![GSMA Internet of Things logo]

THE
GSMA
GUIDE TO THE
INTERNET
OF THINGS

MOBILISING THE IoT

Enabling a world in which consumers
and businesses enjoy rich new services,
connected by intelligent and secure
mobile networks

THE INTERNET OF THINGS BY 2026*

$1.8 Trillion Total IoT Market Application Service Revenue Opportunity

* Source: Machina Research, 2017

North America: **$419bn**

Latin America: **$115bn**

Europe: **$453bn**

Middle East/Africa: **$86bn**

Asia-Pacific: **$707bn**

TOTAL CONNECTED DEVICES

2016: 6.6bn	2026: 30bn

CELLULAR CONNECTIONS

2016: 0.43bn	2026: 6bn

2G, 3G, 4G	LPWA	2G, 3G, 4G	LPWA
2016: 0.04bn	2016: 0.4bn	2016: 2.2bn	2026: 3.8bn

56% in licensed spectrum by 2022

OPPORTUNITY IN SELECTED VERTICAL SECTORS

Smart Cities: **$78bn**

Connected Industry: **$164bn**

Connected Vehicles: **$273bn**

Consumer Electronics: **$376bn**

Smart Home: **$441bn**

THE GSMA INTERNET OF THINGS PROGRAMME

The Internet of Things describes the coordination of numerous machines, devices and appliances connected to the Internet through multiple networks.

These connected devices include everyday appliances and machines such as vehicles, utility meters, tracking devices, vending machines, consumer electronics and wearable technology, as well as smartphones and tablets.

The GSMA's Internet of Things Programme is an industry initiative designed to help mobile operators accelerate the delivery of compelling and secure IoT solutions that harness big data to deliver value to individuals and enterprises alike.

By developing key enablers, facilitating industry collaboration and supporting network optimisation, the Internet of Things Programme is enabling consumers and businesses to harness a host of rich new services, connected by intelligent and secure mobile networks. Bringing to the table decades of experience in providing trusted, secure and reliable connectivity, mobile operators are a key component of the IoT and invaluable strategic partners for cities, governments and companies.

KEY INITIATIVES OF THE GSMA INTERNET OF THINGS PROGRAMME

Mobile IoT = TRUSTED IoT
The GSMA is working with mobile operators and the wider ecosystem to deliver cost effective managed solutions that securely scale the IoT.

IoT Security
The GSMA has delivered a set of IoT Security Guidelines, backed by an IoT Security Assessment scheme, to provide a proven and robust approach to end-to-end security.

IoT Big Data
The GSMA is working with mobile operators on common enablers, to unlock the potential of the vast amount of data within the IoT.

IoT Policy & Regulation
The GSMA is working to create a sustainable policy and regulatory environment to support the successful scaling and socio-economic benefits of the IoT.

Industry Engagement
The GSMA is working to align market perspectives, drive adoption and grow the market across key vertical sectors, including smart cities, connected vehicles and drones.

MOBILE IoT = TRUSTED IoT

Cost effective operator managed
solutions to securely scale the IoT

Mobile IoT refers to low power wide area (LPWA) 3GPP standardised secure operator managed IoT networks operating in licensed spectrum, including Narrowband-IoT (NB-IoT) and Long Term Evolution for Machines (LTE-M). These are designed for IoT applications that are low cost, use low data rates, require long battery lives and often operate in remote and hard to reach locations, often beyond power sources.

LPWA technologies will connect billions of new devices, and existing cellular networks have evolved to deliver service that can scale as the market grows and provide complete IoT connectivity.

Mobile operators and their ecosystem partners are experienced and trusted providers of secure, managed IoT solutions, and are therefore best placed to extend their reach to serve the full range of IoT applications.

The adoption of these standardised technologies in licensed spectrum will securely and sustainably scale the market, allowing cost effective delivery of services and eventually enable the supply of mobile modules for devices for a few dollars. Global commercial deployments of NB-IoT and LTE-M networks have commenced and will reach critical mass in 2017.

Find out more:
www.gsma.com/MobileIoT
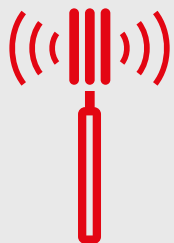
To help build a vibrant ecosystem around licensed spectrum low power wide area (LPWA) technologies, the GSMA has created the Mobile IoT Innovators community consisting of developers, device makers, network vendors, operators and end customers. To receive valuable insights and enjoy exclusive benefits, join the Mobile IoT Innovators now.

www.gsma.com/MIoTI

LPWA: EXTREME WILDLIFE TRACKING

To protect threatened species, conservationists need to fully understand their behaviour and which habitats are key to their survival. To that end, a mobile operator is working with the Sea Mammal Research Unit (SMRU) in Scotland to track the movements and health of harbour seals, which have suffered a precipitous drop in numbers in the past decade.

Both organisations will explore the use of new low power wide area connectivity in licensed spectrum to build up a comprehensive picture of the seals' behaviour, help understand why the population is in decline and then take remedial action. Monitors attached to the seals can use the cellular networks to feed location, activity and environmental data into SMRU scientists' computer systems.

LPWA technologies are specifically designed to bring connectivity to millions of devices spread over large geographic areas, while minimising power consumption and the need to replace batteries. This new class of mobile technologies is set to make it much easier and more cost-effective to deploy and manage connected wildlife and asset trackers over extended periods of time and in remote areas.

IoT BIG DATA:
Unlocking the potential of the Internet of Things

The Internet of Things is generating a huge amount of data that is currently retained in vertical silos. However, a common, global approach to big data that utilises rich data sets from operators and relevant industry sources will accelerate the development of new IoT solutions.

The GSMA is working with the mobile industry to make harmonised data sets available to developers and third parties through common application programme interfaces (APIs).

By working with mobile operators on common enablers, the GSMA is also helping to remove commercial and technical barriers to create value from the IoT big data opportunity.

The GSMA IoT Big Data API Directory lets you find details of IoT and context data sets available from multiple sources worldwide. Our goal is for innovative data-driven IoT services to be developed based on this data, generating value for both data providers and developers.

http://apidirectory.iot.gsma.com/

UNLOCKING THE FULL VALUE OF IoT BIG DATA ACROSS VERTICALS

Data silos constitute valuable assets and offer great monetisation potential. To illustrate how data from multiple sources can be combined and utilised to the benefit of all parties, consider the following examples:

SMART CITIES
Data from various sources could be used to improve traffic flow and optimise public transport in real time. Sensor data from public and private vehicles, traffic lights and road sensors may be combined with information on weather and large events or festivals, in order to optimise event traffic flow and transport.

CONNECTED VEHICLES
Data sources such as car sensor data from a private vehicle, weather information from a government source and driver information could be cross-referenced to enable services such as usage-based insurance, underwriting and pre-emptive maintenance. These and

similar services could be offered to many parties including drivers, automotive manufacturers and insurance companies to improve efficiency and reduce costs.

UTILITIES
Data from different sources, for example gas, water and electricity meters, and pressure and temperature sensors, can help detect and pinpoint faults more accurately, while monitoring for changing levels of potentially dangerous gases, such as methane, and automatically shutting of service, thus not only creating more efficient work flows, but also improving personnel and customer safety.
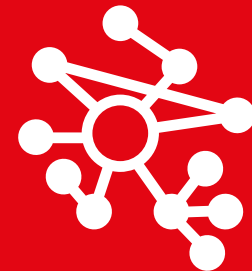
IoT SECURITY

Securing the connected future

Without security the Internet of Things will cease to exist. To enable a secure market, companies have to take responsibility to embed security from the beginning, at every stage of the IoT value chain.

As the established, trusted providers of secure IoT services in licensed spectrum, operators can ensure the long term sustainability and growth of the market. Therefore the GSMA, together with the mobile industry, has developed a comprehensive set of IoT Security Guidelines, backed by an IoT Security Assessment scheme, to provide a proven and robust approach to end-to-end security.

The GSMA IoT Security Assessment enables companies to build secure IoT devices and solutions as promoted in the IoT Security Guidelines, by providing a flexible framework that addresses the diversity of the IoT market. The assessment specifies Security by Design and allows IoT companies to enhance their reputation as trusted IoT solution providers.

The GSMA is now working with mobile operators and the wider industry to further accelerate the adoption of the guidelines and the assessment.

To ensure your IoT products and services are secure, download the GSMA IoT Security Guidelines for free and take part in the GSMA IoT Security Assessment.

www.gsma.com/IoTSecurity

SECURING THE PORT OF THE FUTURE – SECURE IoT SOLUTIONS FOR THE SMART CITY

Led by the University of Seville and the Port Authority of Seville, the Tecnoport 2025 project uses Internet of Things solutions to improve the efficiency of transport and logistics in south west Spain. Implemented by a consortium of five companies, including telecoms operator Telefónica, the project uses new wireless networks and sensors to improve the tracking and remote control of containers passing through the port, and to optimise the rail and river traffic in the area.

In line with the GSMA IoT Security Guidelines, Tecnoport 2025 uses a combination of virtual private networks (VPNs), private access point names (APNs), multiple-factor authentication mechanisms and other measures to keep the new IoT solutions secure.

In the fourth quarter of 2016, Tecnoport 2025 employed the new GSMA IoT Security Assessment scheme to test the security of two key components of the project – the managed connectivity platform that controls cellular connectivity, and the FIWARE-based Smart City Platform that aggregates the data generated by remotely deployed sensors connected via wireless networks.

Telefonica has found that the assessment process has helped to highlight some important security features that hadn't been raised before, all of which were implemented by the Tecnoport 2025 team. Tecnoport 2025 are now planning to use a similar approach as the basis of other smart city services in the port and the city of Seville, considering that the assessment scheme has not only strengthened the security of their networks and systems, but has also increased competitiveness and efficiency of the port.

$1.8 TRILLION

TOTAL IoT APPLICATION
SERVICE REVENUE OPPORTUNITY BY 2026

Source: Machina Research, 2017

IoT POLICY AND REGULATION:

Growing the socioeconomic benefits of the Internet of Things

The accelerating growth of the Internet of Things is transforming economies and societies. The GSMA is working to create a sustainable policy and regulatory environment to support the successful scaling of the IoT.

Promoting government support for the growth of IoT services is the most effective way of establishing a trusted network, capable of realising the socioeconomic benefits of the IoT. Governments and regulators can help build consumer trust by promoting an industry led approach to privacy and security, and fostering collaboration and a constructive dialogue across the various players of the IoT industry value chain aimed at identifying industry best practices. Building trust and providing a level playing field for all technologies will give confidence to consumers and the industry that will generate help to drive global adoption of the IoT.

The IoT spans multiple departments, organisations and industries, therefore new challenges arise. Working in collaboration, on a common and consistent approach, will maximise the market opportunity.

The IoT Knowledgebase for Policy and Regulation is an online tool to help policymakers and regulators unlock IoT opportunities in their regions, understand new IoT business models and learn about emerging policy and regulatory best practice from around the world.

www.gsma.com/IoTKB

INDUSTRY ENGAGEMENT:

The GSMA is working to align market perspectives, drive adoption and grow the market across key vertical sectors

The GSMA works closely with its partners in the industry to align its strategy and to ensure its initiatives are adopted. By determining common capabilities, we will make a positive impact on the industry creating solid foundations for the Internet of Things.

Regular engagement and communication with the industry will lead to better market understanding, resulting in improved IoT products and services, superior user experience and greater connectivity, enabling the market to grow.

In particular, the GSMA is working with

- governments and city planners to create smarter, more efficient cities;
- the automotive industry and wider ecosystem to grow the connected vehicle market;
- mobile operators and the drones industry to identify common challenges which would benefit from collective action

SMART CITIES

Creating smart city benefits through IoT technologies

The growth of the Internet of Things will help drive cost efficiencies and deliver rich new services to smart cities. With vast experience and existing network infrastructure, mobile operators are the trusted partners for delivering IoT solutions. The GSMA is helping mobile operators and cities work together to create sustainable, long-term benefits for businesses and citizens through IoT technologies.

Find out more:
www.gsma.com/smartcities

CONNECTED VEHICLES

Driving the successful growth of the connected vehicle market

Only a standardised and collaborative approach of the industry can unlock the full potential of a secure market. The GSMA is therefore working with mobile operators, automotive OEMs and suppliers, relevant industry associations, and regulatory bodies to accelerate the growth of the

Connected Vehicle market by agreeing a common approach to security, regulatory and infrastructure solutions.

Find out more:
www.gsma.com/automotive

DRONES

Promoting a central role for the mobile industry in shaping the UAV market

Drones can be utilised to enhance smart city services such as safety, improved traffic flow, improved delivery services and crowd control measures. Mobile networks can be used to securely identify a drone and its location in order to help ensure the safety of commercial drones and to help mitigate privacy, safety and security risks. This makes mobile networks the preferred solution, offering drones superior wide area, high speed and secure connectivity.

Find out more:
www.gsma.com/drones

Internet
of Things

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