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Business Trend: 5G –The Dawn of Highspeed Wireless Communications

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# 5G- What is it?

5G is a communications standard, a commonly agreed upon way to transfer information.

Many Futurists believe that the degree of 5G's impact on the world will be equivalent to 1G's Impact:

1G enabled people to place and receive phone calls no matter their location.

5G's fast transfer speeds will eliminate the need for hardwiring and enable 100s of nascent technologies.

5G is the fifth such standard since cell phones came into existence.

1G provided cell phone service.

2G Added the ability to text.

3G Added the ability to Access the web from mobile devices.

4G Added the ability to download movies. 4G transfers data at 20 mega bytes per second (MBPS).

5G Will provide ultra high wireless data speeds (2000 MBPS) that will enable new technologies such as:  
Autonomous vehicle navigation, mobile surgery, augmented and virtual reality, the Internet of Things (IoT) and Edge Computing (the ability to distribute computation through decentralized devices rather than centralized cloud computing centers).

# 5G- How Does It Work?

5G is a set of communications standards that incorporate and govern thousands of individual sub technologies.

There are three new differentiating technologies that drive the improvements, new radio wave spectrum and one legacy technological standard that 5G will rely upon for a number of years.

The Three New Technologies (We will use a highway analogy to explain):

- **QAM** (Quadrature Amplitude Modulation) A digital modulation method used to transmit data.

*-Think of it as increasing the speed limit on a two lane road. Cars go faster and get to their destinations quicker.*

-**Carrier Aggregation** (A partial carry-over from late 4G technologies. Carrier Aggregation enables a network operator to combine radio channels within the same frequency band or across different bands to achieve much higher data rates and lower latency than otherwise would be possible).

*-Think of it as adding additional lanes to the highway. Now the data travels faster and there is more capacity to handle additional data.*

**MIMO** (Multiple Input Multiple Output Antennas) MIMO is a method for multiplying the capacity of a radio link using multiple transmit and receive antennas to exploit multipath propagation.

*-Think of it as adding additional data highways you can go from point A to C without having to go through B.*

# 5G- How Does It Work ? (continued)

**Millimeter Wave Spectrum** is the portion of the radio wave spectrum between 30 gigahertz GHz and 300 GHz. The government has recently sold 5G licenses for this section of the spectrum. This Portion of the spectrum has certain limitations that current technologies cannot overcome requiring the adaptation of older technologies.

**LTE** Long Term Evolution is a standard that is sometimes known as 3.95G. It increases network capacity and speed using a different radio interface together with core network improvements. When 5G begins to rollout it will be in a patchwork locations all strung together with LTE standard technology.

- *Think of a person talking on their phone in a car, they drive through an area that has 5G they will avail themselves 5G features (lets say you are video conferencing), but as they exit the 5G area the Video drops out and you are left with a phone conference.*

## **TECHNOLOGICAL AND ECONOMIC LIMITATIONS OF 5G**

Radio waves in the millimeter wave spectrum function basically on a line of sight basis (an object can block or diminish transmission). This presently limits the Use of pure 5G for mobile applications.

5G uses substantially more power to operate greatly reducing battery life.

Many experts say it will cost \$300 Billion in total to gradually rollout, develop and update 5G. Companies need to pass these costs onto consumers in a fully saturated market, many of whom will not willingly absorb the additional cost without a killer app driving their decision.

# 5G- When Will it Arrive?

US operators' launch plans fall into two distinct categories: Fixed wireless and mobile. Fixed wireless typically services residential broadband customers with speeds in excess of 1 Gbit/s using mmWave bands. Mobile launch will use sub-6 GHz spectrum in traditional LTE or newly-allocated bands with similar performance to LTE

Operator	Fixed wireless			Mobile		
	Launch date	Bands	Launch areas	Launch date	Bands	Launch areas
<a href="#">AT&amp;T</a>	TBD	28/39 GHz	Trials: Austin, Waco, South Bend, Kalamazoo	End 2018	TBD	Dallas, Waco, Atlanta (12 cities total)
<a href="#">Verizon</a>	Oct 1 2018	28 GHz	3-5 cities including Indianapolis, Sacramento, Los Angeles, and Houston.	1H2019	TBD	TBD
<a href="#">Sprint</a>	N/A	N/A		1H2019	2.5 GHz	Atlanta, Chicago, Dallas, Houston, Los Angeles, Washington, New York, Phoenix, Kansas City
<a href="#">T-Mobile</a>	End 2018	28/39 GHz	<a href="#">Trials Bellview, WA</a>	End 2018	600 MHz	Los Angeles, New York, Las Vegas, Dallas (30 cities total)
<a href="#">Dish Network</a>	N/A	N/A		2020	600 MHz	
<a href="#">Charter Communications</a>	End 2018	28 GHz	Orlando, Reno, Clarksville TN, Columbus, Bakersfield and Grand Rapids			

Source: Wikipedia

The full buildout of 5G is expected to cost \$30B annually and take about 7 years to complete.

5G will essentially arrive in two waves:

First is fixed site to fixed site (line of sight) applications (Small Cell to 30 homes).

The second wave is Mobile merging 5G with the existing LTE Network and finally 5G displacing LTE.

# 5G- Will There Be New Entrants?

Because 5G is revolutionary, disruptive and expensive, an opportunity exists for a new participant in the delivery of these services. Large, well capitalized tech companies (Google, Facebook and Amazon) have often been mentioned as new disruptive participants. However the reality is that the communications market is already saturated, consumers are likely to resist increased fees while the network builds out and frankly the big techs have higher growth/profit opportunities to pursue.

Established companies in three sectors will likely dominate the first stage of the build out followed by the carriers:

Data Centers (hardware and network upgrades) Cisco, Dell, Hewlett Packard, IBM & Lenovo, Intel, Qualcomm, Broadcom, AMD, and Samsung

Network Transformation Providers (Cos that will help telecoms upgrade networks) Samsung Nokia, Intel, Huawei, Ericsson and Qualcomm

Modem and Intellectual Property Suppliers Qualcomm, Intel, Samsung, Huawei and Ericsson

Mobile Telecoms US: Verizon, AT&T, T-Mobile ASIA: China Mobile, SingTel Europe Vodafone, T Mobile, Orange

# 5G- Summary & Conclusion

5G will be transformative, but not immediate.

Adoption will be tempered by, technological issues, the cost of capital improvements and the perceived unwillingness of businesses and consumers to absorb the additional costs.

Adoption will come in a patchwork fashion. Higher-density urban and well-to-do suburban areas will be the first to receive 5G, but only as a fixed point-to fixed point application not mobile. Think of it as almost a super neighborhood WIFI.

Large regional and eventually national true 5G mobile networks won't come into existence for quite a while (at least 2025) as technological barriers must be overcome, \$300+ Billion of capital must be raised and 400,00-600,000 towers will need to be constructed .

A driverless Uber powered by 5G will not be coming to your door tomorrow morning.