

Nokia IMPACT (Intelligent Management Platform for All Connected Things) IoT Platform

Horizontal IoT Platform for Secure Connectivity, Data Collection, Analytics, Business Application Development and Device Management

- Ensure maximized value of analytics and managed data through end-to-end authentication, security and privacy
- Deliver value beyond connectivity through richer experience and set of services to customers
- Scale by applying a horizontal platform that can serve all verticals, without building discreet solutions for each application
- Deliver functionality that is agnostic to connectivity technologies, protocols and vendors

With the rapid development of opportunities in the Internet of Things (IoT) marketplace, organizations are challenged in developing business-specific solutions while ensuring maximum reusability across their organization.

Fragmentation in the IoT industry, rooted in disparate devices and applications built on proprietary protocols, can stifle innovation. This complex ecosystem makes it harder for application developers to innovate and create new applications cost effectively. In the communications service provider (CSP), enterprise and municipal spaces the effects of this complexity are felt in different ways.

Communications service providers (CSPs) are faced with increasing traffic on their networks due to the rapid growth in the usage of IoT devices. In most applications, the CSP role is limited to providing network connectivity. As traffic becomes more unpredictable, CSPs have little visibility into devices, applications or management of machine-generated traffic — impacting their ability to deliver the appropriate quality of service (QoS).

At the enterprise level, business units struggle to implement and capitalize on the promise of IoT by extending or strengthening their activities by adding a telecommunications link to and from some of the products that they sell.

Municipalities often have several agencies (e.g., Emergency Services, Transportation, Tourism, IT and Infrastructure) wishing to deploy devices and sensors into the city to provide new services to citizens, optimize their operations and/or reduce costs. Unfortunately, these different units work in isolation from each other, by focusing on their own vertical needs. This hinders efficient development and operations, while also leading to high developments costs, little commonality and little reusability — in essence, creating custom solutions for each vertical.

Horizontal solution ideal for fragmented IoT ecosystem

The Nokia IMPACT IoT Platform addresses a fragmented and complex IoT ecosystem comprised of disparate applications and devices. Its common, horizontal platform provides services for all IoT applications and verticals.

Customers looking to streamline their operations by automating the management of devices and applications will benefit from the Nokia IMPACT IoT Platform. Its architecture and feature set allows for complete lifecycle management of fixed and mobile devices, as well as for applications on various devices.

Security is key. Customers are trying to derive increasing value from the data collected with IoT solutions. It is critical to ensure that the data is authentic and comes from a trustworthy source. One cannot trust data from an unmanaged source. Nokia IMPACT ensures end-to-end security for IoT data and the devices that generate the data.

With advanced capabilities to enforce service level agreements (SLAs) with prioritization and provide visibility into data, Nokia IMPACT addresses the concerns of organizations challenged by lack of insight into growing data traffic and device usage. Those challenged by growth or innovation roadblocks can enable new business models (e.g., white label services), create and run applications, and compile data analyses for third parties.

Solution overview

The Nokia IMPACT IoT Platform is a horizontal platform covering connectivity, data collection, analytics, and business application development, on top of device and service management across all verticals through:

- Data collection layers between the devices or aggregators and the enterprise that facilitate data acquisition as well as fault and power monitoring, provisioning, configuration and remote diagnostics
- A console for remote data, event and fault monitoring easily integrates into the workforce management process
- A simple domain, application, device, network and protocol agnostic design that accelerates time-to-market
- A standards-based protocol for device communication that removes developer device management barriers such as access type, network connectivity and communications protocols
- Application Programming Interface (API) layer with an extensible object model that allows for flexible devices and use cases added to the system without programmatic change to the core product
- High-level Representational State Transfer (REST) APIs that expose common IoT functions to reduce time and complexity of development demands
- A head-end system that enables connectivity to meters and aggregators and implementation of Automatic Meter Reading (AMR) and remote device management for utilities use cases

IMPACT IoT Platform empowers organizations through...

Agnostic technology

The Nokia IMPACT IoT Platform will interoperate with network equipment from a variety of network vendors and supports a variety of interfaces, including SGI & T6a. The platform is also agnostic in terms of radio access technology, supporting a variety of technologies, including 3G, 4G/LTE, NB-IoT, LoRa and Wi-Fi.

A number of low-power wide area network (LPWAN) connectivity interfaces are also available, including NB-IoT (licensed) and LoRa (unlicensed). LPWAN technologies present an opportunity for CSPs and Enterprises to increase their relevance in IoT, as device batteries that last for 10 years require this network interface.

Narrowband IOT (NB-IoT)

Narrowband IoT (NB-IoT) is a 3GPP standards-based LPWAN technology developed to enable IoT devices and services. NB-IoT significantly reduces the power consumption of sensors, improves indoor coverage and lowers module costs (compared to regular LTE). Supported by all major mobile equipment, chip set and module manufacturers, NB-IoT can co-exist with 2G, 3G, and 4G. Among all LPWA network technologies, NB-IoT and LoRa are gaining the most momentum. The former utilizes licensed spectrum and is expected to be commercially available in 2017; the latter is an important player in the unlicensed domain and is already available.

NB-IoT also provides many of the benefits associated with other licensed technologies, including advanced security and global coverage, making it optimal for large-scale enterprise IoT applications.

LoRa

For some municipalities or Enterprises, the lack of licensed spectrum may be a blocking factor for the deployment of their own IoT network. LoRa is a low-power, unlicensed wide-area technology that is becoming very popular.

LoRa is an open protocol standard LPWAN specification intended for wireless battery operated network devices. LoRa fulfills some key IoT requirements, such as secure uplink data communication capabilities with very low power consumption. Gateways are required, connecting to the network server via standard IP connections. Communication between gateways is spread out on different frequency channels and data rates. To maximize both battery life of the devices and overall network capacity, LoRa data rates range from 0.3 kbps to 50 kbps.

LoRa finds a sweet spot between short-range network technology (e.g., ZigBee) and cellular LPWAN, providing adequate connectivity for IoT applications that tolerate generous delay tolerance, such as utility metering, environmental monitoring, and asset tracking.

Award-winning technology

Nokia customers know they can rely on us for innovation and quality. And our industry knows it too – every year we're proud to see our leadership in networking highlighted by awards from prestigious industry groups, technology publications and technical forums. In addition to demonstrating our market leadership, these awards showcase the outstanding capabilities that our products, solutions and services bring to our customers. Here are some of our recent awards:

- **2016 Broadband Award:** Nokia won an award in the category “Best Innovation in Internet of Things” with its IMPACT IoT Platform and Nokia Motive® Connected Device Platform (CDP). With IMPACT, CSPs, Enterprises and Governments can easily scale secure IoT services while reducing costs and time to market. IMPACT also integrates the latest release of Motive Connected Device Platform (CDP) for its #1 market-share-leading device management capabilities for all network connected devices and sensors. Motive CDP supports more than 1.5 billion devices and sensors in the market today.
- **2016 CTIA Emerging Technology (E-Tech) Award:** Nokia won both the coveted “Crowd Favorite” award – with more than 8,000 votes in the popular vote – and a second place award in the “Everything Industrial & Enterprise: Industrial IoT (IIoT, M2M, Sensors, RFID, NFC etc.)” category, both for the IMPACT IoT Platform and the Motive® Connected Device Platform (CDP).

Modular architecture

Nokia IMPACT is based on a modular architecture consisting of data collection and fault management, device management, an integration application platform, and a set of normalized APIs, all supported by a robust and open integration framework designed to support existing business/operations support system (B/OSS) infrastructures.

Flexibility points and extensibility

Beyond its modular aspect, the Nokia IMPACT IoT Platform offers several flexibility points and possibilities for extensibility:

- Support of additional new protocols
- Set of northbound APIs for integration with client applications and B/OSSs
- Extension of devices knowledge base

Reliable “lossless” message transfer

Once client applications are registered by the platform, the delivery of their data is guaranteed. Even when devices are powered down, transmitted data is stored in a message queue. The IMPACT IoT Platform provides:

- Policy-based data collection
- High availability of services
- Data replication amongst cluster nodes
- Routing take-over (backup node)
- Queuing of messages per destination
- Retrial of delivery in case of unavailability of a destination
- Controlled notifications delivery (to avoid overloading the network from data surges resulting from a synchronized event, such as a power outage)



- Respect of message ordering
- Persistence of messages and restore in case of crash of the whole system

APIs

Platform Data Collector and Fault Manager expose intuitive, easy to integrate, REST APIs over HTTP(s) (northbound) and interfaces through APIs at the gateway layer (southbound) to address activities such as registration, data stream subscriptions, or events notifications at the northbound interface and device registration, resource configuration, and firmware updates at the southbound interface.

Nokia additionally recommends and supports the usage of Light-weight Machine-to-Machine (LWM2M) standards (when possible) for both data plane (data reporting and devices actuations) and device management.

Security

The Nokia IMPACT IoT Platform provides a highly secure system, audited by numerous large organizations, through three key elements:

Platform access control

- Multi-tenanted system used to reflect the part of an organization within its group structure allows secure access to devices (gateways, aggregators, sensors, meters)
- Delegation allows assignment of secure user roles based on the security policy of the enterprise
- Passwords are controlled by policy (e.g., characters, numbers, time used) and configured by the enterprise
- All passwords and other sensitive security information is encrypted internally within the database
- All security provided by Internet Protocol (IP) upper layers
- Management of security with remote password and access point change capabilities

End-to-end chain of trust

- Security is provided along the whole processing chain and establishes trust with endpoints via:
 - Two-way authentication
 - Certificates, keys and encryption
 - Signed software delivery from trusted source to validate authenticity

Data privacy: multi-tenant

Implements multi-tenancy by definition of groups, or domains. Adequate for both fixed and mobile devices:

- Users/Accounts created on the platform are assigned to a group which manages and accesses data in their own group only
- Devices registered on the platform are associated to a group based on policies and algorithms

The Nokia advantage

Secure networks and data

Customers looking for deeper insights and holistic IoT solution management must ensure that data is secure, authentic and validated for usage. Nokia IMPACT IoT Platform ensures end-to-end security for IoT data and the devices that generate the data, resulting in data that is generated through a trusted and managed source.

Reduce costs

Nokia IMPACT enables significant cost savings advantages that leverage the ability to manage the complexity of delivering IoT solutions (application development, network optimization and service delivery costs) more efficiently as well as improving service delivery and the flexibility of IoT providers to meet market needs.

Monetize IoT

Organizations looking for growth and innovation from their IoT strategy can utilize Nokia IMPACT IoT Platform to monetize SLAs and optimize network efficiency by controlling IoT traffic as well as generating revenue opportunities by building and exposing new platform capabilities.

The Nokia IMPACT IoT Platform is also pre-integrated with a number of applications for video analytics, smart parking, smart lighting and vehicle applications. The inherent value that comes from multiple vertical applications hosted on IMPACT provides cross analytics which help make each application richer and can also turn out new business models from the data. For example, video analytics can be used to monitor and analyze traffic patterns which can be used to make improvements to the Smart Parking application to help people find parking spots more easily.

All Nokia IoT applications include a mobile application (available on both the iOS and Android operating systems), a management dashboard and advanced analytics functionality.

Video Analytics

The Nokia IoT Video Analytics solution leverages machine learning technology (developed by Nokia's Bell Labs), pattern recognition, and behavioral knowledge to anticipate what video footage is relevant, based on the prescribed video surveillance tasks. This adaptive video anomaly detection spots unexpected changes in video images over time, identifies and predicts how subjects and phenomena evolve, and can intelligently shift cameras during critical observations.

Beyond enhancing situational awareness, the Nokia IoT Video Analytics solution can also prioritize streams for their anticipated relevance, automatically allocating network resources, based on dynamic application needs. The least relevant streams are cut off at the source ensuring network availability for the most critical ones.

Existing video analytics solutions have some drawbacks, including false positives. These are caused because real scenes – like what cameras located in cities produce – are too complex for traditional object recognition software. What is required is an intelligent platform that can proactively detect, select and track only relevant video streams for a variety of surveillance tasks. As a result, only a fraction of the massive set of video streams needed has to be handled, transmitted and stored.

Using the Nokia IoT Video Analytics solution, in parallel with the Nokia IMPACT IoT Platform, your video monitoring solution is agnostic to video resolutions, camera brands and networking options.

Smart Parking

One of the inefficiencies associated with city driving is finding a parking spot. In fact, a traffic study completed in San Francisco, California reported that 30 percent of all congestion in that city is caused by frustrated drivers, looking for a place to park their car.

Although cities only occupy two percent of the world's land mass, they consume more than two-thirds of the world's energy and account for more than 70 percent of global CO² emissions. In many cities, automobiles are one of the main contributing factors to rising emissions.

The Nokia IoT Smart Parking solution provides a simple and effective solution that is integrated with existing parking space sensors (and/or video cameras). Drivers are directed to the closest available parking space (or to one that was pre-booked), then are provided with a cashless payment system. Additional value added services (VASs) can also be offered, such as car wash and repair services.

When integrated with the Nokia IoT Video Analytics solution, information from video feeds can be combined with data from parking space sensors. The Nokia IoT Smart Parking solution can then predict parking utilization rates and report on anomalies or other issues, in real time.



Smart Lighting

Electric streetlights are ubiquitous in cities around the world, enhancing visibility and safety for residents and tourists alike. Because outdoor lights are a major source of energy consumption, as traditional lights are replaced with more energy-efficient light-emitting diode (LED) technology, some cities are also using this transition as an opportunity to consider smart lighting solutions.

The Nokia IoT Smart Lighting solution provides energy monitoring and dynamic control capabilities. Integration with the Nokia IMPACT IoT Platform provides data collection and management, integration into existing wireless networks, and device management for light sensors (secure provisioning and communication).

Vehicle Applications

In the automotive, fleet management and insurance sectors, embedded on-board diagnostics (OBD) devices are used to monitor driver behavior and to raise alerts when fuel levels are low, speed limits are violated or when commercial/fleet vehicles stray from authorized areas.

Nokia's solution collects data from either a Connected Head Unit or an after-market OBD2 device, enabling predictive maintenance, fuel efficiency and supply chain optimization. The physical device connects quickly and easily into a vehicle's OBD (or OBD2) port and can establish a geo-fence that facilitates various industry-specific solutions.

When integrated with the Nokia IMPACT IoT Platform solution, data transmitted by the OBD devices can be viewed in real time and combined with data from other applications to provide cross analytics, resulting in richer information and new revenue generation opportunities.

Learn more

Visit our web page on [Nokia IMPACT IoT Platform](#) to learn more about our IoT solutions.

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