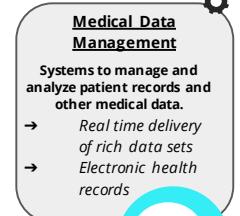


Benefits of SDN for 5G Networks

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INTRODUCTION

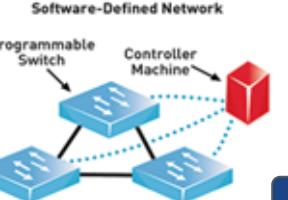
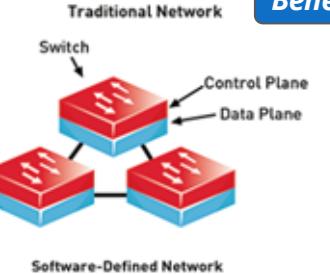
The era of technology has inspired the creation of many technologies that improve our everyday lives. The **Internet of Things (IoT)** is the center of all internet technologies. IoT is described as a network of physical objects or "things" that is connected to each other. These objects range from computers to smart fridges - each have the ability to connect and share data wirelessly over the internet. Developers & Engineers will often develop new technologies to increase the efficiency and security of IoT devices. **Software-Defined Network (SDN)** is the latest emerging technology looking to improve IoT devices, and increase efficiency. In this presentation we will describe the potential improvements SDN will bring to IoT devices.



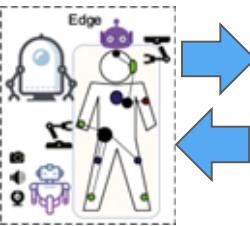
Remote Monitoring

Current consumer-grade wearables are widely used for preventative measures but are not considered sufficiently accurate or reliable for diagnosis.

- High-frequency updates
- Medical grade 5G routers



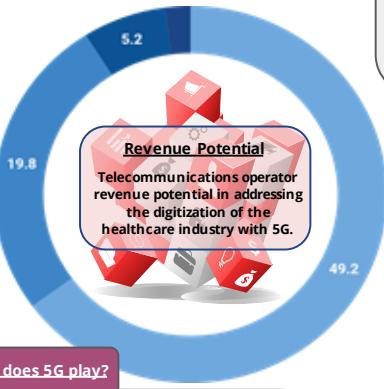
Benefits of SDN for 5G Networks



SDN Potential

SDN has a long way to go when it comes to optimization and potential. Finding new ways to apply it every day. Examples include optimizing how packets are sent by programming the SDN controller differently.

Total: 75.7 Billion USD

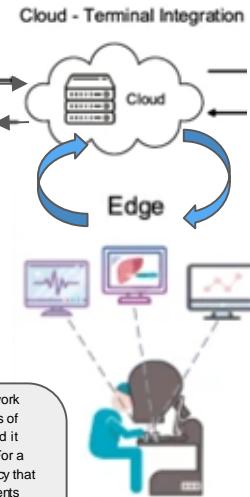


What role does 5G play?

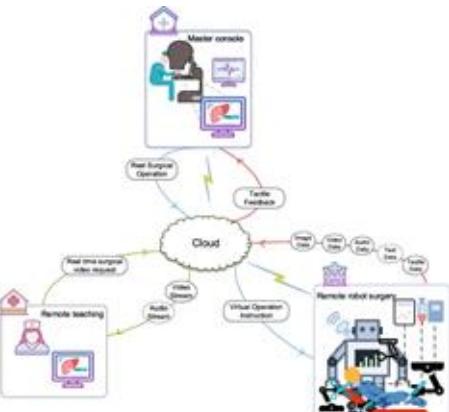
- 5G connects a surgeon in a remote location to a surgical robot
- 5G is mandatory for remote robotic surgery
- 5G provides 1ms latency enabling haptic feedback.
- 5G provides high throughput capacity to transfer HD image streams.

Communication requirements

Data Types	Data rate	Latency	Packet loss rate
EEG	<100 kbit/s	<250 ms	Ultra low
Temperature	<10 kbit/s	<250 ms	Low
Respiration rate	<10 kbit/s	<250 ms	Low
Blood pressure	<10 kbit/s	<250 ms	Low
ECG	<100 kbit/s	<250 ms	Ultra low
EMG	<10 kbit/s	<250 ms	Ultra low
Image	<10Mbps	<100 ms	Low
Audio	<1 Mbps	<100 ms	Very low
Video	<10Mbps	<100 ms	Low



Not only does 5G allow for a more stable, consistent, and faster network required to execute telesurgery, it allows for the tremendous amounts of data required for accurate and precise video and audio necessary and it improves cost efficiency for surgery and other aspects of medicine. For a discipline as precise and tedious as surgery, the extremely low latency that has come with the revolution of 5G allows for the technical requirements that every aspect of the surgery is contingent on, from the respiration monitoring to the blood pressure, as shown in the diagram above. Each part of the surgery has a set amount of latency that it has to be lower than as well as data rates and packet loss rate requirements that the traffic must not exceed during the surgery. 5G takes advantage of other technologies such as artificial intelligence and machines to improve our lives.



Case Categories

Other Cases

Applications for medical assistance.

- 3D printing
- Ambulance drones



Hospital Applications

Applications used in hospitals for medical training, administrative and medical purposes.

- Telemetry
- VR Training in surgical procedures



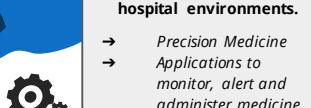
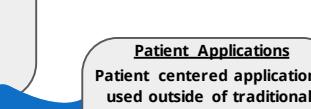
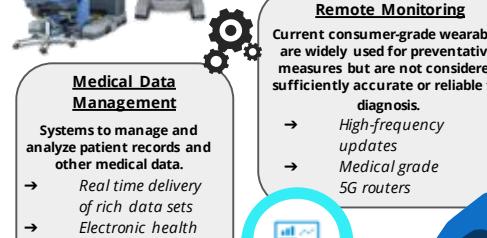
Patient Applications

Patient centered applications used outside of traditional hospital environments.

- Precision Medicine
- Applications to monitor, alert and administer medicine

What role does 5G play?

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Resources

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<https://www.cs.rit.edu/~jmk/papers/sec-sdn.pdf>

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