iSIM and Beyond

The Future of Embedded Connectivity and Telco Opportunities

Executive Summary

The humble SIM card has quietly powered global connectivity for over three decades. Once a plastic rectangle swapped by hand at airport kiosks, it is evolving into software-defined, hardware-integrated intelligence. eSIM (embedded SIM) has already begun replacing physical cards in smartphones, wearables, and vehicles.

Now iSIM (integrated SIM) — the next leap, where SIM functionality lives directly inside the device's chipset — promises even greater efficiency, security, and scale.

For the telecommunications industry, this shift is not merely technical; it unlocks massive opportunities in IoT, seamless global services, and new business models, while demanding adaptation in operations and strategy.

Executive Summary

The global telecommunications landscape is undergoing a fundamental shift characterized by the maturation of Standalone 5G networks, the mass adoption of embedded SIM (eSIM) and integrated SIM (iSIM) technologies, and the rise of digital identity as the foundation for travel and commerce. By 2032, the eSIM market is projected to reach $50 billion, growing at a CAGR of 16.5%.

The telecommunications industry is currently navigating a foundational transition from hardware-centric silos to a software-defined connectivity model. This evolution is driven by the strategic convergence of 5G, eSIM, and emerging iSIM technologies, creating a unified ecosystem for the next generation of industrial scale.

According to ABI Research, shipments of eSIM-enabled devices are projected to exceed 633 million units by 2026. However, while the potential for growth is immense, the current reality remains fragmented: currently, only 33% of cellular IoT modules utilize eSIM technology. The shift toward SGP.32 (eSIM for IoT) represents the critical accelerant required to transition the remaining 67% of the market toward intelligent, flexible connectivity.

Consumer and Enterprise Markets

Despite the promise of "seamless" connectivity, the transition is marked by significant friction, including technical hurdles in device transfers and increasing regulatory intervention—most notably evidenced by Turkey’s 2025–2026 restrictions on international eSIM providers.

Simultaneously, the travel industry is pivoting toward a "smartphone-centric" model, with 78% of passengers desiring a unified digital wallet for passports and loyalty credentials. For industry stakeholders, the strategic integration of these technologies represents a critical revenue opportunity in post-purchase ancillaries and operational efficiency.

For the modern enterprise, "intelligent connectivity" is no longer a luxury but an operational mandate. Global IoT fleets and mobile professionals require a seamless, zero-touch experience that maintains persistent connectivity across diverse borders. Achieving this requires moving beyond the "broken promise" of legacy standards.

Historically, the industry has struggled with the technical friction of manual provisioning and carrier lock-in. SGP.32 resolves these limitations, providing the architectural framework necessary for high-trust, industrial-grade orchestration in an era defined by 5G Standalone (SA) networks and massive IoT deployments.

Background and Overview

For more than three decades the physical SIM card was the quiet gatekeeper of the mobile world—an unassuming piece of plastic that decided who could speak, roam, and transact on global networks. It worked, but it also imposed friction: manufacturing, logistics, inventory, customer churn, lost cards, and the constant trade-off between size and functionality. Then, almost overnight, that gatekeeper disappeared.

eSIM—embedded SIM—arrived quietly in 2016 as a reprogrammable chip soldered directly onto device motherboards. What began as a convenience feature for high-end smartphones quickly became the foundation for a far larger revolution.

By the early 2020s, eSIM had quietly powered seamless device activation for millions of iPhones, Pixel phones, Galaxy watches, connected cars, and industrial IoT sensors. No tray, no pin, no trip to a retail store. Just a QR code, a few taps, and instant global connectivity.

Yet eSIM was only the beginning.

iSIM—integrated SIM—takes the next decisive step. By moving the SIM function directly into the cellular modem or system-on-chip, iSIM eliminates even the dedicated eSIM chip. The result is microscopic size, lower power consumption, hardened security, and manufacturing costs that drop toward zero. Where eSIM freed operators from plastic, iSIM frees device makers from any separate secure element at all. The SIM becomes software-defined firmware that lives inside the silicon itself.

This is not incremental progress; it is the final unbundling of identity from hardware. And it arrives at precisely the moment when the telecommunications industry needs it most. Global 5G and future 6G deployments, the explosion of industrial IoT, private networks, connected vehicles, smart cities, and consumer wearables all demand connectivity that is instant, borderless, scalable, and secure. Traditional supply chains and provisioning models simply cannot keep pace.

The opportunities for telcos are profound and multi-layered. Remote SIM provisioning

(RSP) turns every device into a potential revenue surface that can be activated, switched, or upgraded in real time. Global roaming becomes a software toggle rather than a billing headache. Operators can now offer “connectivity-as-a-service” platforms to enterprises, monetize IoT fleets at massive scale, and partner with device OEMs, cloud providers, and vertical industries in ways that were impossible when every connection required a physical card. At the same time, iSIM’s deeper integration raises the bar on security, privacy, and regulatory compliance—creating new roles for telcos as trusted identity and security orchestrators in an increasingly device-centric world.

The physical SIM is not merely being replaced; it is being retired. In its place rises a programmable, invisible identity layer that will underpin the next century of connected life. The telcos that understand this shift earliest—and act on it boldly—will write the rules of the next telecommunications era. Those that do not risk becoming utilities in someone else’s platform.

Welcome to the invisible SIM revolution. The future is already embedded.

Market Innovations and Opportunities

Revolutionizing the Travel Experience

The travel sector is the primary driver of consumer eSIM adoption, though it faces new regulatory and security-based challenges. Airlines, Online Travel Agencies (OTAs), and hotel chains are increasingly viewing travel eSIMs as a high-margin digital ancillary.

- **Post-Purchase Commercialization:** Connectivity is a universal travel need. Offering eSIMs at the point of booking confirmation or via check-in notifications allows brands to capture revenue from a customer whose trust is already established.
- **Loyalty Integration:** Hotel chains are exploring eSIMs as loyalty perks. Unlike one-off discounts, a travel eSIM provides daily value throughout a guest's trip, strengthening brand affinity.
- **Digital Identity for Telcos:** EU telcos are using unified digital identity platforms (like itsme®) to streamline KYC compliance for eSIM activation, reducing fraud while offering passwordless authentication.

Challenges

In mid-2025, Turkey's Information and Communication Technologies Authority (BTK) began blocking access to major international eSIM providers (e.g., Airalo, Holafly, Saily).

The ban targets the *purchase and activation* process within Turkey to force compliance with local data storage laws and encourage the use of domestic carriers (Turkcell, Vodafone Turkey, Türk Telekom).

Post-Purchase Revenue Strategies: Connectivity as a Premium Ancillary

The "post-purchase moment"—the window after booking but before travel—is a commercial goldmine. Travel eSIMs are the ultimate digital ancillary: they offer **Zero Fuel and Zero Weight costs**, providing 100% margin efficiency for airlines compared to physical goods or heavy in-flight infrastructure.

- **Connectivity as Hospitality, Reimagined:** Unlike traditional in-flight Wi-Fi, which is limited to the cabin, travel eSIMs are destination-based and

device-native. They solve a universal pain point (roaming anxiety) and provide value throughout the entire trip.

- **Hotel Strategy: The "Connectivity Hub":** Hotel chains can leverage eSIMs to build **"Functional Loyalty."** By providing connectivity as a booking perk or loyalty add-on, the hotel app becomes the guest's **"Connectivity Hub"** for their entire stay, even when they are miles away from the property. This shifts the relationship from "aspirational" (future points) to "daily utility," keeping the guest within the brand's digital ecosystem 24/7.

The Digital Identity Opportunity

Digital Identity (Digital ID) is the "source of truth" and the non-negotiable prerequisite for a contactless travel journey. It allows a traveler to verify their identity once and reuse that credential across every touchpoint, from the initial booking to the final border crossing.

The evolution of Digital ID involves three primary actors: **ICAO** (defining digital passport standards), the **Industry/One ID** (biometric processing), and **Governments** (national ID programs).

We currently face a strategic paradox: the industry is ready (One ID), and ICAO has established the standards, but Governments remain the bottleneck. To date, the lack of government-issued **ICAO Digital Travel Credentials (DTC)** prevents "One ID" from scaling globally. Until governments move beyond physical-chip passports to standardized DTCs, the "smartphone-only" journey remains fragmented.

The International Air Transport Association (IATA) is advocating for a "contactless" journey where Digital Identity (Digital ID) replaces repeated document checks.

- **Passenger Sentiment:** 78% of travelers want a smartphone app that combines digital wallets, passports, and loyalty cards.
- **Digital Travel Credential (DTC):** A digital representation of passport data stored on a chip, the DTC enables biometric verification that is government-backed and globally standardized.
- **Operational Efficiency:** IATA estimates that inadmissible passengers (INADs) cost the industry significantly; one case can cost up to $25,000 in penalties and logistics. Digital ID helps verify admissibility before the passenger arrives at the airport.

Tools like 'itsme' provide the blueprint for bridging this gap by offering:

- **Automated KYC Compliance:** Instant identity verification for eSIM activation, replacing manual document uploads.
- **Passwordless Authentication:** Utilizing biometric "Qualified Signatures" to exchange legally binding documents without login friction.
- **Reusable Identity:** Once a traveler is verified through a platform like 'itsme', that verification can be triggered for any ancillary service, drastically increasing conversion rates for post-purchase offers.

By adopting the "One ID" framework and the "Digitalization of Admissibility," passengers can share Verifiable Credentials (VCs) from their digital wallets with airlines before they even arrive at the airport. This creates a "Ready to Fly" state, where all documents are pre-verified, eliminating the redundant checks that lead to delays and fines.

Furthermore, Digital ID serves as a critical defense against **SIM Swap Fraud** and Identity Theft. By linking the eSIM profile to a biometrically verified, government-backed credential, travel brands can ensure that the person using the data—and the payment method—is the rightful owner, protecting both the consumer and the provider’s brand integrity.

Empowering Enterprise IoT

Enterprise IoT is transforming industries from manufacturing and utilities to logistics and automotive, with billions of connected devices generating real-time data for predictive maintenance, asset tracking, smart metering, and operational optimization.

At the heart of this revolution lies SIM technology — evolving from traditional physical cards to embedded (eSIM) and integrated (iSIM) solutions. These technologies deliver remote provisioning, enhanced security, global flexibility, and cost efficiency, addressing the unique demands of industrial-scale deployments where devices must operate reliably for 10–20 years in remote or harsh environments.

As cellular IoT connections surge toward 8 billion by 2030, eSIM and iSIM are no longer optional — they are foundational enablers that simplify deployment, reduce total cost of ownership (TCO), and unlock new business models for enterprises.

From Physical SIMs to eSIM and iSIM: Tailored for IoT Constraints

Traditional physical SIM cards have long powered cellular IoT but come with limitations: manual installation, logistical complexity, vulnerability to tampering, and inflexibility for global or multi-network use.

eSIM embeds a programmable chip directly on the device board, supporting over-the-air (OTA) remote SIM provisioning (RSP).

The GSMA's SGP.32 standard (released for IoT in 2023–2025) is a game-changer, optimized for constrained, UI-less devices. Unlike consumer-focused specs, SGP.32 uses server-initiated "push" provisioning over lightweight protocols like CoAP/UDP, enabling bulk profile management without SMS or user intervention. It supports fallback mechanisms, multi-profile storage, and seamless network switching — ideal for fleets spanning borders or regulatory zones.

iSIM takes integration to the next level by embedding SIM functionality and the secure element directly into the device's System-on-Chip (SoC).

This eliminates a separate component, slashing power consumption (critical for battery-powered sensors), reducing bill-of-materials (BOM) costs, and shrinking device footprints. iSIM enhances tamper resistance and integrates with hardware-rooted security features like trusted execution environments.

Early GSMA-certified platforms (e.g., on Snapdragon chipsets) are already powering low-power NB-IoT and LTE-M deployments. Together, these technologies shift IoT connectivity from a one-time hardware decision to a dynamic, software-defined service.

Core Roles of SIM Technologies in Enterprise IoT

1. **Seamless Remote Provisioning and Lifecycle Management:** Enterprises can activate, update, or switch network profiles OTA at scale — without physical access or device recalls. SGP.32 enables "zero-touch" in-factory or field provisioning, collapsing regional SKUs into a single global design. This accelerates time-to-market and supports long-lifecycle assets like smart meters or industrial sensors that may outlive initial carrier contracts.
2. **Global Scalability and Network Resilience:** Multi-IMSI and multi-profile support allow devices to roam intelligently across 190+ countries or switch carriers dynamically. This mitigates coverage gaps, complies with local regulations, and avoids vendor lock-in — a major pain point in cross-border logistics or energy infrastructure.

3. **Enterprise-Grade Security:** eSIM/iSIM provide hardware-based secure elements that protect credentials with encryption, secure boot, and reduced attack surfaces. iSIM's integration into the SoC makes physical tampering nearly impossible. In an era of rising cyber threats to critical infrastructure, this hardware-rooted trust is essential for sectors like healthcare, utilities, and finance.
4. **Cost Efficiency and Sustainability:** No more manufacturing, shipping, or swapping physical SIMs. iSIM further cuts component count and power draw, extending battery life in remote sensors. Enterprises report lower TCO through simplified supply chains and operational efficiencies. Reduced plastic waste also aligns with corporate ESG goals.
5. **Support for Constrained and High-Volume Deployments:** Optimized for LPWAN technologies (NB-IoT, LTE-M, 5G RedCap), these SIMs enable massive-scale rollouts in smart cities, oil & gas monitoring, and Industry 4.0 factories.

Real-World Impact: Industry Use Cases

- **Utilities & Smart Metering:** Providers deploy millions of long-life meters with SGP.32 eSIMs for remote profile updates and continuous connectivity, even in remote or offshore wind farms.
- **Automotive & Telematics:** Connected vehicles use eSIM/iSIM for global fleet management, over-the-air updates, and real-time diagnostics — reducing downtime and enabling new subscription services.
- **Logistics & Supply Chain:** Asset trackers in containers or pallets switch networks automatically across jurisdictions, improving visibility and compliance.
- **Manufacturing & Industry 4.0:** Sensors on production lines leverage iSIM's low-power efficiency for predictive maintenance and real-time monitoring without frequent battery changes.

Adoption data underscores the shift: 33% of cellular IoT modules shipped in mid-2024 were already eSIM-capable, with acceleration expected through 2025–2026 as SGP.32 infrastructure matures. IoT eSIM connections are projected to grow 30% in 2026 alone, led by logistics, energy, and smart lighting. iSIM is poised for even steeper growth in power-sensitive applications.

The Connected Enterprise Future

While transformative, adoption faces hurdles: ecosystem readiness (chipset and platform certification), initial integration investments, and the need for operators to upgrade RSP systems. Regulatory nuances around permanent roaming also require careful navigation.

Forward-looking enterprises are addressing these by partnering with specialized IoT connectivity providers offering managed eSIM platforms, testing SGP.32 early, and designing devices with future-proof iSIM support.

By 2030, embedded SIM technologies will underpin the majority of new cellular IoT deployments, powering an estimated 39 billion total IoT connections. For enterprises, eSIM and iSIM mean faster deployments, stronger security, lower costs, and greater agility — turning connectivity from a logistical burden into a strategic advantage.

As 5G, AI, and edge computing converge with IoT, SIM technologies will evolve further into intelligent, programmable identity layers. Organizations that embrace them today will lead the next wave of industrial digital transformation — more efficient, resilient, and competitive in a hyper-connected world.

Conclusion: The Path Forward

The telecommunications industry in 2026 is defined by a paradox: technology is becoming more integrated and invisible (via iSIMs and SA 5G) while the regulatory environment is becoming more complex.

For consumers and enterprises, the message is clear: the future is digital-first, but it requires proactive management—whether that means activating a travel eSIM before a flight to Istanbul or migrating an IoT fleet to the SGP.32 standard. Those who master the convergence of ease-of-use and technological complexity will define the next era of global connectivity.