docs.flutter.dev/

Offers a fast development cycle with Stateful Hot Reload

- Especially useful for the Graphical User Interface (GUI)

# FLUTTER VS REACT NATIVE



Free

Uses the Flutter API for GUI

Has two design libraries available

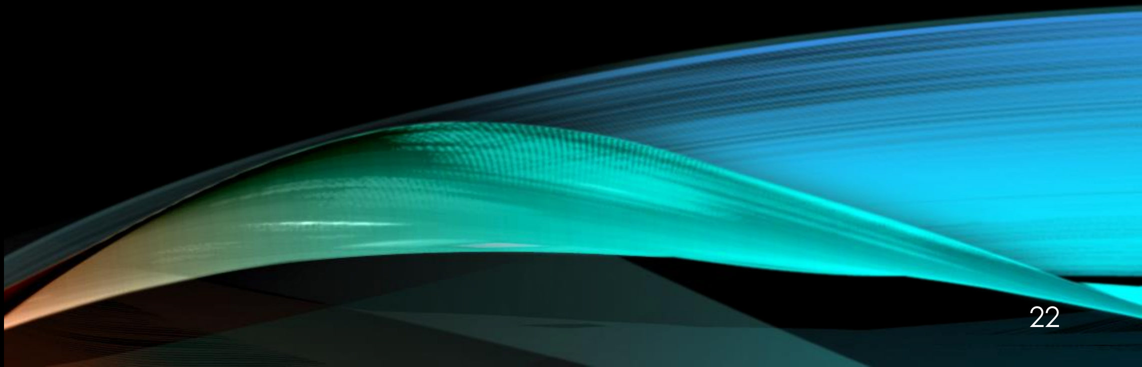
- Material Design
- Cupertino

$300 - $1900 for professional projects

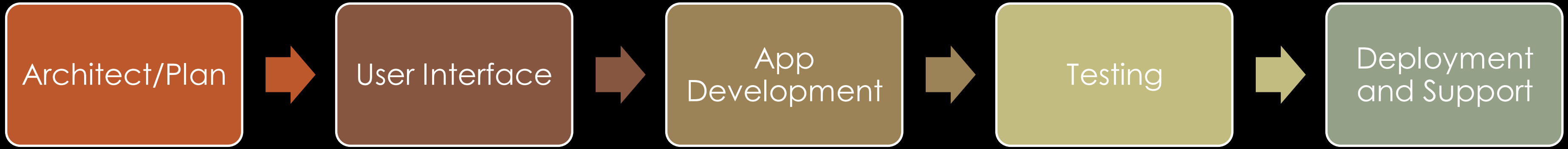
Uses the Android and iOS APIs for GUI

No option to use only one API

# MOBILE DEVELOPMENT



# APPLICATION DEVELOPMENT PROCESS



Architect/Plan

User Interface

App Development

Testing

Deployment and Support

# ANALYSIS / PLAN

## Create

- Create a list of functional requirements
  - What will it need to do?
  - Who will it do it for?
  - When will it do it?

## Prepare

- Prepare a product roadmap
  - Create an MVP
  - Milestones timeline

## Identify

- Identify skills needed
  - Development stack
  - Consider the deployment target(s)

# NAVIGATION TO NEAREST CHARGING STATION

## Create

- Find and give directions to nearest charging stations
- Electric vehicle drivers
- When we are low on battery or when the user wants to
- Offline capabilities

## Prepare

- 1 – Upon user instruction, navigate to closest station
- 2 – Allow user to select from map of stations
- 3 – Automatically begin directions when battery is low

## Identify

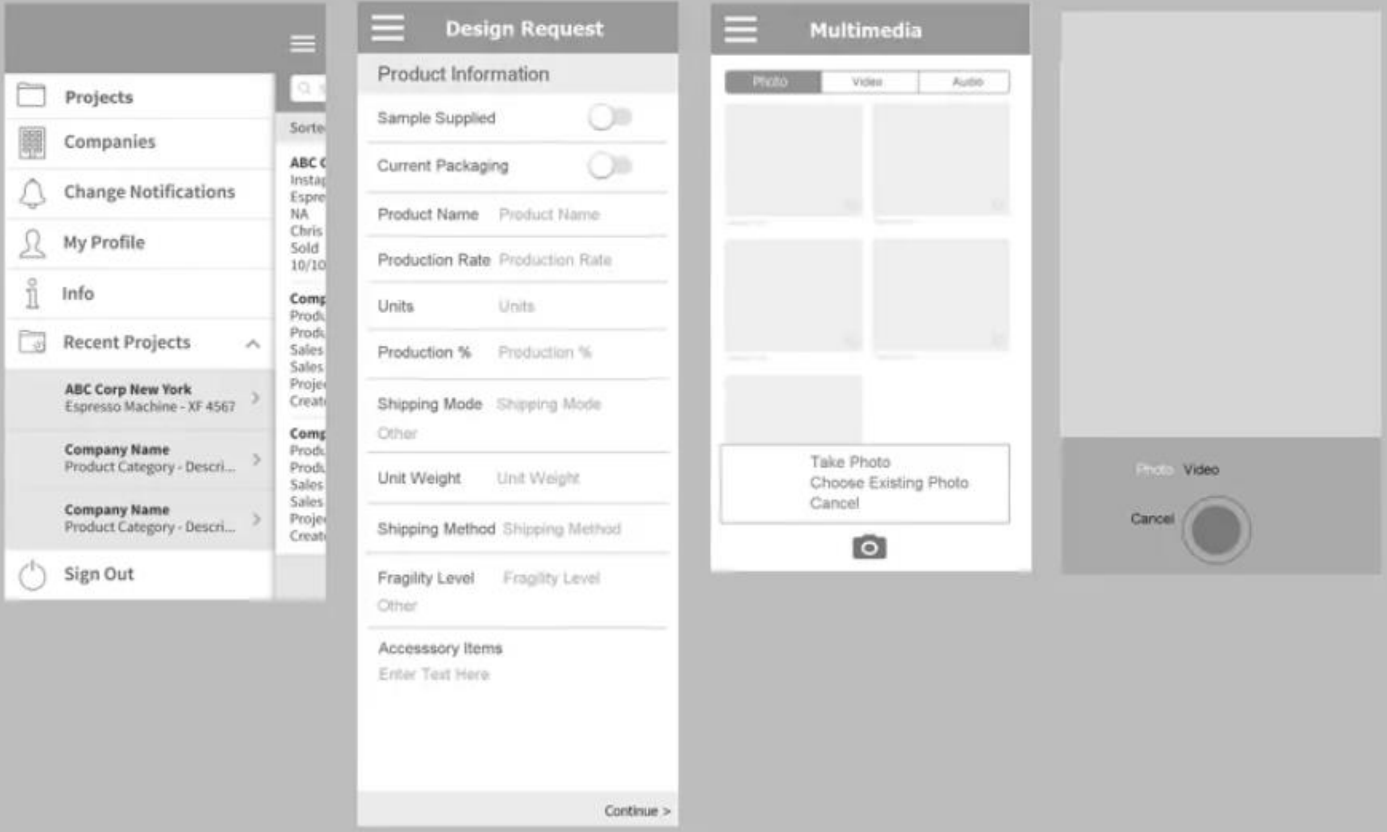
- Android development
- API to retrieve addresses of stations and optimize directions
- Database to store user data

# USER INTERFACE

WIREFRAMES – DIGITAL FORM OF SKETCHES

REFERENCE THE DESTINATION'S STYLE GUIDE

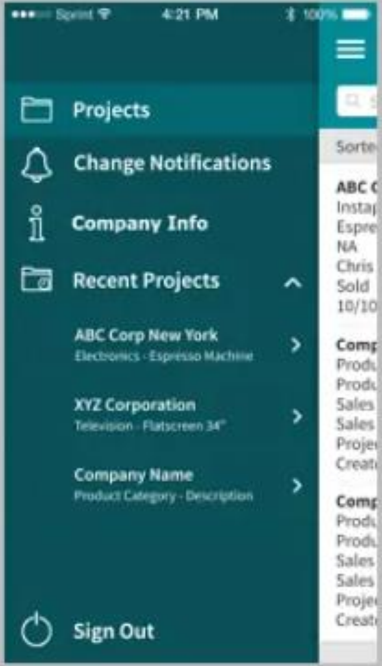
MOCKUPS

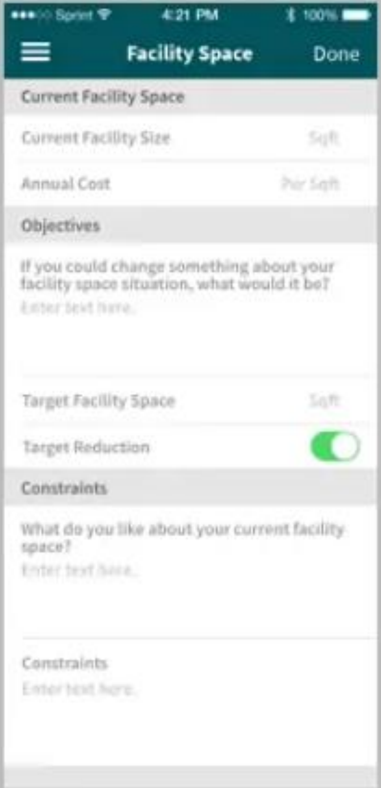


# WIREFRAMES

[1] https://www.figma.com/file/OUK8DHtzk6xGRWBcKEypnR/Wireframing-in-Figma?node-id=0%3A1

# MOCKUPS





Current Facility Space

Current Facility Size Sqft

Annual Cost Per Sqft

Objectives

If you could change something about your facility space situation, what would it be?

Enter text here.

Target Facility Space Sqft

Target Reduction

Constraints

What do you like about your current facility space?

Enter text here.

Constraints

Enter text here.

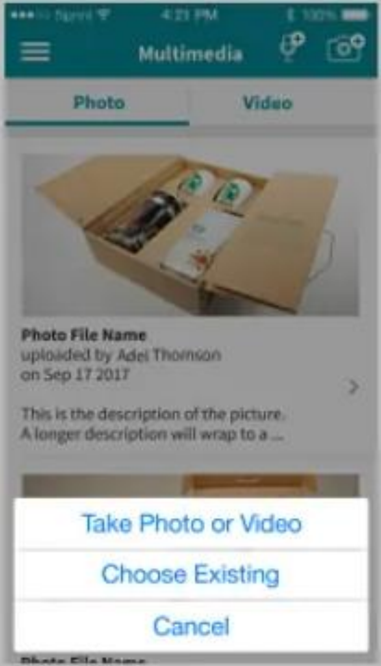


Photo File Name
uploaded by Adei Thomson
on Sep 17 2017

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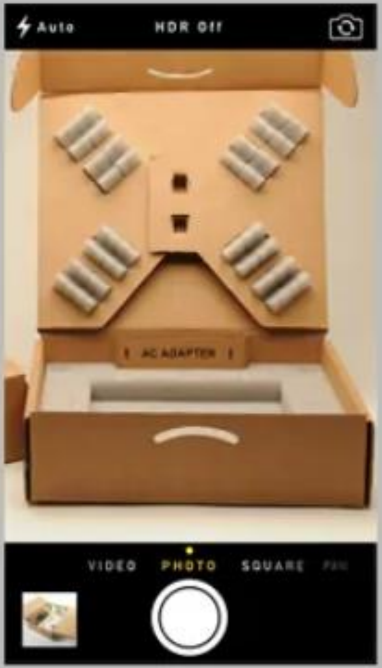


INVONTO

[1] https://www.figma.com/file/TWtbV2xJYPiw704QwnJb7Q/Prototyping-in-Figma?node-id=0%3A1

# ANDROID STYLING

- https://developer.android.com/design
  - Android Auto – Interacting with your vehicle using an Android phone application
  - Automotive OS – Infotainment platform applications are directly loaded onto (no phone necessary)
- Styles and layouts
- Components – things available to build the user interface with
- Car branding – car makers can set accent colors and icons of applications in their systems to reflect their own branding

# PROTOTYPES - FIGMA

Clear expectations for end users and developers

Excellent for demos and marketing

Possibly cheaper

# APP DEVELOPMENT

BACK-END / SERVER TECHNOLOGY

API

MOBILE APP FRONT - END

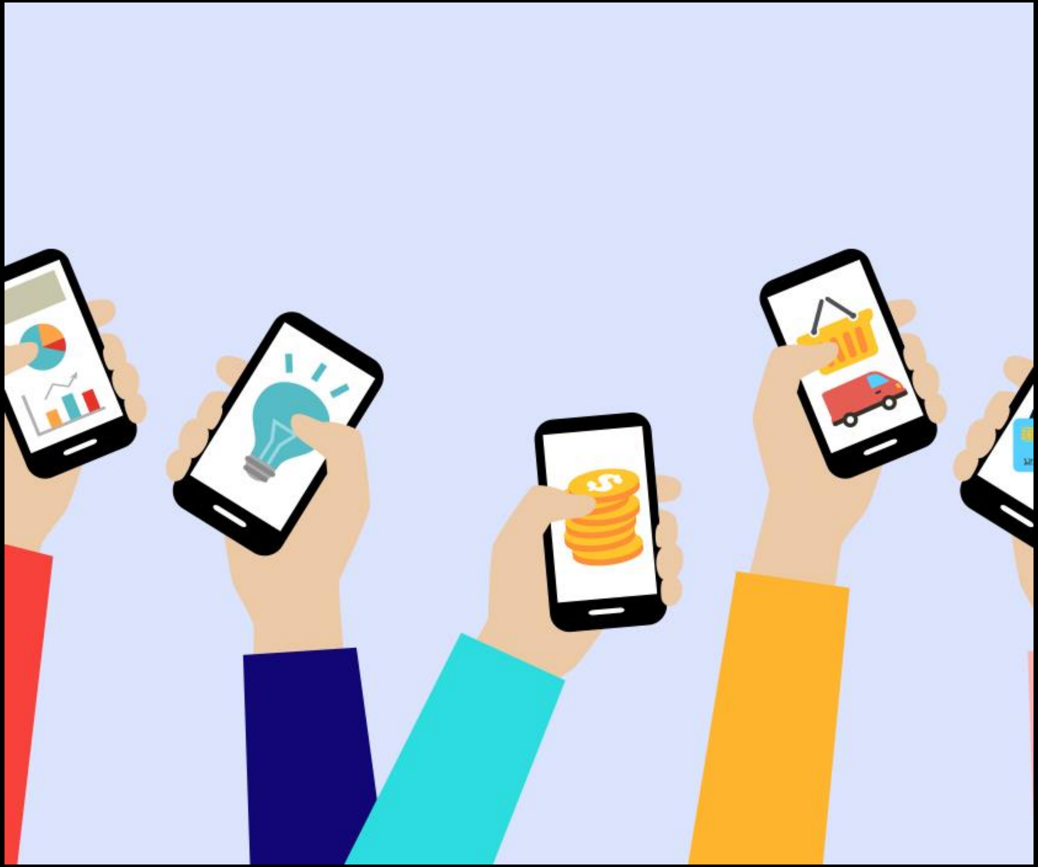
# TESTING

- User experience testing
- Functional testing
- Performance testing
- Security testing
- Device and platform testing

# USER EXPERIENCE TESTING

- Check the visuals, workflow, and interactivity of the app

- Verify there is consistent styling



- Ensure there are no issues with any of the app’s features and functionality
- Test as many cases as possible with as many people as possible
- Can be broken down into system testing, and further into unit testing

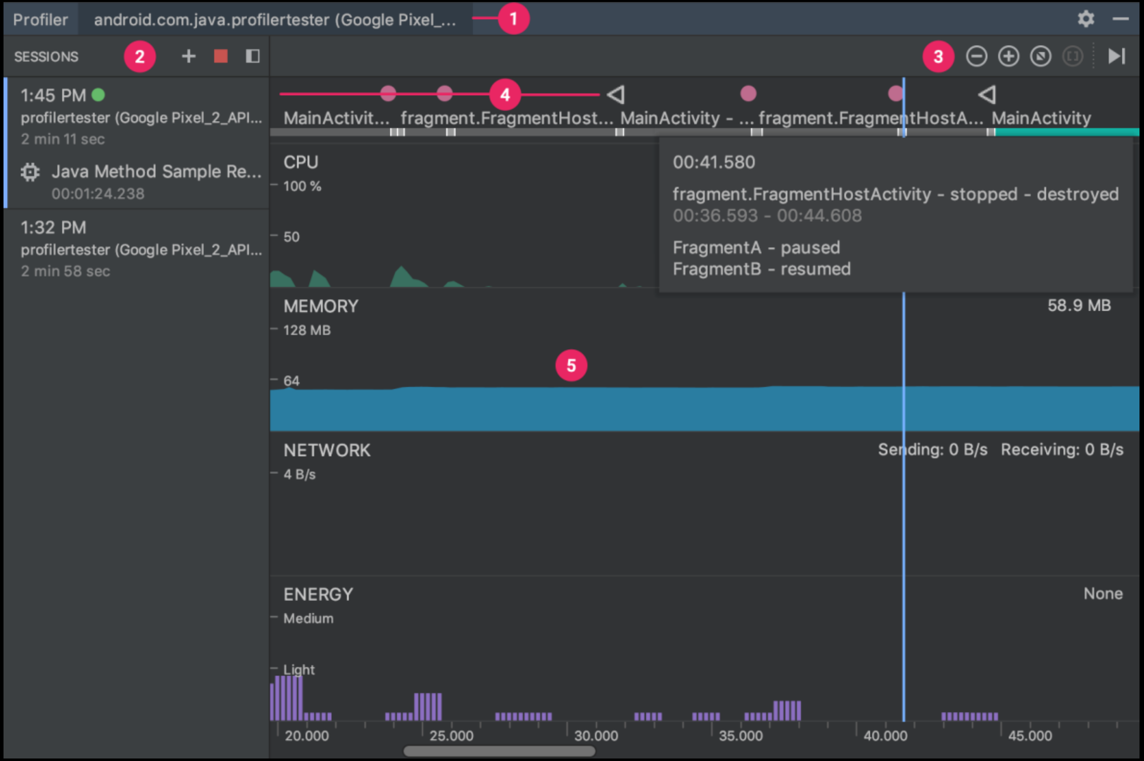
```
•// Example simple function
fun helloWorld(name: String = “World”): String {
      return “Hello, ${name}!”
}

// Example unit test
@Test fun
helloWorldReturnsPersonalizedMessage() {
      assertEquals(“Hello, Molly!”,
      helloWorld(“Molly”))
}

@Test fun helloWorldReturnsGenericMessage()
{
      assertEquals(“Hello, World!”, helloWorld())
}
```

# PERFORMANCE TESTING

- Quantitative criteria to measure the performance of the app
- How fast? Memory leaks? Battery draining? Too big?
- Test to maximum load



00:41.580

fragment.FragmentHostActivity - stopped - destroyed

00:36.593 - 00:44.608

FragmentA - paused

FragmentB - resumed

[3]

# SECURITY TESTING

- Any potential vulnerability can lead to a hack
- Common to hire outside agencies to perform security testing

[4]

# UNECE REGULATION 155

- United Nations Economic for Europe World Forum for Harmonization of Vehicle Regulations
- Baseline of threats, vulnerabilities and attack methods
- Mitigations to the threats which are intended for vehicle types
- Mitigations to the threats which are intended for areas outside of the vehicle types
- Possible attack impacts
- OWASP

OWASP®

# SECURITY TESTING

- Public crowdsourcing of bug discovery - Bugcrowd
- https://media.stellantisnorthamerica.com/newsrelease.do?id=17719&mid=
- Pay the community $150 - $1,500 depending on the severity/impact of discovered bugs

# DEVICE AND PLATFORM TESTING

- New devices landing on an annual basis
- OS updates roughly every few months
- Limited line of devices for iOS
- Many devices for Android, all with different hardware and screen sizes

iOS phones in the last couple of years

Some Android phone brands

- Samsung
- Oppo
- Xiaomi
- Vivo
- OnePlus
- Huawei
- Realme
- And more…

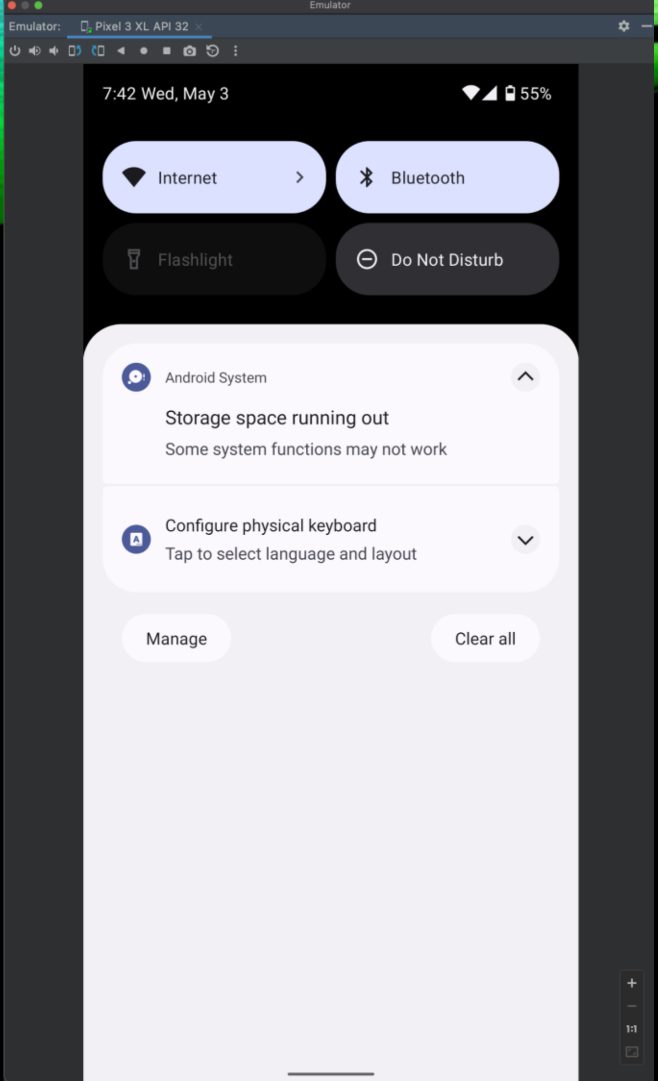
# EMULATOR DEPLOYMENT CONSIDERATIONS

## Pros

- Open and free to download
- Provide analytics for test performance
- Fast to cycle through devices when testing

## Cons

- Can't check color/contrast of display in different weather conditions
- Can't emulate touchscreen issues
- Consumes a lot of storage



7:42 Wed, May 3 55%

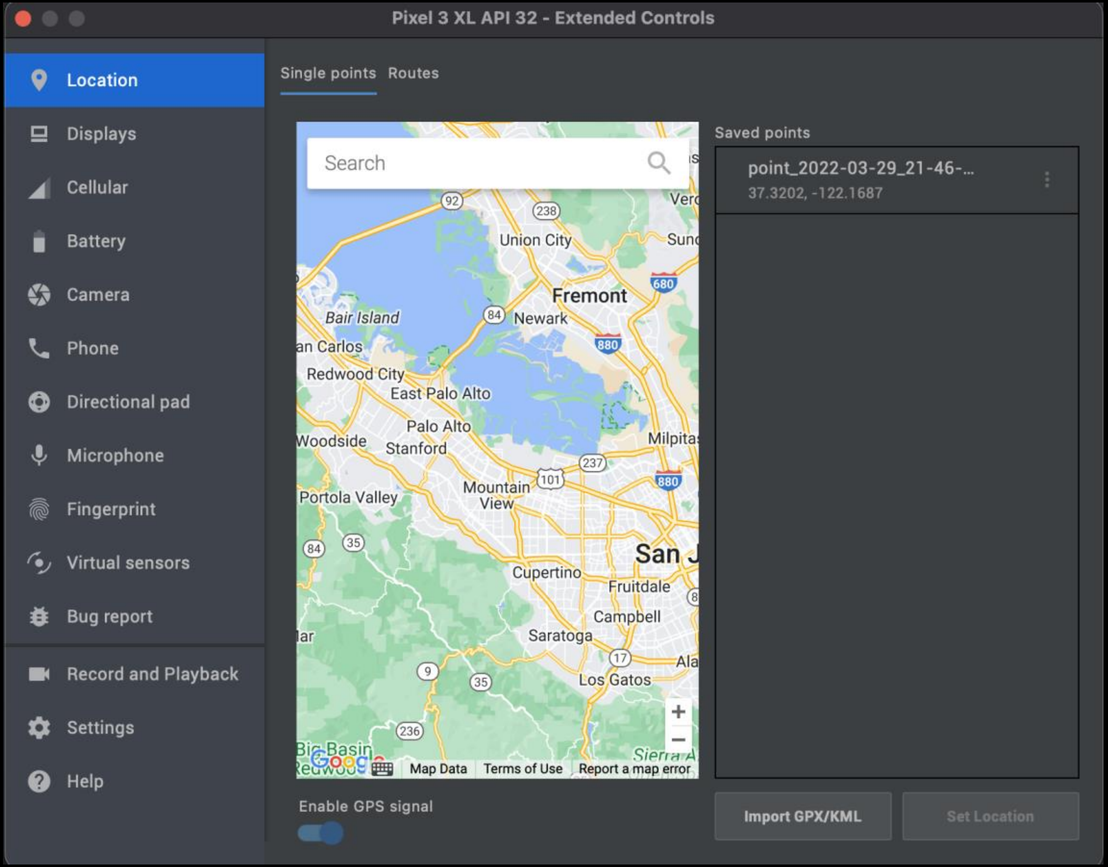
Android System

Storage space running out

Some system functions may not work

Configure physical keyboard

Tap to select language and layout

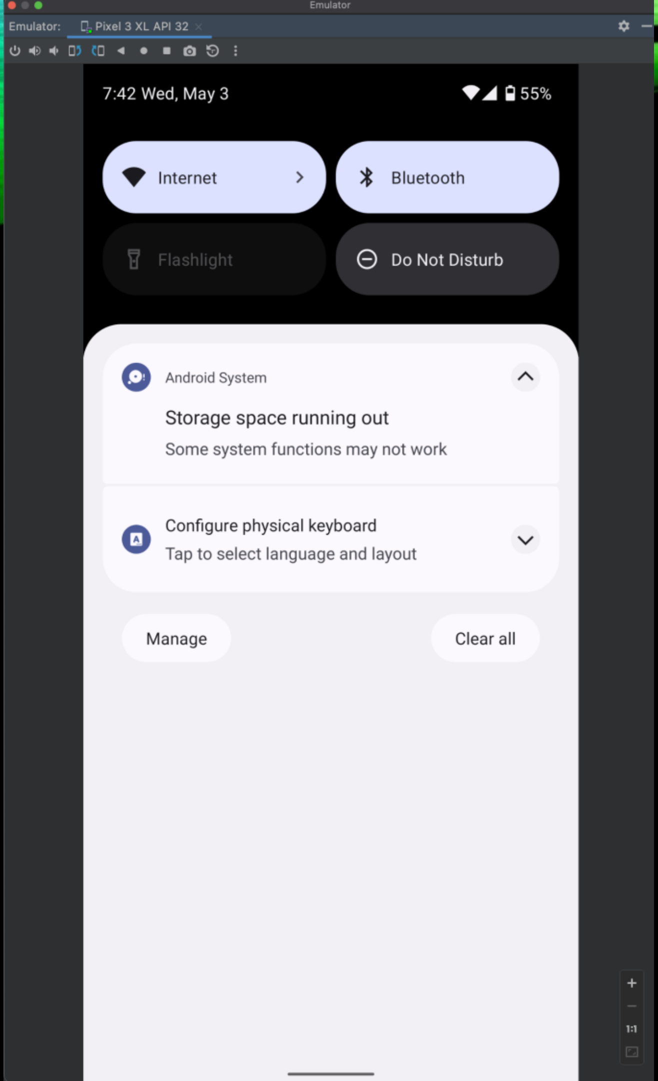


Pixel 3 XL API 32 - Extended Controls

Saved points

point_2022-03-29_21-46-...
37.3202, -122.1687

Enable GPS signal



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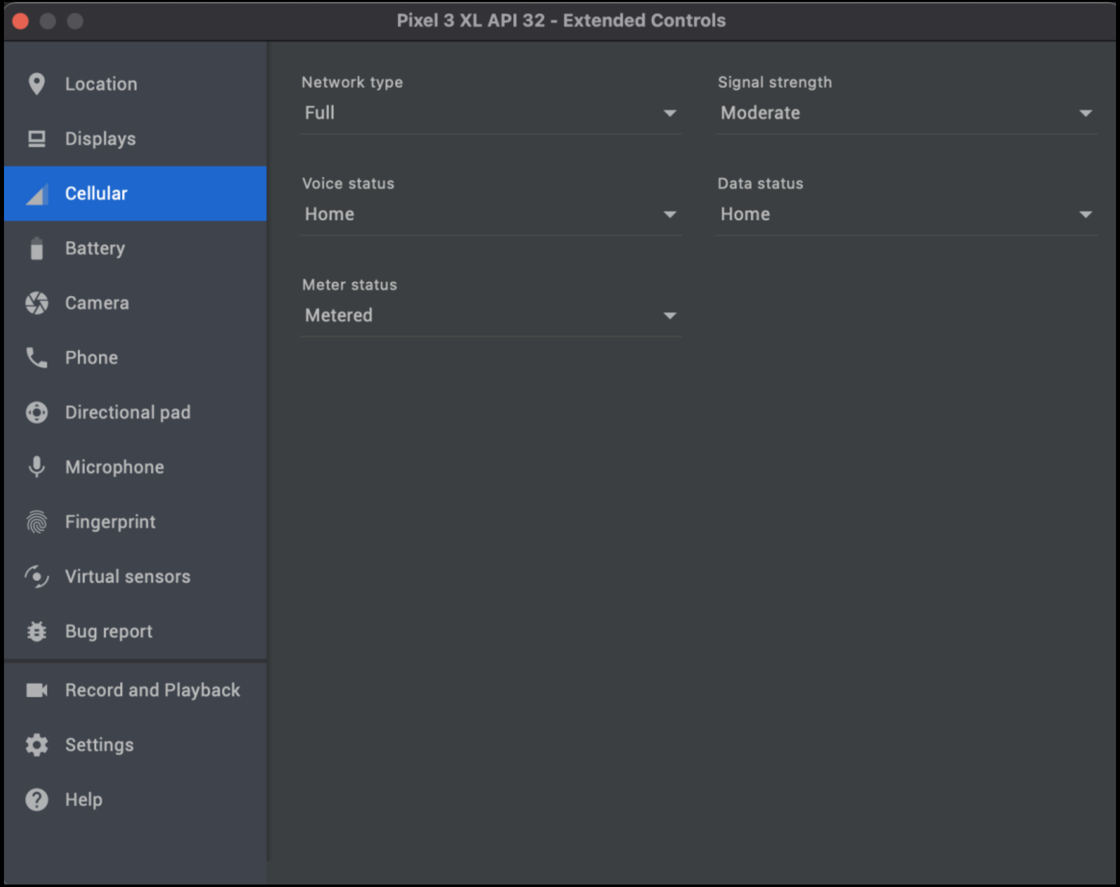


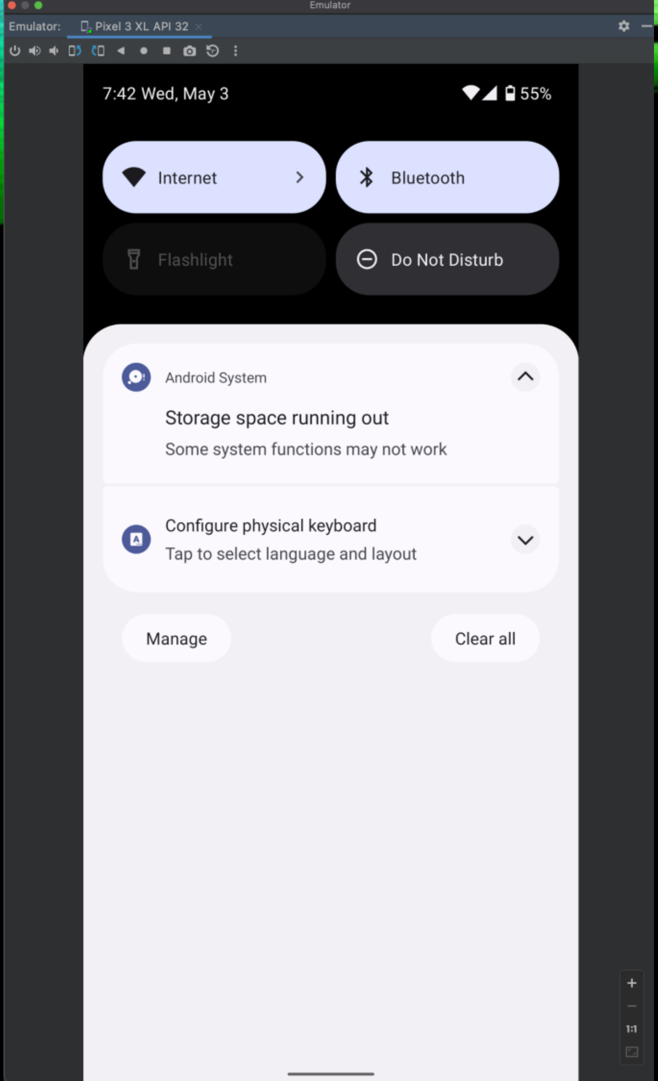
Network type: Full

Signal strength: Moderate

Voice status: Home

Data status: Home

Meter status: Metered



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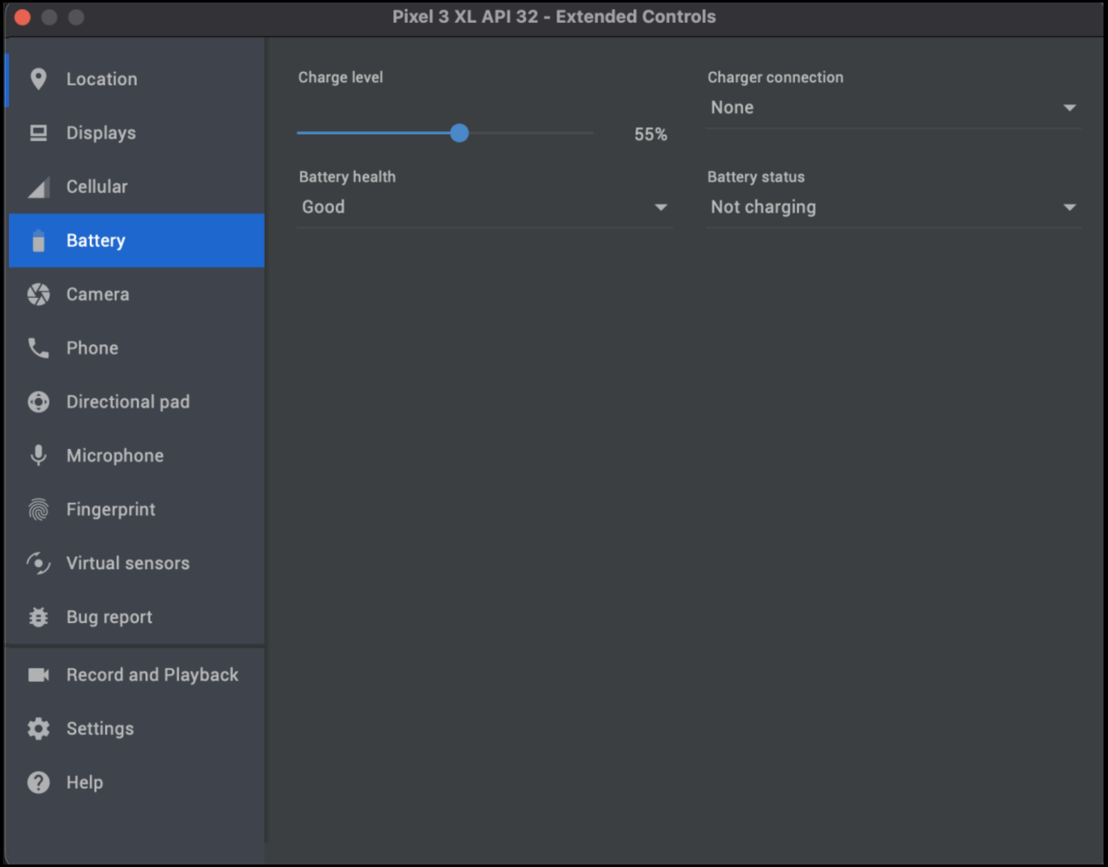


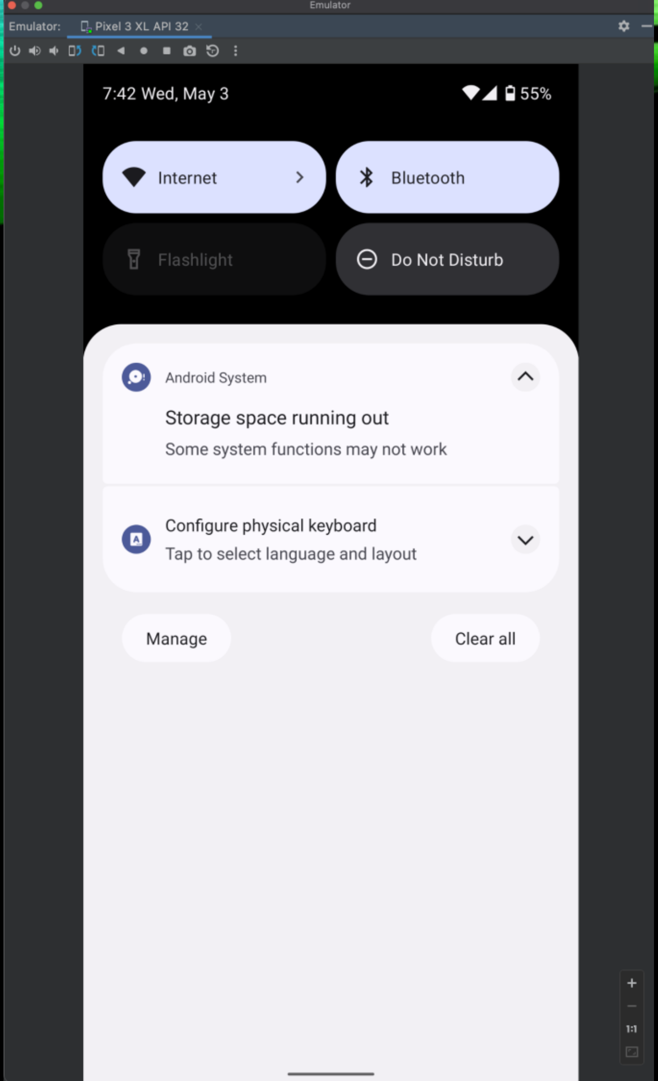
Pixel 3 XL API 32 - Extended Controls

Charge level 55%

Charger connection: None

Battery health: Good

Battery status: Not charging



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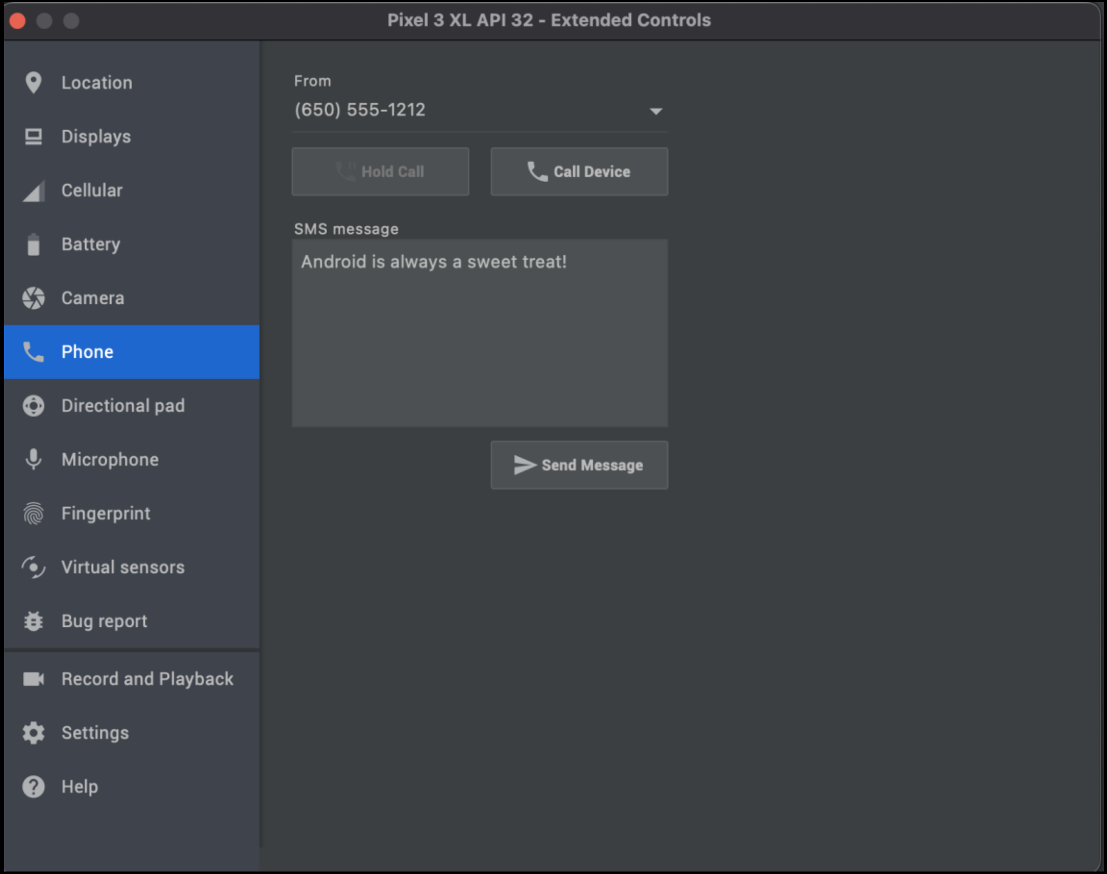

From: (650) 555-1212

SMS message: Android is always a sweet treat!

# DEPLOYMENT AND SUPPORT

- Release the app
- Stay on top of technology advancements
- Bug fixes

# WHAT IS CLOUD COMPUTING?

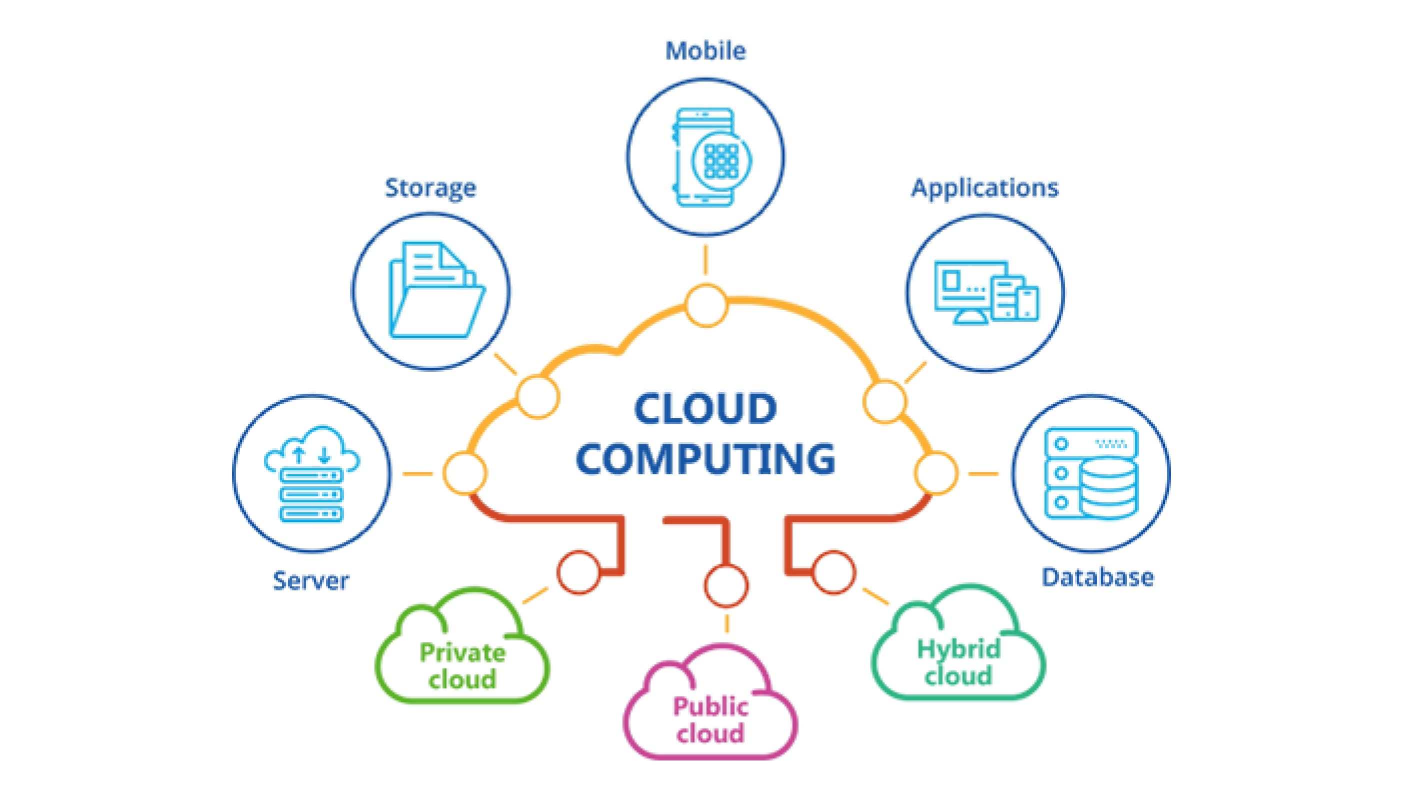

Image: https://knowledgeballs.com/cloud-computing/

# BENEFITS

- Speed
- $$$
- Performance
- Scale
- Security

# DRAWBACKS

Might not be cost efficient for small projects

Data mobility - leaving the cloud

Limited control

- Only have access to the tools the provider has, for example the only databases supported are Amazon Aurora, MySQL, MariaDB, PostgreSQL, Oracle, and Microsoft SQL Server
- Not as much of a problem recently

# TYPES OF CLOUD SERVICES

**Software as a service (SaaS)**

- Google Workspace (Gsuite), Dropbox, and GoToMeeting

**Platform as a service (PaaS)**

- AWS Elastic Beanstalk – deploys, manages and scales web apps and services for you

**Infrastructure as a service (IaaS)**

- Rent IT infrastructure: VMs, storage, servers
- EC2 Instance or RDS Database

- Leading cloud platform
    - Over 1 million active users
- Largest userbase
    - 41.5% global market share (Oct 2022)
- Secure
- Pay-as-you-go
- Over 200 products

# AWS DEVELOPER CONSOLE

- Free to make an account
- Lots of tutorials to learn how to use different tools together or learn the in and outs completely for a specific tool
- Use any AWS product
- See billing and cost reports
- See security management