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Information Technology

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Kalkaji, New Delhi.

Vision

"To be a World Class Institution and to nurture

Value based Professionals."

Mission

"To be student Centric through innovation in Pedagogy, Research,

Faculty Development,

Collaboration with Industry, Institutions and

High Quality Infrastructure."

From the Secretary's Desk

I welcome you all to this new edition of BCIIT Magazine. Banarsidas Chandiwala Sewa Smarak Trust Society is working with a mission "To provide yeomen service in the field of Health and Education". BCIIT was created by the Society to fulfill its mission and the societal needs of higher technical education in the developing discipline of Computer Science in 1999. The Society is aware of its responsibility to provide education to the youth of India.

The Society has provided a serene environment of teaching/learning at BCIIT with state of the art infrastructure comprising:

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- On campus, well-furnished Hostel.
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The thrust areas of BCIIT are practical intensive teaching/learning and all round personality development of the students so that they may be ready to accept the challenges of contemporary professional life of IT industry. I am sure that students of BCIIT are well equipped with necessary skills to deliver what is expected from them by the industry.

Dr. Bhuwan Mohan

From the Director'sDesk

I welcome you all to this new edition of BCIIT Magazine. In the information age, science and technology are the corner stone's on which the structure of society rests. The rapid advances in Information and Communication Technologies (ICT) has made the world increasingly hyper- connected and competitive, offering new challenges and opportunities, thus bringing fundamental transformation in society.

The Banarsidas Chandiwala Institute of Information Technology (BCIIT) has taken this unique initiative to encourage the innovative thoughts of its faculty and students to be put in the form of articles in e-magazine. These articles are put on the Institute website so as to be available to more people for their references, use and comments. This effort is a regular feature of the Institute for the past three years. Some of the faculties and students who ultimately wish to pursue the Ph. D program get lot of inspiration and initiate their research in the area of interest.

One of our dreams is to see that BCIIT stands tall among the other institutes of GGSIP University making an impact with value added contributions in the form of high standard and quality articles through its online endeavor. At our end we feel that we have highly experienced and inspired faculty and excellent and academically brilliant students who can contribute a lot in this manner.

I hope our humble effort will go a long way in putting the resourceful thoughts of our faculty and students in improving the quality of education through technology. It is the genuine and sincere attempt of our faculty and students who are constantly putting their heart and soul to achieve the results.

I pray and wish them good luck in their endeavor.

Dr. Ravish Saggar
Director, BCIIT

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An overview of VANETs

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Abstract— Mobile Ad-hoc network (MANET) is a temporary, wirelessly-linked network, having no centralized base station. In MANET, the battery of the nodes diminishes due to unbalanced load on nodes. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each node also acts as a router, forwarding packets to other nodes. Each node should have the information to route packets to other nodes. Vehicular Ad Hoc Networks (VANETs) are the kind of mobile ad hoc networks which consists of mobile nodes (vehicles) and fixed nodes (roadside units). Various applications such as road safety, comfort of passenger, entertainment, public safety, sign extension and intelligent transportation require the communication between the vehicles. In this paper, we present the features, various possible applications of vehicular network and implementations in the real world.

***Keywords*— MANETs, VANETs.**

I. INTRODUCTION

Vehicular Ad Hoc Networks (**VANET**s) are a type of Mobile ad hoc networks (MANETs) in the domain of Vehicles. Communication within a VANET is called inter-vehicle communication (IVC). With the development of wireless technologies and short range communication technologies, VANETs are quite popular these days [1]. VANETs consist of two entities: vehicles and roadside units. In intelligent transportation system (ITS) vehicles play various roles such as source vehicle, destination vehicle and router to send the packets to other vehicles. The motivation to develop VANETs is to collect road information and distribute it among the vehicles for improving the road safety applications [2]. VANETs are a key technology in ITS due to the availability of navigation system, global positioning system (GPS) and other sensors that can collect the vehicle speed, location [3],[4]. The various ITS applications are vehicle safety, collision avoidance, traffic monitoring and public safety, etc. VANETs have special characteristics like predictable mobility, highly mobile, self-organizing, and no energy constraints.

Although, some characteristics of VANETs resemble with the characteristics of MANETs, but there are many differences also. Some specific features are

1) Highly dynamic topology The high speed of the vehicles along with the availability of choices of multiple paths defines the dynamic topology of VANETs.

2) Frequent disconnected network The high speed of the vehicles in one way defines the dynamic topology whereas on the other hand necessitates the frequent requirements of the roadside unit lack of which results a frequent disconnections.

VAETSs have many unique features which make them distinct. Most of the traditional wireless technologies are not applicable to VANETs directly, due to their high mobility which disconnects the network very frequently. Therefore the highly dynamic nature of vehicles and the rapid changes in network topology are challenging issues in VANETs which need to be addressed efficiently.

Routing in VANETs is one of the vital task. Routing involves transmission of data from source to goal with a certain level of QoS. The QoS means transmission of data from source to goal with some minimum guarantee on parameters such as delay, data loss or overhead. The various QoS parameters are connectivity probability, reliability, availability, link duration, hop count, end to end delay, stability, etc.

II. APPLICATIONS OF VANET

VANETs have many applications ranging from safety to entertainment and commercial applications:

Safety applications: These applications pertain to the safety of people, safety of cars, collision avoidance and cooperative driving. These application are very important and critical and must be prioritised over other applications.

Other Applications include traffic management, traffic optimization, payment of toll, finding the closest petrol pump or restaurant and entertainment related services. These application are though less critical, but they are equally important applications. Traffic management is a very important aspect and necessary in modern time due to heavy inflow of vehicles. If all the vehicles become intelligent and are connected in a VANET, then all modern day traffic problems and chaos will end. By connecting to a VANET, services such as toll can also be paid very easily. There will be no need for physical toll collection and the toll will be automatically deducted from a vehicle's account the moment it crosses the toll point. Location based services can also be offered easily, where a vehicle can easily locate fuel stations, restaurants or shops by intelligent tracking.

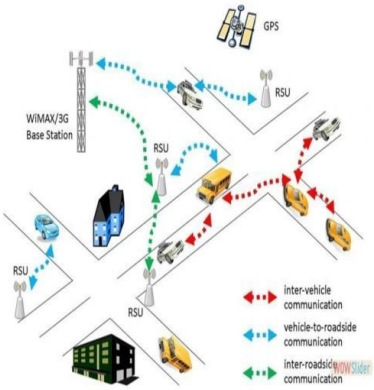

Fig 1: A sample VANET architecture

A VANET uses moving cars as nodes in a network to create a mobile network. VANET turns every participating car into a node, allowing cars some distance away from each other to connect and create a network. These nodes or cars also act as routers, transmitting messages intended for other nodes. Some cars fall out of the signal range and leave the network. At the same time, other cars can join in, connecting vehicles to one another so that a mobile network.

VANETs have special requirement due to their special features. One of them is whether performance of VANET routing protocols can satisfy the throughput and delay requirements of such applications. Though MANET protocols can be applied to VANETs also, their analysis shows that their performance is poor in VANETs. The main problem with protocols such as the ad hoc on-demand distance vector (AODV) and dynamic source routing (DSR) to the VANETs is their route instability. They can lead to frequent broken routes in VANETs due to their high mobility. This can lead to high packet drops, disconnected networks and large overheads. Therefore, MANET protocols are unsuitable for direct implementation. It leads to low delivery ratios and high transmission delays.

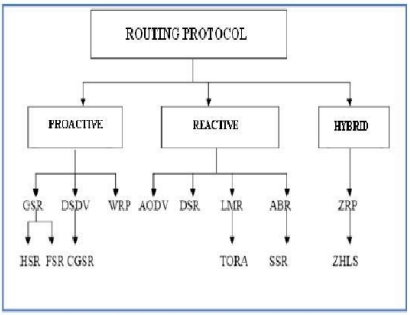

Fig 2. The VANET Routing Protocols

III. SECURITY ASPECTS

The benefits of VANETs can be overpowered by higher risks if such networks do not take security into account. Security aspects are necessary to consider prior to deployment. The risks in VANETs are particularly high as the nodes are strangers to each other.

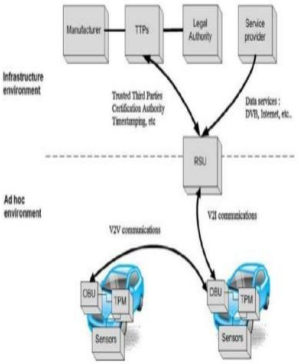

Fig 3. Implementation of VANET

Therefore, it becomes very difficult to authenticate other nodes. It is very easy for an intruder to pose as a valid node and engage in communication. This intruder can then harm the network by disallowing certain functions or it can simply intercept sensitive data to non authorized persons. Therefore, any implementation of VANETs must take into account the security issues and provide some kind of encryption and authentication.

IV. CONCLUSIONS

The opportunities that a VANET present are unlimited. The future introduction vehicular networks offer a tremendous opportunity to increase the safety of the transportation system and reduce traffic fatalities. Various applications such as road safety, comfort of passenger, entertainment, public safety, sign extension and intelligent transportation require

the communication between the vehicles and are expected to benefit from VANET architecture.

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Prospective Mobile Generations with Space Roaming

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***Abstract:*Wireless communication is the transfer of information over a distance without the use of enhanced electrical conductors or "wires". The distances involved may be short (a few meters as in television remote control) or long (thousands or millions of kilometers for radio communications. In the past few decades, the mobile wireless technologies have experience of various generations of technology revolution & evolution, namely from 0G to 4G. An advanced implementation of 5G technology which are being made on the development of World Wide Wireless Web (WWWW). Each generation have some standards, capacities, techniques and new features which differentiate it from previous generations .In this paper we present the study of several generations which are being used 0G,1G, 2G, 3G, 4G and 5G and try to find some future generations which are under research like 6G, and 7G. We also throw light on the evolution and development of various generations of mobile wireless technology along with their significance and advantages of one over the other.**

Keywords: 0G, 1G, 2G, 3G, 4G, 5G, 6G, 7G, CDMA, TDMA, FDMA.

I. INTRODUCTION

The term 'Wireless Communication' refers to the information transmission over a distance without using "wires" or any other guided conductor over a long distance or a short one. This type of network is also known as a cellular network or mobile network. The mobile wireless communication technologies, in past many decades, have evolved through various revolutionary generations such as from 0G to 4G. Furthermore, implementations of advanced 5G technology are under research and development stages. With the coming of each generation having its framework, set of protocols, techniques and innovative features that differentiates it from previous counterparts [1]. This has brought a revolutionary increase in the number of mobile subscribers across the world. In a cellular mobile network the geographical area is divided into cells each with a base station or cell site. The function of base station is to provide network coverage to the cell for transmission of text data, audio, image etc. information [2]. In order to

guarantee quality of service and avoiding interference a cell may use set of frequencies that are different from its adjacent cells. These cells are joined together for enabling wide area radio coverage. Mobile phones and other portable transceivers can therefore communicate with other such fixed or mobile transceivers located anywhere in the cellular network through base stations. The major advantages that cellular system provides includes minimal bandwidth operation catering increased consumer count [2]. The cellular communications networks have evolved through various generations starting from 0G, 1G, 2G, 3G, 4G and so on with 5G in its development phase and 6G with 7G under study and research. Currently, 4G is becoming a craze all around with further researches going on forother higher generations.

II.EVOLUTION OF MOBILE TECHNOLOGIES

A. ZERO GENERATION (0G – 0.5G)

Zero Generation (0G) marked the starting point with Mobile Radio Telephone system after World War-II. It was also known as a pre cellular system. The system was analog because here carriers used were analog signals with the Mobile Radio Telephone system providing half duplex communications [3]. In the working of this system the mobile operator sets up the calls with only a limited number of channels available [3]. The system does not support change of channel frequency i.e no handover feature available. Major technologies of 0G systems were Advanced Mobile Telephone System (AMTS), (MTS) Mobile Telephone System, Mobile telephony system D (MTD), OffentligLandmobileTelefoni o r Public Land Mobile Telephony (OLT), Push to Talk (PTT) and Improved Mobile Telephone Service (IMTS) [2]. OLT was first land mobile telephone network in Norway where it operated at 160 MHz VHF band using frequency 160 -162 MHz modulation for its mobile unit and 168-170 MHz for its base station. 0.5 G represents a group of technologies having improved features than the basic 0G counterparts. These mobile telephone systems found their applicability commercially as a part of the public switched telephone network (PSTN) with their own telephone numbers, differentiating it from closed network system of 0G [3].

B. FIRST GENERATION TECHNOLOGY (1G)

1G represents the group of first generation wireless telephone technologies working on analog cellphone standards introduced in 1980s. Here a voice call is modulated to higher frequency of 150MHz which is then transmitted to and between radio towers sing 1G technology. This is done using the technique Frequency Division Multiple Access (FDMA) [4].

The 1G mobile communication system was an analog frequency modulation scheme based on three technologies: NMT (Nordisk Mobile Telephony), AMPS (Advance Mobile Phone Service) and CDPD (Cellular Digital Packet Data). The most exclusive feature of 1G is the cellular technology i.e. building up of hexagonal cells. At the same time 1G that supports only voice calls possess downfalls regarding its poor connection quality, less capacity of 2KBPS, erratic handoff generally horizontal, reduced voice links and poor security making calls more vulnerable to call dropping or third party interference [5]. Some examples of 1G technologies used included AMPS standard of United States, NMT in Denmark, Finland, Iceland, Norway and Sweden whereas Telecommunications system RTMI was used in Italy [3].

C. SECOND GENERATION TECHNOLOGY (2G-2.7G)

It was in late 1980s that cellular networks based on digital transmission were introduced that used second Generation (2G) bases technologies. 2G brought many improvements over 1G network as digital data transmissions has various benefits over analog data transmission techniques [1]. The 2G technologies may be based on Time Division Multiple Access (TDMA) or Code Division Multiple Access (CDMA) based on which type of multiplexing technique is used [5]. Here the TDMA technologies used include Global System for Mobile Communications (GSM), Personal Digital Cellular (PDC), Integrated Digital Enhanced Network (iDEN), IS-136 (also called Digital AMPS or D-AMPS) [2]. On the other side the CDMA technology is basically IS-95 (also known as cdmaOne). 2G technology using digital transmission of signals increases the system capacity. It allows more number of calls to be packed into the same amount of radio bandwidth by compressing and multiplexing digital voice data. Also digital systems emitted less radio power from handset devices making it more popular than analog 1G. Commercially, 2G networks were based on the GSM technology and were first introduced in Finland in 1991 with no backward compatibility with 1G AMPS [3]. It supports data rate of 9.6 Kbps using 124 channels per cell. Here each channel can support 8 users through TDMA and thus 992 users at maximum for per cell. GSM phones along with voice also provided data use services i.e. on connecting GSM based phone to a PC, it acts as a modem to support Internet browsing, emailing, fax etc. along with roaming services and short message services (SMS) facility to same or any other mobile network [4].

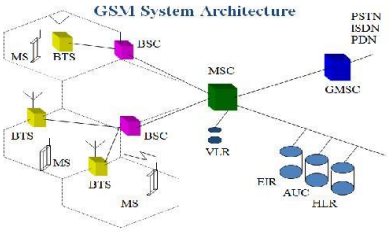

Fig 1: GSM Architecture

2.5G or more popularly called "second and a half generation," is again a cellular wireless technology which acts as a bridge between 2G and 3G wireless technologies for communication. 2.5G is basically based on General Packet Radio Service (GPRS) technique which can be readily added to the GSM substructures by overlaying the packet switched network on existing GSM circuit switched network [4]. Without using any new radio spectrum it can use 200 kHz existing radio channels. GSN (or GPRS Support Node) which receives a packet data and then transfers it either to Internet or other GPRS network forms a major constituent of any GPRS network [3, 5].

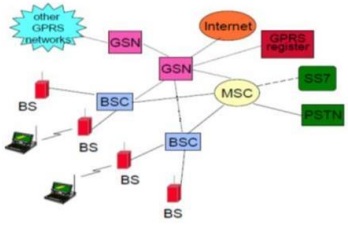

Fig 2: GPRS Architecture

The 2.75G is based on EDGE (Enhanced Data rates for GSM Evolution or Enhanced GPRS) technique. EDGE is a further step forward towards 3G technology. At the physical layer it presents 8 PSK modulation and different ways of data encoding for error protection with no change in the upper layer protocols. EDGE network can support data rates up to 500 Kbps at maximum with the existing GPRS infrastructure. EDGE also termed as IMT-SC or single carrier, allows much clearer and fast data transmission. EDGE technology gets more preference over GSM technology as it provides greater flexibility in carrying packet switched data and circuit switched data [6].

D. THIRD GENERATION TECHNOLOGY (3G- 3.75G)

The 3G mobile communication standards of mobile speed and accessibility were first introduced in 2001 in Japan. The technology facilitates usage of various advanced services like GPS (Global Positioning System), wireless voice telephone, mobile Internet access, video calls, video conferencing, mobile TV etc. all to be used worldwide in single mobile environment with high speed and better bandwidth [8].

3G is much better, faster, and flexible than 2G because it is built to support major radio technologies operating on CDMA, TDMA and FDMA. CDMA

accounts for IMT-DS (direct speed), IMT-MC (multi carrier). TDMA holds for IMT-TC (time code), IMT-SC (single carrier) [6]. This technology is also works comfortably and readily with 2G technologies as it has evolved from and built on 2G GSM. Dual-mode terminals facilitate migration from 2G to 3G [5]. The radio technology in 3G is mostly Wideband CDMA (WCDMA). This is similar to local area network technologies such as Ethernet. 3G has proposed following improvement features over 2.5G and earlier networks [1, 3]:

- Faster audio and video streaming.
- Enhanced data speed.
- Supports Video-conferencing.
- Web browsing in flash of seconds.
- Supports IPTV (TV through the Internet).

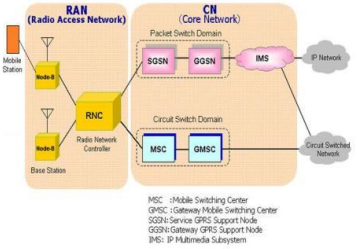

Fig3: 3G Network Architecture Model

3.5G also known as HSDPA (High-Speed Downlink Packet Access) is new protocol for data transmission through mobile phones. HSDPA as its name indicates not only improves the data speed but also facilitates enhanced Quality of downlink data transmission on Universal Mobile Telecommunications System (UMTS) networks [7]. HSDPA technique is a packet-based data service working in W-CDMA downlink with 8-10 Mbit/s data transmission over a 5MHz bandwidth in WCDMA downlink and up to 20 Mbit/s downlink for MIMO systems [8]. HSDPA consist of Multiple-Input Multiple-Output (MIMO), Hybrid Automatic Request (HARQ), Adaptive Modulation and Coding (AMC), advanced receiver design and fast cell search and High-Speed Downlink Shared Channel [5].

The 3.75G also popularly called HSUPA (High-Speed Uplink Packet Access) is a UMTS and WCDMA uplink evolution technology. It is linked directly to HSDPA which makes both of these complimentary to each other [6]. Main focus of HSUPA is to enhance progressive person-to-person data applications such as mobile e-mailing, conferencing, video calling and real-time person-to person gaming at symmetrically high data rates. HSUPA initially supported UMTS / WCDMA uplink up to 1.4Mbps which later enhanced up to 5.8Mbps [8]. Working of HSUPA is similar as that of HSDPA with the only difference between them that HSDPA protocol provides high speed downlink and HSUPA protocol improves uplink speed by increased

capacity, throughput, and less delays. Prominent 3G technologies such enable exchanging a larger amount of data while on the move [9]. Thus it creates the need for convergence and assimilation of digital appliances and technologies. On the other side there are some challenges for 3G:

1. Cellular infrastructure cost of base stations up gradation is quite high
2. Requirement of different handsets.
3. High power consumption.
4. Requires closer base stations and are expensive
5. Spectrum-license costs, network deployment costs and handset subsidies for subscribers are tremendous.

E. FOURTH GENERATION TECHNOLOGY (4G)

The term 4G is used to describe the next complete evolution in wireless communication. 4G is a network operating on internet while combining it with applications such as Wi-Fi and WiMax [8]. A 4G system provides a comprehensive IP solution where voice, data and streamed multimedia can be given to users on an "Anytime and Anywhere" basis at higher data rates.4G facilitates inter-operability between different network types with high speed data transfer rate of up to 100MBPS in case of moving server or the receiver set while for the stationary server and the receiver data transfer rate may be up to1GBPS [9]. It is also expected to provide a comprehensive secure IP based mobile broadband solution and facilities like ultra-broadband Internet access, IP telephony, gaming services, and streamed multimedia to devices such as laptop computer, wireless modems, smartphones, etc. to users. The word "MAGIC" also refers to 4G wireless technology which stands for Mobile multimedia, Any-where, Global mobility solutions over, Integrated wireless and Customized services. 4G built on one of three main cellular-access technologies: LTE, HSPA+, and WiMAX [4]. WiMAX is based on 802.16 wireless standards also known as wireless broadband Internet which is used for homes and offices. Transmissions use orthogonal frequency division multiplexing (OFDM), a method of dividing signal data into multiple channels to speed up delivery and then combining all the bits back into a single unit at the destination with transmission up to 40 Mbps [2]. HSPA+, on the other hand, is an upgrade to a long-existing approach to cellular: HSPA, or High-Speed Packet Access. HSPA builds on the 3G WCDMA infrastructure, which carries signals in either one or two frequency bands depending on mode. In 3G form, HSPA networks have peak data-transfer speeds of 14.4 Mbps [3]. By using higher-order QAM (quadrature amplitude modulation, which encodes multiple data streams into a single transmission, mimicking

increased bandwidth), carriers can achieve HSPA+ speeds of up to 21 Mbps.

4G LTE or Long Term Evolution network is based on Internet Protocol (IP) standards, the kind that delivers Web pages to your computer, and adds voice data to the transmission streams. It uses OFDMA, or Orthogonal Frequency Division Multiple Access. The LTE protocol, though, has the added ability to assign particular data paths to particular users on the fly, optimizing the bandwidth available at any given time [1]. LTE can operate on a wide range of radio frequency bands, which will allow many mobile carriers to switch over to LTE without starting from scratch. It doesn't require a new phone. LTE can operate alongside 2G and 3G networks, and multi-mode phones can access any of them, using LTE [3]. Various issues expected to be considered and resolved in this 4G mobile technology are described below:-

- ❖ It is considered to embed IP feature in the set for more security purpose as high data rates are send and receive through the phone using 4G mobile technology.
- ❖ 4G mobile technology will be able to download at a rate of 100Mbps mobile access and 1GBps for local access [7].
- ❖ Instead of combination of CDMA and IS-95 in 3G, a new technology OFDMA is introduced 4G. In OFDMA, the concept is again of division multiple accesses but this is neither time like TDMA nor code divided CDMA rather frequency domain equalization process symbolizes as OFDMA [8].
- ❖ CDMA sends data through one channel but with the division of time in three slots. Whereas in 4G OFDMA sends data packets by dividing the channel into a narrow band for the greater efficiency [1].
- ❖ IEEE 802.16m is processing for the IEE802.16e comprising the 4G brand will define it as WMBA (Wireless Mobile Broadband Access) [1]. The implementation is in progress to avoid the call interference in case of data download from a website. It will propose 128 Mbps downlink data rate and 56Mbps uplink data rate which is an extra ordinary step in 4G mobile technology.

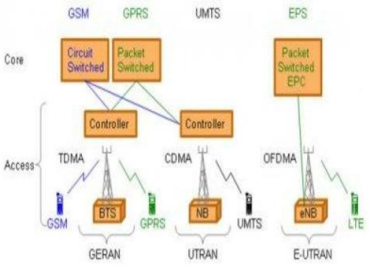

Fig4: 4G Network Architecture Model

Again considering the other side of 4G technology it also has some proposed challenges with it:

- New higher frequencies mean new components to be built in cell towers.
- Increased data cost for consumers
- Requirement of a new devices supporting 4G
- No current equipment or device compatible with the 4G network
- Limited availability of 4G mostly within the metro cities.

III.FUTURE OF MOBILE COMMUNICATION

A. FIFTH GENERATION TECHNOLOGY (5G)

5G is to be a new proposed technology that will provide all the possible applications, by using only one universal device, and interconnecting most of the already existing communication infrastructures thus, defining future of mobile communication. The 5G mobile networks will focus on the development of the user terminal where the terminals have access to the different wireless technologies at the same time and will combine different flows from different technologies [1]. The expectation from 5G techniques apart from increased throughput may be:

- Lower power consumption.
- Wider geographical Coverage with high data rates made available at cell's edges.
- Minimized system latency thereby enabling strict applications having a lower tolerance for delay
- Enabling independence of radio access and packet core networks on each other for achieving greater network and deployment flexibility.
- Developing a flexible core network that can serve as the basis for service innovation across both mobile and generic IP access networks
- Providing in mobility data rates in Gbps.
- Better Security features and Low infrastructure, deployment costs.

Mobile broadband is becoming a reality and various authors predict that High Speed Packet Access (HSPA) and Long Term Evolution (LTE) networks will become the latest trend for wireless communication soon [10]. Currently 5G is not a term officially used for any particular specification or in any official document yet as it is still in the development phase. New 3GPP standard releases beyond 4G and LTE Advanced are also in progress. 5G network is assumed as the perfection level of wireless communication in mobile technology with cable network is becoming a past tense term [10]. Some of the significant applications of 5G are as follows:

- Making unified global standards for all.
- Everywhere network availability to facilitate using computer and other mobile devices anywhere anytime.
- 5G usage will make world real WiFi zone.
- Facilitating people to avail radio signal at higher altitude as well.

B. SIXTH GENERATION TECHNOLOGY (6G)

The 6G mobile system for the global coverage will integrate 5G wireless mobile system and satellite network and is expected to be rolled out in near future. It is considered to be a cheap and Fast Internet Technology to provide unbelievably high data rates or very fast Internet speed access on air through wireless and mobile devices possibly up to 11 Gbps, while travelling or in a remote location [2].The key objective of 6G is to integrate navigation satellite networks used for global position, telecommunication satellite networks used for global telephony, multimedia video and high-speed Internet connectivity and the Earth imaging satellite networks used for resource monitoring and weather information [10]. This will provide position identifier, multimedia and internet connectivity, and weather information services for mobile users all at one place [1]. Since 5G is proposed migration from 4G technology based on MC-CDMA standard, if 6G integrate 5G with these four satellite networks, 6G should have four standards or four technologies, networks and systems [9]. Thus, Handoff/roaming must happen on space between any two of these four networks or systems or technologies [11]. It's implementation still under research and development phase. Various Features/Advantages expected from 6G Technology are as follows [1]:

- Ultra-fast access of Internet with Data rates up to 10-11 Gbps.
- Home automation and other related applications such as Home based ATM systems.
- Smart Homes, Cities and Villages.
- Space technology and Defense applications will be modified with 6G networks.

C. SEVENTH GENERATION TECHNOLOGY (7G-7.5G)

7G mobile network is like the 6G for global coverage but it will also define the satellite functions for mobile communication [1]. In satellite system, the telecommunication satellite will be for voice and multimedia communication; navigational satellite will be for global positional system (GPS) and earth image satellite for some extra information like weather update [2]. The 6G cellular system for mobile wireless network will support local voice coverage and other services. The 7Gwill be the most advance generation in mobile communication but there will be some research on

demanding issues like theuse of mobile phone during moving condition from one country to another country, because satellite is also moving in constant speed and in specific orbit, the standards and protocols for cellular to satellite system and for satellite to satellite communication system [11].Thus, the handoff/roaming must happen between each satellite. Furthermore, any two different satellite systems are necessary for handoff/roaming when mobile users moving from one country to another [11]. This kind of handoff/roaming is space handoff/roaming. The dream of 7G can only be true when all standards and protocols are defined [2,11]. May be this is possible in 7G and beyond.

IV.KEY CHALLENGES FOR FUTURE GENERATIONS

In the above sections the paper has carefully analyzed the current ongoing technologies, their enhancements to the previous networks and their shortcomings. Also the paper gave a review about the future technologies in form of 5G, 6G and 7G. Now in this section the paper tries summarize the key challenges that the current systems, practices and infrastructures pose to the development of future generations. Also it talks about the problems and their desired expected solutions from future generations. The key challenges and advancements required are summarized below:

1. **Integration of various standards:** Till date several Telecom standards have been developed such as 3GPP, 3GPP2, ITU, IETF, etc. In order to integrate these different approaches and standards it requires systematic approach to be searched for [11].
2. **Common Platform:** There is no common architecture for interconnecting various standards thus there is requirement of a governing body for creating a common platform to regularize the interconnectivity issues and knowledge sharing [2].
3. **Super core concept:** Existing telecom networks are fashioned in hierarchical way, where subscriber traffic is aggregated at aggregation point(BSC/RNC) and then routed to gateways [1]. Flat IP architecture will lessen burden on aggregation point and traffic will directly move from Base station to Media gateways. Vision of Super Core is based on IP platform. All network operators (GSM, CDMA, Wimax, Wireline) can be connected to one Super core with massive capacity [1, 2]. This is realization of single network infrastructure. The concept of super core will eliminate all interconnecting charges and complexities, which is right now network operator is facing. It will also reduce number of network

entities in end to end connection, thus reducing latency considerably.

4. **High redundancy requirement:**Under Super core concept, all network operators will be moving to single core infrastructure, high redundancy and security among core network entities is required [2]. A failure of single node will impact huge number of subscribers across various network operators.
5. **Transparency:** among network operators, Subscriber data, management and Governmentregulatory framework for Supercore [10].
6. **Evolution of network infra sharing:** Network operators, worldwide are opting for infrastructure sharing. Currently trend is for passive infra sharing as Active infra sharing has certain limitation. But at invention and deployment of Cognitive Radios (Software basedradios) and multi-port Base station, will promote active infra sharing at Antenna, Base station and spectrum level.
7. **Evolution of managed services:** Network operators are shifting network related activities to managed service vendor. Concept of Super Core complements this trend as all network operators will end up having one massive super core, which will be managed by one or many vendors under managed service contract, bound by SLA (Service level agreements) [1].

V. CONCLUSION

The world is trying to become completely wirelesswith increased demand for uninterrupted access to information anytime and anywhere with better quality, high speed, increased bandwidth and reduced cost.This paper briefly introduced the evolution of mobile technologies right from 0G to 4G, compared the different technologies, their advancements and limitations. 4G is the evolutionary technology based on 3G's limitations and it is expected to fulfill the idea of World Wide Wireless Web (WWWW) thereby, offering better services at high speed and data rate. The paper then revolved around the future generations of mobile communication namely 5G, 6G & 7G. After 4G the next generation 5G aims a real wireless world with no limitations while 6G integrates 5G with satellite networks. Due to variable technologies and standards, with 6G handoff/roaming will be an issue expected to be resolved in 7G through space roaming capabilities that are in research and development phase. To conclude, the paper identified and proposed the set of key challenges for these futuristic mobile generations. These considerations open doors for further research and study regarding their use and deployment in real world.

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Review of Images Steganography using LSB Technique

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Abstract— **Steganography is the science of hiding the information into the other data so that the hidden information appears to be nothing to the human eyes. The processing of simple least-significant-bit (LSB) substitution embeds the secret text in the least significant bits of the pixels in the host image. This paper gives a review of hiding the secret text in not only the least significant bit, but also considering other bits of the pixels of the host image.**

Keywords— **LSB, Steganography, Information hiding**

I. INTRODUCTION

Due to advances in ICT, the information is stored in digital format. the mounting use of digitization and digital technology such as the cloud, big data, mobile, the growing connectivity of everything leads to a greater challange of Information security and data safety.

The growing possibilities of new up-coming communication systems need the special means of security particularly on computer network. The network security is becoming more important as the number of data being exchanged on the internet increases. Therefore, the data secrecy and data integrity are requires to protect against unauthorized, illegal access and use. This has resulted in an explosive growth of the field of information hiding

As most of the information in a system is in the form that can read and understood easily, it becomes vulnerable. The intruder may reveal the vital information to others, alter it to misrepresent an individual or organization, or use it to launch an attack.

Information thrashing is an emerging research area, which comprises applications such as copyright protection for digital media, watermarking, fingerprinting, and steganography This paper discusses one of the solutions to the problem of vulnerability i.e the use of steganography.

Steganography is a technique of hiding data in digital media. Steganography is the practice of transfer data in a masked format. Steganography is an encryption technique. It can be used with cryptography for providing extra-protection to data. Cryptography, which hides the contents of a secret message, steganography conceals the fact that a message is communicated.

II. LEAST SIGNIFICANT BIT SUBSTITUTION

The Least Significant Bit (LSB) substitution method is an approach to embedding information in a graphical image file. In this method the LSB of every pixel is replaced by every message bit.

For a 24 bit color image as the cover image, there are 3 bytes for each pixel (Red, Green and Blue) 3 bits of data can be stored in each pixel which increases the capacity to store by 3 times making it 3/8 of the cover image size. If the message to be embedded is a text message, the

size 1/7th of the grayscale cover image can be stored and in a 24 bit color image as cover a text message of size 3/7 can be embedded.

It is likely that that the message may match approximately 50% of LSB of the cover image and changed thus keeping the other 50% LSB's unchanged and more significant bits unaltered. This will lead to minimal affect on the original image perceptibility

Least Significant Bit (LSB) encoding is a very accepted technique and is the easiest technique used for embedding secret or confidential information in images. However, it is highly vulnerable to attacks. Any change in image such as cropping, intensity, stretching, histogram equalization, addition of noise etc may destroy the embedded message.

A. *Substituiting 1/2/3/N Bits Of Cover Image*

The technique implemented in this section not only replaces the LSB, but the LSB is modified by taking into consideration the other bits of the Cover image.

Advantage of this method is that more number of data bits can be embedded in the image.

B. *Embedding Algorithm*

1. Extract RGB components of pixel intensity of the cover image if 24 bit color images are to be used else for a grayscale image every byte is the intensity of every pixel.

2. Get the ASCII codes of the text message to be embedded

3. Take the successive R, G, and B component values of pixels and convert them into array of values for messages and the cover image. Convert every decimal value into 8 bit binary equivalent for cover images and message. Every message bit is embedded into LSB's of the cover image after processing.

C. *Retrieving Algorithm*

1. Extract Red, Green and Blue Components of pixel intensity values of Stego image.
2. Take successive Red, Green and Blue component values of pixels and convert them into array of values for message.
3. Convert every decimal value into 8 bit binary equivalent.

III. EXPERIMENTAL RESULTS

For Experimental purpose, 2 24-bit colour images and 4 text messages are used.

A. *Mean Square Error Results*

The MSE represents the cumulative squared error between the decompressed/reconstructed and the original image. MSE between two images can be computed as,

$$\mathbf{MSE = \Sigma [\ I1(m,n)\text{-}I2(m,n)\ ]\hat{}2 \ /\ M*N}$$

M and N : number of rows and columns in the input images, respectively.
I1 (m,n) :image pixel value at position (m,n) in the original image
I2(m,n) is the image pixel value at position (m,n) in the stego image.

Lesser the MSE, better the quality of reconstructed image.

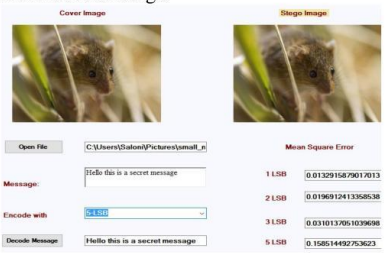

Fig 1.1 Cover image and Steagno-image with Text "Hello this is a secret message

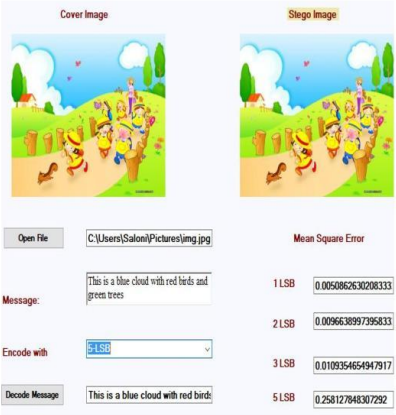

Fig 1.2 Cover image and Steagno-image with Text "Hello this is a secret message

TABLE I.1
COMPARISON OF MEAN SQUARE ERROR

COVER IME	***SECRET MESSAGE***	***Mean Square***			
		1- LSB	***2-LSB***	***3-LSB***	***5-LSB***
Img 1	*Hello this is a secret message*	*0.01329*	*0.0196*	*0.0305*	*0.13636*
	This is an image steganography project	*0.0167*	*0.024*	*0.0418*	*0.2121*
Img 2	*This is a blue cloud with red birds and green trees*	*0.0050*	*0.010*	*0.011*	*0.3012*
	Hello world it is a nice picture and it displays a beautiful world	*0.0073*	*0.0085*	*0.023*	*0.340*

It is likely that that the message may match approximately 50% of LSB of the cover image and changed thus keeping the other 50% LSB's unchanged and more significant bits unaltered. This will lead to minimal affect on the original image perceptibility. But with the increase of the number of bits the MSE is increasing (Table 1.1, Fig 1.1 and Fig 1.2).

IV. CONCLUSIONS

This work presents a scheme that can transmit large quantities of secret information and provide secure communication between two communicating parties. The secret message employing the concept of steganography is sent over the network by hiding the message in an image file. In addition, the proposed procedure is simple and easy to implement. Also, the developed system has many practical, personal and militaristic applications for both point-to-point and point-to multi- point communications.

Experimental results show that 1-LSB technique, show lesser values of Mean Square Error for embedding text message as secret message as compared to 2-LSB, 3-LSB, 4-LSB and 5-LSB. We may conclude that as the number of bit replacement increases though the message size we may embed will be large but the quality of image will deteriorate.

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The Future of IOT on Road

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Abstract

No matter which way you look at it, technology has been headed towards automation for a long time now. In fact, isn't the very basic principle of technology to make our lives easier by leaving fewer things to be explicitly done by us? It might be making us all lazier everyday, or one might argue that it is giving us far greater time to pursue whatever we desire. Whatever might be the effect, there is no doubt that automation is the future and place that it is happening the most significantly is right in our homes. Connected Cars will be one of the biggest elements in the race for expanding the Internet of Things.

Keywords **: Automation System, Hub, Sensor,Iot,Big Data**

1. INTRODUCTION

It was not too long ago that we visualised houses of the future where things would be done on their own- lights coming on by themselves, coffee being brewed just the way you like as you are about to wake up and your shower knowing the weather outside and adjusting the water temperature accordingly. And now we are at a point where technology to achieve all that has been around for a while and has now become affordable. Hence, it is not a particularly big surprise that we are witnessing some amazing things happening in the world of automation.

II HOME AUTOMATION SYSTEM

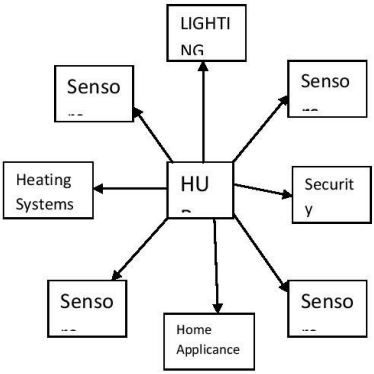
It doesn't take a genius to figure out what home automation entails: it's pretty much just the usage of smartphones and other easily available computing devices to automate and control household items and devices-from electrical appliances to lights to doors-with the help of hardware that can be controlled remotely.

Most home automation begins small-people start with controlling simple binary devices, that could either be in an "on" or "off" state. But it's when these devices are hooked up to the internet that they become truly smart and enter the realm of the internet of things. In fact, most automation systems nowadays use their internet=enabled abilities to record and analyse usage patterns of devices, mostly lighting and heating systems, to reduce monthly electricity bills and overall energy expenditure.

While setting up a home automation system, the best place to start investing in is your personal nuisances, for many people, the most obvious problem is their electricity bill, so most people purchase a few smart lights as their first home automation product. Or if you are the kind of person who is constantly paranoid about whether they left the geyser on, smart switches would ease your paranoia. From there, you slowly build up a full lighting system that can be remotely controlled and would respond to human presence, or an automated home theatre comprising a smart TV with smart ambient lighting.

Any smart home automation system today is generally a central hub that can be configured to control a bunch of smart devices, sensors and switches, all of which communicate with the hub using certain communication protocols. The hub, in turn, is instructed through an app or the web. The main takeaway is the distribution of monitoring and computing functions between the hub and the remote app. For example: in smart lighting system, a hub would act as the central interface between multiple smart devices, say, a bulb and a door contact sensor. The smart devices and hub communicate using certain common communication technologies, and an app would be used to control the lighting system.

If you are still unclear about the role of the Hub, you can draw close parallels between it and a standard Wi-Fi router. In simple terms, both are devices that route signals from multiple sources to one another. In a few products, the hub and router are integrated together, thus reducing the need for two devices. However, in the cases when they are separate, the hub, which needs to be internet enables to function, is connected to the router, so basically, a smart hub provides a centralized method to control all your smart devices, as they can connect all your devices to the cloud and consolidate all apps into the one provided by the hub manufacturer.



III IOT IN ROADS

The roads of the future will be nothing but connected Internet of Things highways as everything, right from the asphalt beneath your cars tyres to the car itself will all be interconnected wirelessly in one way out another. Information will flow between every vehicle on the road and the traffic signals to the transport department itself.

Heck, with the deployment of these IoT devices and technologies for the road, human involvement will be the last and safety will take a proper front foot. Human involvement will be the last and safety will take a proper front foot. After all, technology is here to make our lives simple yet unobtrusive in every way possible and the Internet of Things for the road holds a key to unlocking that potential.

The 5G will enable connected cars to send and receive messages 10 times faster. According to a recent report, the global connected car market is expected to grow from 5.1 Million units in 2015 to 37.7 million units by 2022. Adoption of telematics units and advances in tech with emphasis on driver and passenger experience along with safety and cyber security are ushering in a new era of growth for connected cars globally.

India is expected to emerge as a huge market for such vehicles. Currently, less than 2 percent of all vehicles sold in the country have some form of connectivity embedded in them. But our experience with smartphones has shown that mass adoption of technology can happen fast provided we are comfortable with the price tag.

1.1 Safe Driving

With connected cars, insurance companies can offer incentives to drivers to drive well in return for lower premiums. This will make our roads safer and improve the driving experience. Drivers can also use this information to evaluate and improve their driving skills. In a country where we constantly complain about traffic jams, thanks to big data, your car will someday soon wake you up early to remind you that if you don't reach office early, you will have to deal with more traffic. Big data will bring in more predictability in traffic management with data from each vehicle adding up.

1.2 Predictive maintenance

Drivers and fleet managers will now get inputs on vital vehicle diagnostics data leading to detection of issues before they turn into a major problem. This will reduce vehicle breakdowns and ensure hassle free driving as well as improved mileage. Well maintained vehicles also minimize emissions.

1.3 The data opportunity

According to a recent research, a single connected vehicle has the potential to generate more revenue than 10 conventional non-connected vehicles. In the future, the market share of OEMs will not be based on units sold but on the data revenue generated per vehicle. Data monetization in an IoT context is still in its infancy and we will see plenty of actions on this front in the near future.

IV APPLICATION OF IOT ON ROADS

The application of IoT on roads are endless as we can make use of intelligent technologies and services to travel better by improving planning, control, navigations, safety and plenty of more things that our squishy human mind cannot comprehend. IoT holds a lot of promise when it comes to using it on the road. Think about connected vehicles that can communicate to each other, how they can be connected to a central transportation hub from where they can gather data and relay it to the passengers as well. Not only is IoT the driving force behind self-driving cars, its how the idea flourished into something that's now a reality and is bound to get better over time.

4.1 Intelligent Travelling :

Smarter public transport- We have all been in that situation where we had to wait for a bus at the bus stop for a long time in the heat. Even though we can see the bus timings on the public transport portal online for each individual bus, we know that owing to traffic snarls and punctuality issues, the buses are never on time. Iot can come to the rescue here by making use of wireless technology in buses and bus stops. A simple system can be devised which shares the current location of the incoming bus from the road, difference in distance between the bus and the next bus stop. Citizens who want to hop onto a bus from their nearest bus stop can use their smartphone to get notified of the bus location and leave accordingly. All of the above and then some more can be seen in action with something called as Micro-Navigation for urban bus passengers using the Internet of Things which is being put to test in several countries. The current public transport system can be quite confusing and difficult to navigate for passengers such as disable people, senior citizens and tourists.

4.2 Intelligent driving(Communication and navigation:

Remember the time when many of us referred to paper made physical maps. Well, the times have changed and hardly anyone still makes use of them now for navigation. In-car navigation systems have killed paper maps and most people make the use of either that or use their smartphones for directions to head where they want to. Although GPS navigation through navigators and smartphones has become really powerful. It is just a showcase of what wireless automotive connectivity has in store for us. With the help of IoT, there is bound to be a complete overhaul of this system where navigation will be like one of the basic feature from among a many more advanced features. Connected vehicles for instance can inform the driver about traffic problems beforehand on a selected route of travel, notify the driver using an audio-visual medium about the nearest gas station which sells fuel cheaper due to discounts. A fine example of this is Audi Connect by Audi-the german car manufacturer.

V Conclusion

A connected car can dig into its database to come out with suggestions on your favourite number or best route available to pick up your child from her piano class every Friday. With the arrival of 5G, connectivity issues will be a thing of the past. 5G will enable connected cars to send and receive messages faster(up to 10 times a second). 5G will also enable more situational awareness and provide advance warning in case any roadblock or hindrance were to appear on the road you are driving on thereby giving you more time to react.

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Simulation Environment for DTN

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Abstract
As the name suggests the delay involved is tolerable and thus the network must accept, store and forward any message that is generated. Delay tolerant Network is that challenged class of Mobile Ad hoc Network that works with limited resources and has various routing constraints. Initially defined as special case of MANET, and the area is still evolving. Many network simulation environments is suggested to build and test the network virtually, but existing MANET simulator does not cater to this special DTN class. Author has therefore suggested the simulation environment suitable for DTN and the benefits of using it for simulation experiment to test near real environment.

Keywords – Delay Tolerant Network, Disruption Tolerant Network, Opportunistic Network Environment

I. INTRODUCTION

Ad-hoc means just like that! It's a network where no infrastructure is needed and there is no time constraint when a network comes into contact with another device and when it leaves. Wi-Fi connection is one of the examples of ad-hoc. Delay-tolerant networking is communication networking paradigm, designed to withstand long delays. It is useful where an end-to-end route can be established and no fixed interval is there. Communication opportunities come and go and their interval can be very long and not even known beforehand. Delay-tolerant Networking (DTN) enables communication in sparse mobile ad-hoc networks and other challenged environments where traditional networking fails and new routing and application protocols are required. A routing protocol for such a network is discussed later in the article using social grouping. Here's when simulation comes into action. For finding new protocols, different approaches were tested and evaluated using simulation. Many simulators exit for MANET (Mobile Ad hoc Network). For example Network Simulator 2 (NS2), OMNeT++.

II. PROBLEM FACED

The problems faced by these simulators are:

- It lacks in demonstrating the basic features of DTN for e.g. delay.
- It concentrates solely on routing simulations.
- It needs input data that reports routing protocols when a network link is up and down.
- The availability of real world data and data collection methods are difficult to find and access.

III. TYPES OF ROUTING CLASS

There are various routing protocol algorithm defined earlier for DTN. Some of them are depicted in figure 3.1. The DTN routing protocol is broadly classified in two categories i.e. Flooding based and Forwarding based. The Flooding based routing suggests that any message will be forwarded to any intermediate node.

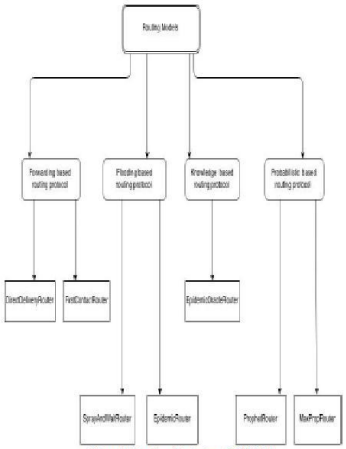

Figure1. Routing Strategies of DTN [5]

IV. Simulation Environment for DTN

The Opportunistic Networking Environment (ONE) simulator is specifically designed for evaluating DTN routing and application protocols. It allows users to create scenarios based upon different synthetic movement models and real-world traces and offers a framework for implementing routing and application protocols. It has three working features:

- MOMENT MODELLING- It can be done either by integrated movement or by external source.
- ROUTING SIMULATIONS- are External DTN routing sim (such as DTsim, DTsim2), Internal routing logic.
- VISUALIZATION & REPORTING- ONE combine's moment modelling, routing simulations and visualization & reporting in one program.

Reason to state that ONE is most efficient and effective simulation environment for DTN simulations is that it is more feasible and understandable. It also generates Input data from random process, real world trace, mobility simulations. The following features make it challenging for DTN to achieve effective results like Unpredictable node mobility, Low node density, Lace of good information etc. In DTN connections are intermittent due to mobility and low node density. So, data forwarding metric watches over data forwarding from source to destination. This is done by exploiting the social contact patterns of humans for Data forwarding in DTN. DTN mainly includes two perspectives. One of them is Centrality i.e. Common acquaintances of other nodes have better capabilities of contacting with each other and the other one is Community that comprises of people that are naturally organized into groups. The data forwarding strategies may be based on Node centrality's evaluated at global scope. This includes all nodes in network to ensure that data is carried and forwarded by relays with higher capability of contacting other nodes. Secondly, when a relay contacts a node within the same community of the destination data is forwarded to that community. Afterwards, node centrality's calculated within the local community scope. The perspectives of transient social contact patterns suggest that nodes are in contact at different time periods. Other way to

connect may be Transient Connectivity. For example some of the nodes stay within each other's contact range during a specific time period. For example: Classmates are in contact with each other unless the class is going on. One more suggested connectivity can be based on Transient Community Structure. Here a node may belong to different Community during specific time periods. For example, if A is in contact with his classmates but belongs to his roommates.

CONCLUSION

In this paper, author discussed the networking approach in DTN. The various factors that may affect routing decision in DTN. Also the DTN is a challenged class of MANET, here the author also suggested why the existing simulation environment available for MANET is not suitable for DTN. Here the author has discussed the Opportunistic Network Environment for DTN in brief.

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Cryptocurrency: A Digital Asset

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ABSTRACT

The market of cryptocurrencies is fast and wild. Nearly every day new cryptocurrencies emerge, old die, early adopters get wealthy and investors lose money. Every cryptocurrency comes with a promise, mostly a big story to turn the world around. Few survive the first months, and most are pumped and dumped by speculators and live on as zombie coins until the last bagholder loses hope ever to see a return on his investment. People all over the world buy Bitcoin to protect themselves against the devaluation of their national currency. Mostly in Asia, a vivid market for Bitcoin remittance has emerged, and the Bitcoin using darknets of cybercrime are flourishing.

Keywords: Cryptocurrency, Bitcoin, Blockchain, Timestamping, Mining

I. INTRODUCTION

A cryptocurrency (or crypto currency) is a digital asset designed to work as a medium of exchange that uses cryptography to secure its transactions, to control the creation of additional units, and to verify the transfer of assets.[1][2][3] Cryptocurrencies are classified as a subset of digital currencies and are also classified as a subset of alternative currencies and virtual currencies. Cryptocurrencies use decentralized control[4] as opposed to centralized electronic money and central banking systems.[5] The decentralized control of each cryptocurrency works through a blockchain, which is a public transaction database, functioning as a distributed ledger.[6]

Bitcoin, created in 2009, was the first decentralized cryptocurrency.[7] Since then, numerous other cryptocurrencies have been created.[8] These are frequently called altcoins, as a blend of alternative coin.[9][10][11]

II. OVERVIEW

Decentralized cryptocurrency is produced by the entire cryptocurrency system collectively, at a rate which is defined when the system is created and which is publicly known. In centralized banking and economic systems such as the Federal Reserve System, corporate boards or governments control the supply of currency by printing units of fiat money or demanding additions to digital banking ledgers. In case of decentralized cryptocurrency, companies or governments cannot produce new units, and have not so far provided backing for other firms, banks or corporate entities which hold asset value measured in it. The underlying technical system upon which decentralized cryptocurrencies are based was created by the group or individual known as Satoshi Nakamoto.[12]

As of September 2017, over a thousand cryptocurrency specifications exist; most are similar to and derive from the first fully implemented decentralized cryptocurrency, bitcoin. Within cryptocurrency systems the safety, integrity and balance of ledgers is maintained by a community of mutually distrustful parties referred to as miners: members of the general public using their computers to help validate and timestamp transactions, adding them to the ledger in accordance with a particular timestamping scheme. Miners have a financial incentive to maintain the security of a cryptocurrency ledger.

Most cryptocurrencies are designed to gradually decrease production of currency, placing an ultimate cap on the total amount of currency that will ever be in circulation, mimicking precious metals. Compared with ordinary currencies held by financial institutions or kept as cash on hand,

cryptocurrencies can be more difficult for seizure by law enforcement. This difficulty is derived from leveraging cryptographic technologies.

III. ARCHITECTURE

A. Blockchain

The validity of each cryptocurrency's coins is provided by a blockchain. A blockchain is a continuously growing list of records, called blocks, which are linked and secured using cryptography. Each block typically contains a hash pointer as a link to a previous block, a timestamp and transaction data. By design, blockchains are inherently resistant to modification of the data. It is "an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way". For use as a distributed ledger, a blockchain is typically managed by a peer-to-peer network collectively adhering to a protocol for validating new blocks. Once recorded, the data in any given block cannot be altered retroactively without the alteration of all subsequent blocks, which requires collusion of the network majority.

Blockchains are secure by design and are an example of a distributed computing system with high Byzantine fault tolerance. Decentralized consensus has therefore been achieved with a blockchain. It solves the double spending problem without the need of a trusted authority or central server.

The block time is the average time it takes for the network to generate one extra block in the blockchain. Some blockchains create a new block as frequently as every five seconds. By the time of block completion, the included data becomes verifiable. This is practically when the money transaction takes place, so a shorter block time means faster transactions.[citation needed]

B. Timestamping

Cryptocurrencies use various timestamping schemes to avoid the need for a trusted third party to timestamp transactions added to the blockchain ledger.

C. Proof-of-work schemes

The first timestamping scheme invented was the proof-of-work scheme. The most widely used proof-of-work schemes are based on SHA-256 and scrypt. The latter now dominates over the world of cryptocurrencies, with at least 480 confirmed implementations.

Some other hashing algorithms that are used for proof-of-work include CryptoNight, Blake, SHA-3, and X11.

D. Proof-of-stake and combined schemes

Some cryptocurrencies use a combined proof-of-work/proof-of-stake scheme. The proof-of-stake is a method of securing a cryptocurrency network and achieving distributed consensus through requesting users to show ownership of a certain amount of currency. It is different from proof-of-work systems that run difficult hashing algorithms to validate electronic transactions. The scheme is largely dependent on the coin, and there's currently no standard form of it.

E. Mining

In cryptocurrency networks, mining is a validation of transactions. For this effort, successful miners obtain new cryptocurrency as a reward. The reward decreases transaction fees by creating a complementary incentive to contribute to the processing power of the network. The rate of generating hashes, which validate any transaction, has been increased by the use of specialized machines such as FPGAs and ASICs running complex hashing algorithms like SHA-256 and Scrypt. This arms race for cheaper-yet-efficient machines has been on since the day the first cryptocurrency, bitcoin, was introduced in 2009.[24] However, with more people venturing into the world of virtual currency, generating hashes for this validation

has become far more complex over the years, with miners having to invest large sums of money on employing multiple high performance ASICs. Thus the value of the currency obtained for finding a hash often does not justify the amount of money spent on setting up the machines, the cooling facilities to overcome the enormous amount of heat they produce, and the electricity required to run them.

One company is operating data centers for mining operations at Canadian oil and gas field sites, due to low gas prices.

Given the economic and environmental concerns associated with mining, various "minerless" cryptocurrencies are undergoing active development. Unlike conventional blockchains, some directed acyclic graph cryptocurrencies utilise a pay-it-forward system, whereby each account performs minimally heavy computations on two previous transactions to verify. Others utilise a block-lattice structure whereby each individual account has its own blockchain. With each account controlling its own transactions, no traditional proof-of-work mining is required, allowing for free, instantaneous transactions.

IV. PROPERTIES

A. Transactional properties:

1.) Irreversible: After confirmation, a transaction can‘t be reversed. By nobody. Not you, not your bank, not your miner. Nobody. If you send money, you send it. Period. No one can help you, if you sent your funds to a scammer or if a hacker stole them from your computer. There is no safety net.

2.) Pseudonymous: Neither transactions nor accounts are connected to real-world identities. You receive Bitcoins on so-called addresses, which are randomly seeming chains of around 30 characters. While it is usually possible to analyze the transaction flow, it is not necessarily possible to connect the real world identity of users with those addresses.

3.) Fast and global: Transaction are propagated nearly instantly in the network and are confirmed in a couple of minutes. Since they happen in a global network of computers they are completely indifferent of your physical location. It doesn‘t matter if I send Bitcoin to my neighbour or to someone on the other side of the world.

4.) Secure: Cryptocurrency funds are locked in a public key cryptography system. Only the owner of the private key can send cryptocurrency. Strong cryptography and the magic of big numbers makes it impossible to break this scheme. A Bitcoin address is more secure than Fort Knox.

5.) Permissionless: You don‘t have to ask anybody to use cryptocurrency. It‘s just a software that everybody can download for free. After you installed it, you can receive and send Bitcoins or other cryptocurrencies. No one can prevent you. There is no gatekeeper.

B. Monetary properties:

1.) Controlled supply: Most cryptocurrencies limit the supply of the tokens. In Bitcoin, the supply decreases in time and will reach its final number somewhere in around 2140. All cryptocurrencies control the supply of the token by a schedule written in the code. This means the monetary supply of a cryptocurrency in every given moment in the future can roughly be calculated today. There is no surprise.

2.) No debt but bearer: The Fiat-money on your bank account is created by debt, and the numbers, you see on your ledger represent nothing but debts. It‘s a system of IOU. Cryptocurrencies don‘t represent debts. They just represent themselves. They are money as hard as coins of gold.

To understand the revolutionary impact of cryptocurrencies you need to consider both properties. Bitcoin as a permissionless, irreversible and pseudonymous means of payment is an attack on the control of banks and governments over the monetary transactions of their citizens. You can‘t hinder someone to use

Bitcoin, you can't prohibit someone to accept a payment, you can't undo a transaction.

As money with a limited, controlled supply that is not changeable by a government, a bank or any other central institution, cryptocurrencies attack the scope of the monetary policy. They take away the control central banks take on inflation or deflation by manipulating the monetary supply.

Cryptocurrencies are digital gold. Sound money that is secure from political influence. Money that promises to preserve and increase its value over time. Cryptocurrencies are also a fast and comfortable means of payment with a worldwide scope, and they are private and anonymous enough to serve as a means of payment for black markets and any other outlawed economic activity.

V. LOSS, THEFT AND FRAUD

GBL, a Chinese bitcoin trading platform, suddenly shut down on October 26, 2013. Subscribers, unable to log in, lost up to $5 million worth of bitcoin.

In February 2014, cryptocurrency made headlines due to the world's largest bitcoin exchange, Mt. Gox, declaring bankruptcy. The company stated that it had lost nearly $473 million of their customer's bitcoins likely due to theft. This was equivalent to approximately 750,000 bitcoins, or about 7% of all the bitcoins in existence. Due to this crisis, among other news, the price of a bitcoin fell from a high of about $1,160 in December to under $400 in February.

Two members of the Silk Road Task Force—a multi-agency federal task force that carried out the U.S. investigation of Silk Road—seized bitcoins for their own use in the course of the investigation. DEA agent Carl Mark Force IV, who attempted to extort Silk Road founder Ross Ulbricht ("Dread Pirate Roberts"), pleaded guilty to money laundering, obstruction of justice, and extortion under color of official right, and was sentenced to 6.5 years in federal prison. U.S. Secret Service agent Shaun Bridges pleaded guilty to crimes relating to his diversion of $800,000 worth of bitcoins to his personal account during the investigation, and also separately pleaded guilty to money laundering in connection with another cryptocurrency theft; he was sentenced to nearly eight years in federal prison.

Homero Josh Garza, who founded the cryptocurrency startups GAW Miners and ZenMiner in 2014, acknowledged in a plea agreement that the companies were part of a pyramid scheme, and pleaded guilty to wire fraud in 2015. The U.S. Securities and Exchange Commission separately brought a civil enforcement action against Garza, who was eventually ordered to pay a judgment of $9.1 million plus $700,000 in interest. The SEC's complaint stated that Garza, through his companies, had fraudulently sold "investment contracts representing shares in the profits they claimed would be generated" from mining.[63]

On November 21, 2017, the Tether cryptocurrency announced they were hacked, losing $31 million in USTD from their primary wallet. The company has 'tagged' the stolen currency, hoping to 'lock' them in the hacker's wallet (making them unspendable). Tether indicates that it is building a new core for its primary wallet in response to the attack in order to prevent the stolen coins from being used.

On December 6, 2017, more than $60 million worth of bitcoin was stolen after a cyber attack hit the cryptocurrency mining platform NiceHash (Slovenia-based company). According to the CEO Marko Kobal and co-founder Sasa Coh, bitcoin worth $64 million USD was stolen, although users have pointed to a bitcoin wallet which holds 4,736.42 bitcoins, equivalent to $67 million.[65][66]

VI. LEGALITY

The legal status of cryptocurrencies varies substantially from country to country and is still undefined or changing in many of them. While some countries have explicitly allowed their use and trade, others have banned or restricted it. Likewise, various government agencies,

departments, and courts have classified bitcoins differently. China Central Bank banned the handling of bitcoins by financial institutions in China during an extremely fast adoption period in early 2014. In Russia, though cryptocurrencies are legal, it is illegal to actually purchase goods with any currency other than the Russian ruble.

On March 25, 2014, the United States Internal Revenue Service (IRS) ruled that bitcoin will be treated as property for tax purposes as opposed to currency. This means bitcoin will be subject to capital gains tax. One benefit of this ruling is that it clarifies the legality of bitcoin. No longer do investors need to worry that investments in or profit made from bitcoins are illegal or how to report them to the IRS. In a paper published by researchers from Oxford and Warwick, it was shown that bitcoin has some characteristics more like the precious metals market than traditional currencies, hence in agreement with the IRS decision even if based on different reasons.

Legal issues not dealing with governments have also arisen for cryptocurrencies. Coinye, for example, is an altcoin that used rapper Kanye West as its logo without permission. Upon hearing of the release of Coinye, originally called Coinye West, attorneys for Kanye West sent a cease and desist letter to the email operator of Coinye, David P. McEnery Jr. The letter stated that Coinye was willful trademark infringement, unfair competition, cyberpiracy, and dilution and instructed Coinye to stop using the likeness and name of Kanye West. 17th of January 2014 Coinye was closed.

In India crypto currencies are treated as illegal. In his recent Union Budget announcement, India's Finance Minister Mr. Arun Jaitley clarified that cryptocurrencies are not legal tender and cannot be used as a substitute for currency. However, this does not restrict the holding of cryptocurrencies.

He said "The government will do everything to discontinue the use of bitcoin and other virtual currencies in India for criminal uses. He reiterated that India does not recognise them as legal tender and will instead encourage blockchain technology in payment systems."The government does not recognise cryptocurrency as legal tender or coin and will take all measures to eliminate the use of these cryptoassets in financing illegitimate activities or as part of the payments system,"

VII. CONCLUSION

The future of cryptocurrencies thus remains largely undefined. The risk of more regulators worldwide declaring them illegal is a strong possibility. South Korea recently took a call to ban the use of anonymous bank accounts in cryptocurrency trading, joining the likes of China and Russia.Bitcoin, by all means, is a fascinating speculative investment. However, as investors, we prefer assets we can value using dividends, income or earnings.

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