The Internet of Everything
THE FUTURE OF TELECOM

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What is the Internet of Everything?
Includes the three waves of the Internet:
1st WAVE: Home Computing
 connected 1 billion people
2nd WAVE: Mobile Internet
 connected 2 billion people
3rd WAVE: Internet of Things (IoT)
 devices connecting to each other (machine-to-machine or M2M)
and to people

When is this going to happen?
NOW!
In 2009, the number of connected devices surpassed the total world population.
Estimates range from 20 to 50 billion connected devices by 2020.
How did we get here?

1 - Cheap Connectivity

- Cost of Sensors: $1.30 → $0.60 over the past 10 years
- Cost of Bandwidth: ↓40x over the past 10 years
- Cost of Processing: ↓60x over the past 10 years

How did we get here?

2 - Technology Breakthroughs

- Big Data
- Wi-Fi
- IPv6

Why is the Internet of Everything important?
Internet and the Web are not the same
The Internet is the physical layer of switches, routers and network
Transports data from one point to another
Web is an application layer on top of the Internet
It makes the information flow usable

The Web has evolved:
Research phase
Commercial phase
Transaction phase
Social media phase

Why is the Internet of Everything important?
The first evolution of the Internet
The Internet now has senses

Smartphones alone can:
- **SEE** – camera
- **HEAR** – voice recognition
- **FEEL** – accelerometer, touch screen
- **DETECT LOCATION & VELOCITY** – GPS

Current sensors encompass much more...

Who is using IoE?

Products already on the market
Where is IoT development focused?

• INFRASTRUCTURE
  Building the pipeline, processing, and devices

• APPLICATIONS
  Software needed to use the torrent of data

• VALUE-ADDING SOLUTIONS
  Finding areas where connectivity legitimately adds value

Telecom Impact: Wi-Fi and Cellular

- Devices will require wireless communications
- Wi-Fi will be the key standard
- Demand for spectrum and fiber transport networks will be high
- There is no wireless without the underlying wireline network

As the President and CEO of CTIA-The Wireless Association has written:

Due to the science and physics of spectrum use, there is only so much capacity that is available. This differs dramatically from landline and cable broadband service. One strand of fiber has more capacity than the entire electromagnetic spectrum. So even if we were able to get all the spectrum available in the U.S., we still wouldn’t be able to have the same capacity as a single strand of fiber.
Telecom Impact: The “Fog”

The “Cloud” - remote servers sometimes thousands of miles away

The “Fog” - moves intelligence to the network edge to increase speed and reliability

WARNING!

Spectrum Interference
- 508 devices all working together in unlicensed spectrum?
- Interference also caused by radio frequency (RF) emitters
  - Cordless phones
  - Bluetooth devices
  - Microwave ovens
  - Wireless remote controls
  - Fluorescent lights
  - Bad electrical connections
- A microwave oven operating at the same frequency as a Wi-Fi access point can reduce throughput by 50%
- May not be noticeable until latency-sensitive applications are used or many devices are used (= IoE)
- Intermittent interference may be hard to locate or reduce
The End of Privacy?

YOU are the real product being sold

- Identity
- Location
- Purchases
- Websites visited
- Word searches
- Preferences

Even tiny items of data in aggregate can identify, define and label us without our knowledge.

Unauthorized access and misuse will be primary concerns