TecFutures Research Perspective

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Unlocking the potential of cellular and satellite for IoT

In an increasingly interconnected world, IoT is revolutionizing industries, driving efficiency, and opening up new possibilities. However, despite the widespread adoption of IoT devices, there are still significant challenges in ensuring seamless connectivity, especially in remote or underserved areas where traditional cellular terrestrial networks struggle to reach. Recognizing this gap, the integration of satellite technology with cellular networks presents a compelling solution, offering unparalleled coverage and connectivity for IoT applications across diverse environments.
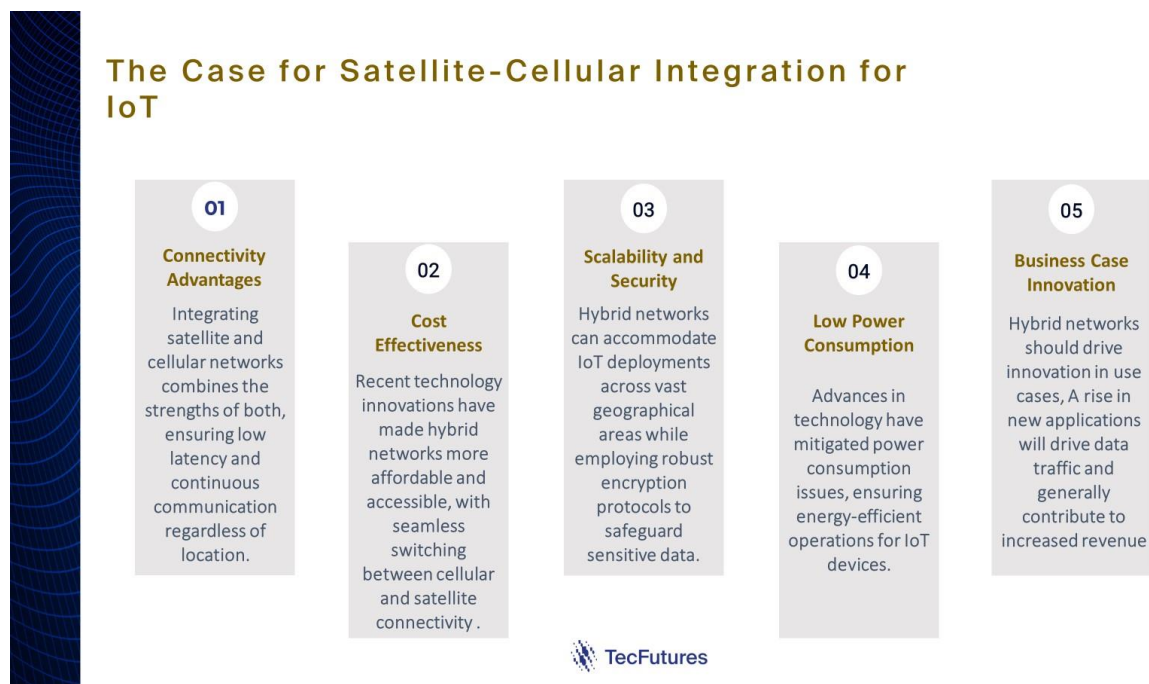
Satellite systems can categorized into GEO, MEO, and LEO orbits, detailing their altitudes, latencies, and applications. Some operators have a mix of satellite constellations.

- GEO satellites, at high altitudes, appear stationary in the sky and offer wide coverage but higher latencies, so are suitable for services like television and business data. GEO players include Eutelsat, Globalstar Inmarsat and Iridium.
- MEO satellite operators, including Oneweb and Galileo, have satellites that are lower in altitude and used for navigation and some communication services.
- LEO satellites operators, including Hiber and SpaceX (Starlink), operate at lower altitudes, offer the lowest latency and higher data rates, making them ideal for mobile broadband and IoT applications. 3GPP Release 17 introduces IoT non-terrestrial networks, utilizing both GEO and LEO satellites for IoT connectivity, addresses technical challenges like handover and discontinuous coverage for IoT.

At the heart of this transformation lies collaboration—between terrestrial and satellite operators—to build a unified, resilient, and truly global network. By leveraging open 3GPP specifications, satellite systems complement terrestrial networks, creating a seamless IoT connectivity solution that addresses the unique challenges of today's connected world.

To explore the topic in more depth, TecFutures examines the key drivers, challenges, and questions to ask around hybrid cellular-satellite IoT.

The Case for Cellular-Satellite Integration for IoT

The Case for Satellite-Cellular Integration for IoT

01 Connectivity Advantages
Integrating satellite and cellular networks combines the strengths of both, ensuring low latency and continuous communication regardless of location.

02 Cost Effectiveness
Recent technology innovations have made hybrid networks more affordable and accessible, with seamless switching between cellular and satellite connectivity.

03 Scalability and Security
Hybrid networks can accommodate IoT deployments across vast geographical areas while employing robust encryption protocols to safeguard sensitive data.

04 Low Power Consumption
Advances in technology have mitigated power consumption issues, ensuring energy-efficient operations for IoT devices.

05 Business Case Innovation
Hybrid networks should drive innovation in use cases, A rise in new applications will drive data traffic and generally contribute to increased revenue

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Hybrid Connectivity Advantages:

Integrating satellite and cellular networks combines the strengths of both, ensuring continuous communication regardless of location. Whether in bustling urban centers or remote rural areas, IoT devices can maintain connectivity, enabling real-time data transmission and analysis.

Cost-effectiveness and Flexibility:

Recent innovations in Low Power Wide Area Network (LPWAN) technologies and the extension of 5G standards to include satellite networks have made hybrid networks more affordable and accessible. Hybrid networks offer a flexible solution that optimizes costs by seamlessly switching between cellular and satellite connectivity based on location and network availability.

Scalability and Security:

Hybrid networks are highly scalable and secure, accommodating IoT deployments across vast geographical areas while employing robust encryption protocols to safeguard sensitive data. This scalability ensures that businesses can expand their IoT deployments without compromising security.
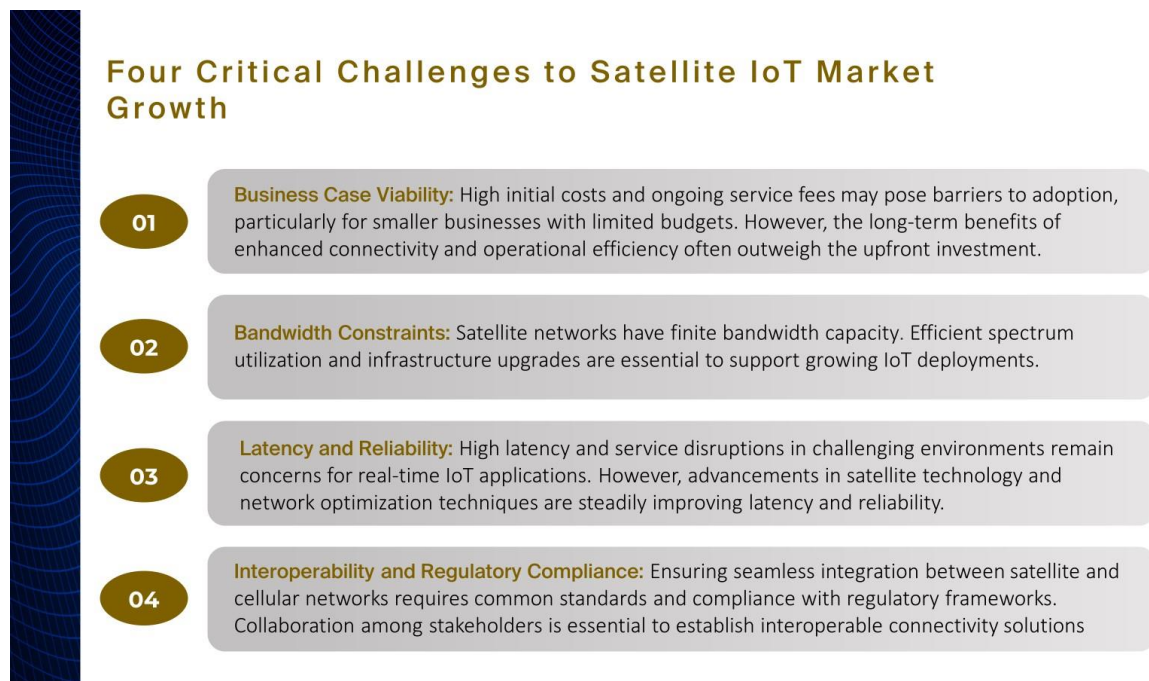
Latency and Low-power Operations:

While latency and power consumption have historically been concerns with satellite connections, advancements in technology have mitigated these issues, ensuring responsive and energy-efficient operations for IoT devices.

Business Case Innovation:

Hybrid networks enable applications to match their bandwidth, latency, and coverage requirements in a highly flexible way which should lead to increased innovation. A rise in new applications will drive data traffic and generally contribute to increased revenue.

Addressing Challenges and Maximizing Opportunities

Despite the numerous benefits of cellular-satellite integration, several challenges must be addressed to allow operators to fully realize its potential.

Four Critical Challenges to Satellite IoT Market Growth

01 **Business Case Viability:** High initial costs and ongoing service fees may pose barriers to adoption, particularly for smaller businesses with limited budgets. However, the long-term benefits of enhanced connectivity and operational efficiency often outweigh the upfront investment.

02 **Bandwidth Constraints:** Satellite networks have finite bandwidth capacity. Efficient spectrum utilization and infrastructure upgrades are essential to support growing IoT deployments.

03 **Latency and Reliability:** High latency and service disruptions in challenging environments remain concerns for real-time IoT applications. However, advancements in satellite technology and network optimization techniques are steadily improving latency and reliability.

04 **Interoperability and Regulatory Compliance:** Ensuring seamless integration between satellite and cellular networks requires common standards and compliance with regulatory frameworks. Collaboration among stakeholders is essential to establish interoperable connectivity solutions

Business Case Viability:

High initial costs and ongoing service fees may pose barriers to adoption, particularly for smaller businesses with limited budgets. However, the long-term benefits of enhanced connectivity and operational efficiency often outweigh the upfront investment. A challenge for service providers is therefore to find innovative ways to support the business case.

Bandwidth Constraints:

Satellite networks have finite bandwidth capacity, which can lead to congestion and reduced data throughput in densely populated areas. Efficient spectrum utilization and infrastructure upgrades are essential to support growing IoT deployments. Hybrid networks can offer more intelligent traffic management by leveraging the most appropriate connectivity to match application requirements.

Latency and Reliability:

High latency and service disruptions in challenging environments remain concerns for real-time IoT applications. However, advancements in satellite technology and network optimization techniques are steadily improving latency and reliability. Operators need to consider how to best to market and deliver the advantages of hybrid networks across critical and non-critical applications.

Interoperability and Regulatory Compliance:

Ensuring seamless integration between satellite and cellular networks requires common standards and compliance with regulatory frameworks. Collaboration among stakeholders is essential to establish interoperable connectivity solutions and navigate the inevitable regulatory complexities.

Five Key Questions for Suppliers to Embrace Hybrid Connectivity

As the cellular-satellite market continues to evolve, businesses must remain agile, proactive, and customer-centric in their approach to innovation and strategy execution. By addressing challenges and embracing opportunities, organizations can unlock new possibilities and drive sustainable growth in the dynamic landscape of IoT connectivity.

1. Where are the areas of greatest opportunity in terms of revenue growth and your ability to execute?

2. How can you anticipate and adapt to evolving customer demands and market dynamics in the short, medium and longer term?

3. How can you differentiate your offerings in a crowded market landscape and communicate your value proposition?

4. Which strategic partnerships and industry collaborations do we need to strike to take advantage of the available opportunities?

5. What does the return-on-investment look like given the market growth potential?

With exceptional experience in IoT connectivity, TecFutures is well placed to support you in answering these questions and in optimizing your approach to the opportunities from satellite IoT.

About TecFutures

At TecFutures, we're committed to helping our clients in developing their marketing strategies and tactics for the next wave of technology adoption.

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Contact Rysio Pakula at rysio@tecfutures.com to learn more about how we can support your journey towards ongoing success.

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