

## ECC Newsletter April 2016 – M2M Special Edition

# ECC to support future needs for M2M applications

One of the CEPT's largest ever workshops took place in March, as 134 participants came together to discuss existing and future needs for Machine-to-Machine (M2M) applications.

The event was a first for Europe as it brought experts from the numbering and spectrum arena into the same room to discuss spectrum, numbering and harmonisation needs of M2M.



## *Opening of the M2M Workshop, 21-22 March 2016, Mainz, Germany*

It was a timely workshop and one that was first proposed at the ECC's 40th meeting in July 2015 in response to related initiatives between spectrum and numbering popping up in various fora within the ECC.

M2M's possibilities and requirements have been discussed at ITU, ETSI, 3GPP, and, of course, CEPT meetings. At EU level, Internet of Things (IoT) is referred to in the Radio Spectrum Policy Program and the Radio Spectrum Policy Group has published some recommendations accordingly. The aim of the M2M workshop in March was to understand better the spectrum, as well as numbering and addressing harmonisation needs of existing and future M2M applications. To do this in one workshop was important as related initiatives are present in many fora within the ECC and a consistent and common approach across all fora is needed.

Hosted by the Federal Network Agency in Mainz, Germany, the two-day workshop touched upon a wide range of issues for the ever-expanding world of M2M.

Participants included those from national regulatory authorities, industry representatives, experts and professionals. And even more – several hundred people signed in worldwide to watch parts of the workshop unfold online through a live streaming service.

The fact that industry was present was important as it enabled an exchange of views and general discussion among representatives from the telecommunications, energy and automotive industries among others. Speakers from companies such as Vodafone, Ericsson, Huawei Technologies, SIGFOX, and more, took to the stage to give their views on M2M and the requirements emerging as a result of this rapidly-evolving area.

The two-day event enabled a general consultation and an exchange of views between the industry and European administrations. The workshop identified a number of spectrum issues and numbering and addressing issues for which the ECC and its working groups will now consider, work on and revise their work programmes as appropriate.

But what is M2M? And where do numbering and spectrum come in when we discuss it?

The term M2M is all encompassing: any wired or wireless technology, or combination of technologies that enables connected devices to exchange information and perform actions typically without the manual assistance of humans in support of services to business customers and consumers.

A high degree of scalability will be required from IoT network solutions. The lifetime of these network solutions will exceed 10 years and this will also trigger the need for interoperability and often, the avoidance of “vendor-lock-in”.

Healthcare, retail, utilities, energy, transportation, automotive, construction, manufacturing, finance, insurance, banking and public services are all covered by M2M. And it is filtering right throughout our daily lives, from the connected home to the smart city.

Recent studies have found that M2M communications are set to grow rapidly. They have forecast a quadrupling of M2M traffic in wireless networks between 2015 and 2022. Some market sectors are expecting even bigger exponential growth.

In his opening remarks at the workshop Eric Fournier, Chairman of the ECC, said: "There are several regulatory regimes – smart cities, smart homes, smart networking and more. It involves a number of industry players from big ones to small ones - that's an important aspect of M2M."

"We decided to organise this workshop to try to ensure that we get all visions, all requirements from all sides of the industry"

Regulatory issues will inevitably arise as a result of this explosion in the usage of M2M. When it comes to spectrum, the harmonised bands are suitable for providing M2M services based on various systems such as 2G, 3G and 4G. Neutral usage conditions have been implemented in the ECC framework as mobile/fixed communication networks.

But this is only one piece of the whole story.

Other frequency bands and other radio applications - such as private mobile radio systems (PMR), public access mobile radio (PAMR), short range devices (SRDs) or radio local area networks (RLANs) - are all relevant when it comes to finding specific solutions for providing M2M communications.

Areas that were discussed over the two days included looking at the interest in dedicated spectrum for M2M networks, e.g. for critical utility control networks in the 400 MHz bands. It was examined whether the CEPT/ECC working group on Frequency Management should consider if LTE studies in this range could also take into account Narrowband-IoT (NB-IoT). Other solutions presented at the workshop consist of networked short range devices in some parts of the 862-876 MHz and 915-921 MHz ranges.

With forecasts expecting M2M traffic in wireless networks to quadruple, this will undoubtedly cause pressure on the current use in frequency bands, especially below 1 GHz. In the future, spectrum usage below 1 GHz could be complemented with higher frequency bands.

In his opening remarks, Didier Chauveau, ECC PT1 Chairman said "Spectrum managers need to respond to the requirements from the markets and the pressure that's coming from the industry".

He recognised that while there is no single radio solution for all M2M applications, radio-based solutions aren't relevant alone: in many cases M2M applications rely upon a wired network infrastructure.

Similarly, there is no single numbering and addressing solution for all connected devices. In some cases public IPv4 or IPv6 addresses are preferable; in others further identifiers are used. For example, devices that are dependent on cellular coverage and require interoperability with public networks may need International Mobile Subscriber Identity (IMSI) numbers and possibly E.164 telephone numbers.

Johannes Vallesverd, Chairman of the CEPT/ECC working group on Numbering and Networks, pointed out that it is a complex structure.

While not all M2M devices will require public numbering resources, the demand will still be significant, he said.

Embedded smart card technology ("eUICC" or "eSIM") and its potential to provide the solution to the "operator lock-in" issue was discussed.

Overall, it was a stimulating and productive two days as the workshop identified an array of spectrum, numbering and addressing issues. As the ECC and its working groups examine the outcomes of the workshop, they will consider and adapt their work programmes as appropriate.

Above all, the M2M workshop in March allowed experts from spectrum and numbering to come together to identify issues surrounding M2M.

It inspired a new appreciation of the work involved on both sides of the M2M coin, and it armed ECC members and industry with lots of insights to address the challenges and exploit the opportunities in the exciting and rapidly changing M2M arena.

Workshop presentations, photos, and first results are available on the workshop [web-page](#).

---

# Numbering resources in support of M2M

---

Not all M2M devices will require public numbering resources but in the coming years the demand will be significant. That was the consensus of the attendees at the CEPT workshop on Machine to Machine (M2M) communications in March.

We heard from a range of speakers, and in typical numbering expert fashion, they wowed us with a multitude of statistics.

Mike Corkerry, Head of the External and Regulatory Affairs Function at AT&T EMEA, had lots of figures. He said the world is sitting on the “verge of a fourth industrial revolution being powered by the Internet of Things (IoT)”, and that Cisco estimates that 50 billion things will be connected to the internet by 2020. Such objects will range from smart meters to sensors in cars to household appliances.

## The eSIM

Much of the discussion around numbering and M2M was based on embedded smart card technology, the eSIM or eUICC (embedded Universal Integrated Circuit Card).

This is a platform that is used for any mobile telecommunication system. It hosts all the tools, physical interfaces and logical interfaces to communicate between the card and the mobile device. It is not restricted to telephones and could be used to support banking applications, utilities, manufacturing and so on.

One of the keynote speakers Johannes Vallesverd, Chairman of the CEPT ECC Working Group on Numbering and Networks, said the drive for eSIMs comes from “the inherent difficulties there is when you want to change SIM cards in M2M applications”.

Despite its diminutive proportions, the eSIM could be a major solution provider, especially in solving the “operator lock-in” issue.

“It could be an economical disaster to send out technicians to change SIM cards and sometimes it can even be dangerous,” said Mr Vallesverd.

He referred to a smart meter buried in the ground, which might use a removable SIM but a sealed box makes access very difficult. Constraints like temperature, vibration and humidity mean that SIMs sometimes need to be soldered to the circuit board of the device.

The point was echoed by Xavier Piednoir, Technical Officer to the Technical Committee on Smart Card Platforms at ETSI. He gave a fascinating talk about the emergence of the eSim on a global scale.

Mr Piednoir pointed to other examples where SIMs could be difficult to reach – such as vending machines and car communication modules.

“If you cannot easily replace the card, does it translate to ‘I have to stick with the network provider’? There is a need to change and manage subscriptions without having physical access to the device. We need these mechanisms to be standard,” said Mr Piednoir.

Doing so will mean convenience for consumers and convenience and cost-effectiveness for manufacturers.

This throws up issues around who owns the eSIM. At present the mobile network operator owns it, but when it is soldered into the device does ownership and responsibility transfer to the device manufacturer?

“If network operators are not choosing the SIM card anymore or assessing the security level, how will they find out that the security of the device matches their requirements? It means that the industry will have to converge to a fixed set of algorithms,” said Mr Piednoir.

The eSIM could certainly provide a platform for M2M devices to “leverage economies of scale” within the supply chain. AT&T has devices that monitor containers as they travel around the globe, checking where they are and whether they’ve been opened. Device manufacturers can embed a single SIM into the product, track the device pre-sale and automatically activate it and initiate billing upon sale.

The eSIM presents a number of advantages to consumers: it gets rid of plastic as everything is handled online, according to Mr Piednoir. Also, there is no form factor jungle anymore here SIM cards come in different sizes for different devices. Though, he pointed out that there are some downsides, including no easy SIM swap and if the battery is dead it’s “too bad”. 

Issues are arising around interoperability.

“We need one or two years before we see products that can be used with any subscription, any device. Easy replacement does not have to translate into a lifetime contract with the card issuer,” said Mr Piednoir.

## Connected cars

Mr Corkerry pointed out that, according to research from Machina, connected cars will account for 52% of all cellular M2M connections in 2024.

The connected car allows you to access information on tyre pressure and fuel, and to lock and unlock your doors remotely from a smartphone application. Gartner predicts there will be 250 million connected cars globally by 2020.

Freddie McBride, Numbering and Networks Expert with the European Communications Office also had some interesting stats about cars. He focused on eCall, the European-wide initiative bringing rapid assistance to motorists involved in a collision within the EU. This is a compelling advancement in emergency services and by April 2018 all new cars sold in the EU must to be fitted with eCall.

“We've been looking at the issue of numbering (around eCall) for two years. Does eCall need numbers at all? Cisco say that by 2019, 50% of total M2M connections in Europe will be M2M. We should also look at it from the point of view of the traffic that generates: in the overall M2M market only 3% of connections will be cellular based.”

Essentially a mobile service, eCall needs wide geographic coverage and the ability to roam between networks.

Emergency calls from “simless” devices are not supported in a lot of European countries. eCall in-vehicle systems need an International Mobile Subscriber Identity Number (IMSI) and they need a telephone number (or E.164 number) to make a call and to the emergency services and present a valid calling line identification (CLI) to facilitate callback if needed.

There are some 270 million vehicles in Europe at present and each year 5% of stock is renewed. This means that every year, from 2018, there will be a demand for approximately 13 million new mobile telephone numbers for eCall devices alone.

Mr McBride said there are a number of options: Each country can assign national numbers; there can be dedicated M2M numbers or international numbering resources assigned by ITU-T.

“The biggest risk is that the burden of addressing eCall devices falls disproportionately on larger European countries,” said Mr McBride. These are the countries with strong car manufacturing industries, i.e. where the bulk of cars are made.

National authorities should be engaged with MNOs and the automotive industry to lessen the risk of number exhaustion, according to Mr McBride. Recycling numbers is one way to reduce this but he pointed out that there will be no significant recycling opportunity for at least 15 years.

The WG NaN is actively participating in the European eCall Implementation Platform's Task Force “Lifecycle management” in order to raise awareness of the numbering challenges related to the SIM during the vehicle's life time, and is expected

to publish a report in June. The WG NaN may follow up with guidelines in the form of an ECC Recommendation.

## Number portability

The relevance of number portability for eCall, or M2M in general, is not obvious as an E.164 number is used for addressing devices rather than a personal subscription. In fact, the workshop found that while number portability is important in many aspects of telecommunications, within M2M it does not seem very relevant.

Mr Vallesverd said: “There are 167 billion addresses available and the amount of assigned numbers is only 167 million. Is there a scarcity of M2M numbering available? Probably not.”

“Number portability is not too crucial for M2M. The most important thing is that you can switch providers easily,” he added.

However, the end-user has a strong right to retain the use of their number when switching, as is laid out in the EU's Universal Services Directive. With this in mind, the issue of portability and the M2M market needs careful consideration in the forthcoming review of the regulatory framework. One outcome of the M2M workshop was that it was recognised this was something worth revisiting in the future to encompass the switching of the M2M connectivity provider.

Panellists agreed that a new European Numbering solution was not necessary. Dr Julia Marquier, Member of the BEREC (Body of European Regulators for Electronic Communications) drafting team and Legal Expert/ Numbering referred to the recent BEREC report on IoT and M2M.

“From a cost-benefit perspective, BEREC believes that the introduction of a European numbering scheme does not seem to carry any significant benefits which would justify the deployment costs of setting up such a solution.”

It found that no special treatment of IoT or M2M communication appears necessary or appropriate except for roaming, switching and portability.

“The use of existing resources seems to be a realistic approach: the extraterritorial use of national numbers and the use of global numbers. There are very high costs to implement yet another layer of numbers,” she said.

However, clarification and/ or a new approach may be appropriate in certain areas. For example, in areas like switching providers, roaming or number portability.

“Roaming is very important in the IoT context because many M2M services, which use mobile connectivity, are currently based on permanent roaming,” said Dr Marquier.

Robert McDougall, Head of Enterprise Regulation at Vodafone, said the tech giant “wholeheartedly supports” BEREC’s statement that the number portability obligation might not be appropriate in cases where the E.164 number of the connected device is not known by the IoT user.

Extra-territorial use of E.164 numbers is an inevitable evolution of an inherently global M2M market, however.

Mr Corkerry said: “It would be harmful to insist on ITU global numbering resources as the exclusive, or even preferred, numbering option for deploying global M2M services.”

Restriction on extra-territorial use of numbers would stifle M2M roaming, he added.

“Manufacturers would need to build between 200-700 platforms to have global coverage and each platform costs hundreds of thousands of euros.”

There may be latitude for considering the creation of a light-touch pan-EU authorisation or notification for M2M/IoT. This could, it was found, reflect customer demand and facilitate pan-EU service provision.

Use of national numbers and international ITU-numbers should be considered as complementary options for the provision of global M2M services. Some speakers said they shouldn’t be promoted, imposed or prevented by regulation.

## National regulation

Francesco Bernabei, Chairman of the ECC/WG NaN’s Project Team on Future Numbering Issues talked about ECC Report 153 whose aim is to help National Regulatory Authorities (NRA) in their considerations on efficient numbering and addressing solutions for M2M applications

Options considered in the analysis included existing number ranges and the possible exhaustion of mobile resources in some countries; a new number range; an international numbering solution; network internal numbers and IPv6 addressing.

The report recommended that NRAs, working with market players, should establish solutions for M2M applications as part of the national numbering plan. It found that as a long term solution IPv6 addresses or numbers/addresses other than E.164 numbers should be used for M2M applications.

Permanent extra-territorial usage of E.164 for M2M services should not be prevented by national regulation. Instead, the introduction of 15-digit M2M number ranges should be recommended, it found.

“The important element here is to have a solution that can be used across Europe,” said Mr Bernabei.

At the M2M workshop, it was agreed that some of the challenges with international resources could be investigated further. However, transparency regarding the extra-territorial use of national numbers needs to be promoted, without putting disproportionate burdens on the M2M market.

## Security issues

Security and protection of data was a topic that arose time and again over the course of the two-day workshop. Mr McDougall spoke about how M2M was changing the way Vodafone is looking at how it does business.

“Data has a very important role to play. We have to put the right security and safety safeguards in place,” said Mr McDougall.

Dr Marquier drew attention to the fact that personal data may be collected by a number of devices. “If you have a sensor in your heating and it collects information from you such when you are home there are security issues,” she said.

With every new piece of technology, there are still questions to be answered and issues to be solved.

Collaboration between key stakeholders is necessary to ensure that the most appropriate solution is found, according to Mr McBride.

“From a numbering plan management perspective the numbering solution should provide sufficient capacity in the long term and be efficient and sustainable.”

---

# Spectrum Requirements and Technology Developments for M2M



With machine-to-machines communications set to grow rapidly in the coming years, this will cause pressure on the frequency bands, especially below 1GHz.

M2M traffic in wireless networks is expected to quadruple between 2015 and 2022. This is especially the case as machine type communications expand to different market segments. Energy, transportation, banking, healthcare, and consumer electronics are just some sectors in which the technologies are being advanced.

At the M2M workshop in Mainz in March, experts from across Europe gathered to discuss spectrum issues surrounding M2M.

Spectrum regulation is increasingly coming to the fore as regulators, industry and administrations try to meet the challenges and address potential issues created by the introduction of a multitude of M2M technologies into the market.

## 3GPP

The 3rd Generation Partnership Project has defined solutions for M2M. They include extended coverage GSM for Internet of Things (EC-GSM-IoT). Long Term Evolution cellular system and its variant LTE-M is another solution, which could carry a lot of the traffic for M2M communications.

Likewise, Narrowband Internet of Things (NB-IOT) is flexible and enables easy implementation, providing operational coverage and support for thousands of devices. Based on 200 kHz channel width it can easily be inserted in GSM, UMTS (universal mobile telecommunications systems) or LTE bands.

Interesting times lie ahead as 3GPP's Release 15 "pre-5G" will include M2M solutions. This is aimed for June 2018, with Release 16 coming by the end of 2019.

With a harmonised spectrum for mobile/ fixed communication networks (MFCN) already used for M2M, the question of whether there will be an impact on GSM switch off was posed at the workshop.

## Dedicated spectrum – 400 MHz bands

A number of speakers expressed interest in a dedicated spectrum for LTE M2M networks for utilities. Such spectrum in the 400 MHz bands was emphasised, taking into account the propagation characteristics of these bands.

Colin Chandler, chair of the Standards and Regulatory Working Group within 450 Alliance, said 450 MHz is best positioned for critical connectivity. The 450 MHz spectrum should, he said, be exclusive, offer cost effective coverage, low latency and robust mobility among other things.

"Physical propagation properties of 450 MHz allow building and operation of wireless networks for critical M2M applications with low investment and operational costs," said Mr Chandler.

Dr. Bernd Sörries, Chairman of the Information and Telecommunication Committee of the German Association of the Chambers of Industry and Commerce, said "from a technical viewpoint, lower frequency spectrum enables wider area coverage and better penetration deep into buildings".

The ECC/WGFM was called upon to consider whether Long Term Evolution studies in these bands could potentially take into account narrowband IoT. Other technologies for dedicated networks for M2M applications were also named such as LTN (Low Throughput Network), RPMA (Random Phase Multiple Access), Wireless M-bus, and IEEE 802.15.

## Dealing with increased congestion

One major issue facing the influx of M2M technologies is the increased congestion on the networks. More traffic will be carried over cellular networks, as well as low power local and wide area metropolitan networks, causing pressure on the current use in frequency bands - especially below the aforementioned 1GHz.

While spectrum demand is predominantly for spectrum below 1GHz, it may be complemented in the future with higher frequency bands.

Dr Michael Sharpe of the European Telecommunications Standards Institute (ETSI) said it was important to ensure that M2M devices do not send their data all together and congest the network. He referred to some solutions like that in 2G, where the Core Network (CN) can notify the Radio Access Network (RAN) of a CN overload situation.

“An implicit reject mechanism can be used by the network to reject all devices configured for low priority access,” he said.

With the majority of M2M devices sending or receiving only small amounts of data, their power consumption shall be as low as possible. This, said Dr Sharpe, should mean that the use of network resources “remains as efficient as possible”.

## The bands

From a regulatory point of view, commercial mobile bands may be suitable for providing many M2M services if certain conditions are met. The commercial networks may need to be 'hardened' or made more robust. For example, the radio link and network availability may need to be increased over time. In some cases dedicated networks may be necessary – especially when used for mission critical purposes such as smart electricity grids.

However, at the M2M workshop it was agreed that the M2M solutions will demand both, generally authorised spectrum as well as individually licensed spectrum (MFCN, Private Mobile Radio Systems (PMR), and Public Access Mobile Radio (PAMR)) as they are suitable for specific M2M requirements.

Not all solutions need to be treated the same in frequency regulation: solutions for short range / long range communication, including mesh network and ad-hoc network solutions may need to be treated differently. Similarly, some very asymmetric network solutions can also be treated contrarily.

## Generally authorised spectrum

Demand for generally authorised spectrum was also discussed. There is a strong request for more harmonisation in 870-876/915-921 MHz (Seven ETSI System Reference documents have been created and many presentations at the workshop addressed this topic) for technologies such as 802.11ah, BTLE, and 802.15.

Dr Benoît Ponsard, Director of Standardization in SIGFOX, said his organisation believes dedicated networks for IoT should “remain on license-exempt network bands”.

“It's important to keep them on license-exempt spectrum because of business issues. We don't want to have fully dedicated spectrum for one technology, this is not the spirit of sharing the spectrum. But we consider that in the long run if we wanted to be very effective in the spectrum policy it's better to have technologies sharing the same time frequency of occupation.”

Hamid Reza Karimi director at Huawei Technologies' Corporate Strategy Department, said his firm believes “sufficient harmonised spectrum is available for licence-exempt use by the IoT”. “In Europe this includes the well-established 862-870 MHz, 2.4 GHz, and 5 GHz bands, and the new 870-876/915-921 MHz bands which are in a process of harmonisation right now.”

Current regulatory framework conditions with regard to M2M, such as considering separately licensed and license-exempt bands, were not questioned.

Individually licensed, but non-exclusive, spectrum access may be an option (especially in 400 MHz, 870-876/915-921 MHz). So far, some demand has also been expressed for license-exempt usage of the 1900-1920 MHz band (DECT community, and some SRDs). It could also be an alternative for some more critical wireless industrial applications.

## Harmonisation

There was a strong request for more harmonisation in 870-876/915-921 MHz bands. Some 10 speakers addressed the topic. The 870-876 and 915-921MHz bands for SRDs, which is being underused in most European countries (see ECC Report 189), have been the subject of intensive studies within CEPT, such that now, new entries have been made on CEPT Recommendation 70-03 encouraging its release.

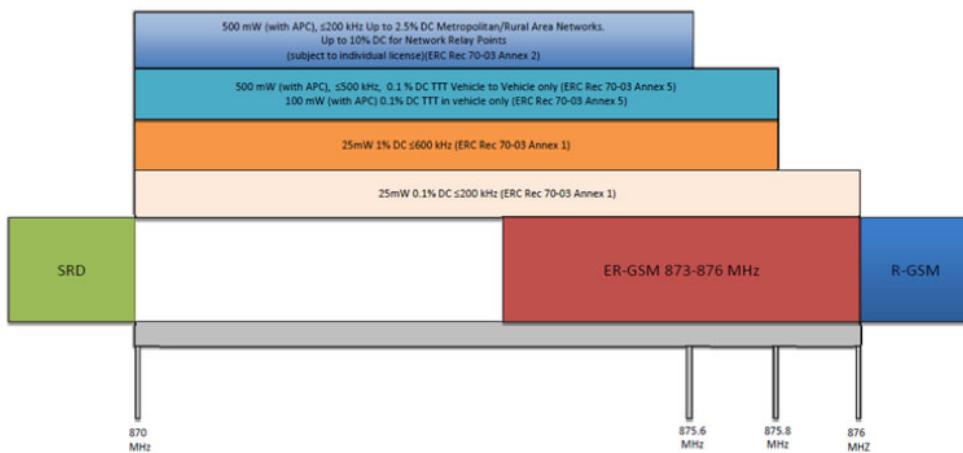


Figure: Current ERC Recommendation 70-03 – 870-876 MHz

One such speaker was Dr Joachim Sachs, Principal Researcher with Ericsson Research, who said harmonisation was important.

“If you really want to have a successful market that will enable economy of scale, it's really important that there is harmonisation of the rules within the EU and also on a global basis,” he said.

CEPT announced that an Addendum to CEPT Report 59 (6th update of EC Decision on SRDs) is planned for the end of this year.

For this, there is also the need to find a balance between national flexibility and the right level of EU harmonisation.

There are also some studies on-going and changes in the future may occur for the regulations, for example the introduction of more flexibility for the duty cycles.

## Duty cycles

The suitability of duty cycle definitions for M2M was taken into account. Some devices may normally transmit at very low duty cycles but have a need for a higher duty cycle when a specific event happens. For example, in cases of emergency or when an alarm goes off.

PMR solutions were discussed, notably in the 400 MHz band, in particular for mission-critical M2M applications and platforms. Likewise, they could be presented where there is a need for a larger degree of customisation of the network to the needs of the M2M network provider.

Different models, dedicated and shared IoT networks, also hybrids, are possible, and may be driven by business case needs. This could also trigger the need to find synergies for common national platforms.

## Shared spectrum access

Another option could be the appropriate authorisation or notification for shared spectrum access (especially in 400 MHz, 870-876/915-921 MHz). This could, it was suggested, achieve coexistence between M2M and the incumbent application, as well as between various M2M networks (see also ECC Report 132 for these options).

Over the course of the two days we heard from speakers from a variety of sectors. It was clear from the presentations that building, home automation, smart metering, intelligent transport systems, and wireless industrial sectors will be key areas when it comes to M2M. Even new market sectors could be developed by M2M applications such as remote healthcare and smart agriculture.

With this in mind, extra high voltage and high voltage smart grids will require enhanced communications and resilient systems. A low voltage smart grid would be appropriate for licence-exempt M2M spectrum.

Dr Simon Dunkley from Silver Spring Networks talked about metropolitan and rural area networks which use the Wi-Sun mesh network and how a smart grid can lead to a smart city. He looked at examples like Glasgow where sensors gather data and implement a dimming operation on street lighting based on pedestrian footfall, vehicular traffic, noise measurement and environmental sensors.

He called for consideration of the requirements for mesh-networks (self-organisation, indoor/outdoor frequency agile systems), as well as spectrum requirements: a minimum of 3 MHz would be required based on his experience.

## Constraints and needs

There are several challenging needs for some of the M2M applications. Massive deployment is one issue, i.e. the deployment will see up to several thousands of devices per square metre in metropolitan areas. But also in some cases – most notably when it comes to high voltage smart grids - very high reliable and very low latency communications will be needed.

Some questions still need to be answered for future road safety related intelligent transport systems. For example, how could the interoperability/coexistence of different technologies be ensured (ITS-G5, LTE-V2X) in the band 5875-5905 MHz?

In this regard, the views from the automotive industries are certainly relevant. Hybrid solutions with vehicle sensor platforms will also play an important role in future developments in road safety.

Interoperability between M2M devices should be achieved, and spectrum for Wireless Industrial Applications in the range 1.4 GHz to 6 GHz (about 80 MHz, e.g. 2 x 40 MHz) may need some review, by taking into account global requirements.

One thing's for certain lots more discussion will be needed as the IoT and M2M communications become ever-more commonplace in our society.

---