M2M ROAMING PLAYBOOK

V.1

Industry Extract

M2M/IOT
ROAMING LAB

INNOVATIVE OPERATORS

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Introduction

1.1 What is M2M Roaming?

M2M (Machine to Machine) refers to a system where direct communication occurs between two or more machines or devices, without human intervention. More broadly, M2M refers to any technology that enables the exchange of data and instructions automatically between various devices (health WPAN devices, sensors, embedded controllers, actuators, etc.) over wired or wireless networks, to perform a variety of actions without human intervention (or very limited human intervention). M2M applications typically involve devices where the data exchange is often limited to a specific task or function.

IoT, (Internet of Things, not to be mistaken for IOT Inter-Operator Tariff) on the other hand, refers to a network of connected devices, sensors, and objects that can communicate with each other and exchange data over the Internet. IoT applications involve many devices and are designed to collect and analyse data from various sources to generate insights and enable new capabilities. IoT devices are often integrated with cloud computing platforms and other technologies to enable advanced analytics, machine learning, and artificial intelligence.

M2M is considered a subset of IoT, like H2H (Human to Human) and H2M (Human to Machine) and refers to a specific type of communication between machines or devices, while IoT encompasses a broader range of applications and technologies that enable connected devices to interact and communicate with each other specifically using the Internet.

Some M2M devices typically require low latency, high reliability, and often consume low power compared to other standards. M2M systems are known to support a large volume of M2M devices and often transmit small amounts of data at regular or irregular intervals. It is also noted that often traffic is exchanged in off-peak hours.

A device in an M2M system not only collects data for its own usage, but may also share the data with other devices automatically to achieve certain goals. Therefore, emerging M2M systems for civil transportation, electric power grid, medical treatment, industrial automation, etc., can be set up based on the networking of devices.

M2M Roaming refers to the ability of these devices, machines, or sensors to communicate with each other across different wireless networks in different geographic locations.

M2M Roaming was first discussed in around 2009 when industry working parties started to consider how M2M devices were not easily verifiable in the context of roaming. Historically, the provision of SIMs by Mobile Network Operators (MNOs) in large quantities had been happening for decades, but only in recent times had MNOs started to identify a subset of these SIMs as M2M SIMs and having unique character traits.

Verification of M2M Devices in the roaming context emerged as important to MNOs because technical issues had been raised about the M2M devices causing (1) congestion in the radio network, (2) overload of the network elements.

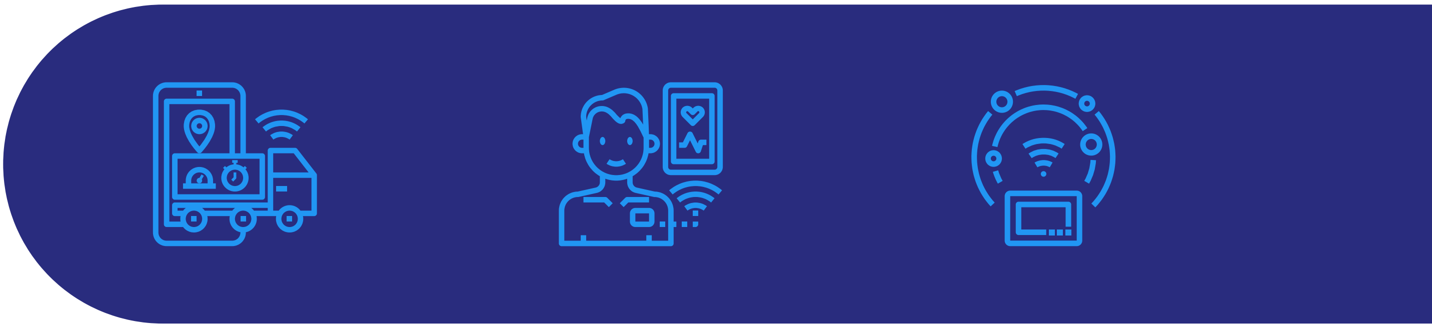
Examples:

- GGSN overload because 100K smart meters of an energy utility company all started to upload their data at 03:00 AM each day.
- Local radio access network at a major seaport is congested due to a high number of active sea container track & trace applications.



M2M Roaming is considered particularly important where devices need to be able to communicate with each other to exchange data and perform all kinds of automated tasks. For example, a fleet of trucks equipped with M2M devices could use M2M roaming to communicate with each other and with a central control system, allowing the fleet to be managed and monitored in real-time, regardless of where the trucks are located.

To enable M2M roaming, MNOs need to have Roaming agreements in place to allow their networks to interconnect and exchange data. These agreements can be unilateral, bilateral, or multilateral and typically involve the exchange of several GSM Association documents (IR.21, AA.14, etc), typically exchanged for standard Roaming Agreements.



1.2 The future of M2M Roaming

Those who work in the telecoms industry will know well, how easy it is to find analysts who share hyped-up data on M2M / IoT and how successful it is going to be in the future. Everyone talks positively about the potential of M2M / IoT. While IoT can be deployed using other wireless technologies, such as Wi-Fi, Bluetooth, etc. Mobile Network connectivity is clearly a major enabler of IoT connectivity and has high potential to continue to be an important enabler in the future.

These days, many industry players consider 5G specifically an important enabler for IoT, as it provides the necessary connectivity and bandwidth to support the large number of devices and data traffic generated by IoT applications, whilst also having the option of network slices to support all types of use cases.

With the advent of 5G Standalone Roaming, M2M is expected to receive several benefits, including:

> **1. Increased Connectivity:** 5G networks offer faster connectivity than previous generations of wireless networks, which means that M2M devices can communicate more efficiently and effectively and perform more complex tasks.
>
> **2. Lower Latency:** 5G networks have lower latency, which means that M2M devices can communicate with each other and with central control systems in real-time, without any noticeable delays. Some IoT solutions will demand this lower latency and speeds offered by 5G.
>
> **3. Migration from earlier network generations:** Since the decommissioning of 2G and 3G networks which have historically hosted M2M devices and are considered to host the majority of M2M devices today, M2M devices are expected to migrate to 4G or 5G networks, potentially allowing for more global roaming and interconnectivity.
>
> **4. Quality and security differentiation:** 5G networks offer improved features, such as network slicing, which allows different M2M applications to operate on dedicated virtual networks, with their own security and privacy settings.
>
> **5. Increased Innovation:** 5G networks provide a platform for innovation and experimentation, which can lead to the development of new M2M applications and use cases that were not previously possible.

5G Roaming for M2M clearly has the potential to accelerate the growth of the IoT and connected devices, by providing a more advanced and reliable network infrastructure that can support a wider range of applications and use cases.

While there's no doubt that 5G brings benefits, to realise these benefits for M2M the interoperability between MNOs needs to be fully optimised to ensure that they can seize the wide opportunity anticipated by M2M in the 5G world.

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Objectives

2.1 Main Drivers

Many MNOs feel a handicap in the lack of optimisation of M2M Roaming. Even for 2G and 3G where the majority of M2M Roaming exists today, a clear efficient path for working together to ensure the delivery of robust M2M services is not fully defined. Many pieces of useful best practices have been generated in the past 15 years, but no complete end to end approach on how to leverage the opportunity.

Several key objectives have been discussed:

> **1. Best Practices:** There is a need for education on best practices and adoption of them: Best Practices are created for the industry but are often not followed. One of the most effective ways to encourage companies to follow best practices is to educate them about why they are important and how they benefit both as companies and as a community. Providing training can also help companies understand why they are important.
>
> **2. Collaboration and openness:** The industry needs more openness and verification of M2M traffic. Collaboration is needed for growth. Creating a culture where following best practices is seen as the norm can encourage individuals to comply with them.
>
> **3. Business incentives for the Visited Mobile Operator:** MNOs need to consider the Visited MNO perspective and their business incentive to receive M2M traffic in their network. A proper mechanism for verification of M2M Traffic and a good pricing model which allows all companies to benefit is needed.
>
> **4. Global thinking:** MNOs need to consider regional diversity, M2M must be considered from a more global perspective. With the right measures, all MNOs should have the chance to offer services for M2M globally.
>
> **5. Leadership by Example:** Leaders and role models who consistently follow best practices can set a positive example for others to follow.

This document is created to assist MNOs with these objectives for M2M Roaming. The M2M Roaming Playbook is a companion to any roaming manager trying to navigate what to do with M2M business, how to educate internal teams, what commonly perceived path people like themselves are taking. However, the playbook also recognises the areas where all MNOs must collaborate as a community.

This playbook includes the combined views of MNOs within the IO community who have addressed these points in workshops and who have asked the fundamental questions about how to proceed with a successful M2M Business. This guide will continue to evolve based on the continued work of the IO M2M/IoT Lab in its understanding of the challenges and opportunities ahead of us.

3
M2M Roaming Definition

3.1 Background to the IO Definition of M2M for Roaming

There have been many attempts to define what M2M is, but many have failed to capture it. From workshops held within IO, a definition has been made, which is summarised below. Defining M2M is important because it helps to clarify what type of device is being identified and what its capabilities are on the network and how it can be charged.

M2M devices are becoming increasingly common in a wide range of industries, from healthcare and transportation to manufacturing and energy, and they are often used in complex systems and networks. Having a clear and consistent definition of M2M devices can also help to ensure that all MNOs involved are aligned and have a shared understanding of what M2M devices are and how they work. Additionally, a clear definition of what are considered M2M devices can help to guide the development of new business opportunities. By understanding the characteristics and requirements of M2M devices, MNOs can create specific roaming agreements and discount agreements more efficiently and update their IR.21 with data that helps with the verification of these devices.

M2M refers to machine-to-machine communication that involves communication between two machines without human intervention.

In pure M2M scenarios, machines are programmed to communicate with each other to achieve specific tasks, such as collecting data or controlling devices. However, there can be grey areas in M2M communication, particularly in cases where human intervention is involved in some capacity. For example, a vending machine that uses a wireless network to report inventory levels could be considered pure M2M communication, but if a human operator must manually adjust inventory levels based on the data reported by the vending machine, it may be considered a grey area.

From an activity perspective, M2M can be divided into two types, namely, dynamic M2M systems and static M2M systems. The major difference between these two types is the topology of the M2M system. In **dynamic M2M**, devices are moving, i.e., the topology is changing over time, which can result in a change in wireless link quality, communication mode switch, and dynamic resource allocation. In contrast, the topology for **static M2M** systems stays unchanged for a relatively long time. For example, vehicular M2M system, medical M2M system, and robotic M2M system are dynamic M2M systems, and energy M2M system, home M2M system and industrial M2M system are static M2M systems.

It's important to note that not all wireless communication involving machines is considered M2M communication. For example, communication between a smartwatch and a smartphone is not considered M2M communication, as it involves direct interaction between a human and a machine. The following section summarizes the levels to which one can address defining M2M.

3.2 The IO Definition of M2M for Roaming

1) The device can be:

- **Function:** downloading or uploading.
- **Network Tenure:** temporary or Permanent Roaming.
- **Activity:** dynamic or static.
- **Signalling:** generating signalling volumes regularly or irregularly
- **Technology:** May use many different types of underlying networks. GSM, GPRS, HSDPA, LTE, NB-IoT, LTE-M, Wi-Fi, Wi-max, Satellite, etc. It was noted NB-IoT sometimes causes congestion in the network as well as other solutions.

2) But to be called M2M must be:

- **Signalling:** Is present on the network.
- **Automated:** Is working in the background, automated and self-triggering.
- **Non-Human:** Has no human or minimal human interaction (e.g. sending technical data) or intervention.

If the device relates to the above criteria, it is considered M2M.

3) Then may be differentiated by behaviour / use case:

- **Data Usage:** Low or high.
- **Reliability:** Low or high.

- **Quality:** May require low or high bandwidth.
- **Security:** May have security features.
- **Network:** May require new specific network features.
- **Interactive:** May be interactive with other devices.

Some examples of M2M Use cases are all as follows:

- Smart Meter in your home
- Tracker chip in your pet (or roaming animal)
- Motorway speed camera
- Vending machine
- Car Telemetry
- Cargo tracker
- Digital signage
- Heart monitor
- ...

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