



# Assuring quality of service in M2M and IoT connectivity

Despite being a key building block of any wider M2M solution, there are important differences between M2M connectivity services and traditional mobile services that need careful consideration as these, by definition, can't provide human feedback. On top of this, many M2M users need global connectivity, which in turn involves international roaming partners. Is trusting global roaming partners sufficient or should the market demand a more sophisticated approach from those operators providing M2M services - in particular where mission-critical M2M/IoT services are involved, asks Miguel Angel García Matatoros, managing director, **Blue Telecom Consulting**.



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This IoT Masterclass is intended for operators and MVNOs who provide connectivity services via cellular to M2M businesses and for companies who already employ or are planning to implement M2M/IoT technologies in their businesses.

### Are roaming partners the Achilles Heel of M2M?

As has been said many times, "trust is good, but control is better". Given the contractual responsibilities of any M2M operator, they need tools to not only assure services within their own network but, just as importantly, in visited networks as well - and that includes all possible roaming scenarios. It would be nice to believe all networks are similar, but they are not. From the research BlueTC has carried out to date, the quality of service depending on location and roaming partner can vary dramatically and, on occasions, falls below acceptable thresholds. Just allowing devices to connect to any network is a dubious strategy and, instead must be appropriately controlled and optimised to get true industry grade connectivity.

### Measure the real-time performance of any network

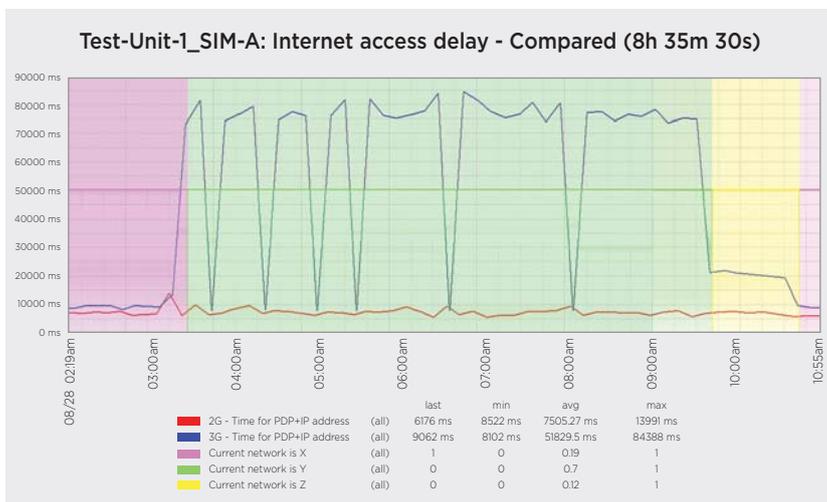
At BlueTC we have come up with a cost effective way for anyone to be able to independently monitor the QoS provided by any M2M operator and use this to improve customer experience. To provide better insight, BlueTC has developed its M2M Active Monitoring System, a cloud-based solution that gives M2M operators, M2M service providers, vertical solution providers, MVNOs and corporate customers the ability to independently monitor QoS across the value chain.

Designed for national and international use, the solution supports roaming but can also be used by operators for internal measurements. These may be performed in real-time on 2G, 3G or 4G/LTE networks and go beyond the traditional measurements often made of just connection availability and pure radio or core network metrics. Instead, the solution can control and analyse all service layers, from radio access to OTT applications via IP, SMS and voice, and these should support most M2M/IoT services and applications.

The system measures the quality experienced and gives the customer the ability to optimise its services and so improve customer experience in any location, all based on real-time data.

This has proven to be more effective than just placing SIM cards in data centres or using an operator's internal measurements. These approaches have limitations as they're essentially simulations, don't provide an end-to-end perspective and they normally only measure basic metrics. In comparison, BlueTC's solution collects real-time data that's relevant to each company's specific business needs and based on a series of KPIs previously defined and variable from industry to industry and customer to customer.

More importantly, this is all non-intrusive and does not need the involvement or agreement of ▶





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the host operator. This makes it possible to compare the performance of different operators before or after signing an agreement with them.

BlueTC's solution also includes the ability to configure customised alarms that are triggered when the required KPIs reach specific thresholds, so enabling corrective action.

Our system is already working in live networks around Europe and delivering powerful data. In this Masterclass, we are able to present surprising results as shown in our Use Case below where M2M relevant measurements have been collected from three anonymised operators. While this Use Case focuses on international roaming and data traffic, there could of course also be Use Cases for SMS or even voice.

### **Use Case - significant variations on KPIs for data services**

As connectivity is normally available through several partner networks, the visiting operator - who we've named Operator A - can steer the roaming to their preferred network. Alternatively, it can leave it up to the device to attach to a network by default, with the possibility of fall-backs when needed. In this case, our assumption was that the QoS provided would vary depending on the host network selected - here named Operator X, Y and Z.

BlueTC monitored the service provided for M2M devices roaming abroad on behalf of Operator A. Roaming agreements were in place with three local operators in the country in question and there was no preferred network. By using data SIM cards from Operator A, we were able to run tests that measured several KPIs for data services and gave important insights into the KPIs from an end-to-end customer perspective. These allowed Operator A to make adjustments that directly enhanced the M2M service that they were able to deliver to their customers.

Automatic tests were run every 9 minutes, forcing 2G and 3G access in each testing cycle and including batches of ping and file transfer tests. Our system allows remote control of the testing devices to select which network operator - the PLMN - was to be tested, and we performed several test cycles for each of the three networks across various periods of time. Which PLMN was provisioning radio service at each cycle, across both 2G and 3G technologies, also provides a valuable KPI because it shows when a network fails and fallback to another is needed.

We found differences in many KPIs for each operator, particularly regarding latency (e.g. ping RTT delays between 200 and as much as 800 ms) and also for upload throughput. However, the most significant difference involved Internet access delay - the time elapsed from the moment the application requests the cellular modem to apply for a PDP context until the device is assigned a public IP address and can access the Internet. The graph below shows the values of the KPI for Internet access delay for both 2G and 3G, represented by red and blue lines respectively. The PLMN values have been mapped to identify exactly when our testing device was registered with each network.

In the area with purple colour that represents Operator X, we can see that the time it takes to get full access to the Internet from an unregistered state is around 7 seconds for 2G and 9 for 3G - 'normal' M2M parameters. When we steered the testing device to choose network Z, represented by the yellow

area, the delay in 3G increased to around 20 seconds - much higher, but still within acceptable parameters.

However, when we forced the device to select network Y, shown in the green area, the performance for 3G fell dramatically. On some occasions, the value was around 9 seconds, but in most of the cycles it took between 75 and 85 seconds to connect to the Internet! This means that it was almost 1.5 minutes before the device could start sending data after waking up and, on top of this, comes the time the actual data transfer lasts. While the device would still be working and the delay might go unnoticed by the end customer, in the case of critical M2M applications, acceptable QoS levels and even the service delivery itself may be endangered, with possible damage not only to the end customer but also to any verticals basing their operations on M2M.

### **Main takeaways for operators and MVNOs**

Operators should monitor the QoS both of their own and third party networks. It's only when they hold this objective data that they can make informed decisions that will actually improve the QoS delivered to their customers. As this solution can be used for both internal and external third party networks, many interesting Use Cases may be devised. Comparing data from several operators will give insights into which ones are best to collaborate with for national or international roaming, both with regards to quality and to volume.

When combined with other service elements - such as M2M platforms - monitoring can also help operators to effectively differentiate their offerings and offer a premium service for superior QoS. Some corporate customers might also be interested in a service where they can get real-time insights into the QoS that they receive. This could form a new, value-added service that operators could offer as a demonstration of transparency to enhance their reputation and/or to charge for at a premium.

### **How enterprise customers might benefit**

Network performance data allows enterprise customers to make better informed decisions about which operator to choose for their M2M/IoT services. They can monitor and analyse how a M2M operator is actually handling services, with quality of the connectivity or other network metrics being an intrinsic part of the enterprise customers' own service assurance process. By not having to wait for a notification or feedback about a faulty service from the operator, staff can work proactively before the end customer is impacted, ultimately providing an improved service, saving time and money. Even the end-users themselves can be automatically alerted to abnormal situations when certain KPIs reach values outside customised thresholds.

### **About Blue Telecom Consulting**

Blue Telecom Consulting (BlueTC®) provides innovative solutions and services aimed at evolving and optimising telecom networks for operators, system integrators and network equipment manufacturers. It divides its offerings into the following main areas: network and performance analytics, service monitoring and assurance, network security and conformance audits, and system and operational automation and optimisation. The company works with top tier companies in the telecommunications sector in various countries and takes on projects globally. BlueTC was established in Madrid in 2005, opened an office in Sweden in 2012 to serve the Nordic countries, and began commercial activities in the United Kingdom in 2013. ■