1G, 2G, 3G, 4G, 5G

Dr. John W Carey M

G?

- G → Generation

- Generation of wireless phone technology

1G

- Frequency: 150MHz / 900MHz
- Bandwidth: Analog telecommunication (30KHz)
- Characteristic: First wireless communication
- Technology: Analog cellular
- Capacity (data rate): 2kbps

- From 1980 to 1990
- Bad voice quality
- Poor battery, cellphones
- Big cellphones

- Better than nothing, at least its wireless and mobile

2G

- Frequency: 1.8GHz (900MHz), digital telecommunication
- Bandwidth: 900MHz (25MHz)
- Characteristic: Digital
- Technology: Digital cellular, GSM
- Capacity (data rate): 64kbps

- Why better than 1G?

- From 1991 to 2000
- Allows txt msg service
- Signal must be strong or else weak digital signal

- 2.5G
  - 2G cellular technology with GPRS
  - E-Mails
  - Web browsing
  - Camera phones

3G

- Frequency: 1.6 – 2.0 GHz
- Bandwidth: 100MHz
- Characteristic: Digital broadband, increased speed
- Technology: CDMA, UMTS, EDGE
- Capacity (data rate): 144kbps – 2Mbps

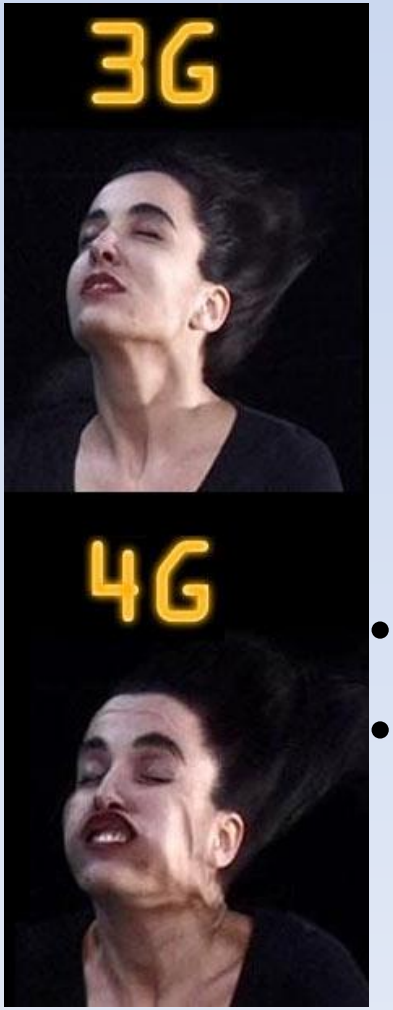
- Why better than 2G?

- From 2000 to 2010
- Called smartphones
- Video calls
- Fast communication
- Mobil TV
- 3G phones rather expensive

4G

- Frequency: 2 – 8 GHz
- Bandwidth: 100MHz
- Characteristic: High speed, all IP
- Technology: LTE, WiFi
- Capacity (data rate): 100Mbps – 1Gbps

- Why better than 3G?



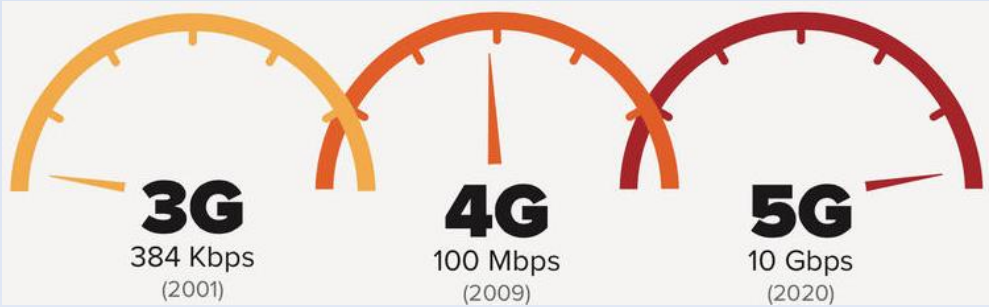
- From 2010 to today (2020?)
- MAGIC
  - Mobile multimedia
  - Anytime, anywhere
  - Global mobile support
  - Integrated wireless solutions
  - Customized personal service
- Good QoS + high security
- Bigger battery usage

5G

- https://5g.co.uk/guides/5g-frequencies-in-the-uk-what-you-need-to-know/
- Capacity (data rate): 1Gbps – ULIMITED?

- Why better than 4G?

- From X (2020?) to Y (2030?)
- High speed and capacity
- Faster datatrasmission than 4G
- Supports
  - Interactive multimedia
  - Voice streaming
  - Buckle up.. Internett
- More efficient

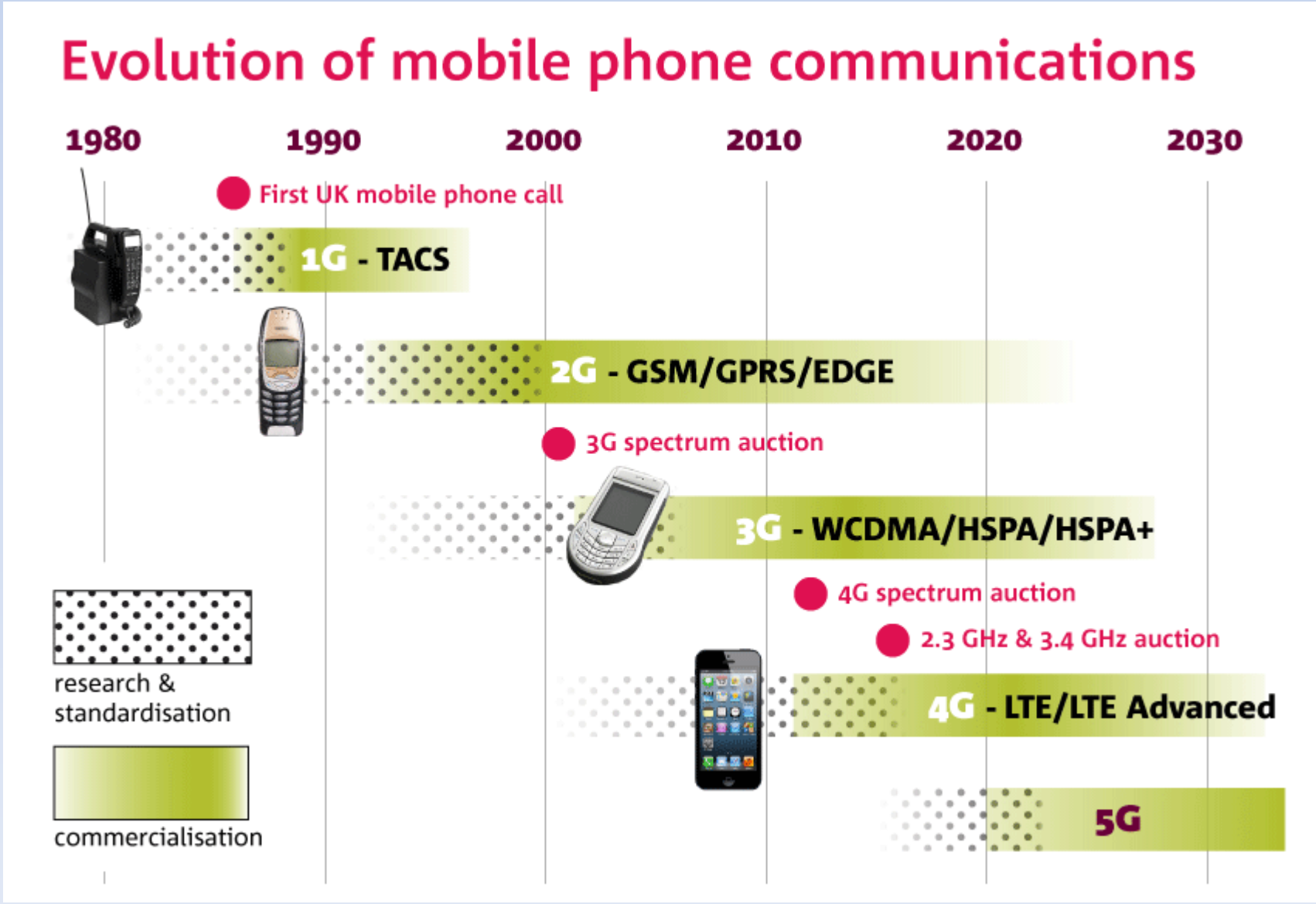


Comparison

	1G	2G	3G	4G	5G
Period	1980 – 1990	1990 – 2000	2000 – 2010	2010 – (2020)	(2020 - 2030)
Bandwidth	150/900MHz	900MHz	100MHz	100MHz	1000x BW pr unit area
Frequency	Analog signal (30 KHz)	1.8GHz (digital)	1.6 – 2.0 GHz	2 – 8 GHz	3 – 300 GHz
Data rate	2kbps	64kbps	144kbps – 2Mbps	100Mbps – 1Gbps	1Gbps <
Characteristic	First wireless communicatio n	Digital	Digital broadband, increased speed	High speed, all IP	
Technology	Analog cellular	Digital cellular (GSM)	CDMA, UMTS, EDGE	LTE, WiFi	WWWW

- https://www.linkedin.com/pulse/evolution-mobile-communication-from-1g-4g-5g-6g-7g-pmp-cfps

Comparison


Evolution of mobile phone communications
1980
1990
2000
2010
2020
2030
First UK mobile phone call
1G - TACS
2G - GSM/GPRS/EDGE
3G spectrum auction
3G - WCDMA/HSPA/HSPA+
4G spectrum auction
2.3 GHz & 3.4 GHz auction
4G - LTE/LTE Advanced
5G
research & standardisation
commercialisation

EVOLUTION OF THE G

1G
1ST GENERATION
wireless network
- Basic voice service
- Analog-based protocols

2G
2ND GENERATION
wireless network
- Designed for voice
- Improved coverage and capacity
- First digital standards (GSM, CDMA)

3G
3RD GENERATION
wireless network
- Designed for voice with some data consideration (multimedia, text, internet)
- First mobile broadband

4G
4TH GENERATION
wireless network
- Designed primarily for data
- IP-based protocols (LTE)
- True mobile broadband

THE NEED FOR SPEED *in kilobits per second*

2.4 kbps	64 kbps	2,000 kbps	100,000 kbps

GENERATIONAL GROWTH
~ equivalent to ~

the height of a GRASSHOPPER	the height of a BORDER COLLIE	the height of a 5-STORY BUILDING	the height of BURJ KHALIFA *tower in Dubai*

Comparison

WHERE ARE WE HEADING?

2013 FOR THE FIRST TIME EVER MORE THAN ONE
EXABYTE
of data will travel across the global mobile network
EVERY ~ MONTH

10.8 EXABYTES *~ per month ~*

2013 2016

1 EXABYTE
~ is equivalent to ~
1 BILLION GIGABYTES

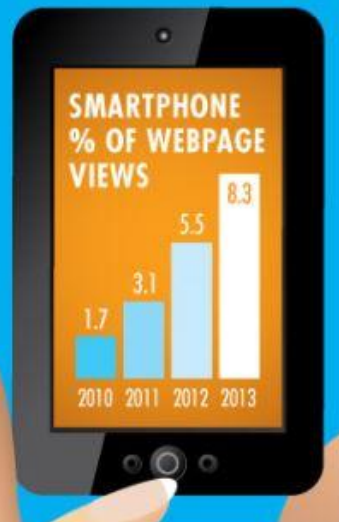
~ or ~

~ downloading the entire ~
STAR WARS
~ SERIES ~
130 MILLION TIMES

WHAT'S DRIVING THIS GROWTH?
SMARTPHONE USERS
~ among other things ~

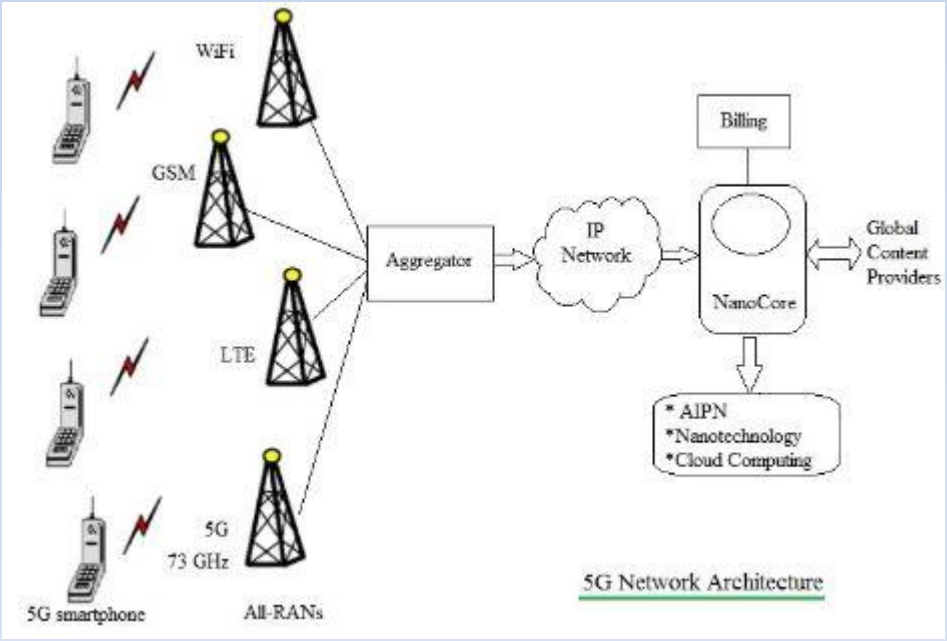
2013 1 in 3

2017 1 in 2



Future: 5G? 6G?

- 5G:



- 6G:
  - Integrate 5G with satellite network for global coverage
  - Ultra fast Internet access
  - Smart home/cities
- 7G:
  - Space roaming
  - World completely wireless