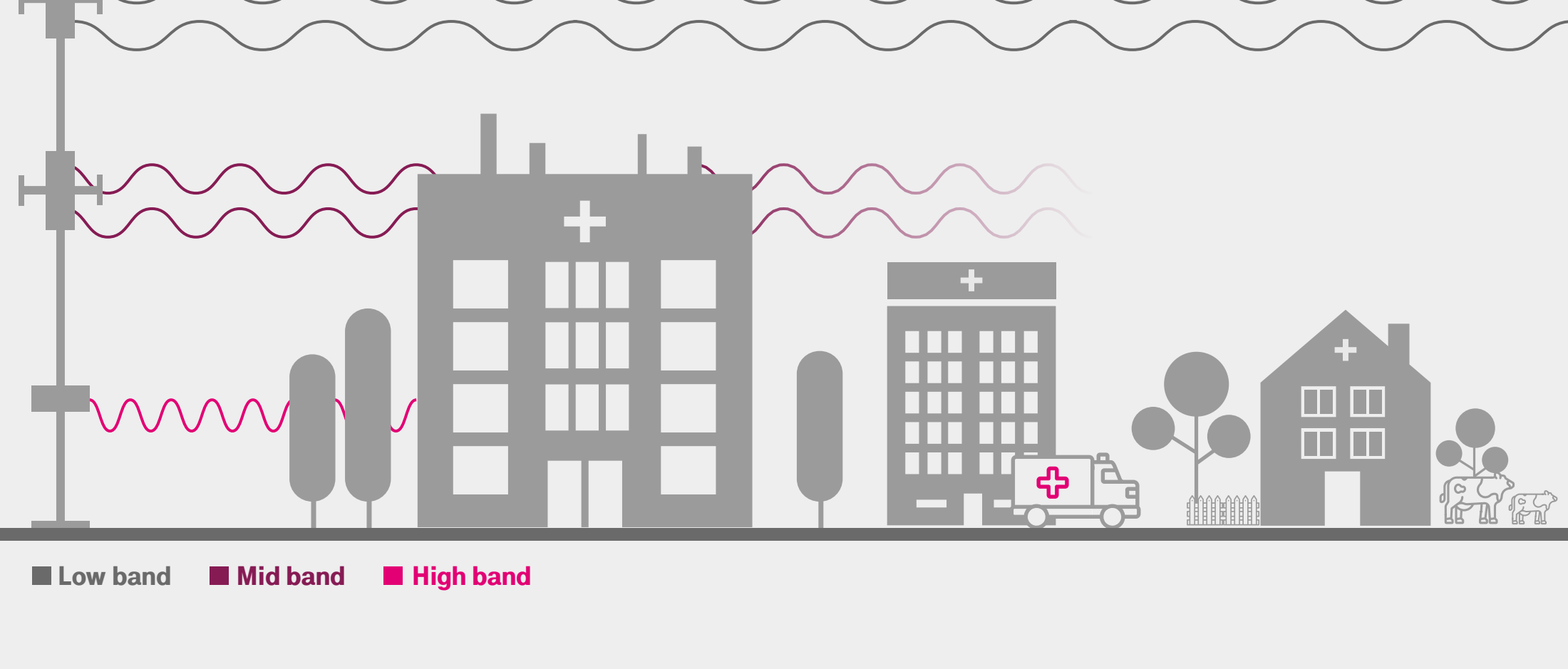


5G & Advanced Telemedicine

5G, the 5th generation wireless network, will offer greater healthcare accessibility with exponentially faster transmission speeds, ultra-low latency, more reliability, and greater network capacity than its 4G predecessor.

New 5G capabilities will transform what's possible in telemedicine and extending advanced care to more people.



■ Low band ■ Mid band ■ High band

Metrics At-A-Glance

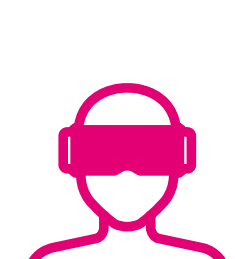
Source: *BantCell*

	2G	3G	4G	5G
Mass market introduction	1993	2001	2009	2018
Applications	SMS, Voice calls	GPS, Mobile TV, and video conferencing	Mobile TV, high data-consumption mobile applications, wearables, IoT	High-res video and streaming and, in the future, autonomous vehicles and remote medical procedures
Peak data speeds	2 Mbps	2 Mbps	150 Mbps (LTE) to >1 Gbps (LTE Advanced Pro)	>2 Gbps

Timeline of Telemedicine

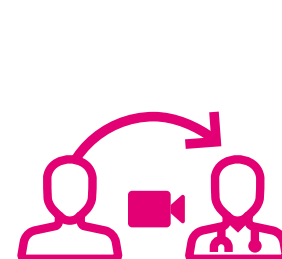
- 1950s** The Nebraska Psychiatric Institute and Norfolk State Hospital use closed-circuit television link for psychiatric consultations.
- 1960s** NASA researches ways to deliver telemedicine to astronauts.
- 1989** The World Wide Web is invented, opening new opportunities to expand telehealth.
- 1993** The American Telemedicine Association (ATA) forms with the goal of accelerating the adoption of telehealth. *Source: ATA*
- 1999** CMS launches coverage of telehealth consultations to provide greater healthcare access for underserved patients in rural areas. *Source: Centers for Medicare and Medicaid Services*
- 2001** Commercial 3G launches in Japan; the MobiHealth project develops new services and applications for mobile health. *Source: ZDNet*
- 2003** The National Institutes of Health (NIH) cites an EU-funded study highlighting the efficacy of telemedicine. *Source: National Institutes of Health*
- 2009** The first 4G network goes live, enabling patient-doctor videoconferencing and wireless patient monitoring. *Source: Deloitte*
- The American Recovery and Reinvestment Act (ARRA) dedicates **\$20 billion for investment** in health information technology. *Source: U.S. Dept. of Commerce*
- The World Health Organization releases a report on the state of telemedicine, noting: *It is imperative that telemedicine be implemented equitably and to the highest ethical standards.* *Source: WHO*
- 2010** Telecom industry trade group GSMA cites telemedicine as a major use case in its call for additional spectrum to enable broadband coverage. *Source: GSMA*
- 2012** The estimated number of telemedicine services networks in the U.S. reaches 200, with **3,500 service sites across the U.S.** *Source: Rural Health Information Hub*
- The U.S. Army announces prototype medical military software that uses 4G to deliver telemedicine services. *Source: U.S. Army*
- 2015** The American Academy of Pediatrics releases a policy statement noting telemedicine technologies *have the potential to improve current models of care by increasing communication among clinicians, resulting in more efficient, higher quality, and less expensive care.* *Source: AAP*
- 2016** A study in China supports the efficacy of a telemedicine wound-care model using 4G with smartphones or smart glasses. *Source: ResearchGate*
- 2018** The first commercial 5G network launches in South Korea. *Source: SDX Central*
- 2019** Emory University School of Medicine study finds that 5G will open up possibilities for healthcare, including improved hospital intelligence, remote surgery, and management of wearable devices. *Source: National Institutes of Health*
- T-Mobile launches first nationwide 5G network in U.S., leveraging low-band spectrum to reach rural and suburban communities.**
- 2020** The Federal Communications Commission launches the COVID-19 Telehealth program, earmarking **\$200 million in telemedicine technology** funding, as a component of the Coronavirus Aid, Relief, and Economic Security (CARES) Act. *Source: FCC*

How 5G improves and accelerates telemedicine



REHABILITATION

Healthcare organizations could one day use AR and VR healthcare applications for things like fine motor skills training, gravity compensation exercises, and tailored video programs. 5G's lower latency may remove the lag effect of these applications, improving the experience.



REMOTE CONSULTATIONS

High-speed, high-capacity, and low-latency 5G networks of tomorrow will support the transfer of 8K quality ultra-high-definition video, enhancing the telemedicine experience in urban, suburban, and rural areas.

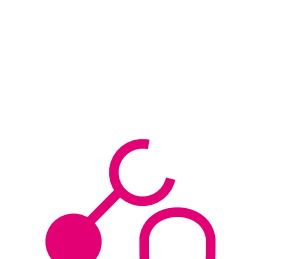
8K Quality ultra-high-definition video enhances the telemedicine experience.



MEDICAL IMAGERY

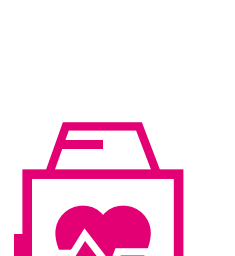
High-speed 5G networks will support the transfer of large data volumes nearly instantaneously, including large medical imagery files like MRIs and PET scans.

1GB PET scans can generate up to 1GB of information per patient per study



ROBOTIC SURGERY

The robotic arms used in remote control surgery will need 5G's future-state ultra-low latency to operate with precision. Surgical robots may also need 5G's high speed and large data transmission capability to process camera imagery.



REMOTE HEALTH

5G's high-speed, high-bandwidth data transmissions could one day help healthcare providers monitor patient diagnostic information in real time. Wearable fitness and medical devices increase patient engagement in their health and treatment adherence.

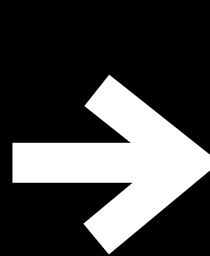
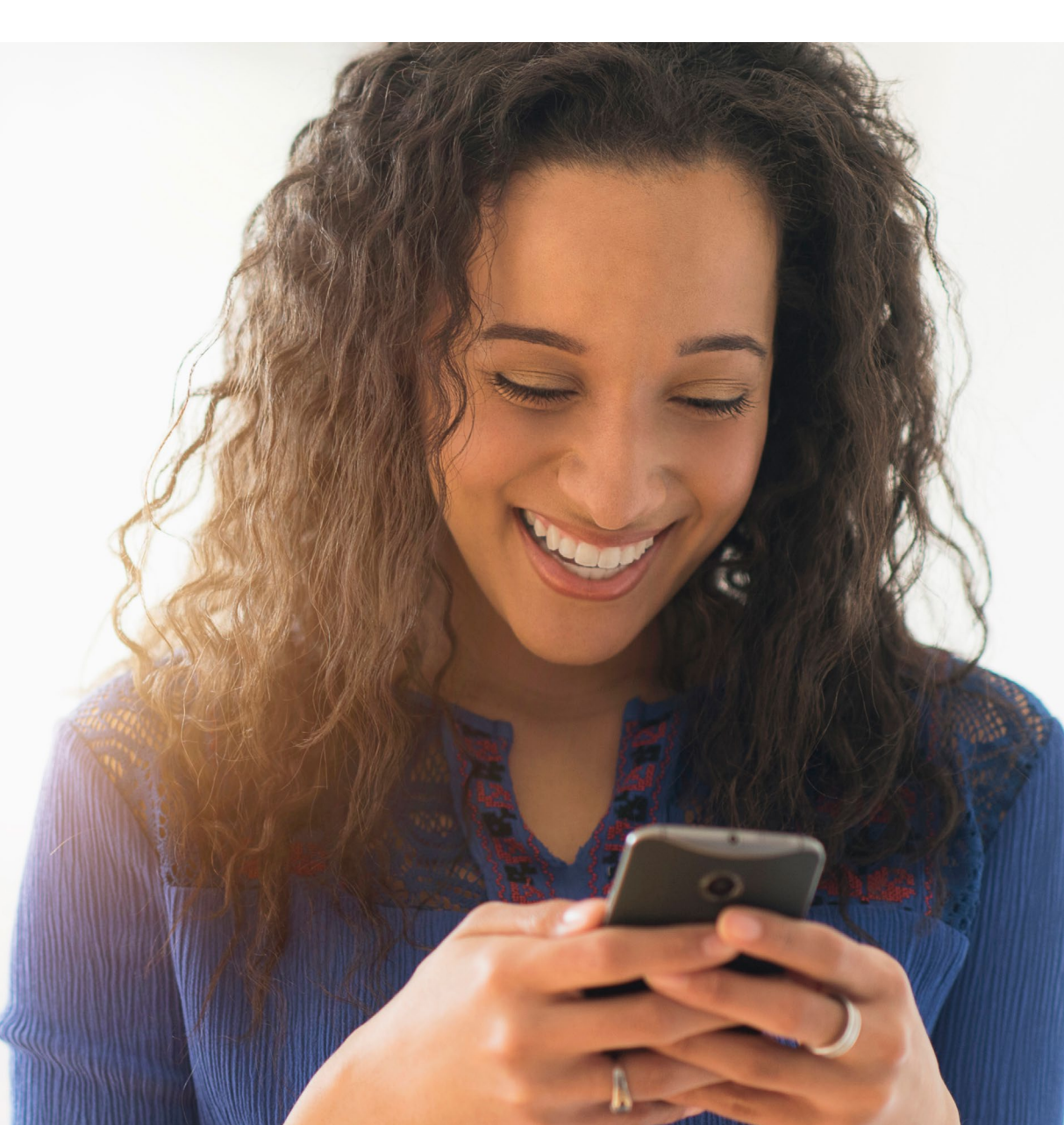


IIoMT

The Internet of Medical Things (IIoMT) market will grow nearly four-fold by 2022 and by 2023, 68% of medical devices will generate data. The volume of sensors and their proximity to edge computing make 5G networks essential, enabling greater predictability of patient care efficacy and outcomes.

Industry analysts project that by 2024, the wearables and remote patient monitoring market will grow to **\$612B**

(Source: Grand View Research)



Next steps

T-Mobile.com/business