

What will 5G mean to you?

We're literally at the very beginning of the 5G era.

By Ron Brown
SilvercomCTC



The Chinese Ministry of Science and Technology recently launched preparatory work for the development of the future network. The foundations are already laid and in the opinion of some experts, 6G speeds could reach 1 terabyte per second, or approximately 8,000 times the speed of 5G.

January 18, 1982 / \$1.50
Newsweek

The Big Breakup

Ma Bell Loses
Its Phone
System

How Phone
Bills Will
Go Up



Its Coming
Computer
War With IBM

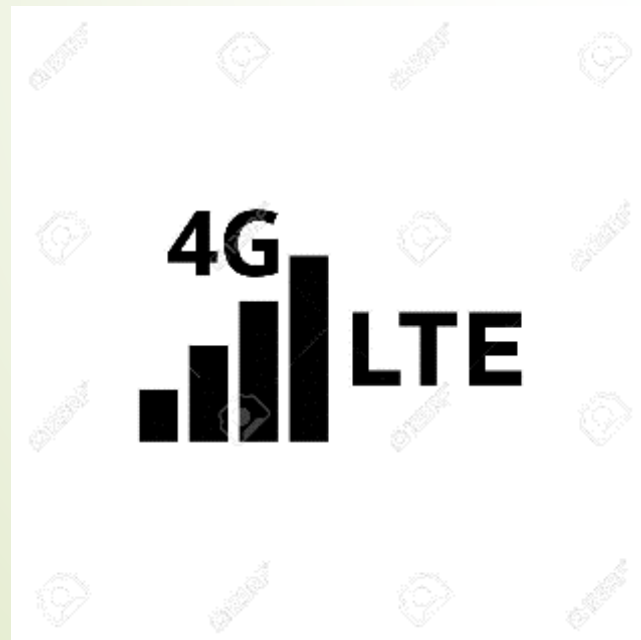
The Impact
On Cable TV
And the Press



~1980	→	1G
~1990	→	2G
~2000	→	3G
~2010	→	4G
~2020	→	5G

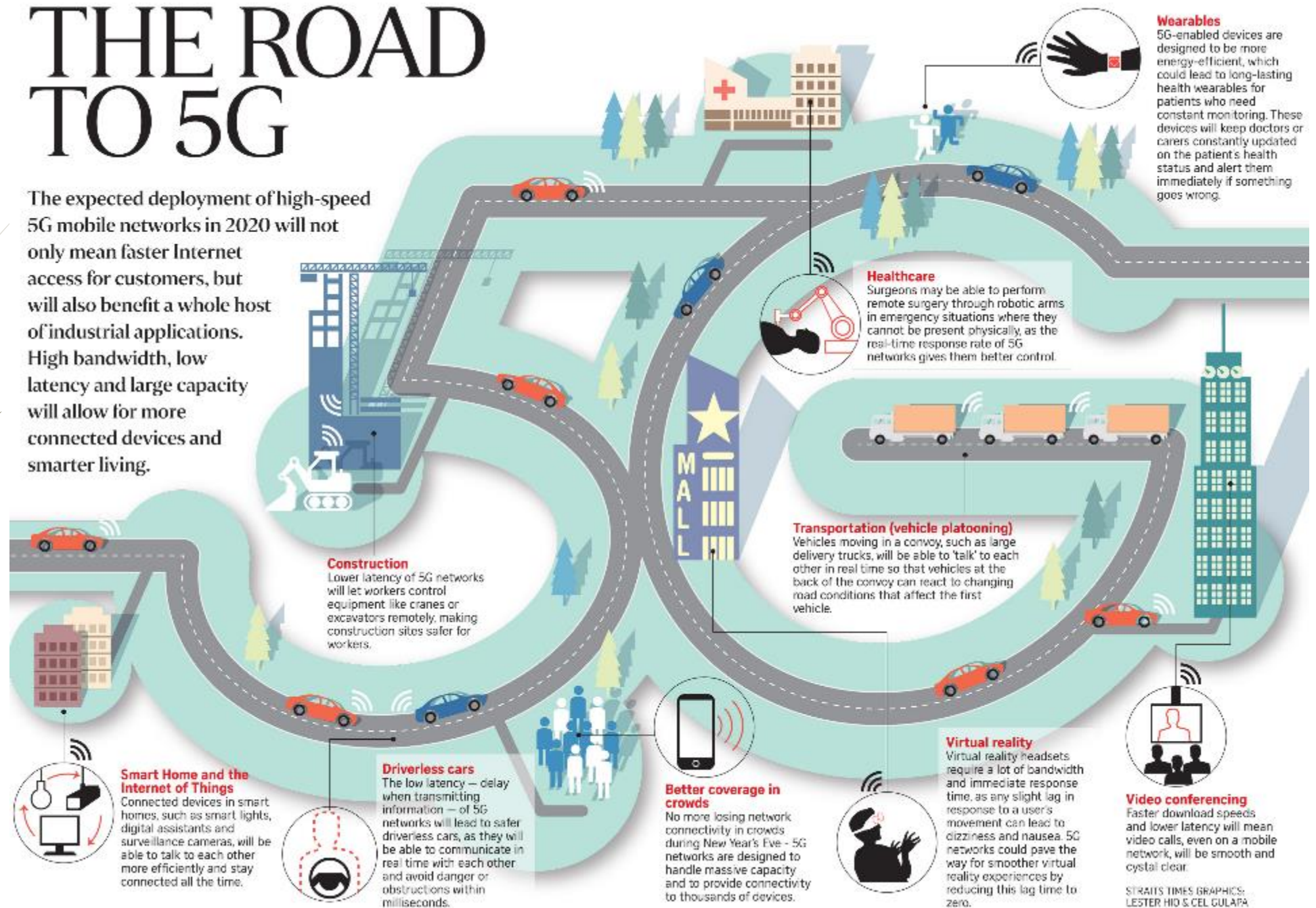


Don Johnson – Miami Vice

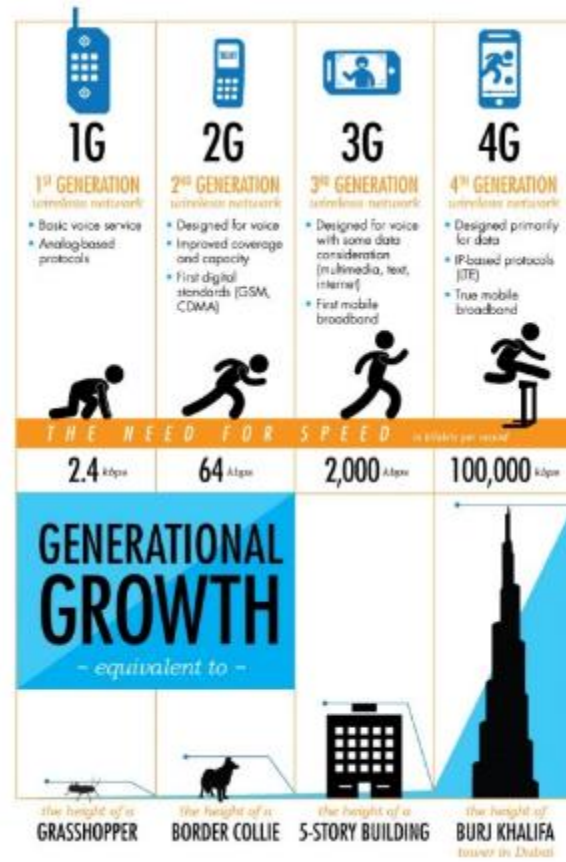


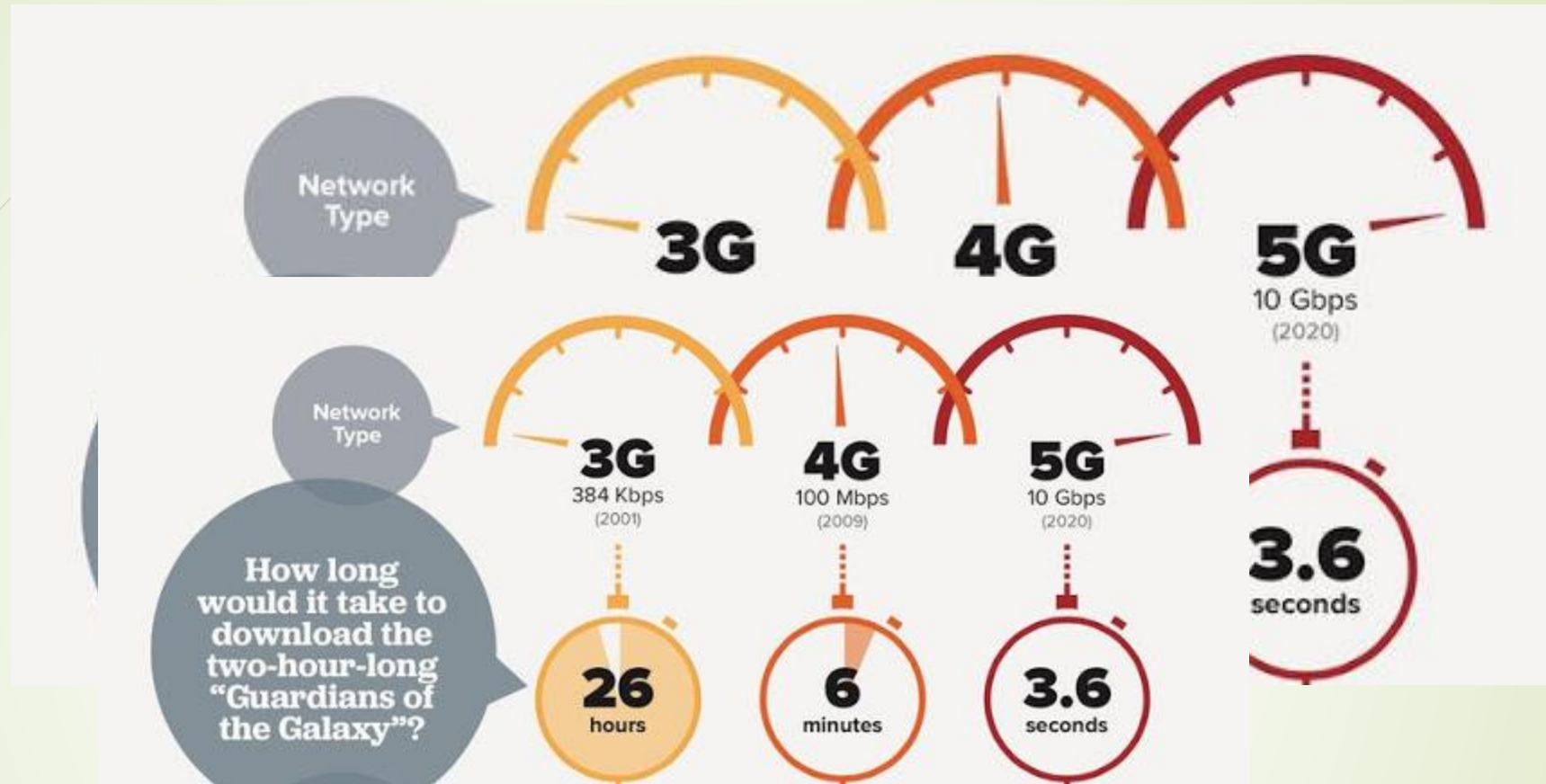
THE ROAD TO 5G

The expected deployment of high-speed 5G mobile networks in 2020 will not only mean faster Internet access for customers, but will also benefit a whole host of industrial applications. High bandwidth, low latency and large capacity will allow for more connected devices and smarter living.

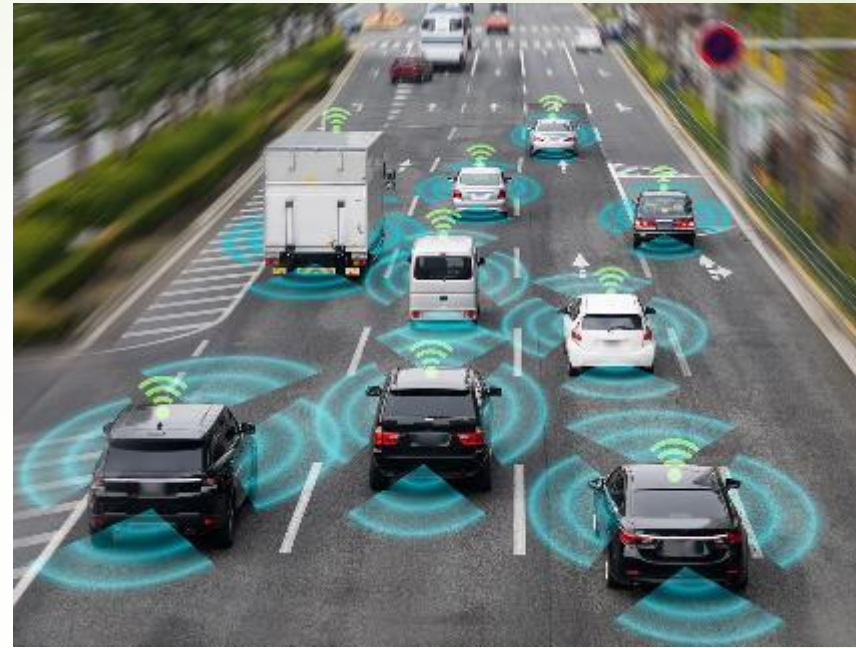


EVOLUTION OF THE G





How much faster is 5G?

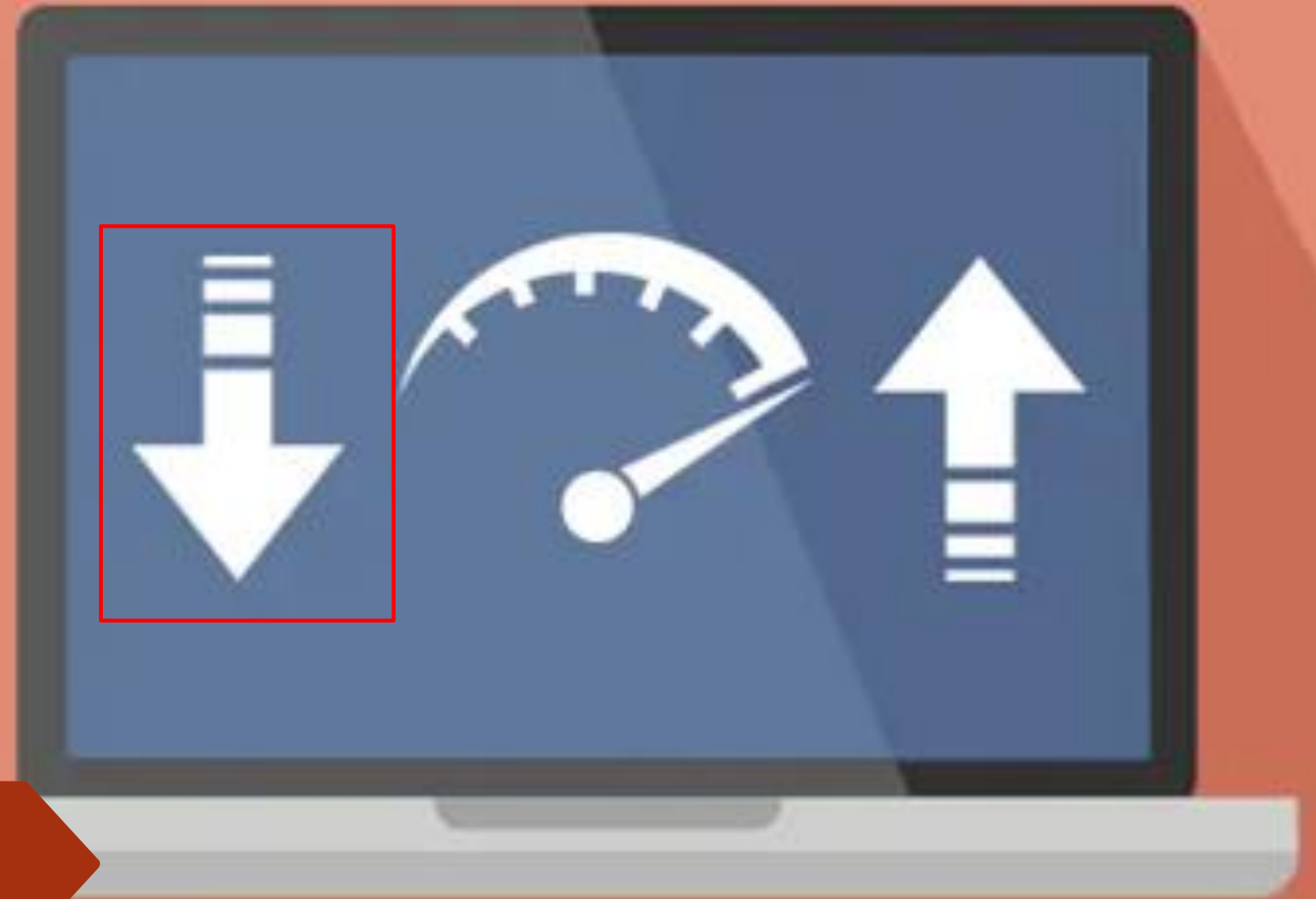


With fast speed brings low latency

CABLE - 100 MBS

WIRELESS LTE – 1500
MBS

5G- 5000 MBS





Verizon LTE Tower

2017- 30 MBS
Network congestions- 5 MBS

2019 – 180 MBS
Network congestion- 130 MBS

2020 – 5G 1000 MBS



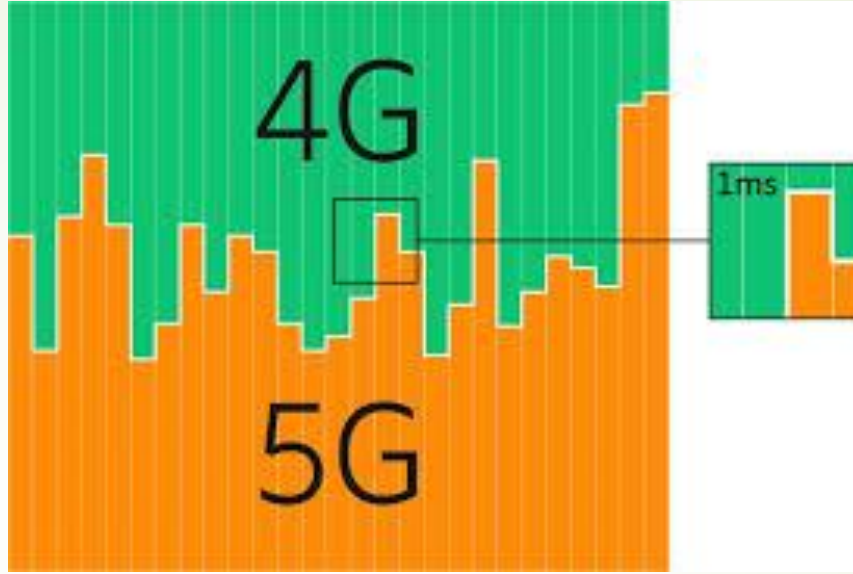
4G- LTE

**Slow 5G-LTE - 1000
MBS**

**Fast 5G- Millimeter
Wave 5000 MBS**

**One Million Cell Towers in USA
One Million Dollars per Cell Tower**





**Dynamic Spectrum Sharing- Coming
late 2020**

What is a 5G Network – No One Knows

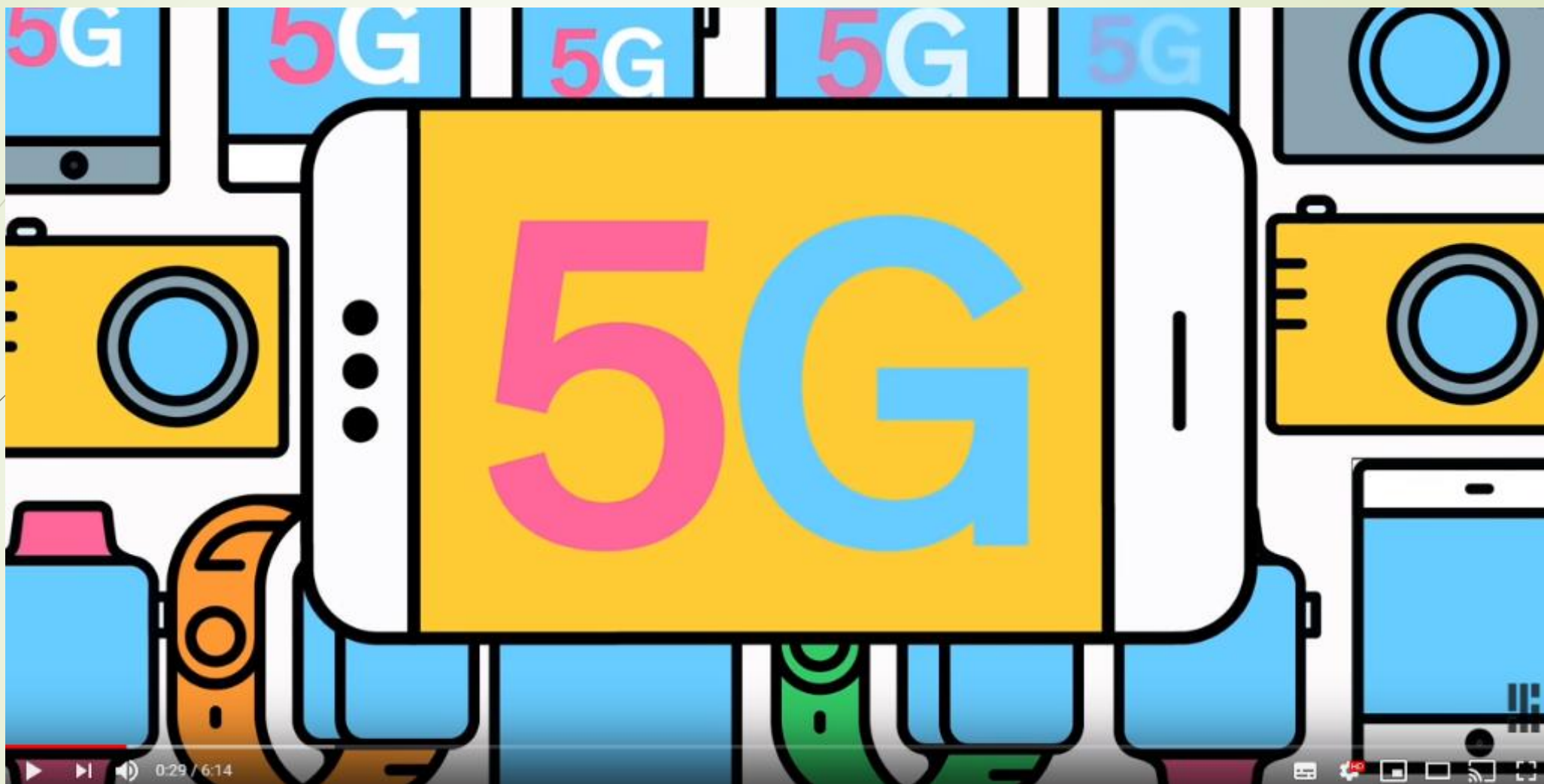
► 5G Standards

- Low Latency
- High Bandwidth
- Higher capacity for # of devices

- Spec: Upper limit of 20 gb/sec
- Minimum 5 gb/second

1 millisecond
latency







**Millimeter
Waves**



Small Cell



**Massive
MIMO**



Beamforming

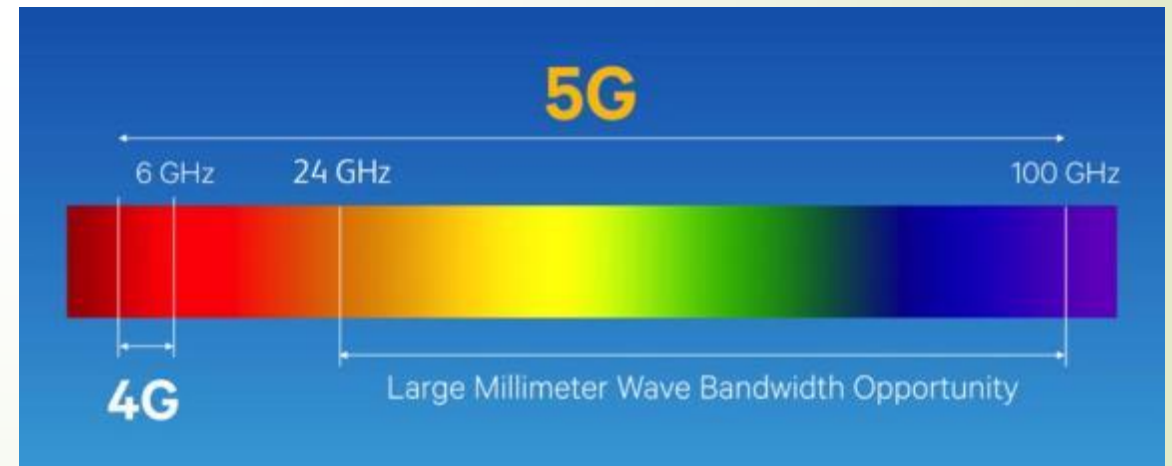
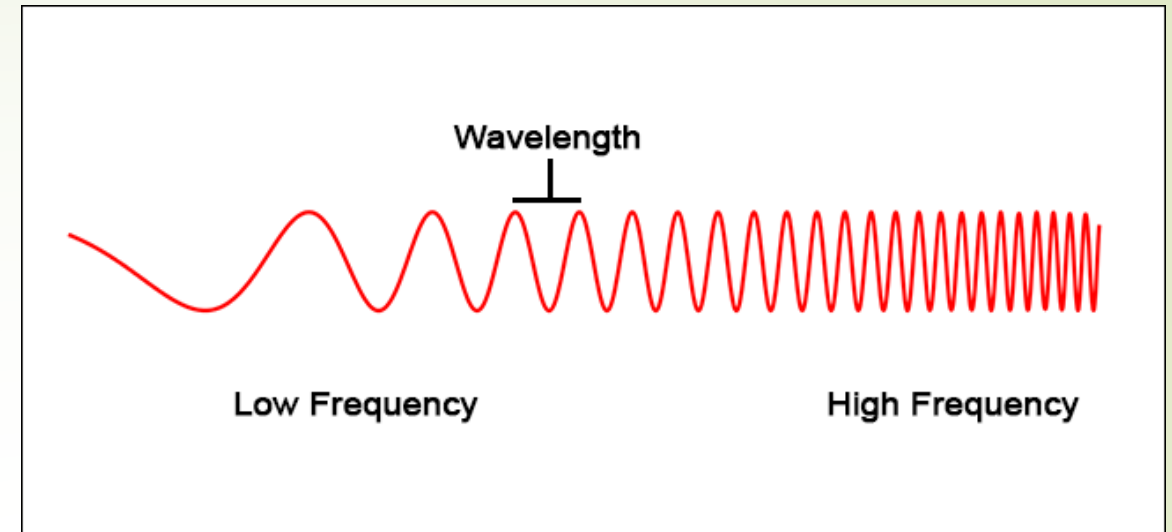


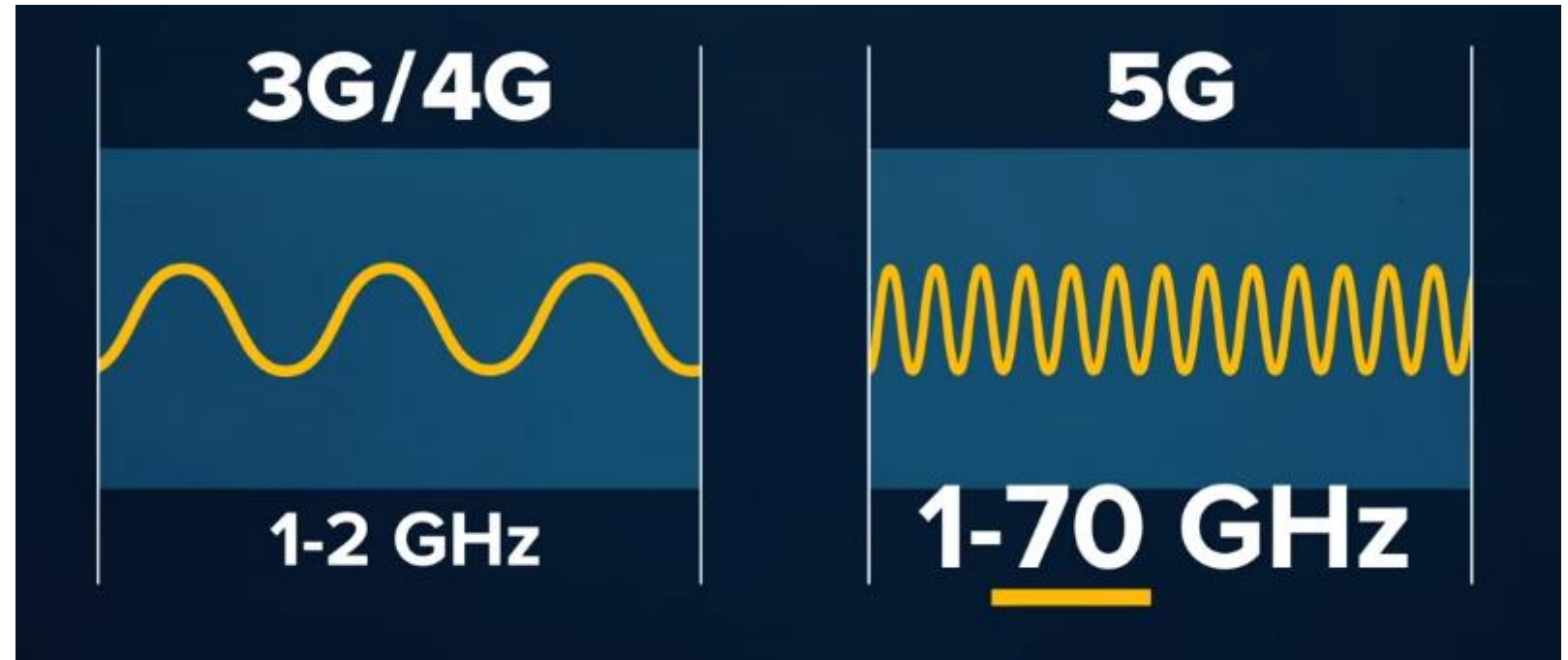
Full Duplex

5 – Technologies forming the foundation of
5G

Millimeter Wave

- ▀ MmWave has worse range and worse penetration compared to LTE.
- ▀ A mmWave signal can be blocked by buildings, trees, and even your hand.
- ▀ MmWave doesn't work well in the rain or fog
- ▀ The higher-frequency means mmWave has plenty of bandwidth and low latency if you can get it

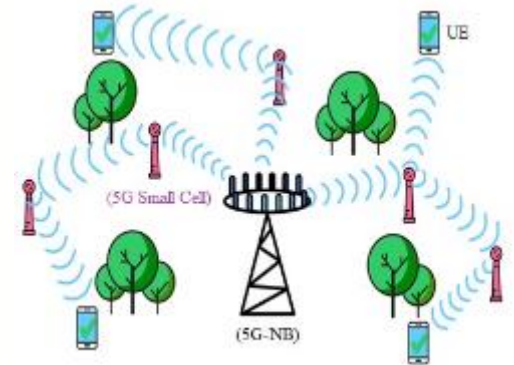


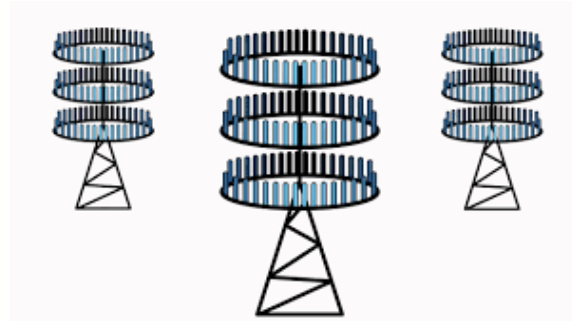




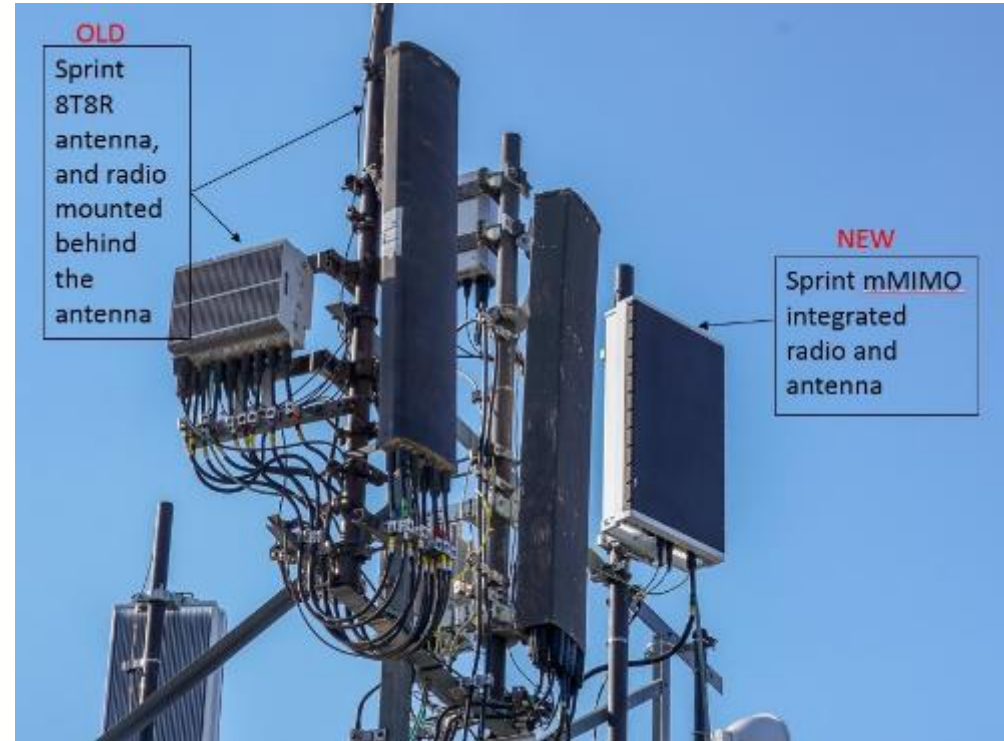
In a perfect world, your 5G-ready phone will always be connected to a millimeter wave spectrum. But this ideal world would need a ton of millimeter wave towers to compensate for millimeter wave's shoddy coverage.

5G- Small Cell





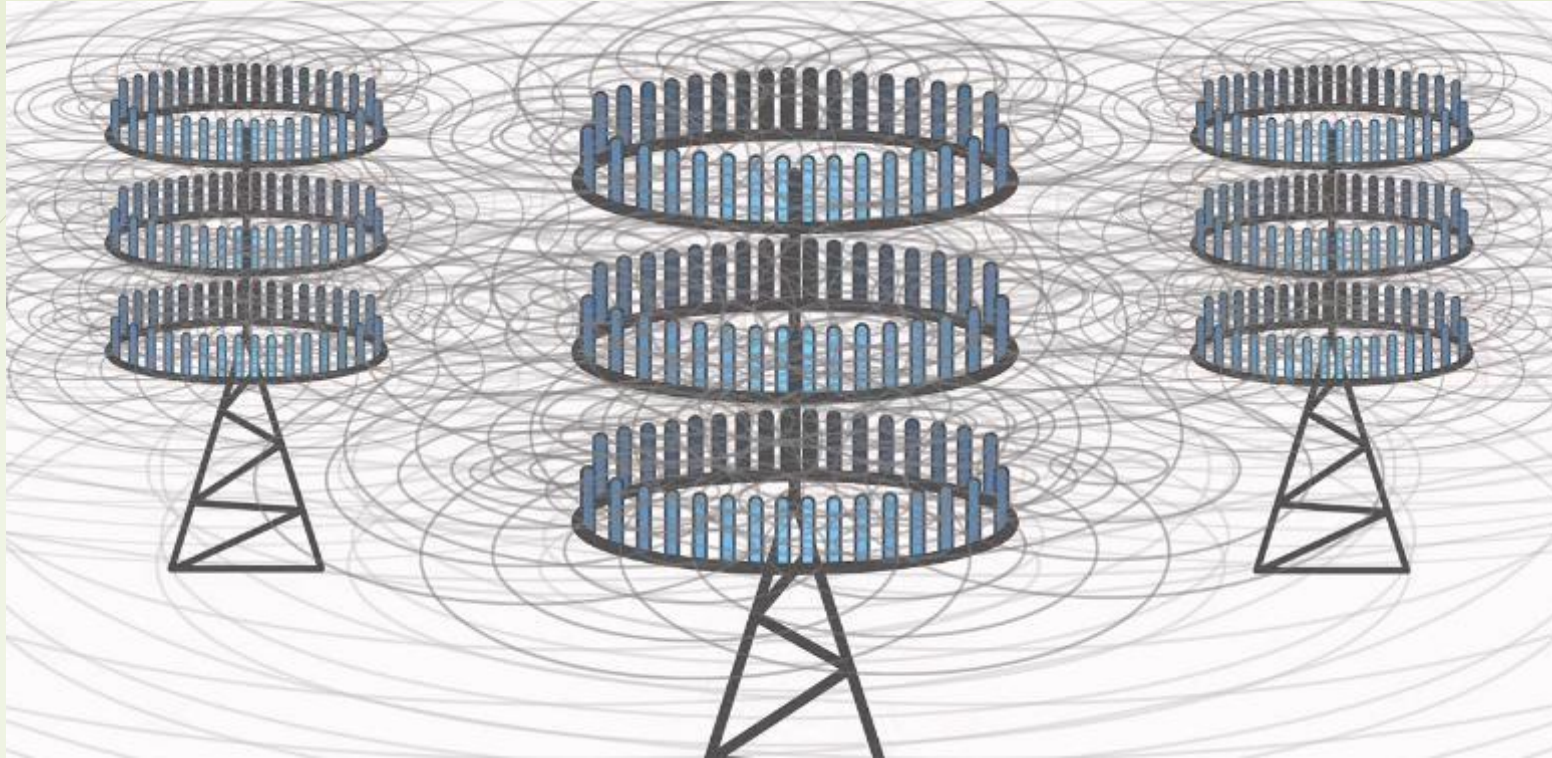
MIMO
Multiple Input Multiple Output



Massive MIMO

Cell Tower @
Ellsworth &
60 N Side

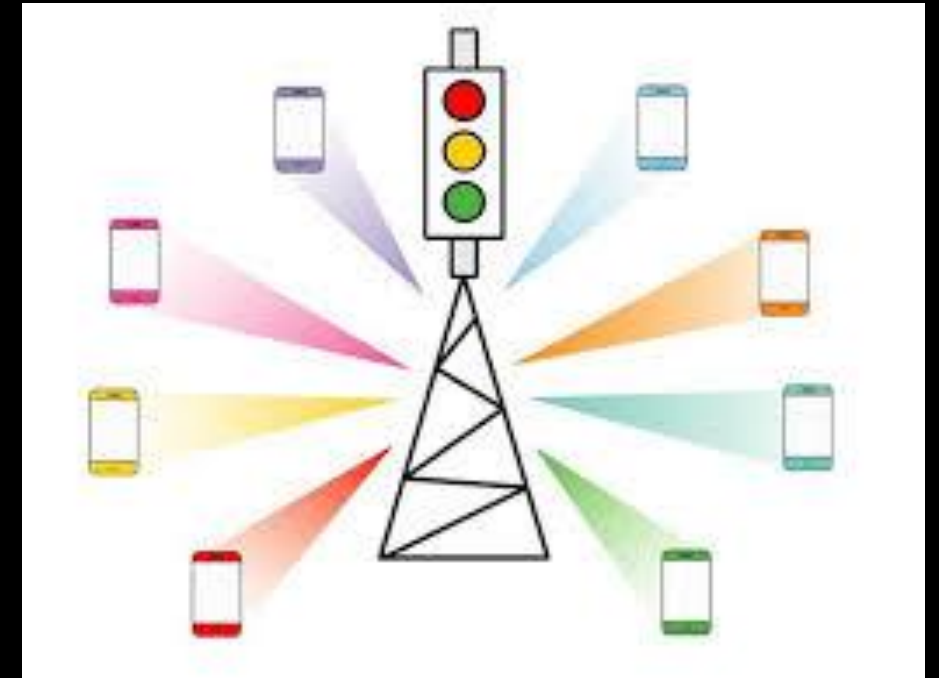




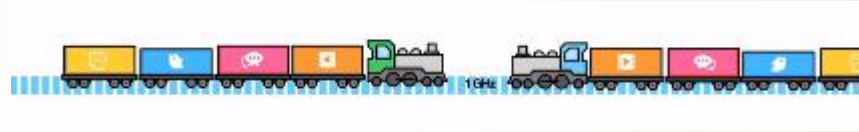
Massive MIMO lead to signal interference



5G devices use something called ***adaptive beam switching***

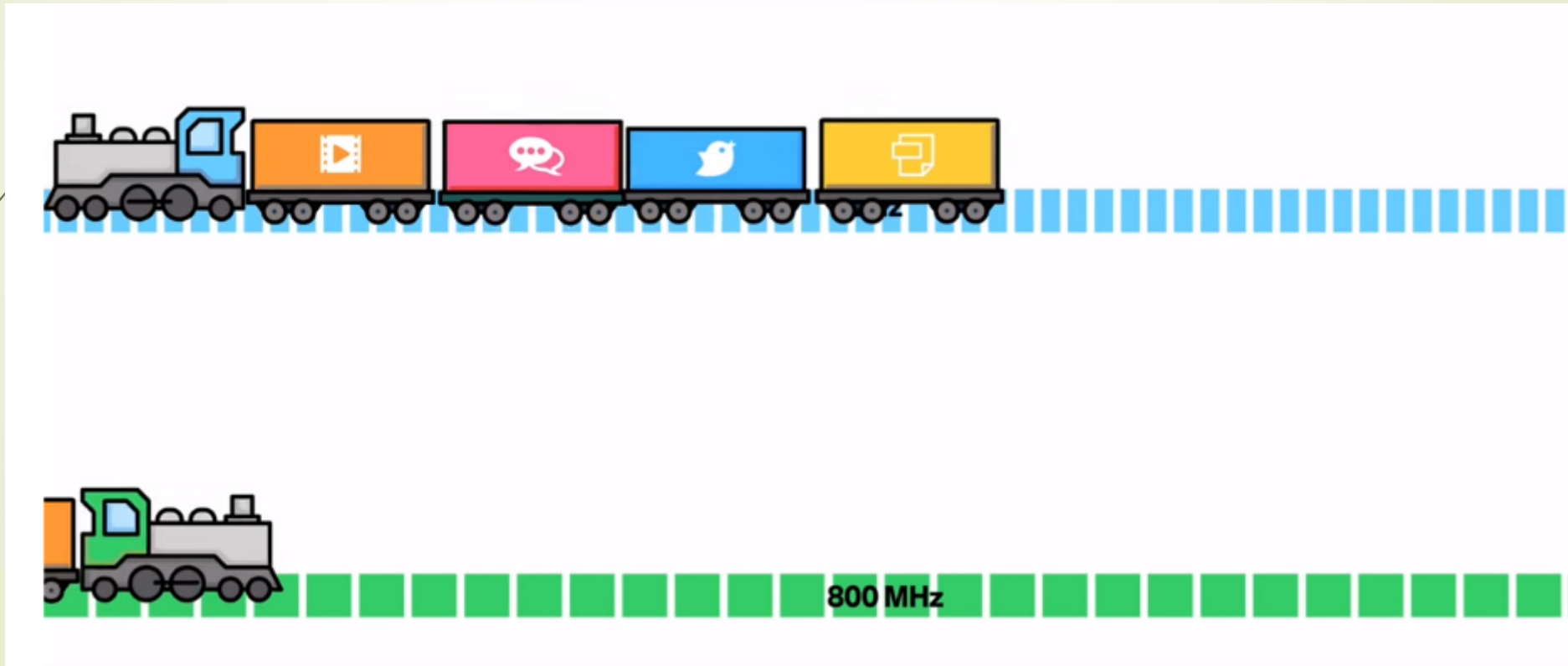


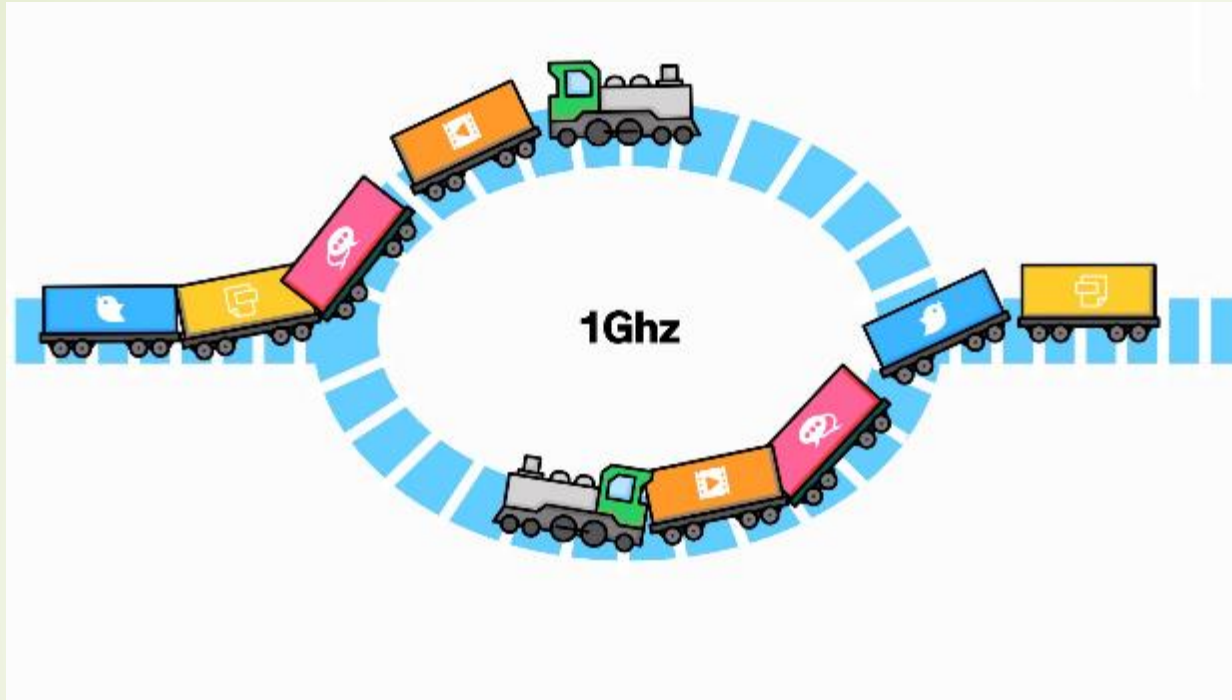
Beamforming Technology



Full Duplex – Current towers can transmit OR receive

Current Solution to put signals on different frequencies





Full Duplex



**Millimeter
Waves**



Small Cell



**Massive
MIMO**



Beamforming

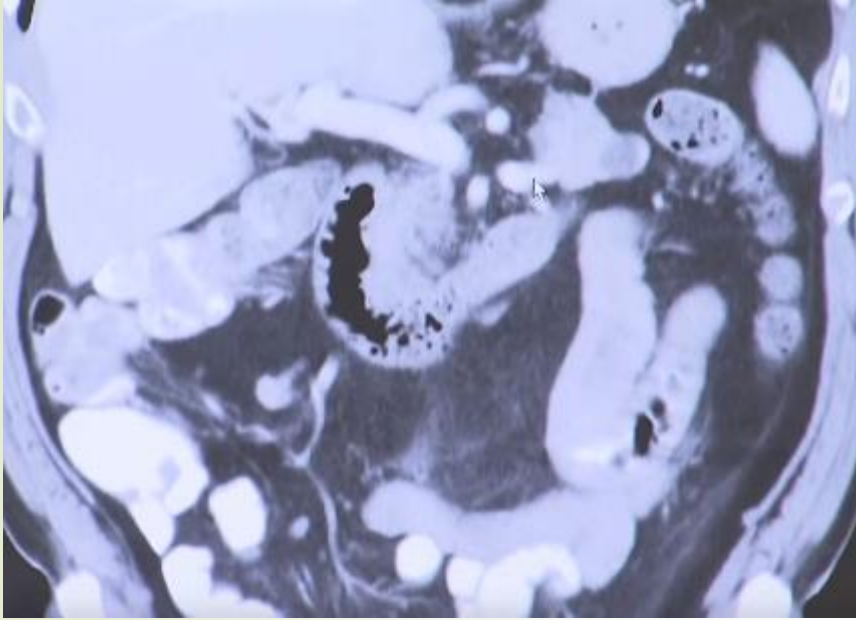


Full Duplex

5 – Technologies forming the foundation of
5G



How
Worried
Should You
Be About
the Health
Risks of 5G?



Is 5G Safe?

mmWave is a near line-of-sight technology. It is relegated to outdoor use, as it cannot penetrate buildings



Electromagnetic Spectrum

Radio Waves

Microwaves

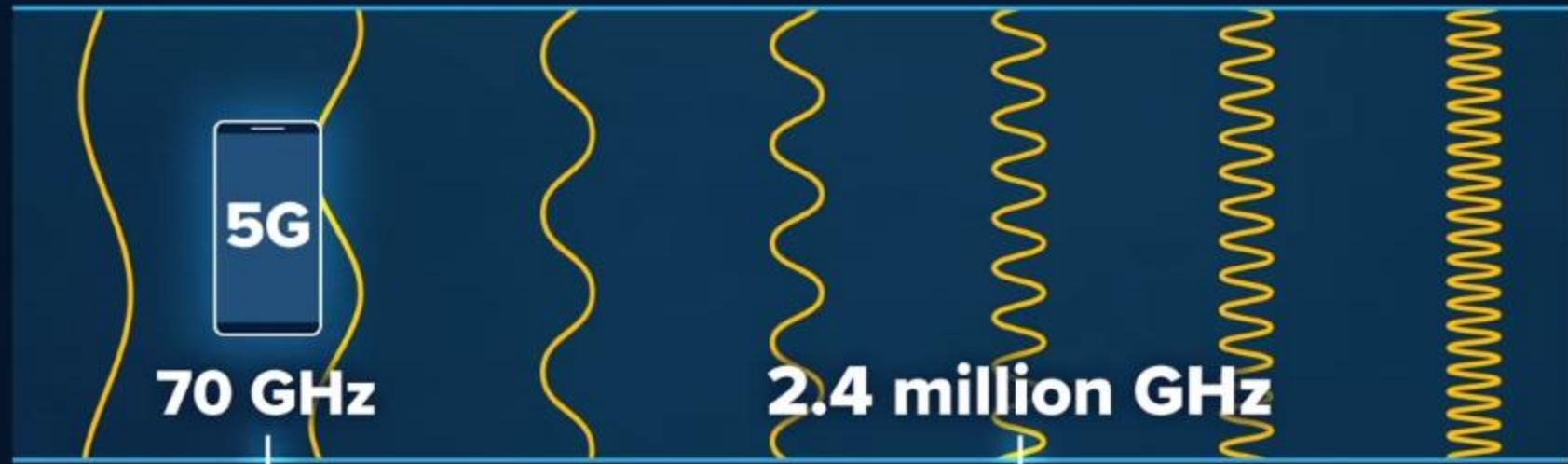
Infrared

Visible Light

Ultraviolet

X-rays

Gamma Rays



70 GHz

2.4 million GHz

**Non-ionizing
Radiation**

**Ionizing
Radiation**

International Agency for Research on Cancer



World Health
Organization

PRESS RELEASE
N° 208

31 May 2011

IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS
POSSIBLY CARCINOGENIC TO HUMANS

Group 1: The agent is carcinogenic to humans.

Group 2A: The agent is probably carcinogenic to humans.

Group 2B: The agent is possibly carcinogenic to humans.

Group 3: The agent is not classifiable as to its carcinogenicity to humans.

Group 4: The agent is probably not carcinogenic to humans.





31 May 2011

IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS
POSSIBLY CARCINOGENIC TO HUMANS

Conclusions

Dr Jonathan Samet (University of Southern California, USA), overall Chairman of the Working Group, indicated that "the evidence, while still accumulating, is strong enough to support a conclusion and the 2B classification. The conclusion means that there could be some risk, and therefore we need to keep a close watch for a link between cell phones and cancer risk."

Group 2B: The agent is possibly carcinogenic to humans.

This category is used for agents for which there is *limited evidence of carcinogenicity in humans* and less than *sufficient evidence of carcinogenicity in experimental animals*. It may

Changes Over Time: Brain and Other Nervous System

New Cancers, All Ages, All Races/Ethnicities, Both Sexes

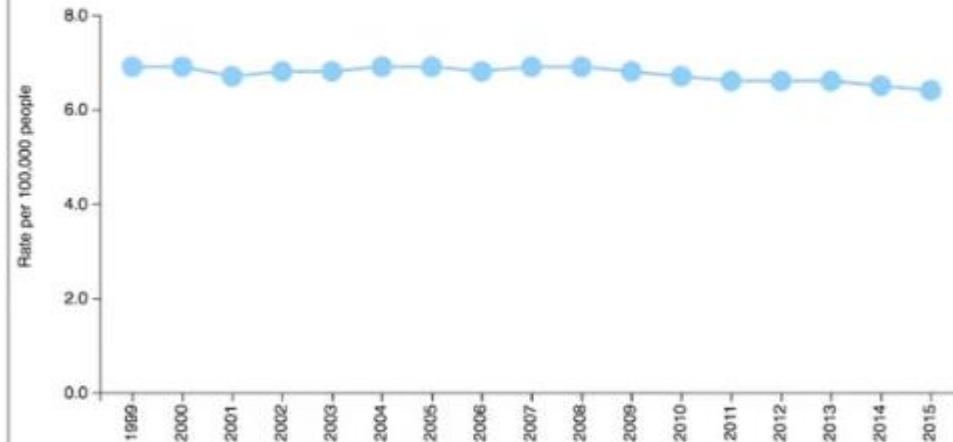
While rates of cancer cases and deaths is year.

As you can see on the indicates a steady dec

Annual Rates of New Cancers, 1999-2015

United States

Chart Table Export



Nationwide Changes in Rates of New Cancers, 1999-2015



"At this time **we do not have the science** to link health problems to cell phone use. Scientific studies are underway to determine whether cell phone use may cause health effects."



"There is **no scientific evidence** to date that proves that wireless phone usage can lead to cancer or a variety of other health effects, including headaches, dizziness or memory loss."



"The totality of the available scientific evidence **continues to not support** adverse health effects in humans caused by exposures at or under the current radiofrequency energy exposure limits."

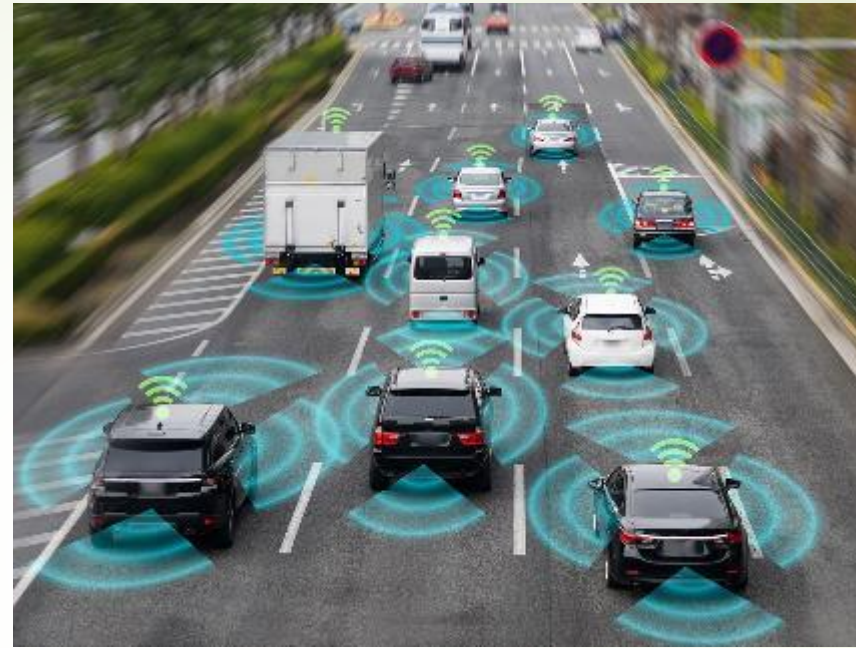


NATIONAL
CANCER
INSTITUTE

"There is currently **no consistent evidence** that non-ionizing radiation increases cancer risk in humans"

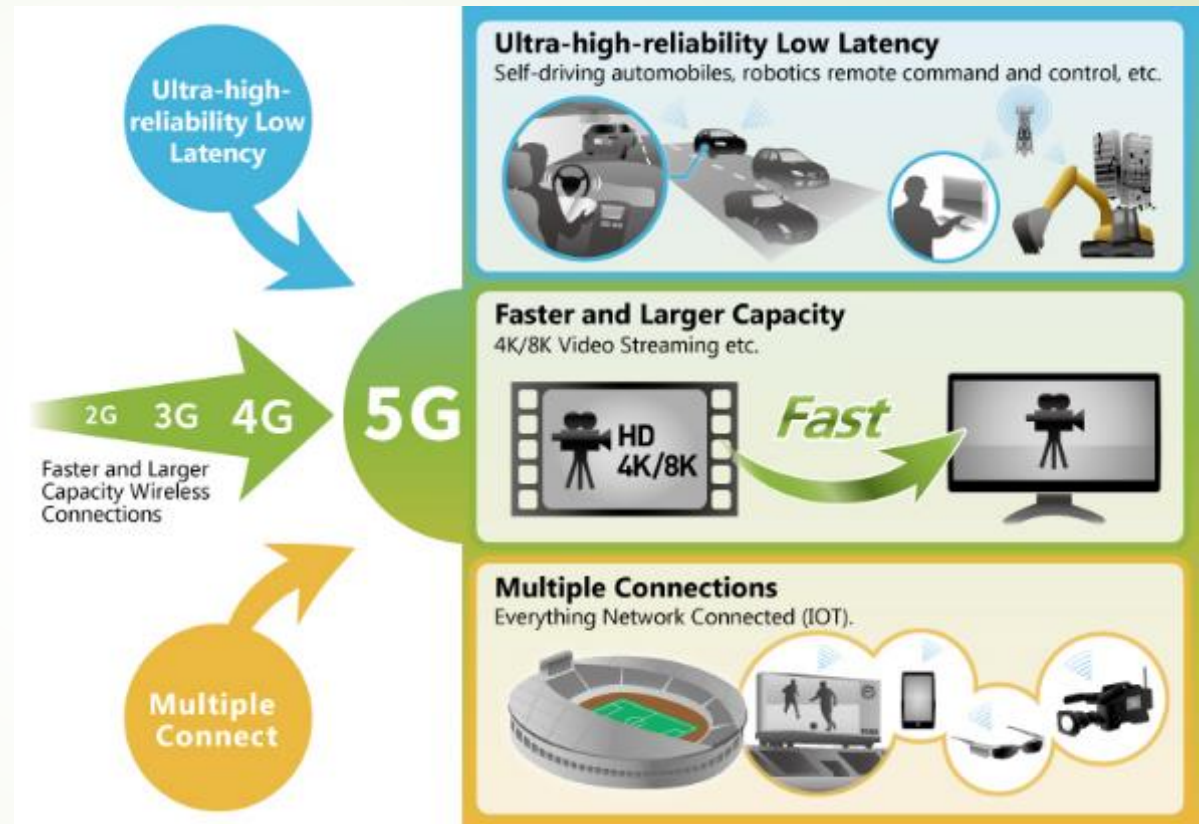
5G and the IoT





Internet of Things Technology Will Connect
Highways, Street Lights, and Vehicles

What will it mean to me?





Will I need a new phone to use 5G?



5G phones
are more
expensive
than 4G
phones



Consistency is
more
satisfying than
speed





QUALCOMM'S MODEM COMPETITION

Smartphones today are almost entirely powered by a single chip, appropriately called an "SoC" or "System on a Chip."

Qualcomm is the only company with a single-chip SoC+modem solution that sees significant distribution around the world.

This single-chip solution is a huge advantage, resulting in a smaller, less-complex, cheaper motherboard and more room for battery



4G:



Snapdragon 855
SoC

Chips needed: 5G vs 4G

(All pictures are to scale)

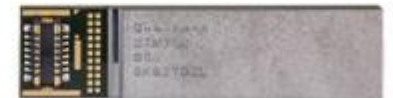
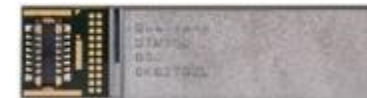
5G:



Snapdragon 855
SoC

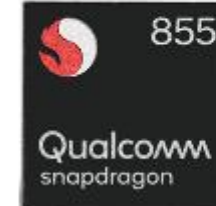


Snapdragon x50
Modem



QTM052
antenna modules

An entire Snapdragon 855 SoC



A Snapdragon x50 5G Modem



A 5G Antenna Module



Introducing the Qualcomm®

QTM052 5G mmWave antenna module

Expands portfolio of fully-integrated 5G NR mmWave modules for mobile devices



Previous



New



The weather could
get in your way

***Summer Heat
cripples 5G***

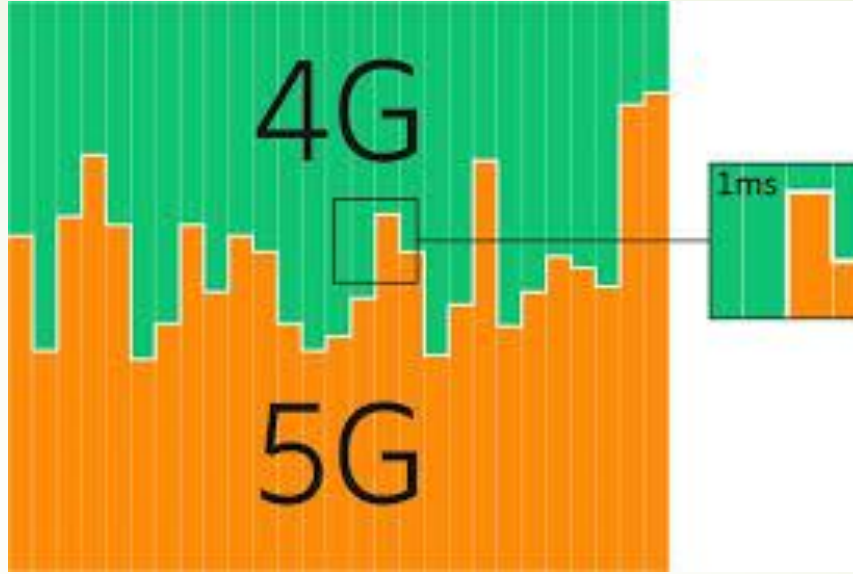


You may also
pay a price
with battery
life





1. More Expensive (\$500-\$1000)
2. More Hardware – Bigger
3. More Power – Battery capacity
4. Reception problems with mm wavelength
5. Backward compatibility with 4G
6. Future compatibility with different 5G
7. Increased cost of 5G plans

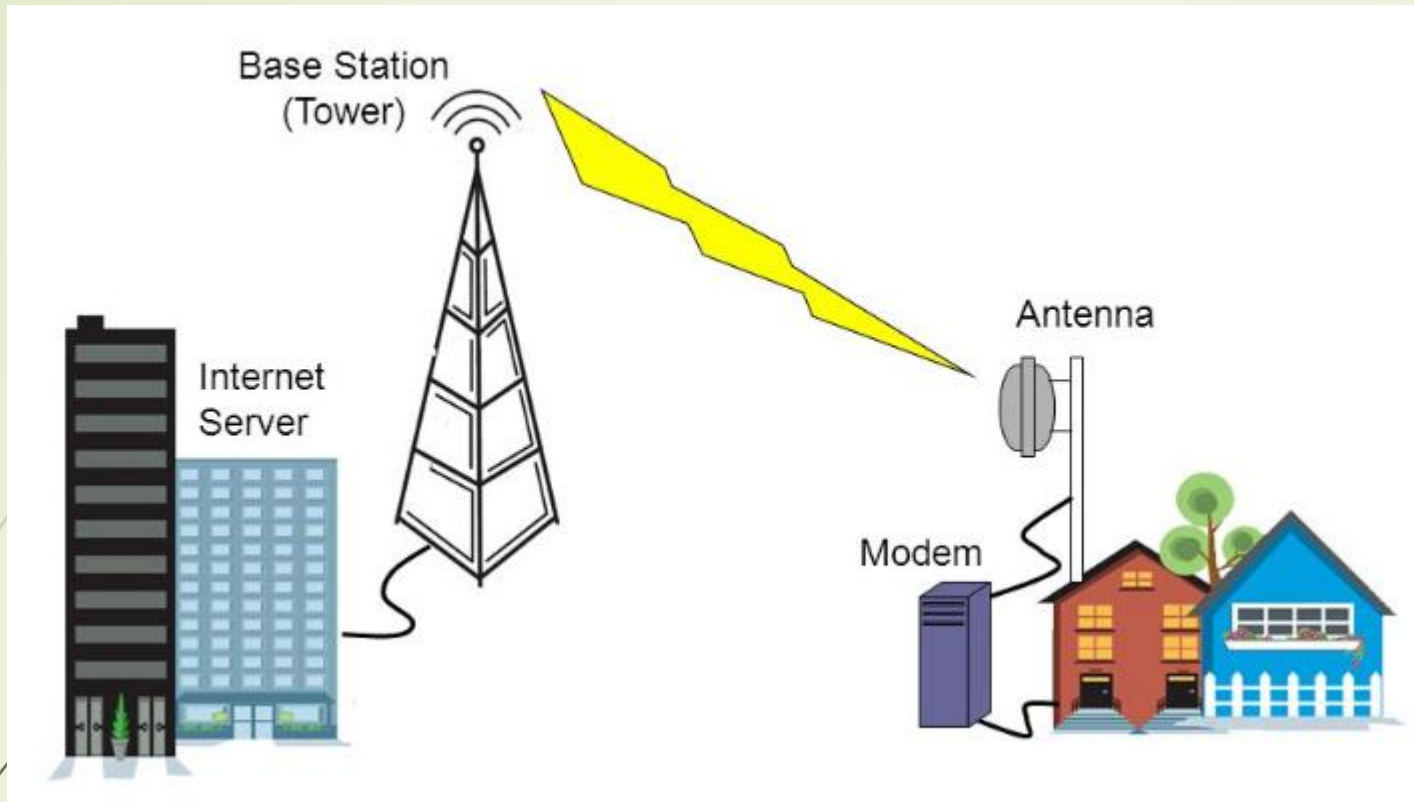


**Dynamic Spectrum Sharing- Coming
late 2020**



Mobile
5G

Fixed
Base 5G



verizon✓

**5G is ~~coming~~
here.**

Where can I use 5G today?





VERIZON'S 5G HOME BROADBAND SERVICE AT A GLANCE

INITIAL MARKETS

Los Angeles, Houston, Indianapolis, Sacramento

PRICE

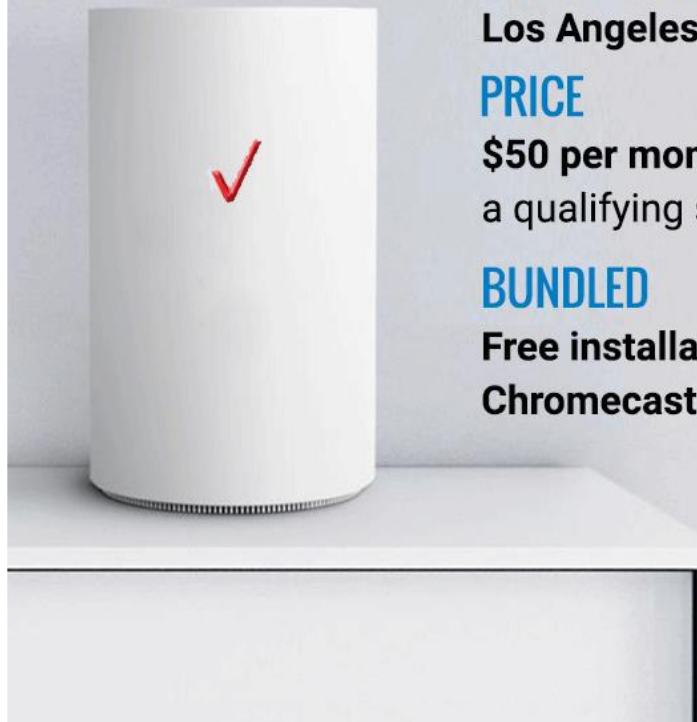
\$50 per month for Verizon Wireless customers with a qualifying smartphone, \$70 per month for others

BUNDLED

Free installation, choice of an **Apple TV 4K** or **Google Chromecast Ultra** set-top

PERFORMANCE

"Typical speeds" of 300Mbps promised, with peak speeds of nearly 1Gbps





5G Home is not yet available or this address already has 5G service **8265 East Southern Avenue, apt 507, Mesa, AZ, 85209**. Provide your contact information to stay in the loop on 5G Home availability.

Get more with 5G Home Internet.

[See comparison chart](#)

Try 5G Home. Free for 3 months.

Try it risk-free. No annual contracts. After free trial, pay \$50/mo with a Verizon mobile plan of \$30/mo or more. ①

Disney+ on us for the first year.

Stream the best stories in the world, on us. When you switch to 5G Home Internet. Then \$6.99/mo after. ①

[Learn more](#)

YouTube TV. One month on us.

Get YouTube TV on us for the first month with unlimited DVR storage space and 70+ channels of live TV. ①

[Learn more](#)

Questions?

What will 5G Mean to you?

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SilvercomCTC – Mesa**

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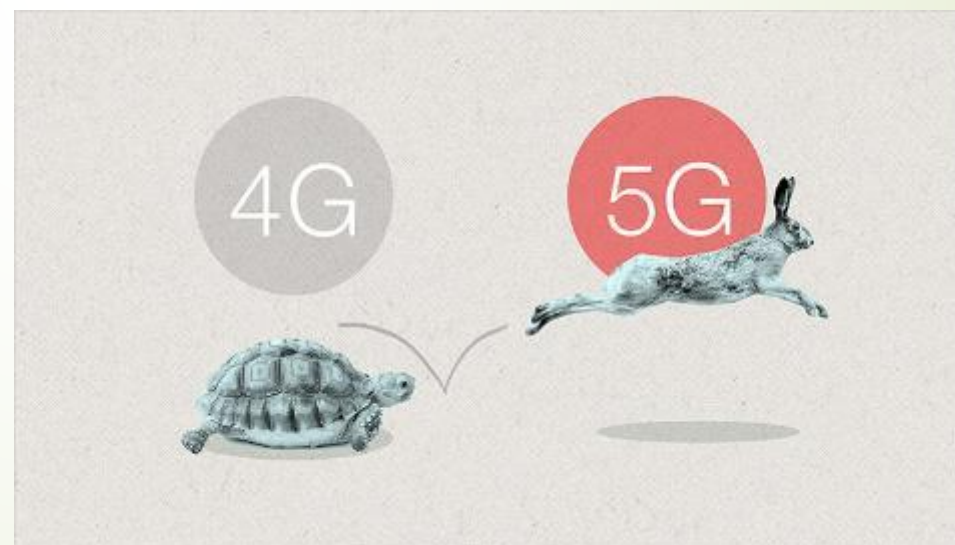


**An International
Association of Technology
& Computer User Groups**

THE END

The End.

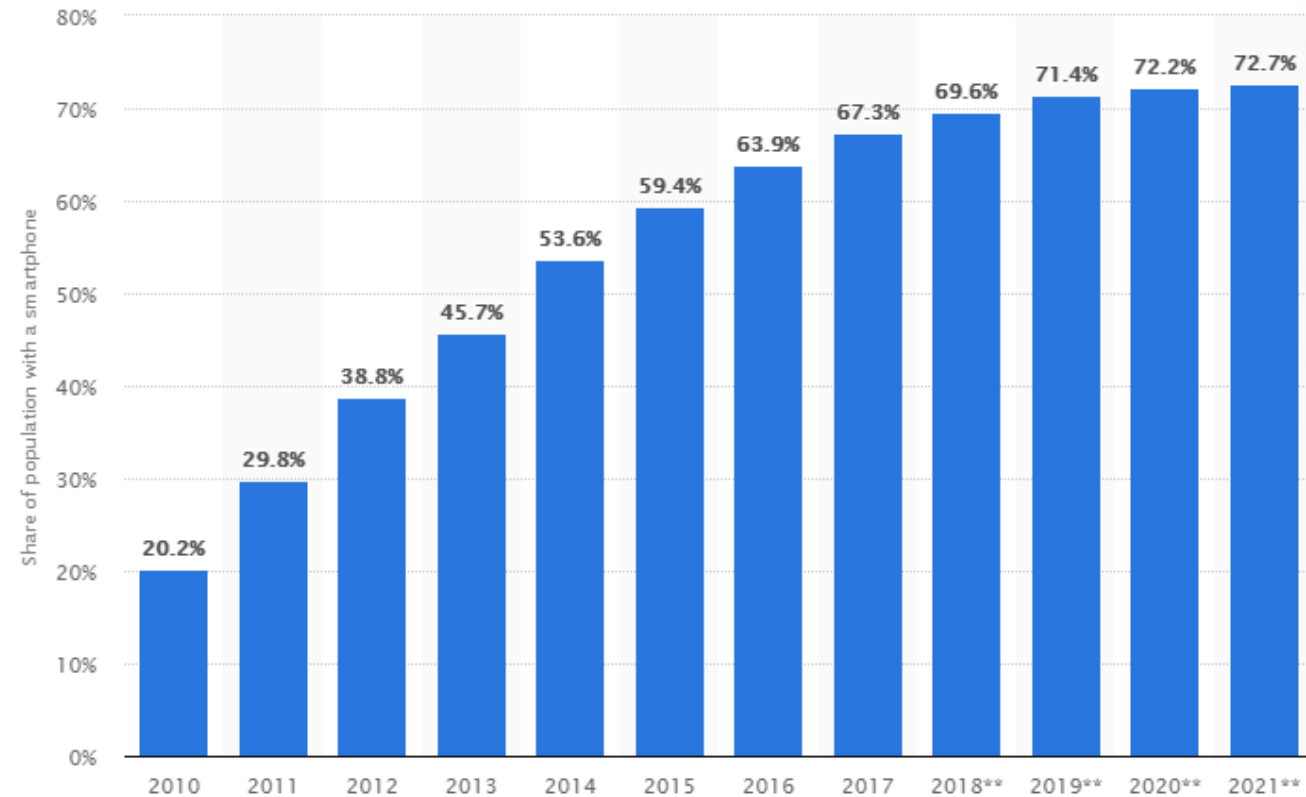


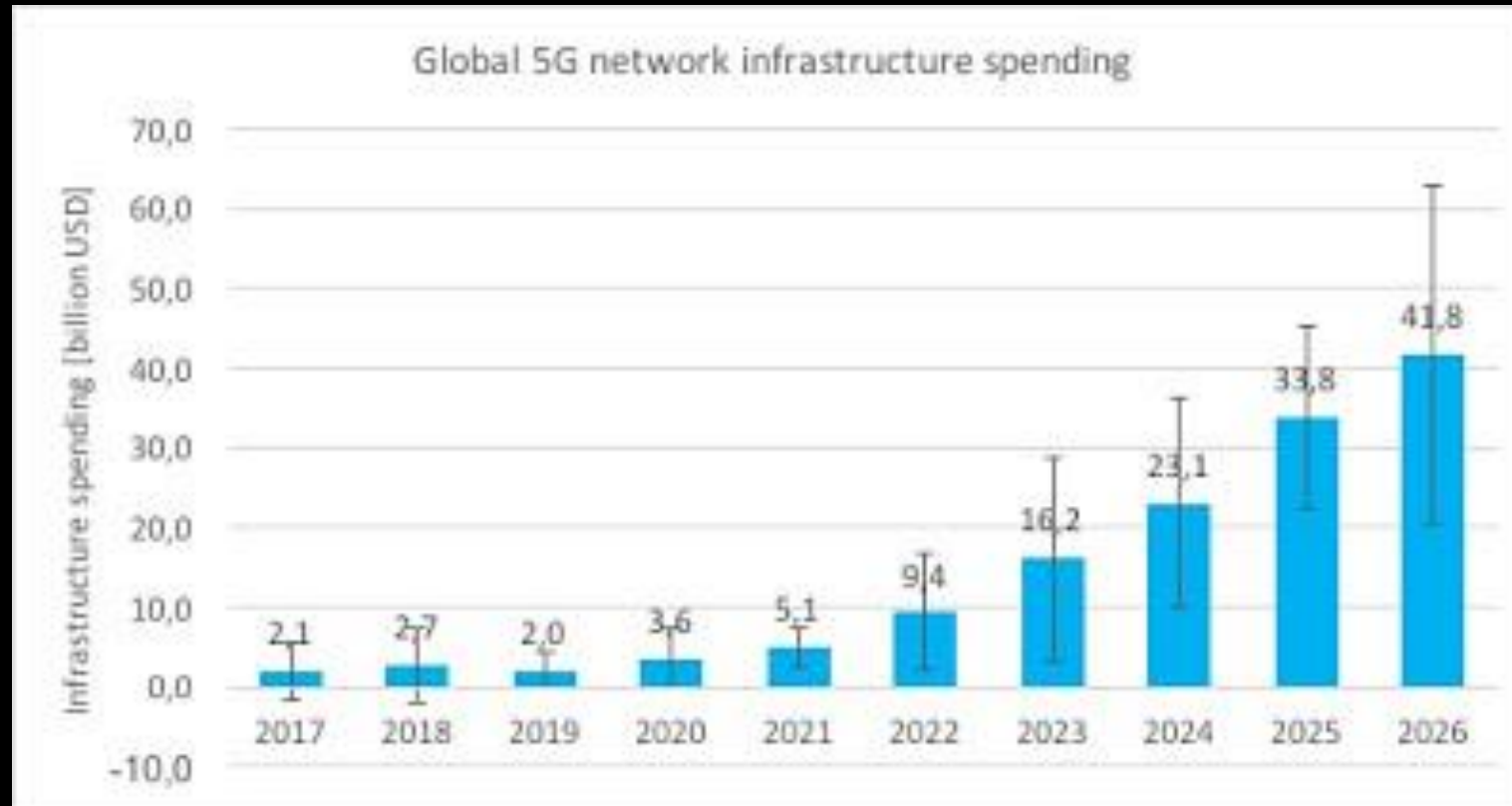


One Million X One Million = One Trillion

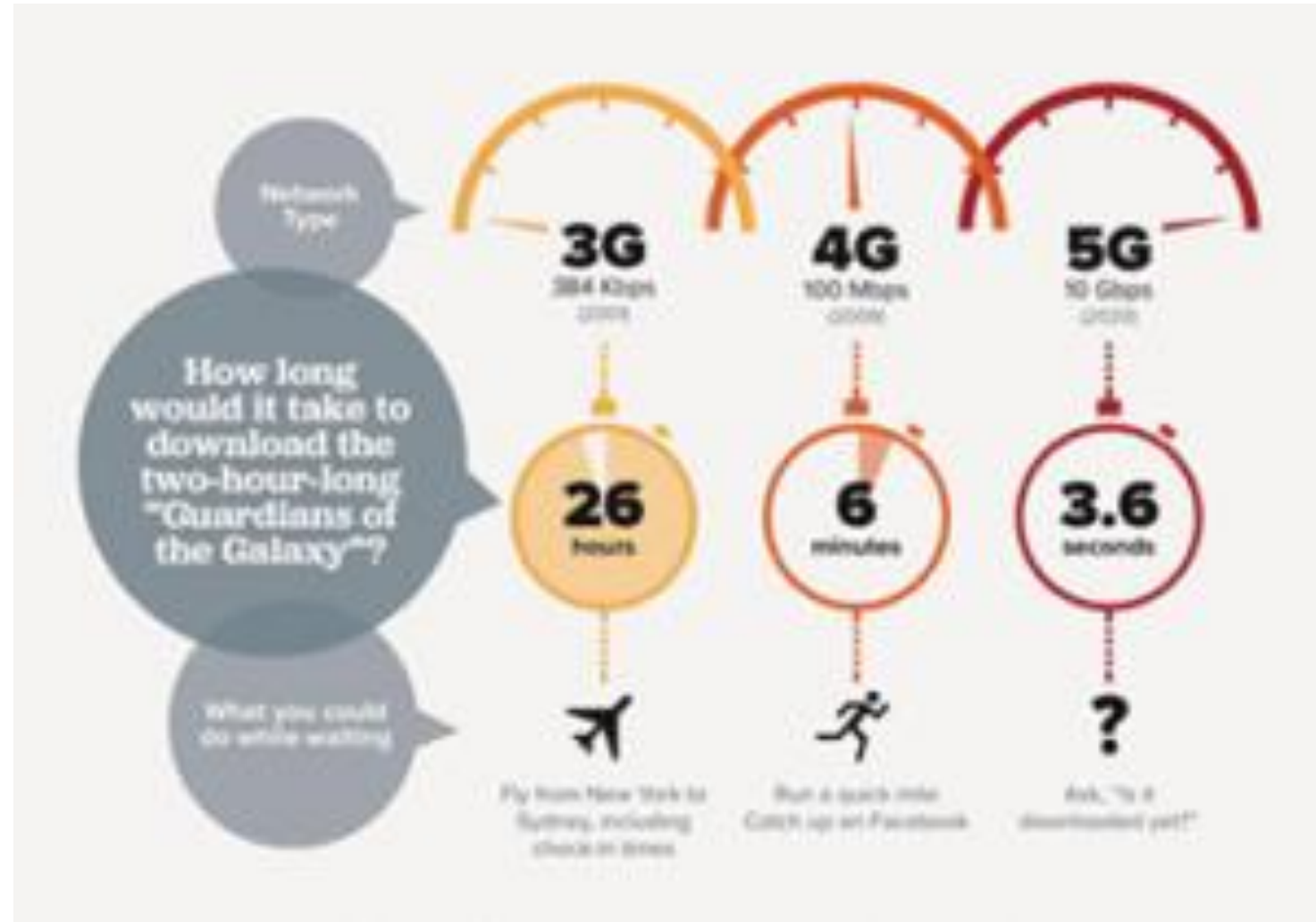
One Trillion divided by 235 Million = \$4200

4200 divided by 120 = \$35





Carriers have spent billions of dollars building out 5G networks



Testing T-Mobile's 5G Network in New York

June/2019

