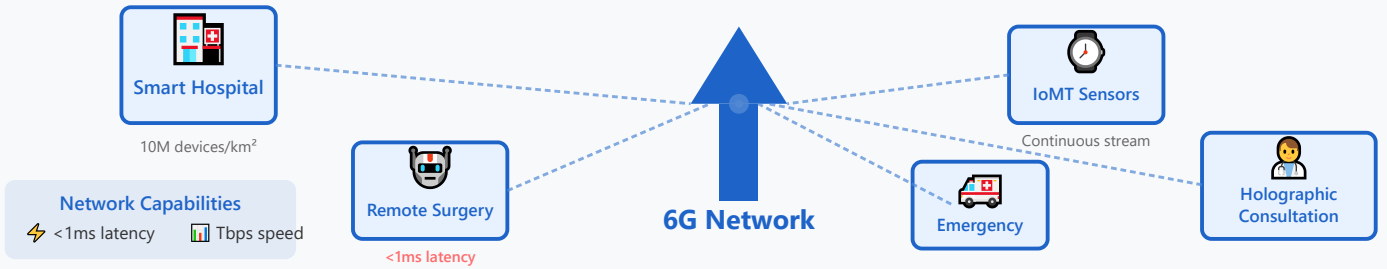
6G and Internet of Medical Things (IoMT)



Ultra-Low Latency

- <1 millisecond latency
- Critical for remote surgery
- Real-time patient monitoring
- Haptic feedback systems

Massive Connectivity

- 10 million devices/km^2
- Hospital-wide sensor networks
- Smart city health infrastructure

AI-Native Networks

- Built-in AI processing
- Intelligent resource allocation
- Predictive maintenance
- Network-edge collaboration

Holographic Communication

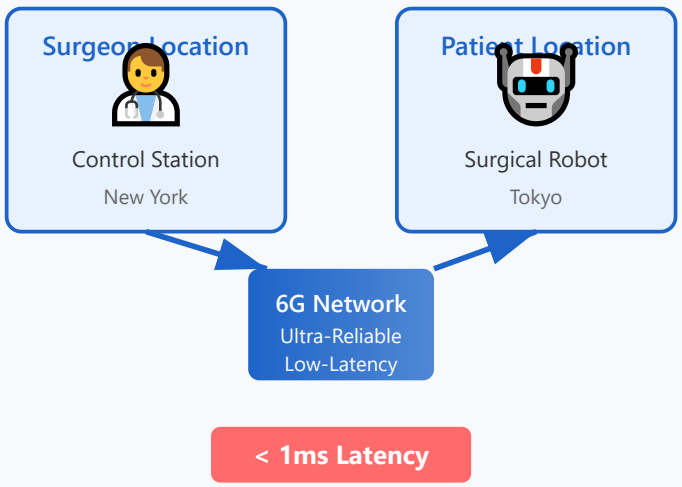
- 3D holographic consultations
- Virtual presence surgery
- Enhanced medical education

Medical Applications: Remote surgery robots, continuous vital sign streaming, emergency response coordination

1. Ultra-Low Latency in Medical Applications

Sub-Millisecond Response Time

Critical for Life-Saving Procedures



Why Ultra-Low Latency Matters

In medical procedures, delays measured in milliseconds can mean the difference between success and failure. 6G's sub-millisecond latency enables:

- **Haptic Feedback:** Surgeons can feel tissue resistance in real-time, just as if they were performing the surgery in person
- **Precise Control:** Instantaneous response to surgeon commands ensures accurate movements
- **Safety Systems:** Emergency stop functions activate without delay

> **Real-World Impact:** A surgeon in New York can perform a delicate neurosurgery on a patient in Tokyo with the same precision as being in the operating room, thanks to **<1ms latency**.

Technical Requirements

- End-to-end latency: <1 millisecond
- Reliability: 99.9999% (six nines)
- Jitter: <0.1ms variation
- Bandwidth: 100+ Mbps for HD video and haptic data

< 1ms
Network Latency

99.9999%
Reliability

1000x
Faster than 4G

24/7
Global Availability

2. Massive Connectivity for Healthcare Ecosystems

10 Million Devices per km²

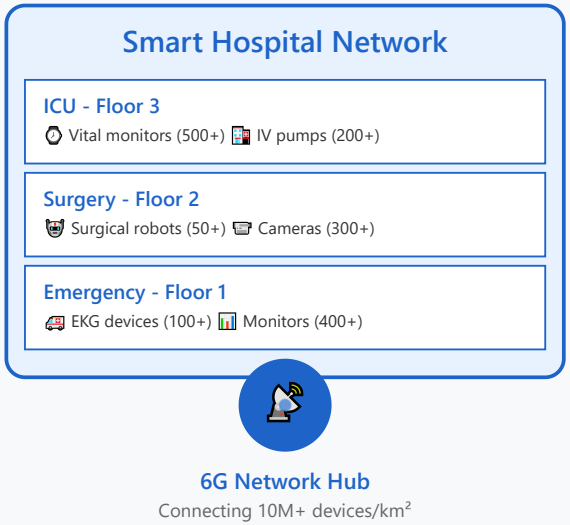
Enabling Smart Hospital Infrastructure

Smart Hospital Ecosystem

6G networks can simultaneously support millions of medical devices within a single hospital complex, creating an intelligent, interconnected healthcare environment.

Connected Device Categories

- **Patient Monitoring:** Wearable sensors, vital sign monitors, continuous glucose monitors, cardiac monitors
- **Medical Equipment:** IV pumps, ventilators, imaging devices (MRI, CT, X-ray), diagnostic equipment
- **Robotic Systems:** Surgical robots, medication dispensers, autonomous transport vehicles
- **Environmental Sensors:** Temperature, humidity, air quality, occupancy detection
- **Staff Devices:** Tablets, smartphones, AR/VR headsets for training and procedures



Scale Example: A large metropolitan hospital with 1,000 beds can have over 50,000 connected devices operating simultaneously - from patient wearables to imaging equipment - all communicating seamlessly through 6G.

Network Benefits

- Automated device coordination and scheduling
- Predictive maintenance and resource allocation
- Real-time data aggregation for clinical decisions
- Seamless patient tracking throughout facilities

10M Devices per km²	**100x** More than 5G
99.999% Uptime	**< 10ms** Device Sync Time

3. AI-Native Networks for Intelligent Healthcare

Built-in Artificial Intelligence

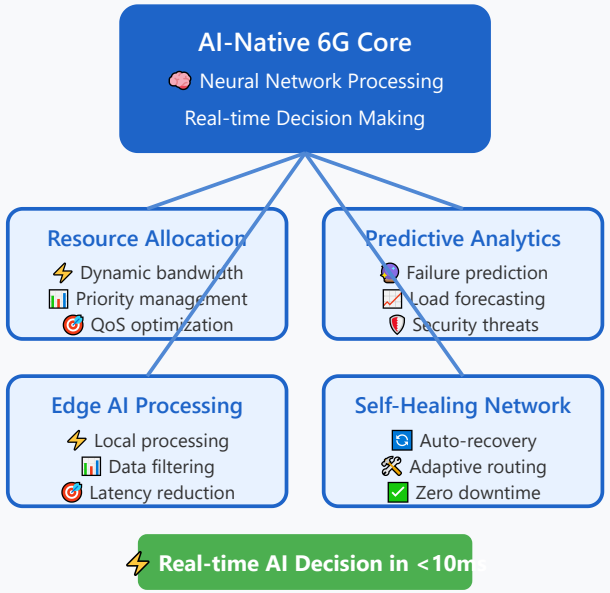
Self-Optimizing, Predictive Healthcare Networks

AI Integration at Network Level

Unlike previous generations where AI was an add-on, 6G embeds artificial intelligence directly into the network architecture, enabling autonomous operation and intelligent decision-making.

Key AI Capabilities

- **Intelligent Resource Management:** AI dynamically allocates bandwidth based on medical priority - emergency surgeries get instant priority over routine monitoring
- **Predictive Maintenance:** ML algorithms predict equipment failures before they occur, scheduling maintenance during low-usage periods
- **Anomaly Detection:** Real-time identification of unusual patterns in patient data or network behavior
- **Adaptive Quality of Service:** Network automatically adjusts to ensure critical medical applications always have sufficient resources



Clinical Example: When an emergency surgery begins, the AI-native network automatically prioritizes bandwidth for the surgical robot and monitoring systems, ensuring <1ms latency while temporarily reducing non-critical data transfers.

Edge Intelligence

AI processing occurs at multiple network layers:

- Device edge: Initial data filtering and preprocessing
- Hospital edge: Local analytics and immediate response
- Cloud core: Complex analysis and long-term learning

< 10ms AI Decision Time	**99.9%** Prediction Accuracy
50% Energy Reduction	**Zero** Manual Intervention

4. Holographic Communication in Medicine

3D Holographic Telepresence

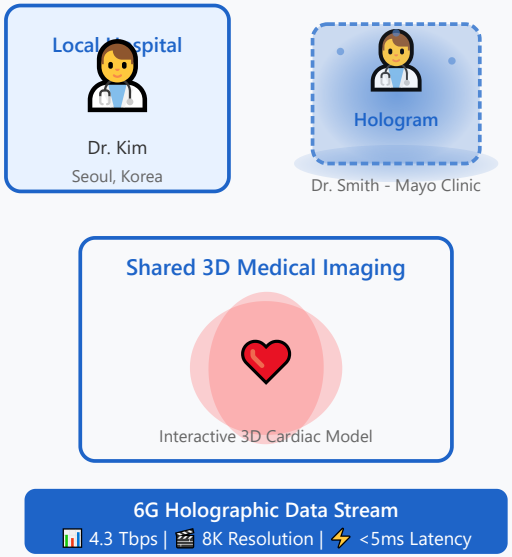
Immersive Medical Collaboration and Education

Immersive Medical Collaboration

6G's enormous bandwidth enables transmission of holographic data, creating lifelike 3D representations of doctors, patients, and medical imaging for unprecedented collaboration.

Medical Applications

- **Specialist Consultations:** World-class specialists appear as holograms in local hospitals, providing expertise without travel
- **Surgical Guidance:** Expert surgeons provide real-time holographic guidance during complex procedures
- **Medical Education:** Students interact with 3D holographic anatomy models and observe procedures from multiple angles
- **Patient Communication:** Families separated by distance can have holographic visits with patients in ICU



Use Case: A rural hospital performs a complex cardiac surgery with a holographic cardiac surgeon from Johns Hopkins appearing beside the local surgical team, providing real-time guidance while viewing shared 3D imaging of the patient's heart.

Technical Requirements

- **Bandwidth:** 4-5 Tbps for full holographic transmission
- **Resolution:** 8K per eye for realistic depth perception
- **Latency:** <5ms to prevent motion sickness
- **Field of View:** 200° horizontal for immersive experience

Benefits

- Access to specialist expertise regardless of location
- Reduced healthcare disparities in rural areas
- Enhanced medical training and education
- Improved patient outcomes through collaboration

4.3 Tbps
Holographic Bandwidth

8K
Per Eye Resolution

< 5ms
End-to-End Latency

200°
Field of View