Google I/O Recap

June 2014

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https://www.google.com/events/io

We were greeted by...

Outline

- tech highlights
- general, emerging trends
- vision and graphics-specific applications

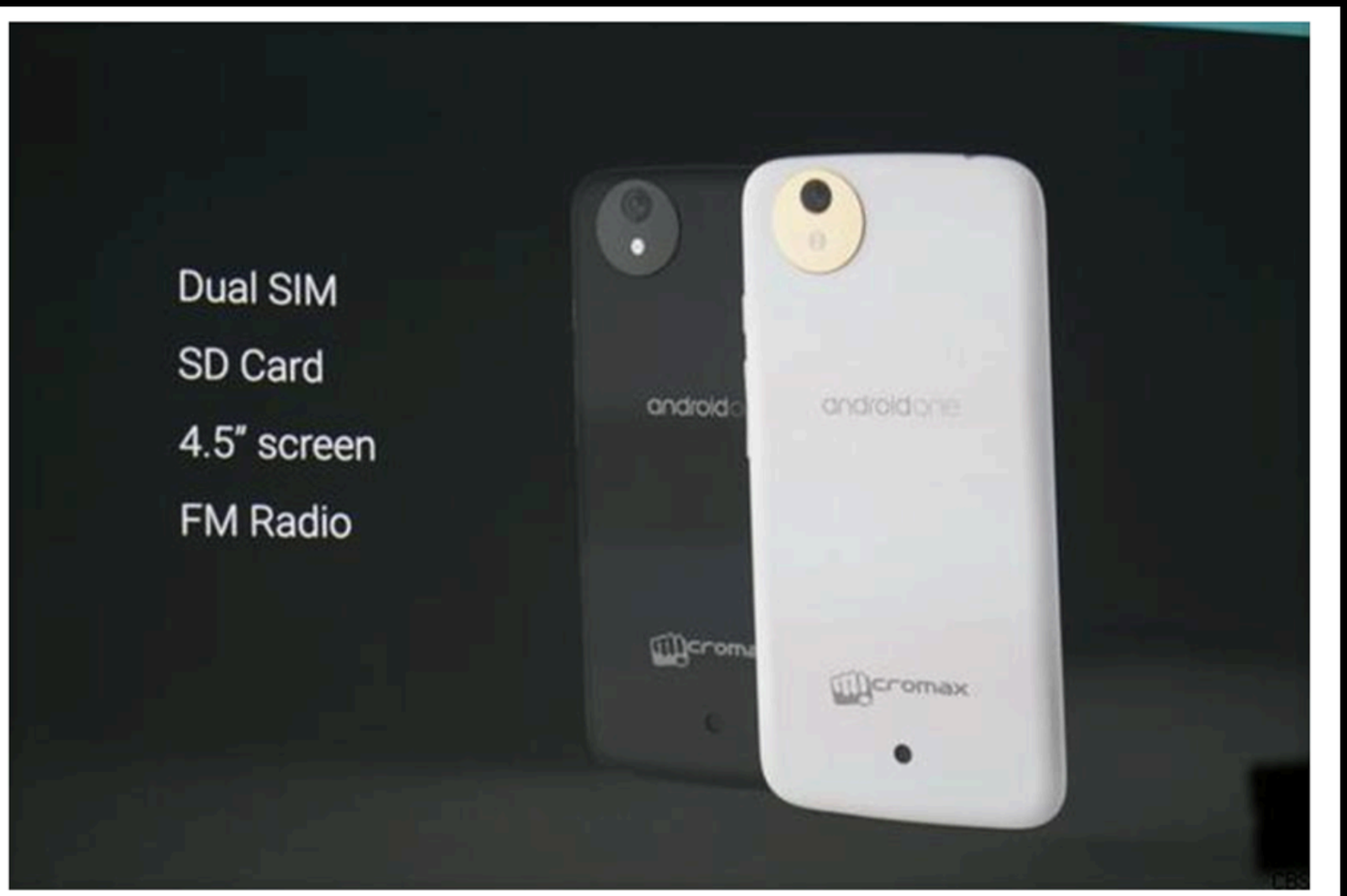
“Material Design”: new UI for Android L

Where UIs are heading these days

- more 3D: elements come not just with a position, but also a depth value - rendered with virtual lighting and shadows
- more dynamic: more interactive transitions, more customization, not just within, but across, applications

- adapting to evolving user experiences
- more intuitive

A phone for the developing world



CNET

With AndroidOne, Google pushes for low-cost mobile devices

Dual SIM cards, a 4.5-inch display, expandable storage, and an FM radio -- all for under $100 USD. With AndroidOne, Google is creating a series of hardware reference platforms aimed at bringing a quality Android experience to emerging markets, at affordable prices.

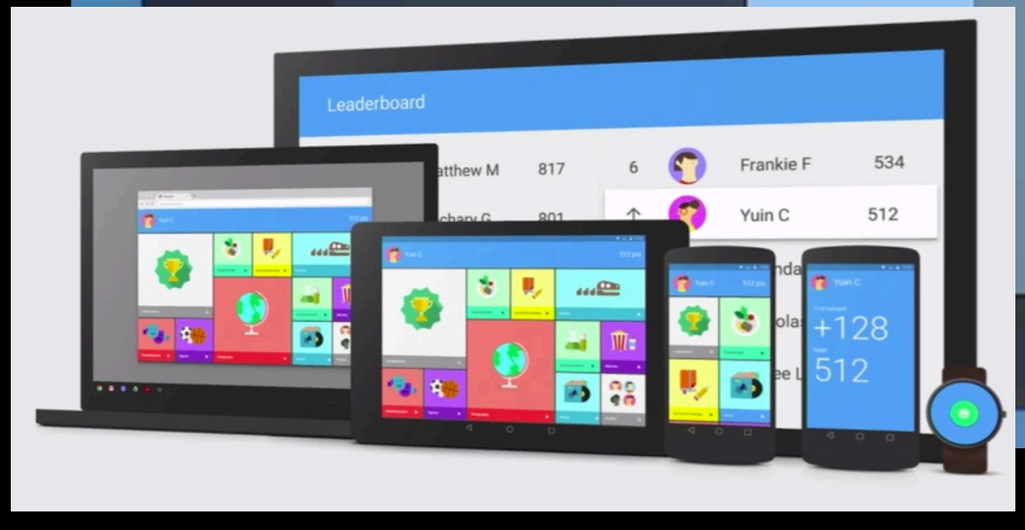
- goal: to distribute at scale in developing countries
- will start this fall in India
- Google to work closely with companies that can provide hardware to handle the mobile operating system while keeping costs down

Chromebooks gaining popularity

- new forms of synchronization
- can use laptop like a phone (receive and make calls, etc.)

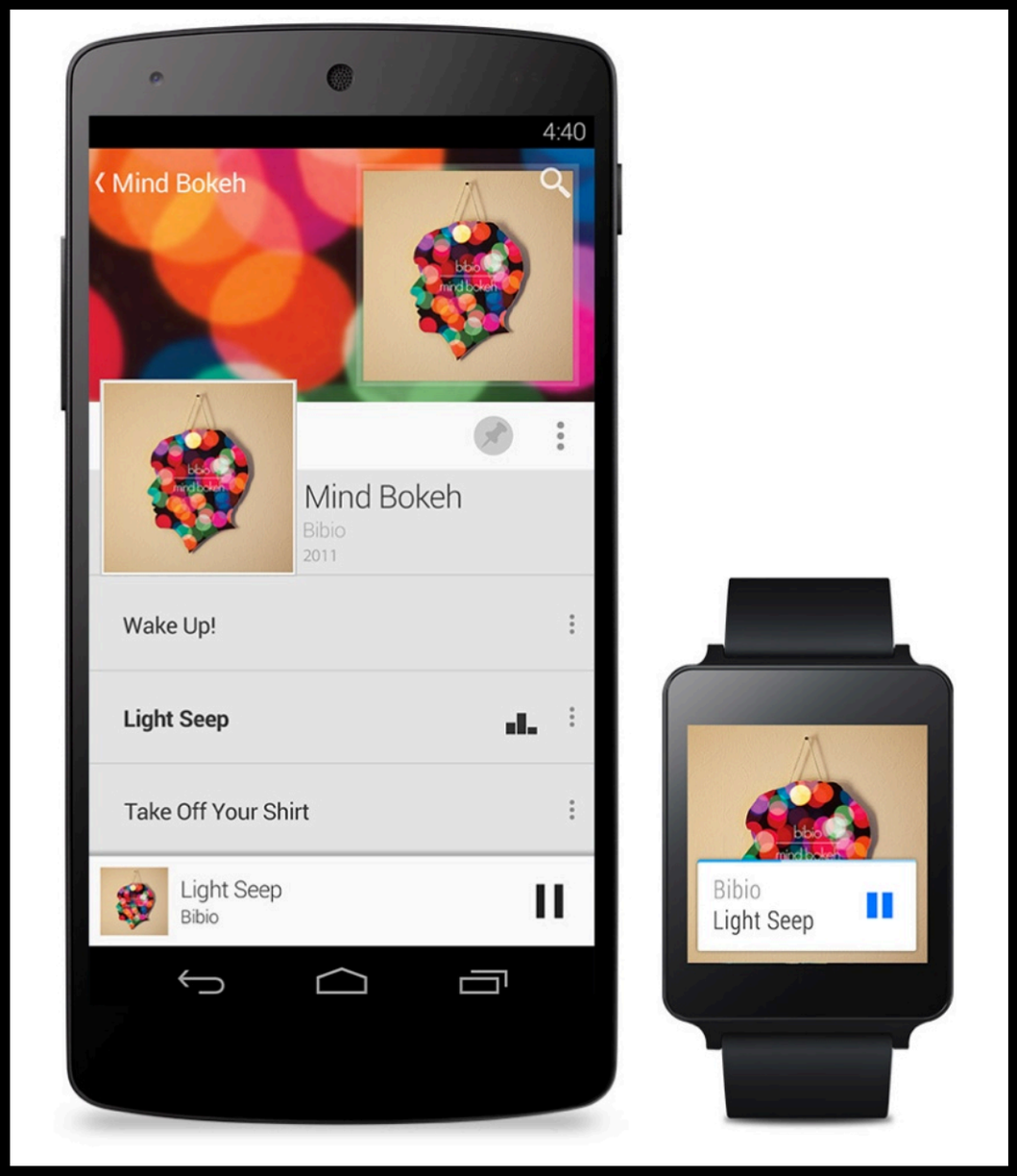
Android everywhere: syncing up (style and functionality) on all devices

- apps adapted to multiple devices
- seamless transition between one device and another (syncing of activities)
- automatic log-in if detect nearby devices



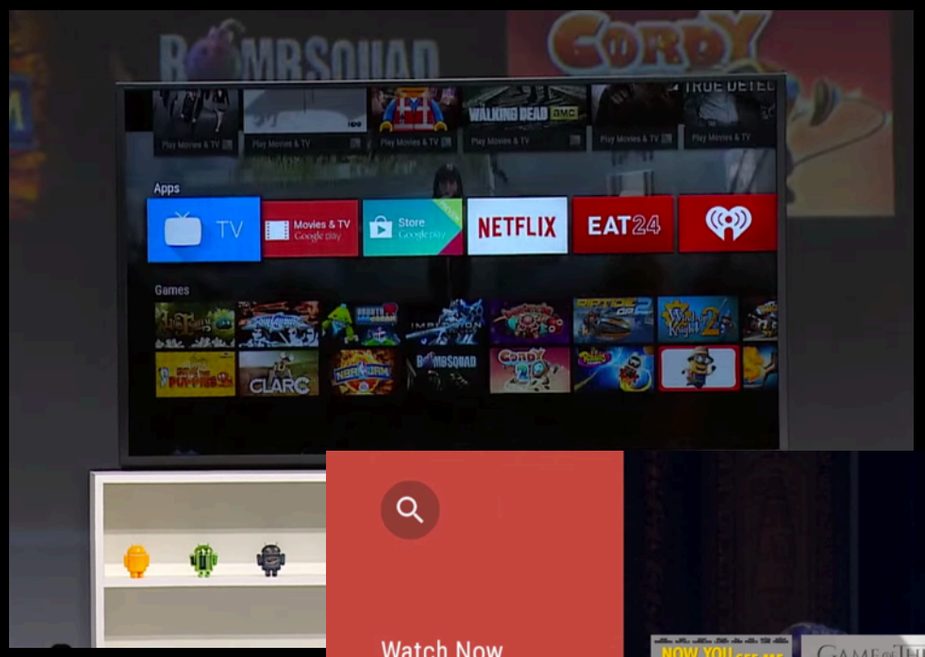
- apps adapt to device specifications and format

Android wearables

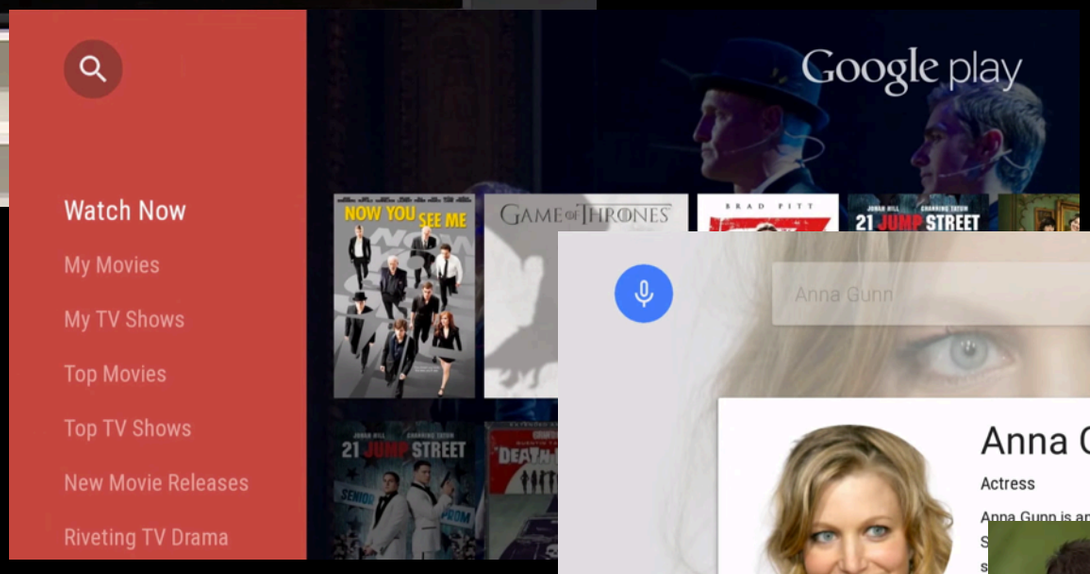


- SDK already available
- LG G Watch and Samsung Gear Live already available
- Motorola 360 to come out later this year

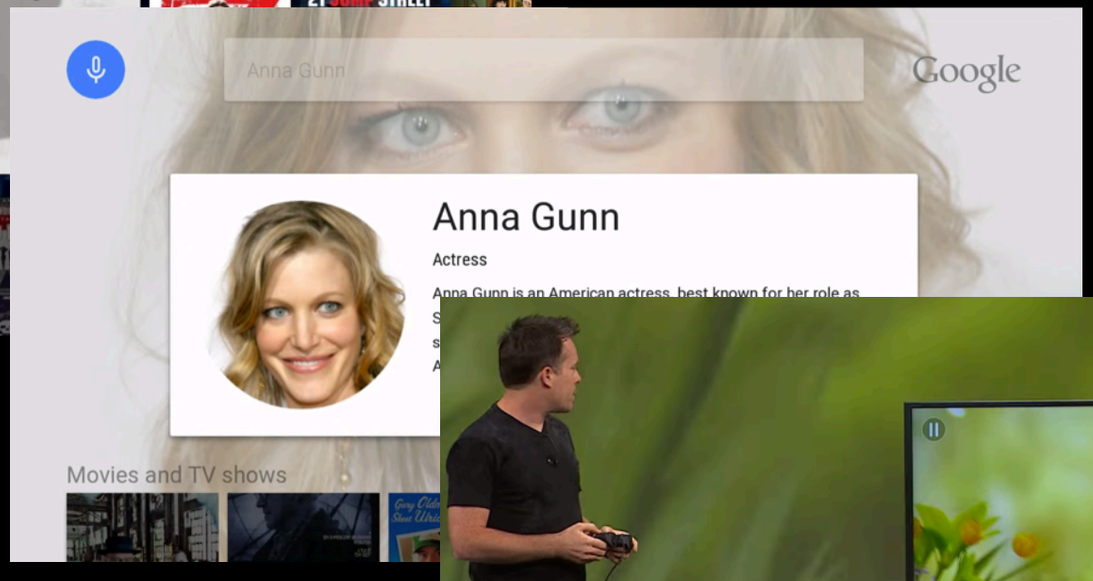
Android TV: one-stop entertainment box



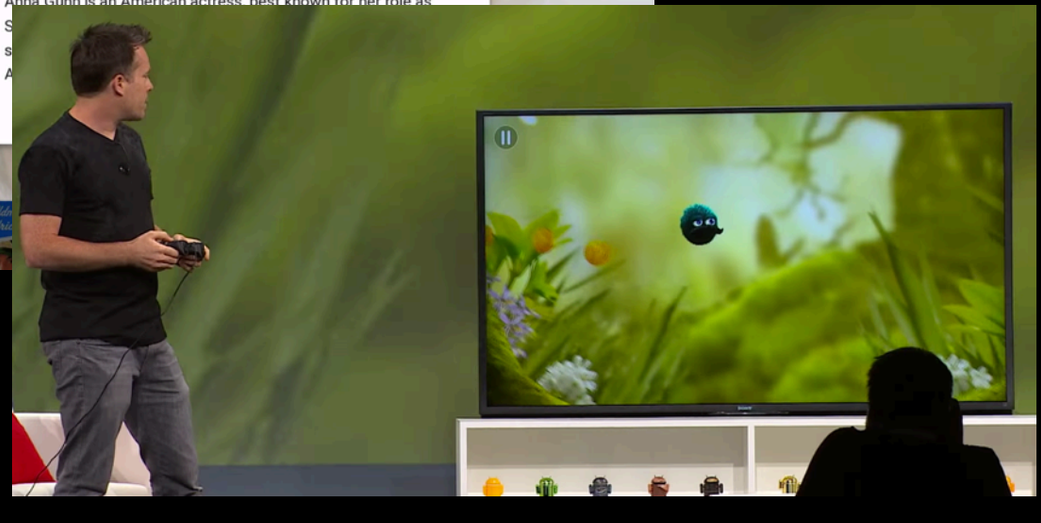
as a cinema



as a search engine



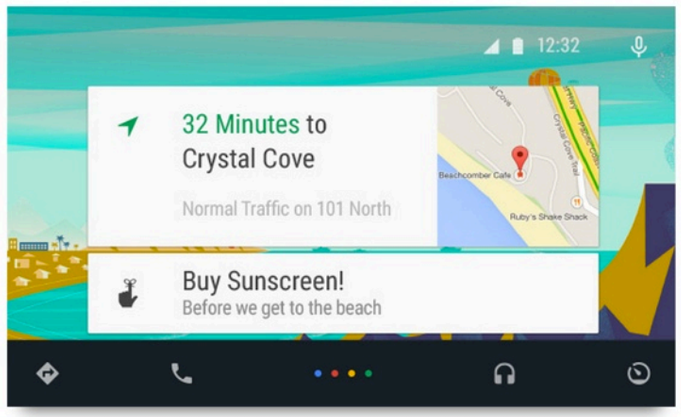
as a game console



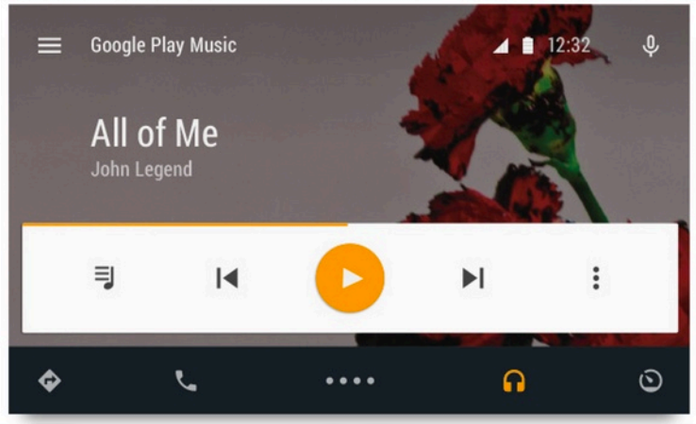
+ Chromecast mirroring
of any Android device

- next attempt by Google to make a TV
- use any Android device as a remote

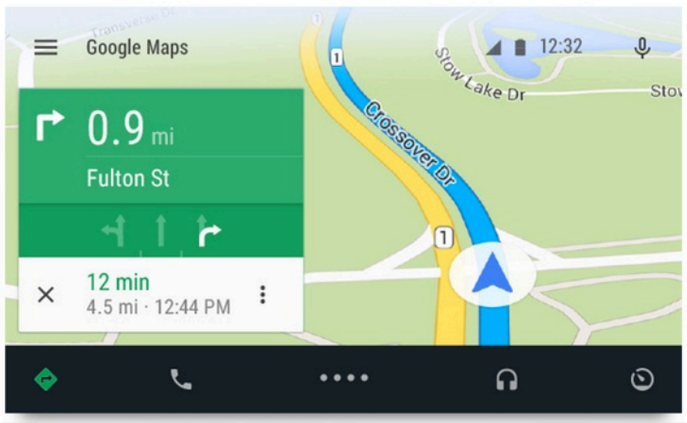
Android Auto:
it doesn't stop at Google maps



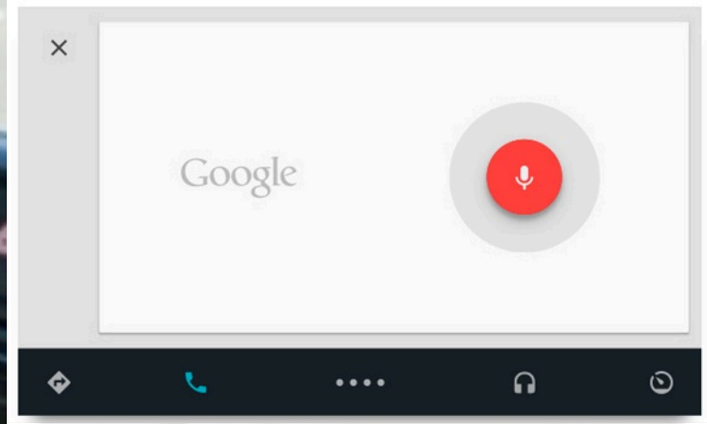
Android Auto automatically brings you useful information, and organizes it into simple cards that appear just when they're needed.



Your favorite tunes—to go. Access and stream your favorite music with apps like Google Play Music, Pandora, and Spotify.



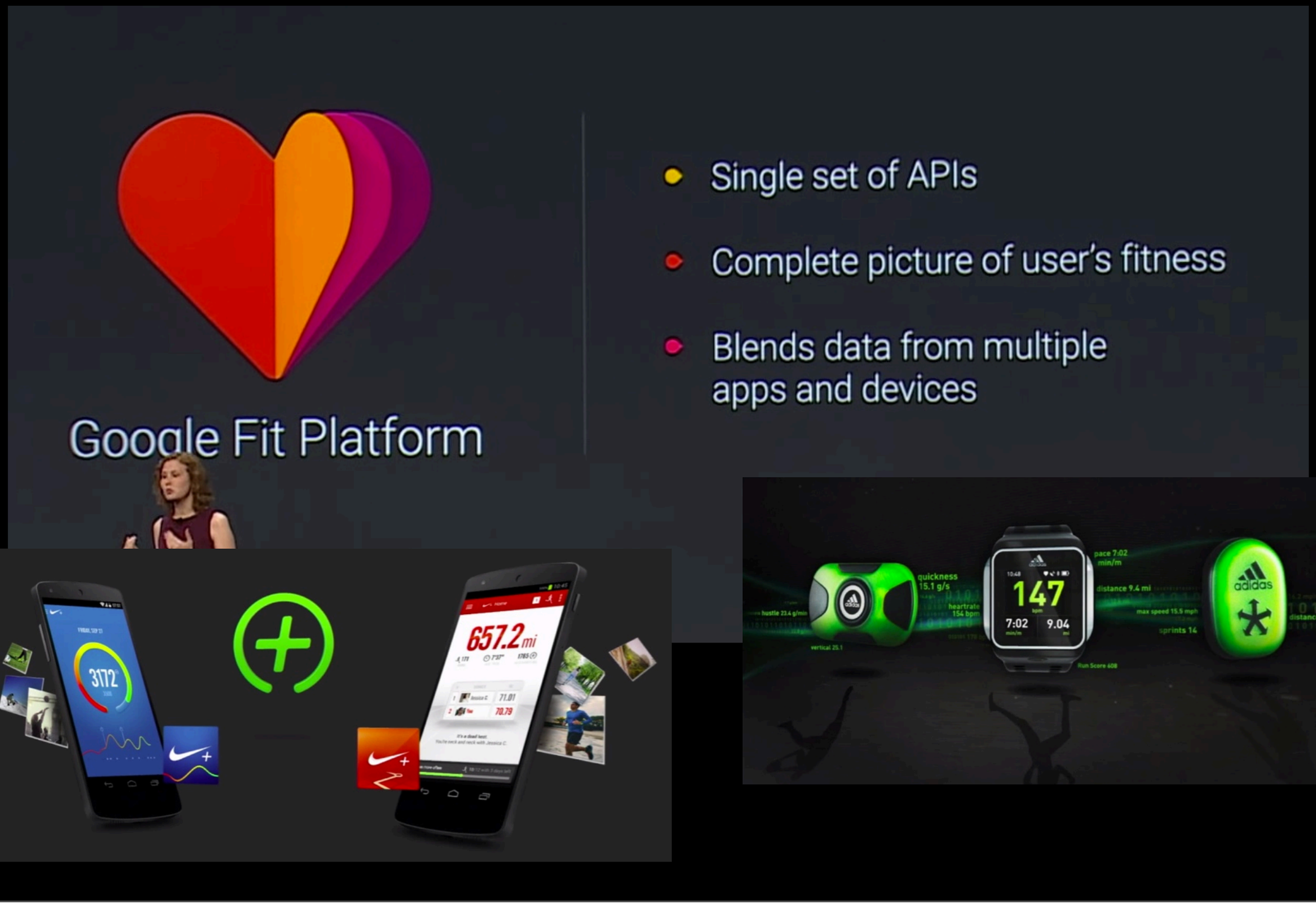
Let Google Maps lead the way. It's easy to get where you're going with free voice-guided navigation, live traffic information, lane guidance, and more.



Just say the word—best-in-class speech technology makes controlling everything with your voice fast and easy.

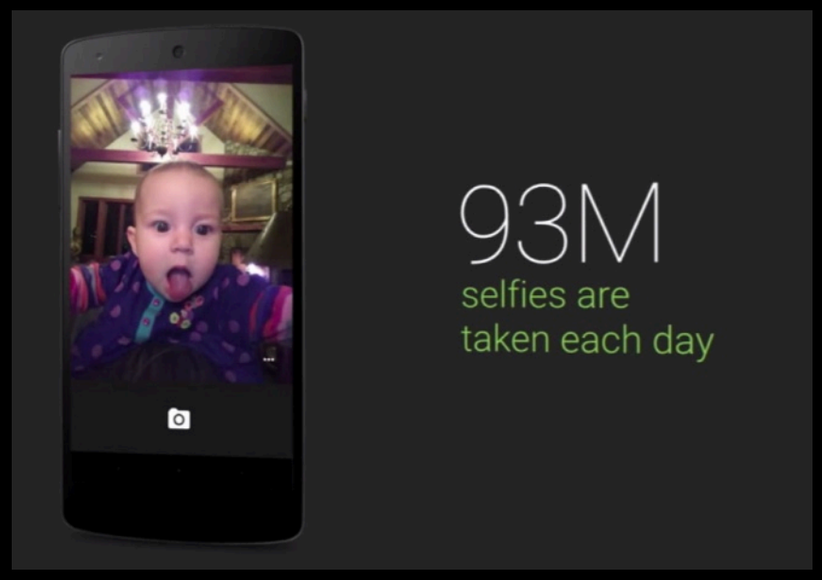
- to keep your eyes on the road: audible messages, voice commands
- set to be on roads at end of this year

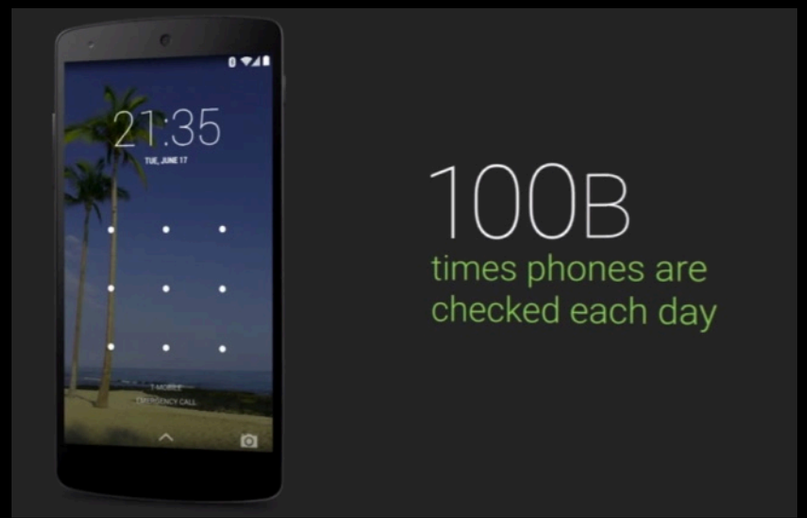
What about monitoring your fitness? Google's got that covered too.

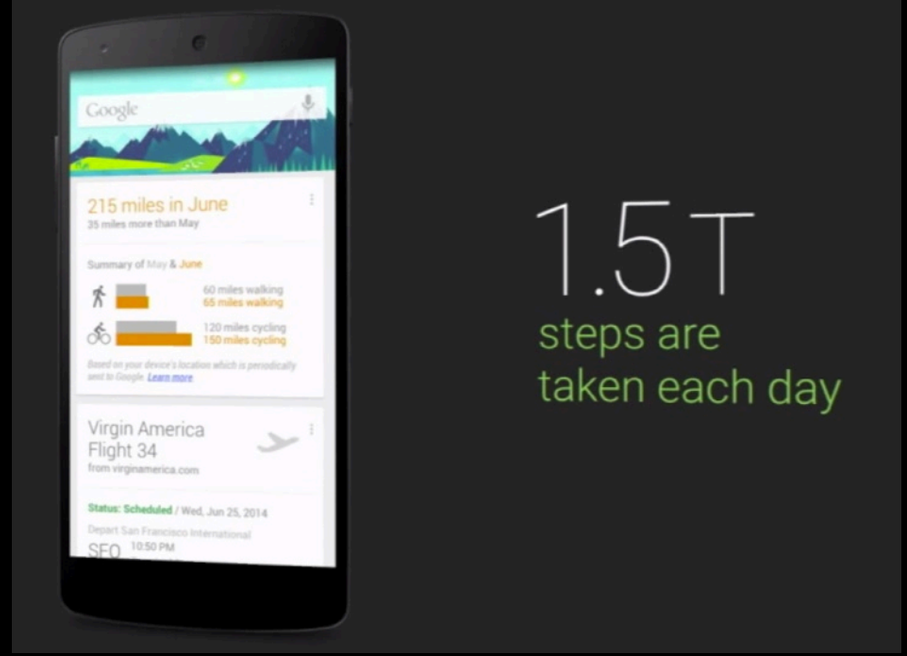


- sensors on phone, apps manage fitness data
- e.g. Nike's FuelBand wearable, etc.
- data openly available for apps to use

Consider all the phone data available...



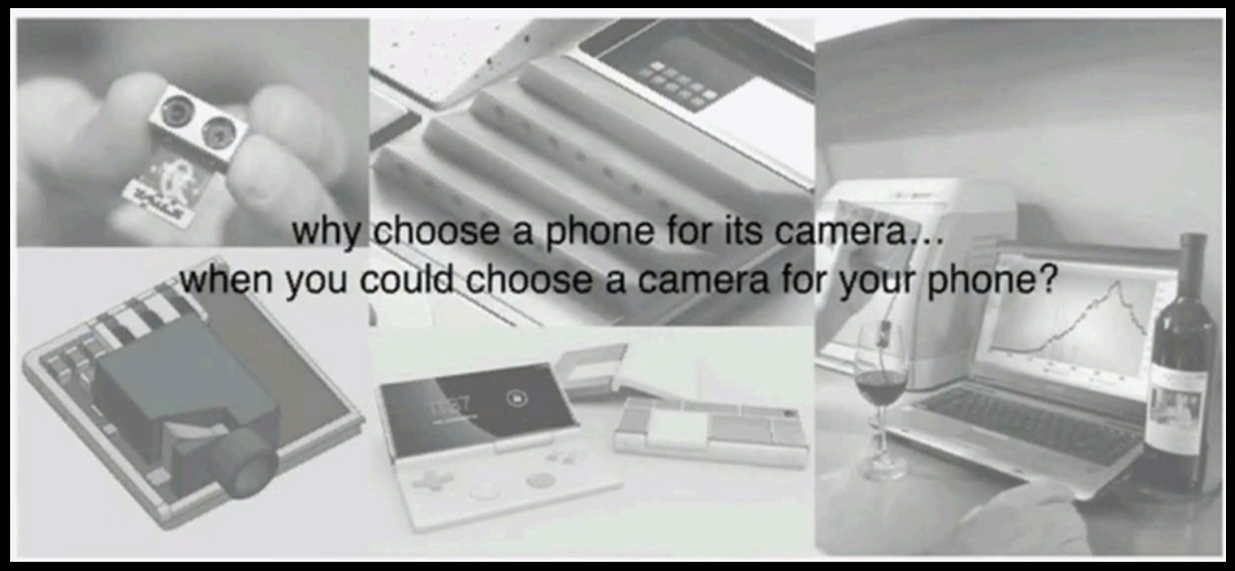




- important use cases for Google
- how much (and what) can we learn from all this data?

Project Ara: the modular phone

versatile
computing
platform



cameras
speakers
medical devices
printers
laser pointers
game controllers
specialized sensors
...

- came out of ATAP (Google's Advanced Technology and Products Group)
- share expensive sensors among friends, family, villagers

Project Ara: the modular phone

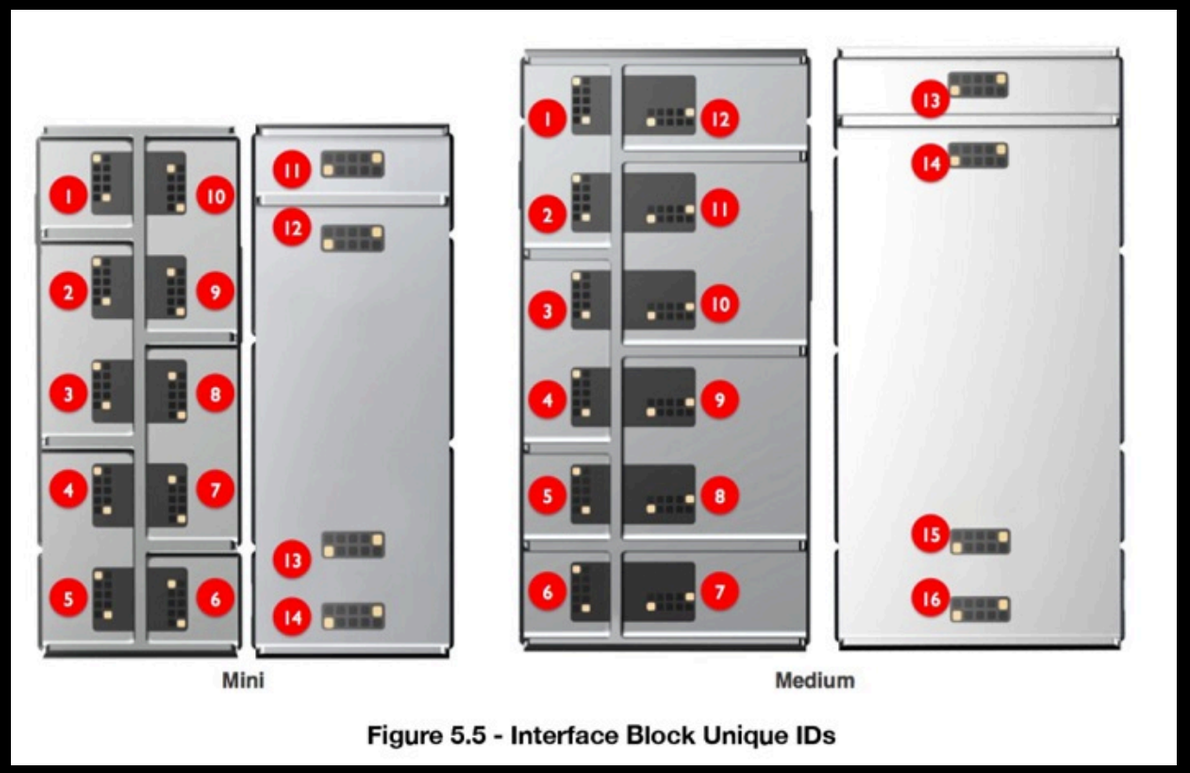
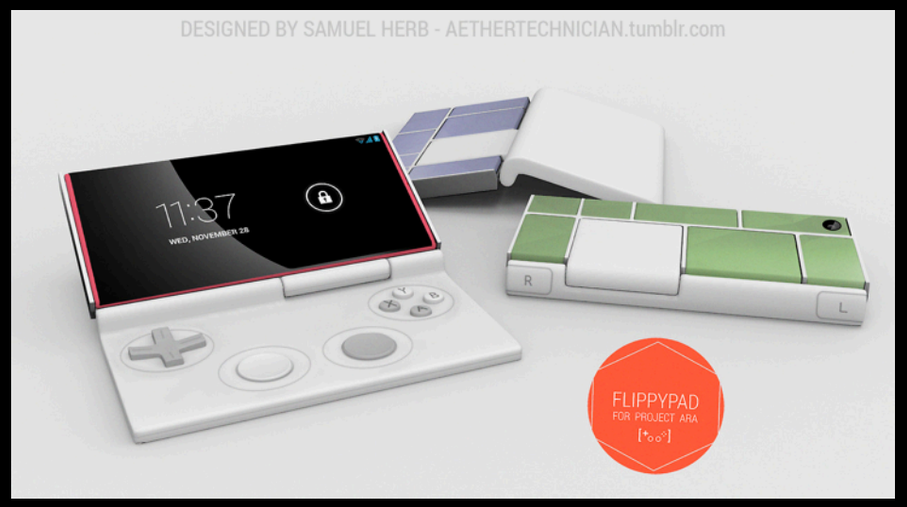
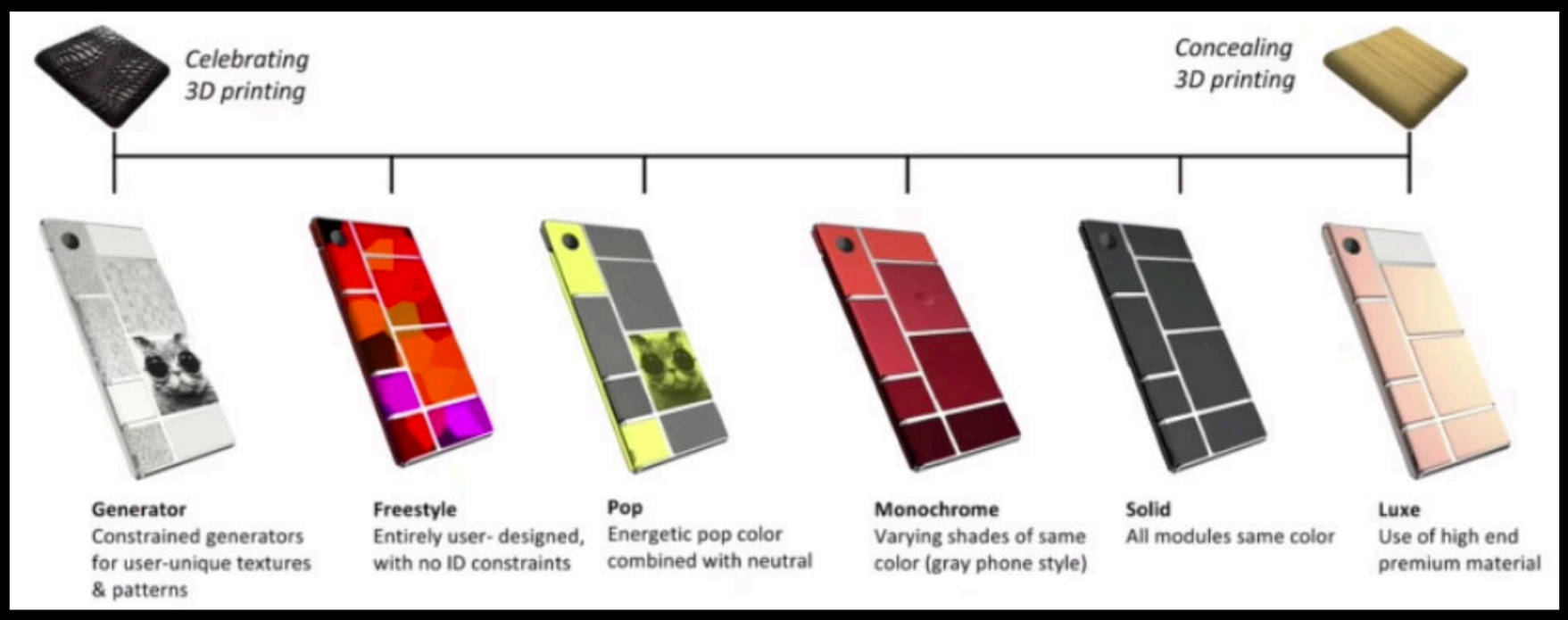


Figure 5.5 - Interface Block Unique IDs

- “like the Android app ecosystem, just in hardware”
- MDK (module development kit) is out
- 100K prize for module design (projectara.com/prize)

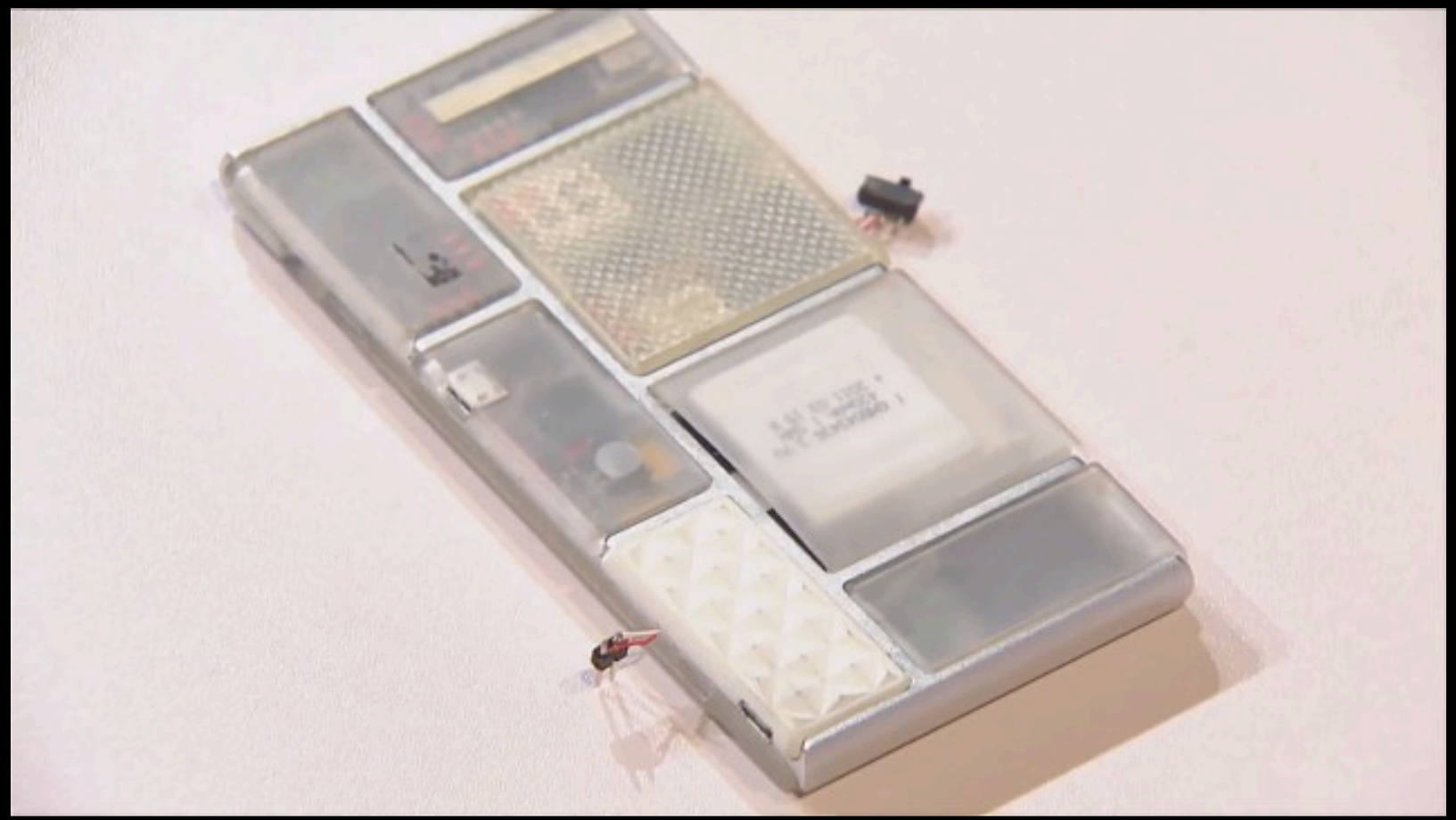
Project Ara: the modular phone





- commercial release planned for beginning of 2015

- commercial at 6:04: https://www.youtube.com/watch?v=0He3Jr-fZh0

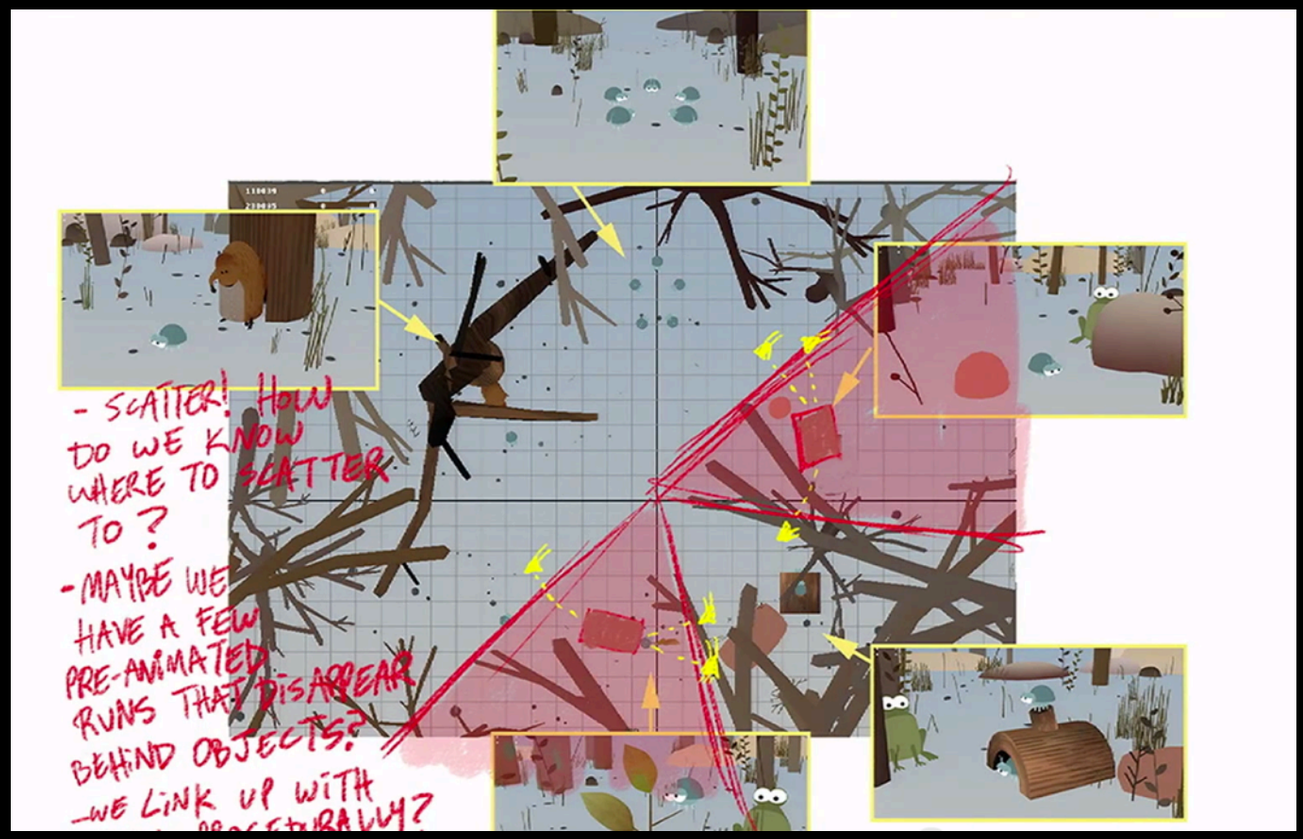


- one of the key developers: Boston company, MIT PhD graduate Ara Knaian

Project Spotlight: bringing together art and technology

"...where your phone is a window into a new world"

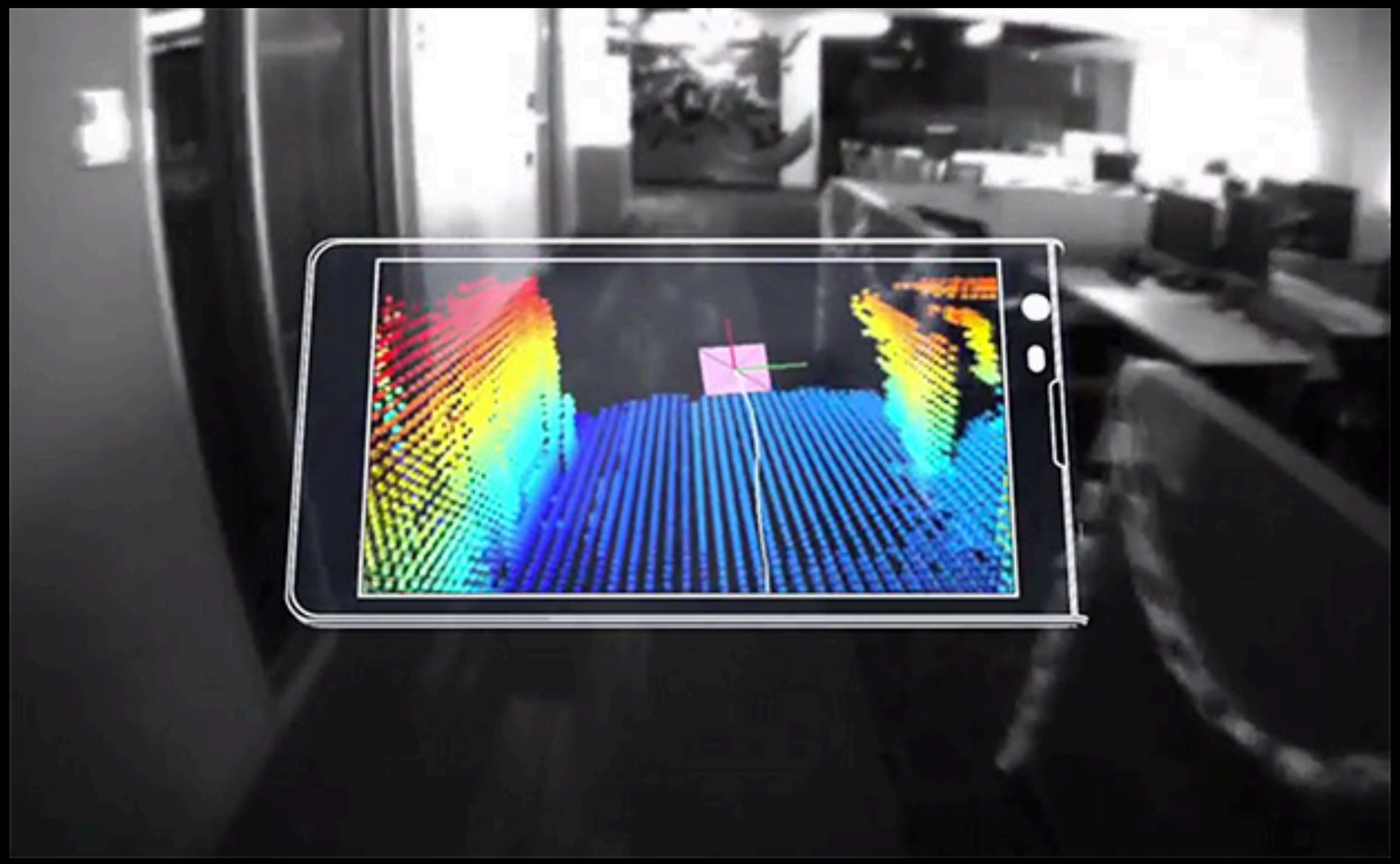
Project Spotlight: bringing together art and technology



- rethink storytelling on a mobile canvas
- GPU and IMU developments make real-time rendering where the user is looking possible
- storytelling development kit in dev

- IMU = inertial measurement unit
- first realtime rendering (at 60 fps) implementation, and mobile use, of OpenSubdiv
- tessellation to fit to the hardware requirements of realtime
- watch 0:12-0:40 of: https://www.youtube.com/watch?v=xw4552Cp9Pc

Project Tango: mobile 3D sensing



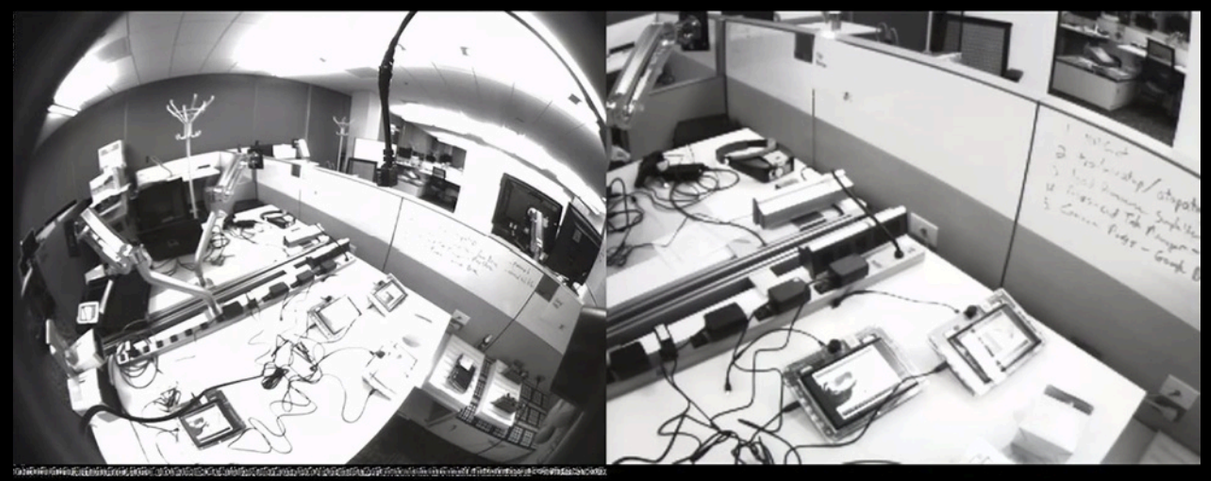
- 3D navigation
- robotics
- augmented reality

Project Tango: 3D on your phone

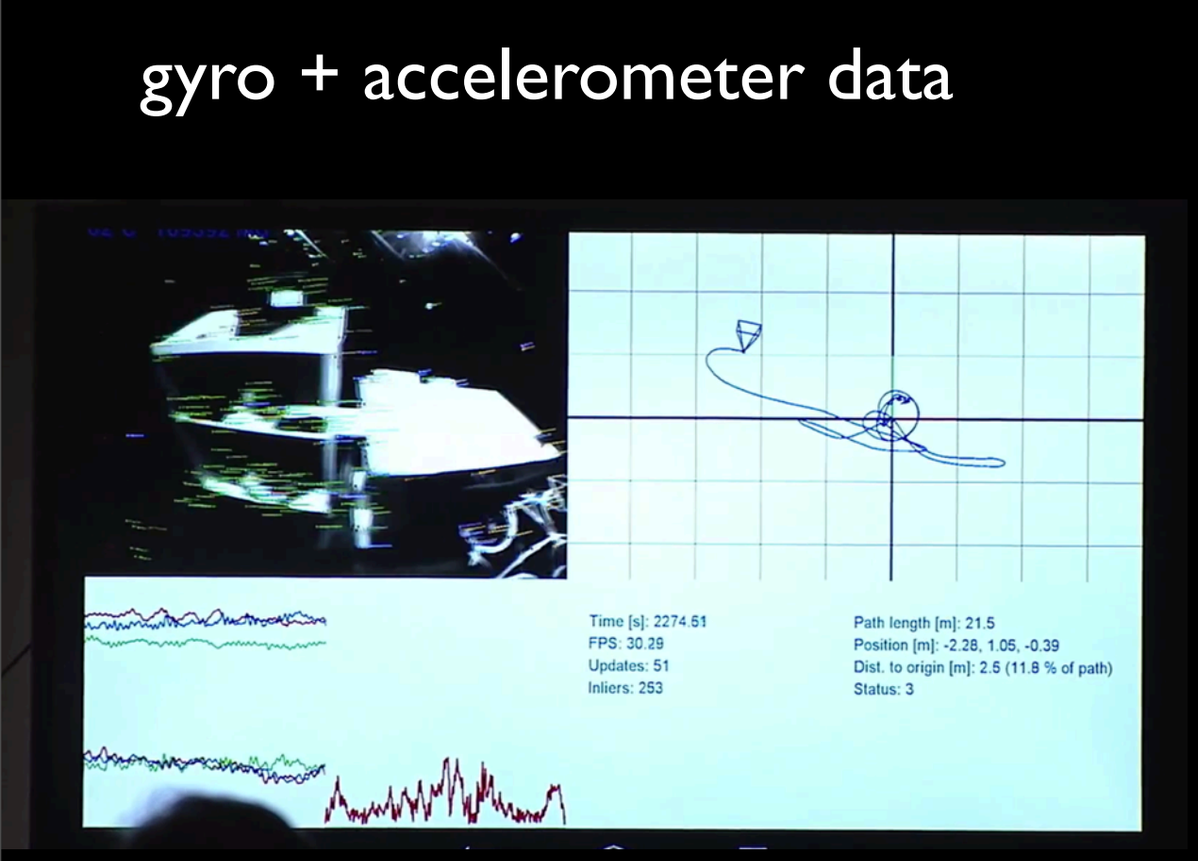
- 3D computing shown to work on consumer-grade hardware, mobile processor, can fit form-factor requirements of phone
- high-speed light-sensitive sensor, 3D tracking, as much RAM and storage as laptop

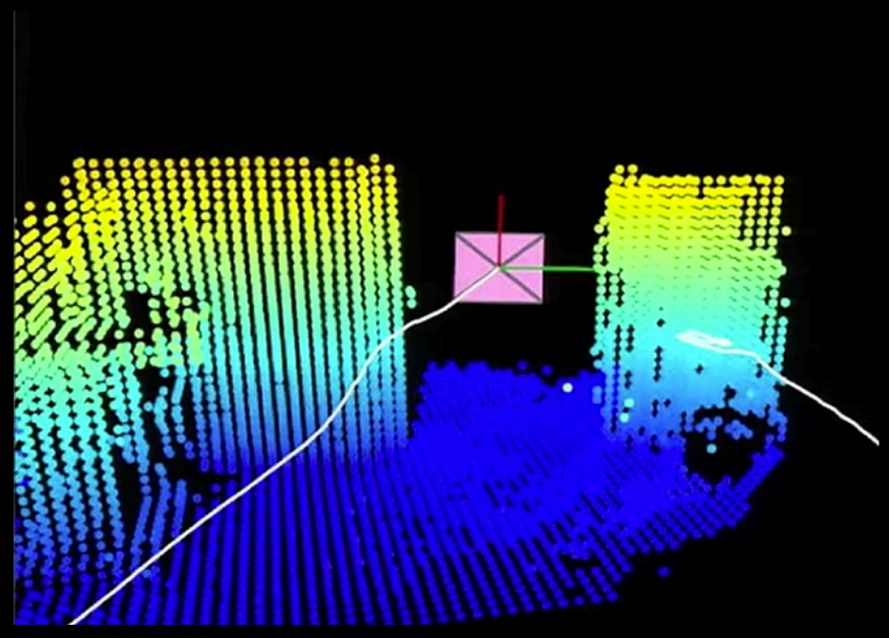
Project Tango: 3D on your phone

wide-fish eye
+
traditional FOV
cameras



gyro + accelerometer data

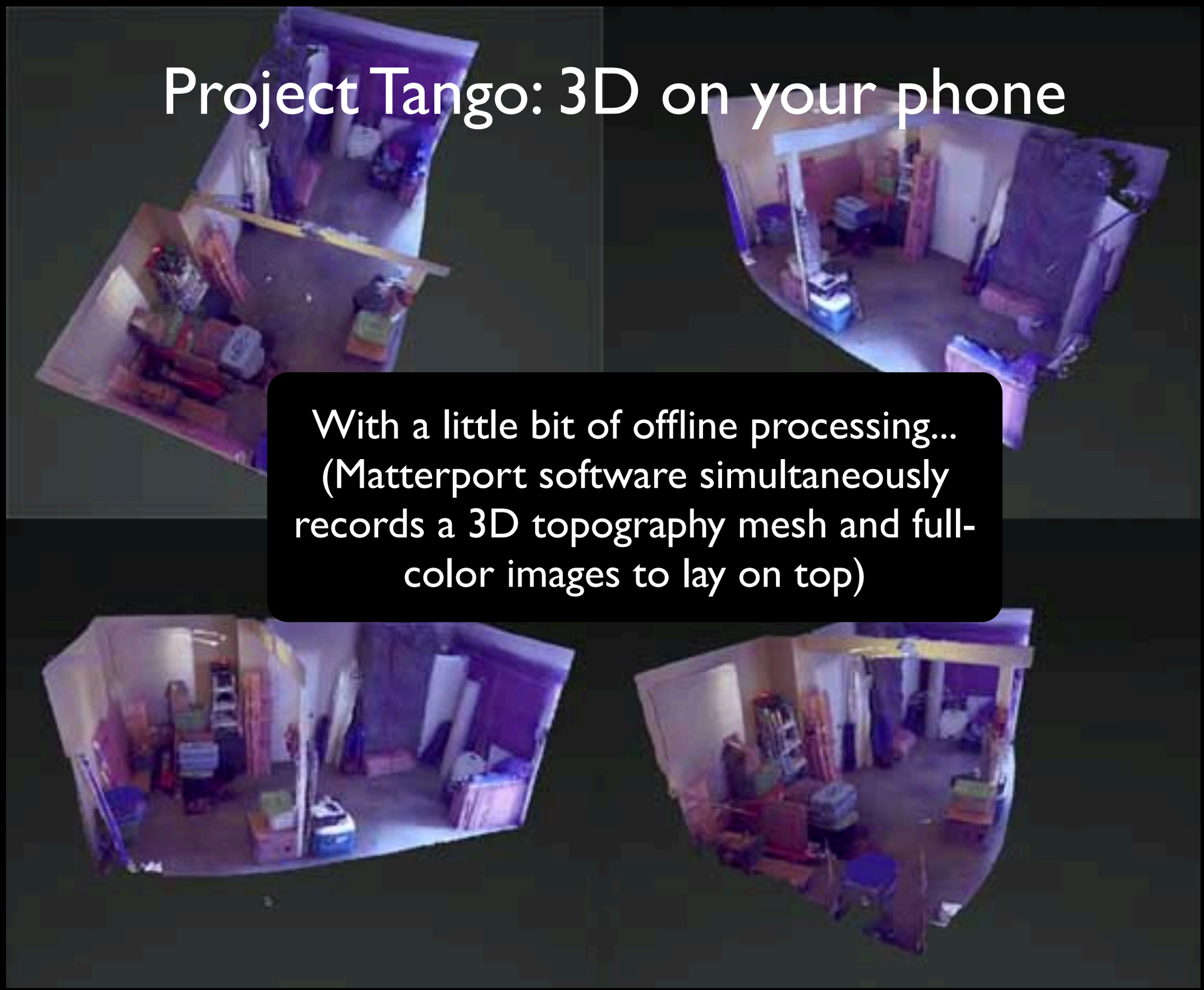




fused sensing + tracking data:
simultaneously estimate
environment + position of device

- no GPS, wifi, or bluetooth
- 1/4 million 3D measurements every second
- demo at 9:55 (https://www.google.com/events/io/io14videos/f47f19a5-63b9-e311-b297-00155d5066d7)

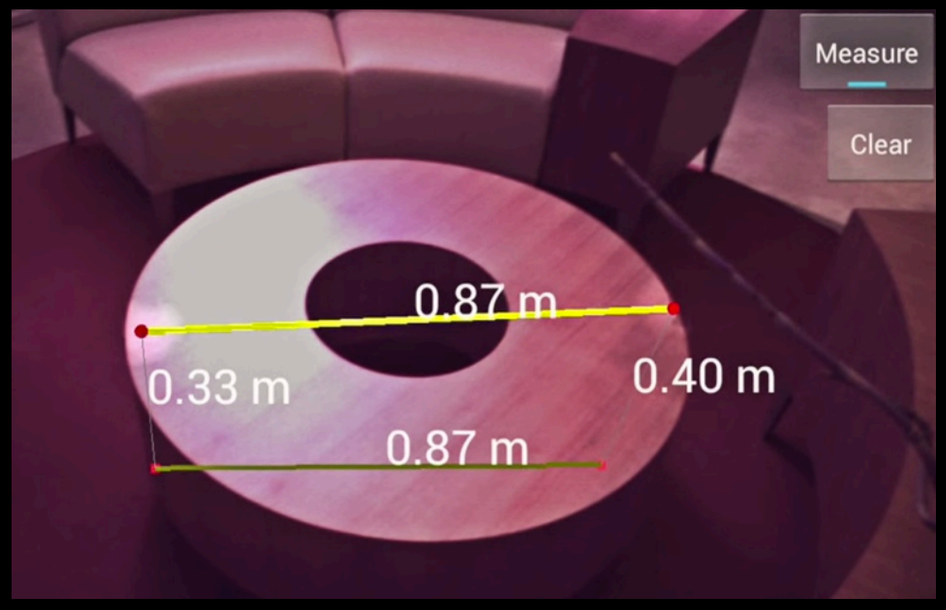
Project Tango: 3D on your phone



With a little bit of offline processing...
(Matterport software simultaneously records a 3D topography mesh and full-color images to lay on top)

- what storing data and a little bit of offline processing can do
- very dense mesh available from Tango

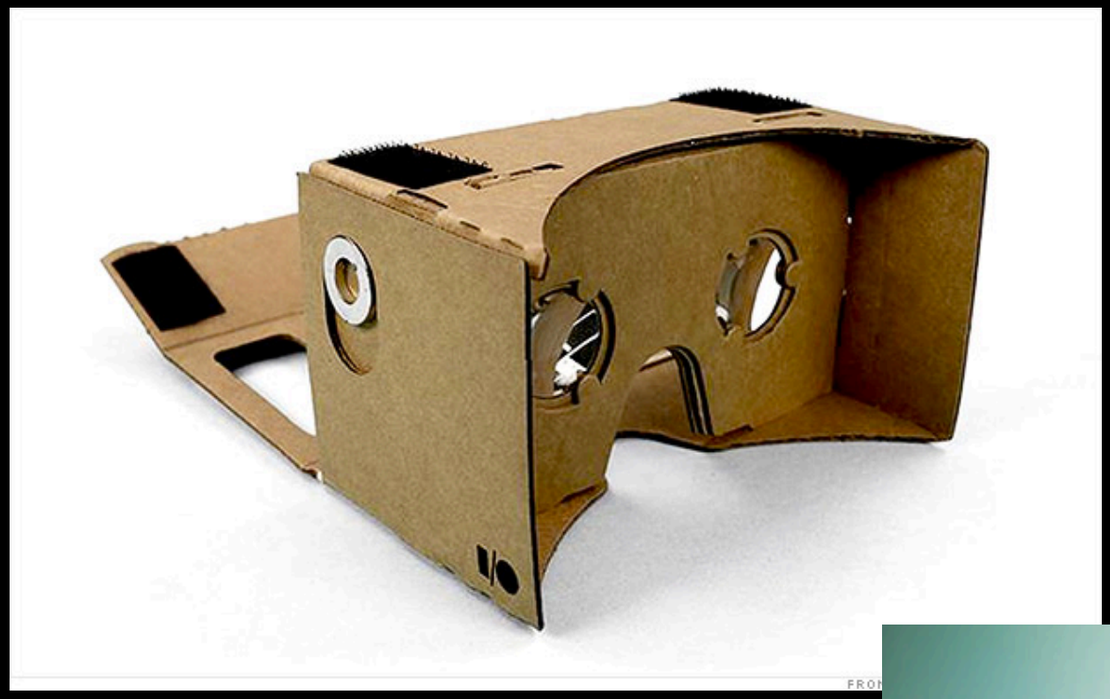
Project Tango: 3D on your phone



- consumer-scale device next year from LG
- dev kit available by application

Google cardboard: cheap virtual reality

Google cardboard: cheap virtual reality



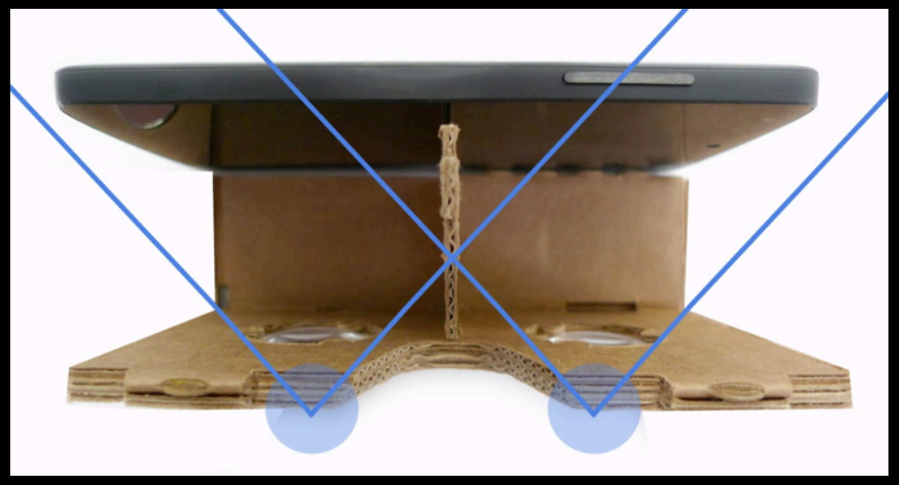
- cardboard shell
- lenses
- magnet clicker
- NFC tag

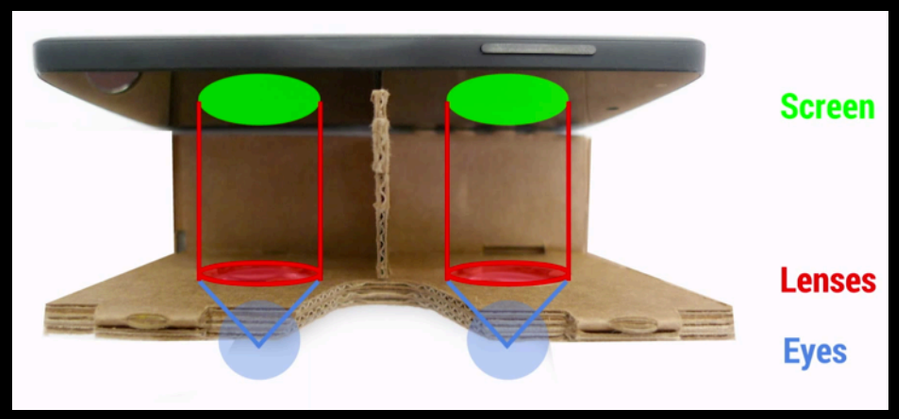
- key ingredient:

Android phone equipped with Google Play apps

– started as a 20% time project

Google cardboard: cheap virtual reality



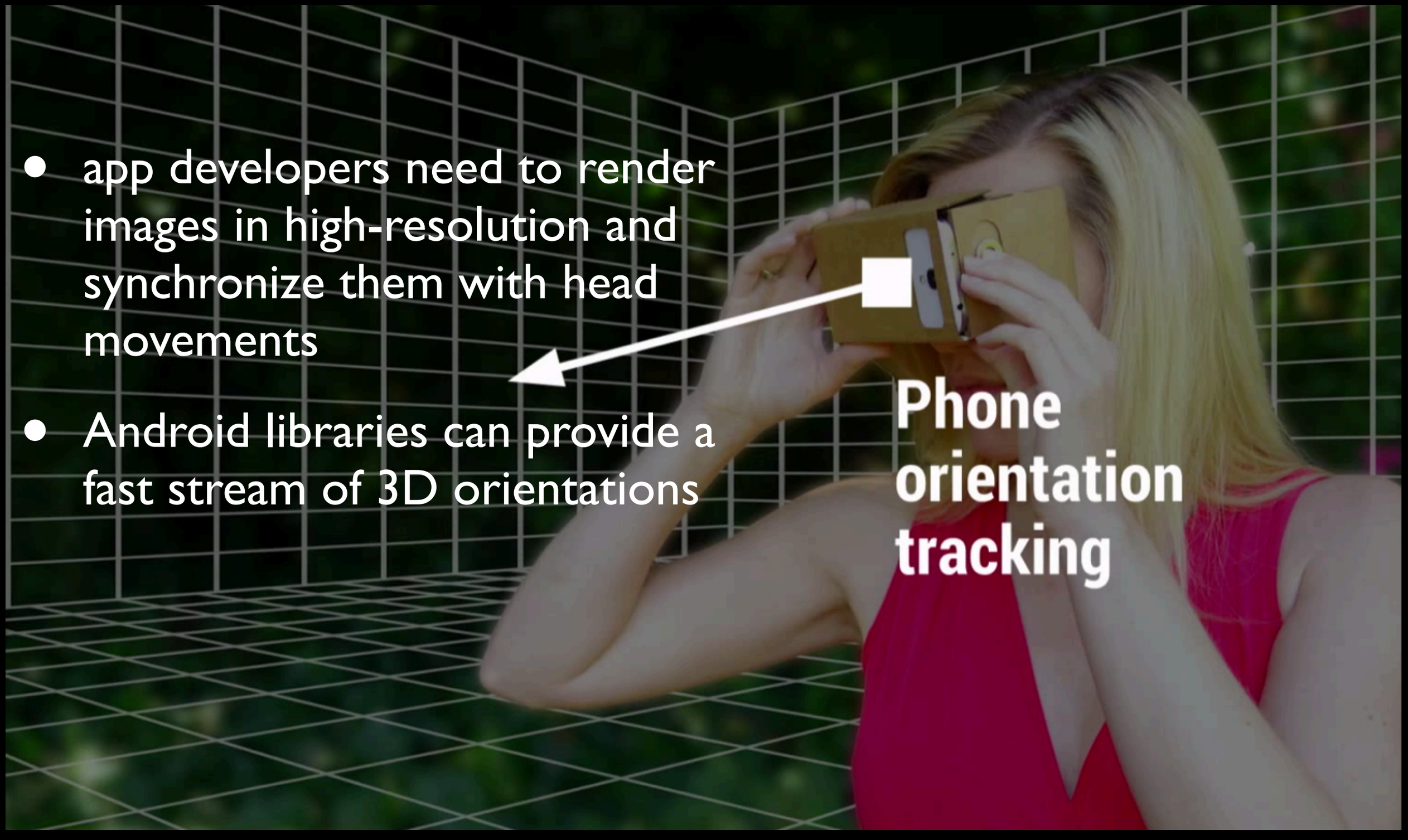


- lenses concentrate wide field of view on small area
- images need to be barrel-filtered to compensate for lens distortion

- can encode hardware modifications inside the NFC tag to render image appropriately
- experience 80deg FOV - like being a foot or two from a 50 inch TV screen

Google cardboard: cheap virtual reality

- app developers need to render images in high-resolution and synchronize them with head movements
- Android libraries can provide a fast stream of 3D orientations



Google cardboard: cheap virtual reality

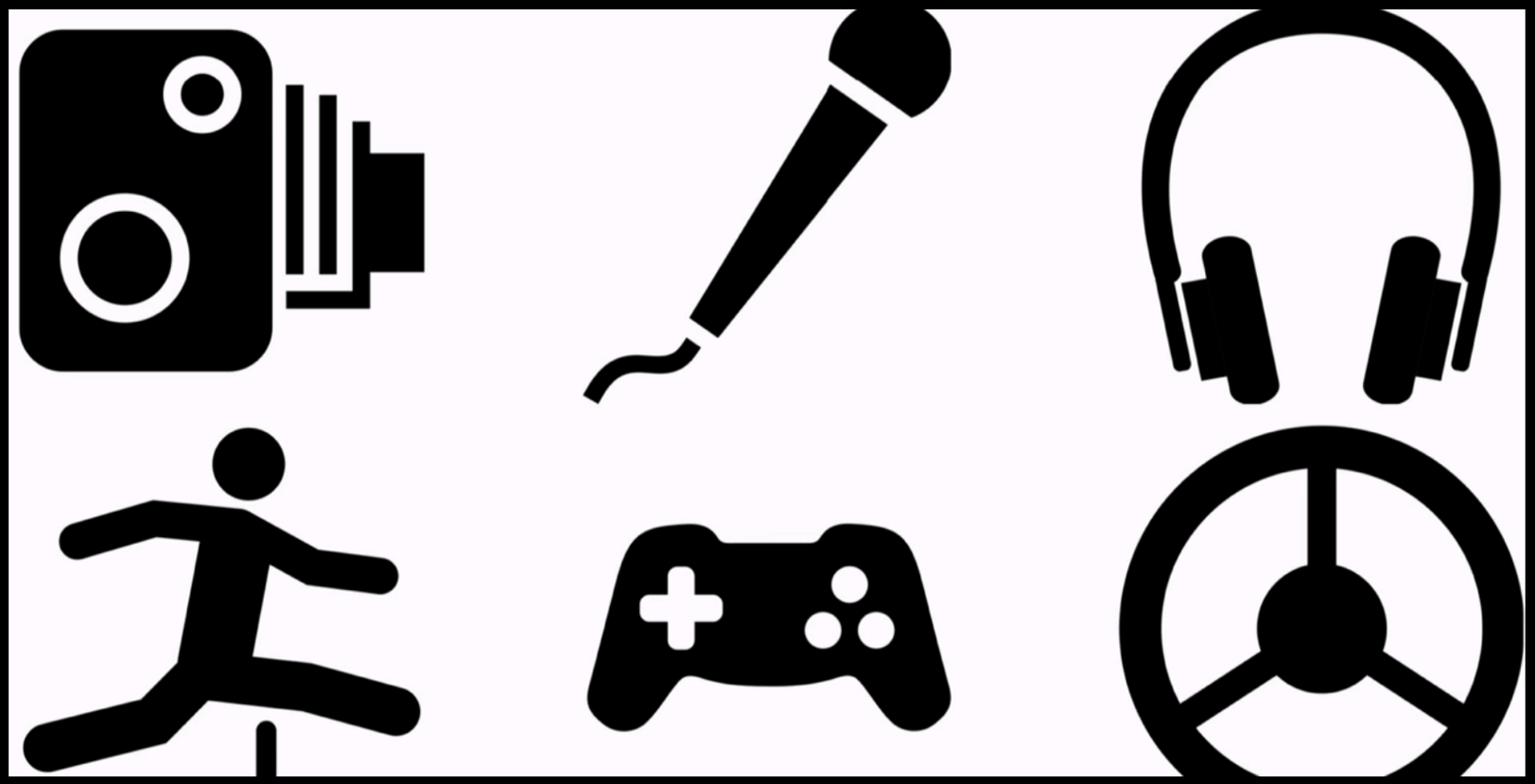
- ring magnet used as input control - picked up by phone's magnetometer
- NFC tag comes into contact with phone to set it to "VR mode"
- Apps already available: Google Earth, Your Guide, YouTube, Exhibit, Photo Sphere, Street "Vue", Windy Day

- magnet interferes with compass and absolute heading tracking

Google cardboard: cheap virtual reality

- Exhibit Demo: augmented reality that uses external camera to track manipulations of real object and render new objects in the same orientations on the phone screen

Google cardboard: cheap virtual reality



"this is just a placeholder... this is a piece of cardboard"

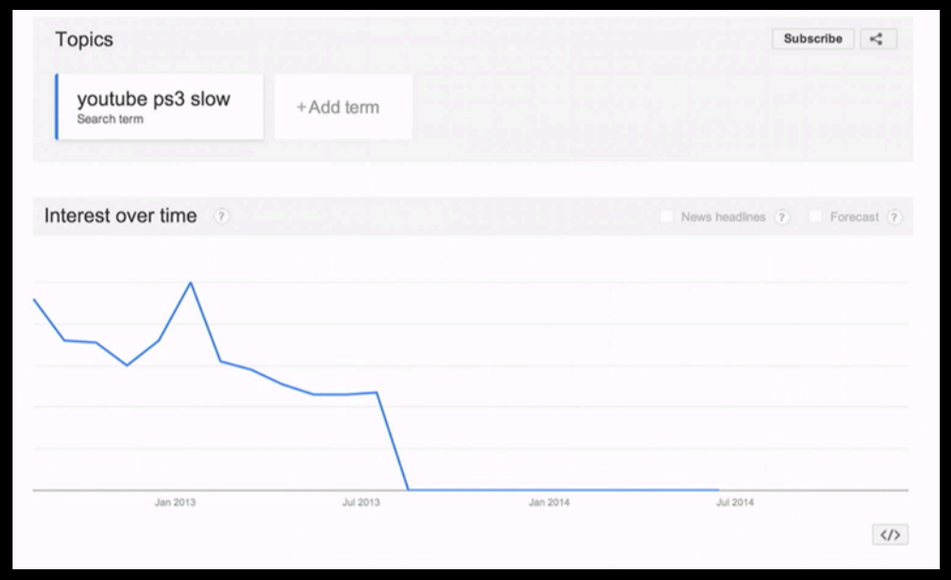
- accelerometer can detect jumps
- can interface with game consoles
- can add an immersive sound experience

YouTube: debugging at its finest

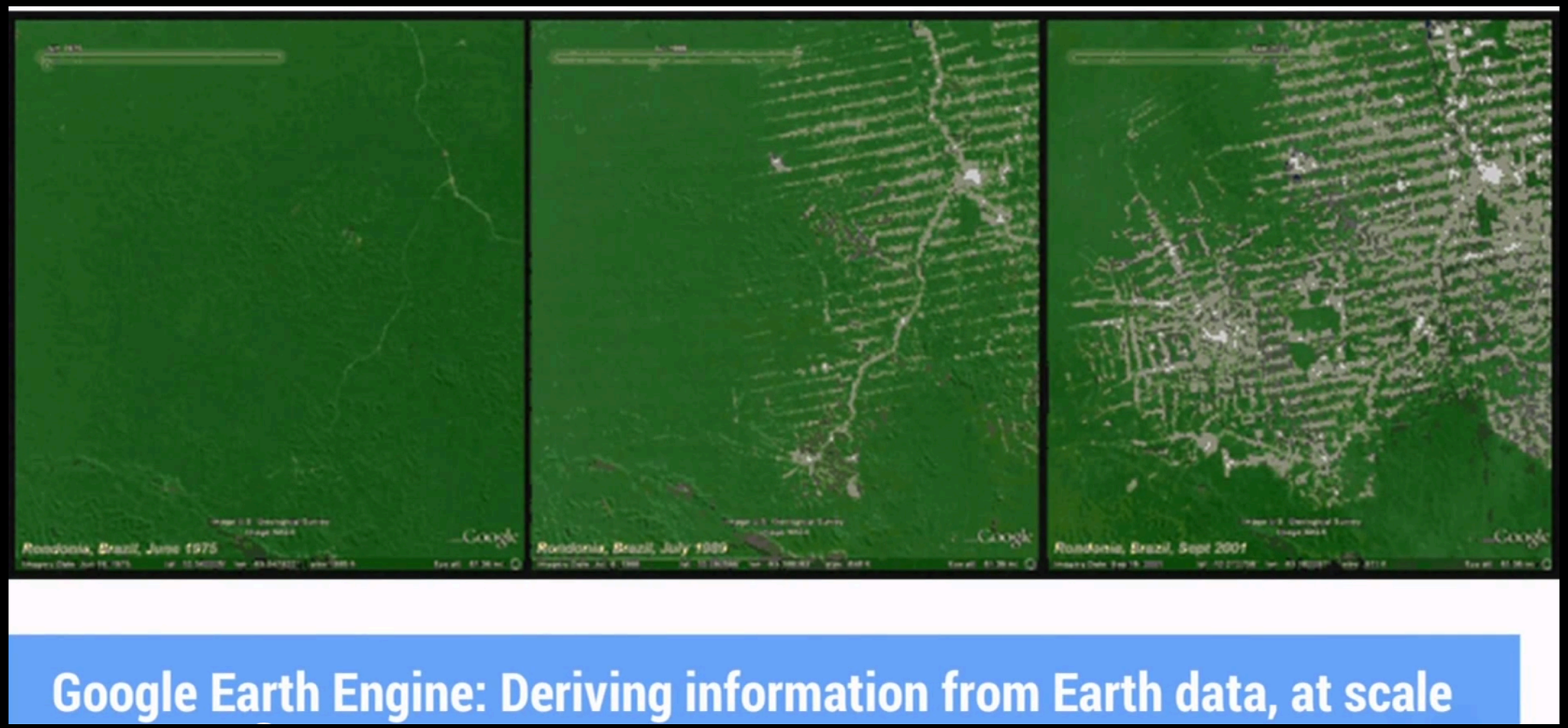
Push fast.
Learn fast.

Sharing code has serendipitous benefits.

- A/B testing at scale
- pushing code to production multiple times EACH WEEK
- deploy code across millions of devices
  - no-cost instant deployment
  - find problems quickly
- quantitative + qualitative metrics

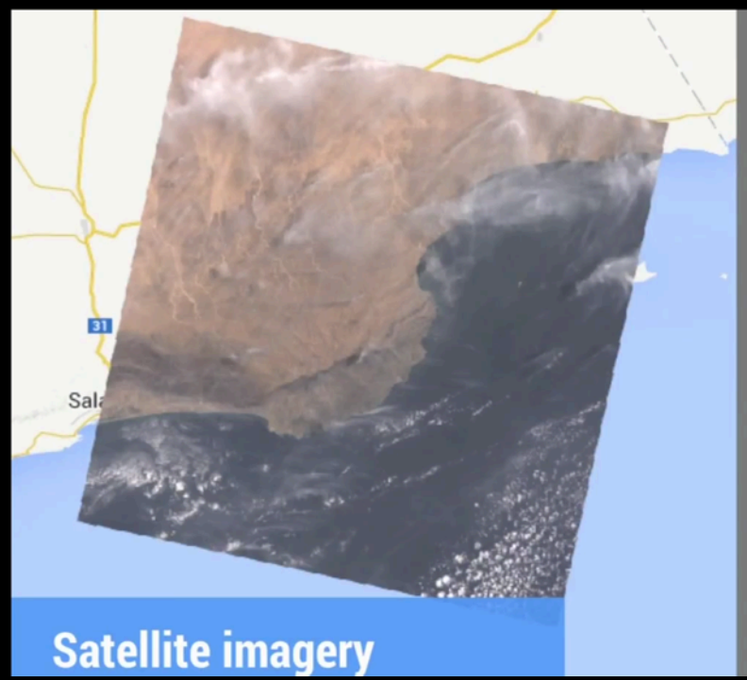


Google Earth Engine: maps for good



- earth data analysis done with a lot of data, and VERY fast

Google Earth Engine: maps for good



One Landsat 8 image:
- 64M pixels (30m resolution)
- 10 spectral bands
- 12 bits/band
- 600 images/day

MORE THAN 3.6M IMAGES FROM 40 YEARS OF LANDSAT.

Many other satellites with different combinations of spatial resolution, spectral bands, collection frequency.

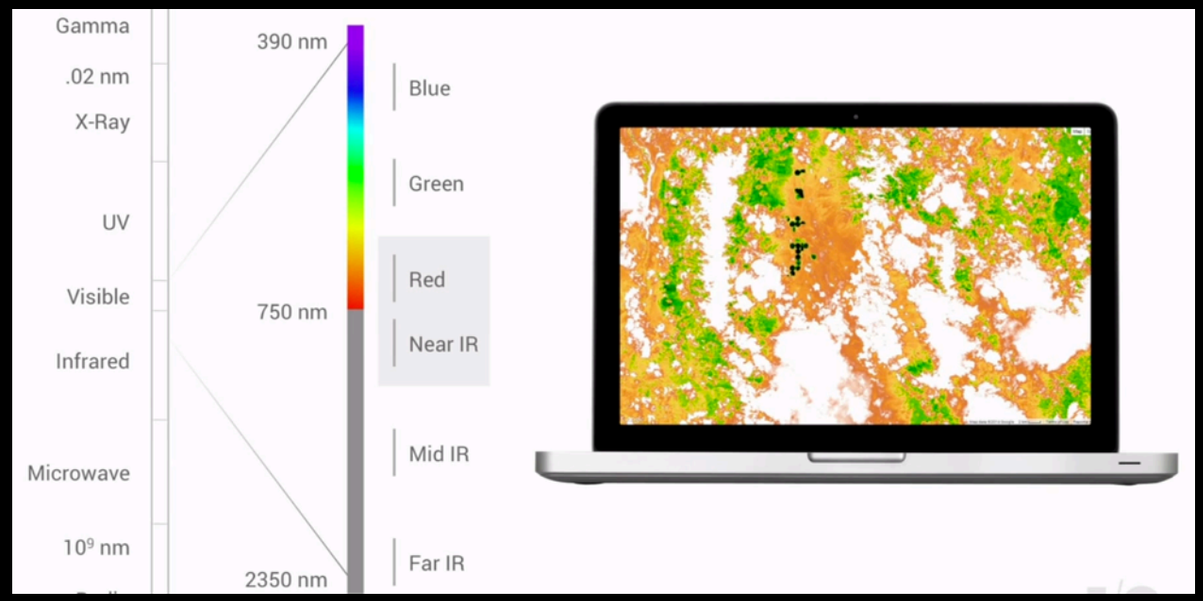
- data used to be stored on tapes in vault in South Dakota
- expensive for researchers to access

Google Earth Engine: maps for good

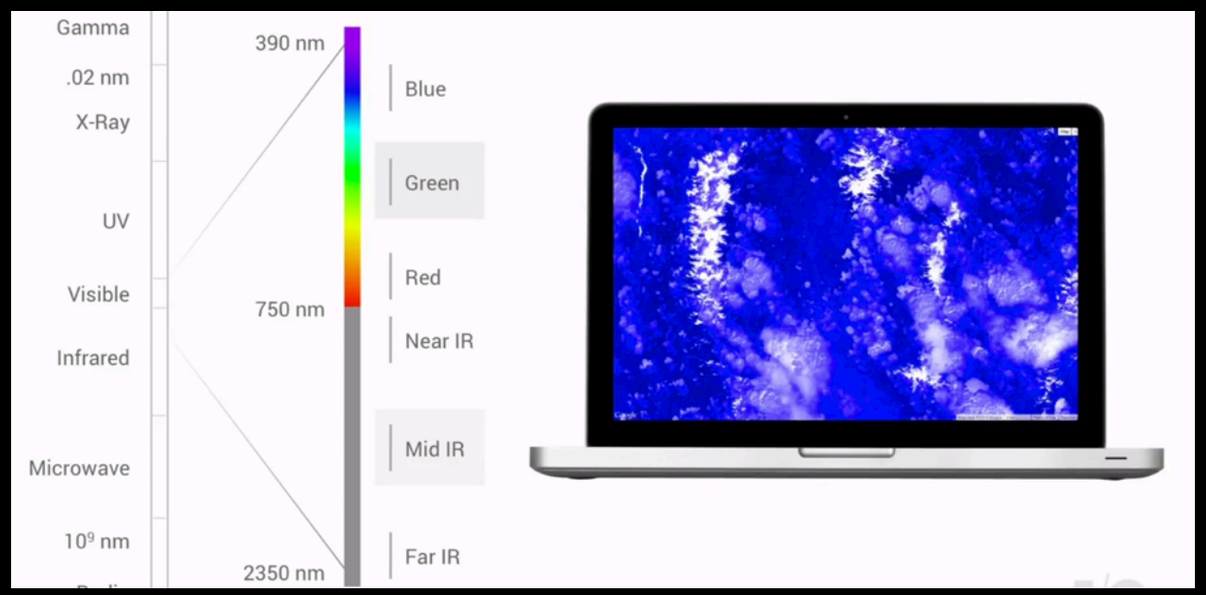
- data became free in 2008 and available for data mining (via cloud computing!)
- petabytes of data

Google Earth Engine: maps for good

discriminate vegetation

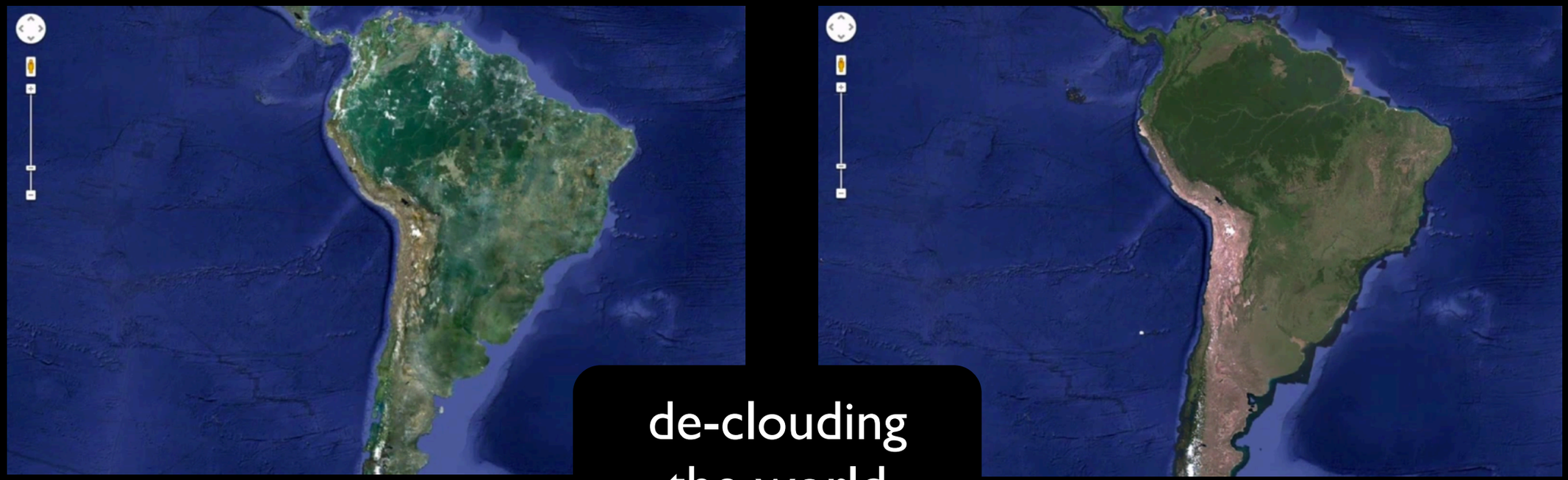


discriminate ice+snow

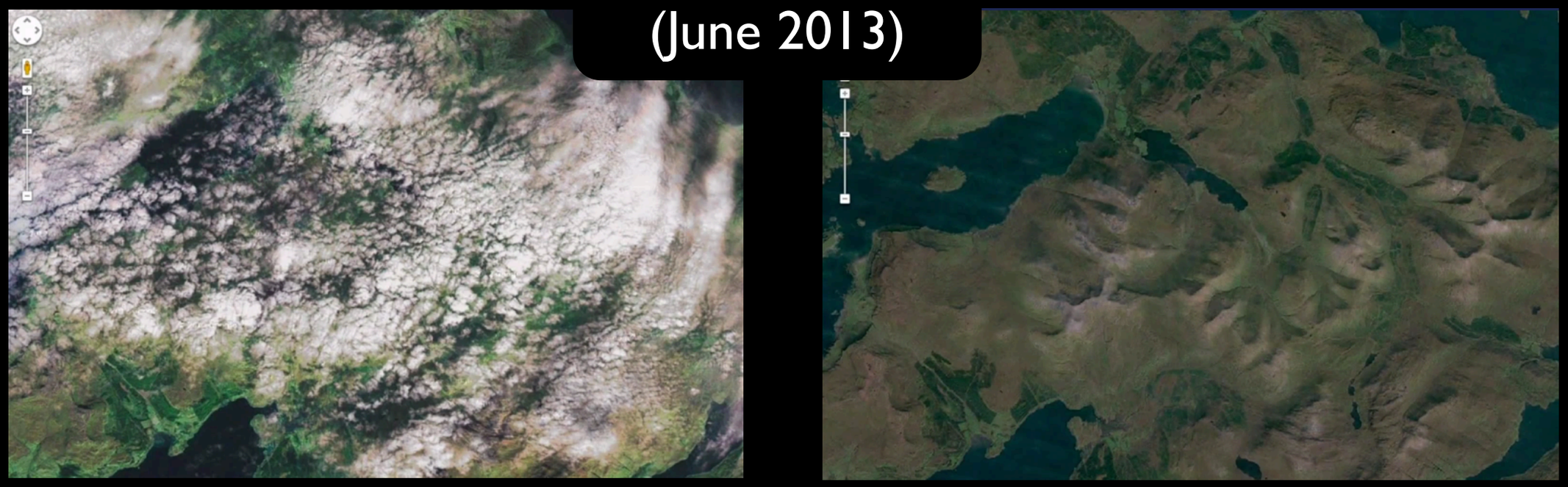


- committed to storing all spectral bands of information
- also: weather, elevation, etc. data

Google Earth Engine: maps for good



de-clouding
the world
(June 2013)



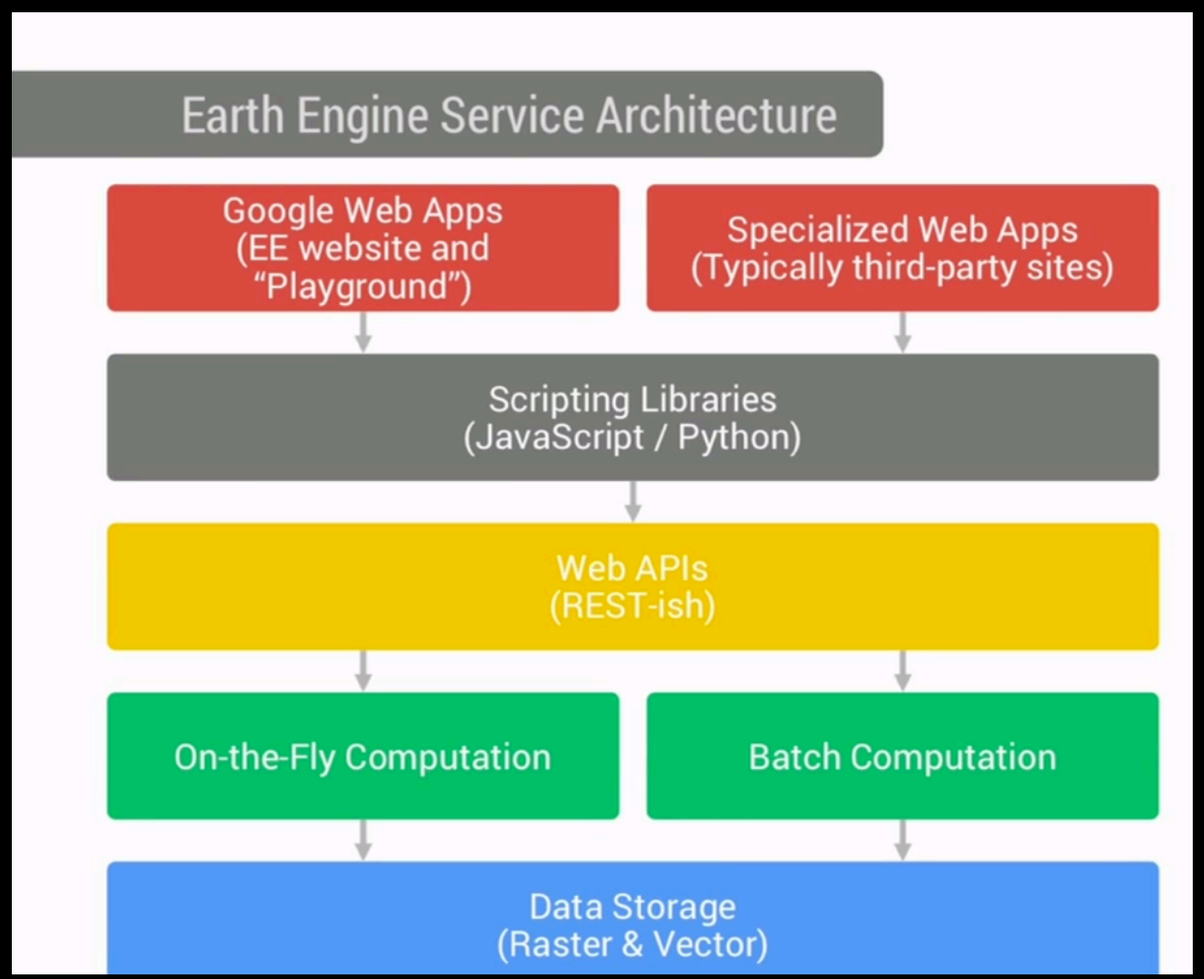
- API available to do things like this in 4 lines of code

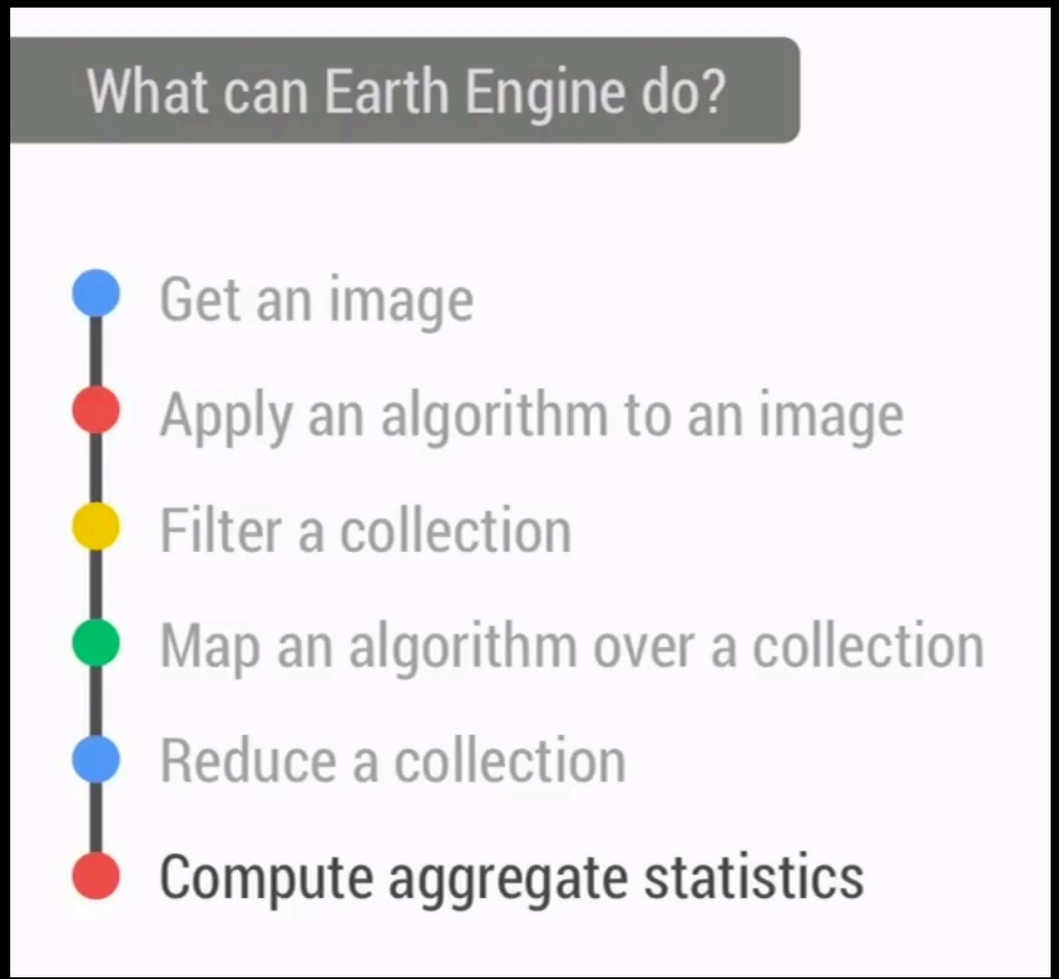
Google Earth Engine: maps for good

- urban expansion
- desertification
- deforestation
- climate change

https://earthengine.google.org/#intro

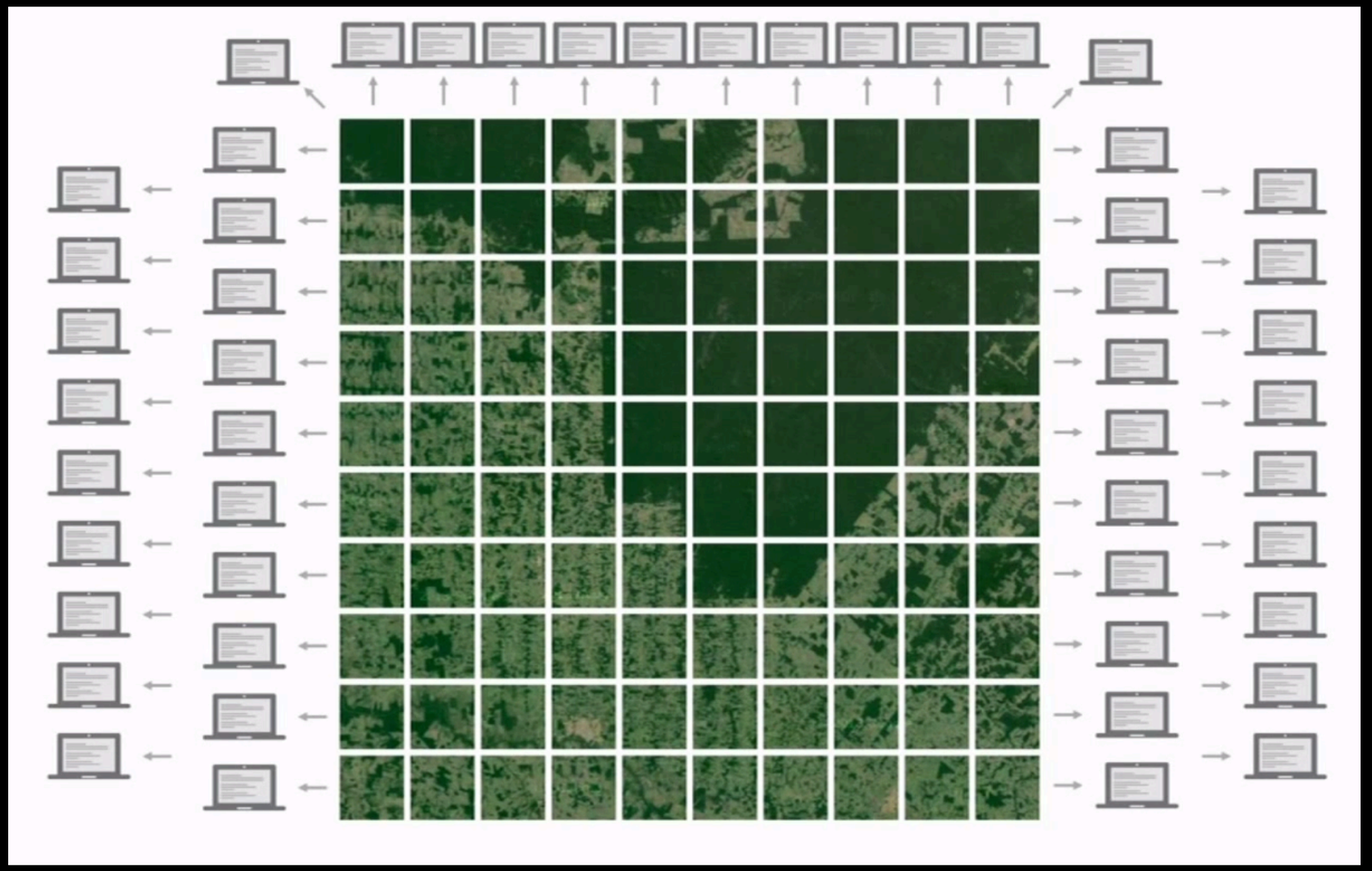
Google Earth Engine: maps for good





- hundreds of data analysis library functions available
- built for really BIG data
- can analyze public Earth data or privately-uploaded data (using Google’s compute resources!)

Google Earth Engine: maps for good



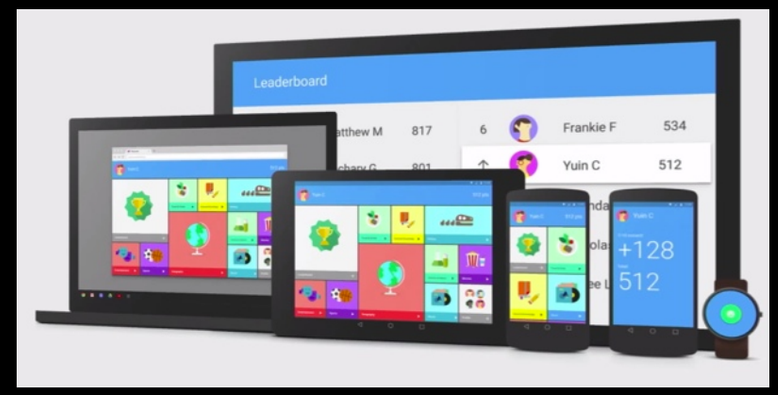
Google for specialists
("this is not a tool that lets you send 'YO' to someone")

- machine learning infrastructure available on back-end
- watch at 24:55-27:25 for real-time demo: https://www.google.com/events/io/io14videos/f7dab6e9-19d7-e311-b297-00155d5066d7
- experimental API, sign-up, tutorials, documentation available

Google Earth Engine: maps for good

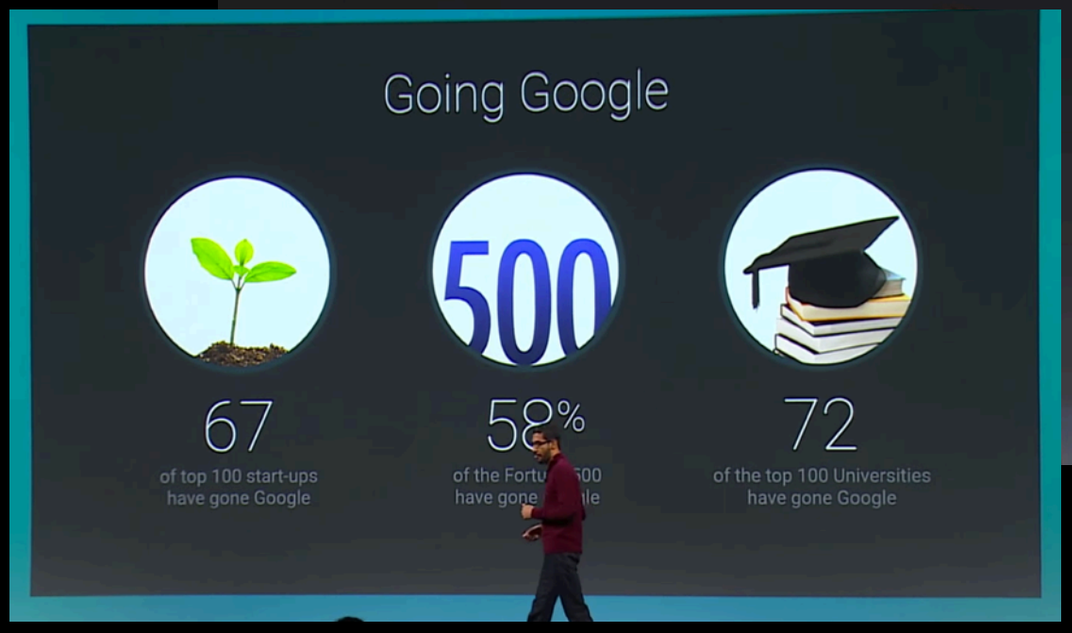
- where is MIT?

Some trends:



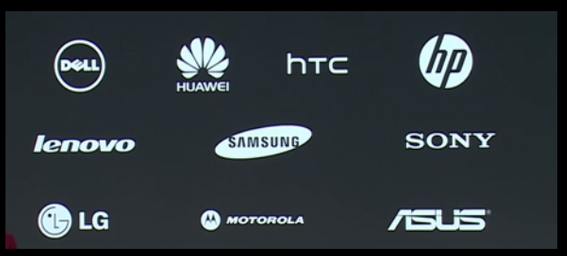
- “seamless”
  - synchronized devices
  - apps treated same as webpages
  - transition across environments - auto, VR, etc.
- “intuitive”
  - material design principles
  - apps and devices adapt to human motion
- “ubiquitous”
  - wearables, phones, computers, TVs, autos, etc., etc.

You're either with us, or... you're with us



Android TV

Android Phone



Chromebooks

Android Auto

etc., etc., etc...

Looking forward...

- little on Glass, waiting for developments next year
- Google Home: purchased Nest Labs (smart thermostat) and Dropcam (wifi remote video monitoring technology for the home)
- Android creator Andy Rubin leading robotics project after Google acquired Boston Dynamics
    - 8th robotics company acquired in 6 months (end of 2013)
- long-term investments in AI: Geoffrey Hinton, Ray Kurzweil, DeepMind

Links:

- full keynote: https://www.google.com/events/io/schedule/session/12fb26f5-e2e1-e311-b297-00155d5066d7
- keynote in < 9 minutes: https://www.youtube.com/watch?v=EgeMgjpIANY
- project Ara commerical at 6:04: https://www.youtube.com/watch?v=0He3Jr-fZh0
- demo of Tango at 9:55: https://www.google.com/events/io/io14videos/f47f19a5-63b9-e311-b297-00155d5066d7
- Earth engine demos: https://earthengine.google.org/#intro