Dear Sir,

We welcome the opportunity to submit our views on the Consultation Paper on 'Spectrum, Roaming and QoS related requirements in Machine-to-Machine (M2M) Communications', dated 18th October-2016 issued by the Telecom Regulatory Authority of India (TRAI).

Our recommendations are structured in two parts. First, we provide a general response to the need for developing efficient regulation for the introduction of M2M services to boost competitiveness and growth of the Indian ICT sector. This is followed by a detailed response to the questions raised in the Consultation paper.

Regards,

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Response to the TRAI Consultation Paper on 'Spectrum, Roaming and QoS related requirements in Machine-to-Machine (M2M) Communications'

Dear Sir,

We acknowledge TRAI's efforts to develop a regulatory framework for M2M in India and welcome the Consultation Paper on 'Spectrum, Roaming and QoS related requirements in Machine-to-Machine (M2M) Communications' initiated by TRAI. With a potential market of probably 50 million connected devices M2M offers tremendous opportunities across diverse fields.[1]

Recognizing the potential of M2M technology to improve the quality of life the government of India included M2M in its National Telecom Policy (NTP-2012). In May 2015, Department of Telecom (DoT) introduced the National Telecom M2M Roadmap to guide the development of M2M-related policies.[2] With improvements in the processor, sensor and wireless spaces, and development of applications the interest in M2M in India has never been higher. Given its benefits and unique challenges, M2M is more relevant than ever for consumers, business community, policymakers and academics.

Facilitating viable introduction and rapid adoption of M2M services in India requires frameworks that are flexible, limit barriers for participation, and minimize risks to consumers. Given that M2M technology is still at a nascent stage, we believe that the starting point for regulatory discussions should be consumer welfare, and encouraging new and diverse entrants into the M2M market. It is also critical that the economic costs and benefits of M2M services are weighed correctly against the harms they present to consumers. Failure to do so runs the risk of restricting innovation and depriving consumers of these benefits. As the M2M ecosystem develops regulation must foster technologically-neutral policies developed through an appropriate cost-benefit analysis incorporating economic insights.

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[1]TEC, " White Paper on "Machine-to-Machine Communication (M2M)",
http://tec.gov.in/pdf/Studypaper/White%20Paper%20on%20Machine-to-Machine%20(M2M)Communication.pdf
[2] Department of Telecom, National Telecom M2M Roadmap, May 2015
http://www.dot.gov.in/sites/default/files/National%20Telecom%20M2M%20Roadmap.pdf

M2M services may spread across industries as varied as road transport, aviation, shipping, power, agriculture, healthcare, industries, education etc., with the provision of connectivity being a common factor. M2M services require close coordination across sectors and industries, and the role of mobile network is largely confined to serve as a transport network. M2M communication could be carried over mobile networks (e.g. GSM-GPRS, CDMA EVDO networks). Accordingly, our recommendations focus only on the connectivity part of these M2M services as designing a regulatory framework for specific services is beyond our expertise.

Licensing Framework

We recommend an approach to licensing framework that enables existing and future TSP license holders to provide ancillary M2M services. Accordingly, we recommend that M2M Service Providers (MSP) should be introduced under the existing Other Service Provider (OSP) registration framework. Under this framework the network license is separated from service aspects however, the OSP as non-network operators are still required to register with DoT so that can bear responsibility for KYC compliance for SIMs in India.

Importantly, RFID and Bluetooth may also be connectivity options for future M2M services. Presently these technologies do not require a telecom license or authorization. TRAI should bear in mind that M2M connectivity providers typically contract with M2M device makers and not the consumer. Registration rather than a licensing framework would prove to be flexible approach that would encourage investment and growth of M2M services in India.

Spectrum: Additional Requirement

We recommend the allocation of a band of 10-12 MHz for low power M2M devices (other than those given in Table 2.3 of CP), as the current allocation of 3 MHz is not sufficient to cater to future M2M demands.

Spectrum: Bands

In addition to the bands identified Table 2.3 of the CP, we recommend the use of frequency band of 0 - 500 KHz for narrowband M2M communications and 2 - 200 MHz for broadband M2M communications. Use of additional bands is currently being tested globally and M2M services in the future could vary in their characteristics such as high throughput/low throughput; long range/short range, etc. We recommend TRAI introduce a flexible framework for spectrum that can accommodate issues such allocation of additional frequencies in the future. TRAI should also benchmark the need and use of spectrum

following a review of the agenda and activities leading up to WRC-19 at the International Telecommunications Union (ITU).

Roaming: Permanent / International

We recommend that permanent roaming be allowed for foreign SIM / eUICC as not doing so will impede growth of M2M applications. Consumer welfare and economic performance through M2M application and services is not possible without the free flow and exchange of data. There remains an apprehension about the ownership, collection and use of data, however requiring the use of a local SIM may not enhance the availability of data significantly. On the other hand, it is also important that laws must be in place, to give Indian law enforcement agencies (LEAs) have access to data when necessary and compliance of foreign companies with LEA requests has been an issue in the past.

Keeping in view the potentiality of consumer harm, and need for Indian government to control the flow of data, we recommend that permanent roaming be allowed on the condition that a framework to regulate the collection and use of data to minimize the risk of data abuse is put in place. These risks must be weighed with as much precision as possible, as is the case with potential consumer benefits, in order to guide sensible policy for data collection and use.[3] Roaming charges for permanent roaming should be decided by market dynamics, and commercial roaming agreements in India, provide adequate guidance on this.

Roaming National

We recommend that the national roaming agreement for MSP must be framed based on commercial roaming standards as implemented across the telecom sector.[4] Roaming charges should not be prescriptive but be market driven and decided through mutual agreement between TSP's and MSP's. Critical services such as Emergency Services must be exempted from such charges.

Numbering: Mobile Network Code

We recommend following the MVNO / OSP numbering model. Numbers should only be assigned to the TSP and it should have an option of sub-assigning them to the MSP. The TSP should bear the primary responsibility of complying with interconnection, roaming etc.

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[3] How to Regulate the Internet of Things Without Harming its Future: Some Do's and Don'ts Remarks of Joshua D. Wright∗ Commissioner, Federal Trade Commission at the U.S. Chamber of Commerce Washington, D.C. https://www.ftc.gov/system/files/documents/public_statements/644381/150521iotchamber.pdf

[4] License Agreement for Unified License, DoT, Ministry of Communications & IT accessed on 10th January, 2017.. http://dot.gov.in/sites/default/files/Unified%20Licence_0.pdf

Growth of M2M devices will increase demand of numbering series for such services. However, the numbering resources are limited and will not be sufficient to support future growth in the devices. To address this problem, separate numbering scheme (such as 11 digit or more) should be prescribed for M2M Services. TSP's are eventually moving to Packet Switching based 4G / LTE network and M2M is a data based service. We recommend M2M services must be based on IPv6 platform.

Data: Network / Privacy / Security

As per our recommendations TSP's will be the data carrier for M2M and must comply with regulations mentioned in the Indian Telegraph Act, 1885 and the Information Technology Act (IT Act 2000). However, there is an urgent need for India to align itself to global best practices in privacy and data protection. TRAI should not approach privacy specifically in the context of M2M services and devices rather seek a more holistic framework that minimizes security and privacy risks across the ecosystem.

Responses to Specific Questions

Q1. What should be the framework for introduction of M2M Service providers in the sector? Should it be through amendment in the existing licenses of access service/ISP license and/or licensing authorization in the existing Unified License and UL (VNO) license or it should be kept under OSP Category registration? Please provide rationale to your response.

Framework

We recommend that the M2M Service Providers (MSP) should be registered as Other Service Provider[5] (OSP). MSP should be a Company or a LLP registered under the Companies Act, 1956[6], or the Companies Act-2013[7], or as "LLP" registered under LLP Act-2008[8]. They must fulfill the terms and conditions as prescribed in the agreement for OSP's. They must also not interfere in the jurisdiction of any TSP's license and shall not provide any service which has not been registered by them.

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[5]Terms and conditions for OSP registration.
http://dotosp.gov.in/OSP_files//ospTermsandConditions.pdf
[6]The Companies Act, 1956
http://www.wipo.int/edocs/lexdocs/laws/en/in/in088en.pdf
[7] Ministry of Law and Justice. (Legislative Department), "The Companies Act, 2013" published on 29th August, 2013
http://www.mca.gov.in/Ministry/pdf/CompaniesAct2013.pdf
[8] Ministry of Corporate Affairs, "The Limited Liability Partnership Act- 2008", Home>Acts & Rules>The Limited Liability Partnership Act, 2008. Accessed on 2nd December, 2016.
http://www.mca.gov.in/MinistryV2/llpact.html

In countries like USA and Germany, the VNO are licensed to provide the M2M services, under the existing TSP's. In UK and Brazil, the MVNO provide the M2M Services (Please refer to the appendix). This is basically because of the fact that, connectivity is the common link between various types of M2M Services and all M2M services work on the backbone of Data Infrastructure.

In India, we recommend following the OSP framework, as it will allow more players to come into the M2M ecosystem. This is necessary, as M2M services are in initial development stage and such a step will help the sector to flourish, promote innovation and support growth. OSP framework will allow the MSP to build on the existing infrastructure of the TSP's. This will reduce their investments and hence bring in more players into the M2M ecosystem. This will also encourage competition and ultimately benefiting consumers.

Registration

The MSP must be registered under the Indian Companies Act, 1956 or Indian Companies Act-2013[9] OR as "LLP" registered under LLP Act-2008[10]. MSP must work on the backbone of a TSP, licensed under the Indian Telegraph Act, 1885. TSP's must provide resources to the MSP only after examining the nature of service they tend to provide.

Regulatory Power

TRAI must have the power to take strict action such as a financial penalty or cancellation of the registration, if the MSP violates any of the conditions. TRAI must also have the right to audit the MSP as and when needed. Sector specific regulations must also be framed with the coordination of various agencies, ministries and stakeholders.

A MSP must:

- Ensure proper record of all the devices used in their M2M ecosystem. (User details as well as device details like - IP / MAC address / IMEI, ESN etc).

- Adhere to the Know Your Customer (KYC) and traceability guidelines issued by TRAI. TSP responsible for all telecom resources including SIM enabled devices, devices on local networks, etc.

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[9]Ministry of Law and Justice. (Legislative Department), "THE COMPANIES ACT, 2013" published on 29th August, 2013
http://www.mca.gov.in/Ministry/pdf/CompaniesAct2013.pdf

[10]Ministry of Corporate Affairs, "The Limited Liability Partnership Act- 2008", Home>Acts & Rules>The Limited Liability Partnership Act, 2008. Accessed on 2nd December, 2016.
http://www.mca.gov.in/MinistryV2/llpact.html

- Maintain details of all the customers of M2M services i.e. physical ownership of the machines fitted with SIMs, shall be maintained by the MSP.

- Update information like details of M2M devices i.e. IMEI, ESN, etc. / Make, Model, Registration number, etc. of the machines (Cars, Meters, POS, etc.) & corresponding physical custodian's name and address. Changes in the customers and machines details must also be updated by the MSP.

- Ensure the Quality of Service (QoS) as stated by the regulator. They must adhere to the QoS standards of the authority and provide timely information when required. Failure to follow the QoS standards must be treated as breach of terms and conditions of their registration.

- Follow the regulations related to the disaster management/emergency services as instructed by TRAI.

Q2. In case a licensing framework for MSP is proposed, what should be the Entry Fee, Performance Bank Guarantee (if any) or Financial Bank Guarantee etc? Please provide detailed justification.

TRAI's regulations regarding OSP in context of entry fees and bank guarantee may be applied to MSPs. There shall be no Entry Fee for the MSP's and the Bank Guarantee shall be Rs. 50 Lakhs or Rs. 1 Crore as applicable under section 4(A) or 4(B), Chapter IV of OSP regulations.[11]

Q3. Do you propose any other regulatory framework for M2M other than the options mentioned above? If yes, provide detailed input on your proposal.

We do not recommend other regulatory frameworks than the OSP model, for the reasons outlined above. However, there is need for close cooperation and liaison between multiple agencies, ministries and stakeholders. This is because M2M Services will be spread across sectors. For example M2M based Healthcare Emergency service will involve Telecom, Road Transport and Healthcare Sectors. Similarly other M2M Services may be linked to one or more of the sectors like Industries, Telecom, Healthcare, Education, Power, Infrastructure, Road Transport, Shipping, Railway, etc.

Regulatory bodies of these sectors must discuss, develop and implement sector specific regulatory sub-framework. A multistakeholder approach for coordination, cooperation and

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[11] Revised "Terms and Conditions - Other Service Provider (OSP) Category"
http://dotosp.gov.in/OSP_files//ospTermsandConditions.pdf

consensus between various departments and ministries for such services may be most appropriate. We recommend that TRAI serve as the supervising body for any such coordination frameworks, as communications will be the common link between all sectors.

Q4. In your opinion what should be the quantum of spectrum required to meet the M2M communications requirement, keeping a horizon of 10-15 years? Please justify your answer.
Q5. Which spectrum bands are more suitable for M2M communication in India including those from the table 2.3 in the consultation paper? Which of these bands can be made delicensed?
Q6. Can a portion of 10 MHz centre gap between uplink and down link of the 700 MHz band (FDD) be used for M2M communications as delicensed band for short range applications with some defined parameters? If so, what quantum? Justify your answer with technical feasibility, keeping in mind the interference issues.

On assessing the potential implications for radio spectrum of growing demand for machine to machine (M2M) applications over the next decade, Aegis Systems Ltd and Machina Research, have identified two broad categories namely short range and wide area. In their report, 'M2M application characteristics and their implications for spectrum[12] they note that some applications may involve more than one technology. Many technologies are already widely available, whereas others are relative newcomers or still under development. M2M networks could develop utilizing both fixed and mobile communication networks and network types may be either concentrated or dispersed. The basic M2M technologies identified in the report are summarized below:

M2M Technologies.

Sr. No.	Coverage.	Description.	Use.	Spectrum Used.
1.	Short Range.	Bluetooth.	Alarm, Medical Devices, etc.	2.4 - 2.485GHz[13].
2.	Short Range.	Wi-Fi.	RF ID, Traffic Signals, etc.	2.4, 3.6, 5 and 60 GHz[14].

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[12] Aegis Systems Ltd and Machina Research,'M2M application characteristics and their implications for spectrum', Final Report, 13th May 2014, https://www.ofcom.org.uk/__data/assets/pdf_file/0040/68989/m2m_finalreportapril2014.pdf

[13] What is Bluetooth?, Home> What is Bluetooth> How It Works> Bluetooth BR EDR, https://www.bluetooth.com/what-is-bluetooth-technology/how-it-works/br-edr , accessed on 28th December, 2016.

[14] What is WiFi and How Does it Work?, published in December, 2016, http://ccm.net/faq/298-what-is-wifi-and-how-does-it-work , accessed on 28th December,2016.

3.	Wide Area.[15]	GSM Cellular Network.	Long range outdoor network.	800, 850, 900, 1800, 2100, 2300, 2500 MHz[16]
4.	Wide Area	CDMA Cellular Network.	Long range indoor network.	700, 800, 850, 1900 MHz[17].
5.	Short Range.	Sigfox.[18] (Ultra Narrow Band)	Electric Meter, Smart watches, Washing Machines. (emits small but continuous data.)	Sub 1GHz[19].
6.	Wide Area.	Weightless.[20] (Low power, wide area network)	Vehicle Tracking, Asset Tracking, E-Payment Infrastructure, Industrial Machines, etc.	Sub-1GHz[21].
7.	Wide Area.	Narrowband[22]. (Low power, wide area network)	Gas Meter, Water Meter, Goods Tracking, Street Light operations, etc.	Sub 1 GHz[23].

According to Cisco Internet Business Solutions Group (IBSG) there will be around 50 million connected devices and 6.58 devices per person, across globe by 2020.[24] Based on the above Cisco-IBSG research TEC DoT calculated that in a Unit Cell of 2 Square Km there

[15] Aegis Systems Ltd and Machina Research,'M2M application characteristics and their implications for spectrum', Final Report, 13th May, 2014.
https://www.ofcom.org.uk/__data/assets/pdf_file/0040/68989/m2m_finalreportapril2014.pdf

[16] GSM Bands, http://www.gsmarena.com/network-bands.php3, accessed on 28th December,2016.

[17] CDMA Network and Frequency, http://www.droid-life.com/2015/02/05/us-wireless-carrier-bands-gsm-cdma-wcdma-lte-verizon-att-sprint-tmobile/ , accessed on 28th December,2016.

[18] "We power the IoT with the simplest communication solutions.", https://www.sigfox.com/, accessed on 27th December,2016

[19] "What's the Difference Between Broadband and Narrowband RF Communications?" by Jean-Jacques DeLisle , published on 14th November, 2014
http://mwrf.com/systems/what-s-difference-between-broadband-and-narrowband-rf-communications

[20] "What is weightless", http://www.weightless.org/about/what-is-weightless , accessed on 27th December, 2016.

[21] "What is Weightless?", http://www.weightless.org/about/what-is-weightless, accessed on 28th December, 2016.

[22] "Narrowband IoT (NB-IoT)", Home>Innovation>Technology>Narrowband IoT, https://www.u-blox.com/en/narrowband-iot-nb-iot accessed on 27th December, 2016.

[23] "What is Narrowband IOT?",Home » 5G guides » What is Narrowband IoT?, https://5g.co.uk/guides/what-is-narrowband-iot/ accessed on 28th December, 2016.

[24] "The Internet of Things: How the Next Evolution of the Internet Is Changing Everything" by Dave Evans, published in April, 2011. http://www.cisco.com/c/dam/en_us/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf

will be a need of 65800 Nodes.[25] Further, the average amount of data transmitted by all the devices in the Unit Cell will be 6580000 Bits / Second. Hence, the frequency band required to handle all the data will be 20 MHz in the 200 KHz channel if the data rate is 50 KBPS and 20.8 MHz in the 400 KHz channel if the data rate is 100 KBPS.

Various countries have allocated large amount of unlicensed frequencies for IoT/IoE/Smart Cities initiatives, in the sub-GHz band. North America and South America have allocated 26 MHz, Australia has 13 MHz and Japan has 8 MHz. Europe and most of the middle-east countries and even Africa has allocated more than 7 MHz of unlicensed spectrum. However India has allocated only 3 Mhz for this purpose.[26] Currently, USA is in process of allowing use of 900 MHz frequency for M2M Services.[27] UK has plans to provide extra spectrum for M2M services based on the future needs.[28] Germany is allocating 700 MHz and 800 MHz (mix of licensed and unlicensed) for M2M services.[29] Brazil is also planning to allocate 700 MHz spectrum for telecom and M2M services[30]. The existing unlicensed frequency band of 865-867 MHz in India, would not be sufficient to cater to future requirements of M2M Services. Based on research conducted by TEC and DoT we recommend allocation of a band of 10-12 MHz for low power RF devices.[31]

In addition to the bands identified Table 2.3 of the CP, we recommend the use of frequency band of 0 - 500 KHz for narrowband M2M communications and 2 - 200 MHz for broadband M2M communications. Given that use of additional bands for M2M is being tested currently or in the light of any new technologies (uptake of 5G across globe) which may evolve in the

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[25] "3.3 Quantitative analysis of spectrum requirement ", page 24, Technical Report, TEC, DoT, http://tec.gov.in/pdf/M2M/Spectrum%20requirements%20%20for%20PLC%20and%20Low%20power%20RF%20communications.pdf

[26] "3.6 Global Frequency Spectrum Allocation Scenario", page 28, Technical Report, TEC, DoT, http://tec.gov.in/pdf/M2M/Spectrum%20requirements%20%20for%20PLC%20and%20Low%20power%20RF%20communications.pdf

[27] "Wireless Telecommunications Bureau seeks comment on M2M spectrum networks petition for rulemaking to allow specialized mobile radio services over 900 Mhz business / industrial land transportation frequencies." dated 21st August, 2015
https://apps.fcc.gov/edocs_public/attachmatch/DA-15-944A1.pdf

[28] "Transport Final Report", by Steve Methley, Chris Davis and John Parker, published on 24th June, 2008
https://www.ofcom.org.uk/__data/assets/pdf_file/0027/31878/trans1.pdf

[29] "M2M Monthly: a guide to recent machine-to-machine and IoT developments", Home > Research Services > Commsupdate, published on 10th november, 2016,
https://www.telegeography.com/products/commsupdate/articles/2016/11/10/m2m-monthly-a-guide-to-recent-machine-to-machine-and-iot-developments/

[30] 700 MHz Spectrum Processes in Latin America, published in August,2015
http://www.4gamericas.org/files/8314/4051/7653/4G_Americas_700_MHz_Spectrum_Process_Lat_Am.pdf

[31] "M2M Enablement in Power Sector - Spectrum requirements for PLC and Low power RF communications", TEC, DoT, released in November,2015.,
http://tec.gov.in/pdf/M2M/Spectrum%20requirements%20%20for%20PLC%20and%20Low%20power%20RF%20communications.pdf

future, TRAI must keep provisions for accommodating the same in any regulatory framework for M2M related spectrum management.

> Q6. Can a portion of 10 MHz centre gap between uplink and down link of the 700 MHz band (FDD) be used for M2M communications as delicensed band for short range applications with some defined parameters? If so, what quantum? Justify your answer with technical feasibility, keeping in mind the interference issues.

No Comments.

> Q7. In your opinion should national roaming for M2M/IoT devices be free?
>
> (a) If yes, what could be its possible implications?
>
> (b) If no, what should be the ceiling tariffs for national roaming for M2M communication?

We recommend that the national roaming agreement for MSP must be framed based on the telecom[32] standards. The mutual agreement between TSP's and MSP's must be left to the market dynamics. Critical services such as Emergency Services must be exempted from such charges. Ceiling tariffs for national roaming should also be the same as applicable for TSP's because the network and infrastructure used will be of the TSP's.[33]

> Q8. In case of M2M devices, should;
>
> (a) roaming on permanent basis be allowed for foreign SIM/eUICC; or

Currently, there are lots of uncertainties around the issue of permanent roaming regulations globally. Research conducted by Machina Research on issues related to permanent roaming across 68 countries, shows over 80% had regulatory uncertainty on this issue.[34] Of the two countries have strict rules against it, eleven permitted it and the rest fifty-five were not clear about this issue, on regulatory part. Certain countries have strict rules prohibiting permanent roaming, whereas the others allow it as of now.

This is based on the fact that permanent roaming includes challenges like:

- National regulatory oversight.

- Customer protection.

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[32]License Agreement for Unified License, DoT, Ministry of Communications & IT accessed on 10th January, 2017..
http://dot.gov.in/sites/default/files/Unified%20Licence_0.pdf

[33] TRAI, "TRAI reduces ceiling tariffs for national roaming service and mandates a special roaming tariff plan" Information note to the Press (Press Release no. 26/2015), published on 9th April, 2015.
"http://trai.gov.in/WriteReadData/WhatsNew/Documents/PR-of_TTO_60th-09042015.pdf"

[34] Press Release, 'Regulation has the potential to disrupt the growth of the Internet of Things', Survey Press Release, 20 August 2014 https://machinaresearch.com/news/press-release-regulation-will-increasingly-disrupt-the-iot-landscape-survey/

- Lawful interception

- Number portability.

- Possible exhaustion of number ranges[35].

Allowing permanent roaming on the other hand will help the M2M ecosystem to develop in India at the same pace with that in other countries. It will allow India to take up the advanced M2M technologies from the very beginning itself. This will ensure we do not lag behind the world as it happened in case of 3G and 4G telecom adoption. We recommend, allowing permanent roaming on the condition that the Indian TSP, on whose infrastructure, the SIM will be roaming in India, be the primary data owner. This will ensure that Indian law enforcement agencies will have a direct access on these data, as and when needed.

Q8. (b) Only domestic manufactured SIM/eUICC be allowed? and/or

Q8. (c) there be a timeline/lifecycle of foreign SIMs to be converted into Indian SIMs/eUICC?

Using an Indian or foreign SIM may not be an issue, as long as the data ownership is with an Indian TSP. Though, the MSP must be motivated to have the SIM / eUICC of an Indian TSP integrated at the OEM's end, in case the device will be permanently roaming in India. This will not be tough as Indian TSP's have provisions for all kind of SIM / eUICC as per the global standards. Financially allowing international roaming will not have much impact and switching is possible as the cost of a SIM / eUICC is negligible if compared to any basic M2M Device. Services support for M2M services should adequately equipped to integrate SIM / eUICC of Indian TSP into the M2M Devices.

Q8. (d) any other option is available? Please explain implications and issues involved in all the above scenarios.

Programmable SIM solution (eUICC)[36] is a better option to be used in the case of permanent roaming. A eUICC has a minimum memory of 512KB and has multiple profile holding capacity. These can be easily programmed as a local SIM, in contract with any Indian TSP.

A second solution can be using dynamic 'IMSI swap'. This technology will allow remotely downloading a new mobile identity into the devices.[37]. This will enable any M2M device to

[35] Matt Hatton, 'Regulation, and particularly permanent roaming, promises a significant impact on M2M and IoT in 2015', IoT Now, 8 January 2015, http://www.iot-now.com/2015/01/08/28998-regulation-particularly-permanent-roaming-promises-significant-impact-m2m-iot-2015/

[36] 'eUICC: what it is and why it matters', by Casey Angland, published on www.emnify.com, dated 29th January, 2016, https://www.emnify.com/2016/01/29/euicc-what-it-is-and-why-it-matters/

move from its home network and become a local device in its new roaming network, by downloading a local MNC. This technology is still in its development phase.

Q9. In case permanent roaming of M2M devices having inbuilt foreign SIM is allowed, should the international roaming charges be defined by the Regulator or it should be left to the mutual agreement between the roaming partners?

Decision regarding the international roaming charges must be left to the market dynamics and regulator must not intervene into such issues. The data ownership in such cases must be mandated to be with Indian TSP, on whose network the international SIM is roaming.

Q10. What should be the International roaming policy for machines which can communicate in the M2M ecosystem? Provide detailed answer giving justifications.

The mutual agreement between TSP's and MSP's must be left to the market dynamics. The Data ownership in such cases must be mandated to be with Indian TSP, on whose network the International SIM is roaming.

Q11. In order to provide operational and roaming flexibility to MSPs, would it be feasible to allocate separate MNCs to MSPs? What could be the pros and cons of such arrangement?

In reference to numbering, we recommend following the MVNO numbering model for MSP. The MSP latches to it's primary TSP (UL Access). Numbers should only be assigned to the TSP and it should have an option of sub-assigning them to the MSP. The primary responsibility of complying with interconnection, roaming etc., should be that of the TSP. M2M devices work on the SIM cards issued by the TSP's and is assigned numbers accordingly.

Growth of M2M devices will increase demand of numbering series for such services. However, the numbering resources are limited and will not be sufficient to support future growth in the devices. To address this issue Germany`s 'Bundesnetzagentur'[38] and Belgium regulator IBPT conducted consultations[39] as early as 2011. The European Conference of

[37]Evolving Systems, 'Dynamic SIM Allocations', White Paper, 2009 http://www.gsma.com/membership/wp-content/uploads/2012/03/Dynamic_SIM_Allocation_Solution_Overview_WP.pdf

[38]'German telecommunications regulator enacts new rules to facilitate M2M communication', by Sven-Erik Heun, Valerian Jenny, Simon Assion, published on 23rd June, 2016. http://www.twobirds.com/en/news/articles/2016/germany/june/german-telecommunications-regulator-enacts-new-rules-to-facilitate-m2m-communication

[39]'Consultation of 7 September 2010 on setting out the numbering policy relating to M2M communications', dated 30th September, 2010, http://www.bipt.be/en/operators/telecommunication/Numbering/regulation/consultation-of-7-september-2010-on-setting-out-the-numbering-policy-relating-to-m2m-communications

Postal & Telecommunications Administrations (CEPT)[40] has also issued a recommendation on this issue. Some other countries like Malaysia, have started an 8 digit numbering for M2M Devices and are planning to move to IPv6 standards soon.

Numbering Series

A separate numbering scheme (such as 11 digit or more) should be prescribed for M2M Services so that these services can be easily identified, if it doesn't adds to the complexity of the TSP's. We may have shortage of MNC in the future keeping in mind the fast paced growth of devices across the globe.

IPv6

TSP's are eventually moving to Packet Switching based 4G / LTE network and M2M is a data based service. So we recommend M2M services must be based on IPv6 platform.[41] Building M2M services on the advanced and upcoming technology (IPv6) will be economically feasible in the long run. This will also eliminate the problems of switchover from IPv4 to IPv6 in the future.

Q12. Will the existing measures taken for security of networks and data be adequate for security in M2M context too? Please suggest additional measures, if any, for security of networks and data for M2M communication.

Security and protection of data are critical issues linked to the deployment and creation of regulatory framework for M2M. Data has a very important role to play as personal data may be collected by a number of devices. 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 right security and safety safeguards are in place. In general, there is increasingly stringent legislation on how data is managed. For instance, the EU's General Data Protection regulation was passed into law in March. This will have implications for any organization looking to transfer or store data. One of the specific ways in which data regulations might affect M2M and IoT deployments relates to the international transfer. So-called 'data sovereignty' concerns the ability of organizations to send data overseas.

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[40]Numbering and Addressing in Machine-to-Machine (m2m) Communications, dated November, 2010, http://www.cept.org/files/5424/documents/ECC%20REP%20153%20-%20Numbering%20and%20Addressing%20in%20Machine-to-Machine%20(M2M)%20Communications.pdf

[41] 'IPv6 (Internet Protocol Version 6)', by Margaret Rouse, Home> IP networks> Internet acronyms and lingo> IPv6 (Internet Protocol Version 6), http://searchenterprisewan.techtarget.com/definition/IPv6

Regulations vary wildly around the world and could have implications for how applications are managed, and even how connectivity is provisioned.[42]

Additional measures: M2M specific measures can be stated as[43]

1. M2M Data with the TSP: TSP's will basically act as data carrier only in the M2M service sector Hence existing security and encryption related regulations mentioned in the UL License, are enough.

2. M2M Data with the MSP: The MSP's will be inducted under the MVNO framework. Hence, they have to comply with regulations mentioned in the Indian Telegraph Act, 1885 and IT Act 2000. These both will provide a comprehensive framework for ensuring network and data security. For data in the service provider's domain, the data collections rules will be regulated by architecture standards, on which One M2M alliance and TEC working groups are currently deliberating. These standards in conjunction with IT Act governing current data service will be enough for ensuring security among service providers.

3. M2M Data at Device: Device specific regulatory guidelines need to be framed for M2M devices. Guidelines for Mobile and WiFi devices (IMEI) can be taken to frame these regulatory guidelines

Guidelines make MSP liable for content placing on them the obligation to take necessary measures to, "prevent objectionable, obscene, unauthorized or any other content, messages or communications infringing copyright, intellectual property etc., in any form, from being carried on the network, consistent with the established laws of the country. Once specific instances of such infringement are reported to the MSP by the enforcement agencies, the MSP shall ensure that the carriage of such material on the network is prevented immediately." Guidelines also state that MSP is liable for ensuring public safety in installations, maintaining security of network, confidentiality of data, protection of privacy, guarding against illegal interception of communication, counteracting espionage, sabotage and other illegal activities. Such broad regulations may be restrictive in facilitating M2M growth in India.

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[42] Jyoti Panday, 'Contestations of Data, ECJ Safe Harbor Ruling and Lessons for India', October 2015, http://jyotipanday.com/2016/03/08/contestations-of-data-ecj-safe-harbor-ruling-and-lessons-for-india/

[43] Vivek Pai, 'DoT's national M2M roadmap: On regulation, policy, issues and focus areas', Medianama, May 2015 http://www.medianama.com/2015/05/223-dots-national-m2m-roadmap-on-regulation-policy-issues-and-focus-areas/

> Q13. (a) How should the M2M Service providers ensure protection of consumer interest and data privacy of the consumer? Can the issue be dealt in the framework of existing laws?
>
> (b) If not, what changes are proposed in Information Technology Act. 2000 and relevant license conditions to protect the security and privacy of an individual? Please comment with justification.

As per our recommendations TSP's will be the data carrier for M2M and must comply with regulations mentioned in the Indian Telegraph Act, 1885 and the Information Technology Act (IT Act 2000). However, there is an urgent need for India to align itself to global best practices in privacy and data protection. TRAI should not approach privacy specifically in the context of M2M services and devices rather seek a more holistic framework that minimizes security and privacy risks across the ecosystem. There are a wide variety of standards bodies and industry coalitions working on security specifications for M2M and TRAI should pay close attention to their recommendations. Regulatory guidelines may need to be framed for M2M devices and existing guidelines for mobile and WiFi devices (IMEI) can provide guidance on this. As M2M technology is evolving very fast, there are many threats that are as yet unknown. Therefore, instead of prescriptive framework TRAI should develop a flexible approach that can adapt to emerging and evolving risks.

Annex 1

Jurisdictional Analysis for M2M Connected Vehicles.

The following framework for the M2M connected vehicles across countries was developed to do a comparative study of M2M ecosystem in those countries. USA and UK were taken for study as they are amongst the two most advanced countries in this field. Germany was taken as it is comparatively more advanced in the field of automobiles. Brazil was taken due to its resemblance with the ecosystem in India. The major issues taken into consideration were regulations, protocols, operations-roaming & network management. Regulations frame the base of the study. Protocol studies the regulatory authority, framework, legal instrument governing the M2M services. It covers the category under which the M2M service operators are given license to operate. It covers the data security, data management and storage issues. Specific spectrum and numbering requirements are also covered it. Vehicle interception, monitoring and M2M specific registration issue is also covered in this section. Taxation, QoS, user privacy and personal data are also covered in regulations. Protocols cover issues related to M2M standards developing authority, type of vehicles, telecommunication technology, communication technology, interoperability issues, connectivity solutions, technology integration and connectivity protocols. Operations cover the roaming related issues. These look into TSP wise roaming across area, operators, automobile roaming, etc. Emergency / Disaster management services,

prioritization, network management issues are also discussed under operations. **Similar approach can be used while designing a framework for other M2M services too.**

USA

FCC is the Authority governing the M2M Services in USA. FTC develops the framework for the same. Road Transport, IT and Internet laws make the basis for the M2M Services. M2M Service Providers work as a Virtual network Operator of the Telecom operator. Security, Storage and Data Protection is based on the Telecom regulations. Separate Spectrum related provision is made for M2M Services and 900 MHz is used for M2M services. Special purpose SIM cards are used for these services. Continuous interception and monitoring provision are there. Subscribers need to register for these services separately. Users insurance is directly linked to the driving style. QoS is managed under network management services. GSM is the preferred means of M2M Services. PS/CS/WiFi is used to provide connectivity. Embedded SIMs is preferred. Permanent roaming is not allowed but roaming among domestic operators is allowed. There are provisions for emergency / disaster management services.

UK

OFCOM is the M2M regulatory body and European Telecommunications Standards Institute is the standards developing body. The M2M operators are registered as MVNO under the TSP's. Laws governing the TSP's and Data Protection Act 1998 also applies on M2M Operators. No special provision of spectrum is there as of now but planning is there to provide extra spectrum if need in the future. No specific numbering is given to the M2M Service Providers. Continuous tracking is there but the user can stop the tracking if he wants. Separate registration for M2M services is required. QoS regulations focus on security, criticality, and sensitivity to delay or error. Data protection laws are same as for TSP's. GSM is the preferred connection technology and PS as well as CS technology is used. SIM is used in the telematics box and preference is given to 4G as M2M is Data intensive service. Permanent roaming is not allowed but inter operator roaming is allowed. Emergency / Disaster management services are linked to M2M services.

Germany

Bundesnetzagentur is the M2M regulatory Authority in Germany and European Telecommunications Standards Institute / Body of European Regulators for Electronic Communications are the standards developing body. ISP/ TSP framework is the governing body for these services. M2M service providers register as a VNO under the existing TSP's. Data Security, Management and Storage is based on the TSP Regulation (EU) 2015/2120. 800Mhz spectrum is used for M2M services along with Telecom services but 700 Mhz is auctioned for only IoT / M2M applications. M2M numbering system is different from normal numbering to separate them. Continuous tracking of vehicle is enabled via the embedded eSIM. QoS is application driven. Federal Privacy Act (Act) and

Teleservices Data Protection Act are used to cover the Privacy and Personal Data. GSm and PS are the preferred connectivity solutions. Connectivity is SIM based and works on 4G. Permanent roaming and operators roaming is allowed. Emergency as well as Disaster Management Services are linked to M2M services.

Brazil

DENATRAN the Brazilian State Traffic Department is the authority governing the M2M services in Brazil and ANATEL is the standards developing body. The M2M service operators are registered as MVNO. Brazil Personal Data Protection Law governs the Data Security, Management and Storage issues. 700 Mhz is in process of being restricted only for M2M services. TSP's provide numbering as per their will. SIM registration is needed but no specific M2M registration is needed. Continuous monitoring of the vehicle is enabled. Users are given Tax rebate to promote M2M services. QoS is managed as per the Telecom laws. GSM is used for communication and a mix of PS/CS network is used for the process. 3G and 4G connectivity is used and connection is SIM based. Permanent roaming is not allowed and users can change between domestic operators by paying some fee. Emergency / Disaster Management services are provisioned though not mandatory.

Recommendations for India

As per the "National Telecom M2M Roadmap" DoT and TRAI will be the authority for M2M services in India. UL / USAL (Telecom), IT Act-2000 and Indian Companies Act 1956 / 2013 along with LLP Act-2008 will be the basis of the M2M services. Government must allow the M2M Service providers to work as MVNO as in various countries like USA,UK,Brazil, etc[44]. The data servers must be situated in India and must provide full data sharing with all security agencies. 4G / LTE must be the basic connectivity option but 3G, 2G backup option must be available. Different numbering series must be provided to M2M services in order to easily identify them. All the interception / monitoring regulations of TSP's will automatically apply to MSP's, as they will be a MVNO. User must have separate registration for M2M services and for automobiles. Insurance premium can be linked to driving style of the user as in USA[45]. QoS can be governed by TRAI based on the VoIP regulations[46]. User data and privacy issues can be governed by IT Act-2000[47]. TRAI and TSDSI will be the M2M standards development authority[48]. As the Telematics unit installation process is complex, hence provision for both GSM as well as WiFi connectivity must be there. Packet Switched Network is better for M2M operations but until the ecosystem develops, Circuit Switched Network can be used as

[44] Please refer to Table No. 2,3,5.
[45] Please refer to Table No. 2.
[46] TRAI, Consultation Paper on Internet Telephony (VoIP), dated 22nd June, 2016.
http://trai.gov.in/WriteReadData/WhatsNew/Documents/Consultation_Paper_on_Internet_Telphony.pdf.pdf
[47] http://www.itlaw.in/
[48] National Telecom M2M Roadmap by MCIT, DoT. Government of India.
http://www.dot.gov.in/sites/default/files/Draft%20National%20Telecom%20M2M%20Roadmap.pdf.

base to provide M2M services. Local SIM card based connectivity solution must be present[49]. 4G network is better suited to provide data intensive M2M services but they must be 3G compatible too as 4G network is still in development phase in India. As per DoT, permanent roaming of International SIM cards will not be allowed due to interception and security issues. Emergency Service provisioning must be made mandatory by the regulator. Basic network management and Net Neutrality principles must also apply.

Table No.: 1

Recommendations for M2M Connected Vehicles in India.		
Issue	**Criteria**	**Comments**
Regulations	Authority	TRAI
	Framework	National Telecom M2M Roadmap.
	Legal Instrument	UL / USAL and IT Act,2000 and Indian Companies Act 1956 / 2013 along with LLP Act-2008
	Definition M2M (Automobiles)	Machine to machine (M2M) refers to technologies that allow both wireless and wired systems to communicate with other devices of the same ability.
	M2M Service Providor.	MVNO.
	Data Security, Management and Storage	Servers in India, Full data shairing for all providers.
	Spectrum Requirements (Frequencies & Alternate Technologies)	Focus on 4G connectivity and probable spectrum allocation for that.
	Numbering	Go for different numbering series for M2M.
	Interception and Monitoring	TSP / ISP rules of IT Act must apply.
	Subscriber Registeration	Vehicle Separate and M2M Service seperate
	Taxation	Driving style can be linked to Insurance and Tax Premium.
	QoS	As per TSP standards - VoIP standards.
	User Privacy and Personal Data	IT Act
Protocols	Standards Development Authority	TRAI, TSDSI
	Type of Vehicles	Passenger and Commercial both.
	Telecom Technology Mandated (GSMA/CDMA)	GSM and WiFi.

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[49] National Telecom M2M Roadmap by MCIT, DoT. Government of India.
  http://www.dot.gov.in/sites/default/files/Draft%20National%20Telecom%20M2M%20Roadmap.pdf.

	Communication Technology (PS/CS/WIFI)	PS / CS/ WiFi - all three
	M2M Device Interoperability	Allow - but require re-registration
	Connectovity solution (SIM/Chip)	SIM based
	Technology Intergration (3G/4G/5G)	3G / 4G
	Connectivity Protocol (Embedded/Tethered/Integrated)	Tethered / Integrated
Operations - Roaming	Permanent Roaming	No - Local SIM mandatory
	Inter-State Roaming of Automobiles (RTO)	Allowed - No charges
	Inter-State Roaming of Network Providers	As per TSP regulations, USL, USAL
	Interoperability of Domestic Network Providers	As per TSP regulations, USL, USAL
Operations- Network Management	Emergency Services Access	Must be mandatory
	Disaster Management	As per TSP regulations, USL, USAL
	Priortisation of M2M	Only Emergency Services must be top priority, rest as per Data Priority.
	Congestion	Voice top priority. Resonable Network Management must be allowed.
	Net Neutrality	Net Neutrality pricipals must apply across.
Source:	http://www.dot.gov.in/sites/default/files/Draft%20National%20Telecom%20M2M%20Roadmap.pdf http://telecom.economictimes.indiatimes.com/tele-talk/virtual-network-operators-a-revolutionary-step-in-indian-telecom-industry/625 http://www.trai.gov.in/writereaddata/recommendation/documents/recom6aug08952012.pdf http://trai.gov.in/WriteReadData/WhatsNew/Documents/Consultation_Paper_on_Internet_Telphony.pdf.pdf	
Note:	Indian and European Geo- Political ecosystem are completely different from each other. User generally travell across Europe in their vehicle, passing through various countries in the EU. But in India the case is different. Users rarely travell across the countries border using vehicles. So M2M vehicles in India will mostly remain in the Indian geo-terrotiry. Hence we must have specific local rules and regulations governing the M2M services in India. Whereas for Indian Auto Manufacturers they are free to follow the rules of the country they plan to export to.	

Table No.: 2

USA		
Issue	**Criteria**	**Comments**
Regulations	Authority	FCC
	Framework	FTC

	Legal Instrument	Legal -Insurance, (http://www.naic.org/documents/cipr_study_150324_usage_based_insurance _and_vehicle_telematics_study_series.pdf)
	Definition M2M (Automobiles)	M2M communication refers to digital communication between an endpoint and an enterprise's backend system over cellular / IT networks.
	M2M Service Provider.	VNO
	Data Security, Management and Storage	Security regulations same as Telecom but integrated with others.
	Spectrum Requirements (Frequencies & Alternate Technologies)	Provision for separate Spectrum. (900MHz. Band) (https://apps.fcc.gov/edocs_public/attachmatch/DA-15-944A1.pdf)
	Numbering	Special purpose SIM. (differentiated for specific purpose)
	Interception and Monitoring	Continuous
	Subscriber Registration	Required
	Taxation	Usage - based insurance.
	QoS	Quality of Service managed under network traffic conditions.
	User Privacy and Personal Data	Same as Telecom standards.
Protocols	Standards Development Authority	FCC
	Type of Vehicles	Passenger and Commercial
	Telecom Technology Mandated (GSMA/CDMA)	GSM / CDMA (Moving to pure 3G / 4G network)
	Communication Technology (PS/CS/WIFI)	PS / CS / WiFi.
	M2M Device Interoperability	no mention.
	Connectivity solution (SIM/Chip)	SIM mostly used
	Technology Integration (3G/4G/5G)	Moving to full 3G / 4G
	Connectivity Protocol (Embedded/Tethered/Integrated)	Embedded / add On
Operations - Roaming	Permanent Roaming	Not Allowed
	Inter-State Roaming of Automobiles (RTO)	No charge - Allowed
	Inter-State Roaming of Network Providers	No charge - Allowed
	Interoperability of Domestic Network Providers	Allowed
Operations- Network	Emergency Services Access	Provision for Emergency Services
	Disaster Management	Provision for Disaster Management.

Management	Prioritization of M2M	Traffic prioritization, after voice.
	Congestion	Network management allowed
	Net Neutrality	Not Specified.
Source:	https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf https://www.business.att.com/content/whitepaper/M2M-ControlCenter-White_Paper_Frost_and_Sullivan.pdf	

Table No.: 3

UK		
Issue	**Criteria**	**Comments**
Regulations	Authority	OFCOM
	Framework	Telecom based MVNO.
	Legal Instrument	TSP laws, Data protection laws.
	Definition M2M (Automobiles)	Machine to Machine communications of similar types of devices through both wired and wireless networks.
	M2M Service Provider.	MVNO
	Data Security, Management and Storage	Same as TSP, Data Protection Act 1998 (DPA)
	Spectrum Requirements (Frequencies & Alternate Technologies)	Planning to provide extra Spectrum in future. (http://stakeholders.ofcom.org.uk/binaries/research/technology-research/trans1.pdf)
	Numbering	No specific mention.
	Interception and Monitoring	Continuous but tracking can be stopped by user.
	Subscriber Registration	Required
	Taxation	No specific mention.
	QoS	Focuses on security, criticality, sensitivity to delay or error
	User Privacy and Personal Data	Based on Telecom Standards, Specific personal data protection laws.
Protocols	Standards Development Authority	European Telecommunications Standards Institute / OFCOM
	Type of Vehicles	Passenger and Commercial
	Telecom Technology Mandated (GSMA/CDMA)	GSM / CDMA
	Communication Technology (PS/CS/WIFI)	PS / CS

	M2M Device Interoperability	No mention.
	Connectivity solution (SIM/Chip)	SIM
	Technology Integration (3G/4G/5G)	GPRS as basic, 3G, 4G- LTE
	Connectivity Protocol (Embedded/Tethered/Integrated)	Integrated
Operations - Roaming	Permanent Roaming	Not Allowed
	Inter-State Roaming of Automobiles (RTO)	No Charge - Allowed
	Inter-State Roaming of Network Providers	Allowed
	Interoperability of Domestic Network Providers	Allowed
Operations- Network Management	Emergency Services Access	Yes
	Disaster Management	Yes
	Prioritization of M2M	1st Priority. (But after voice)
	Congestion	Reasonable network Management allowed.
	Net Neutrality	Regulation EU 2015/2120
Source:	http://www.eena.org/download.asp?item_id=111 http://ec.europa.eu/digital-agenda/en/ecall-time-saved-livessaved http://stakeholders.ofcom.org.uk/binaries/research/technology-research/2014/M2M_FinalReportApril2014.pdf www.nesta.org.uk/blog/what-does-growing-internet-things-market-mean-privacy-and-regulation	

Table No.: 4

Germany		
Issue	**Criteria**	**Comments**
Regulations	Authority	Bundesnetzagentur (BNetzA)
	Framework	Based on ISP / TSP framework
	Legal Instrument	Federal Data protection Law.
	Definition M2M (Automobiles)	M2M is a generic concept covering a wide range of technologies enabling the automated exchange of information and data between machines themselves or via a central data processing system. (http://www.bundesnetzagentur.de/EN/Areas/Telecommunications/Companies/Technology/Standardisation/RadioApplications/M2M/M2M_node.html)
	M2M Service Provider.	VNO

	Data Security, Management and Storage	Same as TSP / ISP based on Regulation (EU) 2015/2120.
	Spectrum Requirements (Frequencies & Alternate Technologies)	800 MHz normal Telecom, 700MHz auctioned for IoT, mix of Unlicensed and Licensed.
	Numbering	Different Numbering for M2M Connectivity.
	Interception and Monitoring	Continuous
	Subscriber Registration	eSIM registration needed.
	Taxation	Insurance linked to driving style.
	QoS	Application driven QoS.
	User Privacy and Personal Data	Federal Privacy Act (Act) and Teleservices Data Protection Act (TDDSG) apply
Protocols	Standards Development Authority	European Telecommunications Standards Institute / Body of European Regulators for Electronic Communications.
	Type of Vehicles	Passenger and Commercial
	Telecom Technology Mandated (GSMA/CDMA)	GSM
	Communication Technology (PS/CS/WIFI)	PS is preferred but CS and Wi-Fi also an option.
	M2M Device Interoperability	Devices enable interoperability amongst services providers
	Connectivity solution (SIM/Chip)	SIM based.
	Technology Integration (3G/4G/5G)	4G -LTE
	Connectivity Protocol (Embedded/Tethered/Integrated)	Embedded / Integrated.
Operations - Roaming	Permanent Roaming	Allowed
	Inter-State Roaming of Automobiles (RTO)	Not Mentioned
	Inter-State Roaming of Network Providers	Not Mentioned
	Interoperability of Domestic Network Providers	Allowed
Operations- Network Management	Emergency Services Access	Yes
	Disaster Management	Yes
	Prioritization of M2M	After Voice
	Congestion	Network Management allowed.
	Net Neutrality	Regulation EU 2015/2120

Source:	https://www.embedded-world.de/en/ausstellerprodukte/embwld17/exhibitor-25527997/m2m-germany-gmbh
	http://www.m2mgermany.de/startseite/m2mgermany-gmbh.html
	http://www.gemalto.com/m2m/markets/connected-cars
	http://www.iotm2mcouncil.org/germanyauctionsspectrum
	http://www.twobirds.com/en/news/articles/2016/germany/june/german-telecommunications-regulator-enacts-new-rules-to-facilitate-m2m-communication
	https://www.gi-de.com/en/trends_and_insights/subscription_management_m2m_automotive/subscription-management-m2m-automotive.jsp
	http://ieeexplore.ieee.org/document/6081100/?denied

Table No.: 5

Brazil		
Issue	**Criteria**	**Comments**
Regulations	Authority	Brazil's State Traffic Department (DENATRAN)
	Framework	Telecom (as MVNO)
	Legal Instrument	SCM licence from ANATEL, Article 422 of the Brazilian Civil Codex
	Definition M2M (Automobiles)	M2M typically refers to devices connected to the Internet. These devices might be sensors, tools, data storage units, or POS terminals. Traditionally many M2M devices were proprietary to particular companies, manufacturers, or users. IoT is about using M2M devices to promote interoperability over networked platforms.
	M2M Service Providor.	MVNO.
	Data Security, Management and Storage	Brazil Personal Data Protection Law
	Spectrum Requirements (Frequencies & Alternate Technologies)	Planning to allocate 700 Mhz band for Telecom / M2M.
	Numbering	TSP based.
	Interception and Monitoring	Continuous.
	Subscriber Registration	Required via SIM.
	Taxation	Tax Reduction to promote M2M
	QoS	As per Telecom Laws.
	User Privacy and Personal Data	Brazil Personal Data Protection Law
Protocols	Standards Development Authority	ANATEL
	Type of Vehicles	Passenger and Commercial

	Telecom Technology Mandated (GSMA/CDMA)	GSM
	Communication Technology (PS/CS/WIFI)	Mix of PS/ CS
	M2M Device Interoperability	SIM can be changed.
	Connectivity solution (SIM/Chip)	SIM based.
	Technology Integration (3G/4G/5G)	3G and 4G
	Connectivity Protocol (Embedded/Tethered/Integrated)	SIM
Operations - Roaming	Permanent Roaming	Not allowed.
	Inter-State Roaming of Automobiles (RTO)	Allowed
	Inter-State Roaming of Network Providers	Allowed
	Interoperability of Domestic Network Providers	Allowed with small fee.
Operations- Network Management	Emergency Services Access	Available though not mandatory.
	Disaster Management	Process of integrating Emergency Services with M2M.
	Prioritization of M2M	After voice.
	Congestion	Network Management Allowed.
	Net Neutrality	No Mention.
Source:	http://www.autofind.com.br/siniav.php http://mph.gsma.com/publicpolicy/taxation-brazil-boosts-m2m-take-up-via-tax-cuts http://www.4gamericas.org/files/8314/4051/7653/4G_Americas_700_MHz_Spectrum_Process_Lat_Am.pdf	