

PUBLIC CONSULTATION ON:
MACHINE-TO-MACHIN (M2M) AND INTERNET OF THINGS (IOT)
20 JANUARY 2019

Part 1: General Information

Legal Disclaimer

This Consultation is not a binding legal document and also does not contain legal, commercial, financial, technical or other advice. The Telecommunications Regulatory Authority is not bound by it, nor does it necessarily set out the Authority's final or definitive position on particular matters.

Invitation to Public Consultation

Request for comments

1. The Telecommunications Regulatory Authority (the “Authority”) invites all interested parties to submit written comments with regard to the issues addressed in the consultation document.
2. The Authority particularly welcomes comments and responses to the specific numbered questions set out in the “Public Consultation on the Machine-to-Machine and Internet of Things IoT” supported by appropriate substantiation.
3. Responses should be sent to the Authority preferably by email (PDF format) or post (Comments submitted in printed format, especially by post, must be accompanied by a CD-ROM or USB storage key containing the same comments in electronic format) to the attention of:

Telecommunications Regulatory Authority
P.O. Box: 3555
PC: 111, Seeb
Sultanate of Oman

Email: telecomlicense@tra.gov.om

4. Responses should include:
 - a. The name of the company/institution/association etc.;
 - b. The name of the principal contact person;
 - c. Full contact details (physical address, telephone number and e-mail address);
and
 - d. In the case of responses from individual consumers, name and contact details.

Format of comments

1. In providing their comments, interested parties are kindly requested to use the following template. In particular, any comment should clearly specify the numbered questions it is referring to and indicate any attachment relevant to the specific comment.

[Name of the company/ institution/ association]	{Name of principal contact person, and position}	[Contact information i.e. email address, telephone number, fax number, postal address etc.]
[Enter number of question] Example: Q1	[Enter here the exact wording of the question referred to]	
Comment	[Enter here your comment on the question referred to above]	
Substantiation	[Enter here the substantiation in support of your comment]	
Attachment	[Enter here number and title of any attached document relevant to your comment]	

2. The Authority expects the comments to follow the same order as the one set in the “Public Consultation on the Machine-to-Machine and Internet of Things IoT ” and summarized in the list of questions.
3. The Authority also invites respondents to substantiate their responses. Any response submitted without any substantiation may not be considered. In case of disagreement with one of the approaches proposed by the Authority, the respondent is invited to provide an alternative to such approach together with detailed justifications.
4. In the interest of transparency, the Authority intends to make all submissions received, available to the public. The Authority will evaluate a request for confidentiality in line with relevant legal provisions.
5. Respondents are required to mark clearly any information included in their submission that is considered confidential. Where such confidential information is included, respondents are required to provide both a confidential and a non-confidential version of their submission (soft copies and not scanned copies). If a part or a whole submission is marked confidential, reasons should be provided. The Authority may publish or refrain from publishing any document or submission at its sole discretion.

Way Forward

1. This consultation is open for public comments.
2. All relevant (substantiated) comments will be reviewed and the Authority may, at its sole discretion, consider those acceptable. Therefore, the Authority will not be bound to comply with any comment or opinion received and may not respond to comments or opinions individually. or more clarification concerning this specific consultation process, interested parties are invited to contact.

Part 2: The Consultation

Public Consultation on the Machine-to-Machin (M2M) and Internet of Things (IoT)

Preamble

The Internet of Things (IoT) is set to enable large number of devices to communicate and share data. This new connectivity has the potential to deliver significant benefits to the economy and society in general, across different sectors including: healthcare, transport, energy, agriculture...etc.

The IoT value chain comprises multiple elements: devices, connectivity, big data, data analytics, applications...etc., that form the echo system for the IoT and involves multi stakeholders.

As part of TRA mandate towards embracing new technologies and services in the telecom sector in the Sultanate, TRA is continuing the work it started to formulate an appropriate regulatory position that will support the uptake of the IoT; TRA approach towards formulating this position is based on the existing international development and experience while taking into consideration the legal and regulatory frameworks in the Sultanate and the stakeholders inputs.

After its call for inputs and the responses received from different stakeholders, TRA is proceeding with this public consultation on the subject in order to decide on the actions that it will take.

Issues that may be raised by IoT connectivity

Due to the fact that IoT interconnected devices will be growing significantly with the associated cross sectoral services and applications that will accompany this growth in the connectivity, TRA predicts the following:

- a. Wireless connectivity is likely to be the preferred approach for providing many of the interconnection between IoT devices.
- b. Such significant connectivity and its associated services and applications has the potential to raise new issues:

- (1) The need for additional spectrum and network infrastructure to provide the needed wireless connectivity.
- (2) The need for interoperable IoT standards to allow devices from different sectors to communicate with one another.
- (3) The security and privacy of the data gathered, stored and processed by IoT devices and/or service providers.
- (4) The vulnerability of devices to cyber threats.
- (5) The need for electronic addresses, including internet addresses, telephone numbers and other identifiers to identify the IoT devices.

Definition of the IoT

IoT services/applications are in varying phases of development worldwide and there is not yet a common definition of IoT services and applications.

A report published by the European Commission defines IoT as:

The Internet of Things enables objects sharing information with other objects/members in the network, recognizing events and changes so to react autonomously in an appropriate manner. The IoT therefore builds on communication between things (machines, buildings, cars, animals, etc.) that leads to action and value creation.

The ITU definition of IoT stipulates:

A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies.

The GSMA also defines IoT as:

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

For the purpose of this consultation and the state of the IoT industry, it may not be necessary to determine in detail which definition is most appropriate. Fixing a definition for IoT only makes a crucial difference if obligations depend explicitly on this definition.

So TRA will consider IoT to be a broadly defined term and it is always associated with machine to machine, or M2M communications, the two terms are related, but are slightly different:

- a. M2M describes the connectivity, usually through the use of wireless technologies, of devices that previously were not able to communicate.
- b. The IoT is a broader term, describing the connectivity of multiple M2M applications, often enabling the exchange of data across multiple industry sectors.

For simplicity, TRA will use the term IoT to refer to both internet of things and its constituent M2M connections.

Question

- 1. Do you agree with TRA point of view on the definition of M2M and IoT, if not please provide your justified point of view on this matter?**

IoT services/applications in the context of the telecommunications legal and regulatory frameworks in the Sultanate of Oman

Stakeholders are likely to raise the question on the applicability of the telecommunications legal and regulatory framework in the Sultanate of Oman on the IoT services and applications.

Such question concerns the obligations derived from qualifying an IoT service as a telecommunications service. Hence TRA has the role to identify the criteria for identifying an IoT service as a telecommunications service to eliminate/reduce any risk associated with the stakeholders' concerns.

The applicability of the current telecommunications legal and regulatory framework depends on whether the respective service in the IoT value chain is qualified as a telecommunications service according to the provisions of the Telecommunications Regulatory Act.

The definition of telecommunications service and the applicable legal and regulatory framework will be important elements in assessing whether a given service in the IoT value chain is a telecommunications service.

If a service is considered a telecommunications service, the proper regulatory set of rules including licensing as well as any other sector specific rules on data protection and network/data security will need to be applied.

According to the Telecommunications Regulatory Act, the following provisions are considered to be relevant to the qualifications of a service as a telecommunications service:

Article (1):

4. Telecommunications: Every conveyance, emission, transmission or reception of signals or symbols or signs or texts or visual and non-visual images or sounds or data or information of any nature by wire, radio, optical system, or other electro-magnetic or electronic systems.

10. Public Telecommunications Services: services offered by a licensee either by establishing infrastructure for public telecommunications network or by hiring a leased capacity from other telecommunications public network infrastructure available to any one according to the provisions of this act.

12 Repeated 5: Private telecommunications Services: Provision of telecommunications services for the interest of a natural or legal person or a group of persons having joint ownership for their private purpose, or the establishment or operation of a private telecommunications network infrastructure.

12 repeated 6: The Licensee: A natural or legal person who obtains the license in accordance with the provisions of this Act, whether the license is issued by a Royal Decree, a decision by the Minister or a decision by the Authority.

15. Frequency Spectrum (Radio Waves): A limited natural resource, of electro-magnetic wave of frequencies of less than three thousand GHz which are propagating in space without artificial guide.

16. Radio Communications: Conveyance, transmission or emission or reception of signals or symbols or signs or text or visual and non-visual images or sound or data of information of any nature through radio waves.

17. Repeated (1) License: The permission granted to a natural or legal person to establish, operate, manage telecommunications system or telecommunications network or to provide telecommunications services or use specified radio frequencies for specific uses in accordance the provisions of this law and the regulations and decisions issued in execution thereof.

Article (20)

No person is permitted to either establish or operate a Telecommunications system, nor provide telecommunications services, unless after obtaining license pursuant to the provisions of this Act, unless it is decided to exempt him pursuant to the regulations issued for this purpose.

Article (21):

1. Establishment or operation of public telecommunications network, or international telecommunications infrastructure or offering public telecommunications services or international access services shall be by way

of a "Class One" license issued by a Royal Decree based on a proposal by the Minister after the approval of the Authority. The Minister shall raise his proposal within two weeks of the Authority's approval of the application. The Decree shall determine the duration of the license; the license shall not include any terms or conditions which grant licensee is exclusive rights. In the event of the Minister's disapproval of the license application, he shall notify the applicant and the Authority on which ground he rejected the application within the specified period.

2. The provision of public telecommunication services that depend on using the capacity of telecommunication network of Class 1 license and the provision of additional public telecommunication services which require exploiting the national resources (numbering), without exploiting any natural resource of the Sultanate shall be through Class Two license issued by a decision of the Minister based on a proposal of the Authority after its approval. The decision shall determine the duration of the license which is not to exceed 10 years. The Authority may renew this license under the same conditions for a period not exceeding two thirds of the original duration. If the period is more, the renewal shall be as per new conditions and by a Royal decree for Class One license and by a decision of the Minister for Class Two license. The Authority, may by the same procedure, amend or reduce the duration of the license whenever public interest requires.

3. Establishing or operating private telecommunication services or offering these services by establishing or operating an infrastructure of a private telecommunications network not connected to the public network or by exploiting the capacity of public telecommunication network, shall be through Class Three License issued by a decision of the Authority for a period not exceeding 5 years.

Article (30)

No person may establish or operate a system or equipment using frequency spectrum, or provide telecommunications services or broadcasting services, except after being license by the Authority pursuant to the provisions of this

Act, unless it has been decided to exempt him pursuant to the regulations issued for this purpose.

According to the above provisions:

- a. The basic criteria for finding if an IoT service as a telecom service is that if the connectivity part of the service involves conveyance, emission, transmission or reception of signals or symbols or...etc.
- b. Telecom service need to be licensed, unless they are exempted pursuant to the regulations issued for this purpose.
- c. Frequency spectrum use needs to be licensed unless they are exempted pursuant to the regulations issued for this purpose.

Questions

- 2. Do you agree with TRA that an IoT service is a telecom service if the connectivity part of the service involves conveyance, emission, transmission or reception of signals or symbols or...etc. and this service needs to be licensed? If you do not agree please justify your point of view by using the relevant regulatory and legal framework applicable in the Sultanate.**
- 3. Do you agree that the type of the needed license shall be in line with the types of licenses listed in the Act? If you have a different opinion, please present it justified.**
- 4. Do you think that the license terms and conditions applicable to services used by Humans (voice, data, value added services) shall be applicable to IoT licenses? If not, what are the changes that you think are needed.**
- 5. In a future licensing regime, do you think that the IoT needs to be treated in a different approach?**

Numbering and Addressing

IoT devices will need to be assigned addresses so that they can be identified on the network and communicate with other devices. There is a range of options for addresses, depending on the network technologies used and whether the devices or applications require connectivity to the whole internet, or a local, private network, specifically:

1. Where devices are connected to a conventional mobile network, a telephone number could be used. This mirrors the allocation of telephone numbers to mobile phones;
2. Where the IoT application requires access to the global internet, a public internet protocol (IP) address could be used; and
3. Where the IoT application only requires access to a closed network, a private IP address, or some other form of locally recognizable address, could be used.

Mobile telephone numbers

IoT devices connected to a mobile network could, in principle, use a conventional telephone number for an address. However, if a significant number of devices were addressed in this way, this could put pressure on the supply of new mobile telephone numbers. Our initial assessment suggests that IoT devices are unlikely to use telephone numbers to the extent that this would put pressure on available numbers.

Global internet connectivity

1. There will be IoT applications that require access to the global internet, which will require devices to be assigned a public IP address. There are a relatively limited number of unique addresses conforming to the most commonly used format (known as IPv4/6). If the IoT develops to include a significant number of devices, as expected, there may be pressure on the pool of available IP addresses.

2. To date, the scarcity of unique IPv4 addresses has been managed by the use of network address translation (NAT). This effectively increases the number of IPv4- addressed devices that can be connected to the internet by having additional network equipment act as a gateway between local networks and the global internet. However, the use of NAT could lead to more complex and inflexible network architectures and is unlikely to be a sustainable solution given the expected number of IoT devices.
3. This suggests that, where global connectivity is required, a move from IPv4 to IPv6 is necessary to open up a significantly greater number of unique addresses for IoT devices. We note that many communications providers are progressing plans to support IPv6 and that a more widespread deployment of IPv6-capable equipment could act as an enabler for the IoT.

Local connectivity

1. The use of the term “Internet of Things” implies that all devices and applications will be connected to the internet. In practice, there will be many IoT applications that will only require access to a closed, private network, with no wider connectivity. In this case a public IP address is not required and the entire range of IPv4 or IPv6 addresses can be used.
2. Alternatively, and depending on the size of the deployment, a different type of address could be used. For example, it would be possible to use hardware or medium access control (MAC) addresses to uniquely identify devices within a local area network.
3. Such arrangements of having proprietary addressing may have limitations on switching the IoT service provider.

Questions

6. **Do you agree with TRA on the initial assessment of the demand of telephone numbers and IP addresses? If you don't agree, please justify your point of view.**

- 7. Do you agree with TRA that using proprietary addressing will limit the consumer choice when wanting to switch to another IoT service provider? If you don't agree, please explain why?**

Quality of Service

A number of wireless technologies may be used for the provision of IoT connectivity, some of them use dedicated licensed spectrum whereas others use shared unlicensed spectrum.

Different IoT services/applications require different networks performance measures, mission critical applications will require high availability networks as well as low latency response.

IoT services using shared spectrum are likely to be subject to multi user interference that will affect the quality of the connectivity, whereas services using dedicated licensed spectrum are already subject to different quality of service requirements.

TRA sees that IoT services /application using dedicated licensed spectrum should be subject to the quality of service measures applicable to the scope of other services and/or similar services utilizing this spectrum, whereas IoT services using shared spectrum the quality of services can be best effort.

Question

- 8. Do you agree with TRA approach on the measures for quality of IoT services control?**
- 9. Do you have another approach that can be seen as an alternative to TRA approach, please provide enough details on such alternative if it is proposed?**

Security and Privacy of Networks and Data

With the development and proliferation of IoT services, it becomes increasingly important to ensure secure and reliable communication among connected IoT devices. Different services will have different requirements for security and resilience. Many consumer services will not require a highly resilient network connection since temporary service interruptions will not significantly impact the integrity of the service provided. On the other hand, services that control important processes will require high levels of security and service availability. Such services could also be deployed over private networks.

Traditional security approaches may not be sufficient to address low cost devices used by many IoT services. When previously unconnected devices and then turned into connected devices, the security of the devices (through passwords, encryption and software updates) could be neglected in many instances. Due to limited resources in terms of energy and computing power, such IoT devices may be vulnerable to cyber-attacks. An increasing number of less secure connected devices, which are exposed to a wider audience, can become a potential privacy and information security target that can have negative effects on consumer perception of security and acceptance of IoT services.

There will also be some issues related to the capture, exchange and processing of personal or commercially sensitive data. Some of these issues may be common to networks used for human-centric communication, such as the capture of personal information by smartphones. However, the development of the IoT will lead to new privacy issues; for example, it may not be obvious to users that their data is being captured, especially if IoT devices and user interfaces are unfamiliar.

There is a danger that these privacy issues could hinder the development and widespread take-up of the IoT if they are not addressed. We are therefore interested in stakeholders' views on the scale and nature of privacy issues that will emerge.

Question

10. In your opinion, what are the steps required to enable the IoT to support high levels of security, resilience and privacy?

Roaming

Depending on the particular business model, the underlying connectivity service linked to IoT services, which is incorporated into IoT services, can be provided by mobile public communications networks. In such a case, the connectivity can be provided via international roaming or via domestic networks. Furthermore, according to the business models being developed, roaming can function on a permanent or a transitory basis. Examples of this fact can be found in some of the business models such as connected cars, agriculture measuring devices or smart meters that are distributed worldwide.

Question

11. What are your views on connectivity through roaming for both transitory and permanent roaming?

Spectrum

IoT services may be deployed using a range of communication technologies, both wired and wireless. However, many of these services will require the flexibility or mobility of wireless networks and will, therefore, rely on the availability of spectrum to support their connectivity

Moreover, there is no one, single description of the spectrum requirements for IoT services; rather, the spectrum requirements for a given IoT service will be heavily influenced by the specific nature of that service.

More specifically, in many cases, the requirements of a particular IoT service will influence the technologies used to provide it, which, in turn, determine the underlying spectrum requirements.

Questions

- 12. In your opinion, what would be the scale of magnitude of future spectrum demand for IoT services?**
- 13. Which specific frequency bands would be desirable for this demand?**
- 14. Should the spectrum be made available on a licensed or license exempt basis, and whether shared or dedicated spectrum bands will be needed?**

Summary of the Consultancy Questions

- 1. Do you agree with TRA point of view on the definition of M2M and IoT, if not please provide your justified point of view on this matter?**
- 2. Do you agree with TRA that an IoT service is a telecom service if the connectivity part of the service involves conveyance, emission, transmission or reception of signals or symbols or...etc. and this service needs to be licensed? If you do not agree please justify you point of view.**
- 3. Do you agree that the type of the needed license shall be in line with the types of licenses listed in the act? If you have a different opinion, please present it justified.**
- 4. Do you think that the license terms and conditions applicable to services used by Humans (voice, data, value added services) shall be applicable to M2M and IoT licenses? If not, what are the changes that you think are needed.**
- 5. In a future licensing regime, do you think that the M2M and IoT needs to be treated in a different approach?**
- 6. Do you agree with TRA on the initial assessment of the demand of telephone numbers and IP addresses? If you don't agree, please justify your point of view.**
- 7. Do you agree with TRA that using proprietary addressing will limit the consumer choice when wanting to switch to another IoT service provider? If you don't agree, please explain why?**
- 8. Do you agree with TRA approach on determining the quality of IoT services measures?**
- 9. Do you have another approach that can be seen as an alternative to TRA approach, please provide enough details on such alternative if it is proposed?**
- 10. In your opinion, what are the steps required to enable the IoT to support high levels of security, resilience and privacy?**

- 11. What are your views on connectivity through roaming for both transitory and permanent roaming?**
- 12. In your opinion, what would be the scale of magnitude of future spectrum demand for IoT services?**
- 13. Which specific frequency bands would be desirable for this demand?**
- 14. Should the spectrum be made available on a licensed or license exempt basis, and whether shared or dedicated spectrum bands will be needed?**
- 15. Do you agree that IoT devices should be subject to get type approval, and in the way TRA issues these type approvals?**
- 16. Do you think that TRA missed any important issue related to the IoT that you can add and elaborate on?**