

# Google I/O 2015

Zoya Bylinskii

<https://events.google.com/io2015/videos>

with  
research  
outlooks

Friday, June 12, 15

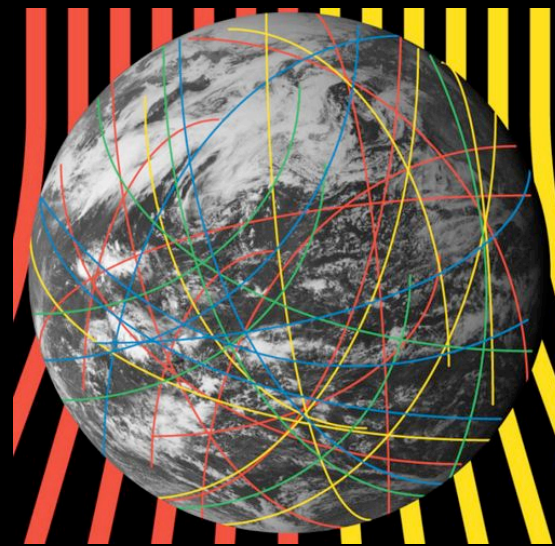
- a yearly 5,000+ conference for developers and tech enthusiasts
- watching parties available globally
- keynote and many other sessions posted online

# Key trends (I extracted) from the keynote

- the next billion users
- the internet of things
- context-aware apps

# Thinking about the next billion users

- cheaper phones (AndroidOne)
- optimized apps, search, and loading
- offline support
- new use cases



computer science  
more in demand as  
billions of new people  
come online

hot research  
directions: optimizing  
efficiency of storage,  
transmission, and  
display of data

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- already over a billion users for Chrome, Android, and YouTube, almost a billion users for Gmail
- 2.8 billion people online (out of 7 billion)
- now tackling developing markets, spotty connectivity, small budgets
- just six countries, including China, Mexico, and Brazil, will be responsible for 1.2 billion smartphone sales by 2016, but many of them lack pervasive Internet access
- \$100 AndroidOne phones
- project Loon providing mobile broadband (balloons stay up for 400 days)

# 4000+ apps for wearables already available



want  
impact? start  
thinking about  
converting your  
research into mobile  
and wearable  
apps

# Internet of Things



Tom Tuohy

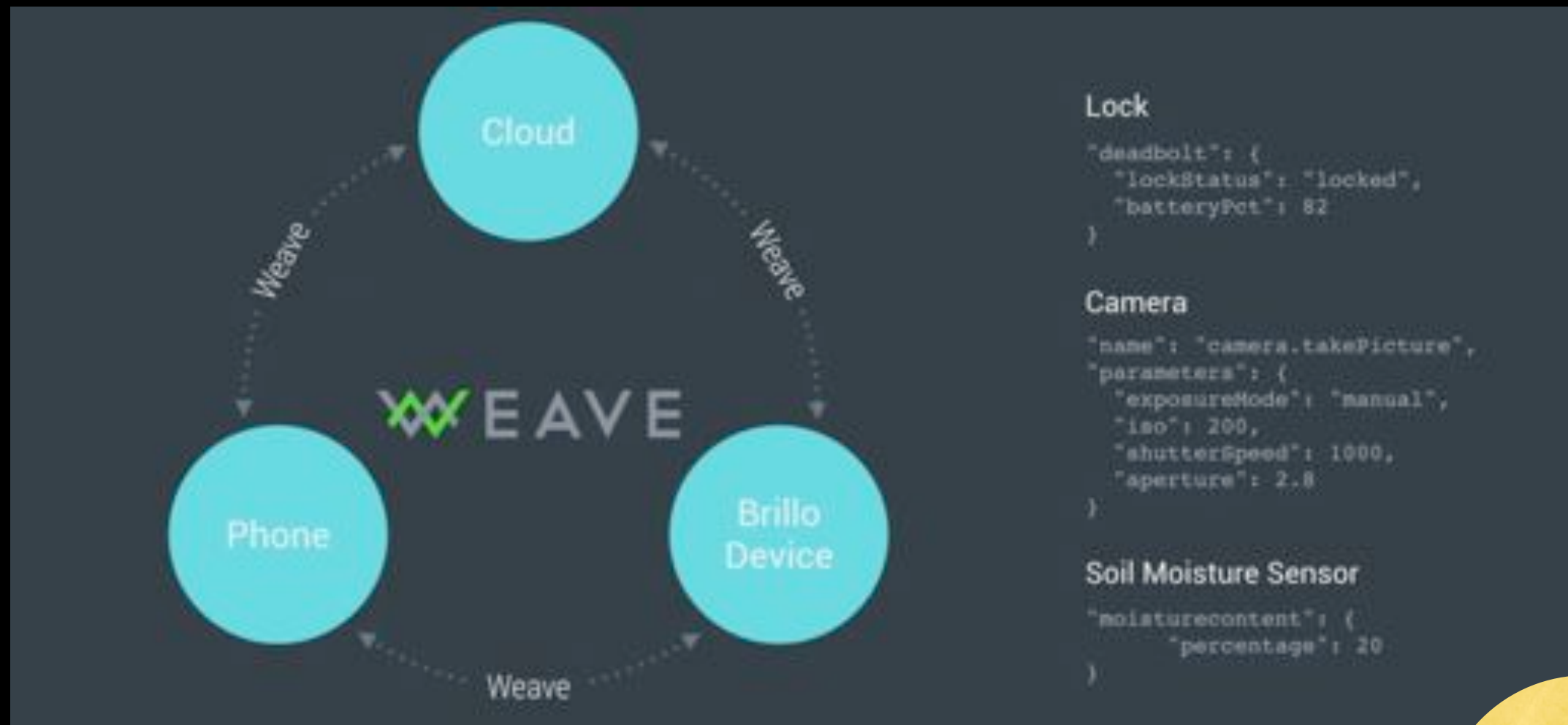
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- connected devices, seamless manipulation
- control, adjust, monitor all your devices using similar (mobile) interfaces



# Internet of Things

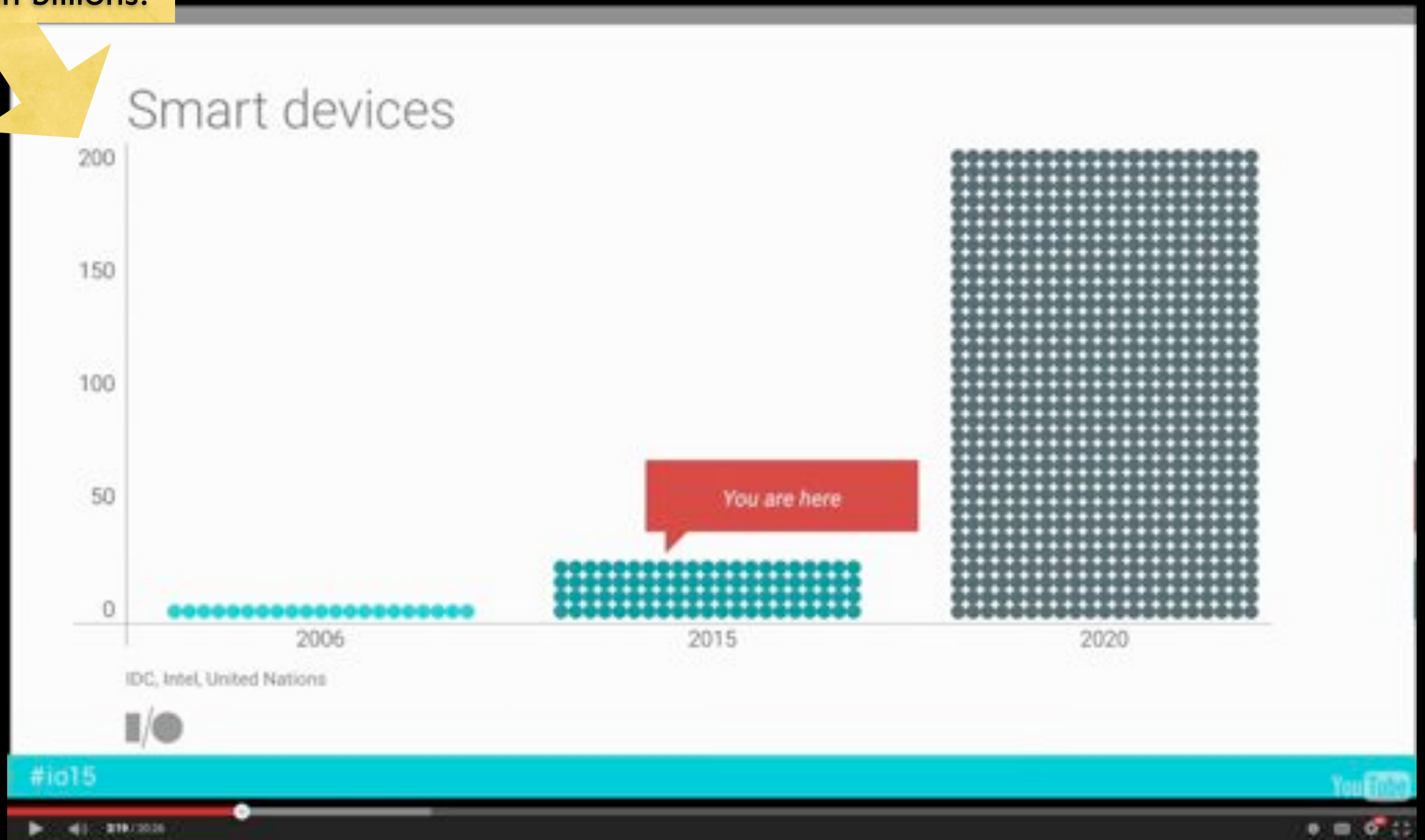


consider all the  
sensor and device  
use data that will  
soon be available

- streamlining for the developer
- just released: specially-designed OS (Brillo) and communication platform (Weave)

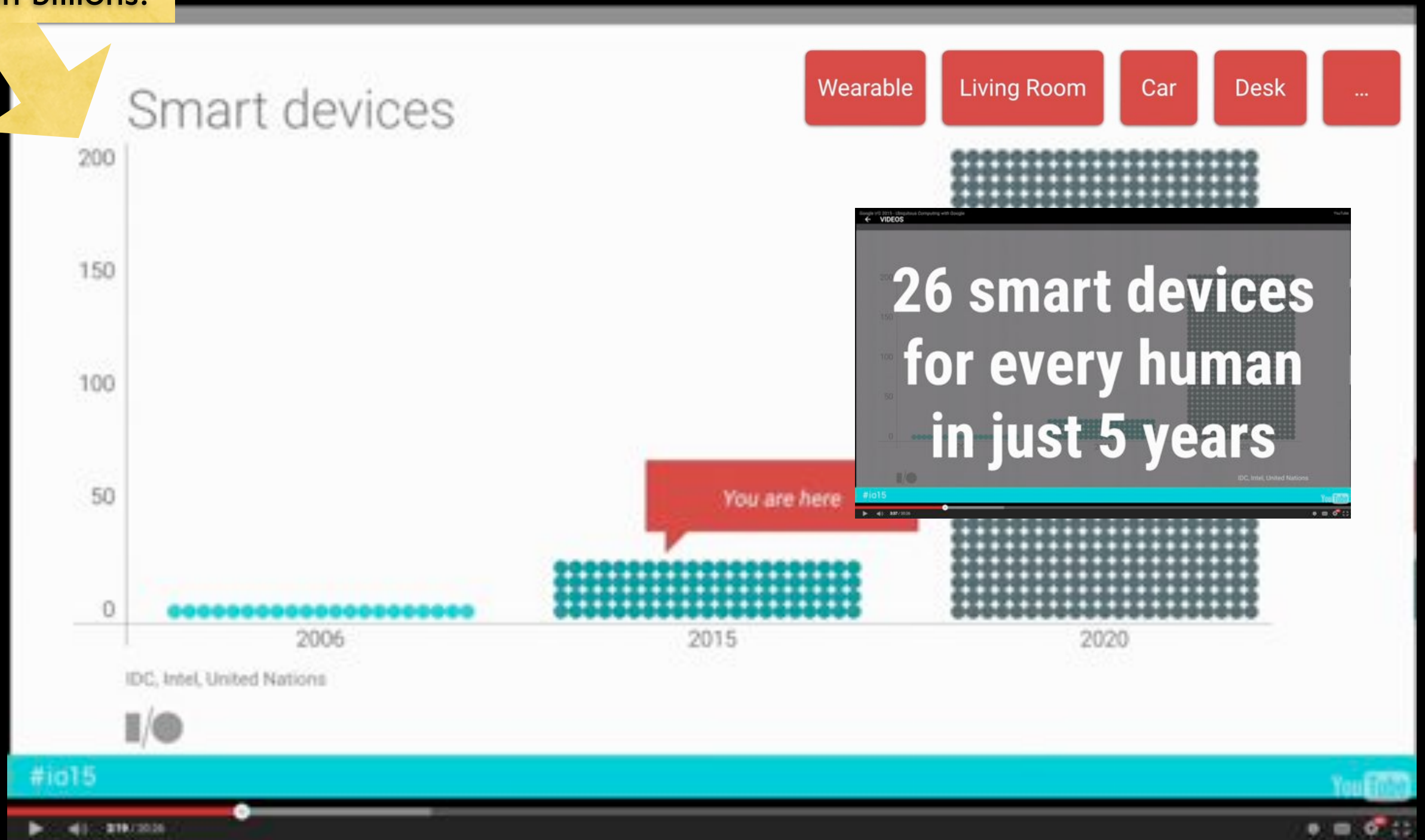
# looking into the future of smart devices...

in billions!



# looking into the future of smart devices...

in billions!



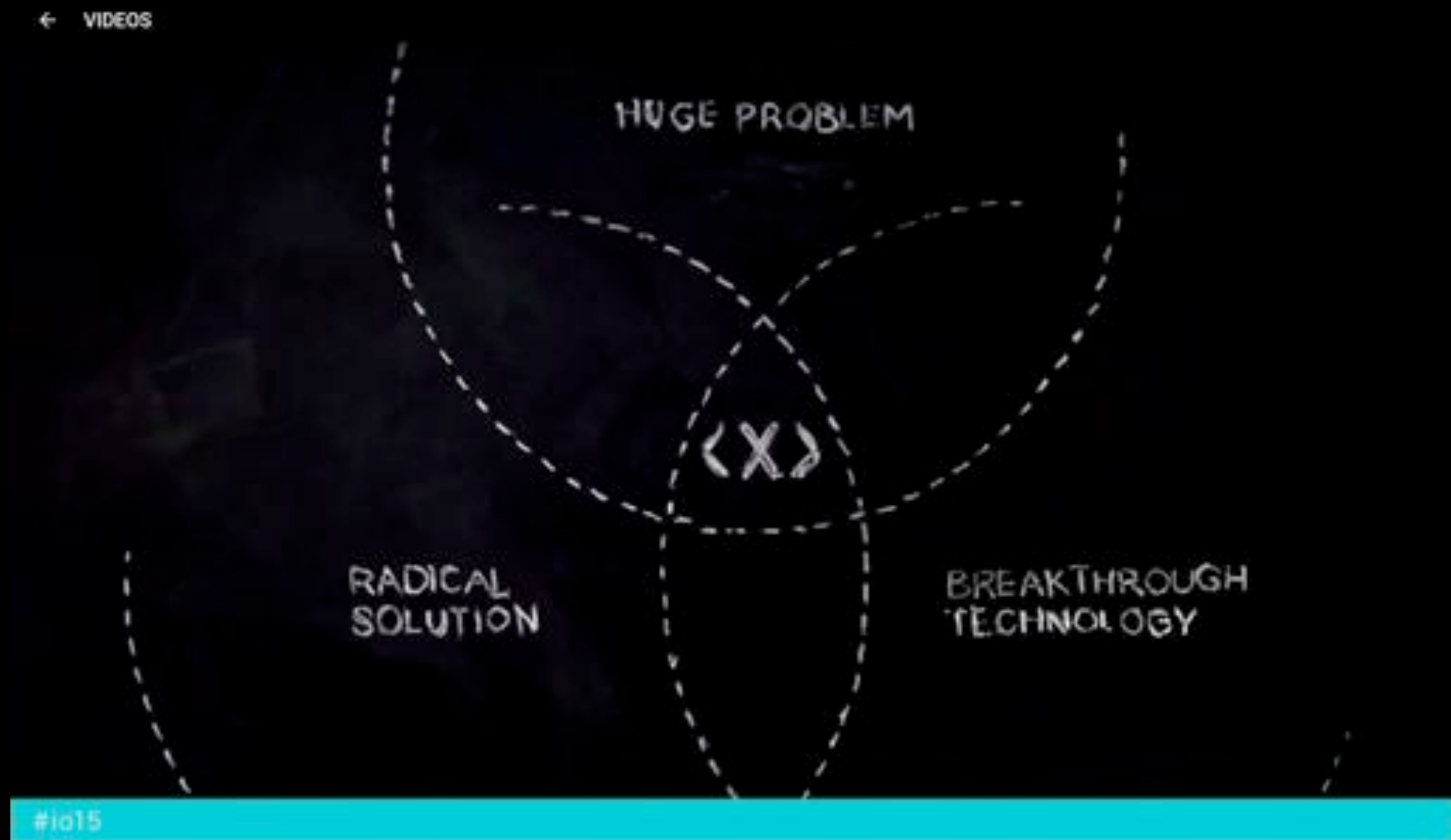
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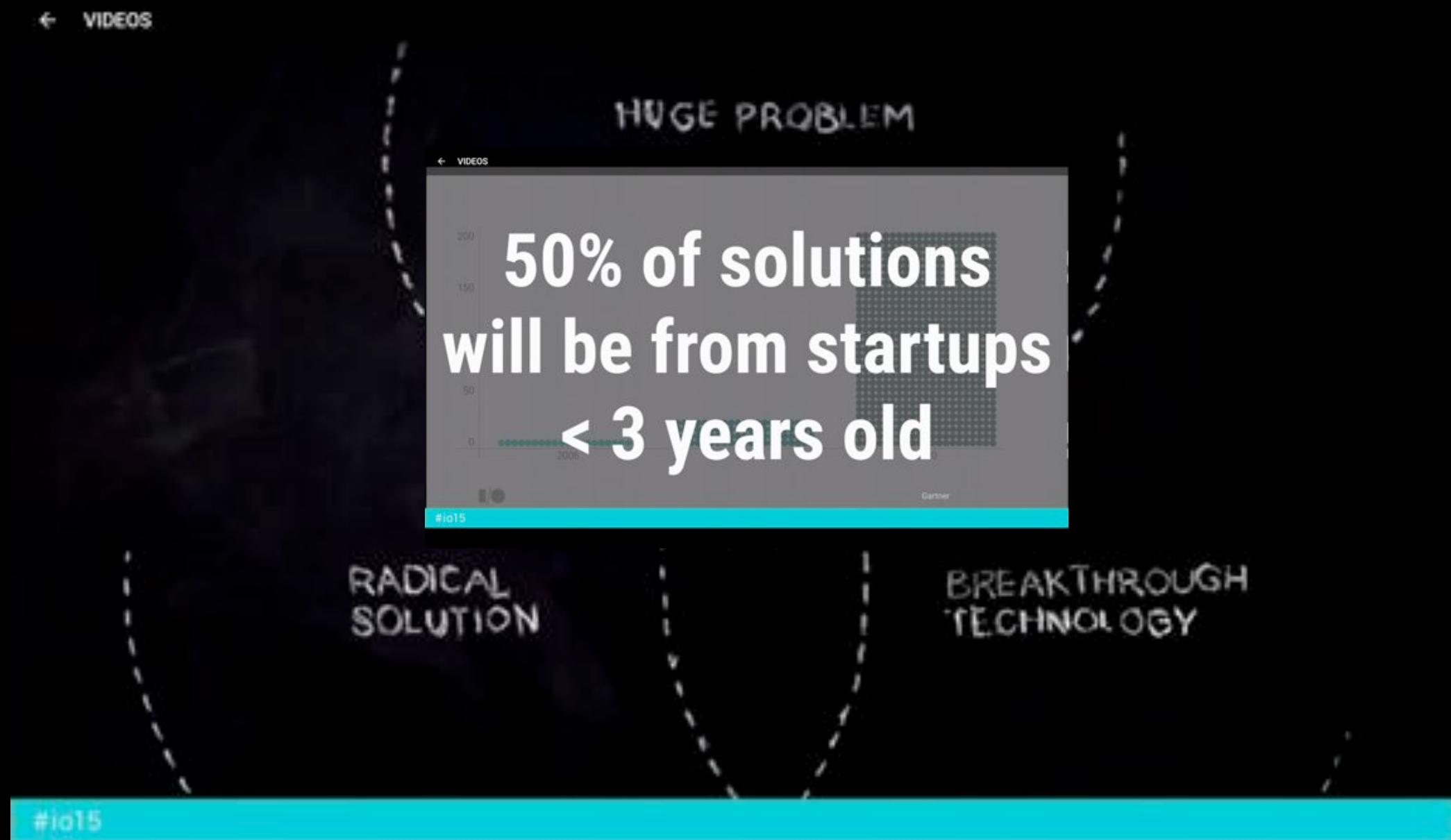
how'd they estimate 26? who knows (but then again, it's Google, so they probably know better than you exactly how many devices you will buy and how much your neighbor will buy)



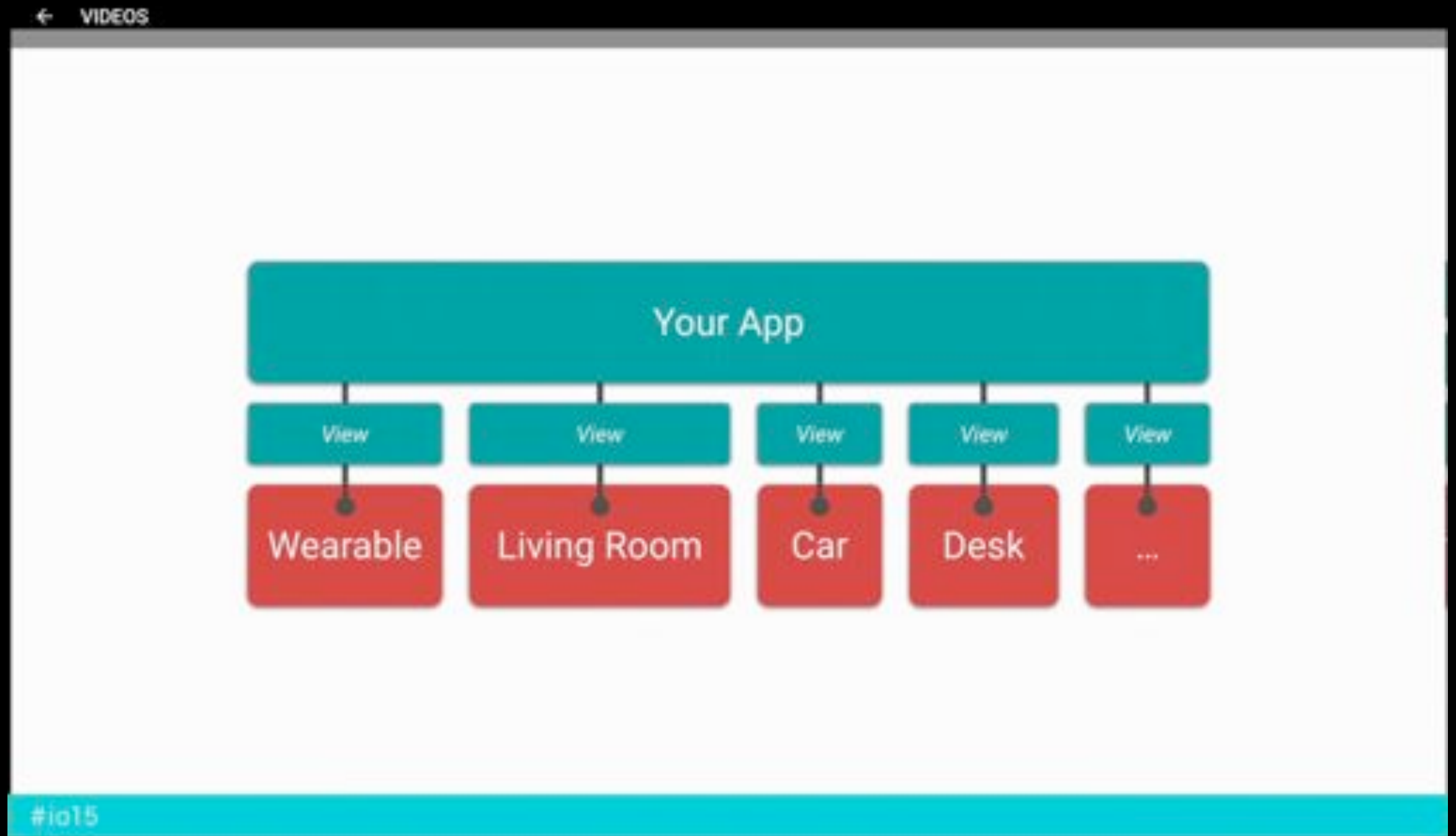
# looking into the future of tech innovation...



# looking into the future of tech innovation...

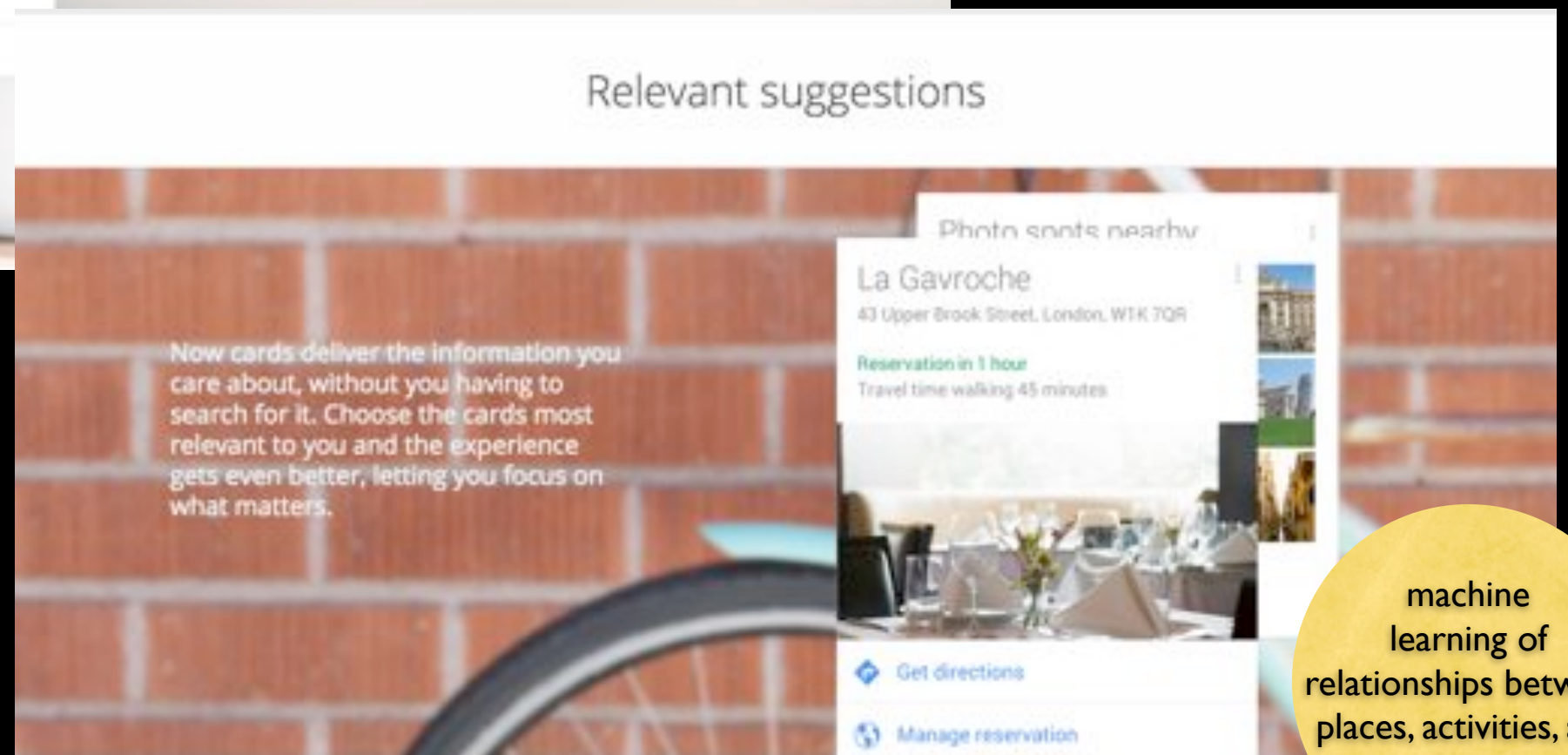
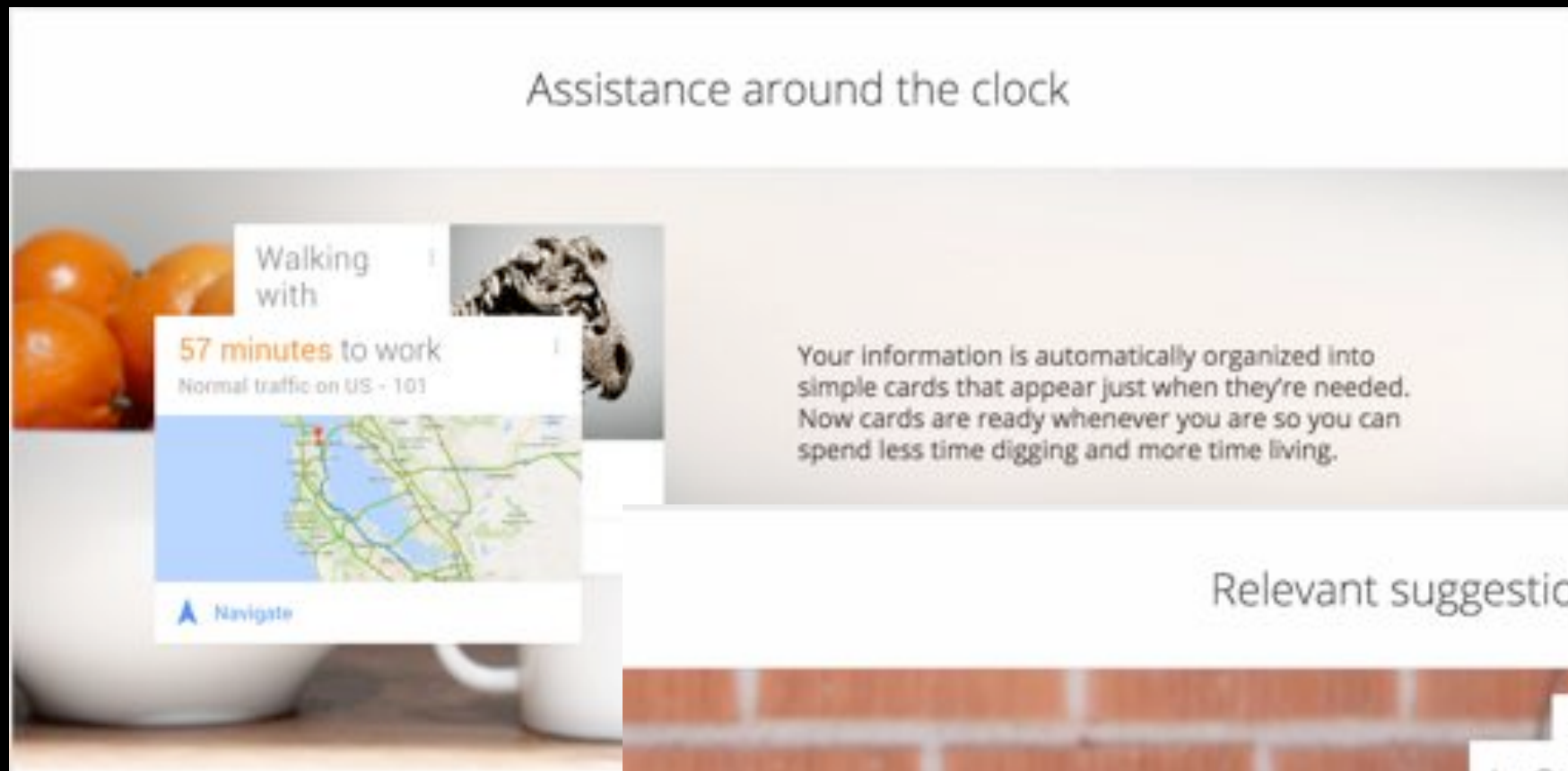


# trending: ubiquitous computing



– developers need to start thinking now about developing for the future (the internet of things)

# Context-aware apps: Now on Tap

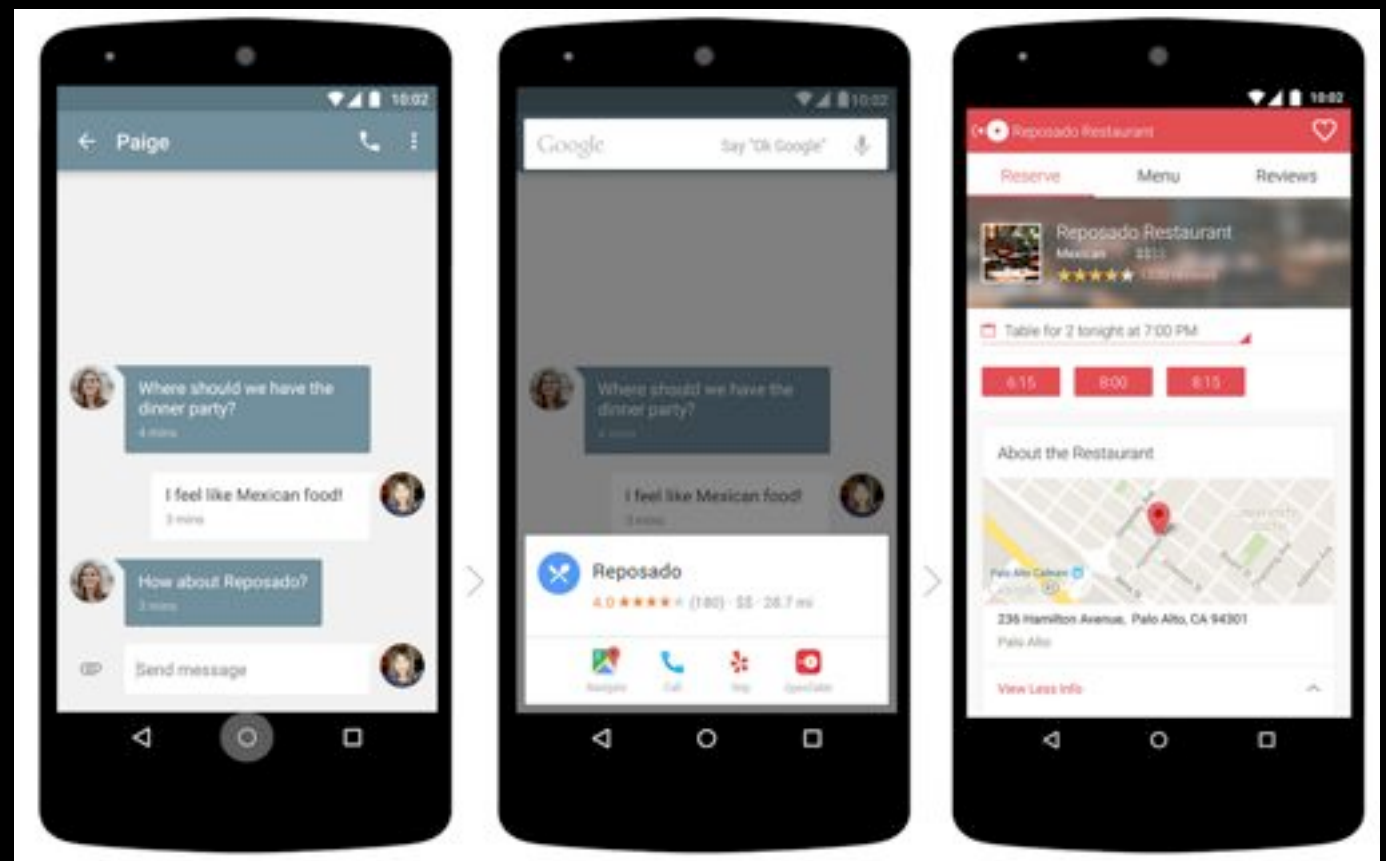
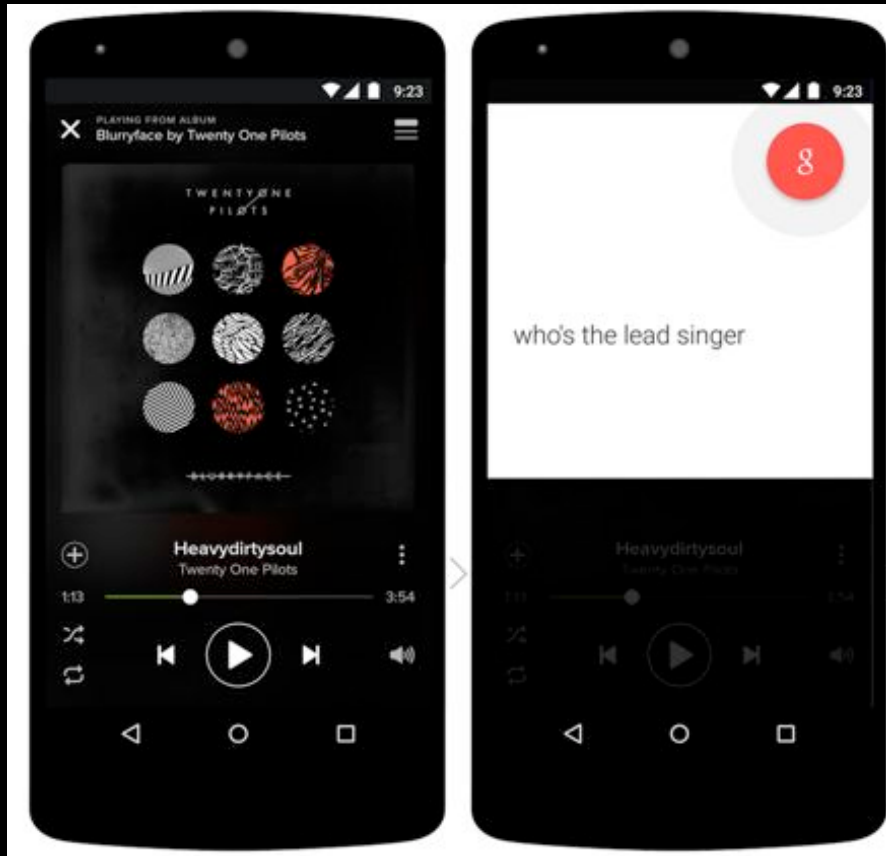


machine learning of relationships between places, activities, and objects

- proactively bringing you answers
- relevant data for your current location and activity
- using machine learning that knows which activities take place in which locations



# Context-aware apps: Now on Tap



# Popular use-case for tech: photos

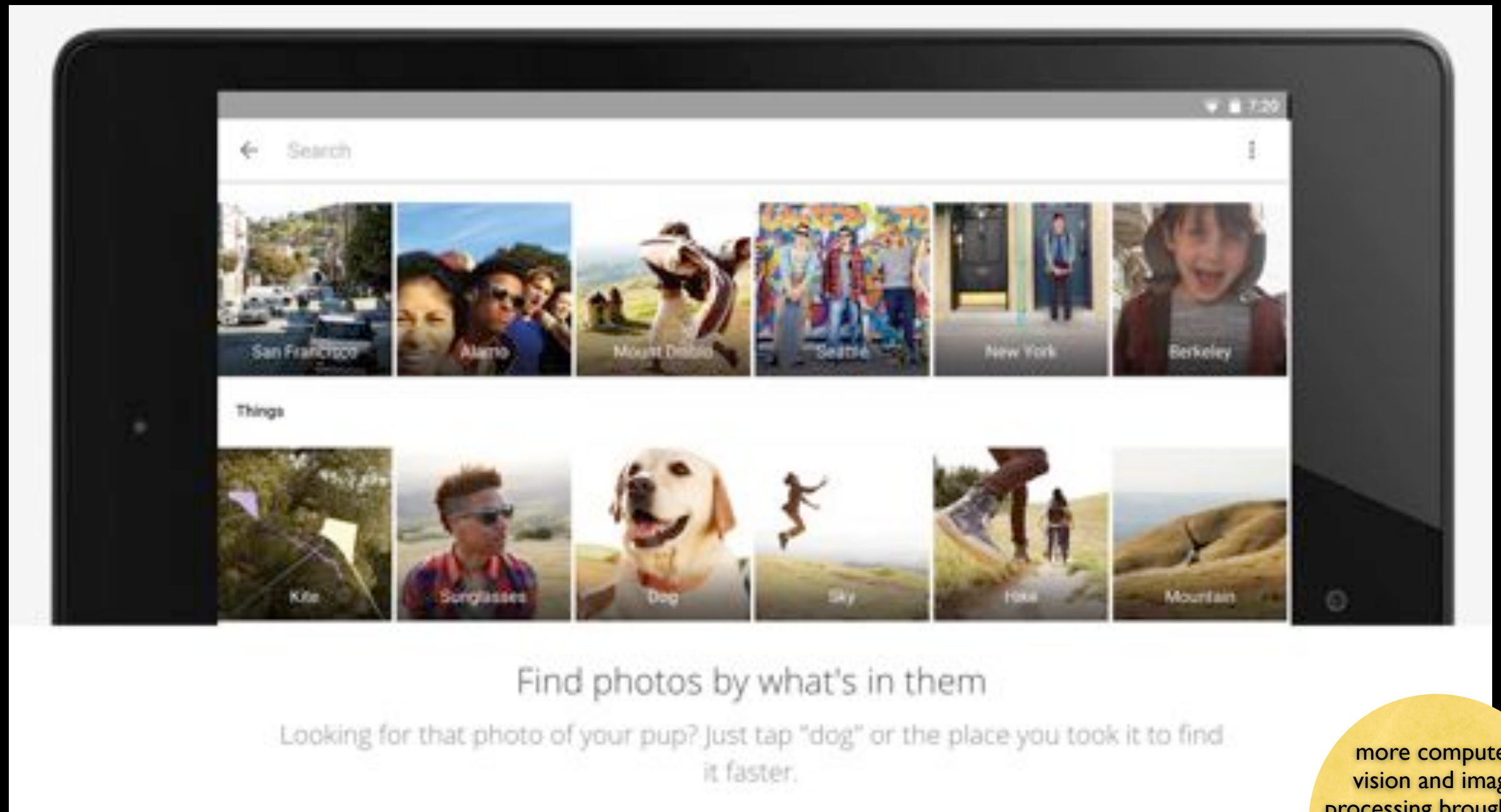
UNLIMITED photo storage announced

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- as part of Google photos
- Google first to cross “race to zero” finish line
- other companies may follow suit to remain competitive in terms of user base –> may see competition in the form of more developments in terms of organization, sharing, and displaying of photo collections

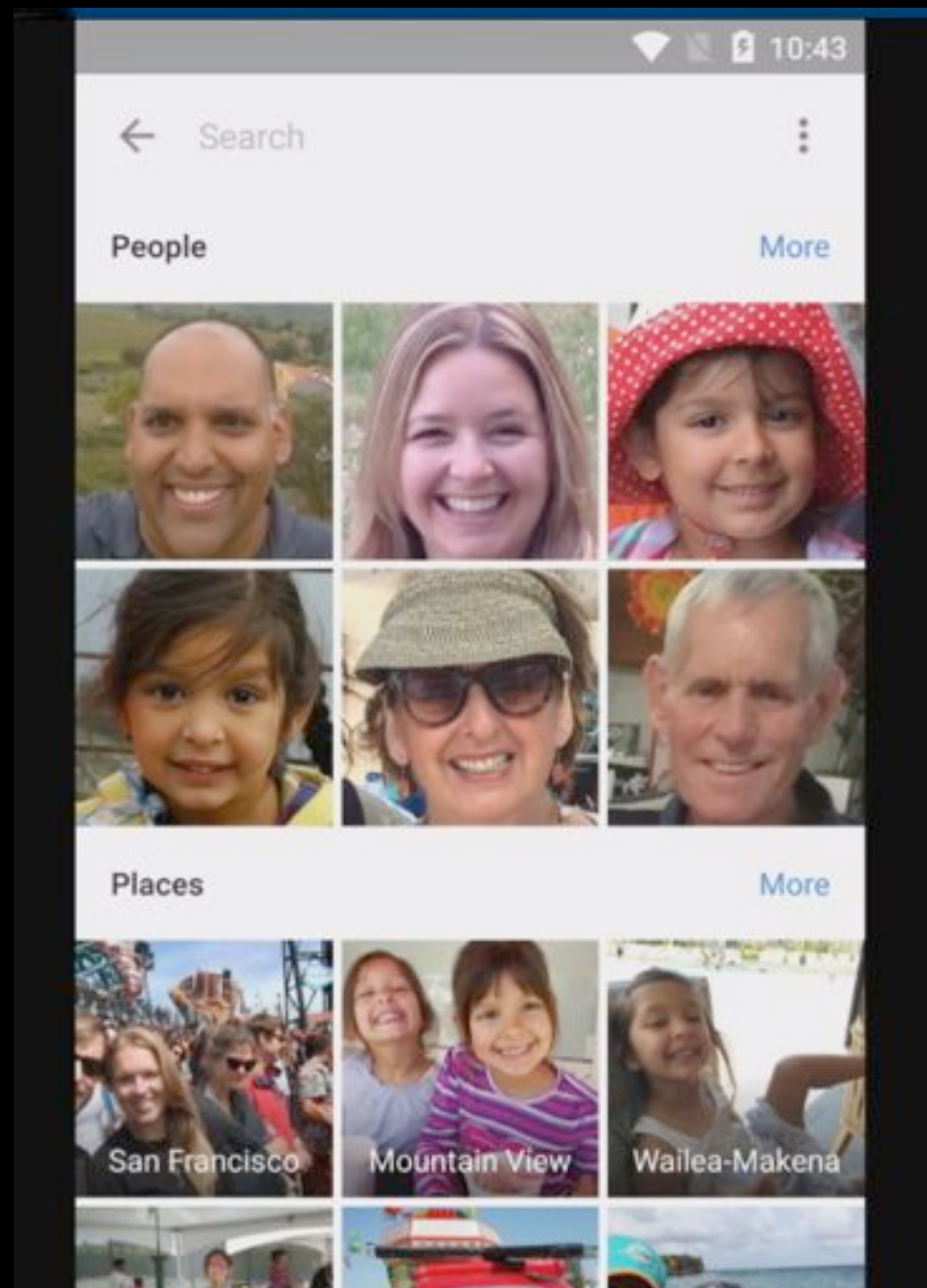
# Image understanding of your photo collections



more computer vision and image processing brought to the user (think real-time, mobile algorithms)

- with the amount of photos taken by each individual on a daily basis, need a personal search engine to navigate photo collections
- the power of Google image understanding applied to all your photos
- other utilities: image processing (photo enhancement, filters), panorama stitching, gif creation, automatic slideshows and videos (with automatic soundtracks)

# Automatically self-organizing photo collections

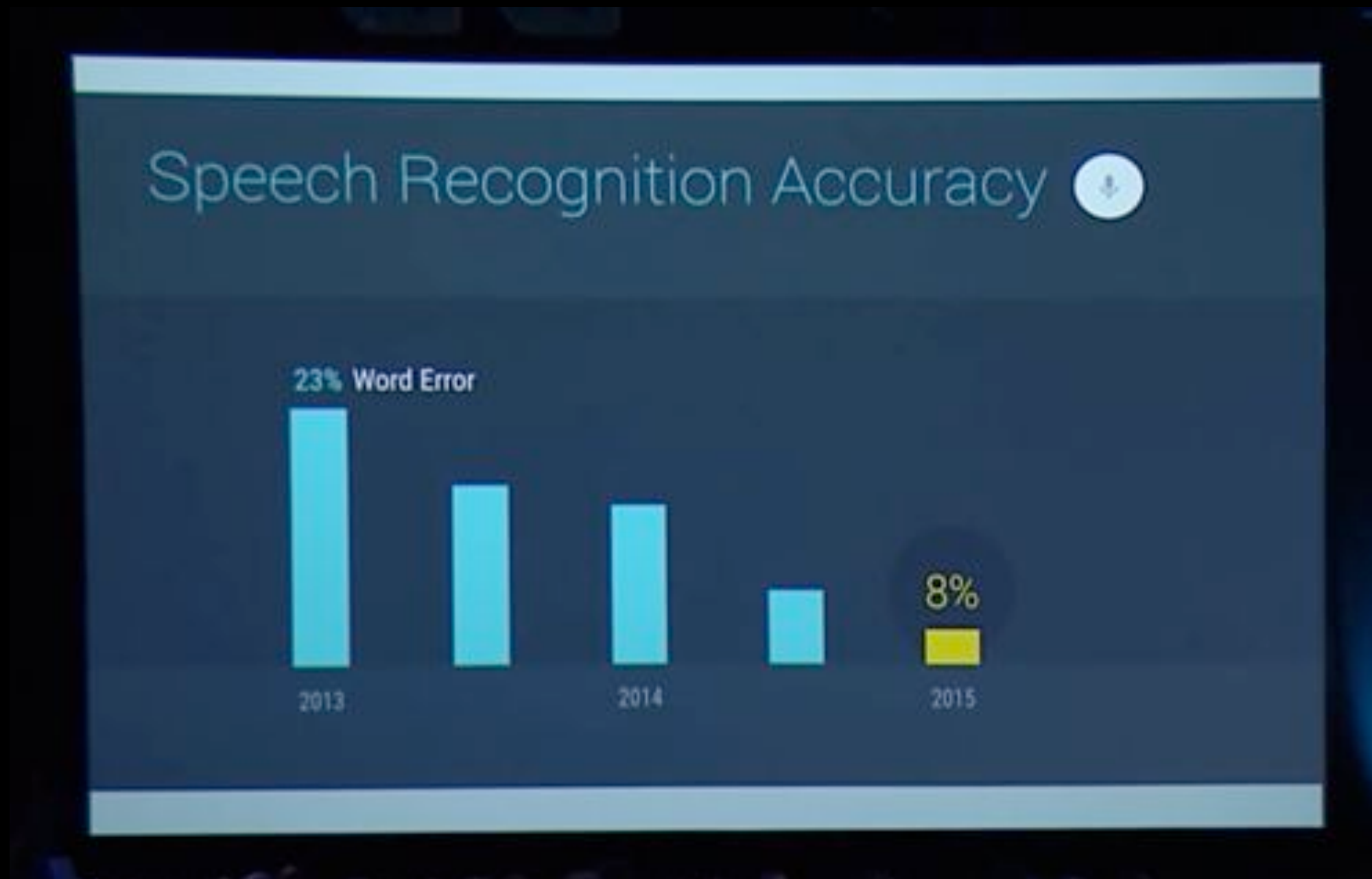


consider  
what other  
computer vision  
problems are relevant  
in the context of a  
user and their  
photos

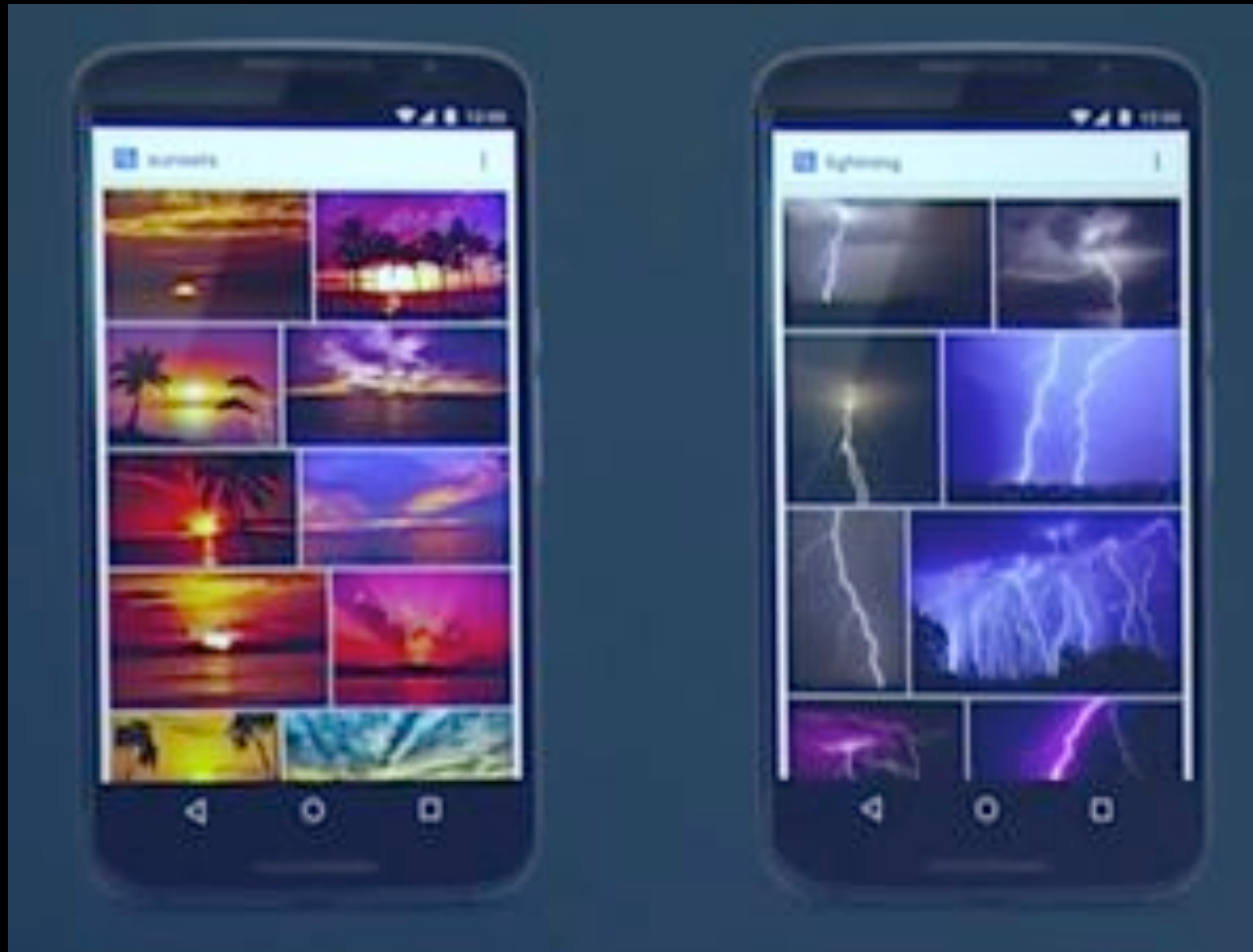
- automatic clustering by people, places, and timepoints
- clustering by person is also done over time, so as a person changes/grows/transforms, identity is still preserved across photos (all automatically)



# Investments into machine learning are panning out



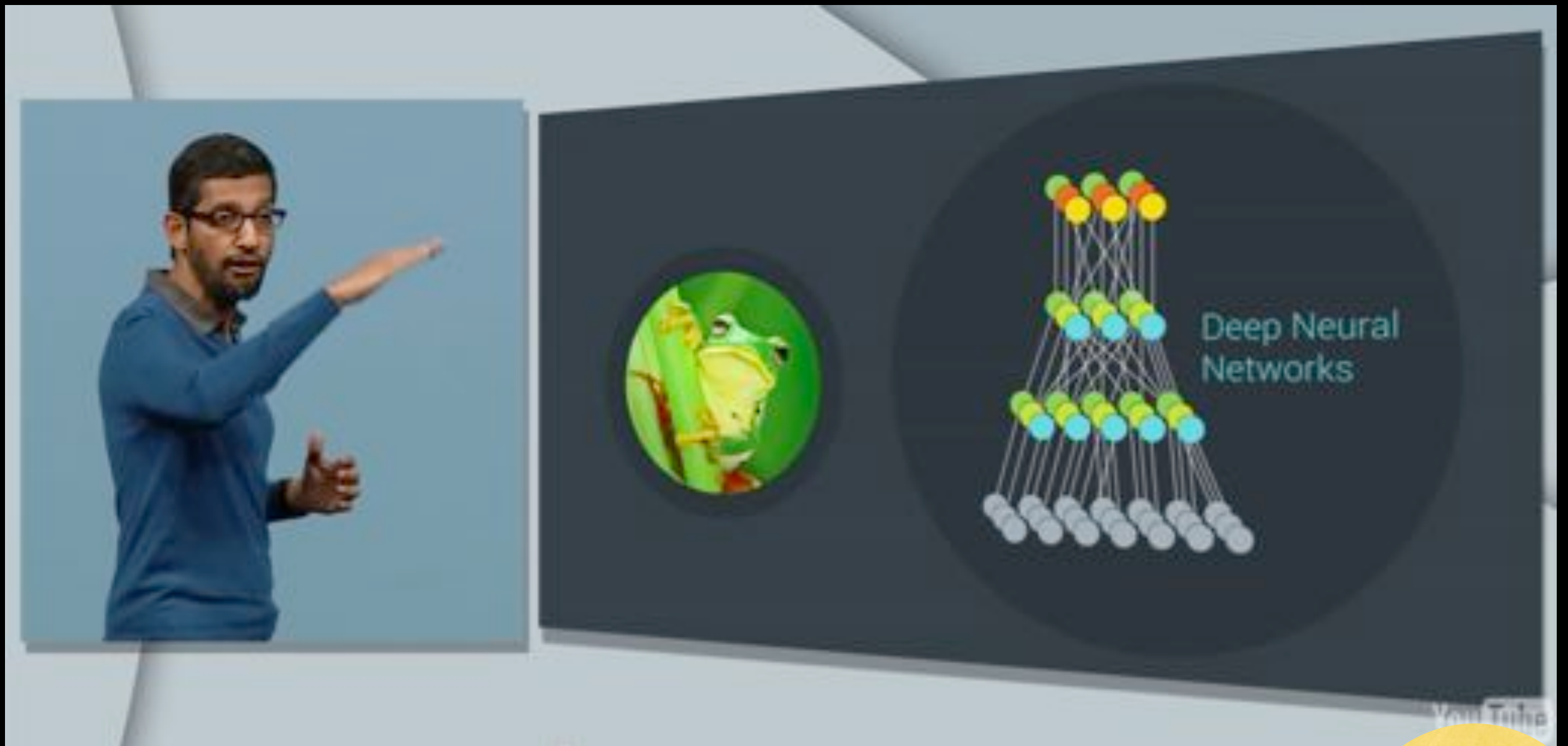
# Deep nets are why image search has improved



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- for search and for organizing photo collections
- at the backbone of Google Photos

# Deep nets are why image search has improved



what more is there  
to say?

# Sebastian Thrun on democratizing education



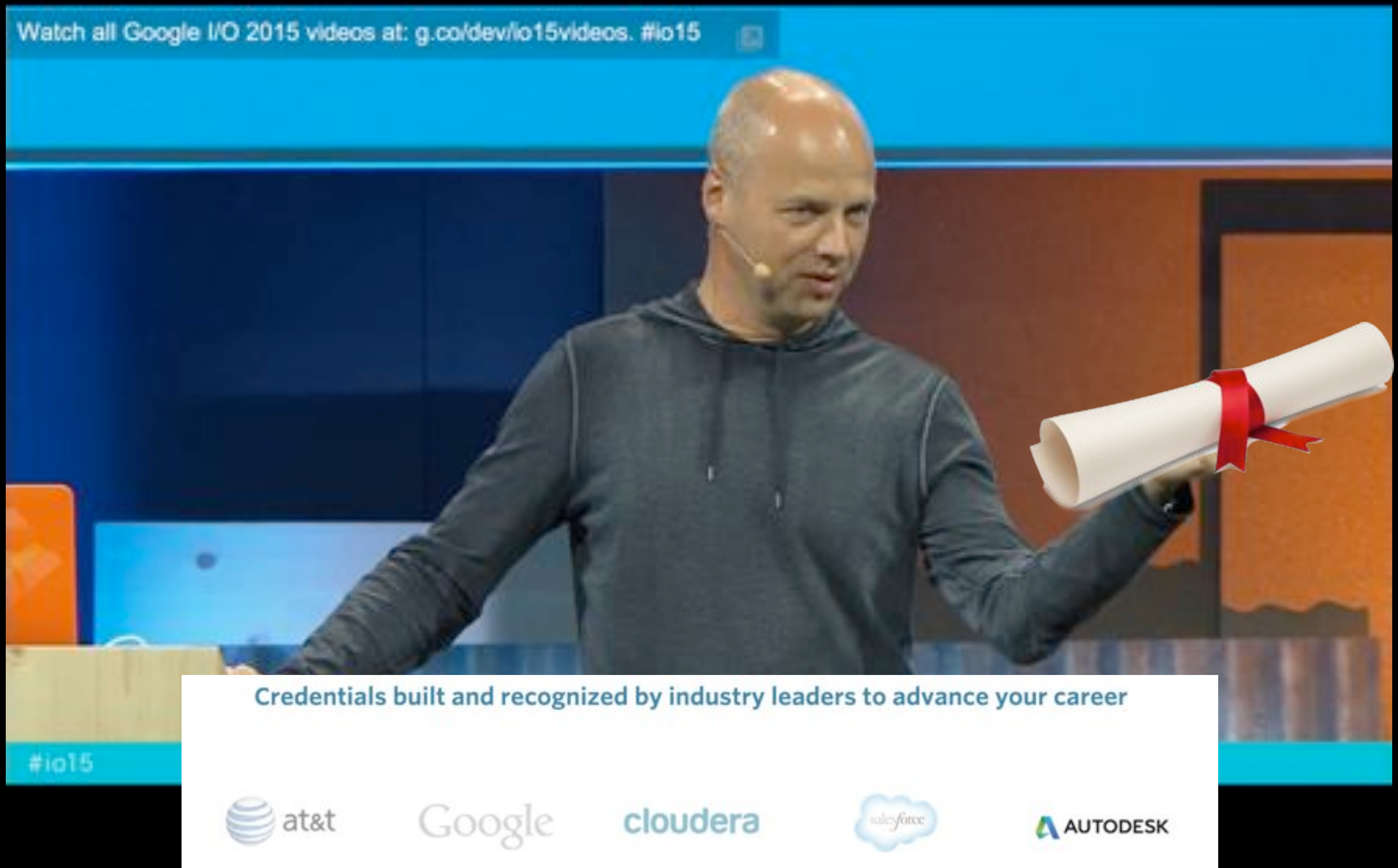
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- because physical colleges and steep tuitions are becoming outdated
- “Education will be a toothbrush phenomena, to be used twice a day for 5 minutes”



# Future of education: nanodegrees



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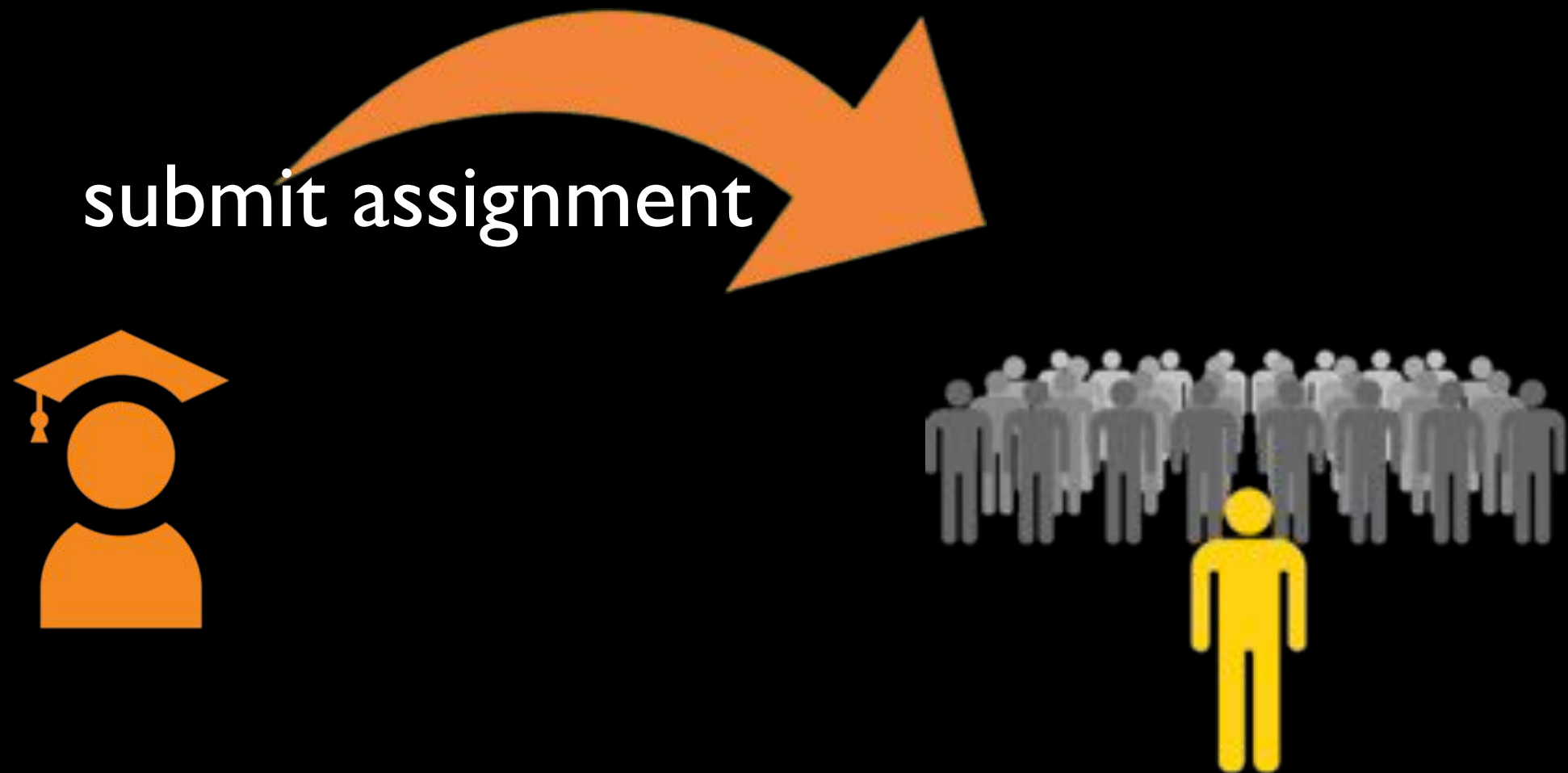
- suite of courses designed to make you a fully competent developer in some area with a portfolio that industry will appreciate
- e.g. Google's nanodegree on "android development": <https://www.udacity.com/course/android-developer-nanodegree--nd801>
- incentive for finishing: \$200/month regular, \$100/month rebate for completing degree

# How to grade thousands of students?

crowdsource the TA-ing as well!

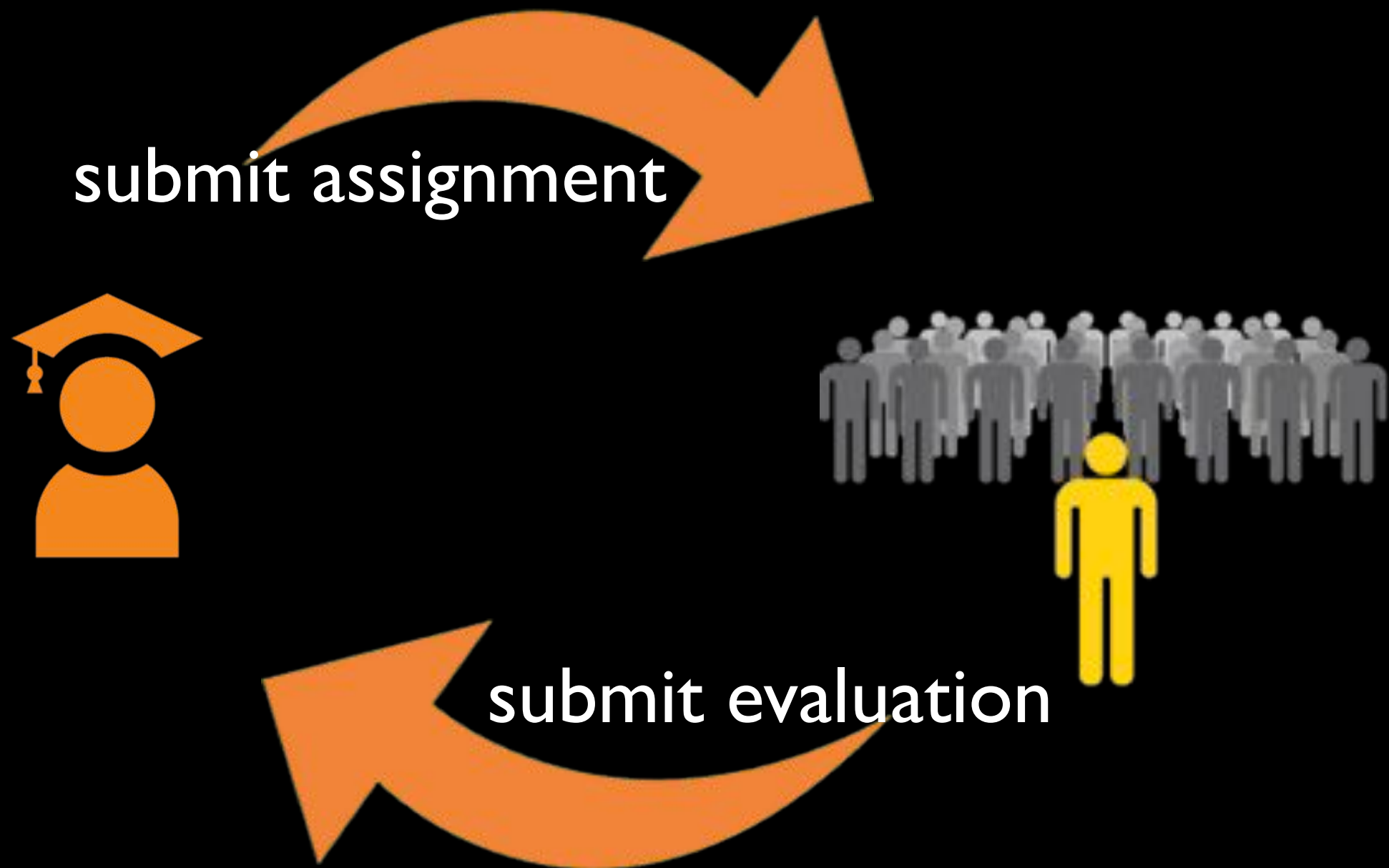
– for nanodegrees to result in portfolios, students have to complete customized, complex coding project → automatic grading becomes infeasible

# How to grade thousands of students?



- starting 2/3 months ago, began building a global code reviewing network to grade class projects
- now have hundreds of worldwide graders with a project grading turn-around of one day, or in most cases even one hour (unheard of in classical college education settings!)

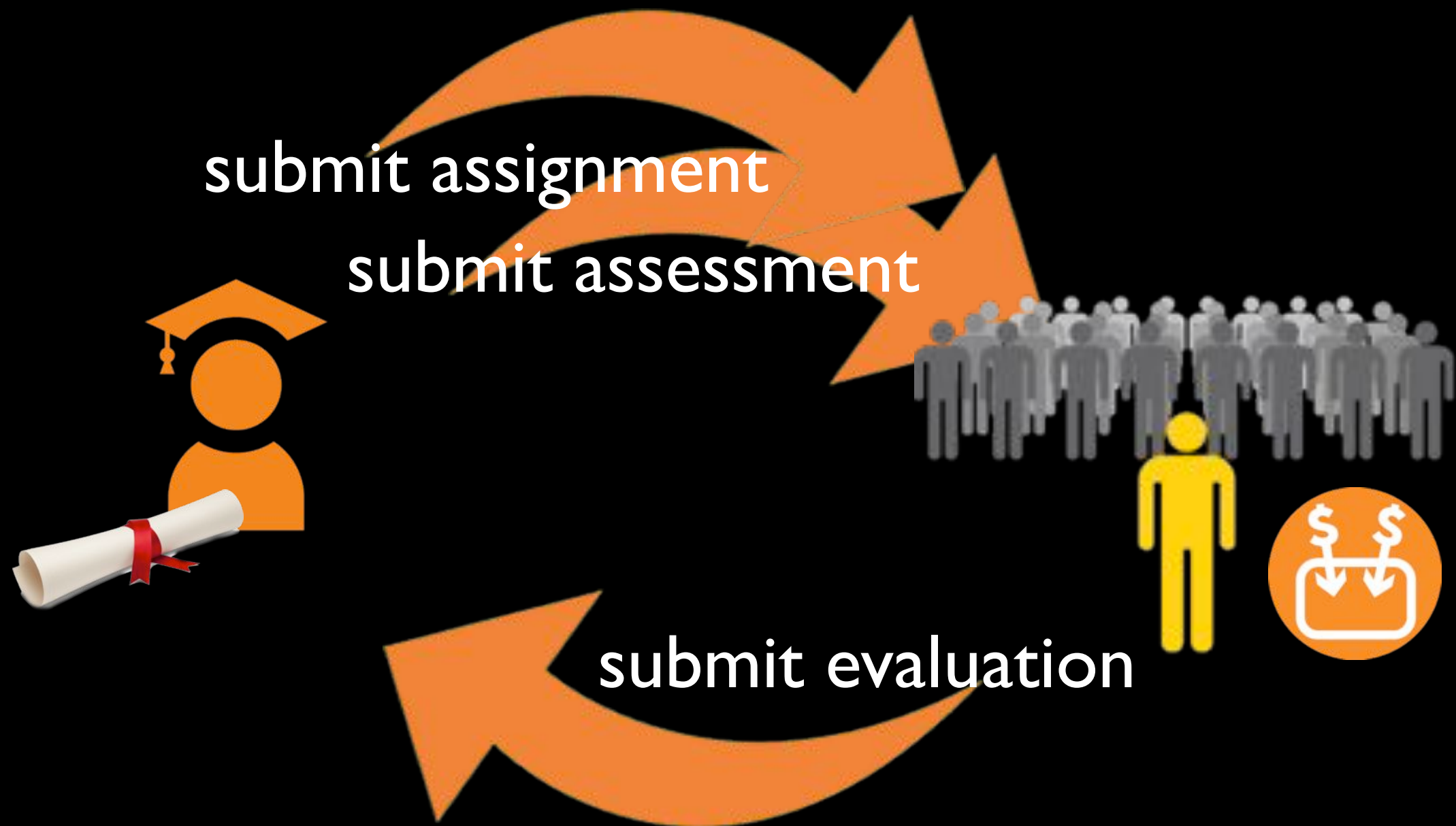
# How to grade thousands of students?



– student posts project on Github –> reviewers accept grading jobs –> return back to student –> student rates reviewer on grading quality –> reviewer is compensated



# How to grade thousands of students?




- student posts project on Github -> reviewers accept grading jobs -> return back to student
- > student rates reviewer on grading quality -> reviewer is compensated
- all material on Udacity free but students who need feedback and certification (thus requiring grading, etc.) are charged \$200/month for their nanodegrees but get returns later if successfully complete (motivation to complete)

# How to grade thousands of students?



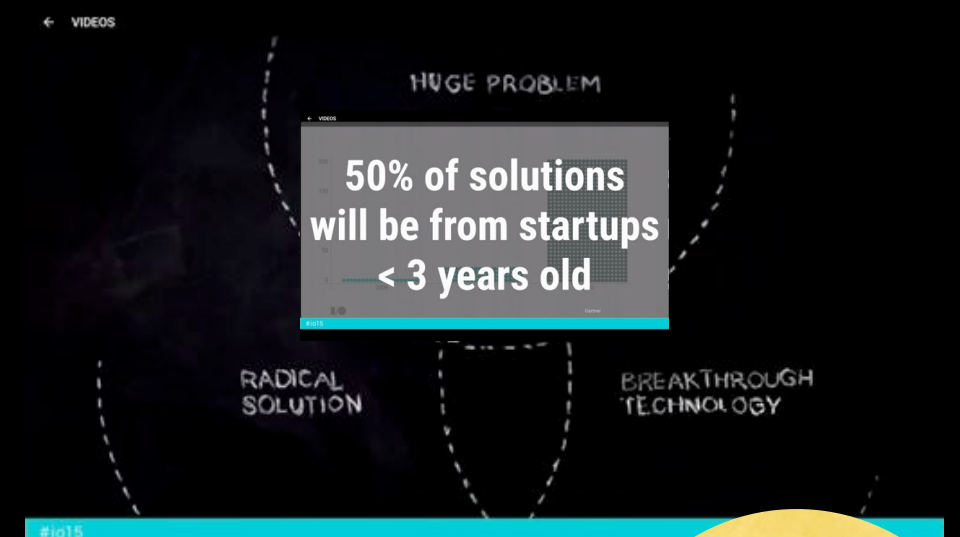
# Guide to surviving in the future



if research fails...

- based on the last few slides...
- make some money as a code reviewer -> get an online tech nanodegree -> start a tech startup -> succeed and be acquired by Google or raise more money by starting over

# Guide to surviving in the future



if research fails...

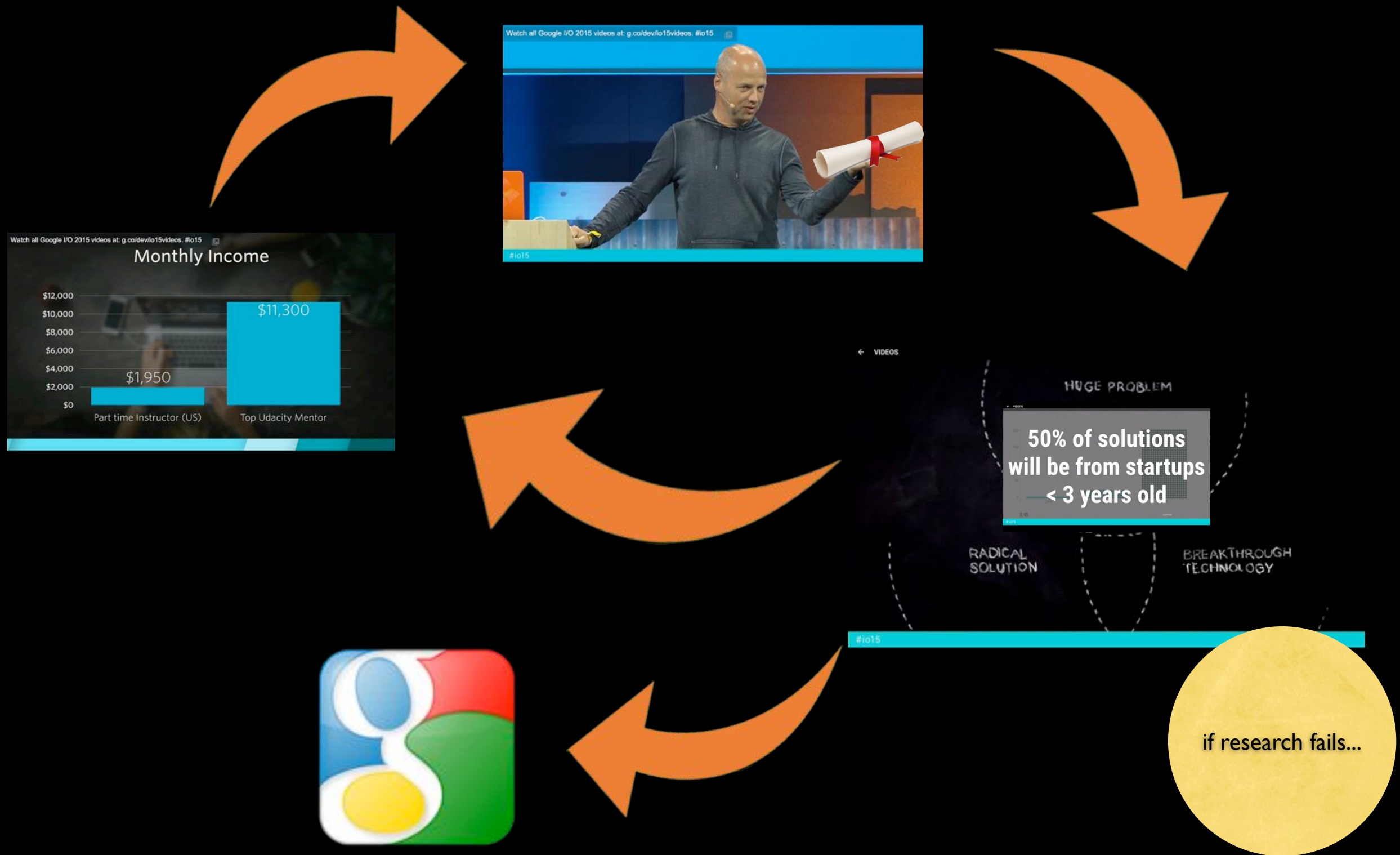
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# Guide to surviving in the future



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# Google.org: Google's philanthropy



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- panel with social innovators
- start-ups in the context of social change



# Social innovators panel



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- panelists: Code for America (data-driven approach to services for better governments), Nexleaf Analytics (smart fridge sensors to monitor expiration of vaccines), Charity Water (sensors in wells to automatically monitor well quality), HandUp (direct giving to the homeless)
- tackling hard problems, innovating technological solutions (e.g. how to make a battery in sensors last for many years and remain durable in different climates, etc. to make it useable in rural areas for automatic monitoring?)

# Google's philanthropy: some general stats

← VIDEOS

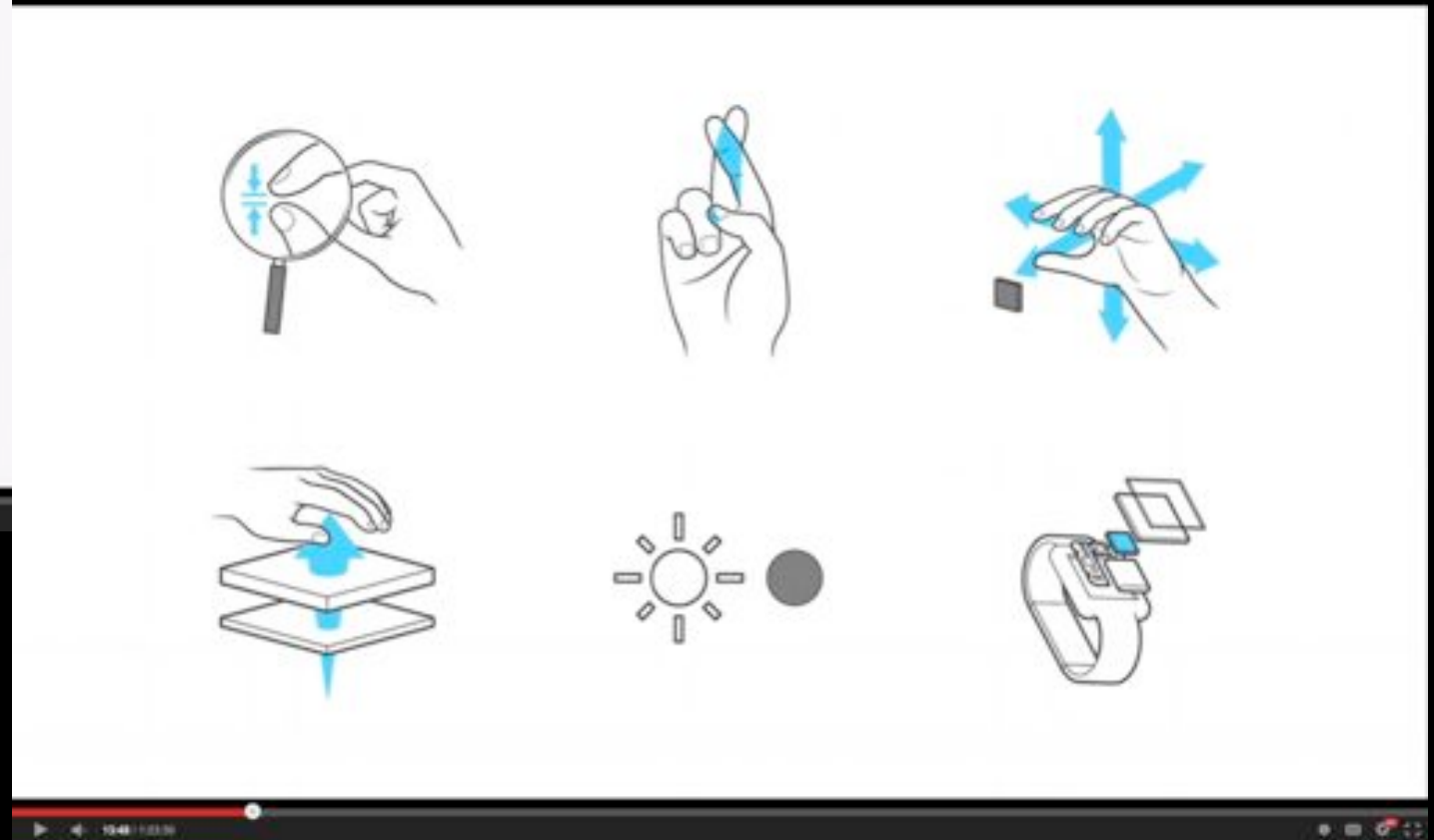
100M each year to nonprofits and schools around the world  
100K Googler volunteer hours  
100B free products to nonprofits  
20M current open call for technology for the disabled  
50M to increase visibility of women and underrepresented groups

#io15

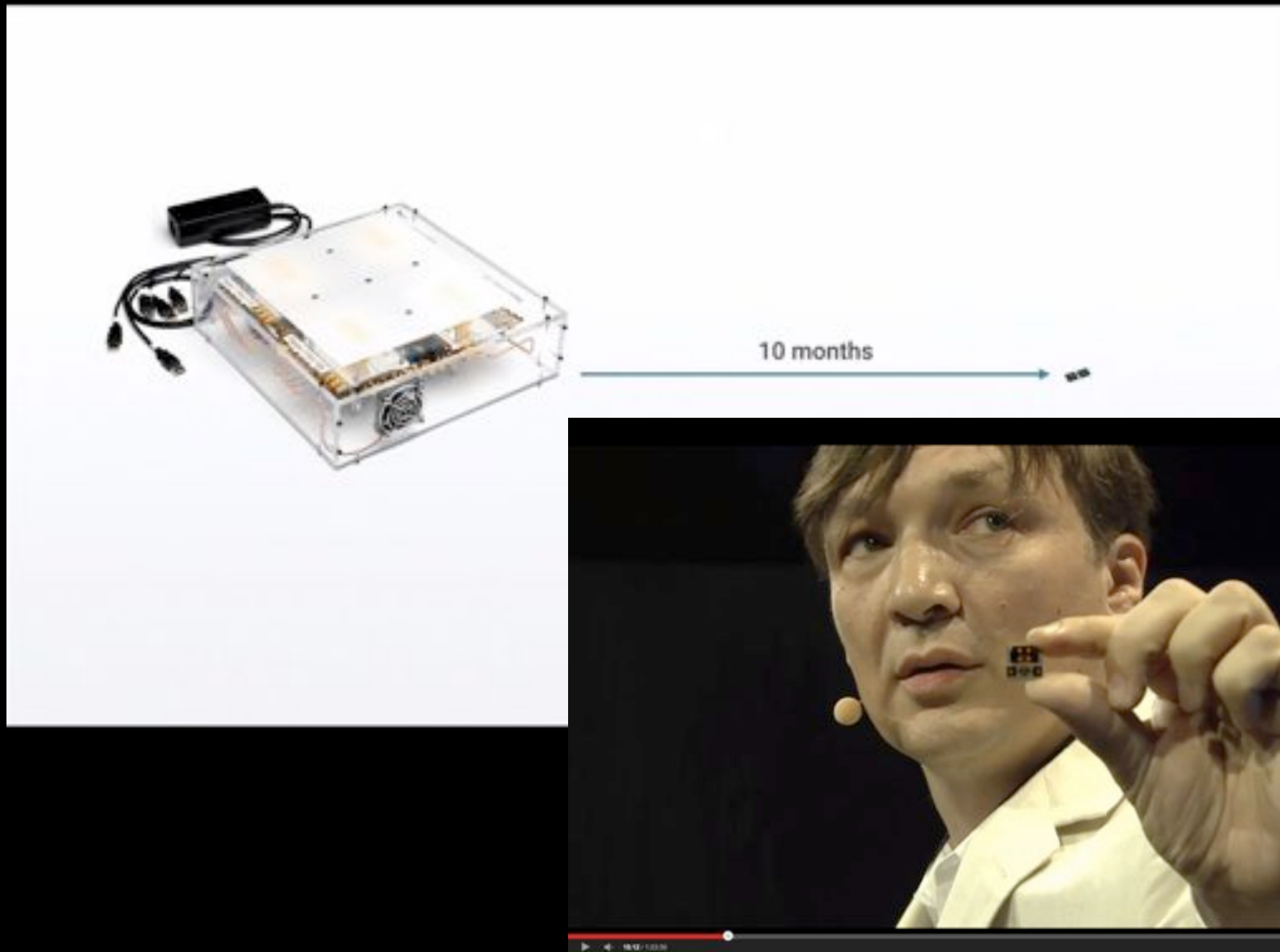


# Google ATAP: start-up-like innovation

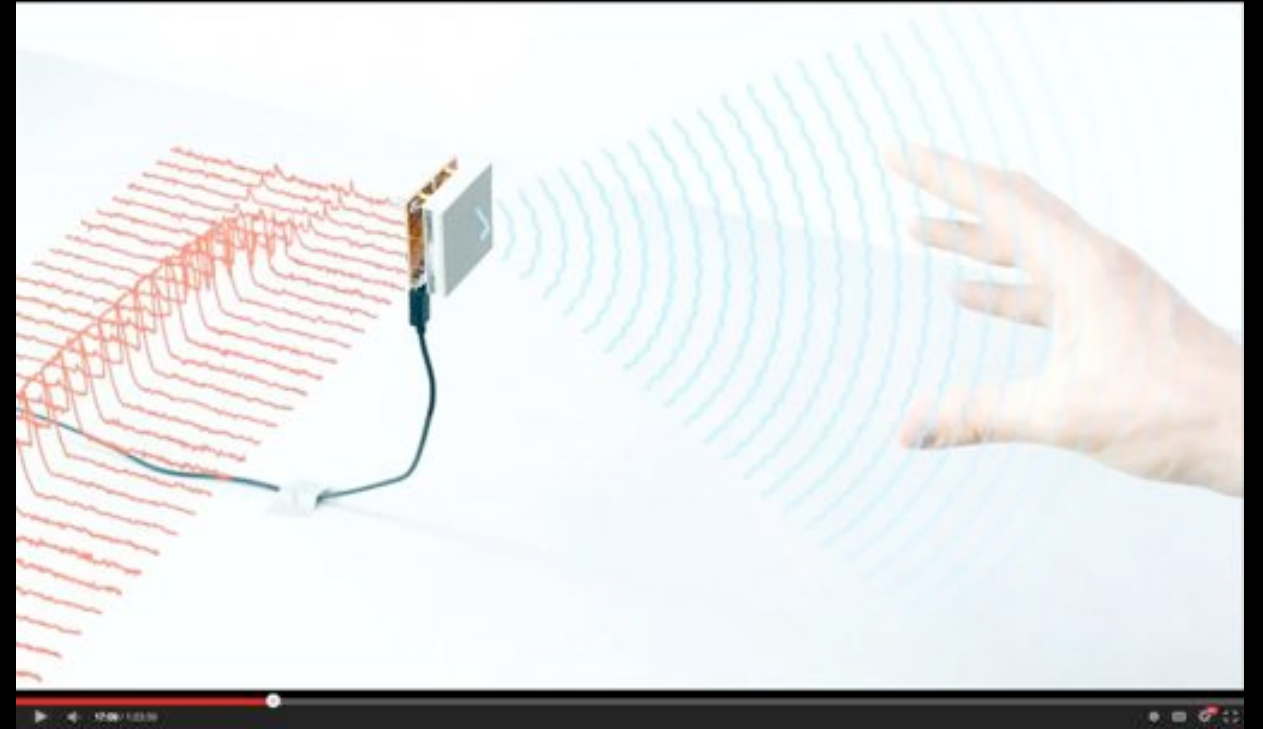
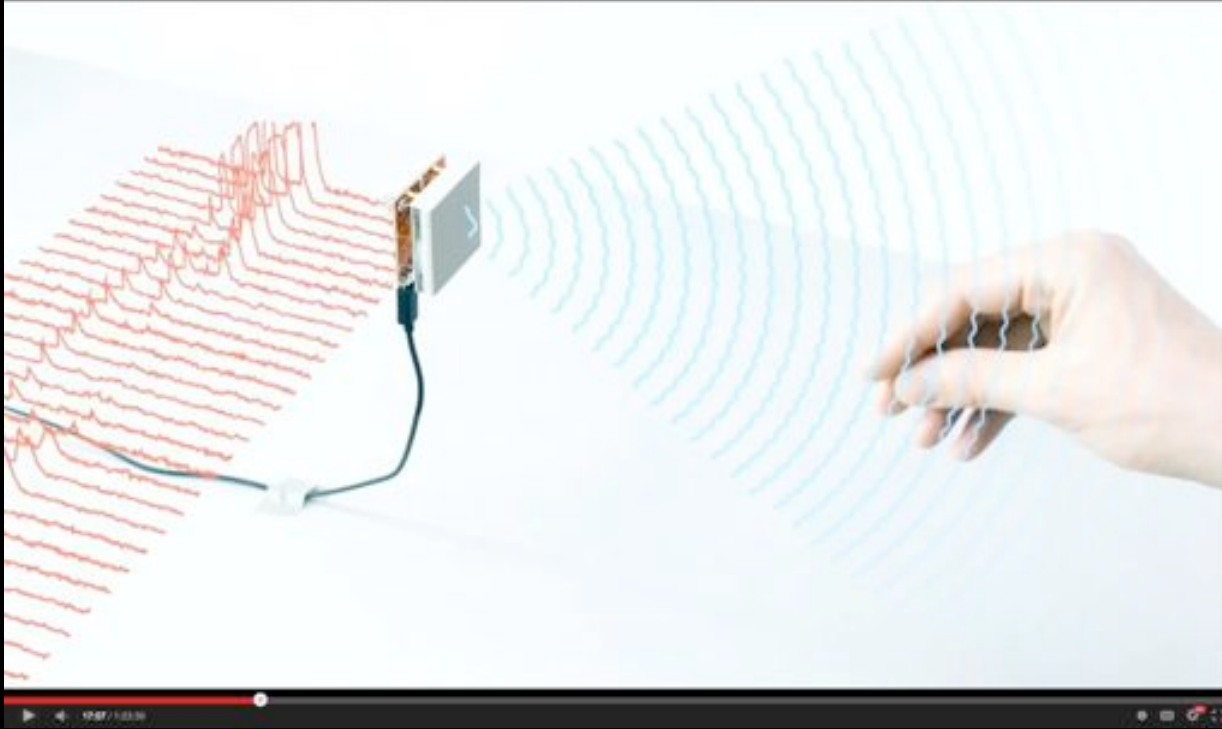
# The future of controls



# The future of controls: RF sensors



# The future of controls: RF sensors

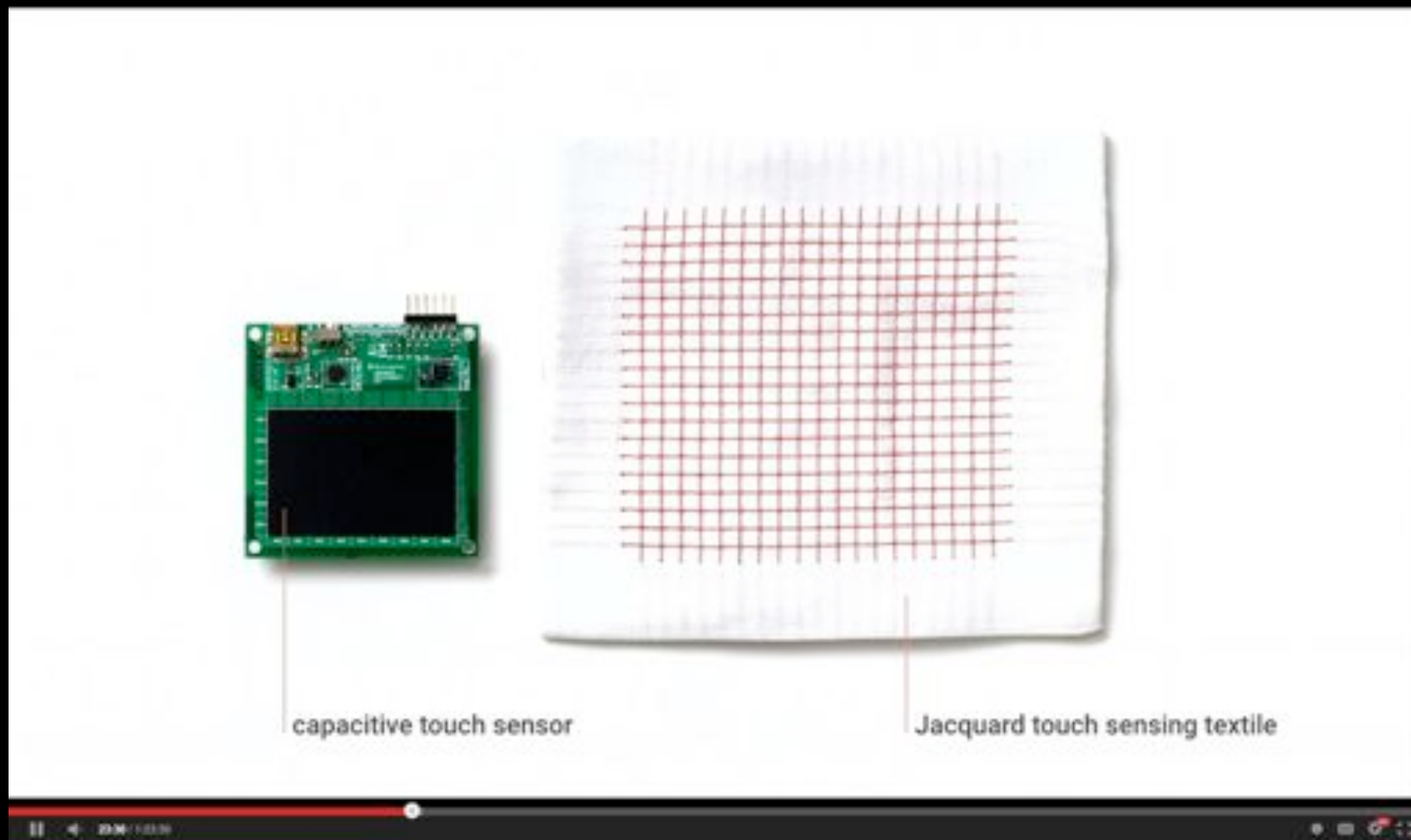


RF sensors for fine-grained pose estimation

- raw radar signal converted to features including specular reflections, electromagnetic phenomena
- a demo of the processing: [https://youtu.be/mpbWQbkl8\\_g?t=1010](https://youtu.be/mpbWQbkl8_g?t=1010)



# The future of devices: interactive textiles

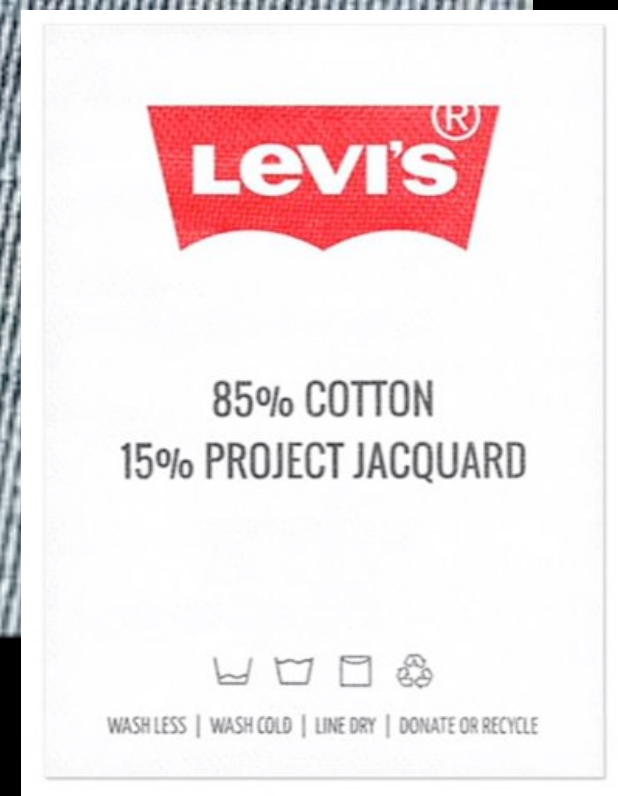
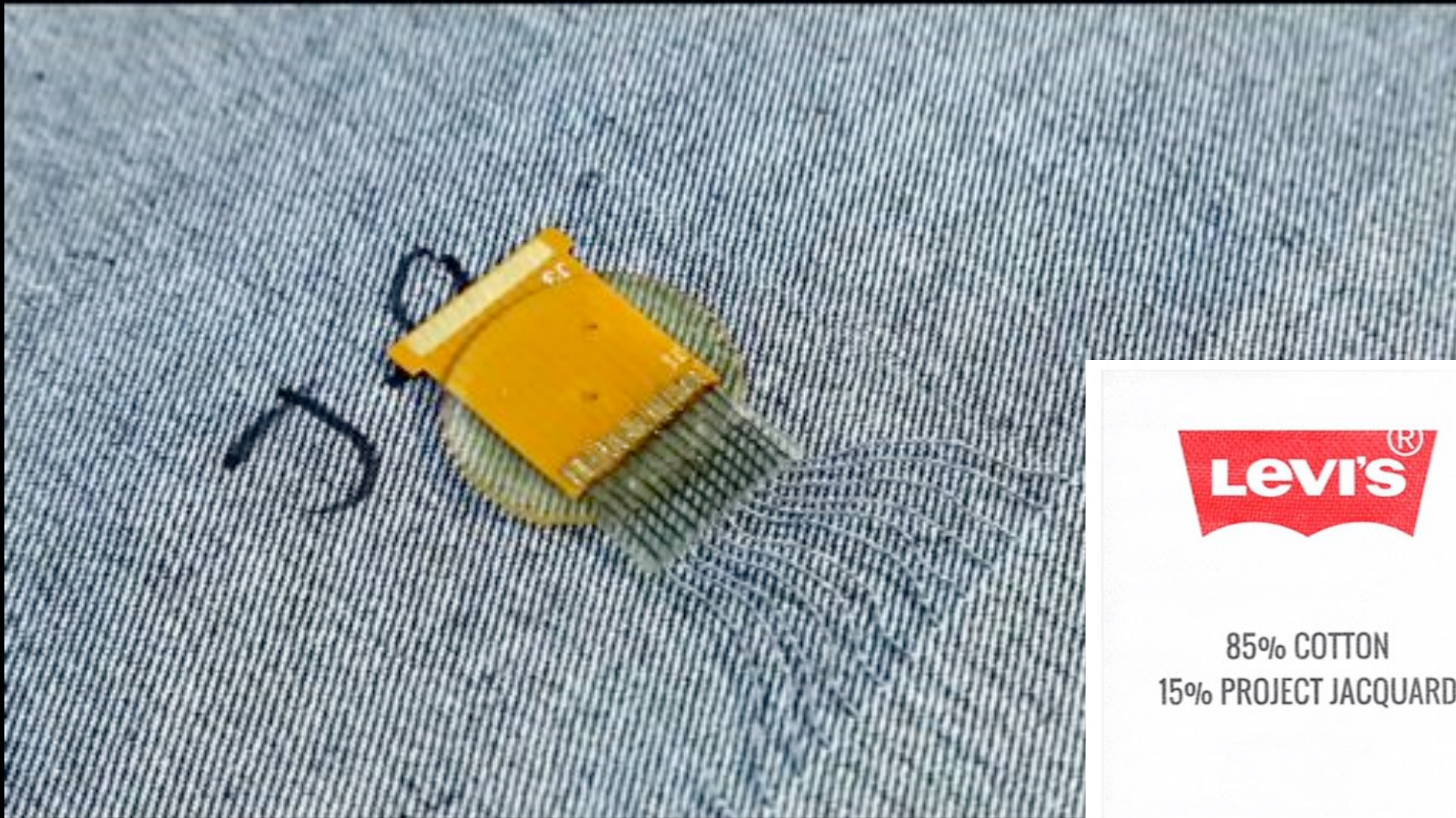


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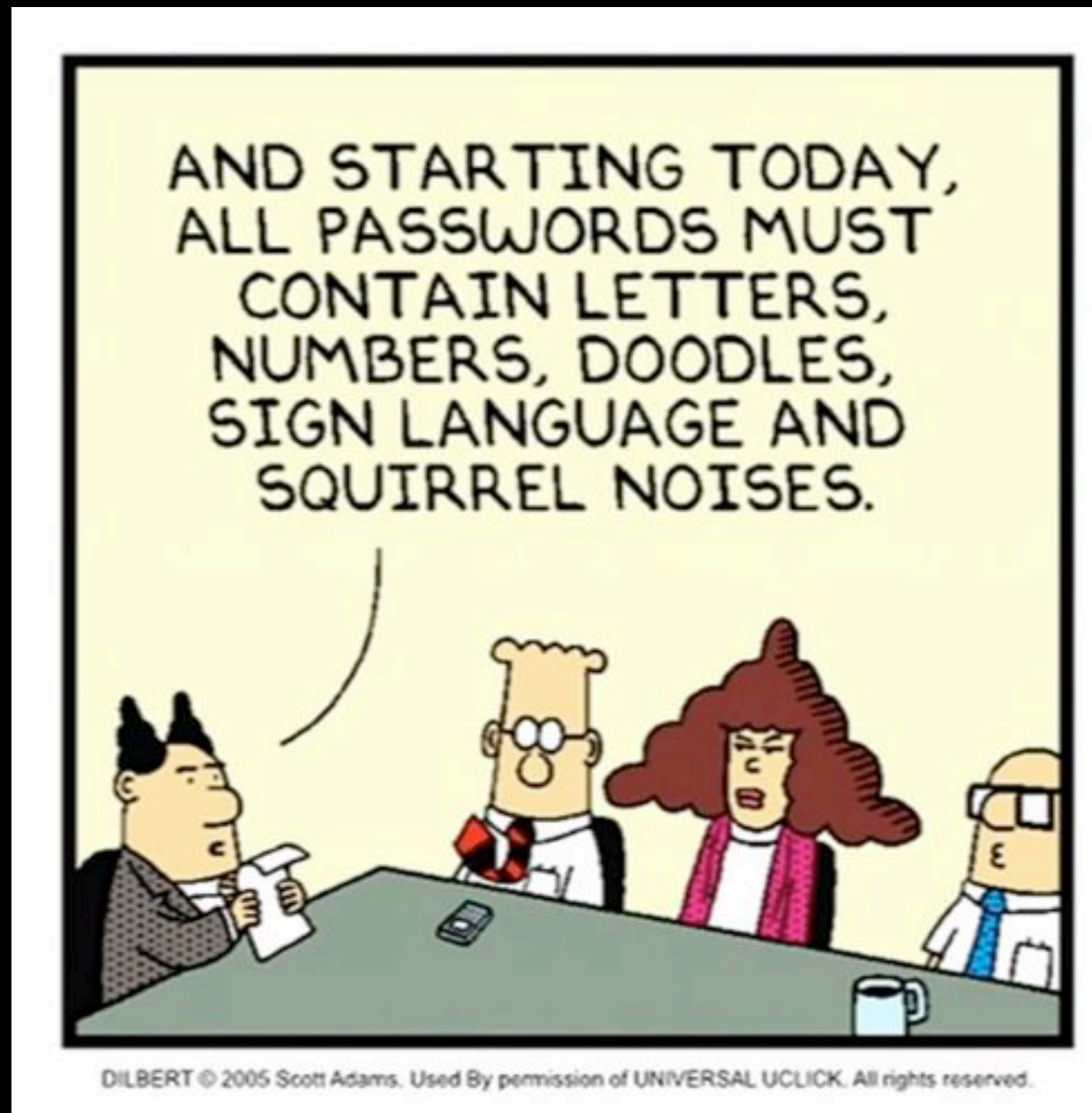




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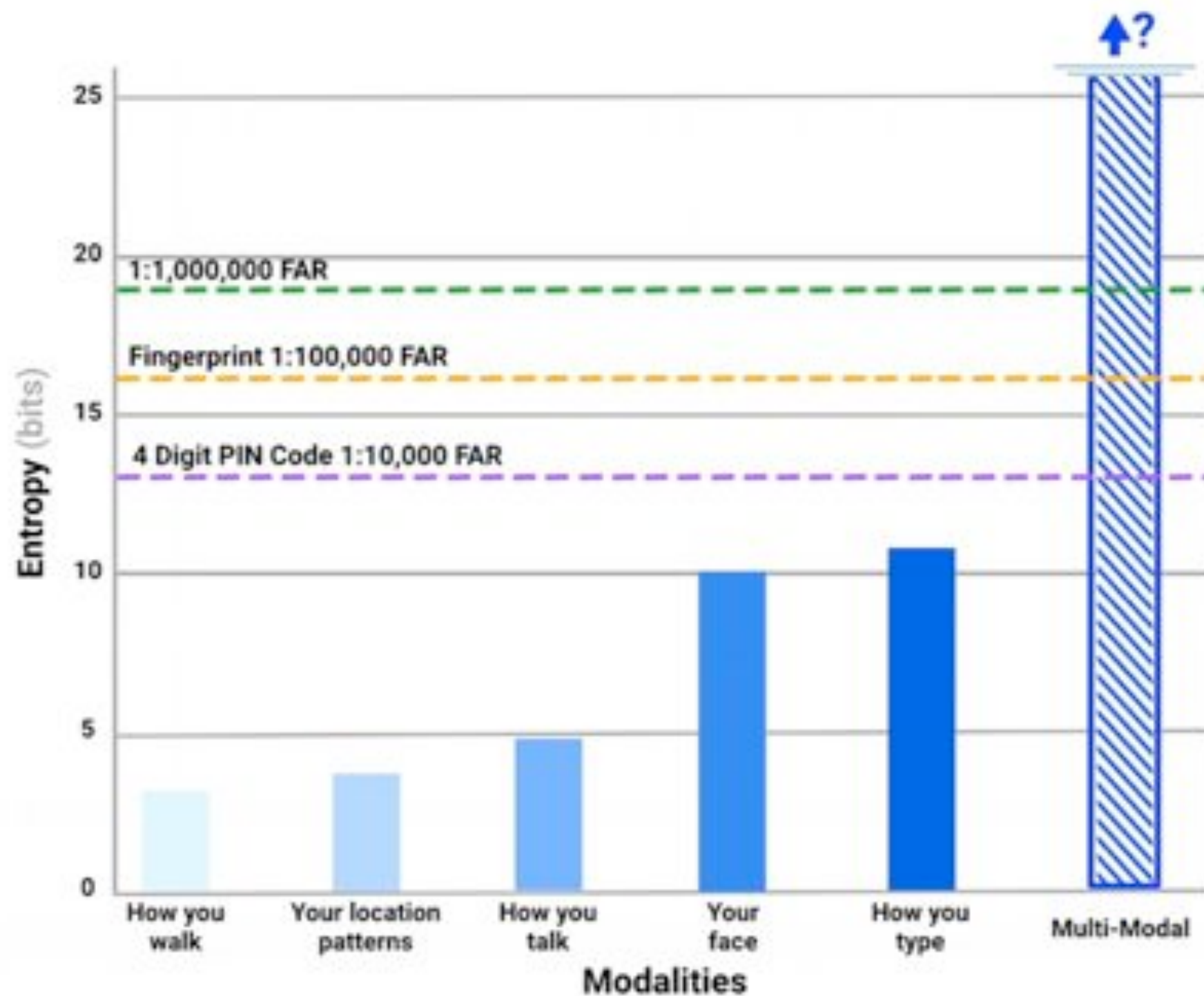


# The future of authentication: multi-modal verification





# The future of authentication: multi-modal verification



customizing  
technology more and  
more to the  
individual user

# The future of storytelling: 360° of interactive



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- high resolution, fast moving action, in 360 (viewer can look around to decide which part of the scene to view)
- efficient streaming, decoding, and rendering; dynamic spatial tiling system
- more about this: [https://youtu.be/mpbWQbkl8\\_g?t=3744](https://youtu.be/mpbWQbkl8_g?t=3744)



# The future of storytelling: 360° of interactive



developments in  
efficient streaming,  
rendering,  
compression,  
stitching, etc.

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– rig: 4 red epic dragon cameras with 8 mm fisheye lenses from canon capturing at 6K res each

# Links and suggestions

- about ATAP and frontline technological innovations
  - [https://youtu.be/mpbWQbkl8\\_g](https://youtu.be/mpbWQbkl8_g)
- some projections about ubiquitous computing
  - <https://youtu.be/9YFGN8vCYm4>
- developing for virtual reality
  - <https://youtu.be/QwhILBzz3AU>
- project Tango: 3D reconstruction and navigation
  - <https://youtu.be/iP9m9a2KEN4>
- about philanthropy at Google (4 social innovators discuss their start-up experiences)
  - <https://youtu.be/DcezrMhwaSs>
- Sebastian Thrun on online education, Udacity, and nanodegrees
  - <https://youtu.be/898S7o9UnPA>
- <https://events.google.com/io2015/videos>