Consultation on the Mobile Network (SIM) Based IoT Numbering Plan and Implementation in Bhutan

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December 2022

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1. General Background

The International Telecommunication Union (ITU-T)[1] has defined Internet of things (IoT) as "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. Through the exploitation of identification, data capture, processing, and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst ensuring that security and privacy requirements are fulfilled"

Internet of Things (IoT) applications and its implementation is significantly taking place around the world. For instance, the number of IoT devices worldwide is expected to be tripled from 9.7 billion in 2020 to 29 billion in 2030. As of 2021, there are 11.3 billion IoT connected devices.[2] Majority of the IoT devices are being used in fields of electricity, gas, steam & A/C, water supply & waste management, retail & wholesale, transportation & storage, and government.[3]

Similarly, the IoT applications are also gradually being implemented in Bhutan. For instance, some of the applications such as GPS vehicle tracking[4], Smart water metering[5] and Smart street lighting systems have already been implemented by the concerned agencies in Bhutan. It is definite that Bhutan will see an increase in usage of IoT applications with time. IoT development can benefit all sectors including agriculture, utility companies, transportation and logistics, energy, telecom, healthcare, finance, remote monitoring, manufacturing and industries, safety and security and other vertical sectors.

The IoT applications consist of ***mobile network based IoT applications*** and ***non-mobile network based IoT applications***. For a mobile network based IoT application, there is a need for specific IoT Subscribers Identity Module (SIM) cards that need to be inserted into the IoT devices, for the devices to be connected to the network or with each other.

2. Purpose of Consultation

The Bhutan InfoComm and Media Authority (Authority) is in receipt of a request from the Bhutan Telecom Limited (BTL) requesting the separate mobile number series for implementing mobile network (SIM) based IoT applications in Bhutan.

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[1] https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-Y.2060-201206-I!!PDF-E&type=items
[2] https://woosuite.com/stats/iot/
[3] https://www.statista.com/statistics/1183457/iot-connected-devices-worldwide/
[4] http://www.bbs.bt/news/?p=175973
[5] http://www.thimphucity.bt/counter/direct_download/2359

Currently, there is no National Numbering Framework developed for the mobile network (SIM) based IoT applications except for the conventional subscribers' Mobile Number Framework in Bhutan. The conventional subscribers' number format allotted to the BTL is **17xxxxxx** and Tashi InfoComm Limited (TICL) is **77xxxxxx**. It is critical that the conventional subscribers' numbers are not mixed and used with the IoT devices applications. Since the current National Numbering Plan Framework of Bhutan does not accommodate the mobile network (SIM) based IoT numbering plan, it is important for a conducive National Numbering Plan Framework accommodating emerging technologies such as IoT applications.

In this regard, the Authority has proposed to develop a separate numbering format for the IoT applications to be used in SIM based IoT services. This will help in drawing out the clear distinction between the SIMs used for conventional mobile subscribers and the SIM based IoT application.

Therefore, the Authority has floated this consultation paper to develop the mobile number structure for the SIM based IoT applications and the obligations of the Network Service providers and the IoT service providers in implementing the IoT services in the country.

3. Policy Directives

In order to enable reliable, effective and secure implementation of IoT services in Bhutan, the Authority is in receipt of Policy Directives from Ministry of Informations and Communications (MoIC) which specifically requires to ensure the following in IoT implementation:

a. The implementation of Cellular IoT does not affect the primary services of 3G/4G mobile network viz cellular voice and mobile data,
b. Network Service providers to implement an IoT testbed before deployment in the live networks,
c. Quality of Service (QoS) provided by the Network Service Providers in view of IoT deployment,
d. Encourage deployment of IoT applications using 5G networks,
e. IoT technology uses open standards that are interoperable and secured across all transmission networks,
f. Encourage Network service providers to deploy IPv6 in IoT devices,
g. Maintain a registry for all the IoT devices, including but not limited to owners and focal points in event of any issues,
h. Ensure security, data protection, privacy and safety of the general public which may get exposed through the use of IoT,

i. IoT device owners will to be held accountable for any damages to the property of life because of mishandling/malfunctioning of IoT devices,
j. Separate data packages for cellular IoT, in view of intensive internet data usage by IoT devices,
k. BICMA to study the overall impact on QoS to voice and data services from the introduction of IoT services in the country.

4. IoT Classification

The IoT applications can be divided into two broad categories. They are ***mobile network (SIM) based IoT applications*** and ***non-mobile network based IoT applications***. For a mobile network based IoT application, there is a need for specific IoT SIM cards that need to be inserted into the IoT devices for the devices to be connected to the network or with each other.

a. Mobile Network (SIM) Based IoT

Mobile Network (SIM) Based IoT/Cellular IoT is the technology that connects physical objects to the Internet utilizing the same cellular network currently used by smartphones. In other words, this technology can connect IoT devices using existing mobile networks. Mobile IoT refers to low power wide area (LPWA) 3GPP standardized secure operator managed IoT networks in licensed spectrum.

Some standards which are applicable under the cellular IoT are:

1. LTE Cat 1: Designed for servicing IoT applications, LTE CAT 1 is known as a cost- and power-saving option for large-scale and long-range applications thanks to its relatively low bandwidth and low communication demand.[6]

2. LTE Cat M1: Also known as Cat-M, LTE Cat M1 is a low-cost, low-power, wide-area network that specializes in transferring low to medium amounts of data. Many operators favor LTE Cat M1 as it is compatible with the prevailing LTE network, which means major carriers don't need to invest in new antennas when they pivot to LTE Cat M1.[7]

3. NB-IoT : It is a low-power, wide-area technology intended to specifically target the needs of battery-powered IoT devices. It offers significant improvements in power

[6] https://www.inhandnetworks.com/lte-cat-1-vs-cat-m1.html
[7] https://www.inhandnetworks.com/lte-cat-1-vs-cat-m1.html

consumption, system capacity, and spectrum efficiency, and can support huge fleets with up to 50,000 devices per network cell.[8]

b. Non-Mobile Network Based IoT

Non-Mobile Network based IoT uses other forms of wireless technology for communication between the equipment. These IoT devices do not require cellular technology to function, which means there is no requirement of the eSIM or hardware SIM card in the device. The device itself has the wireless processors and the antenna.

Non cellular IoT devices use unlicensed ISM bands for operation which makes it ideal for small scale, low budget applications. Popular examples of Non cellular IoT are LoRa, SigFox and non cellular 5G IoT. Non cellular IoT can include IoT devices which use short range standards of communication such as Bluetooth and WiFi too.

LoRa is a Low Power, Wide Area (LPWA) networking protocol designed to wirelessly connect battery operated devices to the internet in regional, national or global networks, and targets key Internet of Things requirements such as bidirectional communication, end-to-end security, mobility and localization services. The low power, low bit rate, and IoT use distinguish this type of network from a wireless WAN that is designed to connect users or businesses, and carry more data, using more power.

Similarly SigFox is a long range, low power, low data rate form of wireless communications that has been developed to provide wireless connectivity for devices like remote sensors, actuators and other M2M and IoT devices. The SigFox wireless interface has been developed to enable any communications that take place to consume a minimum amount of power. In this way the remote devices can run on battery power for very extended periods without the need for any battery changes or maintenance.

5. Applications Sectors of IoT

Some of the verticals and related IoT applications as per sectors are given in the table below but not limited to:

Sl. No	Sectors/Industry Verticals	IoT Applications

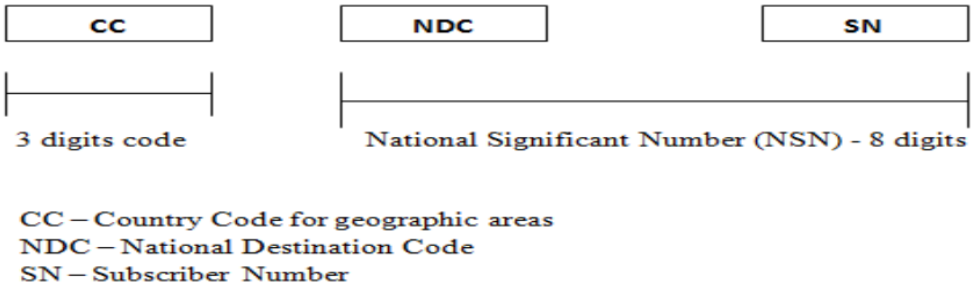
[8] https://www.particle.io/iot-guides-and-resources/cellular-iot/#:~:text=NB%2DIoT%20This%20new%2C%20fast,50%2C000%20devices%20per%20network%20cell.

1.	Automotive/Transportation /Logistics	Vehicle tracking, Traffic control, Navigation, Infotainment, Fleet management, Asset tracking, Manufacturing, Logistics, etc.
2.	Utilities/Energy	Smart power metering, Smart grid, Electric line monitoring, Smart water metering, pipeline monitoring, etc.
3.	Telecom	Data storage and management, Asset monitoring
4.	Healthcare	e-health, Remote diagnostics, Medication reminders, Tele-medicine, wearable health devices, etc.
5.	Financial/ Retail	Point of sale (POS), ATM, Vending machines, Digital signage, and Handheld terminals, etc.
6.	Public Safety	Highway, Bridge, Traffic management, Homeland security, Police, Fire, and Emergency services, Fire alarm, home security monitoring etc.
7.	Smart City	Intelligent transport System, Intelligent waste management, Street Light control system, Water distribution, Smart Parking, etc.
8.	Agriculture	Farm management and real time farm monitoring etc,
9.	Others	

6. Existing Mobile Numbering Allocations for Bhutan

The existing Mobile Numbering Allocations for Bhutan are based on the following format which is consistent with the ITU-T Recommendation E.164 and other relevant ITU-T Recommendations.

The National Numbering Plan uses only the decimal character set 0 – 9 for all allocations. Letters and other non-decimal characters do not form part of the National Significant Number (NSN).



CC – Country Code for geographic areas
NDC – National Destination Code
SN – Subscriber Number

The international prefix '00' or '+' is used for international dialing for Bhutan and is followed by the country code and the national significant number (NSN). The country code allocated by ITU-T to Bhutan is '975'. This code follows the international prefix for calls made from outside the country and should be followed by the NSN of the destination within Bhutan. The National Significant Number (NSN) is the eight digits number for both cellular mobile and fixed telephony services.

The MSISDN of mobile cellular number services in Bhutan has a fixed number length of eleven digits including the country code. The Network Destination Code (NDC)/Network Identification Code (IC) is a two digit number. Currently, the two operators (BTL and TICL) are allocated with the following blocks for mobile cellular numbers.

Particulars	**Numbers**	**Remarks**
Country Code	975	
Network Destination Code (NDC)/Mobile Access Code	17	NDC/IC for Bhutan Telecom Limited
	77	NDC/IC for Tashi InfoComm Limited
Subscriber Number	$X_1X_2X_3X_4X_5X_6$	X_1 to X_6 is any number from 0 to 9.

7. International Practices in Numbering Allocations for SIM Based IoT

a. SIM based IoT Numbering Allocation in India

The operators can provide the networks for the IoT under the unified license. The Department of Telecom, India has approved the 13-digit numbering scheme for SIM based M2M devices (excluding country code) which will result in a capacity of 50 billion M2M SIMs in India. It has been implemented from 1st October 2018. The structure of 13-digit numbering scheme is:

Country Code 2 digits (+91)	M2M Identifier 3 digits	Licensee Identifier 4 digits (10000 blocks)	Device Number 6 digits (1 million)

b. SIM based IoT Numbering Allocation in Singapore

Operators are required to have a license to offer M2M services under the framework of the regulator, InfoComm and Media Development Authority (IDA). Licensees have to ensure that SIM cards used for M2M services are only used for automated communication[9].

Licensees shall list out the following:

- The range of International Mobile Subscriber Identity (IMSI) numbers and Mobile Station International Subscriber Directory Number (MSISDN) to be used,
- Working with any local operator partner in relation to the provision of M2M services
- Identification of M2M equipment importer,
- Registration of all SIM cards used to provide M2M services in Singapore,
- The records to be maintained in Singapore for a minimum of 12 months from the date of termination of the service

The M2M license enables the licensee to provide M2M services using equipment with embedded SIM cards. Singapore Public Consultation proposed M2M Access Code Allocation Framework, by IDA ensuring that there is sufficient numbering capacity for all M2M devices, IDA has reserved a block of 4-digit M2M Access Code (i.e. "144X") for M2M services and also took the view that a maximum digit length should be adopted[10].

- Singapore would allow numbers of up to 13-digit length, using the designated 4-digit Access Code (excluding the country code), based on current network routing technology and arrangements,
- Service-based Operator (SBO) (Individual) licensees providing M2M services are eligible for '144XX' access code,
- The M2M access code allocated may be used with international connectivity and international roaming services,

[9] Public Consultation on Proposed M2M Access Code Allocation Framework, iDA Singapore.Proposed Machine -To- Machine ("M2M") Access Code Allocation Framework ,11 April 2013

[10] National numbering Plan(Issue 1 – 1 October 2016) Info-communications Media Development Authority,Singapore

- Licensees providing M2M services using the M2M access codes, i.e. '144XX' are encouraged to maximize the allowable numbering capacity with a 13-digit numbering format (excluding country code) for each M2M access code.

c. SIM based IoT Numbering Allocation in Hong Kong

Hong Kong is having an 8 digit numbering scheme in fixed and mobile service, excluding country code. The code of practice relating to the use of numbers and codes in the Hong Kong Numbering Plan was revised in April 2015. Important points related to M2M numbering proposed in Hong Kong are as given below[11].

In differentiating the "4500X" M2M numbers from the ordinary subscriber numbers, following guidelines were issued to the operators while assigning "4500X" numbers:

- The numbers should be of 12 digits in length,
- The numbers shall not be required to support number portability,
- The numbers should not be used for voice and SMS communications. In case any M2M application would require communications via SMS, operators should assign ordinary 8-digit subscriber numbers for the application,

d. ECC recommendations on M2M[12]

The ECC on addressing number resource allocation for M2M services has recommended the following;

- The potential number of M2M applications/connections may have a big impact on National Numbering Plans,
- Meet the needs of operators to avoid possible lock-in of M2M users.
- The IP addresses might be a long term solution.
- The E.164 number length for the new M2M numbering range should be as long as possible (maximum of 15 digits including Country Code),
- As a long term solution IPv6 addresses, or numbers/addresses other than E.164 numbers should preferably be used for device based communication applications. These numbering/addressing schemes or switching from E.164 numbering plan to a new plan should not prohibit market development or competition.
- The NRA should ensure that the new number range(s) are not used as an alternative to existing number ranges to escape regulatory requirements.

[11] https://www.coms-auth.hk/filemanager/statement/en/upload/385/cop-numbering_e.pdf

[12] ECC REPORT 153, NUMBERING AND ADDRESSING IN MACHINE-TO-MACHINE (M2M) COMMUNICATIONS, Luxembourg, November 2010

e. SIM based IoT/M2M numbering allocation in Malta

- The numbers allocated are of 10 digits (excluding country code).
- If the demand is more, they shall consider increasing to 12 digits.
- Initially the Malta Communications Authority (MCA) shall allocate blocks of 100,000 numbers solely within 10 digit subranges 40YYY XXXXX to 42YYY XXXXX.
- The MCA will not allow IoT users/Service Providers to reserve the numbering blocks.
- The MCA may authorize the extra-territorial use of numbers in the '4' range in other EU/EEA Member States.

f. Other Example of SIM based IoT numbering

Several European countries (For example, Belgium, Bulgaria, Croatia, Denmark, Finland, France, Netherlands, Norway, Portugal, Spain, and Sweden), which have introduced a special range of numbers for M2M communication have number blocks which use a longer number sequence (up to the full 15 digits) in E.164 format.

8. Proposed SIM based IoT Number Series Allocation in Bhutan

The number series of the following is specifically proposed for the SIM based numbering for IoT devices in Bhutan. The SIM based IoT numbering series has a 12-digit numbering scheme (excluding country code) which will result in the capacity of 10 billion SIM based IoT devices for each operator's network in Bhutan.

This numbering scheme is unlike the conventional subscribers 8 digit numbering allocation which otherwise would provide capacity of only 1 million devices.

Country Code (3 digits)	**Network Identification Code (2 digits)**	**M2M Identifier (Application based Code) (2 digits)**	**Device Number (8 digits)**
(975)	**"19" for devices using BTL IoT SIMs** **"79" for devices using TICL IoT SIMs**	**XX** **"00" to "99"**	**YYYYYYYY** **"00000000" to "99999999"**

a. Country Code

The "Country Code" for Bhutan in "975".

b. Network Identification Code

For the SIM based IoT numbering scheme, the number "19" shall be allocated for BTL and the number "79" shall be allocated to TICL for SIM based numbering in IoT implementation.

c. M2M Identifier (Application Based Code)

The two digits from "00" to "99" shall be used for the M2M Identifier based on the application. It shall be used strictly based on the following applications mentioned in the table below while issuing the IoT SIMs to the users. For instance, if it is for ***Smart power metering*** using BTL SIM, the M2M Identifier shall be "01", thus the SIM numbering shall be "975 19 01 YYYYYYYY"

Sectors/Industry Verticals	**M2M Identifier (Application Based Code)**	**IoT Applications**
Automotive/Transportation/Logistics	00	Vehicle tracking, Traffic control, Navigation, Infotainment, Fleet management, Asset tracking, Manufacturing, Logistics, etc.
Utilities/Energy	01	Smart power metering, Smart grid, Electric line monitoring, Smart water metering, pipeline monitoring, etc.
Telecom	02	Data storage and management, Asset monitoring
Healthcare	03	e-health, Remote diagnostics, Medication reminders, Tele-medicine, wearable health devices, etc.
Financial/ Retail	04	Point of sale (POS), ATM, Vending machines, Digital signage, and Handheld terminals, etc.
Public Safety	05	Highway, Bridge, Traffic management, Homeland security, Police, Fire, and Emergency services, Fire alarm, home security monitoring etc.
Smart City	06	Intelligent transport System, Intelligent waste management, Street Light control system, Water distribution, Smart Parking, etc.

Agriculture	07	Farm management and real time farm monitoring etc,
Others	…..	The operators shall use additional M2M identifiers if not mentioned in above. However, before the operator uses the new M2M Identifier Code, the operator has to consult the Authority. Once one of the operators is allowed to use additional M2M Identifiers, the same M2M Identifier code has to be used by the other operator for same/similar services.

9. Obligations for Network Service Providers

Along with the conditions highlighted in the policy directives, the Network Service Provider shall be obligated to:

a. The implementation of SIM based IoT by network service providers like telecom service providers does not need a separate license as it shall be under the scope of the ICT Facility and Service license for the Telecom operators. However, if the network service provider is not the telecom operator, a separate license is required.

b. The network service provider shall ensure that the implementation of any sort of IoT in which the network is provided by the network service providers, in the country, shall be as per the Policy Directives issued by the Ministry (MoIC).

c. The network service providers shall abide by any directives and notifications issued by the Authority at any time for the IoT services which use the operator's network.

d. The implementation of SIM based IoT by the network service providers shall not affect and compromise the Quality of Service (QoS) of cellular mobile voice and data services in 2G, 3G, 4G and 5G. The network service provider shall not blame the SIM based IoT services as the cause for degradation of their cellular mobile voice and data services.

e. The network service provider shall carry out the trial testing of any SIM based IoT services in the live networks before the implementation and present to the Authority the details of trial testing.

f. The network service provider shall strictly abide by the SIM based IoT numbering structure while issuing the IoT SIM numbers to the IoT service providers/users.

g. The network service providers are required to put in place a proper registration and assignment processes similar to the conventional SIM registration, for IoT based SIM issuance to the IoT service providers and users.

h. The network service providers shall register all SIM cards issued to the IoT service provider/users in Bhutan, maintain a detailed database and provide quarterly updates to the Authority with all details.

i. The network service provider shall ensure that the numbering range provided is exclusively used for IoT SIM cards only and not for conventional SIM cards.

j. The network service providers shall ensure that the separate IoT SIM cards different from conventional subscribers SIM is issued for the IoT usage and it shall be used only for automated communication.

k. The IoT SIM cards shall not provide any voice and sms services and shall provide only the automated data communications.

l. The network service providers shall inform the IoT service provider/users to apply to the Authority for IoT services implementation license/permits before issuing any IoT SIMs.

m. Any IoT devices with embedded SIM (eSIM) facility in future shall be based on the "Over-The-Air" provision where it can be re-provisioned remotely over-the-air with a new service provider avoiding sole-service provider lock-in. The eSIM in IoT devices should be allowing the "over-the-air" provisioning of an initial operator subscription, and the subsequent change of subscription from one operator to another.

n. The numbering systems in IoT devices shall be explored based on IPv6 addressing wherever possible in future in addition to the IMSI based numbering format.

o. The network service providers shall provide end to end Quality of Service (QoS) for any SIM based IoT deployment to the IoT service providers/users.

p. The network service providers shall implement a separate tariff for IoT network services to the IoT provider/users and shall submit the information to the Authority.

q. The network service providers shall share a copy of any agreements drawn with the IoT service providers/users to the Authority.

r. The network service providers shall maintain end-to-end network security for the connected devices in their network, and ensure and maintain the privacy of information transmitted over the IoT networks, and it's the network service provider's responsibility to set up a secure network.

s. The network service providers shall encourage deploying IoT applications using 5G networks wherever possible.

t. The network service provider shall ensure security, data protection, privacy and safety of the general public which may get exposed through the use of IoT networks provided by the network providers,

u. The network service provider and the IoT service provider shall host all servers used in providing IoT services in Bhutan and store all data within the national territory.

v. Devices with pre-fitted eUICC should be allowed to be imported only if it is able to get reconfigured 'Over-the-air' (OTA) with local subscription. GSMA approved guidelines shall be followed for provisioning of new profiles remotely with 'Over-the-air' (OTA) mechanism.

10. Obligations for IoT Service Providers

The IoT service providers shall be obligated to:

a. The implementation of SIM based IoT by any IoT service providers (e.g. utility companies) shall apply for a IoT service provider license from the Authority and it shall be under the scope of ICT service license.

b. The IoT service provider shall ensure that the implementation of any sort of IoT services in the country shall be as per the Policy Directives issued by the Ministry.

c. The IoT service providers shall abide by any directives and notifications issued by the Authority at any time for the IoT services which use the operator's network.

d. The IoT service provider shall implement the IoT testbed and carry out the trial testing of any SIM based IoT services in the live networks before the implementation and present to the Authority.

e. Any IoT devices with embedded SIM (eSIM) facility in future shall be based on the "Over-The-Air" provision where it can be re-provisioned remotely over-the-air with a new service provider avoiding sole-service provider lock-in. The eSIM in IoT devices should be allowing the "over-the-air" provisioning of an initial operator subscription, and the subsequent change of subscription from one operator to another.

f. The numbering systems in IoT devices shall be explored based on IPv6 addressing wherever possible in future in addition to the IMSI based numbering format.

g. The IoT service provider has to provide end to end Quality of Service (QoS) IoT deployment.

h. The IoT service providers shall maintain end-to-end network security for the connected devices in their network, and ensure and maintain the privacy of information transmitted over the IoT networks, and it's the network provider's responsibility to set up a secure network.

i. The IoT service provider shall maintain a registry for all the IoT devices, including but not limited to owners and focal points in event of any issues,

j. The IoT service provider shall ensure security, data protection, privacy and safety of the general public which may get exposed through the use of IoT networks provided by the network providers,

k. IoT service providers and the device owners shall be held accountable for any damages to the property of life because of mishandling/malfunctioning of IoT devices,

l. The IoT service provider shall host all servers used in providing IoT services and store all data within the national territory.

m. Devices with pre-fitted eUICC should be allowed to be imported only if it is able to get reconfigured 'Over-the-air' (OTA) with local subscription. GSMA approved guidelines shall be followed for provisioning of new profiles remotely with 'Over-the-air' (OTA) mechanism.

11. Any Other

The Global International Mobile Subscriber Identity (IMSI) ranges are signified by the shared Mobile Country Code '901', a code without ties to any particular country. These Global IMSI can be particularly recommended for the usage of IoT numbering where the Global IMSI ranges enable 'global SIMs', providing network-agnostic, cross-border connectivity. The telecom companies can also share their opinions on the ITU allocated shared Mobile Country Code 901.XX (Global IMSI) whether to be implemented by the telecom operators in Bhutan for SIM based IoT services. If not, what are the reasons and challenges in implementation of Global IMSI in Bhutan?

Annexure I

Definitions

a. **Conventional Services:** Services which are regular cellular network services which allows the person to person voice and data communication in a telecom network.

b. **IPv6:** is the most recent version of Internet Protocol, the communication protocol that provinces an identification and location system for computers on networks and routes traffic across the internet.

c. **Internet of Things:** is the interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data.

d. **IoT Service Provider:** IoT Service Providers are a company/organization that provides, operates and facilitates the deployment of Internet of Things using the network provided by network service providers. If the Utility Companies such as Transport, Electricity etc use/provide IoT services applications, the Utility companies shall be considered as the IoT Service providers.

e. **Machine to Machine (M2M):** is the direct communication between devices using any communications channel, including wired and wireless.

f. **Network Servic**e **Provider**: Network Service Providers are a company/organization that provides, operates and sells access to cellular services and Internet backbone infrastructure and services to other organizations/individuals.

g. **Subscriber Identity Module (SIM) card:** is a removable smart card for mobile phones that stores network specific information used to authenticate and identify subscribers on the network.

Annexure II

Acronyms

1. ATM: Automatic Teller Machine
2. eUICC: embedded Universal Integrated Circuit Card
3. GPS: Global Positioning System
4. ICT: Information and Communication Technology
5. IMEI: International Mobile Equipment Identity
6. IMSI: International Mobile Subscriber Identity
7. IoT: Internet of Things
8. IPv6: Internet Protocol Version 6
9. ISM Band: Industrial, Scientific and Medical Band
10. ITU: International Telecommunication Union
11. LPWA: Low Power Wide Area
12. LTE: Long Term Evolution
13. M2M: Machine to Machine
14. MSISDN: Mobile Station Integrated Service Digital Network
15. NB-IoT: Narrowband Internet of Things
16. NSN: National Significant Number
17. OTA: Over-The-Air
18. QoS: Quality of Service
19. SIM: Subscriber Identity Module