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TEC

टी ई सी संचारिका
NEWSLETTER

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Hon'ble President of India with Officers and Probationers of ITS-2014 batch

Officer Trainees of ITS-2014 batch called on the Hon'ble President of India, Shri Pranab Mukherjee on 22.11.2016 at Rashtrapati Bhawan. Addressing the Officer Trainees, the Hon'ble President said that he has a message for them that should guide their thoughts and actions, in the years to come. More than anything else, 3 Is i.e. Integrity, Innovation and India should be at the heart of their thoughts and actions. It will be extremely important for them to have integrity of purpose, innovation in action and the interests of India at heart in every task that they undertake and every responsibility that they are called upon to fulfill. The Hon'ble President asked young officers to use the Information and Communication technology to improve and widen the service delivery mechanism to the citizens of India.

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TELECOMMUNICATION ENGINEERING CENTRE

IN THIS ISSUE

Cellular IOT

1.0 Background

Internet of Things (IOT) is a growing field which has multiple use cases that will impact our daily life in a huge manner, improve the quality of our life and promote sustainable living. Some of the areas in which it has impact are commuting, civic services, power distribution, water distribution, waste management etc. Also, according to the Ericsson mobility report (June 2016), the projected number of IoT devices will be around 16 billion by year 2020.

Some specific examples of IoT are connected car, smart city, intelligent traffic system, e-waste management etc. All of these examples entail presence of large number of sensors deployed in house, car, civic infrastructure etc. and their communication to a central intelligence, which may or may not give commands to the sensors to modify their behaviour. Depending on the specific application, the data communication might be periodic/non-periodic, bandwidth intensive or low bandwidth, with asymmetric bandwidth requirements. These sensors might also frequently be located in places where radio frequency signal strength is low. These sensors are also placed generally in hard to reach areas and are deployed keeping in mind a long lifetime which in turn requires a long battery lifetime or a mains power connection along with over the air upgradability.

The applications can in general be categorised into two sets, as shown in fig below, one which are deployed in massive numbers and require long battery life, low bandwidth and second which requires high bandwidth, high availability and probably, support for mobility.

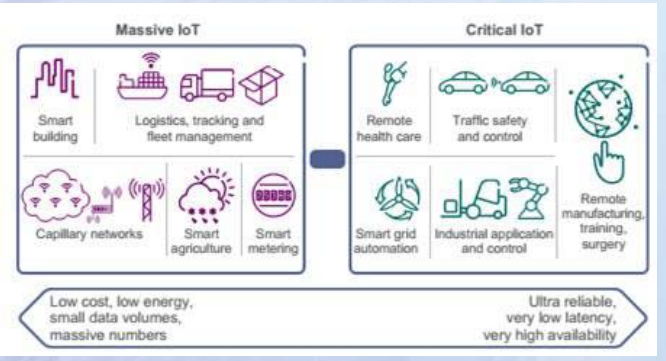

Fig. 1. Differing network requirements of the two classes of IOT applications

The requirements of the first class of IoT applications can be said to include the following:

a) Device cost
b) Battery life
c) Coverage
d) Scalability
e) Diversity

The requirements from the communication networks for these two classes of applications are also very different. For the first class of applications, a new type of network, called the LPWAN is required whereas the second class of applications can be supported by the existing cellular network. Plus, in between there is a huge variety of IoT applications which require communication networks that support different combinations of bandwidth, mobility, power consumption etc.

As discussed in the earlier para, the first class of IoT applications require connectivity solution that is different from the cellular networks. To cater to this need, many short range low power and low bit rate wireless communications have come up such as, ZigBee, 6LowPAN, SIGFOX, LORA etc. ZigBee and 6LowPAN are being mainly used for connectivity from sensor to aggregator/router, SIGFOX and LORA offer complete connectivity solution for IoT from sensor to the central server. While these solutions support some of the required features of IOT, for ubiquitous connectivity they will require the setting up of a whole parallel network which will lead to huge investment.

On the other hand, if the existing cellular networks are utilised to provide suitable connectivity for IoT through modifications which are probably software upgradations, then significant cost savings will be achieved. Some of the other advantages will be enterprise level reliability, guaranteed QoS and service delivery, support for global roaming, harmonised spectrum which will lead to economies of scale, licensed spectrum, mobility, high level of security and trust etc.

With these advantages, use of cellular network with certain modifications for IoT picked up as an idea and is discussed in detail in the next section.

2.0 Introduction to Cellular IoT

To enable support for this growing field we need networks that will support devices that might need low mobility, low power consumption, long range, low cost and high security or a combination of these

properties. Such class of networks have been named as Low Power wide area networks (LPWAN).

The cellular networks were initially not geared up to support the IoT devices which have different requirements compared to a phone. But, with the increased use of IoT devices in a number of applications, telecom standardisation bodies also took note of the importance of IoT and the need for an appropriate connectivity solution.

3GPP efforts were initially focussed on identification of Machine Type Communication (MTC) devices to allow operators to selectively handle such devices in overload situations. Subsequently, efforts have been directed to radio level enhancements for complexity reduction, coverage improvement, reduction of UE power consumption and optimisation for handling small data.

Cellular IoT consists of modification of 3GPP cellular technologies to suit IoT, both narrow band and otherwise through changes in device and network side. It includes LTE-M Cat 0 and Cat-M1, extended DRX and NB-IoT. The evolution of 3GPP technology to support IoT is shown below.

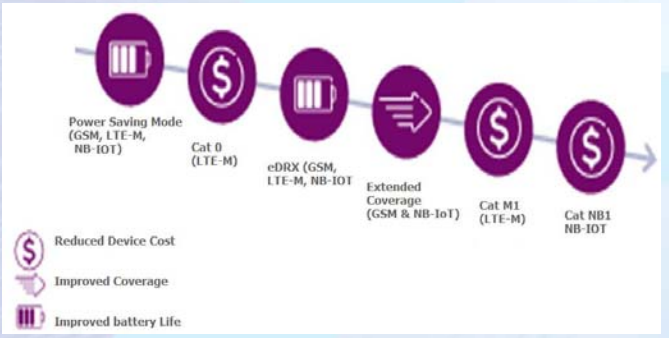

Fig. 2. Evolution of 3GPP technology to support IoT

In 3GPP Release-13, the following key areas were addressed:

a) Lower device cost
b) Improved battery life
c) Improved coverage
d) Support for massive numbers of IoT connections

The following figure shows the features added to support IoT with respect to the Releases.

In the following sections, the changes in the RAN and in the core network and at the device side are discussed in detail.

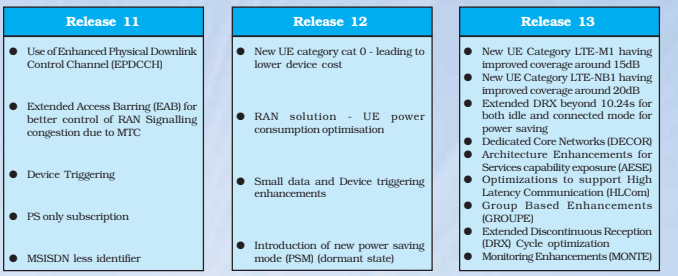

Fig. 3. Different releases

3.0 3GPP Radio Access Solutions to support IoT

3.1 LTE-M

It is an evolution of LTE optimized for IoT in 3GPP RAN which was first released in Rel.12 in Q4 2014, with further optimization being included in Rel.13 with specifications completed in Q1 2016. LTE-M brings new power saving functionality that potentially increases the battery life by 10 years. Also, the LTE-M traffic is multiplexed over a full LTE carrier and thus can efficiently coexist with MBB traffic.

3.1.1 Lower device cost

Rel.12 introduces a new low complexity device category (Cat-0). This low cost category defines a set of reduced requirements, enabling less complex, lower cost devices. The key reductions agreed in Rel.12 are:

- Half duplex FDD operation allowed. This makes it possible to operate LTE FDD time multiplexed, avoiding the duplex filter
- Single receive chain. This removes the dual receiver chain for MIMO
- Lower data rates. With a lower data rate requirement, the complexity and cost for both processing power and memory will be reduced significantly.

The performance summary is given in Table below:

TABLE 1.

LTE CATEGORY 0 PERFORMANCE SUMMARY

PARAMETER	LTE CAT 0 PERFORMANCE
Peak downlink rate	1 Mbps
Peak uplink rate	1 Mbps
Max number of downlink spatial layers	1
Number of UE RF chains	1
Duplex mode	Half duplex
UE receive bandwidth	20 MHz
Maximum UE transmit power	23 dBm

In Release 13, further optimisations to the device side, called LTE category M1 have been done, with the following features being added:

- Low RF bandwidth support (1.08MHz). This reduces complexity as a narrowband RF design is sufficient.
- A lower device power class of 20dBm allows integration of the power amplifier in a single chip solution.

3.1.2 Enhanced coverage

Enhancements in the core and device side to extend the coverage were included in Release 13 only.

3.1.3 Increased battery life

A device power saving mode (PSM) was introduced in Rel.12 to improve device battery life significantly. A device that supports PSM will request a network for a certain active timer value during the attach or tracking area update (TAU) procedure.

During the active timer duration, the paging is checked according to the DRX cycle, but once it expires, device can't be reached, though it's still registered, till mobile originated transmission.

3.2 Extended Coverage GSM for IoT (EC-GSM-IoT)

Many of cellular IOT solutions currently use GSM/GPRS connectivity as the modem cost is sufficiently low and the data rates available are satisfactory for IOT applications. But, for the operators, this has a financial impact as they will have to continue supporting GSM/GPRS even if they want to move on to more spectrally efficient LTE technology. To mitigate this, EC-GSM was taken up in release 13 to further improve GSM.

EC-GSM is achieved by defining new control and data channels mapped over legacy GSM. It allows multiplexing of new EC-GSM devices and traffic with legacy EDGE and GPRS. No new network carriers are required: the new software on existing GSM networks is sufficient. Coverage extension is also achieved for both the data and control planes by utilizing the concept of repetitions and signal combining techniques. It is handled in a dynamic manner with multiple coverage classes to ensure optimal balance between coverage and performance.

EC-GSM includes eDRX to improve power efficiency and hence, the battery life. The resulting EC-GSM functionality enables coverage improvements of up to 20dB with respect to GPRS on the 900MHz band.

3.3 3GPP NB-IoT standards

3GPP NB-IOT technology has been standardised in 3GPP Release 13. NB-IOT is a self-contained carrier that requires a system bandwidth of only 200 kHz and is specifically suited for ultra-low end IOT applications. It is enabled using new network software on an existing LTE network, which will result in rapid time to market.

As per the requirements for IOT connectivity, the 3GPP decided that NB-IOT should support three different modes of operation as shown in figure below as per 3GPP RP-151621:

a) 'Stand-alone operation' utilizing for example the spectrum currently being used by GERAN systems as a replacement of one or more GSM carriers
b) 'Guard band operation' utilizing the unused resource blocks within a LTE carrier's guard-band
c) 'In-band operation' utilizing resource blocks within a normal LTE carrier

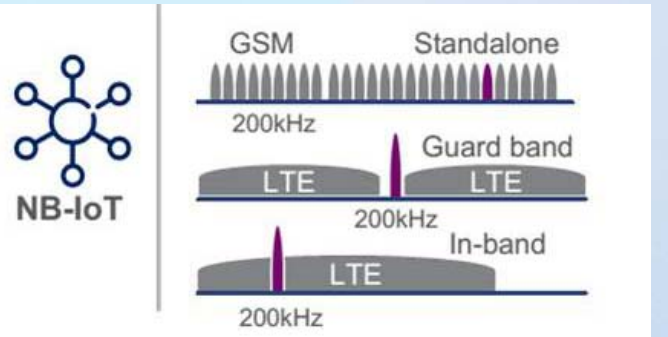

Fig. 4. NB-IOT Deployment options

3.3.1 Lower device cost

In Release 13 NB-IOT, the following features were added to the UE to lower the device cost:

- Reduced device bandwidth of 180 kHz in downlink and uplink
- Reduced throughput based on single PRB operation to enable lower processing and less memory on the modules.

3.3.2 Enhanced coverage

3GPP Release-13 NB-IoT provides 20dB additional link budget, enabling about ten times better area coverage. The enhanced coverage can be achieved using a combination of techniques, including power boosting of data and reference signals, repetition/ retransmission and relaxing performance requirements, for example, by allowing a longer acquisition time or higher error rate.

3.3.3 Increased battery life

For increased battery life, Extended Connected-DRX and Idle-DRX operation has been introduced. In Extended Connected-DRX Extended DRX cycles of 5.12s and 10.24s are supported and in Idle mode (I-eDRX), Extended DRX cycles up to ~44min for eMTC and Extended DRX cycles up to ~3hr for NB-IOT are supported respectively.

NB-IOT trials are being carried out 2016 onwards, by operators like AT&T, Verizon etc. utilising NB-IOT capable modules from vendors such as u blox and Sequans.

4.0 Enhancements in the core network and Service Architecture

4.1 Overload and congestion control at core network and RAN

These aspects were studied in 3GPP Release 10 and 11. A mechanism to control and prevent such situations is done by configuring the MTC UE as LAPI or Low Access Priority Indicator and through EAB or Extended Access Barring. Both identify the devices as delay tolerant and allow the RAN to stagger the MTC originated connections.

4.2 Small Data and Device Triggering

This study was part of 3GPP Release 12. Enhancements are required to RRC procedures and to the RAN to enable efficient transfer of small amounts of data by MTC as transition from RRC Idle to Connected state will entail a huge overhead. Instead, small data may be sent as part of NAS signalling.

4.3 Service Exposure and Enablement Support

This feature was introduced in 3GPP Release-13. Through this feature, 3GPP has standardised support for third parties to interact with 3GPP systems to provide third party services to their customers. Provisioning support for service enablement is being facilitated by making available additional information and defining new interfaces between the 3GPP Core network and application platforms. Other features like, Monitoring Enhancements, Group based Enhancements were also added as part of the core network.

5.0 Conclusion

With increasing interest of the cellular network operators in the IoT field with the ways in which the similarities between the deployment, management and provisioning and support of communication of IoT and cellular communication services can be taken advantage of, 3GPP started the NB-IoT forum in November 2015 with the aim to standardise the technological changes required to support IoT use cases.

3GPP has released the NB-IoT related standards in June 2016 as part of Release 13 specifications. With the interest shown by operators in IoT deployment with many pre-standardisation NB-IoT pilots taking place, it is felt that in the year 2017 NB-IoT based products may start coming in the market. Several manufacturers like Sequans and u-blox have started bringing out commercial products based on LTE Cat 0 and LTE Cat M1 and have indicated 2017 for commercial availability of LTE Cat-NB1 module.

Some of the advantages that are imparted by 3GPP Cellular IOT technology is that it utilises licensed frequencies which come with a guarantee against interference and can be more easily monitored as compared to other LPWAN technologies that function in the ISM bands. When using the ISM-bands, there is a constant risk that some other device or application may disrupt the service. Additionally, there are some fundamental aspects of scalability for unlicensed spectrum because at some point the ISM-bands will become highly congested if extensively used for IoT. Another advantage of cellular IOT is that the use of licensed spectrum facilitates international roaming and interoperability. ISM-band technologies are on the other hand fragmented along geographic lines, with different frequencies allocated in Europe, North America and Asia.

Depending on the business side of the use cases, it's probable that cellular IOT will co-exist with other proprietary communication technologies like ZigBee, 6LOWPan, LORA and SIGFOX for some time to come especially with these proprietary communication technologies being used for sensor to gateway/ aggregator communications.

Activities at NTIPRIT (Nov. 2016 to Jan. 2017)

1. In-service training courses for DoT Officers were conducted at NTIPRIT on the following topics:

i. Training course on "EMF Strength Measuring Instruments", (30-31 January, 2017) [28 Participants]

2. Induction Training of the following Batches of Officer Trainees of ITS/BWS and JTO probationers:

i. ITS-2014 Batch (17 officers)
ii. ITS-2013 batch (4 officers)
iii. ITS-2012 batch (14 officers)
iv. JTO-2015 Batch (20 officers)
v. P&T BWS-2010 & 2013 Batch (8 officers)

Various training programs like technical modules and Field attachment of the ITS/BWS and JTO were conducted during this period as per respective training calendar.

3. A new batch of JTO Probationers comprising of fourteen from JTO-2015 batch, five from JTO-2013 batch (Reserve List) and one from JTO-2014 batch (Reserve List) joined NTIPRIT on 13.12.2016 for 30 weeks long induction training. Various training modules like Administrative & Establishment Rules, Telecom Infrastructure, Switching, Transmission Technologies and IT Tools in Office were conducted during this period.

4. Alliances built by NTIPRIT

NTIPRIT facilitated a "Technology and Innovation Seminar" from 28th November to 2nd December 2016, in the Technological University of Pereira, Colombia on the request of Ministry of External Affairs, Govt. of India by way of deputing Sh. Vineet Verma, Director, NTIPRIT as an expert speaker to deliver technical lectures as part of an alliance between the Embassy of India, the ICT Ministry of Colombia and the Technological University of Pereira.

5. Interaction of Officers Trainees of ITS-2014 batch with Hon'ble Vice President of India

Officer Trainees of ITS-2014 batch called on Hon'ble Vice President of India, Shri M. Hamid Ansari on 10.01.2017 at Vice-President's House. The Hon'ble Vice President in his address to Officer Trainees advised them to work tirelessly in pursuit of delivering excellence in whatever roles & responsibilities they are assigned. The Hon'ble Vice President specifically cited emerging challenges and security concerns in the arena of cyber security due to ongoing digitisation of economic activities and asked Officer Trainees to get themselves prepared accordingly.

Hon'ble Vice President of India with Officers and Probationers of Indian Telecom Service-2014 batch

6. Valedictory Programme of Officer Trainees of ITS-2012 batch

A Valedictory Module as a mark of completion of Induction Training of ITS-2012 batch Officer was organized at NTIPRIT. Sh. R. K. Misra, Member (S), in his valedictory address on 05.01.2017, exhorted upon Officer Trainees to work sincerely and carry out assigned jobs diligently. He also advised Officer Trainees to keep themselves abreast with latest technological changes happening in the telecom sector as this will enable them to discharge their duties efficiently.

Sh. R. K. Misra, Member (S) and other senior officers with Officers Trainees of ITS-2012 batch

हिंदी कार्यशाला

दूरसंचार अभियांत्रिकी केंद्र, नई दिल्ली में दिनांक 21.12.2016 को एक हिंदी कार्यशाला का आयोजन किया गया। इस कार्यशाला में कुल 17 अधिकारियों/कर्मचारियों ने भाग लिया। इस कार्यशाला में एन.जी.एस. अनुभाग द्वारा उपस्थित अधिकारियों/कर्मचारियों को यूनिकोड इन्स्टाल करने, गूगल–ट्रांसलेशन, गूगल वॉइस टाइपिंग, और मोबाइल फोन पर गूगल वॉइस टाइपिंग का अभ्यास करवाया गया।

हिन्दी कार्यशाला के दौरान उपस्थित अधिकारी एवं कर्मचारीगण

Approvals from Nov. 2016 to Jan. 2017

S. No.	Name of the Manufacturer (Trader)/Name of Product & Modal No.
A	SNG Prime Services
1	Video Conferencing Equipment (Stand alone) to work at 384 Kbps/ LFZ015
B	Ericsson India Pvt Ltd.
2	Interchange of digital signals at 2, 8, 34, 45 & 140 Mbps ports/Mini Link TN
C	Cisco Systems India Pvt. Ltd.
3	Router/Cisco 3925
D	Clixxo Broadband Pvt Ltd.
4	PABX For Network Connectivity/IPX-22K (revised IR)
5	PABX For Network Connectivity/IPX-22K (renewal)
E	Sunren Technical Solutions Pvt Ltd.
6	PABX For Network Connectivity/MEDIANT 3000
7	Interchange of digital signals at 2, 8, 34, 45 & 140 Mbps ports/ Session Border Controller AP3900
F	ZTE Telecom India Pvt Ltd.
8	IP Media Gateway/ZXUN iMG
G	Arya Omnitalk Radio Trunking Services Pvt Ltd.
9	Service Approval for PMRTS at Vishakhapatnam, AP
H	NEC India Pvt Ltd.
10	PABX for Network Connectivity/SV9500
I	Progility Technologies Pvt. Ltd.
11	PABX for network connectivity /Openscape 4000
12	PABX for network connectivity/HP-150
J	Vishal Telecommunications Pvt. Ltd.
13	Interchange of digital signals at 2, 8, 34, 45 & 140 Mbps ports/ Digital Multiplexer (PDH) I-Gate 4000 Edge
K	Ciena Communications India Pvt Ltd.
14	Interchange of digital signals at 2, 8, 34, 45 & 140 Mbps ports/ 6110HDE
15	Interchange of STM-1, STM-4, STM-16, STM-64, & STM-256 Signals between different networks/6110 HDE
L	Aspect Contact Centre Software India Pvt. Ltd.
16	Systems Employing Computer Telephony Integration/Aspect Call Centre Entreprise
M	BPL Telecom Pvt Ltd.
17	PABX for Network Connectivity/SIGMA INDX

Important Activities of TEC during NOV. 16 to JAN. 17

New GRs/IRs issued:

- GR on 40/80 Channel Dense Wavelength Division Multiplexing (DWDM) System with Channel bit rate of 10 Gbps for Core /Metro Network Applications
- GR on Long Term Evolution (LTE-A) and Evolved Packet Core(EPC) release 11

Revised GRs/IRs issued:

- GR on Optical Fibre Splicing Machine (Portable)

DCC Meeting conducted:

- GR on Integrated Broadband System for delivery of digital services in rural area
- GR on SPV based hybrid power supply for Wi-Fi Terminal & Similar Telecom Terminal
- IR on embedded sim (e-SIM)
- GR on FTTH/FTTB/FTTC BB access applications using GPON

Sub DCC cum MF meeting conducted:

- GR on Wi-Fi Hot Spot, GR on WLAN Controller
- GR on Wi-Fi access and backhaul in ISM Band for rural area
- GR on Office in a Box, GR on SMPS Power Plant
- GR on Riser Optical Fibre Cable (For Indoor Application)
- GR on Installation accessories and Fixtures for self supporting Metal Free Aerial (ADSS) Optical Fibre Cables (Type-I, Type-II & Type-III)
- GR on Wavelength Division Multiplexing Passive Optical Network
- GR on MPLS-TP based carrier Ethernet switch for aggregation and access network applications
- GR on IVRS. GR on VoIP Protocol Analyser
- GR on VoIP Performance Analyser
- IR on Ethernet to E1 Converter, IR on High Speed Line Driver
- TSTP for measurement of Electromagnetic field from base station antenna

Representation of TEC in Training/Seminar/ Meetings

- In ITU-T SG-12 meetings at Geneva stable draft of recommendation on "QoS norms for TDM Interconnection between Telecom Networks" (G. PoiCong) has been consented as new ITU-T Recommendations E.847
- SG-I meeting by TSDSI in New Delhi
- Seminar on 'Telecom India-2016' in New Delhi
- Conference on 'Transforming India' in New Delhi
- Conference on 'Accelerating broadband in India' in New Delhi
- 2nd workshop on 'End to end device certification for telecom industry in India' in Mumbai

ISO : 9001-2008

Certifications issued by TEC

Type Approval (TA)

Interface Approval (IA)

Certificate of Approval (CoA)

Visit

www.tec.gov.in

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Western Region	:	022-26610900
Northern Region	:	011-23329464
Southern Region	:	080-26642900

Other Activities

- Testing of CDOT STBR completed in IPv6 Ready Logo lab in TEC
- Certificate of CAB for M/s Bharat Test house (P) Ltd and M/s Tarang Lab (Wipro Technologies) were issued
- Seminar organised by TEC on 'Arbitration Act' given by Shri D.R Meena, former Law Secretary
- EMF Web Portal meeting in TEC
- A computer program has been developed to automate the Test and Certification procedure in TEC. Now record keeping and issue of TAC/IAC and preparation of various reports on status of test cases under progress and issue of certificates is being done through this program.

Approvals issued by TEC during the period from Nov. 2016 to Jan. 2017

Interface Approvals 16
Type Approvals 00
Service Approvals 01

टी ई सी संचारिका : दूरसंचार अभियांत्रिकी केन्द्र
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