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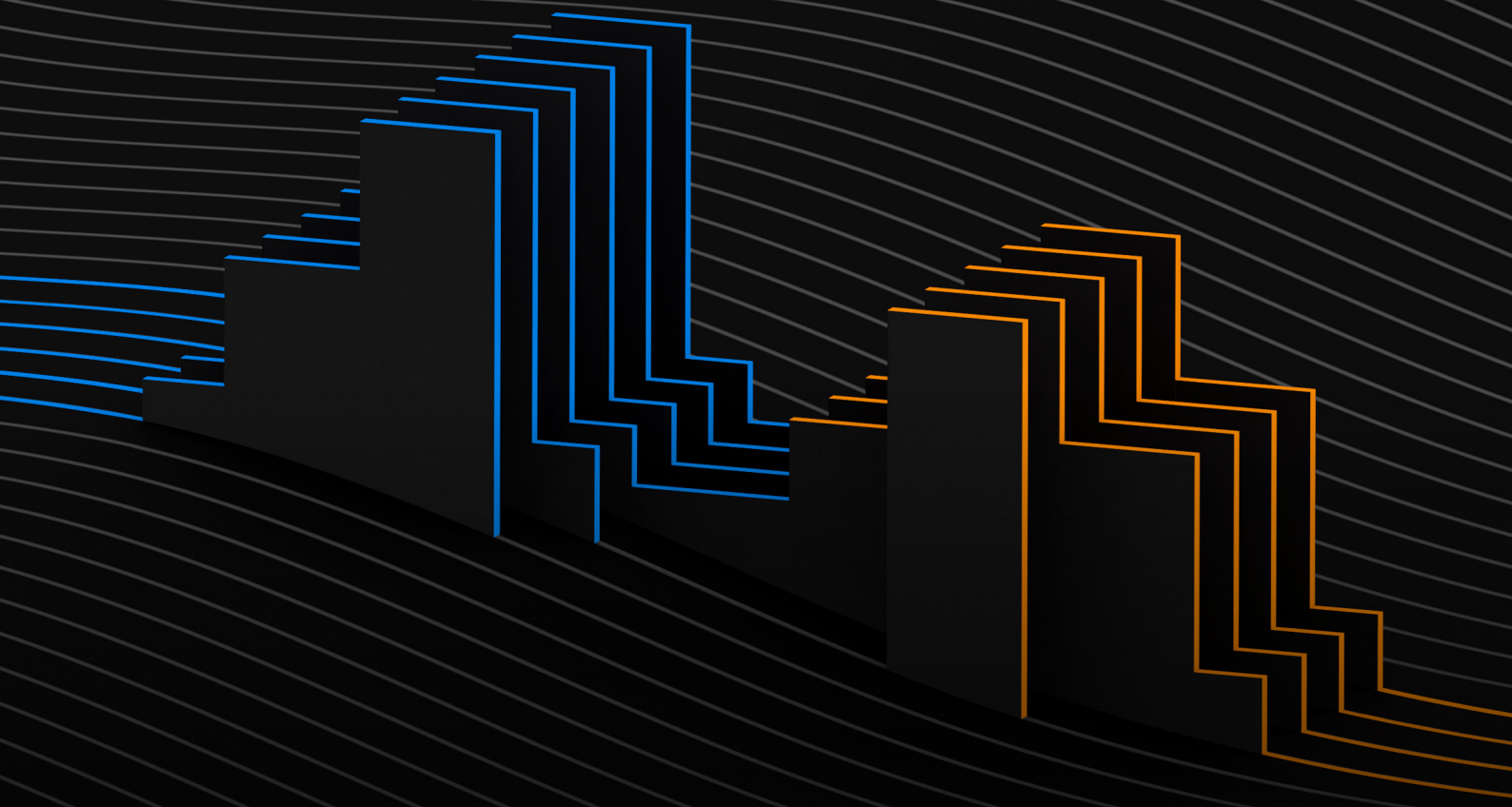
Verizon is transforming fixed and mobile broadband with 5G



Extract from the Ericsson Mobility Report
June 2020

Verizon is transforming fixed and mobile broadband with 5G

5G in millimeter-wave spectrum redefines user experiences.

Verizon is in the second year of delivering 5G services in the US using millimeter-wave spectrum. A journey starting with the launch of 5G Home for fixed wireless access (FWA) in 2018 was followed by 5G mobility services in 2019 with both running on Verizon's 5G Ultra Wideband network.

The 5G millimeter-wave opportunity

The use of the millimeter-wave spectrum for wireless services represents a new opportunity for service providers. The enhancement that 5G connectivity provides changes the game for applications leveraging artificial intelligence, robotics, augmented/virtual reality and/or IoT.[1] This represents a leap in performance compared to what was possible for the first four mobile network generations.

In October 2018, 5G Home was released in select neighborhoods of four cities to provide an alternative to wired broadband. The initial deployments used the TF specification of 5G to enable early field evaluations of performance. These insights provided the foundation for network planning of further 5G millimeter-wave based services.

Verizon's 5G network was launched for mobile services to both consumers and business customers in the spring of 2019. Initial deployments focused on enhancing 5G mobility at outdoor locations primarily in dense urban areas such as commercial zones, parks and landmarks. Sports and concert venues have been a special focus. To date, the build-out includes parts of 17 stadiums and 7 indoor arenas. As of June 2020, Verizon's 5G network mobility services are available in parts of 35 markets/cities across the US.

The 5G user experience will not be limited to the millimeter-wave band and coverage. The service has been designed to use both 4G and 5G and will leverage capabilities such as dual connectivity, carrier aggregation and dynamic spectrum sharing (DSS). This approach has the advantage of minimizing the experience of coverage white spots as millimeter-wave 5G is built out in steps.

Principles for building 5G with millimeter-wave spectrum

The build-out of networks using 5G in the millimeter-wave spectrum required the reinvention of both network design and operational models. To develop these new opportunities, a strategy built on five principles was adopted:

1. Focus on differentiated user experiences, deploying 5G with millimeter-wave spectrum.
2. Learn about building with millimeter-wave characteristics by experiencing real-life network conditions as early as possible.
3. Develop use cases together with enterprises in different industries while building out 5G networks.
4. Combine New Radio capabilities with edge computing.
5. Deploy fiber infrastructure to 5G sites.

This article was written in cooperation with Verizon, a market-leading communications service provider in the US delivering innovative communications and technology solutions to a wide range of customers.

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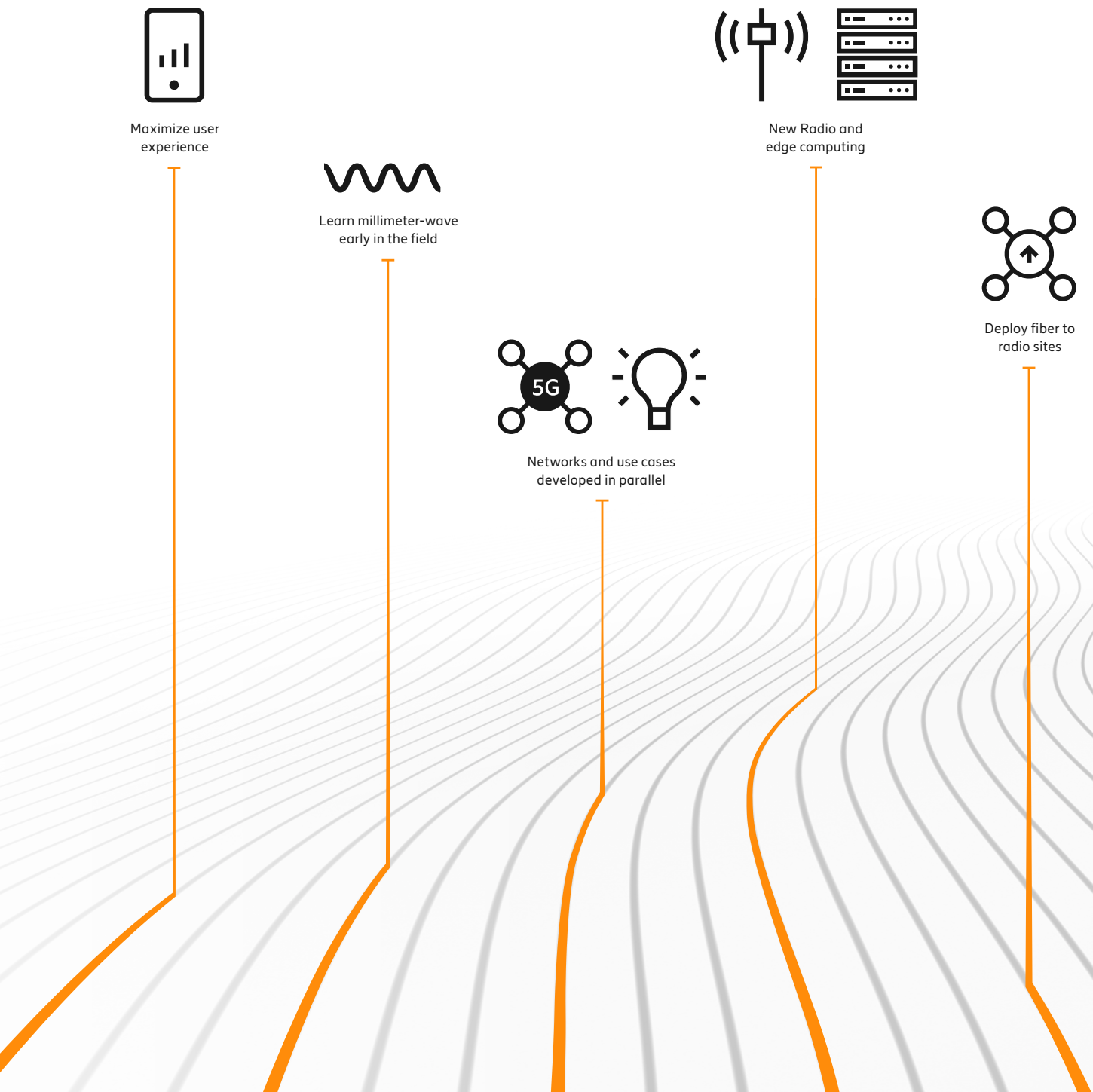
[1] Verizon, "When we say '5G', we mean 5G" (January 7, 2019): www.verizon.com/about/news/when-we-say-5g-we-mean-5g

Figure 24: Overview of five Verizon principles for 5G in millimeter-wave spectrum



Use case innovation in parallel with network deployment

Verizon's 5G Ultra Wideband network was built to support innovative use cases beyond enhanced mobile broadband. Verizon has established six 5G labs in the US and one in London where the company partners with startups, universities and established companies to develop 5G use cases.[2] Each lab has a core focus in areas such as financial services, robotics, public safety, entertainment and information technology. The goal of the labs is to support and foster the next great 5G innovation for the marketplace.

Today, with social distancing due to COVID-19, the public debate concerns how to stepwise reopen economies and when it will be possible to attend large events. The various alternatives offered by 5G, streaming video and augmented reality could play a part in experiencing sports and music events on the way to the new normal.

Verizon is further collaborating with various enterprises to explore how 5G Ultra Wideband could transform industries ranging from manufacturing to healthcare. For example:

- **Corning Inc.**: Verizon partnered with Corning to help create the 5G factory of the future. Initial use cases focus on factory automation, zero touch quality assurance and supply chain tracking in near real-time. Efficient use of automated guided vehicles (AGV) and inventory tracking with 5G-connected cameras will also be explored.
- **Emory Healthcare**: Verizon provided Emory's Innovation Hub with 5G Ultra Wideband service to explore ways to accelerate the development of 5G healthcare applications. Use cases will focus on AR/VR-based medical training, remote physical therapy, patient monitoring and emergency room readiness. The pandemic has put the value of "remote anything" in the spotlight.
- **The Walt Disney Company**: At the premiere of "Star Wars: The Rise of Skywalker", the companies explored how 5G and motion capture technology could enable fans to interact with virtual Sith jet troopers at the movie afterparty. Further, the red carpet action was captured and streamed over 5G and key moments were incorporated into the live broadcast.

The development of use cases in parallel with network roll-outs reduces the time to market for both activities. Network builds can focus on addressing roll-out related challenges without distracting innovation activities. Use case innovations take place in an environment enabling rapid prototyping where projects can evolve stepwise into applications ready for commercial launch. These parallel processes are vital for a timely expansion of use cases beyond mobile broadband.

Performance measurements in commercial networks

The first performance measurements, comparing downstream data rates for 5G and 4G, have emerged. Figure 25 describes the differences between maximum and median downstream measures for two Verizon markets where 5G Ultra Wideband service is available.

Increasing 5G coverage and focusing on the network edge

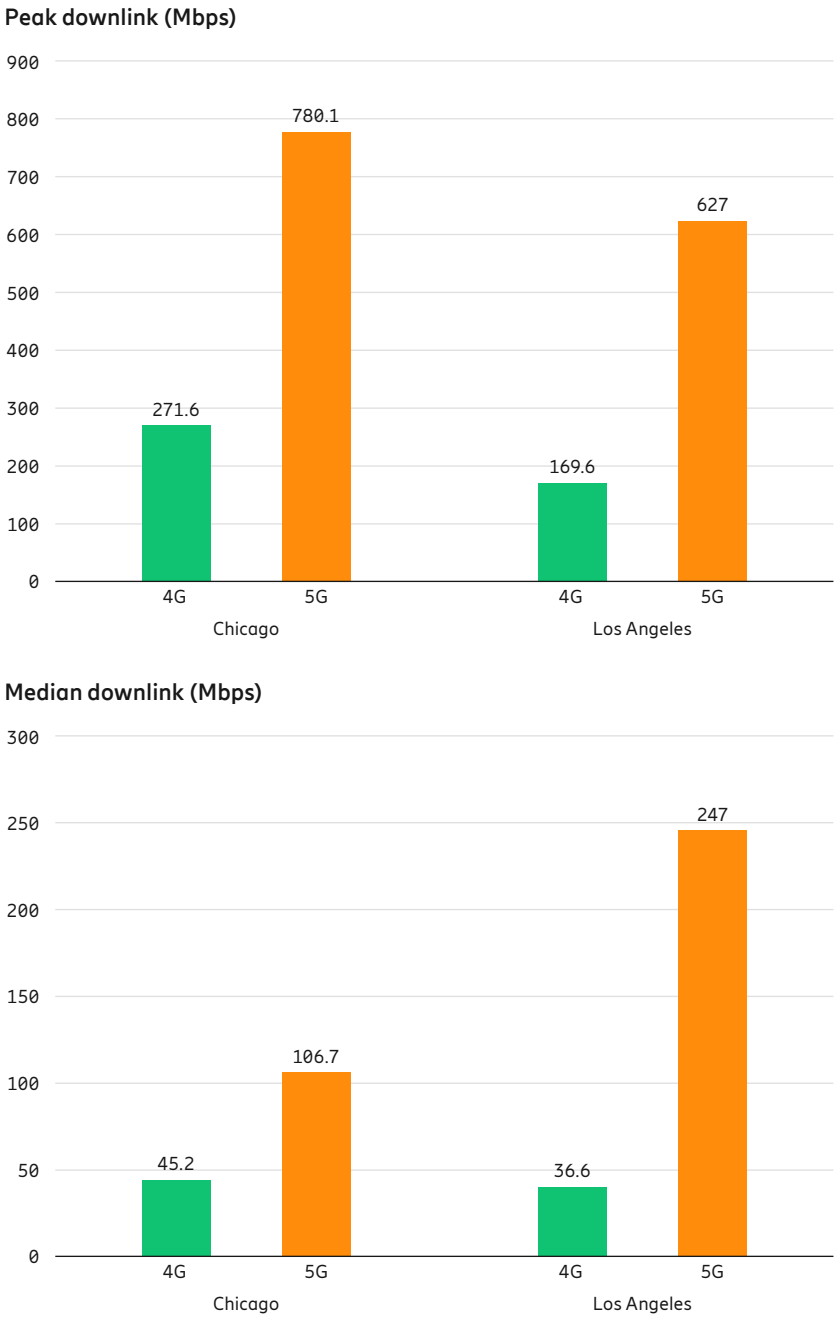
The 5G Ultra Wideband network roll-out continues. The plan includes increasing the market footprint from 35 to over 60 cities during 2020. The number of small cells is slated to grow by a factor of five times, both through expansion in the initial cities and through the addition of new cities.

The 5G Home service (FWA for the consumer market) is planned to be expanded from 5 to 10 markets. In addition, there are plans to launch 20 new 5G devices in 2020 with smartphones as the biggest device category.

As Verizon continues to expand the footprint of its 5G network, it is also working to locate edge computing capabilities at the selected edge sites. These mobile edge computing (MEC) sites will allow Verizon to substantially reduce the end-to-end latency for enterprise applications that are currently being rendered from a centralized cloud from approximately 100ms to 20ms or less. In addition, enterprises that are leveraging the Verizon deployed MEC sites will benefit from being able to offload compute-intensive applications from their end devices to the local MEC compute element. This will enable locally cached data associated with the application, substantially reducing not only the physical size and power consumption of the end devices, but also reducing the backhaul bandwidth required to transport data to a centralized public cloud.

[2] Verizon 5G labs (2020): www.verizon5glabs.com

Figure 25: 5G vs. 4G performance in commercial networks



Source: RootMetrics by IHS Markit (March 2020)

Summary
Verizon is a pioneer in 5G services using millimeter-wave spectrum for both mobile and fixed purposes. The 2020 plan includes expansion to new cities, increased coverage in initial cities and a broader portfolio of devices. Network build and use case innovation take place in parallel to accelerate time to market for both. The plans also include edge computing to move performance-critical applications closer to the user, to take full advantage of the reduced network latency.

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