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ANALYTICAL STUDY OF DEDICATED NETWORK FOR IOT USING LoRaWAN TECHNOLOGIES

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Abstract - *The Internet of things (IoT) is invasive our lives by connecting encompassing human things to the internet. In this paper, we've got an inclination to addresses the long range wide area network (LoRaWAN) that pulls various attentions primarily by their ability to produce low-cost property to the low-power devices which are distributed over very huge geographical areas. LoRaWAN offers radio coverage over very huge area by approach of base stations and adapting transmission rates, transmission power, modulation, duty cycles, etc., such end-devices incur awfully low energy consumption due to their being connected.*

Key Terms-LoRa, LoRaWAN, IoT.

1.INTRODUCTION

Things are outlined as objects that may be known and integrated into communication networks. Things associate info each statically and dynamically. With the event of the internet of things (IoT), a lot of sensible applications are often found in several industries these days. Totally different application areas have specific necessities and concerns. The short-range radio property (e.g., Bluetooth and ZigBee) don't seem to be appropriate for situations that need long-range performance with low information measure. M2M solutions supported cellular technology will give giant coverage, however they consume excessive power. IoT provides a far better answer to manage the huge range of devices perpetually evolving with underlying necessities like coverage, dependability, latency, and value effectiveness. The internet of Things refers to the interconnection of devices like sensors and actuators [1]. The end devices in Iot are usually power strained and have low information rates to send to the network. To supply sensible communication for the increasing range of sensible applications, there's a necessity for low price and long vary Low Power Wide area Network (LPWAN) technologies [2]. LoRaWAN is energy economical and cheap. Low-power, wide-area (LPWA) technologies are targeting at these rising applications and markets.

2. RELATED WORKS

Orestis Georgiou and Usman Raza [1] addressed about distinctive peculiarities of LoRa, together with its chirp spread spectrum modulation technique, regulative limitations on radio duty cycle, and use of acknowledgment protocol. The stochastic geometry frame-work used for modeling the performance of single entree Lo-Ra network. The coverage likelihood drops exponentially because the range of end-devices grows because of intrusive signals victimization identical spreading sequence.The advantage during this paper is that the fundamental limiting issue that may-be a lot of vital to-wards LoRa measurability than as an example spectrum restrictions. The limitation is collision and information loss within the frame.

Usman Raza, Parag Kulkarni, and Mahesh Sooriya-bandara [2] addressed the planning goals and also the techniques, that totally different LPWA technologies and also the standardization activities dispensed by different standards development organizations (e.g., IEEE, IETF, 3GPP, ETSI) still because the industrial consortia engineered around individual LPWA technologies exploit to supply wide-area coverage to low power devices at the expense of low information rates. The limitation during this paper is that the implementation is incredibly advanced.

Aloys Augustin, Jiazi Yi, Thomas Clausen and Wil-liam Mark Townsley. [3] addressed an outline of LoRa associated an in-depth analysis of its useful components.The limitation is its performance degrades quickly once the load on the link will increase and time consumption is high.

Matti Hamalainen, Konstantin Mikhalov and Juha Petajaejaervi [4] addressed the indoor performance of LPWAN technology, specifically LoRa, by the means that of real-life measurements. The measured packet success delivery magnitude relation was ninety six.. The limitation is that the acknowledgements and retransmissions that build less output.

Konstantin Mikhalov,Juha Petajaejaervi and Tuomo Haenninen [5] analyzes the recently proposed LoRa low power wide area network (LPWAN) technology when used under European frequency regulations. It derives the performance metrics of a single LoRaWAN end device, namely uplink throughput and data transmission times. Then it analyzes the maximum number of end devices which can be served by a single LoRaWAN base station and discussed about the spatial distribution of these devices. The limitation is implementation is very high cost.

Matti Hamalainen, Konstantin Mikhalov and Juha Petajaejaervi [6] addressed the scaling laws that dictate both local and global connectivity properties of bounded wireless networks. These laws are defined with respect to the key system parameters of per-node transmit power and the number of antennas exploited for diversity coding and/or beam forming at each node. The advantage is the network domain to the path loss exponent enables efficient boundary effect mitigation and network topology control. The limitation is packet loss is high at high traffic.

Mohamed Aref and Axel Sikora, Germany [7] presented about the semtech lora. The significant benefits are long range, robust performance, and battery lifetime compared to competing technologies. The limitation is data loss is significantly high.

Orestis Georgiou,Carl P.Dettmann and Justin P.Coon [8] presents about the nodes in ad hoc networks with randomly oriented directional antenna patterns typically have fewer short links and more long links which can bridge together otherwise isolated sub networks. This network feature is known to improve overall connectivity in 2D random networks operating at low channel path loss. It established the theoretical results to obtain analytic expressions for the mean degree of 3D networks for simple but practical anisotropic gain profiles, including those of patch, dipole and end-fire array antennas. The analysis reveals that for homogeneous systems (i.e., neglecting boundary effects) directional radiation patterns are superior to the isotropic case only when the path loss exponent is less than the spatial dimension. The ad hoc networks utilizes the directional transmit and isotropic receive antennas (or vice versa) are always sub-optimally connected regardless of the environment path loss. It investigates inhomogeneous systems and studies the geometrical reasons why boundary effects cause directional radiating nodes to be at the disadvantage to isotropic ones. Finally, multi-directional gain patterns consisting of many equally spaced lobes are used to mitigate boundary effects and improve overall network connectivity.

Michel Daoud Yacoub [9] addressed the fading model, which explores the nonlinearity of the propagation medium. It derives the corresponding attenuation distribution–the α-μ distribution–which is really a rewritten variety of the Stacy (generalized Gamma) distribution. supported the attenuation model projected here, higher order statistics are obtained in closed-form formulas. More specifically, level-crossing rate, average fade period, and joint statistics (joint likelihood density operate, general joint moments, and general correlation coefficient) of correlate α-μ variates are obtained, and that they are directly associated with the physical attenuation parameters.

Michael G. Luby, Michael Mitzenmacher, M. Amin Shokrollahi, and Daniel A. Spielman [10] proposed the simple erasure recovery algorithm for codes derived fromcascades of sparse bipartite graphs and analyzes the algorithm by analyzing a corresponding discrete-time random process. As a result, an easy criterion involving the fractions of nodes of various degrees on either side of the graph that is important and spare for the decryption method to complete with success with high likelihood is obtained.

3. LONG RANGE WIDE AREA NETWORK

LoRaWAN is defined as a wireless communication protocol providing long vary property at a small

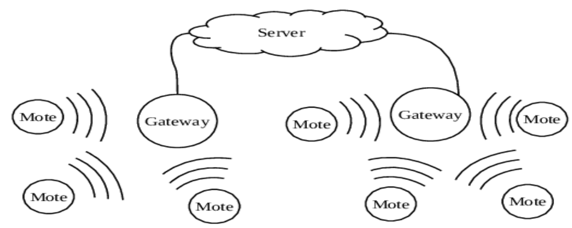

Fig.1. Topology of Lo-RaWAN

Bit rate. LoRaWAN relies on the LoRa modulation [3]. LoRaWAN supports LoRa spreading factors seven to twelve. LoRa is that the physical layer employed in LoRaWAN. It features low power operation (around ten years of battery lifetime), low rate and long communication vary. LoRaWAN could be a LPWAN (Low-Power Wide area Network) communication normal [4]. It aims to exchange knowledge (such as alarms, meters, or watching devices) between low-power devices and a network server, through gateways over long distances. LoRaWAN achieves long-range radio communications at little bit rates (from zero.3 to fifty kbps) and is so similar temperament for several applications [5], together with the internet of Things. End-devices send information to gateways over one wireless hop and gateways square measure connected to the network server through a non-LoRaWAN network (e.g. information science over Cellular or Ethernet).

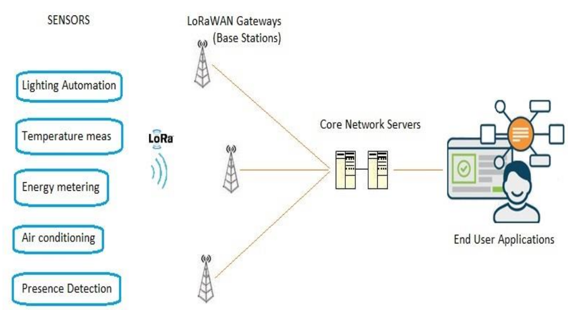

Fig.2. Architecture of LoRaWAN networks

Communication is bi-directional, though transmission communication from finish devices to the network server is powerfully favoured.

3.1. Components of a LoRaWAN Network

Several elements of the network are outlined within the LoRaWAN specification and are needed to create a LoRaWAN network: end-devices, gateways (i.e., base stations) and also the network server.

- End-device: The low-power consumption sensors that communicate with gateways exploitation LoRa.
- Gateway: The intermediate devices that for-ward packets coming back from end-devices to a network server over AN IP backhaul interface permitting an even bigger turnout, like local area network or 3G. There may be multiple gateways in an exceedingly LoRa preparation, and also the same knowledge packet may be received (and forwarded) by over one entryway.
- Network server: It is chargeable for de-duplicating and coding the packets sent by the devices and generating the packets that ought to be sent back to the devices.

Unlike ancient cellular networks, the end-devices aren't related to a selected entryway so as to possess access to the network. The gateways serve merely as a link layer relay and forward the packet received from the end-devices to the network server once adding info relating to reception quality. Thus, an end-device is related to a network server that is chargeable for sleuthing duplicate packets, selecting the acceptable entryway for sending a reply consequently for causing back packets to the end-devices. Logically, gateways are end-devices.

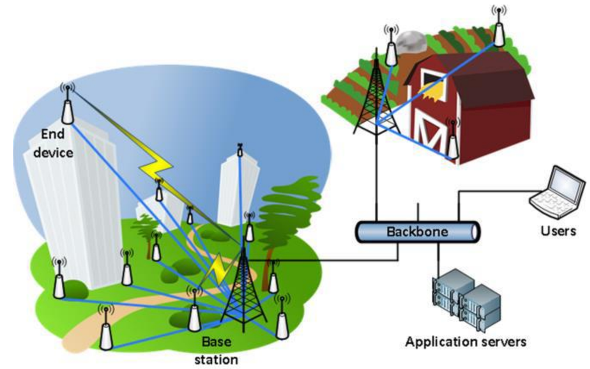

Fig.3. Typical LoRaWAN network landscape

The network server responds with a part of accept that is forwarded by the entranceway. The entranceway will transmit this be part of settle for throughout [6] either the primary receive window (which occur 5 seconds once the top of transmission of the be part of re-quest) or throughout the second receive window (which occur six seconds once the top of transmission of the be part of request).

4. LoRaWAN EXISTING TECHNOLOGIES

LoRaWAN are used in many IoT applications such as smart city, smart home, industrial applications, smart agriculture and farming applications. In this paper, we have conducted a survey by going through different literature, which describes different techniques of LoRaWAN. In section II, we have gone through various literatures, seen brief comparison among existing techniques. Problem in existing system can be easily understandable if we divide the process as follows, Orestis Georgiou and Usman Raza [1] addressed about the scalability when number of end devices increases in single gateway. LoRa employs an adaptive chirp spread spectrum (CSS) mechanism using pure ALOHA protocol which causes lot of collisions that leads to frame loss.

Problems can be summarized as follows,

- Duty cycle is the central factor that causes delay between successive frames sent by devices.
- Energy consumption is high.
- Less throughput.
- Data loss are high.

5. CONCULSION

In this paper, we have discussed about the previously adopted methods and techniques of LoRaWAN. With many IoT applications on the rise, the number of IoT devices is proliferating. To cater to the communication needs of this large number of IoT applications, to collect data from these devices, new architectures called LoRaWAN, a Low Power

Wide Area Network (LPWAN) technology is proposed. We have concluded that if we apply data recovery technique in application layer of OSI model using network simulator (NS2), we can solves the issues. Wide area coverage, low power consumption, and inexpensive wireless connectivity blend together in LPWA technologies to enable a strong business case for IoT/M2M applications.

6. REFERENCES

[1] Orestis Georgiou and Usman Raza" Low Power Wide Area Network Analysis: Can LoRa Scale?" in IEEE WIRELESS COMMUNICATIONS LETTERS, VOL. 6, NO. 2, APRIL 2017.

[2] U. Raza, P. Kulkarni, and M. Sooriyabandara, "Low Power Wide Area Networks: A Survey," arXiv preprint arXiv:1606.07360, 2016.

[3] A. Augustin, J. Yi, T. Clausen, and W. M. Townsley, "A Study of LoRa: Long Range & Low Power Networks for the Internet of Things," Sensors, vol. 16, no. 9, p. 1466, 2016.

[4] Juha Petäjäjärvi, Konstantin Mikhaylov, Matti Hämäläinen, Jari Iinatti" Evaluation of LoRa LPWAN Technology for Remote
Health and Wellbeing Monitoring,june 2015.

[5]Analysis of the Capacity and Scalability of the LoRa Wide Area Network Technology,may 2016.

[6]J. P. Coon, O. Georgiou, and C. P. Dettmann, "Connectivity scaling laws in wireless networks," Wireless Communications Letters, IEEE, vol. 4, no. 6, pp. 629–632, 2015.

[7] M. Aref and A. Sikora, "Free space measurements with Semtech LoRa technology," in Proc. 2nd Wireless Syst. within Conf. Intell. Data Acquisition Advanced Comput. Syst.: Technol. Appl., Offenburg, 2014, pp. 19-23.

[8]O. Georgiou, C. P. Dettmann, and J. P. Coon, "Connectivity of confined 3D networks with anisotropically radiating nodes," Wireless Communications, IEEE Transactions on, vol. 13, no. 8, pp. 4534–4546, 2014.

[9] M. D. Yacoub, "The distribution: a physical fading model for the stacy distribution," IEEE Transactions on Vehicular Technology, vol. 56, no. 1, pp. 27–34, 2007.

[10] Michael G. Luby, Michael Mitzenmacher, M. Amin Shokrollahi, and Daniel A. Spielman" Efficient Erasure Correcting Codes",Ieee transactions on information theory, vol. 47, no. 2, february 2001 5.