NOKIA

Enhancing IoT, fleet management, and location-based services with Network APIs

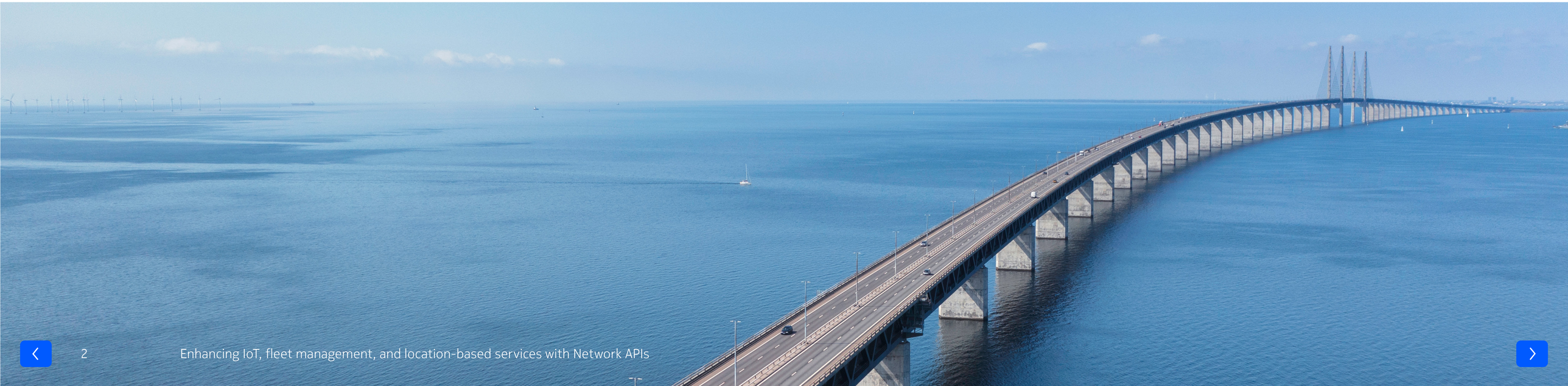
Introduction

The digitalization of enterprises using IoT promises the ability to model and monitor supply chains, better manage manufacturing and production processes, optimize shipping and delivery, and even learn about customer use cases and satisfaction levels. To this end, many enterprises have begun exploring the use of IoT devices, small sensors, monitors, and cameras that relay data about all aspects of the product or service lifecycle. One of the key pieces of data, especially in mobile applications, concerns the location of the device.

The applications for IoT location data include asset tracking, personnel tracking and safety, geofencing, vehicle monitoring, and environmental monitoring.

Enterprise application developers can use the network not only as a scalable communication platform for securely and reliably capturing device data but also as a redundant complement to GPS for locating the device and using its data for better situational awareness and contextual decision-making.

Nokia's Network as Code (NaC) offers powerful new tools and solutions for third-party application developers to exploit the network's powerful capabilities using fully interoperable APIs that provide device insights, including location and reachability, that will prove essential to building innovative enterprise solutions.



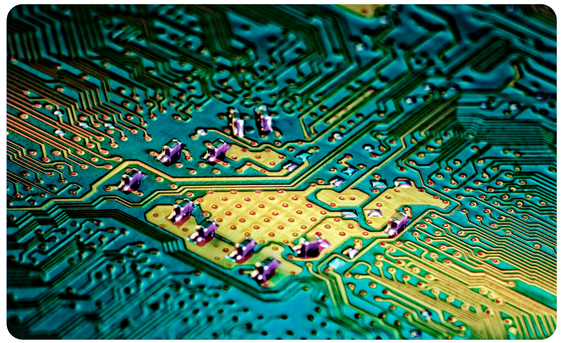
Market need

According to Precedence Research, the global location intelligence market is growing quickly - from USD 22.8 B in 2024, to over USD 68 B by 2034. The collection, analysis, and use of geospatial data is expected to grow at over 11% CAGR over the decade. As AI and data analytics are increasingly adopted into enterprise applications, location intelligence using IoT devices will be in wide demand from verticals such as real estate, transportation and logistics, retail, urban planning, public safety, environmental monitoring, and marketing.
The highest growth by vertical is expected in the transportation and logistics segment, which had the highest revenue share at close to one-fifth of the market in 2024. The North American region is presently leading the world in the adoption of location-intelligent applications, although Asia Pacific is expected to experience the fastest growth by 2034.

Along with logistics and transportation, the smart cities sector is expected to be a big driver of location intelligence applications for better management of traffic, energy use, air quality, emergency services, and public safety. For many of these applications, real-time analytics and AI will play a big role in using location data to automate many urban services. It is also expected to feed into planning and policy processes, giving city administrators more information on where to allocate scarce taxpayer resources, develop infrastructure to better support local businesses, and better plan urban development and service delivery.

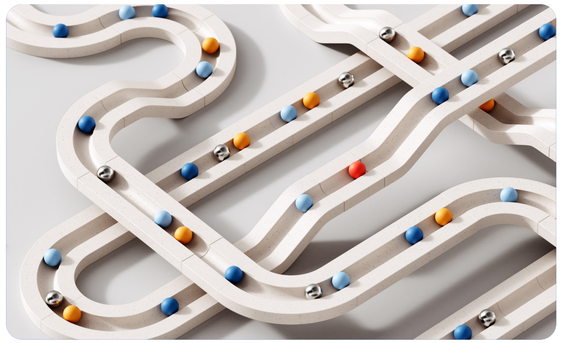
In the enterprise sector, the system integration market will be the biggest consumer of location information. System integrators, independent software developers, and enterprise IT departments are already developing enterprise applications that rely on location data.
They are also integrating this data into their existing CRM, ERP, and other analytics platforms to help better manage their facilities, workforce, supply chains, and customer experiences.
As well, location data can play an important part in mitigating risk, better managing assets, and improving safety throughout their operations.

Challenges



Scalability

IoT device use is forecast to continue expanding throughout the decade, doubling to just under 20 billion devices in 2025 to around 40 billion in 2034, according to Transforma. Of that 40 billion or so devices, 5 billion are expected to be connected to public mobile networks, more than doubling the number connected in 2025. While representing only 12.5% of all devices, most others being connected to purpose-built private networks, these wide-area network-connected devices pose the most significant challenge because they range widely and can pose special scalability issues for the network at times when they converge in specific sites such as stadiums or industrial zones.



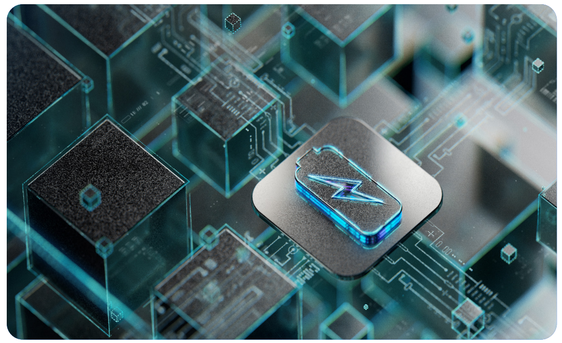
Data reliability

Global Navigation Satellite Systems (GNSS) such as GPS rely on a line-of-sight (LOS) connection to at least four satellites to function properly. However, in environments with dense forests, mountainous regions, or indoor spaces, the effectiveness of GPS-based solutions significantly diminishes. This is particularly problematic in industries requiring real-time worker tracking and asset management, where reliable, accurate positioning is crucial for safety, compliance, and operational efficiency.

In particular, challenges arise in environments like underground parking lots, dense urban areas with high-rise interference, large manufacturing plants, warehouses, hospitals, and shopping malls. These environments suffer from weak or absent GPS signals, multipath bounce, and non-line-of-sight (NLOS) signals, making it nearly impossible to maintain accurate, real-time tracking of workers and assets. This leads to inaccurate positioning or complete signal loss, difficulty in monitoring safety protocols and ensuring compliance, and disruptions in operational flow.

Cybersecurity and data integrity

For business- and mission-critical applications, relying solely on GPS can introduce vulnerabilities that may threaten functions such as geofencing, which defines no-go safety or security zones. GPS-based location tracking, while widely used, has vulnerabilities that can compromise its reliability. GPS signals are susceptible to spoofing, where false signals deceive receivers, leading to inaccurate location data. This is a major concern in fleet management, where stolen vehicles can be deliberately masked from tracking systems, making recovery difficult. Moreover, current fleet management applications fail to provide crucial information about the status of devices, such as whether they are powered on or off, their usage frequency, and operational duration. This lack of visibility can lead to inefficiencies, unauthorized usage, unplanned downtime, and increased maintenance costs



Battery life

Although global navigation satellite systems (GNSS) like GPS provide relatively inexpensive location data, when GNSS devices are embedded in small battery-constrained sensors and other IoT devices, they can pose challenges. Greater precision and accuracy call for more frequent contact with satellite systems, which can more quickly drain batteries. There are ways to conserve battery life by reducing accuracy, putting the devices to sleep, or using cloud processing of GNSS data, but GNSS location data isn't always the most battery-efficient way to generate location data.

Solution

Nokia's Network as Code platform delivers a powerful suite of Network APIs designed to provide real-time, secure, and scalable insights into connected devices.

Our platform offers three powerful location-based APIs for third-party application developers to build innovative enterprise solutions.

Device location

Get credible location of a device without relying on GPS.

Device status

Gain real-time device visibility and resolve issues faster to improve fleet and IoT efficiency.

Device reachability

Ensures real-time status updates on device availability and network connectivity.

These APIs enable businesses to track fleets, monitor worker safety, and manage IoT devices with unmatched accuracy, unlocking new revenue streams and operational efficiencies.

Benefits

Scalability

For enterprises in logistics and transportation, highly scalable 5G networks offer seamless IoT connectivity, ensuring reliable coverage across vast and dynamic environments, from warehouses to ports and distributors. As these industries increasingly rely on interconnected devices to track and manage assets, maintaining consistent and efficient network performance is crucial. In high-density environments such as stadiums, where large volumes of connected devices are simultaneously transmitting their location data, managing the surge of network traffic becomes a significant challenge.

Nokia's Network as Code is an enterprise-grade platform, powered by the world's largest API hub-Rapid. With over 6 million developers and handling 5 billion API calls, it's designed to meet these challenges. It enables seamless network expansion, providing the flexibility to scale IoT infrastructure efficiently while optimizing for both performance and reliability. With this advanced platform, enterprises can ensure optimal connectivity and performance, even as they manage growing networks of connected devices in complex, high-demand environments.

Improved Accuracy

In many real-world scenarios - such as indoor environments, underground parking lots, or dense urban areas with tall buildings - traditional GNSS (e.g., GPS) signals struggle with accuracy and availability due to signal attenuation, multipath interference, and line-of-sight (LOS) limitations. These issues can significantly impact mission-critical applications like autonomous vehicles, V2X (vehicle-to-everything) communications, and emergency response systems.

Rather than replacing GPS, location-based services powered by 5G network APIs can serve as a valuable complementary layer to enhance positioning accuracy and reliability. By leveraging higher frequency bands and dense cellular infrastructure, 5G can deliver low-latency, high-precision positioning data in environments where satellite signals are degraded or unavailable. This makes 5G network APIs especially useful for augmenting GNSS systems in challenging conditions, ensuring more robust location tracking for critical use cases.

Enhanced battery life

One of the most compelling advantages of using 5G network APIs in location-based applications - particularly in mobile and IoT scenarios - is their superior battery efficiency compared to traditional GNSS (e.g., GPS) systems.

GNSS receivers are power-hungry by design. Continuously acquiring satellite signals, decoding positioning data, and maintaining a stable fix require constant processing and radio activity, which can drain a device's battery quickly, especially during extended or intensive operations. This presents a significant limitation for energy-constrained devices such as drones, wearables, or battery-powered IoT sensors.

By contrast, 5G-powered location services, accessed through network APIs like Device Location and Device Reachability, offer a far more energy-efficient approach. Rather than having the device do the heavy lifting of calculating its own position via satellite signals, it can query the network for its location, offloading the processing to the infrastructure. This shift results in substantially lower power consumption, especially when location data is needed frequently but not continuously, or when precision requirements vary throughout the device's operation.

Superior data integrity and data security

Unlike GPS, which depends on satellite signals that can be easily jammed or spoofed, cellular-based tracking via Network APIs leverages multiple network infrastructure points, making location data far more tamper-resistant and secure. This ensures accurate, verifiable location tracking that's significantly harder to manipulate - critical for industries like logistics, security, and asset management.

Beyond enhanced location accuracy, Device Reachability APIs provide a deeper layer of security intelligence by offering real-time visibility into whether a device is connected, roaming, or which network it is currently using. Coupled with Device Status insights - such as whether the device is powered on or off - this allows organizations to instantly detect anomalies like unauthorized device shutdowns, unusual roaming patterns, or network access attempts outside of geofenced areas.

In fleet and IoT management, this intelligence enables proactive detection of tampering, theft, or system failure, while also supporting compliance monitoring and asset protection strategies. It also helps identify inactive or unreachable tracking devices, which could indicate a security breach or technical fault.

To further strengthen data protection, all transmitted information is secured using end-to-end encryption, ensuring that sensitive data - such as location, status, and usage patterns - remains confidential and immune to interception or spoofing.

Together, the Device Location, Device Reachability, and Device Status APIs provide a secure, network-based foundation for managing, monitoring, and protecting connected assets - whether they're stationary IoT endpoints or mobile fleet units operating across borders.

Use cases

Device insights-based APIs serve multiple purposes, including solutions for tracking assets and people in various environments such as indoor, outdoor, and underground. By integrating algorithms and visual computing recognition with network device location data, precise locations can be identified, even in intricate settings. These solutions enhance situational awareness and navigation, thereby enabling everything from workflow efficiency and site safety to enhanced experiences at entertainment venues and management of fleet assets. Location-based APIs can ensure tasks are executed effectively by supporting workers and crews with situationally appropriate resources and information. Geofencing applications can dynamically alter no-go zones in real-time, or alert visitors to augmented reality and other immersive activities at a live event.

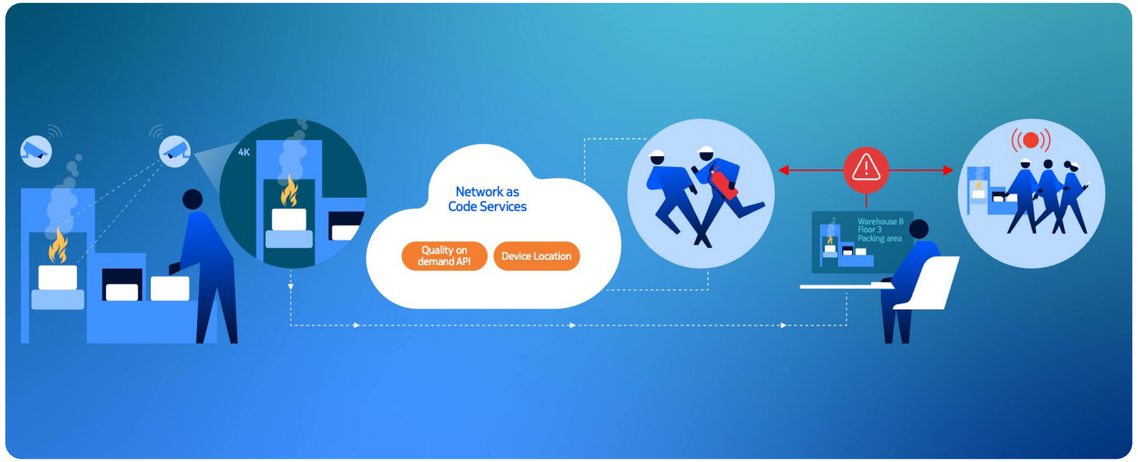
Asset tracking in a crowded closed building

An intriguing example of how location APIs can make a live event more engaging and fun is the immersive arena experience developed by Nokia and Immersal, which was showcased at the Nokia Radio World event held in the 50,000 m2 arena in Tampere, Finland, in September 2023. The Immersal visual positioning system (VPS) uses pre-scanned maps of the facility to visually locate users based on the images their cameras captures. Because so much of the 15,000-person facility looks similar, the location-based API helps to provide greater precision using real-time device location data provided by the 5G network. It is even able to determine, for instance, which floor the event participant is on. The Immersal location data then provides augmented reality (AR) overlays based on where participants are. For there to be complete synchronization between the AR overlay and the participants' surroundings, location data needs to be extremely precise.

Worker safety incident response

Working with Orange and partners such as Radisys and Innova Solutions, our APIs were used to develop a first responder incident application.

During an emergency event such as a fire, someone on site can capture video footage using a smartphone and relay it to an incident command center. Embedded in the video stream can be precise location data that can then be used to direct first responders or work teams to the incident. Such applications could also be expanded to create a geofence around the incident area so that other workers would be alerted to avoid it.



ABI Research ranks Nokia overall leader and top innovator for telco API platforms

Nokia Network as Code

The industry's leading network API platform designed for enterprise business-critical needs

Nokia Network as Code is the industry's leading API platform that enables you to easily integrate specialized capabilities and rich insights from the network into your fleet and IoT management solutions.

Since launching the Network as Code platform in late 2023, Nokia's ecosystem of 50+ Network as Code partners covers leading global networks including BT, Orange, Telefonica, Vodafone and US Majors.

Nokia's commitment to widespread API adoption extends beyond network-side aggregation, and our ecosystem also includes hyperscalers like Google Cloud; Communications Platform as a Service (CPaaS) providers such as Infobip; large system integrators such as Global Logic and Wavemaker; vertical independent software vendors like Elmo; and the world's largest public API hub through Nokia's acquisition of Rapid.

Unified API access across global networks

You don't need to update your codebase for every region and service provider. Network as Code offers an expanded set of Network APIs with unified API access across all leading global networks, greatly simplifying development complexity.

Take advantage of extreme API performance and availability

Powered by best-in-class API hub technology from Rapid (now acquired by Nokia), Network as Code offers you guaranteed API performance and the highest API availability across the industry.

Our API technology has been reliably proven to execute in excess of 63 billion API transactions annually and is trusted by leading enterprises across the financial services, aviation, automotive, fleet, and telecommunications sectors.

You don't need to be a network expert

Designed 'developer-first' with a comprehensive developer portal, sandbox environment and GenAI-based code generation assistant, Network as Code makes it easy to embed network data, insights and specialized capabilities into your application without needing you to interpret complex telecom parameters and data sources.

Flexible billing and charging models to suit your business needs

Whether you're a startup or a global enterprise, you can scale your API usage effortlessly with our transparent pricing. Our pay-as-you-go model means you only pay for the API calls you actually make—ideal for keeping costs low during early development or small-scale deployments. And when your needs grow, you can upgrade to a tiered subscription with customizable packages that fit your exact requirements.

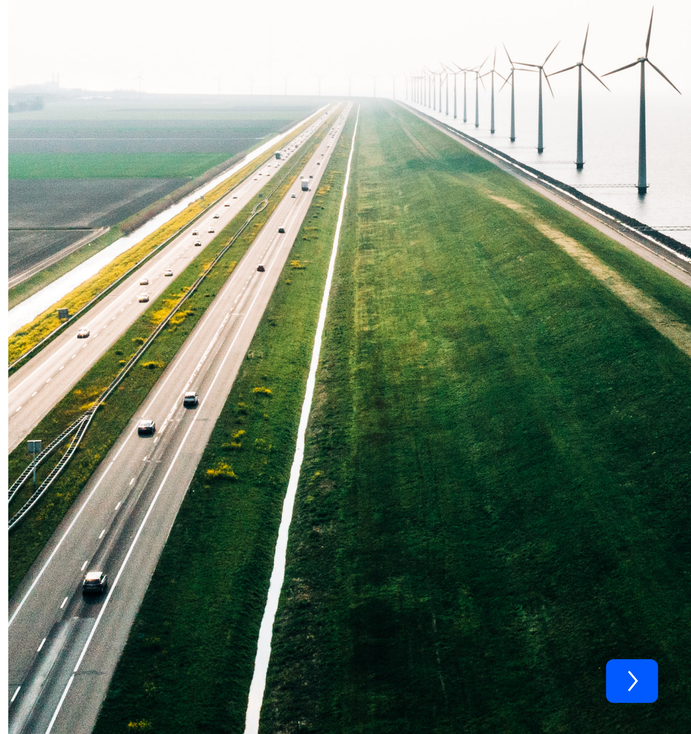
Get started with Nokia Network as Code

Quickly build ready-to-deploy use cases on our developer portal

- Comprehensive documentation, tutorials and sample code for every Network as Code API
- Google Gemini GenAI code generation assistant simplifies use case development for first-time adopters
- Full featured sandbox environment to help you test and evaluate use cases across every network

Accelerate development with prefabs from Nokia and our partners

- Fully customizable, consumer-grade UX
- Prefabs embedded with enterprise-class security
- Code and Ops freedom for extensive scalability
- Embeddable web components for third-party applications



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About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.