Building Global Connectivity: From 5G Expansion to 6G Integration

Building Global Connectivity

From 5G Expansion to 6G Integration

- **Ian Shazell – VP Technology, OQ Technology**
  - leading 5G IoT, NTN and direct-to-device connectivity
  - Responsible for end-to-end system architecture and mission delivery (space, ground, network)
  - 25+ years in satellite systems and operations, including roles at European Space Agency and in the Middle East

- **OQ Technology is a Luxembourgish Low Earth Orbit satellite operator**
  - The world's first LEO 5G IoT satcom company
  - Global IoT and M2M satcom solutions
  - Multi-Industry: energy, mining, logistics, maritime, agriculture, government and defense
  - Our patented technology facilitates IoT connectivity anywhere for billions of users, leveraging 5G NTN IoT chips and integrating both terrestrial and satellite networks

Introduction: OQ

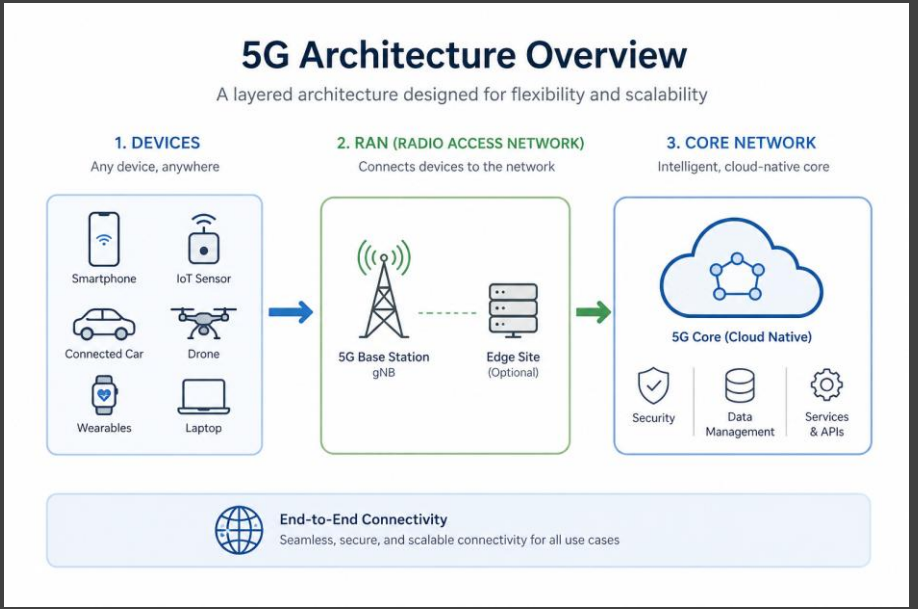
OQ Technology: Delivering 5G NTN in Practice

- OQ Technology is a Low Earth Orbit (LEO) satellite operator focused on delivering Non-Terrestrial Network connectivity as an extension of cellular systems.
- The company develops 5G NTN and NB-IoT solutions that enable direct-to-device communication using standard user equipment, without requiring proprietary terminals.
- OQ's architecture is fully aligned with 3rd Generation Partnership Project standards, ensuring compatibility with existing mobile network operator infrastructure and roaming frameworks.
- The system is designed and delivered as an end-to-end solution, covering satellite payload, ground segment, and network integration to enable scalable and operational deployment.

5G: The Starting Point

5G: A Platform for Network Evolution

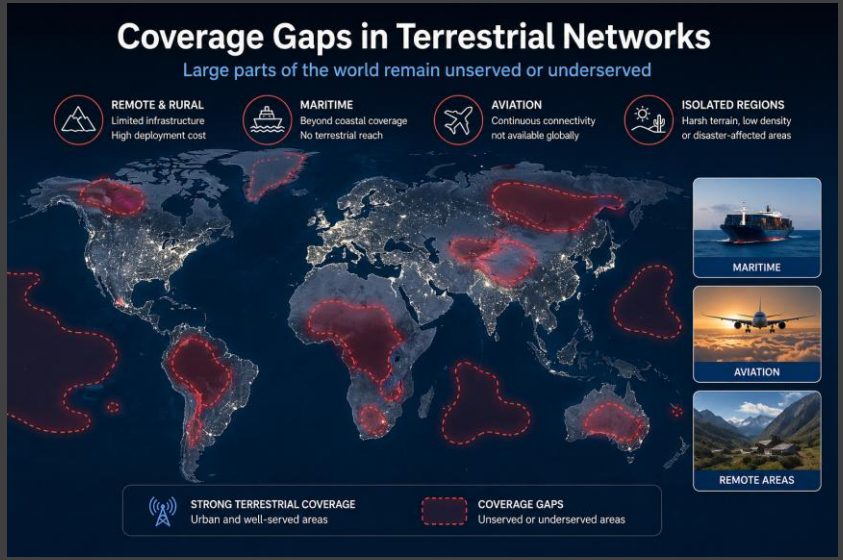
- 5G introduces a service-based architecture (SBA) that enables modular, software-defined network functions and supports flexible deployment across cloud and edge environments.
- The technology enables massive machine-type communications (mMTC) through NB-IoT and LTE-M, allowing large-scale deployment of low-power IoT devices across diverse sectors.
- Native support for network virtualisation and cloud-native core networks allows operators to scale capacity dynamically and integrate new access technologies more efficiently.
- The standardisation framework defined by 3rd Generation Partnership Project provides a common foundation for interoperability, roaming, and integration across vendors and network domains.



The Limitation of 5G

5G Coverage is Not Ubiquitous

- Despite its architectural advances, 5G remains fundamentally dependent on terrestrial radio access networks, which require dense infrastructure deployment to achieve coverage and performance targets.
- Large geographic areas remain unserved or underserved, including maritime regions, aviation corridors, remote land areas, and sparsely populated environments where terrestrial deployment is not economically viable.
- Network availability is constrained by infrastructure dependencies, including power, backhaul connectivity, and physical site access, all of which introduce points of failure in disrupted or degraded scenarios.
- As a result, terrestrial 5G alone cannot provide continuous, resilient, and global connectivity, particularly for mission-critical and mobile use cases that extend beyond traditional coverage boundaries.



NTN as the Extension of 5G

NTN: Extending 5G Beyond the Ground

- Non-Terrestrial Networks (NTN) are defined within 3rd Generation Partnership Project standards (Release 17 onwards), enabling satellite systems to operate as an integrated component of the 5G ecosystem rather than as standalone communication systems.

- NTN supports both NB-IoT and 5G NR access technologies, allowing standard cellular devices to connect directly to satellites without requiring modifications to hardware or protocols.

- The integration of NTN enables a global coverage layer, extending connectivity to areas where terrestrial networks are unavailable or impractical to deploy.

- By leveraging existing cellular frameworks for authentication, mobility management, and roaming, NTN allows seamless interaction between terrestrial and satellite networks within a unified architecture.

OQ in Practice

OQ Implementation: LEO Direct-to-Device NTN

- OQ deploys a Low Earth Orbit (LEO) satellite architecture to enable direct connectivity to low-power IoT devices, balancing link budget, latency, and coverage requirements for mobile and distributed use cases.

- The system supports direct-to-device communication using standard NB-IoT and 5G user equipment, eliminating the need for proprietary terminals and enabling integration with existing cellular ecosystems.

- Network integration is designed to interface with terrestrial mobile network operators, allowing NTN to operate as an extension of existing core networks with standard authentication, roaming, and service continuity mechanisms.

- OQ delivers the solution as a fully integrated system, covering payload design, RF front-end, ground infrastructure, and network integration to ensure operational performance and scalability.

OQ Approach: LEO Direct-to-Device IoT

From Demonstration to Deployment

OQ Technology Makes History: First-Ever Image Sent via 5G NTN IoT Over LEO Satellite

July 29, 2025

World's First Demonstration of LEO 5G Non-Terrestrial Network Connecting to a Flying Drone

July 16, 2025

OQ Technology Successfully Launches Two ERMIS Satellites on SpaceX Transporter-16

March 31, 2026

OQ Technology and Nordic Semiconductor Set New Industry Benchmark by Connecting Standard NB-IoT Module to Fully Integrated LEO Satellite Network

December 17, 2025

OQ Technology Achieves Europe's First Direct-to-Mobile Emergency Broadcast Message from Space

November 19, 2025

OQ Technology wins the ESA x GSMA Foundry Excellence Awards 2026 for Direct-to-Device Connectivity

March 2, 2026

Hyperconverged Networks

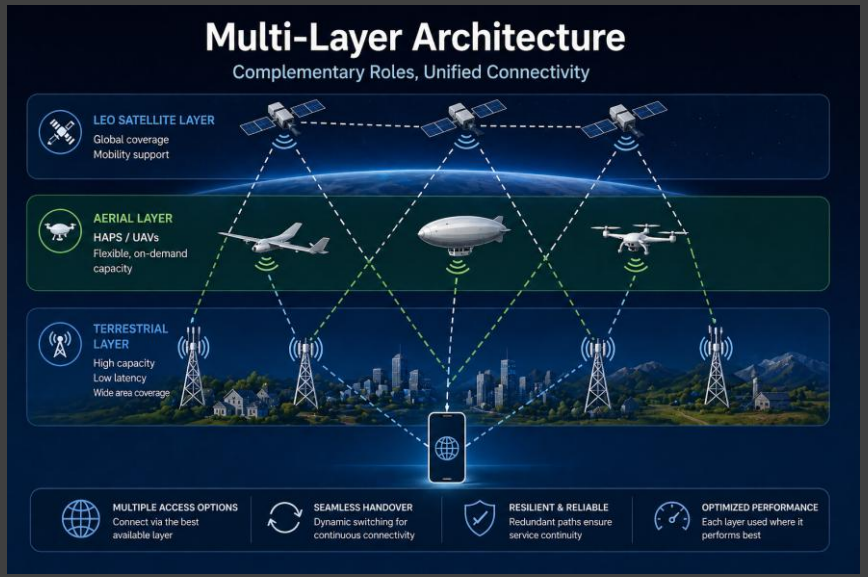
Hyperconverged Connectivity: A Unified Network Experience

- Hyperconverged networks combine terrestrial, satellite (LEO), and aerial platforms into a single, integrated connectivity architecture that operates as a unified system.
- Network access is dynamically managed, allowing devices to connect through the most appropriate layer based on coverage, capacity, and service requirements, without user intervention.
- The convergence is enabled by common standards, shared core network functions, and unified control mechanisms, ensuring consistent service behaviour across different access technologies.
- From a user and application perspective, connectivity becomes continuous and location-independent, abstracting the underlying network complexity into a seamless experience.

Multi-Layer Architecture

Layered Network Architecture: Complementary Roles

- Terrestrial networks provide high-capacity, low-latency connectivity in dense and urban environments, where infrastructure can be economically deployed and maintained.
- LEO satellite systems deliver global coverage and support mobility, enabling connectivity for maritime, aviation, and remote applications where terrestrial infrastructure is unavailable.
- High-Altitude Platforms (HAPS) and UAVs provide flexible, localised coverage and capacity augmentation, particularly in temporary deployments or during network congestion and disruption.
- The combination of these layers creates a complementary architecture, where each access technology addresses specific performance and coverage requirements within a unified network.



Use Cases Enabled

Applications Enabled by Hyperconverged Connectivity

- Autonomous and connected transport systems require continuous, low-latency connectivity across urban, rural, and remote environments, which cannot be achieved through terrestrial networks alone.
- Maritime and offshore operations depend on reliable communication for tracking, monitoring, and safety, where satellite connectivity provides the primary link beyond coastal coverage.
- In-flight connectivity for commercial and operational aviation requires seamless global coverage and mobility support, enabled through integration of satellite and terrestrial networks.
- Public safety and emergency response demand resilient communication capabilities that remain operational during infrastructure failures, supporting coordination and wide-area alerting.
- Energy, utilities, and industrial IoT rely on persistent monitoring and control across geographically dispersed assets, requiring scalable connectivity in remote and hard-to-reach locations.
- Smart agriculture and environmental monitoring depend on low-power IoT connectivity to support large-scale deployments across rural and undeveloped regions.

Toward 6G

6G: NTN as a Native Network Component

- In 6G architectures, Non-Terrestrial Networks are expected to be integrated as a native component from the outset, rather than introduced as an extension to terrestrial systems.
- Future networks will operate as fully converged multi-layer systems, combining terrestrial, satellite, and aerial platforms under a unified control and service framework.
- AI-driven network orchestration will dynamically manage connectivity, optimising access selection, resource allocation, and service delivery across multiple domains in real time.
- The objective is to deliver ubiquitous, resilient, and consistent connectivity, enabling seamless operation of applications regardless of location or access technology.

Why OQ is Positioned

Building the Foundation for 6G Today

- OQ develops NTN solutions that are fully aligned with 3GPP standards, ensuring compatibility with existing 5G networks and a direct evolution path toward 6G architectures.

- The system is designed for direct-to-device connectivity, enabling standard NB-IoT and 5G user equipment to operate over satellite links without modification, which is essential for scalability.

- OQ delivers an end-to-end integrated system, covering satellite payload, RF systems, ground infrastructure, and network integration, ensuring operational performance rather than isolated capability.

- Proven demonstrations and in-orbit deployments show that key elements of hyperconverged connectivity are already implemented, providing a practical foundation for future network evolution.

Conclusion

From 5G Expansion to 6G Integration

- The expansion of 5G has established a flexible, standard-based foundation that enables the integration of new access technologies beyond traditional terrestrial networks.
- The incorporation of NTN extends this foundation to provide global coverage and improved resilience, addressing the limitations of infrastructure-dependent connectivity.
- The convergence of terrestrial, satellite, and aerial networks is already underway, forming a unified connectivity architecture that supports a wide range of applications and environments.
- The transition toward 6G will formalise this convergence, delivering ubiquitous, resilient, and seamlessly integrated connectivity as a core capability of the network.

@oqtec

@oqtechnology

oqtec.com

Thank You
www.oqtec.com