

Internet of Things over LTE/LTE-A Network

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Abstract:

In these days Long Term Evolution (LTE) and Long Term Evolution Advance (LTE-A) both are prominent technologies in respect of Internet of Things (IoT). As far as power saving requirement for IoT devices LTE, LTE-A also provide mechanism to turn off receptions and go to sleep when no data need to be received or transmitted. LTE and LTE-A also provide Quality of Services and perfect robustness. Internet of Things (IoT) might be joined in straightforwardly and consistently an extensive number of various and heterogeneous end framework while giving open access to choose information for improvement of digital services.

Keywords- IoT, LTE, LTE-A, Services

I. Introduction

The Internet of Things is the network of objects or “physical things” which are fixed to a network or with any electronic device, computerized software, antennas/sensors and connectivity to enable it to perform big service by communicating each other (with other connected devices). Everything which is identifiable uniquely in internet communication system and each thing is able to communicate to another thing within Internet infrastructure.

Current performance along with history is described in below diagram clearly.

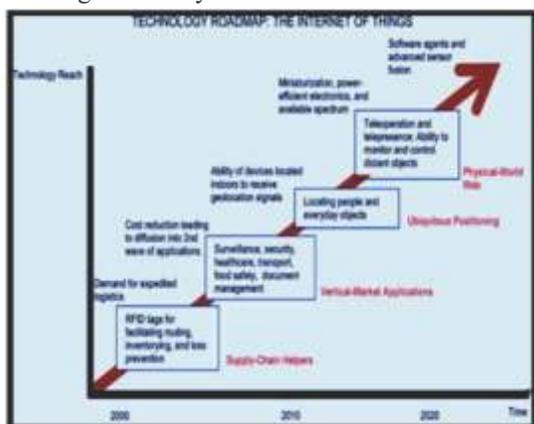


Figure.1: Roadmap of Internet of Things (IoT) [1]

The term “IOT” or Internet of things was first documented in 1999 by a British visionary, Kevin Ashton. Initially, Internet of Things is supposed to offer communicating

connectivity of different systems and devices. Which is somehow we say it is more than machine-to-machine communications (M2M). [2][3]

Wireless system can be classified in two as far as high speed mobile wireless access services are concerned. LTE- A is anticipated that would target considerable change in gashly productivity and lessening in latency.^[12] Now in the IoT prototype, lots of objects that are present with us continuously on the network in form or other. In the result bulky amount of data are generated which is obviously required to stored, then process and present in uninterested efficient form. The evolution towards information and communication is evident for the demand of Wi-Fi and 4 G-LTE wireless internet accesses. The achievement for continuous connectivity is succeeded with the help of Internet of Things (IoT)[4].

There are lots of merits of IoT but many hurdles are available in aforementioned topic point. IoT is similar to a heterogeneous end framework. Such a heterogeneous field of utilization makes the recognizable proof of arrangements satisfying the specific difficulties[5][6].

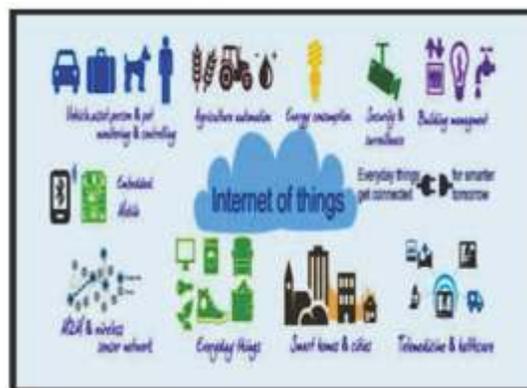


Figure.2. Internet of Things (IoT)[7]

a. Objective

Give a review of network architecture that will bolster LTE-and LTE advanced air interface.

II. Background

A. IOT Data Handling

In traditional data management system, the system manage the storage, retrieval and update of data items, files and others elementary records. As far as IoT is concerned data handling must concise and data online while provide storage. This increases the idea of data handling from offline storage, query processing[8].

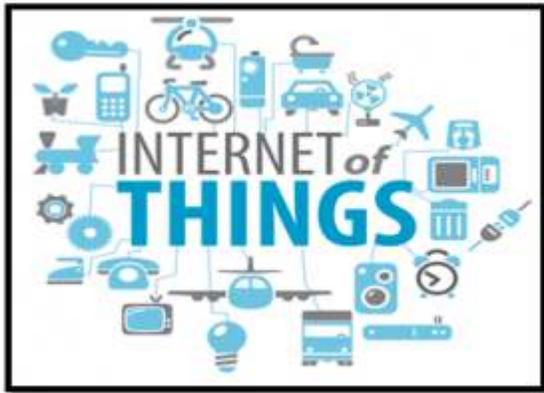


Figure.3. Internet of Things (IoT) [10]

B. IoT Data Lifecycle

The lifecycle of data within an Internet of things, the information continues from information generation to aggregation, optional filtering, exchange and pre-processing, and then at long last to capacity and filing. Examination and questioning are both the end focuses that start and expend information generation, however creation of information can be set to be pushed to the Internet of things administrations of consuming. Accumulation, Production, total, separating the information and some other essential preparatory and questioning handling usefulness are viewed as online in IoT framework. A portion of the operations goalmouth at level of making information accessible one for steady get to the long haul, while authentic is worried with read just information. Since some Internet of Things frameworks may produce, store and process the information in system for constant [11][12][13].

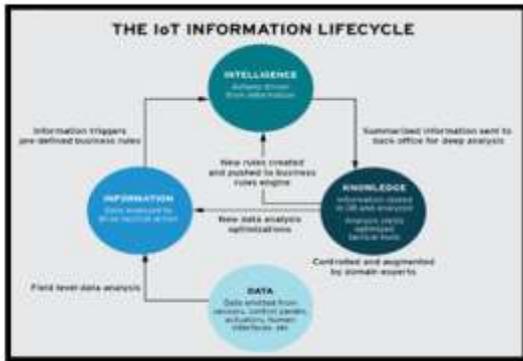


Fig. 4. Internet of Things (IoT) information life cycle [14]

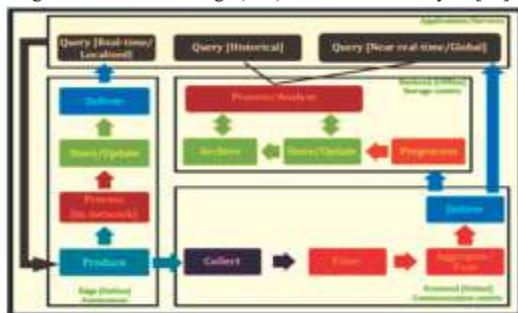


Figure.5. IoT purposed data lifecycle and data management system [14]

C. Querying

As querying is the core process to access any kind of data in a system. It is also used for querying as well for retrieving the data and simply data intensive systems are relied on querying [15].

D. Production

Data production process in IoT's system is exchanging or trading the information from one node another or any sort of machine to machine (M2M) correspondence and detecting. As time is most important factor correspondence. So information is normally time stamped and at some point conceivably geo-stamped [16][17].

E. Aggregation

Data aggregation process in IoT's framework is, transmission of the all raw data in real time out of the network.¹⁹

Which is always sanctioned expensive? Especially when the given data are so huge and the available bandwidth are so limited. Fusion & aggregation are both techniques which are deploy to merge operations in real time. These both techniques perform the compress to the data volume for storage and transmission purposes [18].

F. Delivery

Finally at the delivery point after fusion & aggregation data filtered and this possibly can either on at the autonomous virtual channel/units or at the any concentration points within the Internet of Things systems. For transferring of data for permanent data stores, there can be used any kind of broadband communication connectivity either Wired or wireless [17].

III. Literature And Review

The next generation network (NGN) could be another build and changing into progressively and a considerable measure of fundamental for future telecommunication network in this paper indicates five performs layer of NGN plan and talk about some end to end QOS (quality of administration) Issues for NGN (Called NGNQOS). As far as possible layers are 1) Application layer that support SIP (Session Initiation convention) and SIP can be depicted is a convention for correspondence and overwhelming multimedia system communication sessions. In this manner most regular uses of SIP range unit in web media transmission for voice and video calls, further as moment electronic informing wherever web Protocol (IP) systems.

2) Network Management Layer that goes for beating the bottlenecks issues at edge hubs or servers for end to end affirmation control.

3) Adaption layer that supports totally extraordinary system designs and system quality

4) Network Transmission Layer that offers end-to-end

QoS organization for period exchanges through mix Differentiated Service (DiffServ) and Multi-Protocol Label change (MPLS).

(5) Management Layer that gives Web-based GUI program to information presentation, checking, modification and higher subjective process in NGN.10 [18].

In 1998 Telecomm configuration started to concentrate on a coming era of a system that could be change the present phone arranges. The future in telecomm association move towards a break between the system supplier and specialist co-op[18].

This development is less cost and propels the capacity of system to bolster current administrations and applications and edge of media issue and communication network.

The essential development which is required to appear at noteworthy change in the correspondence market is the modification from circuit change media transmission system to package based framework using the web protocol. The general Plan behind the NGN is wherever in which one framework sends all information besides associations (voice, information, Video) by exemplifying these into parcels the NGN is a package based Network which can make organizations including Telecommunication Services and Can Produce of Multiple Broadband Quality of organization allowed send propels which advantage related Purposed are autonomous.[19]

The client hope to utilize at least one administrations that give by administration verification (i.e who is utilizing) Authorization (i.e. the client would have an authorization to utilize the administration or not). The hardest Challenges in the NGN will give validation and Authorization administrations when wandering is need so the client would be confirmed or approved to change the system on the fly.

The next section defines and briefly the need for information and the communication innovation (ICT) administrations, that is determine above. This paper gives a backdrop for determining the predict market tendency and their implication for the regulator. The final section finishes with guidance and submission for the future research.

Of a particular salient to for the next generation network are the proceed topics in the area of software described network (SDN), network, virtualization, security, application, cloud, services also the numerous important issues are accomplish next generation[20].

NGN conference at IEEE ICC 2015 important to combine and upgrade the new improvement and development rising center ranges. This conference also participation and invites for both academic and industry research doing in the area of next generation network technologies such as services, Architecture, protocols. This paper gives inside and out read on the innovations being considered for Long Term Evolution-Advanced (LTE-Advanced). In the first place, the movement from third era (3G) to fourth

era (4G) is delineating as far as execution needs and fundamental attributes.

The new determination created by the Third Generation Partnership Project (3GPP), that supports the mixing of present and future radio get to technologies, is highlighted. At that point, the most innovations for LTE-Advanced area unit clarified, next to potential improvements, their related difficulties, and some methodologies that are contemplated to handle that difficulty[21].

Relaying is one more of the climate that is acquainted in LTE-Advanced with support the execution of LTE, regarding scope and out-turn with regards to 3GPP the utilization of transfers can allow the resulting upgrades.

- Offer coverage in new areas.
- Temporary network preparation.
- Cell-edge outturn.
- Coverage of high rate.
- Cluster quality.

These improvements will be delegated "cover age expansion" and "throughput upgrade". Also to the past upgrades, the work of transfers brings the following blessings:

- Cost reduction: the cost of a transfer, independent from anyone else, ought to be not exactly the cost of an eNB, forward that the complexness of a hand-off is a littler sum than the many-sided quality of an eNB. Because of the shortage of a wired backhaul, the arrangement esteem and time should even be decreased, contrasted with an eNB.
- Power utilization lessening: The single-bounce separation between the eNB and therefore the UE is split into 2 distances: the separation from the eNB to the transfer, and the separation from the relay to the UE [22].

Types: Sorts the meaning of a ""sort"" of hand-off, in venture with 3GPP, is done by joining a collection of attributes that a transfer relay should have. The first basic qualities wont to order transfers range unit their duplexing subject, layers, and level of coordination into the RAN. On high of those orders, transfers will contain "additional items" like overhauled MIMO limits, joint effort capacities, etc. the resulting area gives an outline of the groupings of relays[22].

Third Generation Partnership Project (3GPP) a gaggle of telecommunication transmission affiliations working towards the change and support of a global System for Mobile communication (GSM) and also created radio get to advances, has started dealing with long-run Evolution progressed (LTE-Advanced) to accomplish the essentials of bleeding edge improvement. The key destinations for this advancement development square measure raised rate, enhanced range strength, enhanced scope and diminished inactivity. The top comes about of those objectives square measure significantly up administration

provisioning and lessening of administrator costs for different activity circumstance[23]

LTE-A helps in integration the present networks, of cutting edge innovation. The key objectives for this development the escalating user demands. The technical options of LTE-A could likewise be outlined with the word reconciliation. LTE-Advanced are standardized inside the 3GPP determination unharnessed ten (Release ten LTE-An) and can be intended to satisfy the 4G requirements as outlined by ITU. LTE-An as a framework needs to take a few choices into concerns in light of enhancements at each level that includes different quality and difficult execution. Different changes on the physical layer might be relied upon to support larger bandwidths with a great deal of adaptable distributions and to shape utilization of further expanded receiving wire innovations. Coordinated base stations, booking, MIMO, obstruction administration and concealment likewise will require changes on the particular[24].

In this Paper offers a summary of the long term Evolution (LTE) of the Universal Mobile Telecommunication System (UMTS), that is being produced by the third Generation Partnership Project (3GPP). LTE constitutes them obstruct step towards the fourth era (4G) of radio advances proposed to grow the limit and speed of versatile correspondences. Particular thought is given to the requirements and centers of LTE, its use of various radio wire strategies, and to the one Carrier Frequency Division Multiple Access (SC-FDMA) regulation utilized as a part of the LTE transmission. Likewise new future examination square measure as are arranged here[25][26].

A diagram of the LTE and LTE-An is given. The summary focused on the LTE needs and targets, course of events for the LTE preparing, various get to innovation in LTE, MIMO, furthermore the anticipated examination ranges. The paper furthermore examines couple of potential new investigation zones covering cloud radio get to arrange, Multi bounce remote systems, and Resilience and dependableness of LTE with MPLS[27].

The third generation partnership project has been developed (3GPP) standards based on advanced Long Term Evolution (LTE), and the potential for 3 GPP 4G, organize and change the expected wireless technologies and the advancement of the transcendent system. This article provides an overview of the review dedicated to 4G to meet the requirements of the job. The technology elements such as broadband and exchange distances which are being multi-acceptance cables, transmit / separate collection (companies), and exchange, and know the needs of the evolving LTE systems[28].

LTE-Advanced meets the execution needs set by ITU-R for IMT-Advanced and absolute it is an improvement of LTE and not is position structure in itself. Keeping obvious the possibility of in turn around similitude, LTE-Advanced terminals are proposed to have the ability to get to frameworks planned as per the fundamental unleash of

the LTE particulars; furthermore, terminals from the basic LTE unleash will be prepared to get to LTE advanced networks[29].

IV. Methodology

The research methodology its addresses several important points, including topic selection research purposes, and previous research on the subject also through collection of information and data by use tools of questionnaires, survey and statistics tables that help in obtaining information and data in find solutions and ways to treat Phenomenon. In this research analyze the 10years previous research papers and articles read and take some main points.

Through the use of quantitative research in the Independence study of the important use of appropriate tools in quantitative research through Mathematical Statistics, data and surveys that give the figures and ratios help to know the extent of the phenomenon and opinions slice search and responders.

The advancement of 3GPP's third era Universal Mobile Telecommunication System (UMTS), the essential broadband CDMA development, starting from its basic unleash in 1999/2000. There are groupings of different landings of UMTS, besides the development of High Speed Down connection Packet Access (HSDPA) in unleash five presented in the casually named three .5G. The resulting extension of the improved Dedicated Channel (E-DCH), higher famous as High Speed transmission Packet Access (HSUPA), completed three. 5G. the mix of HSDPA and HSUPA is at present alluded to as High Speed Packet Access (HSPA). LTE connected with the circulation of the discharge eight judgments in 2008 and LTE-Advanced is being introduced as a bit of unleashed ten. The LTE-Advanced radio get to arrange (RAN) sensibility is needed to be for all intents and purposes cemented by December 2010.

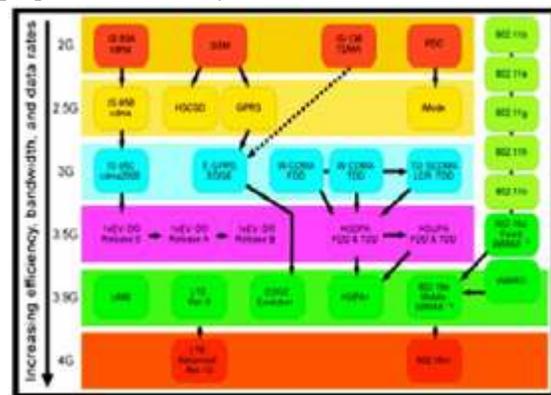


Figure.6. Efficiency of bandwidth with data sets

V. Sampling

Researcher tries to access to research samples close to him such as software houses, universities franchise communications offices , academics and different views on the subject of research and the extent of the

phenomenon in the country and within the means available. In order to overcome the negative results and focus on the positive results, may lead to the development of the telecommunications industry in the country and encourage investors in the field of telecommunications and software and inventors that can have an important role in reducing unemployment and improving the technological industries, especially telecommunications and software application. The sample size is 15; they filled the questionnaires I have been given. So mostly they are in telecommunication companies such as Mobilink, Zong, Telenor, Warid etc. samples representative collect the largest amount of information through statements and interviews and survey research taking information that contribute to the development of a hypothesis and theory research in terms of potential impact of Next Generation Network (NGN) in the field of telecommunications and the extent of social acceptance of such researcher trying to collect information on the research sample representative valid and appropriate that can be broader representation of all the people and the development of the theory of searching through information derived.

A. Primary Research

At the stage of primary data collection research using data collection methods through tools of Statistics such as questionnaires respondents samples that are filled questionnaires then return it, researcher to obtain private data and the original distribution of the research and also by conducting press interviews that contribute to obtain information and data, and through Find used in the surveys that are more stresses of interviews and are typically used to collect the large number of population responses.

B. Secondary Research

Secondary Research depends on the qualitative approach in the search through the collection of the above information for research in similar research from books, documents, magazines, research articles and internet for previous data contribute to the reinforcement Research and get the comparisons with Search, Secondary research relied on Google Universal site for the enormous scientific wealth through previous theories in the same search, and that has credibility and stability, as well as a Institute Of business and technology library and to ensure that wrote the value of such Business laws information management system computer sciences.

Q1. General

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Male	15	100.0	100.0	100.0

Q2. Occupation

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Telecommunication	10	66.7	66.7	66.7
Software	3	20.0	20.0	86.7
Engineer	2	13.3	13.3	100.0
Total	15	100.0	100.0	

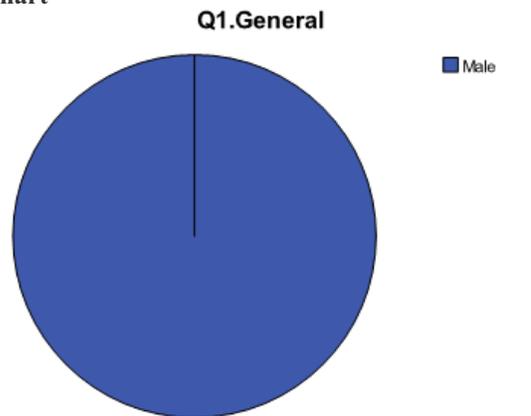
Q3. LTE standard is developed by

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid ITU	1	6.7	6.7	6.7
IEEE	2	13.3	13.3	20.0
3GPP	12	80.0	80.0	100.0
Total	15	100.0	100.0	

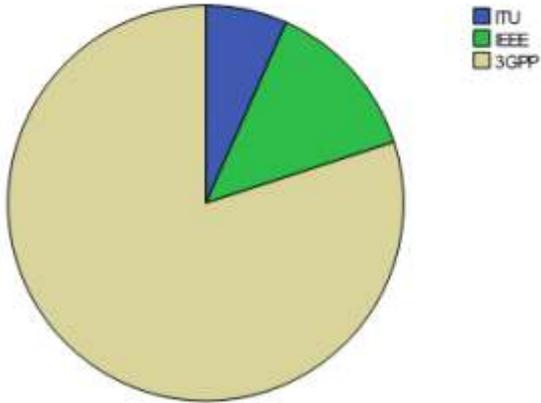
Q10. The radio interface is switched

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Packet Switch	14	93.3	93.3	93.3
Both	1	6.7	6.7	100.0
Total	15	100.0	100.0	

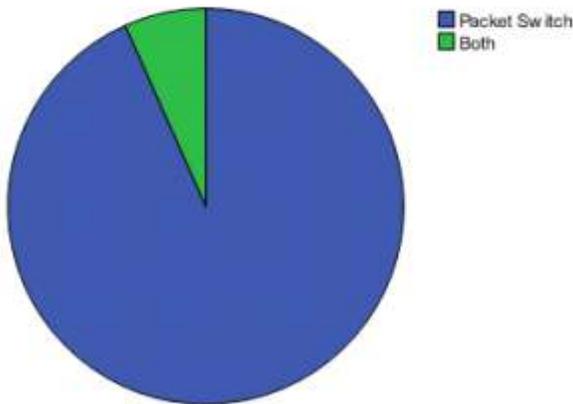
Pie Chart



Q3.LTEstandard.is.developed.by



Q.10.The.radio.Interface.is.switched



Regression Table and Hypothesis

C. Nominal Regression

Case Processing Summary

		N	Marginal Percentage
Q2. Occupation	Telecommunication	10	66.7%
	Software	3	20.0%
	Engineer	2	13.3%
Q10. The radio interface switched	Packet Switch	14	93.3%
	Both	1	6.7%
Valid		15	100.0%
Missing		0	
Total		15	
Subpopulation		2 ^a	

The dependent variable has only one value observed in 1 (500%) subpopulations

Model Fitting Information

Model	Model Fitting Criteria -2Log Likelihood	Likelihood Ratio Tests		
		Chi-Square	Df	Sig-
Intercept Only	6.017			
Fuel	5.170	-846	2	-.655

Parameter Estimates

Q2.Occupation ^a	B	Std. Error	Wald	df	Sig.	Exp (B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
Telecommunication Intercept	17.278	3572.253	.000	1	.996			
[Q.10.The.radio.Interface.is.switched=2]	-.774	3572.253	.000	1	.996	1.41E-7	.000	-
[Q.10.The.radio.Interface.is.switched=3]	0 ^c	-	-	0	-	-	-	-
Software Intercept	.405	.913	.197	1	.657			
[Q.10.The.radio.Interface.is.switched=2]	.000	.000		1	1.000	1.000	1.000	1.000
[Q.10.The.radio.Interface.is.switched=3]	0 ^c	-	-	0	-	-	-	-

3. The reference category is: Engineer.

b. Floating point overflow occurred while computing this statistic. Its value is therefore set to system missing.

c. This parameter is set to zero because is redundant.

Hypothesis: According the analysis the result shows that the technology is showing a better impact as peri scribe

D. Data Management Framework for IoT

In working scenario proposal for data handlings are preferred to WNS, the more sophisticated characteristics of Internet of Things is not to explicitly address. It is also one of the main functionality of the global IoT space. Therefore the proposed framework has a layer approach that sources centric middleware and centres on data

VI. Result and Discussion

Proposed IoT data handling consists of some basic stacked layers namely as Data layer, Things layer, The Communication Layer, Source layer Federation Layer, Query Layer and Transactions Layer.¹⁸

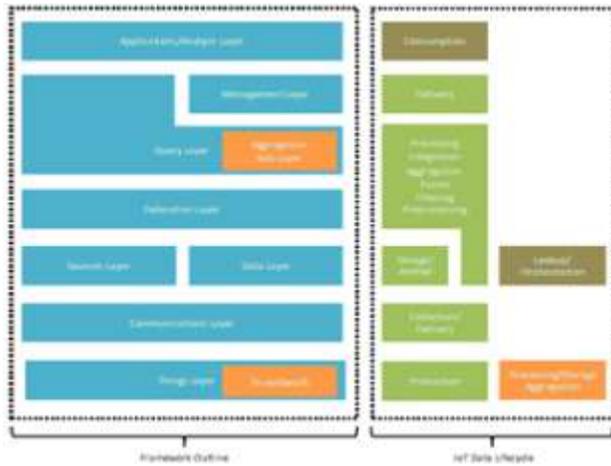


Figure.6. Outline of the proposed IoT data management framework and mapping of its layers to the IoT data lifecycle[29]

A. Data Layer

Data layer is the main and core layer of system of IoT data handling. This layer has all Data handling responsibility. During the procedure of data handling there are some problems to be addressed in IoT handling.

B. Things layer

Things layer can be any device i.e. cell phone/mobile phones, computer laptop, or any sensor device that has capacity of communication to other devices.

C. The Communication Layer

The communication layer functionality is to connect data sources and distributed data sources to more concentrated data storage and to processing unit.

D. Source Layer

The source layer is the system which is design to show data systems that metadata store the locations of data fragments beforehand for purposes of querying or update.

E. Federation Layer

As federation layer is middle or central framework of IoT's structure. The main function of federation layer is to provide the structure that joins broadcast Internet of Things sub-systems and data sources together to form a globalized view of the IoT systems.

F. Query Layer

The obligation of question layer is to exemplify the components of important for producing the inquiries, streamlining the current inquiries and executing inquiries of the Internet of Things (IoT's) database. It is sent both at the nearby and united levels. To being administering the subsystems conveyed by individual associations.

G. Transaction Layer

The transaction layer deals with all the execution of questions and information that are identified with IoT system and IoT services. Depending upon the kind of inquiries and information execution handle given by IoT

system to exchange layer, it can send either a solitary source/established execution technique, or it can convey disseminated or worldwide execution instrument.

VII. Conclusion

LTE-Advance touches the execution requirements set by IMT-Advance and inside and out. It is a development of LTE and not another framework in itself. In above cited subject we discussed about something about IoT and information data handling of system for the Internet of Things. LTE-Advance terminals are intended to have the capacity to get to systems worked by first arrival of the determinations. To compensate for storage, the comprehensive IoT components i.e. data handling framework with core data & support for federation layer and source layers.

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