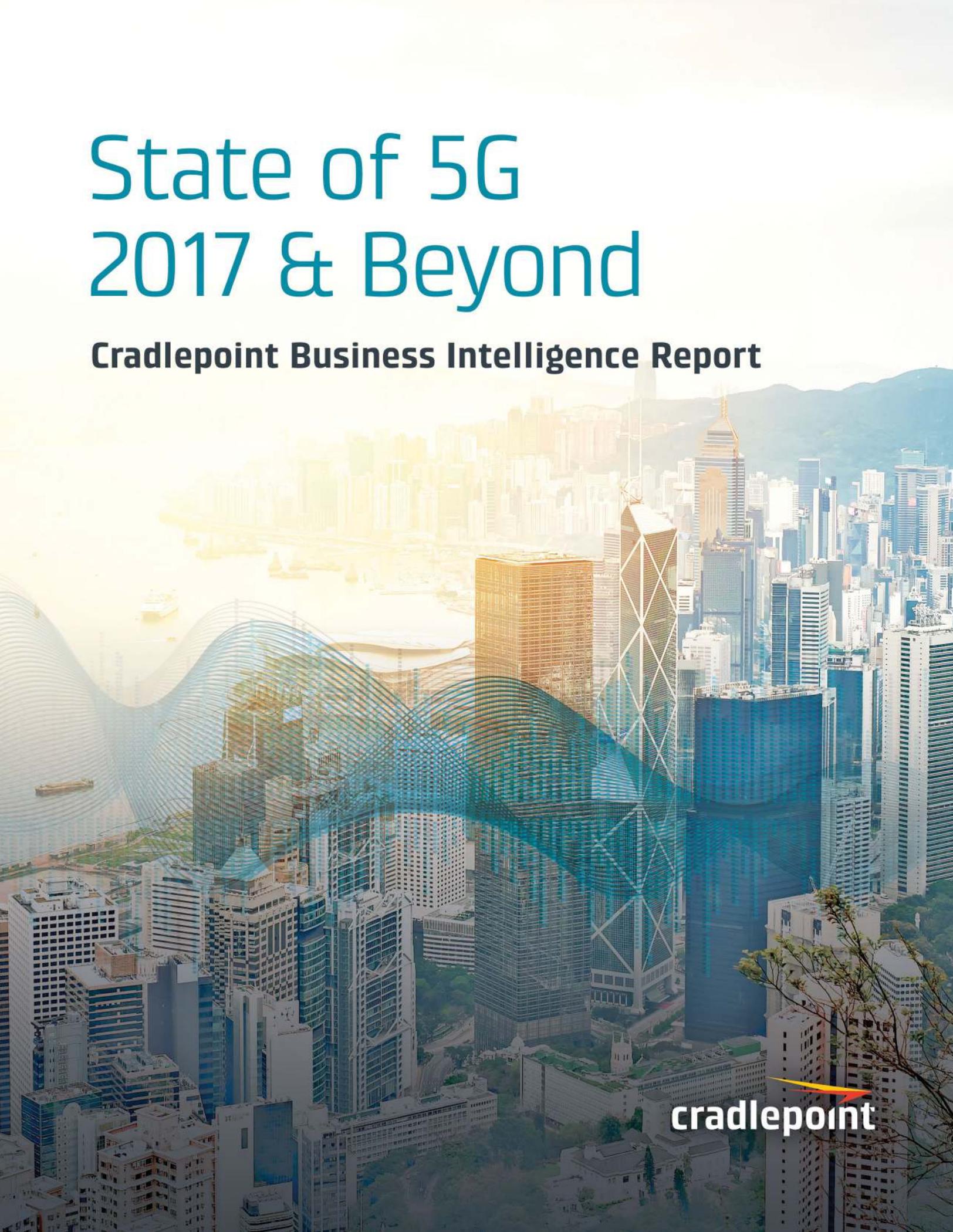


State of 5G 2017 & Beyond

Cradlepoint Business Intelligence Report



cradlepoint

5G – From Fixed Wireless Today to Mobility & Transformative Improvements by 2019

5G is rapidly climbing the hype cycle. Qualcomm has even claimed it could be as “transformative as electricity.”

Wireless network operators in the U.S. are not only talking about 5G, but asserting that their trials are ongoing and deployments are coming soon – in many cases, years earlier than had been thought possible. Both AT&T and Verizon claim trials are under way in more than a dozen cities and that consumers can expect 5G soon in select markets.

Amid the rapidly rising anticipation for 5G, many organizations are asking the same question: “What does 5G mean today, and how long before it can help my business?”

In reality, 5G has a limited but powerful use case today but is poised to reach its exceptional potential – less latency with more throughput, connection density, spectrum efficiency, traffic capacity, and network efficiency – within the next couple of years.

Where Does 5G Stand in 2017?

3GPP, the global standards organization that was created to consolidate various standards for worldwide interoperability, in February 2017 named the next generation of networking 5G.

However, do not plan on buying 5G cellphones in the next year or two; they simply will not exist. The 5G trials being touted by network operators are for fixed wireless access only. The reason is that they are only using millimeter wave spectrum, which is not proficient at penetrating water or objects – such as walls, windows, people, leaves, etc. Thus, 5G initially is only useful for point-to-point, line-of-sight transmission.

5G was not supposed to be available at all until 2020, because the standards were not expected to be set. However, that timeline has been accelerated by network operators and the ecosystem vying to be the first to 5G. This has motivated 3GPP to move up its own timelines as well. How are they doing this?

On March 9, after Mobile World Congress 2017, 3GPP issued a new timeline for its 5G specifications rollout, which they are accelerating by allowing 5G NSA (Non-Standalone). This means 5G can be deployed using the LTE core.

There are two parts to the 5G upgrade: 1) The air interface (RF), and 2) the core, which includes authentication to the network, billing, data centers, traffic routing, etc. NSA allows rapid 5G upgrades to the air interface while still leveraging the LTE core. When the core interface is upgraded, we will have 5G SA (Standalone).

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3GPP Standards Progression

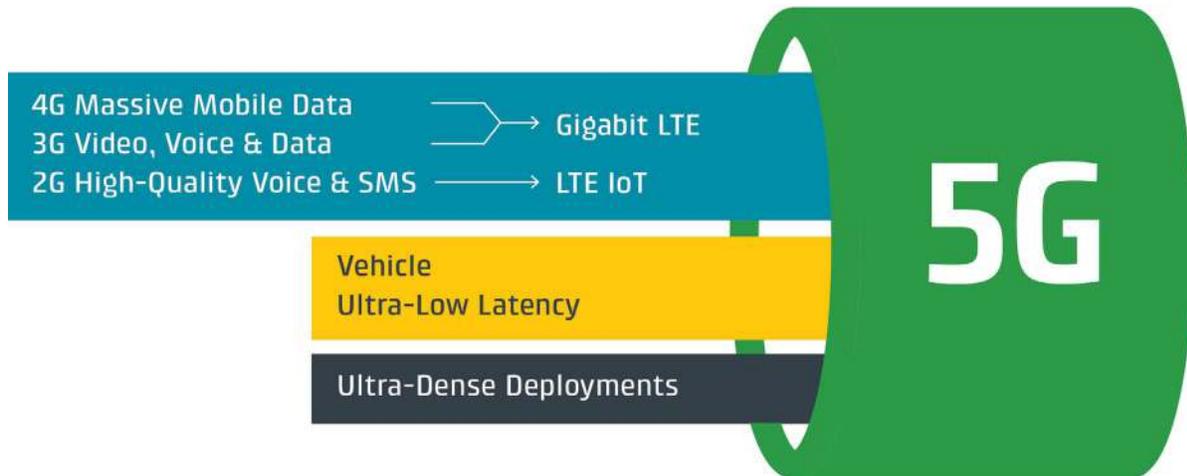


How 5G Will be Built

Eventually 5G will encompass many wireless technologies, including 5G New Radio, Gigabit LTE for super-fast speeds; LTE IoT for low power, long battery life, and long-range coverage; Digital TV, C-V2X, or vehicle to anything; and ultra-low latency.

5G will build on the architecture of voice (2G); voice, video, and data (3G); and massive mobile data (4G)—and add massive bandwidth and density, as well as ultra-low latency. 5G also will integrate aspects of WiFi and long-range/low-power networks.

Next-Generation WAN



5G Standards

3GPP is rapidly working to develop 5G standards, with a project completion date of 2018 and interim milestones along the way. To fully reach its potential across technologies and network operators around the world, standards for 5G will prove essential. Standards allow coordinated handoffs between network operators and technology; roaming; and mobility, including cell phones, tablets, and vehicles. Standards define how cell-site handoff and roaming need to work so one piece of hardware can work across more than one network operator or infrastructure.

Standards will give infrastructure providers and device makers much more leverage when designing solutions, as these solutions will be able to work globally instead of being limited to specific network operators or regions.

5G in 2017: Massive Mobile Data for Fixed Wireless Access

Some network operators are striving to outpace even 3GPP's accelerated 5G specifications completion. How are they doing it?

"We're not waiting until the final standards are set to lay the foundation for our evolution to 5G," says AT&T's John Donovan.

Verizon, AT&T, and others hope to accelerate the pace of innovation, so they are using NSA architecture and developing partial and proprietary specifications, which will have many commonalities with 3GPP's final 5G specifications. Network operators are accomplishing this by selecting the low-lying fruit of 5G: massive mobile data for fixed wireless access.

These providers will use millimeter wave, the portion of 5G that works well to pass large amounts of data from one fixed point to another. They also will use 5G as an alternative to fiber connectivity to homes and businesses.

This limited 5G use case fits nicely within the context of industry trends. Verizon stopped digging trenches 10 years ago for its Verizon FiOS (Fiber Optic Service), and last year Google discontinued its Google Fiber program. Digging trenches and maintaining wired lines has become cost-prohibitive.

5G is so promising that AT&T, Verizon, Sprint, Google, and several others are deploying it now, and EE (Everything Everywhere), BT (British Telecom), Vodafone, and Telstra are actively testing millimeter wave. True wireless 5G may very well be years away, as T-Mobile CTO Neville Ray noted, but the initial deployments of 5G will arrive within the next year.

Timeline for 5G Radio*



NSA = Non-Standalone (5G using LTE Core)
SA = Standalone (5G using 5G Core)

*This timeline does not reflect commercial availability.

5G Today: Abilities & Limitations

Using 5G to move lots of mobile data for fixed wireless access requires wide swaths of spectrum, currently only available in very high frequencies: 15 GHz to 70 GHz millimeter wave for point-to-point transmission. Network operators send it from an antenna on the street or nearby building to an antenna at a home or business, thus eliminating the need for last-mile trenches and wired lines.

Today's 5G is Non-Standalone (NSA) and uses pre-3GPP standards. These super-high frequencies are excellent at carrying lots of data, because there is so much spectrum available, but they are still leveraging the current LTE core. However, today's 5G is very poor at functions such as penetrating anything thicker than clothes.

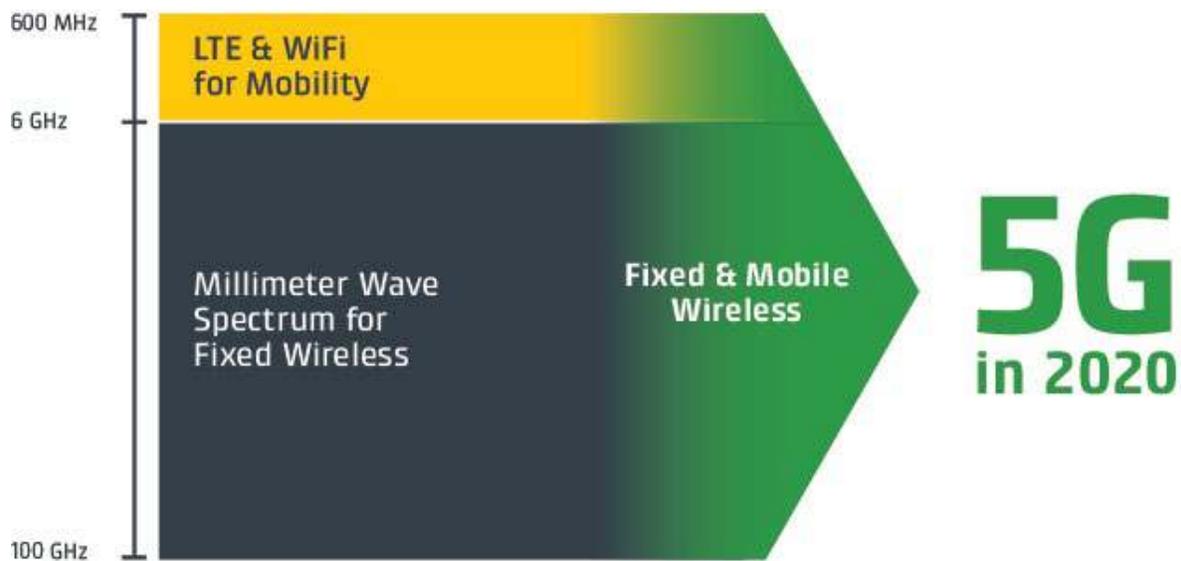
Today's 5G is excellent for point-to-point, line-of-sight communications between antennas that don't move. With NSA architecture and pre-3GPP specifications, today's 5G can get around interoperability, cell-site handoff, and mobility issues because these deployments are fixed. The data speeds are still tremendous, reaching several gigabits per second and keeping up with fiber speeds.

5G Tomorrow

5G has nearly arrived. The initial trials and deployments, built on NSA architecture, are for fixed wireless access only. These deployments are meant to replace fiber, cable, and DSL for last-mile connectivity into homes and businesses.

By 2018 or 2019, the 3GPP specifications will be ready and millimeter wave will be combined with sub-6 GHz spectrum – including all current LTE and WiFi for failover/failback with ubiquitous coverage indoors and out. New sub-6 GHz spectrum will be available as well, including unlicensed 3.5 GHz CBRS and 5 GHz LAA, allowing for increased bandwidth on free spectrum. This important building block will enable network operators to make “true” 5G available.

At that time, perhaps 5G truly will be “as transformative as electricity.”



Global Leader in 4G LTE Solutions Prepares for Future of 5G

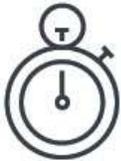
Cradlepoint is the global leader in cloud-based network solutions for connecting people, places, and things over wired and wireless broadband – and is working with industry leaders to lead the way with 5G. Cradlepoint NetCloud is a software and services platform that extends the company’s 4G LTE-enabled multi-function routers and ruggedized M2M/IoT gateways with cloud-based management and software-defined network services.

With Cradlepoint, customers can leverage the speed and economics of wired and wireless Internet broadband for branch, failover, mobile, and IoT networks while maintaining end-to-end visibility, security, and control.

More than 15,000 enterprise and government organizations around the world – including 75 percent of the world’s top retailers, 50 percent of the Fortune 100, and 25 of the largest U.S. cities – rely on Cradlepoint to keep critical sites, workforces, vehicles, and devices always connected and protected. Major service providers use Cradlepoint network solutions as the foundation for innovative managed service offerings.

The Landscape of 5G

5G will differentiate itself by delivering various improvements:



10x

Decrease in latency:
Delivering latency as low as 1 ms.



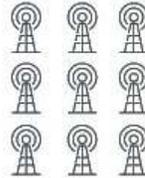
10x

Connection density:
Enabling more efficient signaling for IoT connectivity.



3x

Spectrum efficiency:
Achieving even more bits per Hz with advanced antenna techniques.



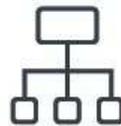
100x

Traffic capacity:
Driving network hyper-densification with more small cells everywhere.



10x

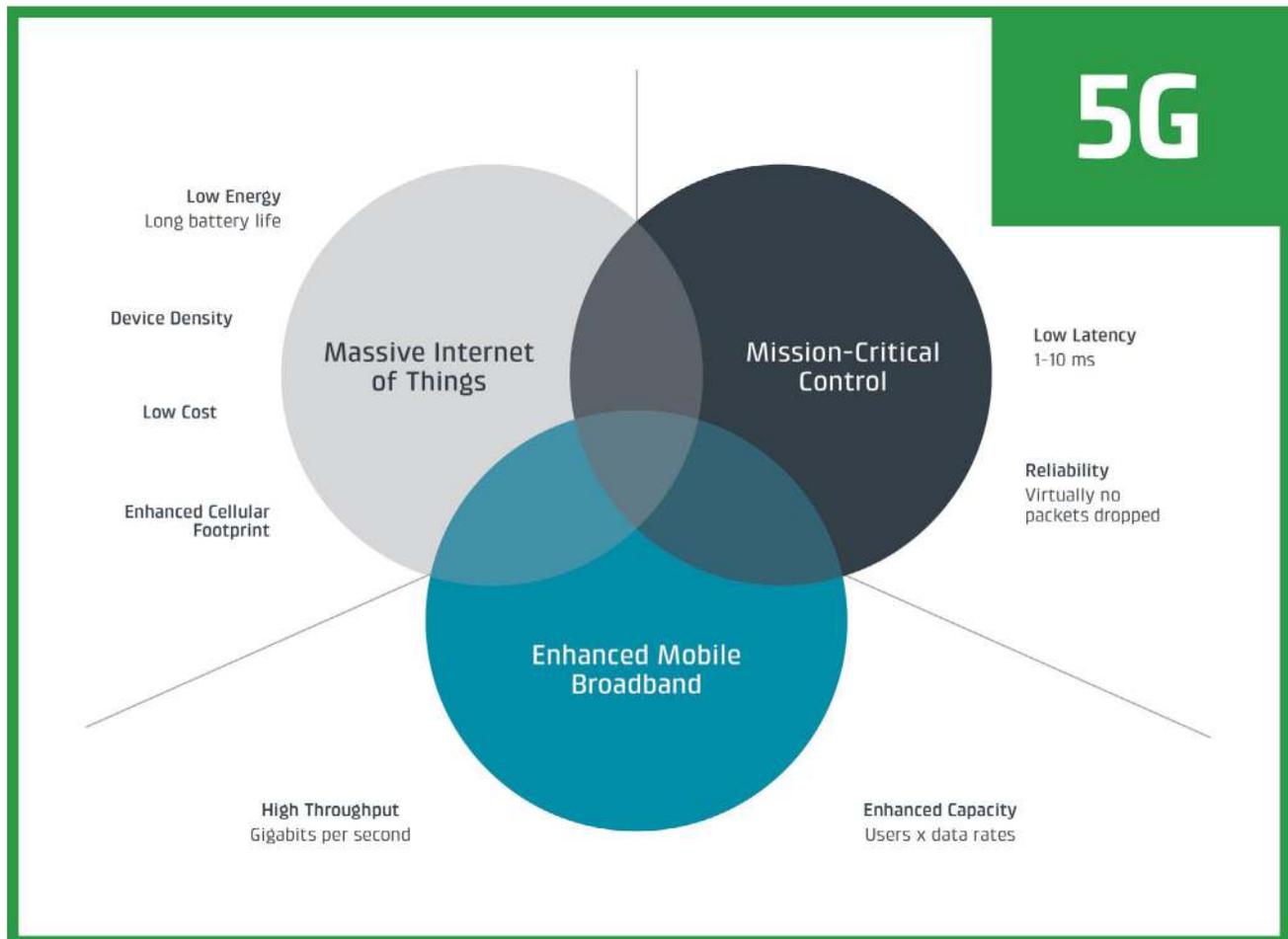
Experienced throughput:
Bringing more uniform, multi-Gbps peak rates.



100x

Network efficiency:
Optimizing network energy consumption with more efficient processing.

The Vast, Diverse Potential of 5G



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