

Wireless!

The forces and strategies that shaped a revolution

Lecture 23: The CEO's Dilemma: Dealing with Slow Growth

Lecture 23- Classwork

1. Please summarize in 3-4 sentences the Pre-Lecture reading for Lecture 23. What are some important takeaways from your reading?
2. Why do you think Apple shares did so much better than Verizon shares after 2012?
3. Why are the cellular service providers now reporting the number of “connections” instead of the number of “users”? How has that worked out?
4. Why did AT&T buy Time Warner and DirecTV? How did that work out?
5. What is the problem with achieving growth by stealing customers from your competitors?

Verizon and Apple since 2012 (ignoring what's happening in recent weeks)

□ Apple

- Profits up 50%
- Share price up 400%

□ Verizon

- Profits flat
- Share price up 30%

Q2

- S&P 500 is up over 400% (so Apple became "average")

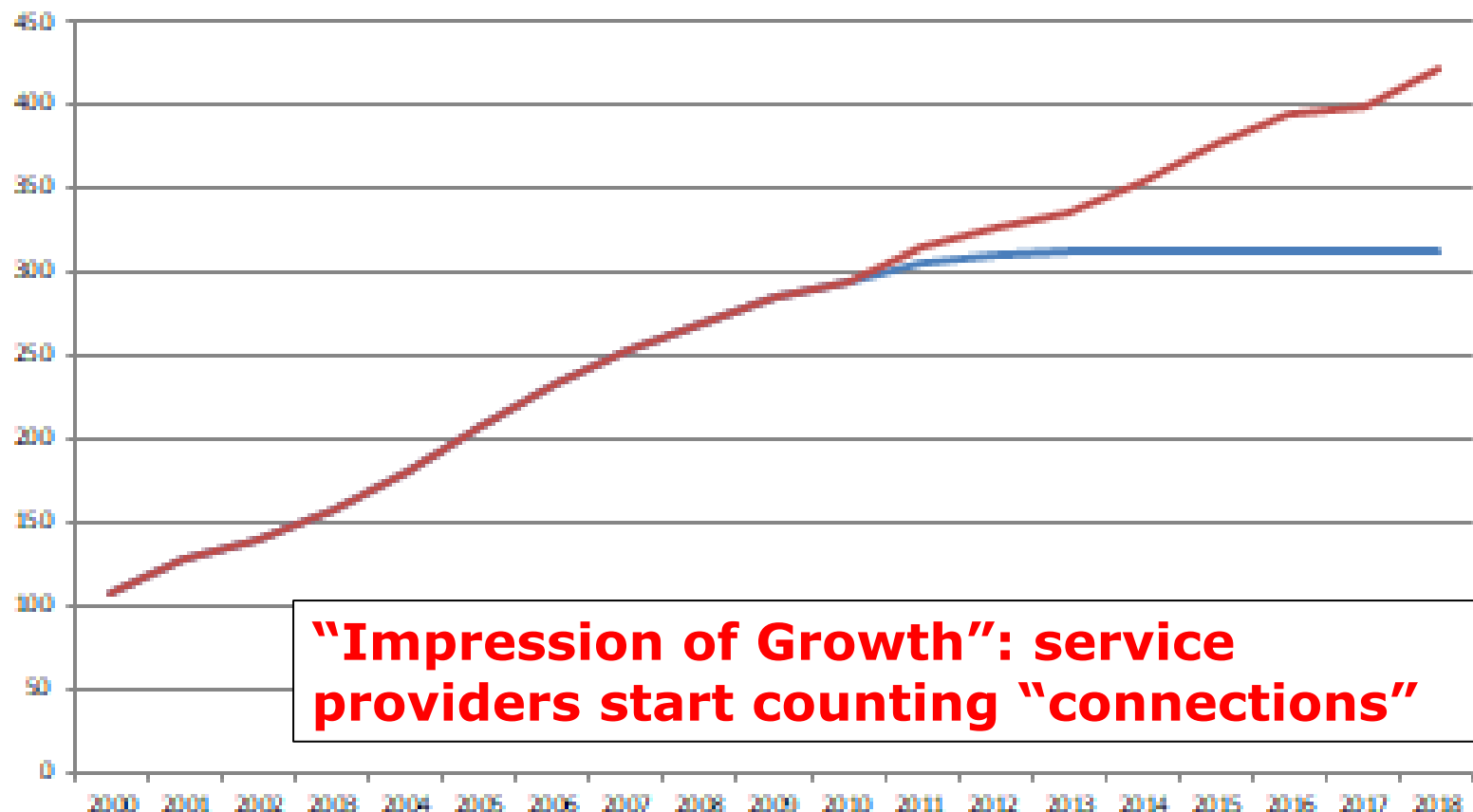
Q3

Slowing Growth in Cellular

- ❑ The end of growth is particularly difficult, since stockholders generally favor growth
 - Cellular was once a profitable growth business
- ❑ How to deal with slowing growth in cellular?
 - Pay higher dividends
 - AT&T: annual dividend of \$1.11 per share; Verizon: annual dividend of \$2.66 per share
- ❑ Some investors favor growth
 - What happens if they leave?

Millions of “users” vs Millions of “connections” 2000-2018

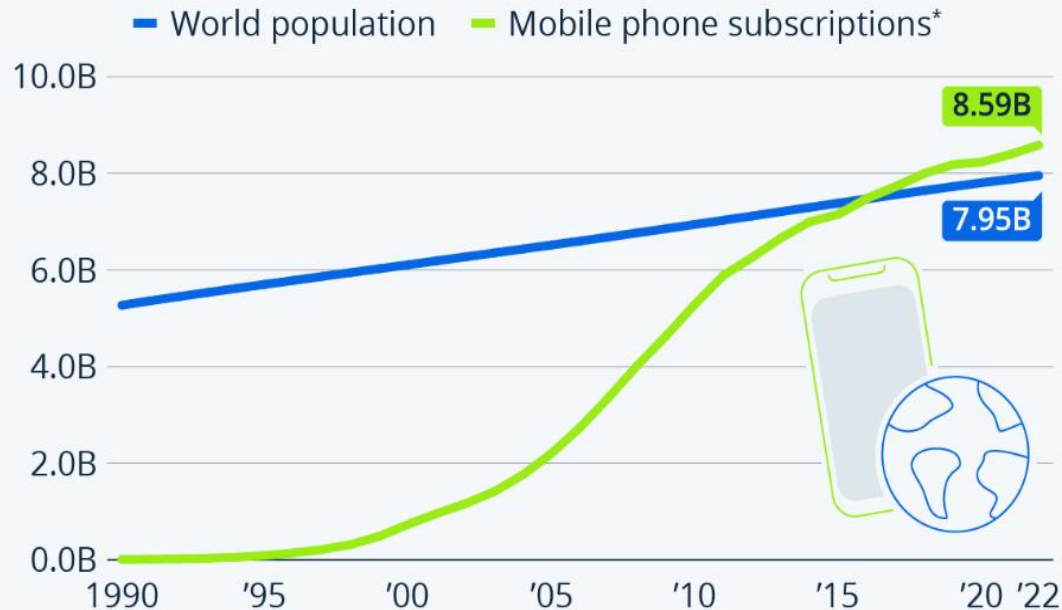
Users vs connections (M) 2000-2018



Connections vs People

More Phones Than People

Estimated number of mobile-cellular phone subscriptions vs. world population estimates



* includes postpaid and active prepaid subscriptions that offer voice communications; excludes subscriptions via data cards or USB modems, radio paging and telemetry services

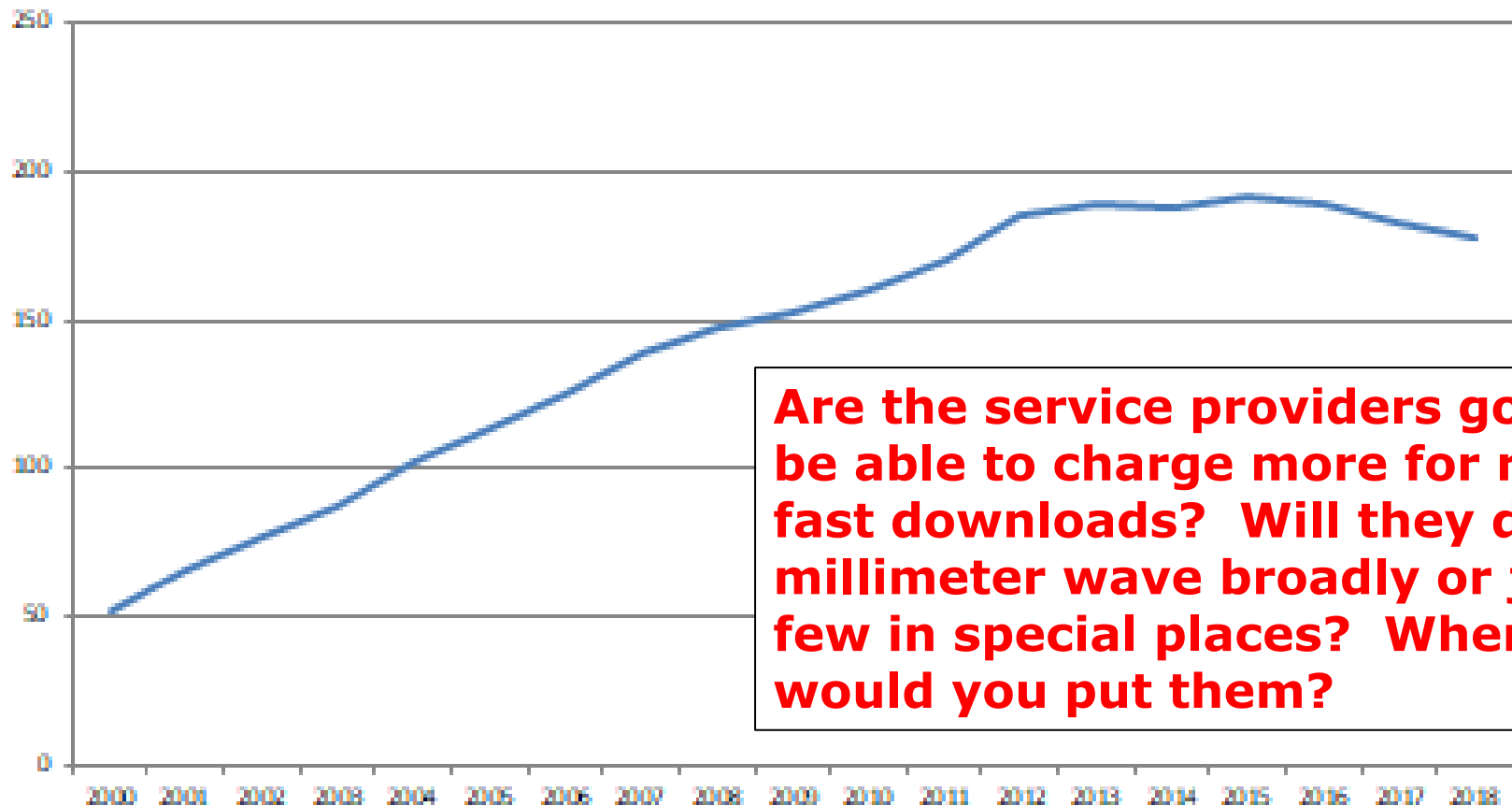
Sources: ITU, World Bank, UN Population Division

Internet of Things (IoT)

- **2023:** 16.1 billion active IoT devices
- **2033:** 39.9 billion IoT devices

Unfortunately, total revenues (\$B) were flattening and would even fall

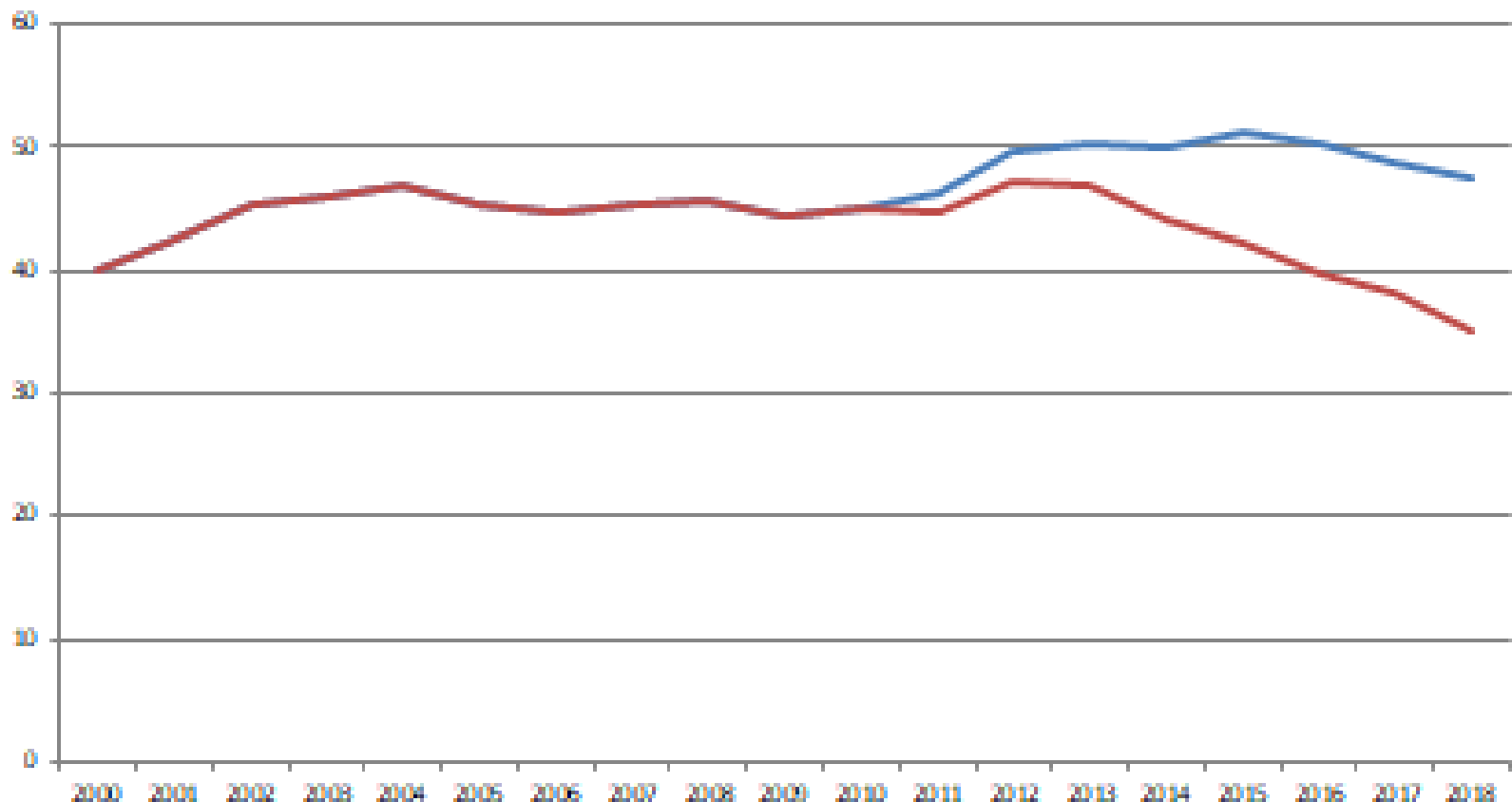
Total revenues (\$B) 2000-2018



Are the service providers going to be able to charge more for really fast downloads? Will they deploy millimeter wave broadly or just a few in special places? Where would you put them?

Revenue/user/month showed a modest decline after 2012, but revenue/connection/month showed a frightening 25% drop

Revenue/user/month vs Revenue/connection/month



A better idea for optimism about growth--5G?

Is 5G a hyper opportunity or an opportunity for hype?

AT&T has a “vision” of the unforeseen

“Much like 4G introduced the world to the **gig economy**, we believe mobile 5G will jumpstart the next wave of unforeseen innovation. AT&T is the only U.S. carrier that has a standards-based, mobile 5G network live in parts of a dozen cities.”

What does this actually mean?

Trump pushes 5G (let's beat China) (circa 2020)

“The president's re-election team is backing a plan the wireless industry fears would impose a heavy government hand over America's communications future”

What does this actually mean?

Investment advisors see immense opportunity

“It's **on track** to reach \$17 trillion by 2035...
... and we know which companies to buy”

What does this actually mean?

Providers are full of claims (but claims are cheaper than systems)

- Explore Verizon 5G Ultra Wideband coverage
 - We're building the most powerful 5G experience for America - 5G Ultra Wideband with massive capacity, ultra-fast speeds and ultra-low latency. 5G Ultra Wideband is now live in parts of select cities across the country in locations where more people can experience ultra-fast speeds together.
- AT&T Begins Extending 5G Services Across the U.S.
- Sprint's True Mobile 5G is powering new experiences for our wireless customers
- T-Mobile has the first, largest, and only nationwide 5G network, covering more people and places than anyone else

A financial analyst's comments on Verizon (2020?)

Verizon stock often attracts income-oriented investors. If Verizon 5G wireless services reignite earnings and revenue growth, however, its shares might have much greater appeal. Verizon stock pays a 4.1% dividend. Even so, Verizon stock has consistently underperformed the S&P 500 and has yet to surpass the high it reached in 1999 — not the mark of a growth stock. Could that change? The Trump administration expects an economic boom from 5G wireless services. It's making more spectrum available for 5G wireless.

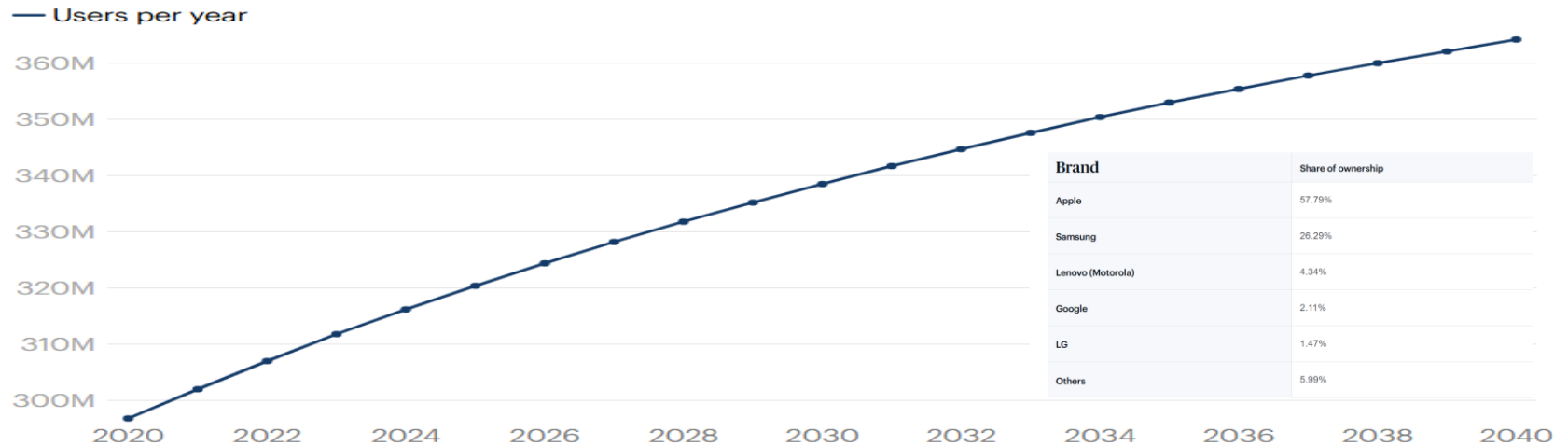
Verizon is much more exposed to the U.S. wireless market than rival telecom firm AT&T. Verizon gets nearly 85% of adjusted earnings from its wireless business. Verizon's foray into the media business through the AOL and Yahoo acquisitions misfired. In December, it took a \$4.6 billion write-down on its media business, called Oath. Meanwhile, Vestberg (the CEO) has embarked on a four-year, **\$10 billion cost-cutting effort** through 2021.

Verizon's problem is that the U.S. wireless market is saturated. Most consumers have unlimited data plans. That's why Verizon 5G growth is key. **Pundits expect** 5G wireless to have a role in manufacturing automation, cloud gaming, autonomous vehicles, drones and remote health care services. But fundamental growth would remain an issue. Verizon has been testing 5G broadband service to homes in four cities — Houston, Indianapolis, Los Angeles and Sacramento. However, Verizon does not expect meaningful revenue from 5G wireless broadband services to homes **until 2021**.

Verizon has told analysts that it expects 5G fixed broadband revenues to become **significant in 2021**, with 5G business services picking up in 2022. Still, emerging 5G wireless apps, such as drones or remotely controlled medical treatments, **could take years to develop**.

Projected Growth in Smart Phone Users?

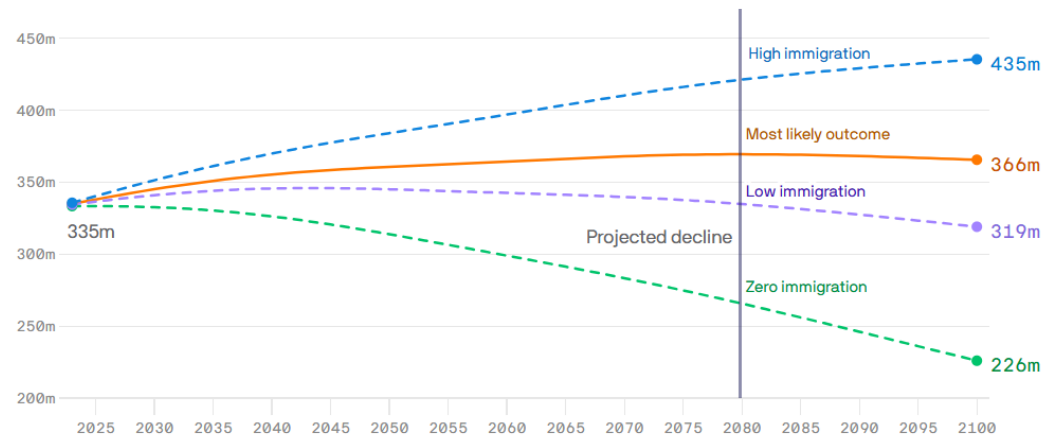
Projected number of smartphone users



ConsumerAffairs

Projected U.S. population

2023-2100; By immigration scenario



Data: U.S. Census; Graphic: Rahul Mukherjee/Axios

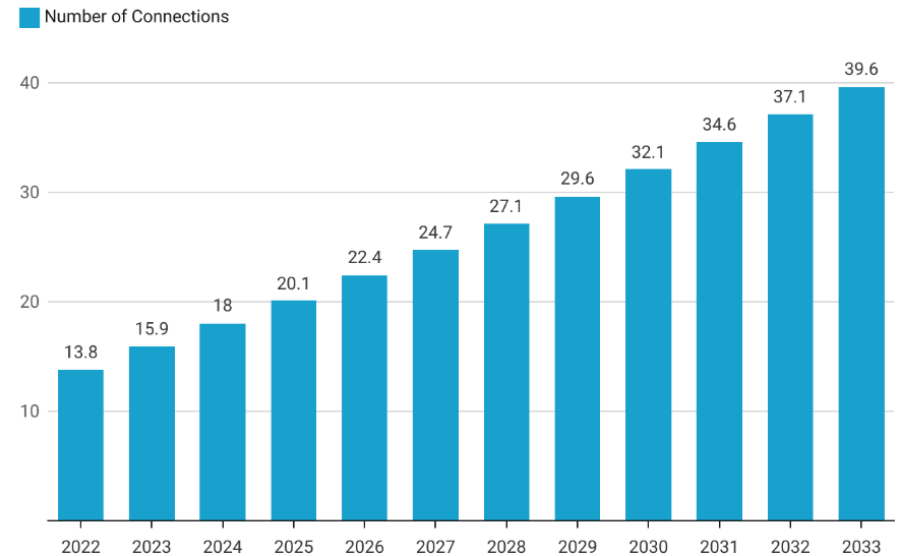
How will 5G create new businesses?

Will the providers be successful?

- ❑ Ultra Wideband to the home (Home Internet)?
- ❑ Driverless cars?
- ❑ Games?
- ❑ Remote medicine?
- ❑ Drones?

Number of Internet of Things (IoT) Connections Worldwide

Connections in billions



Internet of Things (IoT)

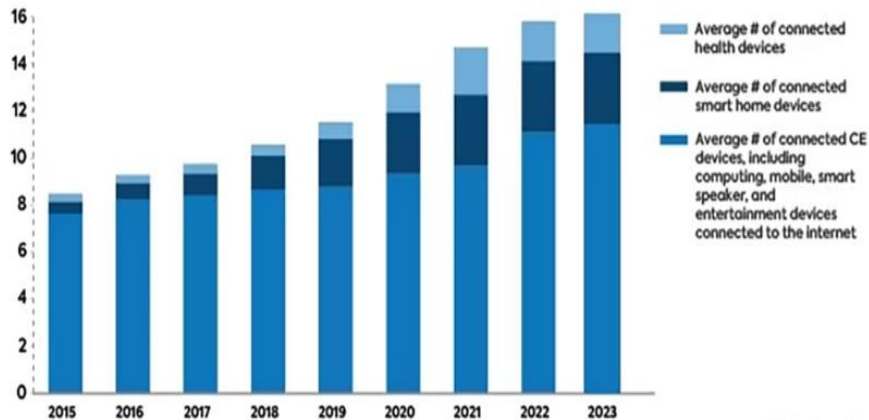
Q4

- 2023:** 16.1 billion active IoT devices
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Smart Home Devices and Connectivity

Average Number of Connected Devices
per US Households

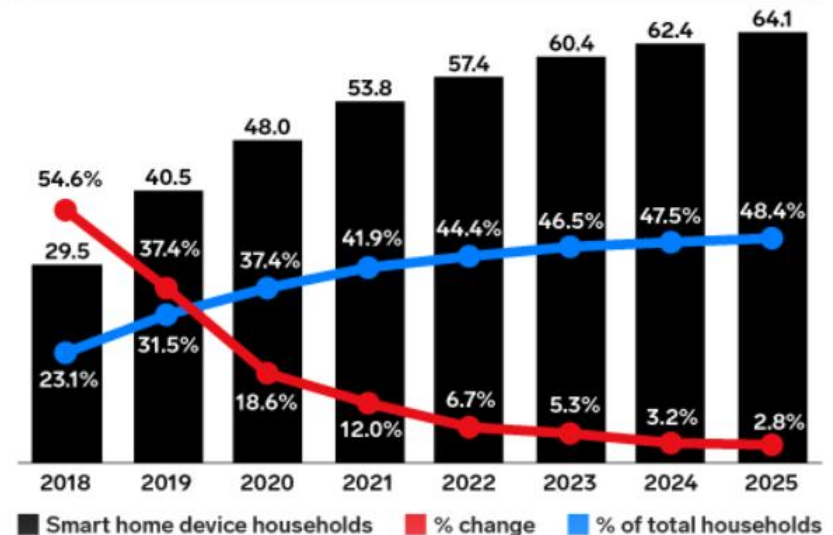
PARKS
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Promising trend?

US Smart Home Device Households, 2018-2025
millions, % change, and % of total households



Note: households that actively use smart home devices at least once per month
Source: Insider Intelligence, Oct 2021

271297

InsiderIntelligence.com

Slowing down?

Growth: How about buying other companies?

❑ AT&T (market cap about 160B)

- Paid \$67B for DirecTV
- Paid \$102B for Time Warner
- Has abandoned both with huge losses
- Has cut dividends

❑ Verizon (market cap about \$220B)

- Paid \$4.4B for AOL
- Paid \$4.5B for Yahoo
- Sold both for \$5B
- Headline "At least they're not AT&T"

- ❑ \$102B for Time Warner and \$67B on DirecTV (losses of \$50B)

Growth: How about stealing customers?

- ❑ The competitor retaliates
- ❑ Nothing is gained
- ❑ Both companies lose money

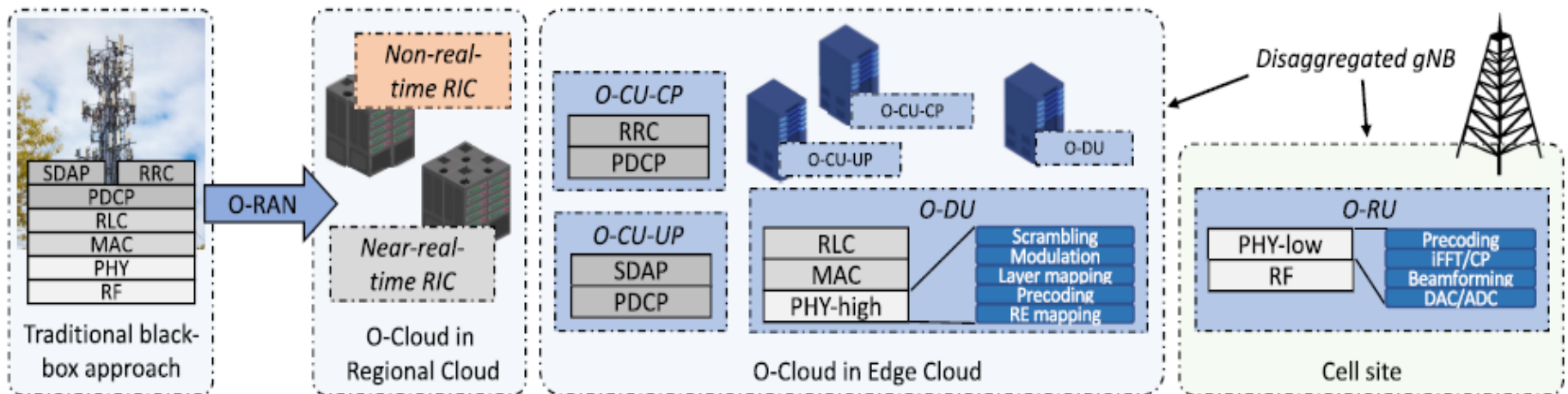
Lesson

- ❑ It's very hard to create billions of dollars in "new growth"
- ❑ Several examples in the history of corporate world
- ❑ Needs nimbleness and creativity
 - E.g. software industry
 - ❑ Cloud Computing
 - ❑ Digital Transformation
 - ❑ Big Data Analytics
 - ❑ Artificial Intelligence

Beyond 5G: Cloud Computing, AI, Data Analytics

❑ O-RAN: Open Radio Access Networks

- From Traditional Base Station Architecture to Virtualized Cloud-based Architecture
- Virtualized RANs where disaggregated components are connected via open interfaces and optimized by intelligent controllers



What is 6G? (courtesy Ericsson)

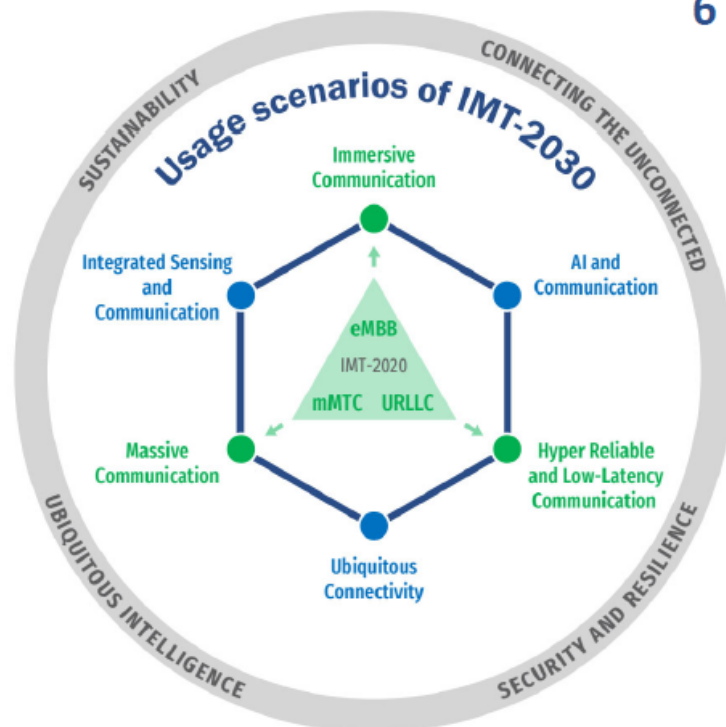
- ❑ Deployments envisioned in 2030
- ❑ Future 6G networks will bridge physical things, people and activities into a fully cyber-physical world where the digital and physical worlds as we know them today have merged
- ❑ This will provide new ways of interacting with the world around us, new possibilities to connect from anywhere and new ways to experience faraway places and cultures
- ❑ In doing so, 6G will form the bedrock of a more human-friendly, sustainable and efficient future society

What are 6G technology capabilities and use cases?

- ❑ As 6G develops, new network technologies will begin to redefine service possibilities, moving networks into new paradigms of:
 - ultra lean design
 - limitless connectivity
 - integrated sensing and communication
 - seamless ground, air and satellite coverage
- ❑ **Use cases:** massive digital twinning, autonomous mobility and wide area mixed reality are all expected to break the commercial mainstream in the 6G era
- ❑ https://www.ericsson.com/en/6g?video-dialog=1_g0m3zaki

6G Usage scenarios (ITU)

Usage scenarios



So called "Wheel diagram"
Source: Document 5/131 and edited in SG 5

6 Usage scenarios

Extension from IMT-2020 (5G)

eMBB → Immersive Communication

mMTC → Massive Communication

URLLC → HURLLC (Hyper Reliable & Low-Latency Communication)

New

Ubiquitous Connectivity

AI and Communication

Integrated Sensing and Communication

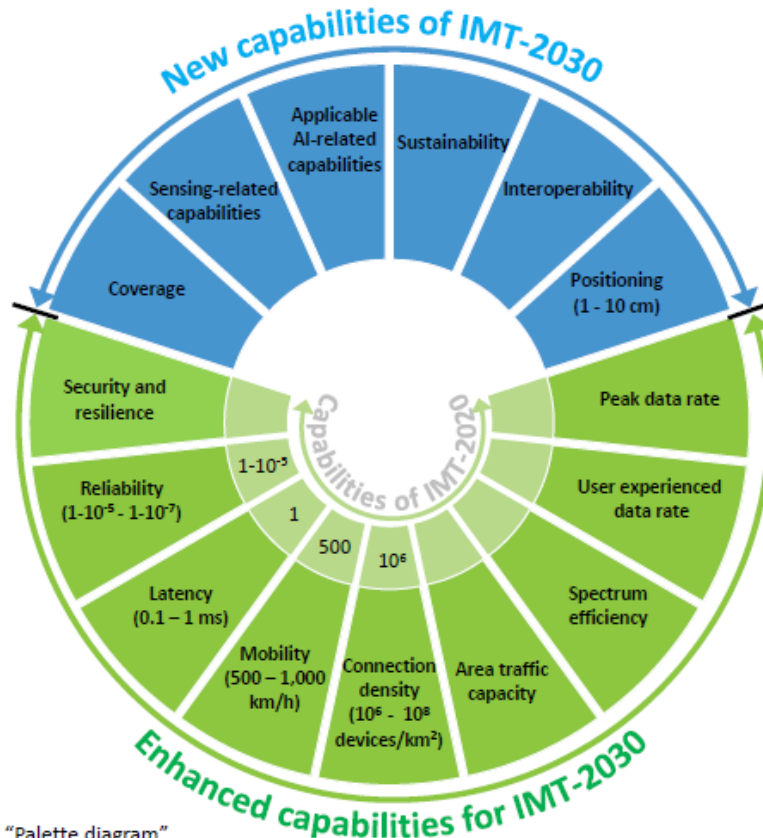
4 Overarching aspects:

act as design principles commonly applicable to all usage scenarios

Sustainability, Connecting the unconnected,
Ubiquitous intelligence, Security/resilience

6G Capabilities (ITU)

Capabilities of IMT-2030



So called "Palette diagram"

The range of values given for capabilities are estimated targets for research and investigation of IMT-2030.

All values in the range have equal priority in research and investigation.

For each usage scenario, a single or multiple values within the range would be developed in future in other ITU-R Recommendations/Reports.

6G Usage Scenarios and Capabilities (ITU)

ITU-R 6G usage scenarios and capabilities

