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Telco as a Platform

Market Roadmap Report

An Analysis of the Market Opportunity for Telcos to Build Services by Offering API-Based Digital Services

The telecommunications industry stands at a pivotal juncture, where traditional revenue streams are increasingly commoditized, and digital transformation is reshaping the competitive landscape. As enterprises and consumers alike demand more integrated, flexible, and innovative solutions, telcos have a unique opportunity to evolve beyond their conventional roles as connectivity providers.

This market research report, titled "Telco as a Platform: An Analysis of the Market Opportunity for Telcos to Build Services by Offering API-Based Digital Services," explores the emerging paradigm of telcos leveraging Application Programming Interfaces (APIs) to unlock new growth avenues.

Executive Overview

By transitioning into platform-based ecosystems, telcos can offer a suite of digital services—ranging from cloud communications and IoT enablement to advanced analytics and cybersecurity—positioning themselves as critical enablers of the digital economy.

This report examines the market dynamics, technological enablers, and strategic imperatives driving this shift, while assessing the potential for telcos to redefine their value proposition in an increasingly API-driven world. Through a comprehensive analysis of industry trends, competitive forces, and customer needs, we aim to provide actionable insights for telcos seeking to capitalize on this transformative opportunity.

Market Context and Evolution

The telecommunications sector has long been the backbone of global connectivity, enabling communication and data exchange on an unprecedented scale. However, the rise of over-the-top (OTT) players, cloud service providers, and hyperscalers has disrupted the traditional telco business model, eroding margins in core services like voice and data.

At the same time, the proliferation of digital technologies—such as 5G, edge computing, and the Internet of Things (IoT)—has created a fertile ground for innovation, pushing telcos to rethink their role in the value chain. In this evolving landscape, the concept of "Telco as a Platform" emerges as a strategic response, where telcos leverage their infrastructure, customer reach, and operational expertise to offer API-based digital services.

These APIs enable third-party developers, enterprises, and partners to build tailored applications and solutions, transforming telcos into agile, platform-driven entities. This shift not only diversifies revenue streams but also positions telcos as central players in the digital ecosystem, bridging the gap between connectivity and value-added services.

This section sets the stage for understanding the market opportunity by exploring the key drivers, challenges, and technological advancements shaping this transition, laying the foundation for a deeper analysis of its potential impact.

Key Drivers, Challenges, and Technological Advancements Shaping the Transition

The shift toward "Telco as a Platform" is propelled by a confluence of market forces, operational imperatives, and technological breakthroughs, each presenting both opportunities and hurdles for telecommunications providers. This section delves into the key drivers, challenges, and advancements that are defining this transformative journey.

Key Drivers

Several factors are driving telcos to adopt a platform-based model centered on API-driven digital services. First, the saturation of traditional revenue streams—such as voice and basic data connectivity—has intensified the need for diversification. With average revenue per user (ARPU) stagnating in many markets, telcos are compelled to seek new income sources beyond commoditized offerings. Second, the growing demand from enterprises for integrated digital solutions, such as real-time analytics, secure IoT connectivity, and cloud-based communication tools, presents a lucrative opportunity. APIs allow telcos to meet these needs by enabling seamless integration with enterprise systems. Third, the competitive pressure from OTT players and tech giants like Amazon, Google, and Microsoft—who already leverage platform models successfully—pushes telcos to innovate or risk irrelevance. Finally, regulatory encouragement in some regions for open ecosystems and data-sharing frameworks further incentivizes telcos to expose their capabilities via APIs, fostering collaboration and innovation.

Challenges

Despite the promise, this transition is not without significant challenges. One primary obstacle is the cultural and organizational shift required to move from a legacy infrastructure mindset to a nimble, software-driven platform approach. Telcos must overcome siloed operations and invest in upskilling their workforce to manage API ecosystems effectively.

Another challenge is the complexity of standardizing and securing APIs at scale—ensuring interoperability, reliability, and protection against cyber threats while maintaining customer trust. Competition also poses a hurdle, as tech-savvy hyperscalers with established developer communities and cloud-native architectures already dominate parts of the digital services market. Additionally, monetizing API-based services requires a clear value proposition and pricing strategy, which can be difficult in a market accustomed to low-cost connectivity. Lastly, legacy systems and technical debt can slow the pace of transformation, requiring significant capital investment and strategic prioritization.

Technological Advancements

The feasibility of the "Telco as a Platform" model hinges on several technological advancements that are reshaping the industry.

The rollout of 5G networks is a game-changer, offering ultra-low latency, high bandwidth, and network slicing capabilities that enable telcos to deliver specialized services via APIs, such as enhanced mobile broadband or mission-critical IoT applications. Edge computing complements this by bringing processing power closer to end-users, unlocking real-time use cases that can be exposed through APIs.

Advances in software-defined networking (SDN) and network function virtualization (NFV) allow telcos to abstract and modularize their infrastructure, making it easier to package and offer network capabilities as programmable services. Furthermore, the maturation of API management platforms and developer portals empowers telcos to create robust ecosystems, streamline third-party access, and accelerate innovation. Artificial intelligence (AI) and machine learning (ML) also play a role, enabling telcos to enhance API offerings with predictive analytics, automated optimization, and personalized customer experiences.

Together, these drivers, challenges, and technological advancements form the backbone of the telco industry’s evolution into a platform-based model. The interplay between opportunity and complexity underscores the need for a strategic approach, which this report

will further explore in subsequent sections, assessing how telcos can navigate this landscape to unlock sustainable growth and competitive advantage.

Industry Standards

TeleManagement Forum

The TM Forum API Program is a transformative initiative designed to standardize and accelerate digital innovation within the telecommunications industry. TM Forum, a global alliance of over 850 telco and tech companies, aims to drive interoperability and efficiency by providing a suite of Open APIs (Application Programming Interfaces) that enable seamless integration and collaboration across the telecom ecosystem. These APIs serve as standardized, reusable building blocks that allow communication service providers (CSPs), vendors, and third-party developers to connect systems, share capabilities, and deliver new services more rapidly.

The program's core offering is a portfolio of over 70 REST-based, event-driven, and domain-specific Open APIs, covering critical business processes such as service ordering, billing, trouble ticketing, and customer management. These APIs are collaboratively developed by TM Forum members and made freely available (currently transitioning to an Apache 2.0 license), with influence over new API development reserved for members. The initiative has seen widespread adoption, with over 870,000 downloads by more than 48,000 developers from 2,500 organizations, reflecting its significance in the industry.

In the context of the "Telco as a Platform" model, the TMF API program plays a pivotal role by enabling telcos to expose their network capabilities and services through standardized interfaces. This allows them to transition from traditional connectivity providers to platform-based ecosystems, where third parties—such as enterprises, developers, and partners—can build innovative applications on top of telco infrastructure. For example, a telco could use TMF APIs to offer real-time IoT connectivity or cloud communication services, making it easier for a smart city developer to integrate traffic management solutions or for a bank to embed secure payment systems.

The program addresses key industry challenges by reducing integration complexity and costs, historically a significant barrier due to fragmented, proprietary systems. By providing a common language and framework, TMF APIs enhance interoperability between CSPs and their partners, streamline operations, and shorten time-to-market for new offerings. Additionally, the recent introduction of "Gen5" Open APIs supports advanced, event-driven architectures and intent-based automation, aligning with emerging needs like 5G network slicing and AI-driven operations.

Beyond technical enablement, the TMF API program fosters a collaborative ecosystem. It partners with other standards bodies, such as MEF and GSMA's CAMARA, to ensure alignment and avoid fragmentation, as seen in efforts to unify API standards for Network-as-a-Service (NaaS) offerings. Conformance certification further validates that implementations meet industry benchmarks, boosting trust and adoption among CSPs and suppliers.

In essence, the TMF API program empowers telcos to unlock new revenue streams, enhance customer experiences, and remain competitive in a digital-first world. By providing the tools to build scalable, interoperable platforms, it underpins the industry's shift toward a future where telcos are not just network operators but vital enablers of the broader digital economy.

CAMARA

CAMARA is an open-source initiative launched by the GSMA (Global System for Mobile Communications Association) in collaboration with the Linux Foundation, aimed at defining and standardizing a set of APIs to unlock mobile network capabilities for developers and enterprises. Introduced in 2022, CAMARA (which stands as an acronym derived from "Common API for Mobile Access to Resources and Applications") seeks to simplify access to telco-specific functionalities, making it easier for third parties to build innovative applications and services that leverage the power of mobile networks. The project is designed to complement and integrate with broader industry efforts, such as the TM Forum's Open API program, to create a cohesive ecosystem of standardized interfaces.

What Are CAMARA APIs?

CAMARA APIs are a collection of open, globally consistent, and developer-friendly APIs that expose mobile network features—such as location verification, quality-of-service (QoS) on demand, SIM authentication, and device status—in a secure and standardized way. These RESTful APIs are built with a focus on simplicity, scalability, and interoperability, adhering to modern software development principles. They are hosted on GitHub under an Apache 2.0 license, ensuring they are freely accessible and collaboratively maintained by a community of telcos, vendors, and developers. As of early 2025, the CAMARA project includes over 30 APIs across various domains, with ongoing efforts to expand the portfolio based on industry demand.

Key Features and Examples

CAMARA APIs are organized into sub-projects or "API families" that address specific use cases. Some notable examples include:

- **Location Verification API**: Allows developers to confirm a device's geolocation, useful for fraud prevention or location-based services.

- **QoS on Demand API**: Enables applications to request specific network performance levels (e.g., low latency or high bandwidth) for time-sensitive tasks like gaming or video streaming.
- **Number Verification API**: Provides seamless authentication by verifying a user's mobile number, enhancing security for login processes.
- **Device Status API**: Offers insights into a device's connectivity status, aiding in diagnostics or IoT management.

These APIs are designed to abstract the complexity of underlying network technologies (e.g., 5G, 4G, or IMS systems), presenting a unified interface that developers can integrate without needing deep telecom expertise.

Role in the Telco Industry

CAMARA plays a critical role in the "Telco as a Platform" paradigm by enabling telcos to expose their network assets as programmable services. This aligns with the broader industry trend of moving beyond connectivity to offer value-added digital solutions. By providing standardized access to mobile network capabilities, CAMARA empowers telcos to:

- **Drive Developer Adoption**: Its open-source nature and developer-centric design lower the entry barrier, fostering a vibrant ecosystem of third-party innovation.
- **Enable New Revenue Streams**: Telcos can monetize APIs directly (e.g., via pay-per-use models) or indirectly by enhancing services that attract enterprise customers.
- **Support 5G Monetization**: CAMARA APIs leverage 5G's advanced features—like network slicing and edge computing—to deliver tailored, high-performance solutions.
- **Enhance Customer Experience**: Simplified access to network features enables faster deployment of seamless, secure, and personalized applications.

Relationship with Other Standards

CAMARA is not a standalone effort but part of a collaborative push to harmonize API standards across the telecom industry. It works closely with TM Forum's Open API program, focusing on network-specific capabilities while TM Forum covers broader operational and business processes. Joint initiatives, such as aligning CAMARA's QoS APIs with TM Forum's service management APIs, aim to create a unified framework. Additionally, CAMARA integrates with the GSMA's Open Gateway initiative, which promotes commercial adoption of these APIs by mobile operators worldwide, with over 50 operators and 250 networks committed as of 2025.

Challenges and Outlook

While CAMARA accelerates telco innovation, challenges remain. Ensuring consistent implementation across diverse operators, addressing security and privacy concerns (especially with sensitive data like location), and scaling adoption beyond early adopters are key hurdles. Nevertheless, its momentum—backed by major players like Vodafone, Telefonica, and Verizon—signals a promising future. By bridging the gap between telcos and the developer community, CAMARA APIs are a cornerstone of the industry's evolution into a platform-driven model, unlocking the potential for telcos to thrive in the digital economy.

What is an eSIM?

An eSIM, or embedded Subscriber Identity Module, is a digital version of the traditional physical SIM card used in mobile devices to authenticate users on a cellular network. Unlike a physical SIM, which is a removable chip, an eSIM is a small, rewritable chip embedded directly into a device's hardware during manufacturing.

It adheres to standards set by the GSMA (Global System for Mobile Communications Association) and can store multiple network profiles, which can be activated, switched, or updated remotely via software—without the need to physically swap cards. Introduced commercially around 2016, eSIM technology has gained traction with devices like smartphones (e.g., iPhone 14 and later), wearables (e.g., Apple Watch), tablets, and IoT devices, offering a more flexible and future-proof approach to connectivity.

The eSIM operates using a secure, standardized protocol (e.g., GSMA's Remote SIM Provisioning) that allows telcos to push network credentials over-the-air (OTA) to the device. This eliminates logistical challenges tied to physical SIM distribution and enables seamless connectivity management, making it a cornerstone of modern digital services in the telecom industry.

Digital Services Enabled by eSIMs for Telcos

The adoption of eSIM technology, combined with API platforms like TM Forum's Open APIs and CAMARA, empowers telcos to offer a range of innovative digital services. By leveraging the programmability and flexibility of eSIMs, telcos can enhance customer experiences, streamline operations, and tap into new revenue streams. Below are key digital services enabled by eSIMs:

1. **Seamless Device Onboarding and Activation**

- **Service**: eSIMs allow users to activate cellular service instantly by scanning a QR code or downloading a profile via an app, bypassing the need for physical SIMs or store visits. Telcos can use TM Forum's Customer Management APIs to automate onboarding and provisioning.
- **Benefit**: Reduces friction for customers and operational costs for telcos.
- **Example**: A traveler lands in a new country, selects a local telco plan via an app, and activates it on their eSIM-enabled phone within minutes.

2. **Multi-Profile Connectivity (Personal and Business Lines)**
   - **Service**: eSIMs support multiple network profiles on a single device, enabling users to switch between personal and business lines or add temporary plans (e.g., for travel) without additional hardware. CAMARA's Number Verification API can enhance security for profile switching.
   - **Benefit**: Appeals to professionals and frequent travelers, increasing customer retention.
   - **Example**: A consultant uses one eSIM profile for work calls on a corporate plan and another for personal use, managed through a telco's self-service portal.
3. **Global Roaming and Localized Plans**
   - **Service**: Telcos can partner with international operators to offer dynamic roaming profiles via eSIMs, allowing users to switch to local networks abroad without exorbitant roaming fees. APIs facilitate real-time profile updates and billing adjustments.
   - **Benefit**: Enhances competitiveness in the travel market and simplifies global connectivity.
   - **Example**: A tourist in Europe downloads a temporary eSIM profile from a local telco, avoiding high roaming charges while maintaining their home number for calls.
4. **IoT Connectivity and Management**

- **Service**: eSIMs are ideal for IoT devices (e.g., smart meters, connected cars, or medical sensors) that require long-term, remote connectivity. Telcos can use CAMARA's Device Status API to monitor eSIM-enabled devices and TM Forum APIs to manage large-scale deployments.
- **Benefit**: Enables scalable IoT solutions for smart cities, logistics, and healthcare.
- **Example**: A fleet management company equips trucks with eSIMs, allowing the telco to remotely update connectivity plans based on route changes.

5. **Subscription-Based Network as a Service (NaaS)**
   - **Service**: eSIMs integrate with NaaS offerings, allowing telcos to provide on-demand connectivity packages (e.g., high-speed data for gaming or low-latency for video calls) that users can activate via their devices. CAMARA's QoS on Demand API can tailor network performance.
   - **Benefit**: Creates upsell opportunities and aligns with the "Telco as a Platform" model.
   - **Example**: A gamer activates a 24-hour "low-latency" eSIM profile for an online tournament, purchased through the telco's app.
6. **Embedded Security Services**
   - **Service**: eSIMs can leverage their secure hardware to offer authentication and encryption services, such as SIM-based identity verification for banking or e-government apps. CAMARA's SIM Swap API can detect fraud attempts.
   - **Benefit**: Positions telcos as trusted providers of digital identity solutions.
   - **Example**: A citizen logs into a government portal using eSIM-based authentication, verified instantly by the telco.
7. **Wearable and Secondary Device Connectivity**
   - **Service**: eSIMs enable standalone connectivity for wearables (e.g., smartwatches) or secondary devices (e.g., tablets), independent of a primary phone. Telcos can bundle these into family plans or offer them as add-ons via APIs.

- **Benefit**: Expands market reach to tech-savvy consumers and families.
- **Example**: A parent activates an eSIM profile on their child's smartwatch for real-time location tracking and emergency calls.

8. **Dynamic Plan Customization**
    - **Service**: Customers can switch between prepaid, postpaid, or usage-based plans on the fly, with eSIMs updating profiles in real time. TM Forum's Billing Management APIs ensure seamless transitions.
    - **Benefit**: Enhances customer flexibility and satisfaction, reducing churn.
    - **Example**: A student switches to a data-heavy eSIM plan during exam season, reverting to a basic plan afterward, all managed via a telco app.

Strategic Implications for Telcos

- **Customer-Centric Innovation**: eSIMs shift telcos toward a software-driven, service-oriented model, enabling personalized offerings that compete with OTT players.
- **Operational Efficiency**: Remote provisioning reduces logistics costs (e.g., SIM production and shipping) and simplifies network management.
- **Ecosystem Expansion**: By integrating eSIMs with API platforms, telcos can collaborate with device manufacturers, app developers, and enterprises, fostering a broader digital ecosystem.
- **Revenue Growth**: eSIM-enabled services open new monetization avenues, from premium IoT connectivity to value-added security features.

Conclusion

eSIM technology is a game-changer for telcos, transforming how they deliver connectivity and digital services.

By eliminating physical barriers and enabling remote, programmable access, eSIMs empower telcos to offer seamless onboarding, global roaming, IoT solutions, and NaaS offerings—all enhanced by API platforms like TM Forum and CAMARA. As eSIM adoption grows—projected to reach over 6 billion enabled devices by 2027—telcos can leverage this technology to strengthen their role in the digital economy, delivering innovative, customer-focused services that redefine the boundaries of traditional telecom.

Network as a Service - Business Models

Exploring Network as a Service (NaaS) Market Opportunities and Business Models Enabled by API Platforms

The emergence of API platforms like TM Forum's Open APIs and CAMARA has catalyzed the evolution of Network as a Service (NaaS), a model where telcos deliver network capabilities as flexible, on-demand services rather than fixed infrastructure. By leveraging standardized APIs, telcos can package and expose their network assets—such as connectivity, bandwidth, latency, security, and advanced 5G features—in programmable, scalable ways.

This shift unlocks a spectrum of market opportunities and business models, allowing telcos to cater to diverse customer segments, from enterprises and developers to consumers and ecosystem partners. Below, we explore different permutations of NaaS market opportunities and the corresponding business models enabled by these API platforms.

Market Opportunities

1. **Enterprise Connectivity Solutions**
    - **Opportunity**: Enterprises increasingly demand tailored, high-performance connectivity for digital transformation initiatives, such as hybrid cloud deployments, remote workforces, or Industry 4.0 applications. NaaS allows telcos to offer dynamic, API-accessible network services like low-latency connections or secure private networks.
    - **Example Use Case**: A manufacturing firm uses CAMARA's QoS on Demand API to request ultra-low latency for real-time robotic control in a smart factory, seamlessly integrated into its existing systems.
2. **IoT Enablement**
    - **Opportunity**: The proliferation of IoT devices—projected to exceed 30 billion by 2030—creates demand for scalable, secure, and manageable connectivity.

NaaS, powered by APIs, can provide IoT-specific network services like device authentication, data prioritization, or edge computing support.
    - **Example Use Case**: A smart city provider leverages TM Forum's Service Management APIs to provision connectivity for thousands of traffic sensors, with CAMARA's Device Status API monitoring their performance.
3. **Developer Ecosystems**
    - **Opportunity**: By exposing network capabilities via APIs, telcos can tap into the global developer community, enabling third-party innovation in areas like gaming, AR/VR, or fintech. This positions telcos as platform players akin to AWS or Google Cloud.
    - **Example Use Case**: A gaming studio uses CAMARA's Location Verification API to enhance multiplayer experiences with geolocation-based matchmaking, paying per API call.
4. **Consumer Value-Added Services**
    - **Opportunity**: NaaS can enhance consumer offerings by embedding network features into everyday applications, such as secure authentication or premium streaming quality. This appeals to tech-savvy users willing to pay for enhanced experiences.
    - **Example Use Case**: A streaming service integrates CAMARA's QoS API to offer uninterrupted 4K video during peak hours, marketed as a premium subscription tier.
5. **B2B2X Partnerships**
    - **Opportunity**: Telcos can collaborate with industries like healthcare, automotive, or retail to co-create solutions, using NaaS as the backbone. APIs enable rapid integration with partner systems, fostering a "business-to-business-to-X" (B2B2X) model where X is the end customer.
    - **Example Use Case**: A telehealth provider partners with a telco using TM Forum's Customer Management APIs to deliver secure, HIPAA-compliant video consultations over a dedicated network slice.
6. **5G Monetization**
    - **Opportunity**: 5G's advanced capabilities—network slicing, edge computing, and massive machine-type communications—can be productized as NaaS offerings. APIs make these features accessible on demand, unlocking new markets like autonomous vehicles or smart grids.
    - **Example Use Case**: An autonomous vehicle fleet operator uses CAMARA's Network Slicing API to secure dedicated bandwidth for real-time navigation data.

Business Models

1. **Subscription-Based NaaS**
    - **Description**: Telcos offer NaaS as a recurring subscription, providing access to a bundle of network services (e.g., bandwidth, security, QoS) via APIs. Customers pay a fixed monthly fee based on usage tiers.
    - **Fit**: Ideal for enterprises needing predictable costs, such as SaaS providers requiring consistent cloud connectivity.
    - **Example**: A small business subscribes to a $500/month NaaS package including 1 Gbps bandwidth and API-driven DDoS protection.
2. **Pay-Per-Use (API Call-Based)**
    - **Description**: Customers are charged based on the number of API calls or the volume of network resources consumed, offering flexibility for sporadic or variable usage.
    - **Fit**: Suits developers or startups testing applications, such as a fintech firm using CAMARA's Number Verification API for user onboarding.
    - **Example**: A developer pays $0.01 per location verification call, scaling costs with app growth.
3. **Freemium Model**
    - **Description**: Basic NaaS features are offered for free via APIs to attract developers, with premium features (e.g., higher QoS, analytics) available for a fee.
    - **Fit**: Targets the developer ecosystem to drive adoption and innovation, with upsell potential.
    - **Example**: Free access to CAMARA's Device Status API, with a $100/month upgrade for real-time analytics.
4. **Revenue Sharing (Ecosystem Model)**
    - **Description**: Telcos partner with third parties (e.g., app developers or enterprises) and share revenue generated from end-user services built on NaaS.
    - **Fit**: Works for B2B2X scenarios, like a retail chain offering in-store AR experiences powered by telco APIs.
    - **Example**: A telco earns 20% of revenue from a gaming app using its QoS API for lag-free play.
5. **White-Label NaaS**

    - **Description**: Telcos provide NaaS capabilities to other service providers or brands, who rebrand and sell them as their own. APIs enable seamless integration into the partner's offerings.
    - **Fit**: Appeals to MVNOs (Mobile Virtual Network Operators) or tech firms lacking network infrastructure.
    - **Example**: A cloud provider white-labels a telco's 5G-based edge computing service, marketed under its own brand.
6. **Outcome-Based Pricing**
    - **Description**: Charges are tied to specific business outcomes enabled by NaaS, such as uptime guarantees or transaction success rates, leveraging API-driven monitoring.
    - **Fit**: Targets mission-critical applications, like healthcare providers needing 99.999% reliability for telemedicine.
    - **Example**: A hospital pays $10,000/month for a guaranteed 5ms latency service, with penalties if unmet.

Enabling Role of API Platforms

- **TM Forum Open APIs**: Provide the operational backbone for NaaS, standardizing processes like service provisioning, billing, and customer management. This ensures telcos can scale offerings efficiently across diverse use cases and business models.
- **CAMARA APIs**: Unlock network-specific capabilities (e.g., QoS, location, slicing), making NaaS tangible and accessible to developers and enterprises. Their open-source nature drives rapid experimentation and adoption.
- **Interoperability**: Together, these platforms bridge operational and network layers, enabling telcos to mix and match opportunities and models—e.g., combining subscription-based enterprise connectivity with pay-per-use developer APIs.

Conclusion

The permutations of NaaS market opportunities and business models illustrate the versatility of API-driven platforms in redefining the telco value proposition. Whether targeting enterprises with subscription-based connectivity, developers with pay-per-use

APIs, or consumers through ecosystem partnerships, telcos can leverage TM Forum and CAMARA APIs to tailor their NaaS strategies. The flexibility to experiment with these models positions telcos to capture new markets, monetize 5G investments, and thrive as platform players in the digital economy. Subsequent sections of this report will analyze the competitive landscape and implementation strategies to maximize these opportunities.

Enabling Governments to Build Smart Cities

As governments worldwide strive to develop smart cities—urban environments that leverage technology to enhance efficiency, sustainability, and quality of life—Network as a Service (NaaS) emerges as a critical enabler.

By utilizing API platforms like TM Forum's Open APIs and CAMARA, telcos can deliver flexible, scalable, and programmable network capabilities that underpin the complex infrastructure of smart cities.

NaaS transforms traditional connectivity into a dynamic, on-demand resource, allowing governments to integrate diverse systems, manage real-time data, and address urban challenges such as traffic congestion, energy consumption, and public safety. This section explores how NaaS supports smart city initiatives, highlighting its role across key applications, operational benefits, and strategic implications.

Key Applications of NaaS in Smart Cities

1. **Intelligent Traffic Management**
    - **Role of NaaS**: Governments rely on real-time data from sensors, cameras, and connected vehicles to optimize traffic flow and reduce congestion. NaaS provides low-latency, high-bandwidth connectivity via APIs like CAMARA's QoS on Demand, ensuring seamless communication between traffic systems and control centers. Network slicing, enabled by 5G and exposed through APIs, can dedicate bandwidth to critical traffic applications.
    - **Example**: A city uses NaaS to prioritize network resources for a traffic management system during peak hours, dynamically adjusting signal timings based on live data from IoT sensors.

2. **Public Safety and Emergency Response**
    - **Role of NaaS**: Smart cities require robust networks to support surveillance, emergency alerts, and first-responder coordination. NaaS delivers secure, reliable connectivity with APIs like CAMARA's Location Verification to pinpoint incidents or TM Forum's Service Management APIs to provision resources instantly. Edge computing, integrated via NaaS, reduces latency for real-time video analytics.
    - **Example**: During a natural disaster, a government activates a NaaS-powered drone network to stream live footage to emergency teams, with APIs ensuring uninterrupted, high-priority connectivity.
3. **Smart Energy and Utilities**
    - **Role of NaaS**: Managing energy grids and water systems in smart cities demands connectivity for smart meters, grid sensors, and renewable energy sources. NaaS enables massive IoT deployments with APIs like CAMARA's Device Status to monitor infrastructure health, while TM Forum APIs streamline billing and service orchestration.
    - **Example**: A city deploys NaaS to connect thousands of solar panels and smart meters, optimizing energy distribution and reducing waste through real-time adjustments.
4. **Environmental Monitoring and Sustainability**
    - **Role of NaaS**: Governments use air quality sensors, weather stations, and waste management systems to promote sustainability. NaaS provides scalable connectivity for these devices, with APIs enabling data aggregation and analysis at the edge or cloud. CAMARA's QoS APIs ensure reliable transmission of environmental data.
    - **Example**: A municipality leverages NaaS to link air pollution sensors across the city, using API-driven insights to trigger public alerts during hazardous conditions.
5. **Citizen Engagement and Digital Services**

- **Role of NaaS**: Smart cities aim to improve resident experiences through digital platforms for public transit, e-governance, or community feedback. NaaS supports these services with APIs like CAMARA's Number Verification for secure logins or TM Forum's Customer Management APIs for personalized interactions.
- **Example**: A government app uses NaaS to deliver real-time bus arrival updates to citizens, with APIs ensuring seamless integration with transit systems.

Operational Benefits of NaaS for Governments

1. **Scalability and Flexibility**
   - NaaS allows governments to scale network resources up or down based on demand—e.g., expanding capacity during a major event or scaling back during off-peak times. API platforms enable rapid provisioning without the need for extensive physical infrastructure upgrades.
2. **Cost Efficiency**
   - By adopting a pay-per-use or subscription-based NaaS model, governments avoid large upfront capital expenditures on dedicated networks. This aligns with tight public budgets while delivering cutting-edge capabilities.
3. **Interoperability**
   - Standardized APIs (e.g., TM Forum and CAMARA) ensure that diverse smart city systems—developed by different vendors—can communicate seamlessly. This reduces integration costs and prevents vendor lock-in.
4. **Real-Time Responsiveness**
   - NaaS, coupled with 5G and edge computing, provides the low latency and high throughput needed for real-time decision-making, critical for applications like emergency response or traffic control.

5. **Security and Resilience**
    - APIs can embed security features like encryption and authentication (e.g., CAMARA's SIM-based authentication), ensuring that smart city data remains protected. NaaS also supports redundancy and failover, vital for continuous operation.

Strategic Implications for Governments

1. **Accelerating Deployment**
    - NaaS eliminates the need for governments to build and maintain bespoke networks, speeding up smart city rollouts. Telcos, as NaaS providers, handle infrastructure complexity, allowing public agencies to focus on policy and implementation.
2. **Fostering Public-Private Partnerships (PPPs)**
    - Governments can collaborate with telcos and tech firms via NaaS, leveraging private-sector innovation and investment. For instance, a telco might offer NaaS under a revenue-sharing model, co-developing smart city solutions with municipal authorities.
3. **Data-Driven Governance**
    - NaaS enables the collection and analysis of vast datasets from smart city systems, empowering governments to make evidence-based decisions on urban planning, resource allocation, and climate resilience.
4. **Enhancing Equity and Inclusion**
    - By providing reliable connectivity for digital services, NaaS helps bridge the digital divide, ensuring that underserved areas benefit from smart city advancements like telemedicine or online education.
5. **Future-Proofing Infrastructure**

- With APIs supporting emerging technologies (e.g., 6G, AI, or quantum networking), NaaS ensures that smart cities remain adaptable to future innovations without requiring constant reinvestment.

Example Scenario: A NaaS-Powered Smart City

Imagine a mid-sized city partnering with a telco to deploy a NaaS-based smart city framework. The telco uses CAMARA APIs to provide QoS on Demand for a network of traffic cameras and TM Forum APIs to manage service orchestration across thousands of IoT devices. During a major festival, the city scales up bandwidth for public Wi-Fi and surveillance via a subscription-based NaaS plan. Post-event, it shifts to a pay-per-use model for environmental sensors tracking air quality. The result: a responsive, cost-effective urban ecosystem that improves safety, mobility, and sustainability.

Conclusion

NaaS, enabled by API platforms like TM Forum and CAMARA, is a linchpin for governments building smart cities. It provides the connectivity backbone for critical applications, delivers operational efficiencies, and aligns with strategic goals like sustainability and citizen welfare. By leveraging NaaS, governments can transform urban landscapes into intelligent, resilient hubs, harnessing telco capabilities to address today's challenges and tomorrow's opportunities. The next sections of this report will evaluate how telcos can position themselves as NaaS providers in this space and the competitive dynamics at play.

Unlocking the Future of Connectivity: eSIM and IoT Innovations

Core Relationship Between eSIMs and Network APIs

The relationship between eSIMs (embedded Subscriber Identity Modules) and Network APIs is fundamentally symbiotic, forming a powerful synergy that drives the next generation of connectivity and digital services.

eSIMs provide the hardware and software foundation for flexible, remotely manageable connectivity, while Network APIs—such as those from TM Forum and CAMARA—act as the programmatic interface that exposes and enhances network capabilities. Together, they enable telcos to deliver scalable, secure, and innovative services, transforming static network infrastructure into dynamic, API-driven platforms.

At its core, this relationship hinges on:

- **Programmability**: eSIMs allow devices to connect and switch networks OTA (over-the-air), while Network APIs provide the tools to control, customize, and monetize these connections in real time.
- **Scalability**: eSIMs support massive device deployments (e.g., IoT), and APIs ensure seamless management and integration with telco systems and third-party ecosystems.
- **Value Creation**: eSIMs unlock device-level flexibility, while APIs expose network features (e.g., QoS, location, authentication) as services, enabling new use cases and revenue streams.

This interplay is particularly transformative in the context of IoT (Internet of Things), where the combination of eSIMs and Network APIs unlocks a future of ubiquitous, intelligent

connectivity. To illustrate this, let's explore the concept of *"Unlocking the Future of Connectivity: eSIM and IoT Innovations"*.

Unlocking the Future of Connectivity: eSIM and IoT Innovations

The phrase *"Unlocking the Future of Connectivity: eSIM and IoT Innovations"* encapsulates a vision where eSIMs and Network APIs converge to revolutionize how devices, networks, and services interact, with IoT as a primary beneficiary. This future is characterized by seamless, secure, and scalable connectivity that powers smart ecosystems—cities, industries, homes, and beyond. Below, we explore this through key dimensions, highlighting the eSIM-API relationship.

1. Seamless IoT Device Onboarding and Management

- **eSIM Contribution**: eSIMs eliminate the need for physical SIM swaps, enabling IoT devices (e.g., sensors, trackers, or smart meters) to be provisioned remotely with network profiles. For instance, IDEMIA's Smart Connect platform can push profiles OTA to millions of devices, supporting GSMA's SGP.32 IoT standard.
- **Network API Role**: APIs like TM Forum's Service Management APIs automate the provisioning process, while CAMARA's Device Status API monitors connectivity health. This ensures devices are activated and maintained without manual intervention.
- **IoT Innovation**: A logistics company deploys eSIM-enabled trackers across a global fleet. Using CAMARA APIs, the telco dynamically assigns local profiles as trucks cross borders, optimizing costs and ensuring uninterrupted tracking—all managed via a single API call.

2. Dynamic Network Customization for IoT Use Cases

- **eSIM Contribution**: eSIMs support multiple profiles, allowing devices to switch networks or plans based on location, usage, or requirements. This flexibility is critical

for IoT applications needing tailored connectivity (e.g., low-bandwidth for sensors, high-speed for video surveillance).

- **Network API Role**: CAMARA's QoS on Demand API lets developers request specific network performance (e.g., low latency or high throughput) for eSIM-connected devices. TM Forum APIs integrate these requests into billing and orchestration systems.
- **IoT Innovation**: In a smart city, eSIM-enabled traffic cameras use CAMARA APIs to request ultra-low latency during rush hour for real-time analytics, reverting to standard settings off-peak. The eSIM adapts to the network profile, while APIs fine-tune performance.

3. Enhanced Security and Authentication

- **eSIM Contribution**: eSIMs embed secure hardware with cryptographic capabilities, enabling SIM-based authentication and encryption. This is vital for IoT devices handling sensitive data, such as medical sensors or payment terminals.
- **Network API Role**: CAMARA's Number Verification and SIM Swap APIs leverage eSIM security to authenticate devices or detect fraud, exposing these features to third-party developers. TM Forum APIs ensure secure profile management.
- **IoT Innovation**: A healthcare provider uses eSIM-equipped wearables to monitor patients. CAMARA APIs verify device identity for secure data transmission to hospitals, while eSIMs protect against tampering, ensuring compliance with regulations like HIPAA.

4. Scalable IoT Ecosystems

- **eSIM Contribution**: eSIMs support massive IoT deployments by simplifying connectivity for devices that may operate for years without human interaction (e.g., smart meters). Solutions like IDEMIA's DAKOTA IoT eSIMs are built for longevity and remote updates.

- **Network API Role**: TM Forum's APIs orchestrate large-scale IoT networks, managing provisioning, billing, and maintenance. CAMARA APIs provide granular control, such as location tracking or bandwidth allocation.
- **IoT Innovation**: A utility company deploys 10 million eSIM-enabled smart meters across a region. TM Forum APIs handle lifecycle management, while CAMARA's Location Verification API ensures accurate grid mapping, unlocking energy efficiency insights.

5. New Revenue Models and Ecosystem Collaboration

- **eSIM Contribution**: eSIMs enable telcos to offer flexible plans (e.g., pay-per-use, subscription) that can be activated or changed via software, reducing barriers to entry for IoT customers.
- **Network API Role**: APIs turn network capabilities into monetizable services. For example, CAMARA's QoS API can be bundled with eSIM profiles as a premium offering, while TM Forum APIs enable revenue-sharing with partners.
- **IoT Innovation**: A smart agriculture startup partners with a telco to connect eSIM-enabled soil sensors. The telco uses CAMARA APIs to offer a "precision farming" package with guaranteed bandwidth, sharing revenue with the startup as farmers subscribe.

How eSIMs and Network APIs Work Together

- **Foundation and Interface**: eSIMs provide the device-level connectivity foundation, while Network APIs serve as the interface to unlock and enhance that connectivity. For example, an eSIM connects an IoT device to a 5G network, and a CAMARA API adjusts its QoS for a specific task.
- **Real-Time Control**: eSIMs enable OTA updates, and APIs allow telcos to respond instantly to changing needs—e.g., switching an IoT device to a low-power profile via TM Forum APIs.

- **Ecosystem Enablement**: eSIMs open the door to third-party integration, and APIs (e.g., CAMARA's open-source framework) invite developers to build on top, fostering innovation.

Conclusion: Unlocking the Future

The relationship between eSIMs and Network APIs is the key to *"Unlocking the Future of Connectivity: eSIM and IoT Innovations"*. eSIMs deliver the flexibility and security needed for IoT devices to proliferate, while Network APIs provide the programmability and scalability to turn connectivity into a platform for innovation.

Together, they enable telcos to support smart cities, industrial automation, healthcare, and more—unlocking a world where billions of devices are seamlessly connected, intelligently managed, and economically viable. This synergy not only enhances the "Telco as a Platform" model but also positions telcos as central players in the IoT-driven digital economy.