



5G Revolution: Transforming Connected Industries in APAC

Eight Case Studies Showcasing the Versatility and Impact of 5G Technologies

Reshaping Industries: APAC's 5G Revolution in Healthcare

National University Health System's innovative 5G enterprise network transforms healthcare in Singapore

National University Health System (NUHS) in Singapore, in partnership with Singtel and IMDA, has implemented a hybrid 5G enterprise network. This innovation enhances medical capabilities through real-time, high bandwidth connectivity, revolutionizing healthcare with applications like Holomedicine for improved surgical precision and patient outcomes.





Clients/partners involved in this 5G deployment

In the pioneering 5G deployment at the National University Health System (NUHS) in Singapore, several key partners have collaborated to transform healthcare practices through advanced connectivity. Singapore Telecommunications Limited (Singtel) serves as the 5G network provider, and the partnership and collaboration with Infocomm Media Development Authority (IMDA) was crucial in the regulation, deployment, and sustainment of the NUHS 5G network.

Transforming Healthcare with 5G: A Hybrid Network Solution

Advanced Connectivity for Medical Innovation at NUHS, Singapore

The National University Health System (NUHS) in Singapore has implemented an advanced hybrid 5G network to support its pioneering Holomedicine program. This hybrid network, featuring both public and private elements with network slicing, operates on the 5G Standalone (SA) 3.5GHz spectrum, delivering impressive performance metrics with a downlink speed of 1Gbps, uplink speed of 150Mbps, and latency of less than 10ms. These capabilities are critical for applications requiring real-time, high-definition camera streaming and rapid connectivity, such as mixed reality (MR) devices used in surgeries. The network ensures secure and prioritized communication channels, safeguarding medical data and maintaining efficiency even during peak usage or emergency situations. By integrating cloud and edge computing, NUHS can process and analyze data close to the end-user, enhancing the responsiveness and reliability of its medical applications. This comprehensive 5G solution marks a significant leap forward in healthcare innovation, providing a robust foundation for future advancements.



"5G technology has empowered us to deliver advanced healthcare solutions and train the next generation of healthcare professionals with unprecedented precision and reliability."

- Dr. Gao Yujia, Assistant Group Chief Technology Officer, NUHS

"The future of 5G in the Asia Pacific region is promising. 5G technology integrated with emerging technologies will continue to drive economic growth, enhance productivity, and improve the quality of life across the region."

- Mohamed Firdaus, Senior Director, Enterprise 5G, Singtel Singapore

Overcoming Connectivity Barriers in Advanced Medical Applications

Addressing Critical Needs for Holomedicine at NUHS, Singapore

The National University Health System (NUHS) faced significant challenges in advancing its Holomedicine program, which leverages mixed reality (MR) devices like HoloLens2 for real-time, high-definition holographic imaging during surgeries. The existing 4G and Wi-Fi networks could not meet the stringent requirements for rapid connectivity and low latency, leading to lag and unreliable data transfer. These limitations hindered the effectiveness of MR applications, compromising patient safety and the quality of medical procedures. The need for secure, uninterrupted communication channels to prioritize critical medical traffic over public usage became evident, especially during network congestion or emergencies. Additionally, the demand for robust cloud and edge computing capabilities to process vast amounts of data in real-time was unmet. These challenges significantly impacted NUHS's ability to innovate and improve healthcare delivery, necessitating a comprehensive solution that only a 5G hybrid network could provide.

Reshaping Industries: APAC's 5G Revolution in Healthcare



Enhancing Healthcare through Advanced Connectivity

Strategic Goals for 5G Integration at NUHS, Singapore

The primary objective of implementing the hybrid 5G network at the National University Health System (NUHS) was to revolutionize healthcare delivery through enhanced connectivity and innovative technologies. The goal was to overcome the limitations of existing 4G and Wi-Fi networks, ensuring that critical medical applications, such as Holomedicine, could operate seamlessly with real-time, high-definition data transfer and minimal latency. NUHS aimed to leverage the high bandwidth and low latency of 5G to facilitate the use of mixed reality (MR) devices in surgeries, thereby improving surgical precision and patient outcomes. Another key objective was to establish a secure, prioritized communication channel that would safeguard critical medical data, ensuring efficient operations even during peak network usage or emergencies. Additionally, NUHS sought to integrate cloud and edge computing capabilities to enhance data processing and analytics, providing faster and more accurate medical insights. This strategic initiative aimed to position NUHS at the forefront of medical innovation, setting a new standard for healthcare excellence in Singapore.



Integrating 5G for Holomedicine Excellence

Hybrid Network Solutions for NUHS, Singapore

To address the critical connectivity challenges faced by NUHS, a decision was made to implement a hybrid 5G network. This technology was selected due to its ability to provide high bandwidth, low latency, and secure, prioritized communication channels essential for Holomedicine applications. The implementation involved deploying 5G network slicing to ensure prioritized bandwidth for medical data, mitigating congestion issues. The network operates on the 3.5GHz spectrum, offering speeds up to 1Gbps downlink and 150Mbps uplink with less than 10ms latency, meeting the stringent requirements for real-time high-definition streaming and rapid data transfer. Innovative aspects of this implementation included the integration of cloud and edge computing, allowing data to be processed closer to the end-user for faster response times. Customized configurations ensured that MR devices like HoloLens2 could function optimally, enhancing surgical precision and patient safety. This strategic deployment has transformed NUHS's capabilities, enabling cutting-edge medical procedures and innovations.



Transformative Outcomes of 5G Integration

Enhanced Medical Capabilities at NUHS, Singapore

The implementation of the hybrid 5G network at the National University Health System (NUHS) has led to significant advancements in medical capabilities and operational efficiency. The seamless real-time streaming of live surgeries, supported by the 1Gbps downlink and 150Mbps uplink speeds with less than 10ms latency, has become routine in operating theatres equipped with indoor 5G antennas. This has enabled precise, real-time holographic imaging during surgeries, significantly enhancing surgical accuracy and patient outcomes. To date, over 20 surgeries have successfully utilized this technology, with ongoing clinical trials for two additional applications. The high-compute capabilities provided by Multi-access Edge Computing (MEC) have allowed for complex data processing and analytics, previously constrained by traditional networks. NUHS has reported a marked improvement in overall operational efficiency and patient care quality.

Insights from the 5G Healthcare Deployment

Reflective Learning at NUHS, Singapore

The deployment of the hybrid 5G network at NUHS provided several valuable lessons. One key insight was the complexity of integrating 5G technology within an existing hospital infrastructure, particularly due to legacy systems and the need for minimal disruption to ongoing medical services. Sequential installation, while ensuring patient safety and operational continuity, required meticulous coordination with hospital operations and building management teams. Another critical lesson was the importance of user training. Ensuring that medical staff could effectively use the new 5G-enabled devices and applications was essential for maximizing the technology's benefits. Additionally, the project highlighted the necessity of forming an internal team proficient in managing and maintaining the 5G system, underscoring the need for specialized knowledge and skills. The complexity of developing integrated data networks and obtaining regulatory approvals also emerged as significant challenges, emphasizing the importance of early and ongoing engagement with relevant authorities. Overall, the project reinforced the need for a well-coordinated, adaptive approach to successfully implement cutting-edge technology in a healthcare setting.

Revolutionizing Healthcare with 5G

NUHS's Journey Towards Advanced Medical Solutions

The implementation of the hybrid 5G network at the National University Health System (NUHS) in Singapore has fundamentally transformed its medical capabilities. By addressing critical connectivity challenges, the 5G solution enabled seamless real-time data transfer, essential for the innovative Holomedicine program. This advancement has significantly improved surgical precision and patient outcomes, showcasing the profound impact of 5G technology in a healthcare setting. The successful integration of cloud and edge computing further enhanced data processing and analytics, driving operational efficiency and high-quality care. The project also highlighted important lessons in managing complex technological deployments within a hospital environment, reinforcing the need for comprehensive planning.

Advancing Healthcare Connectivity

Next Steps for NUHS's 5G Journey

Building on the success of the hybrid 5G network implementation, NUHS plans to expand its 5G capabilities to further enhance healthcare delivery. Future initiatives include the sequential upgrading of 5G infrastructure to support new medical applications, such as the 5G Cloud Robotics Program and remote patient monitoring through wearable sensors. Additionally, NUHS aims to leverage the 5G network for remote proctoring and training of healthcare professionals globally, fostering a collaborative and innovative medical community.

About Singtel

Singtel is a leading Asian communications technology group, operating next-generation connectivity, digital infrastructure and digital businesses including regional data centre arm Nxera and regional IT services arm NCS. The Group has presence in Asia, Australia and Africa and reaches over 780 million mobile customers in 21 countries.

For consumers, Singtel delivers a complete and integrated suite of services, including mobile, broadband and TV. For enterprises, Singtel offers a complementary array of workforce mobility solutions, data hosting, cloud, network infrastructure, analytics and cyber security capabilities.

Singtel is dedicated to continuous innovation, harnessing technology to create new and exciting customer experiences, support enterprises in their digital transformation and shape a more sustainable, digital future.

For more information, visit www.singtel.com.

About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

We invite you to find out more at [gsma.com](https://www.gsma.com)

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GSMA APAC 5G Industry Community

Launched at the Mobile 360 Asia Pacific 2021, the APAC 5G Industry Community is a forum for people to learn and advocate 5G benefits to industries and enterprises. The Community has been designed for stakeholders across the value chain including government and agencies, industry associations, mobile network providers, enterprises and industry players, solution providers, analysts, and consultants. It serves as a collaboration platform to support 5G industry innovation, application and business opportunities, and to unlock the power of 5G connectivity so that people, industries and society thrive.

www.gsma.com/asia-pacific/communities/ap5gic/

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