A Study paper on 4G and MANET, Wireless Network of Battlefield in Future

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Abstract-4G, is the evolving technology of future wireless networks. The fourth generation of cellular system will provide single interface to all kinds of wireless networks allowing participating nodes to access to the network through cellular, wireless LAN networks. Future wireless network especially in hostile military environment. By combining two hottest wireless network topics, 4G (the fourth generation of cellular communication systems and MANET, explores potentials as well as foreseeable challenges to the wireless communications. 4GM@4GW is the idea of implementing the fourth generation of wireless technology into mobile ad-hoc network in the next generation of military .

Index Terms—4G, Mobile Ad-hoc Network, Military Wireless Network, MIMO

1 INTRODUCTION

The fourth generation of cellular communication systems, generally known as 4G, is the emerging technology of future wireless networks. For the past years, many researchers and scientists from all over the world have been working on projects funded by governments and business institutions whose goals are efficient wireless networks by merging all current technologies and adapting new solutions for the enhanced which provides superior quality, efficiency, and opportunities where the wireless communications were not feasible. Some researchers define 4G as a significant improvement of 3G where current cellular networks' issues will be solved and data transfer will play more the significant role. For others, 4G unifies cellular and wireless local area networks and introduces new, the routing techniques, efficient solutions for sharing dedicated the frequency band, and increases mobility and bandwidth capacity. Like 4G project, the MANET is also in a developing stage. MANET standardizes the static and mobile techniques of creating mesh networks using available wireless technology. Nowadays, 802.11 wireless networks defined by the IEEE standards are being used at the homes, offices, and also could be found in the initial MANET infrastructure. So, what limits cellular networks and WLANs will limit MANET as well. On the other hand, any solution that can increase capabilities of wireless networks can influence capabilities of MANET as well and furthermore could mitigate serious issues like hidden terminal problem and fading. New wireless communication technologies are expected to significantly influence the design and implementation of MANETs in the military environment. So the future technology combining wireless local networks and cellular networks is more and more being referred to, and defined as the fourth generation of communication systems, it is critical to understand the meaning of 4G and its potential in influencing wireless networks, particularly MANET. Since to assume low infrastructure of the mobile ad-hoc networks in the hostile military environment, 4G could be an answer to offer significant solutions for the mobile MANETs to achieve highquality transmissions and constant connectivity. So, the implementation of 4G may be significantly more complicated than in the civil environment because of the unique specification of the military environment. So the term 4GM@4GW that describes possible issues of the fourth generation of cellular network in the fourth generation of warfare. Combining two hottest wireless network topics, 4G (the fourth generation of cellular communication systems and MANET, we explore potentials as well as foreseeable challenges to the wireless communications in future battlefield.

2 LITERATURE REVIEW

2.1 4G Concept

This is the short name for fourth generation wireless, the stage of mobile communication that will un able things like IP based voice, gaming services and high quality streamed multimedia on portable devices with cable modem like transmission speeds. The nomenclature of the generations generally refers to a change in fundamental nature,non-backwards-compatible the transmission technology, higher peak bit rates, new a frequency bands, wider channel the frequency bandwidth in Hertz, and higher capacity for many simultaneous data transfers .It is a successor to 2g and, 3g wireless, whereby the first signified the shift from analog to digital transmissions, bringing data services like email to mobile phones for first time, and the second concern with the advent of things like global roaming as well as data rates. As opposed to the earlier generations, a 4G system does not support traditional circuit-switched telephony service, but all-Internet Protocol based communication such as IP telephony. As seen below, spread spectrum radio technology used in 3G systems, is abandoned in all the 4G candidate systems and replaced by OFDMA multi-carrier transmission and other frequency-domain equalization schemes, making this easy to transfer the very

high bit rates despite extensive multi-path radio propagation . Peak bit rate is further improved by smart antenna arrays for multiple-input multiple-output communications .

2.2 History of 4G and pre-4G technologies Goal

The 4G system was originally envisioned by the Defense Advanced Research Projects Agency .The DARPA selected the distributed architecture, and end-to-end Internet protocol ,and believed at an early stage in peer-to-,peer networking in which every mobile device would be both a transceiver and a router for other devices in the network, eliminating the spoke-and-hub weakness of 2G and 3G cellular systems. So the 2.5G GPRS system,cellular systems have provided dual infrastructures: packet switched nodes for data services, and circuit switched nodes for voice calls. In the 4G systems, circuit-switched infrastructure is abandoned and only a packet-switched the network is provided, while 2.5G and 3G systems require both packet-switched and circuit-switched network nodes, i.e. two infrastructures in parallel. That means that in the 4G, traditional voice calls are replaced by the IP telephony.

2.2.1 LTE:-

Short for Long-Term Evolution, LTE is considered by many to be the natural successor to current-generation 3G technologies, in part because it updates UMTS networks to provide significantly faster data rates for both uploading ,and downloading. The specification calls for downlink peak rates of at least 100Mb/s and an uplink of 50Mb/s, but going by real world tests its transfer speeds will more likely range from 5-12Mb/s for downloads and 2-5Mb/s for uploads. LTE is being developed by a group of telecommunications associations known as the 3rd Generation Partnership Project, or 3GPP, as an eight release of what has been evolving since 1992 from GSM family of standards.

There are many fundamental aspects of LTE. First is that the technology finally leaves behind the circuit switched network of its GSM roots and moves to an all-IP flat networking architecture,. This is a significant shift which in very simple terms means that LTE will treatthe everything that it transmits, even voice, as data. The other big change relates to the use of MIMO technology, or multiple antennas at both the transmitter and receiver end to improve communication performance. This setup can either be used to increase throughput data rates or to reduce interference.

Reason behind the LTE's strong industry support lies in relative ease of upgrading from the current 3G networks worldwide over to LTE mobile broadband.

2.2.2 WiMax:-

WiMAX is a wireless broadband access standard developed and maintained by the IEEE under 802.16 designation. As its name suggest, WiMAX can be thought of as an extension of Wi-Fi designed to enable pervasive, high-speed mobile Internet access on a wide range of devices, from the laptops to smartphones. Current implementation is based on the 802.16e specification which offers theoretical downlink rates upwards of 70Mbps and up to 30-mile ranges.

Again, "theoretical" is keyword here as WiMAX, like all wireless technologies, can either operate at higher bitrates or over longer distances but not both. Production networks being operated in United States are seeing average speeds go from 3 to 6Mb/s, with bursts up to 10Mb/s. Like LTE -- and Wi-Fi 802.11n for that matter -WiMAX supports MIMO technology, which means that additional antennas can increase potential throughput.

There is no uniform global licensed spectrum for WiMAX, but three have been listed: 2.3 GHz, 2.5 GHz and 3.5 GHz

WiMAX is available now, but even Sprint and Clearwire's highest ranking executives have admitted that LTE might eventually become dominant 4G technology throughout the world. That's not to say they are fighting an already lost the battle. While they believe WiMAX has a lot of ,potential, and plan to continue pushing it, their decision to back this technology is all about timing. By time LTE hits market WiMAX will be available in at least twice as many cities.

On the other hand, GSM network standards dominate over 80% of cellular markets worldwide, so it is only natural that most mobile operators will want to move to LTE, as it's rooted on same technology they have worked with for over a decade.

2.3 IPV6 Support

Unlike 3G, which is based on two parallel infrastructures consisting of circuit switched and packet switched network nodes, 4G will be based on packet switching only. This will require low-latency data transmission. By the time that 4G ,was deployed, the process of IPv4 address exhaustion was expected to be in this final stages. So, in the context of 4G, IPv6 is essential to support a large number of the wireless-enabled devices. By increasing the number of IP addresses available, IPv6 removes the need of network address translation, a method of sharing a limited number of addresses among a larger group of devices, although NAT will still required to communicate with devices that are on existing IPv4 networks.

• Advanced antenna systems :-

Performance of radio communications depends on an antenna system, termed smart or, Intelligent antenna. Recently, multiple antenna technologies are emerging to achieve the goal of 4G systems such as high rate, high reliability, and long range communications. In the early 1990s, to cater for the growing data rate needs of data communication, many transmission schemes were proposed.

• Open-wireless Architecture and Software-defined radio (SDR)

One of the key technologies for 4G and beyond is called Open Wireless Architecture (OWA), supporting multiple wireless air interfaces in an open architecture platform.SDR is one of the form of open wireless architecture (OWA). Since 4G is a collection of wireless standards, the final form of a 4G device

will constitute to the various standards. This can be efficiently realized using SDR technology, which is categorized to the area of the radio convergence.

• Integration:-

Integration is a key concept in defining 4G capabilities since we should support all kinds of multimedia by offering single access to all wireless networks. Understanding the significance of unifying Wi- Fi, WiMax and Cellular networks into one product, the most important factor of 4G will be "seamless integration of wireless networks" based on flexibility of the software radio technology, with improved bandwidth capacity, and improved routing techniques allowing multi-hop peer-to peer networks. Due to the lack of single military scenario where and how 4G will be used, it is critical that future wireless technology will be capable of effortlessly accessing all kind of radio communications.

• DVB:-

DVB is the "global standard for the global delivery of digital television and
data services .Researchers see DVB-H and DMB
as the additional component of 4G providing video transmission to mobile devices.
Understanding the technical requirements of soldiers fighting on the battle-field, it is believed that DVB can become a significant utility for army by providing necessary information such as soldiers' view and access to the maps and immediate satellite pictures.

• MIMO:-

Technological innovations like MIMO OFDMA (Orthogonal Frequency Division Multiple Access) and HIP (Host Id Protocol) that could significantly increase security, mobility and throughput of 4G. Beam forming that is the significant concept of MIMO.
(Multiple-Input Multiple-Output) allows doing just that using smart antennas system. But that's not all what
MIMO has to offer. MIMO achieves great success thanks to multiple antennas that allows simultaneous
directional transmission of two or more unique data streams sharing t same channel. Increasing speed and
Range, MIMO is already accepted by researchers as one of the main components of projects such as the WiBro,

2.4 Deployment plans in India

Bharti Airtel launched the India's first 4G service, using TD-LTE technology, in Kolkata on April 10, 2012. Fourteen months prior to official launch in Kolkata, a group consisting of China Mobile, Bharti Airtel and Soft Bank Mobile came together, called Global TD-LTE Initiative (GTI) in Barcelona, Spain and they signed the commitment towards TD-LTE standards for the Asian region. It must be noted that,the Airtel's 4G network does not support mainstream 4G phones such as Apple iPhone 5, Samsung Galaxy S III, Nokia Lumia 920 and others. Airtel 4G services are available in the Kolkata, Bangalore and Pune. Airtel is currently launching 4G services in Chandigarh, Mohali and Panchkula; in Punjab.RIL is launching 4G services through its subsidiary, JioInfocomm. RIL 4G services are currently available only in Jamnagar, where it is testing the new TD-LTE technology. RIL 4G rollout is planned to start in Delhi, Mumbai and Kolkata and expand to cover the 700 cities, including 100 high-priority markets. As India uses the TD LTE frequency #40 (2.3 GHz), there are no compatible phones or tablets available.

2.5 MANET Concept:-

MANET is a self-configuring infrastructure less network of mobile devices connected by wireless. Ad hoc in Latin means only for this purpose . Every device in a MANET is free to move independently in any and will so change its links to other devices frequently. Each must forward traffic unrelated to its own use, and so be a router. The primary challenge in building a MANET is just equipping each device to continuously maintain the information required to properly route traffic. These networks may operate by themselves or may be connected to the larger Internet. MANETs are a kind of Wireless ad hoc network that usually has a routable networking environment on top of Link Layer.

The routers are free to move randomly; so, the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a standalone fashion, or they may be connected to the larger Internet.

Sensor nodes, they consist of the sensing, data processing, and communication components and typically form ad hoc networks. Due to a lack of infrastructure support, each node acts as a router, and forwards the data packets for other nodes.

Can be classified as:-

- Server: Contains the complete DBMS and bear primary responsibility for data broadcast and satisfying client queries.
- Clients: They have sufficient resources to cache portions of the database as well as storing some DBMS query and processing modules.

1) A node with not having remaining power, or one that is off, is not currently a part of the network.

2) Also if the source and the destination nodes are not within each other's communication range, data packets are forwarded to the destination by relaying transmission through other nodes that exist between the two nodes. Single hop wireless connectivity to a wired world. Setting up of fixed the access points and backbone infrastructure is not always viable in some cases.

3) Infrastructure may not be present in a disaster area or war area.

4) Infrastructure may not be practical for short-range radios; like Bluetooth (range ~ 10m)

5) Ad hoc networks do not need backbone

infrastructure support, and are easy to deploy anywhere.

It is useful when infrastructure is absent, destroyed or impractical optimal solution may be achieved. Nodes can appear, disappear and re-appear as the time goes on and all the time the network connections should work between the nodes that are part of network. Connectivity and robustness is very demanding than in the wired case.

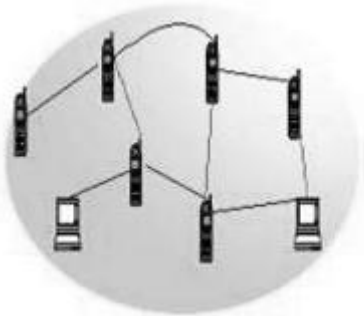

Fig .1 MANET

Ad hoc networking is not new concept. As a technology for dynamic wireless networks, it has deployed in military since 1970. Commercial interest has recently grown due to the advances in wireless communications. A new working group for MANET has been formed within the Internet Engineering Task Force, aiming to investigate and developed candidate standard Internet routing support for mobile, wireless IP autonomous segments and developed a framework for running IP based protocols in ad hoc networks. Research in the area of ad hoc networking is receiving more attention from academic, industry, and government sector. Since these networks pose many, complex issues, there are many open problems for research and significant contributions yet.

A MANET is a most promising and rapidly growing technology in the world it is based on a self-organized and rapidly deployed network. Due to its great features, MANET attracts different real world application areas where the networks topology changes very rapidly.

3. Analysis of Problem:-

Before1990, during warfare, no wireless technology was used. The main focus was only on the forced and armed equipment. But after the successful implementation of MANET, combined use of MANET and 4G is raising. This makes focus on the soldiers, that is making them technosavy. The war held initially was not technologically advanced. So due to this there was a crucial problem of communication and data exchange between the soldiers. As there are unfavourable conditions, the network could not be established. It was studied that 4G and MANET could be the best service for military environment.

4 Proposed works

4.1 4g and MANET in battlefield:-

By considering combined use of MANET ang 4G, Whatever program yields the device that will be in every soldier's pocket, it will likely differ from today's radios in terms of size weight, and cost. Not only must the device be small and inexpensive for distribution and use by every soldier, but because it is meant for tactical use, it must operate with virtually not any fixed infrastructure. Any cell towers cannot be erected on the battlefield.

The efforts will replace older, hardware-intensive radios with software applications for waveform generation and processing, encryption, signal processing, and other major functions. This approach will support military operations across a spectrum of environments — from backpacks to ships.

The key technology supporting these initiatives is ad hoc peer-to-peer wireless networking ,also known as a mobile mesh network. Ad hoc p2p operates by taking a collection of mobile terminals that communicate directly with each other without the aid of established infrastructure.

5. Advantages and Disadvantages

5.1Advantages:-

The military and DARPA have outlined specific capabilities for the devices. At a minimum, they will need:

- Deploying ability with little or no fixed infrastructure- Military engagements are often spontaneous, and a communications solution needs to be, as also. 4G Soldiers bring their
- Minute troops exit a transport, helicopter or ship.
- Geo-location well beyond the limitations of GPS:- Soldiers cannot afford themselves to expose themselves on a battlefield to acquire GPS coordinates. GPS is also limited in that satellite signals cannot penetrate caves, underground bunkers or inside shielded building. Ad hoc p2p wireless has built-in geo-location using an extremely accurate form of triangulations. The 4G soldier can triangulate position, or that of another soldier, based on mesh-enabled vehicles or other devices, even when hiding in caves.. Readings are faster than GPS because soldiers don't have to wait for multiple satellites to acquire a fix.
- Security:-The device security must address both communications security and a way to protect the network from unauthorized use if the device is captured.

Communications is more secure when mesh networks

allow for route diversity.. This lowers the probability of detection and increases battery life. Should a device be captured, the 4G soldier can blacklist that device to maintain the integrity of that network.

- Anti-jamming robustness:- The 4G soldier is neither dependent on a single frequency nor constrained to any military band. The mesh architecture is the best deterrent to jamming because noise can now be routed around problem areas. These self-forming, self-healing networks will have the ability to instinctively and proactively reduce the probability of the jamming.
- High-mobility connectivity:- Communications devices must operate while vehicles or soldiers are even mobile, even at speeds in excess of 100 mph. 4G soldiers can receive real-time streaming video from aircraft, such as the Predator Drone flying over a battlefield. Multitap take receivers minimize the effects of Doppler radar to maximize the impact of the theater air assets.
- End-to-end IP:- Modern soldiers grew up with computers and will demand the same applications and user interfaces that are available to civilians. The 4G soldier, using instant messaging, can send photos of enemy positions back to the Pentagon for analysis, and use voice over IP to communicate with non-military phones in an occupied city or area.

5.2 Disadvantages:-

- Vulnerable to the attacks.
- The Volatile topology makes it hard to detect the malicious nodes.

6 Applications

To meet the primary operational requirements and challenges, new communications systems need to operate on wide-ranging frequencies and bandwidths (from 20 MHz to 2.5 GHz at bandwidths from 500 kHz to 20 MHz), subject to constraints of local spectrum management regulations and operational military imperatives.

The technologies within the device are very tightly related and are highly complementary. Tight integration is exemplified by combining physical, media access, and link protocols, and a remote intranet-forwarding table on the programmable modem hardware. This allows 4G soldiers' devices to constantly adapt to changes in their environments at rates faster than the environments change, continuously monitoring and controlling the system at the lowest possible level of the communication protocol stack capable of adapting to changes.

Modem is the key component in maintaining connectivity under rapidly changing link conditions using a specialized packet-based waveform. The waveform is similar to today's IEEE 802.11 standard, but supports broader flexibility of the operation.

The result of the differences, plus additional design features of the modem/waveform combination, provide up to 50 dB processing in signal acquisition in additional to the processing gain associated with adapting the data rate from 4 Mbps down to 16 bps. The affect of the embedded serial probe and multiwall acquisition results in significant improvements in the system's ability to acquire and maintain that signal.

The dual-receiver, single-transmitter configuration provides a novel solution to the problem encountered when a node loses track of transmission requests while either transmitting or receiving data packets. In such cases, the node wanting to transmit would either add to packet collisions by initiating its own RTS, or wait in receive mode for a significant time for any of outstanding reservations to clear. In the dual-receiver case, the node uses one channel to constantly monitor the reservation channel while using the second receiver to accept the incoming data packets.

As an adjunct to the traditional link-layer protocols, the system performs neighbor discovery at the link level. Neighbor discovery results from either periodic broadcast of neighbor discovery messages or by “ease-dropping” on any other's transmissions. Placing this function at the link level reduces the amount of coordination between the intra networks protocols hosted in the separate processor, and allows dynamic adjustments in connectivity without the need to the update of routing tables. It also allows the link layer to make local connectivity and data-rate decisions based in frequency dependent characteristics of a channel..

Formation of the algorithms executed by distributed networking agents at the intranet level automatically self-organize the nodes. As every node activates, it listens for periodically broadcast neighbor discovery messages.

The newly activated node listens for a period of time to establish a list of potential islands with which it may seek to affiliation. Once it is accepted, the entering node is notified immediately by message while other members are notified as part of the routing table updates. If no existing island is available or accepts the entering nodes, the node may be establish itself as an island and potentially accept future members.

The distributed-agent algorithms also self-elect gateway nodes to act as bridges between tiers of connectivity,

relying on alternate frequencies and higher processing gain data rates to achieve the connectivity.

Advanced routing concepts tailored to highly mobile environments distribute routing information within as routing table updates. However, between the islands, the routing process employs data-hiding techniques to control the amount of overhead transmissions required over lower capacity inter-island links. Using the "near sighted" routing technique, overhead is typically held to less than 5 percent of the link bandwidth.

Multicast protocol increases the network efficiency by supporting to the concept "party conference" connections, characteristic of voice and data distribution patterns in military operations. These protocols form a reversible tree that transcends direct connectivity or node affiliation to create an "all-informed" party line activated by any of the member. Elastic virtual circuits improve reliability for information requirements demanding continual end-to-end connectivity in spite of loss of intermediate nodes or links.

All of the battlefield network devices including those embedded in tanks or other vehicles will instantly form, heal, and update the network as users come and go. Means, they will associate in an ad-hoc manner. Moreover, the devices will automatically and continuously optimize network connections as users merge in and out of network at will. As intelligent elements, all of the devices will constantly reconfigure the routing tables to determine the best network routes and, unlike cell-based solutions, network coverage and service levels will improve when soldier density increases.

The network resources are better utilized because networks are self-balancing, also. The soldiers' subscriber devices can hop to distant network access points, away from points of congestion, shifting network capacity to meet demands. Network deployment will be veryfast and easy because it is tower less. While commercial versions of the technology will require some fixed infrastructure mounted on the streetlights, billboards, and buildings, the 4G battlefield will be entirely mobile, with satellites or other communications systems providing the backhaul. And the network will disappear as fast as it was formed once soldiers leave the particular area. This technology could function as a personal are network , local area network, or wide area network , simultaneously. This means that same network can connect a soldier to the squad or platoon, to the battalion, and to a fully mobile division. It is the equivalent of a Bluetooth, 802.11, and 3G convergences, but, in a single network, with a single device.

Military planners want war fighters to have the same capability that civilian consumers get from their smart phones and are testing different devices. However, they still have to overcome security hurdles.But still reaserch is going on.

7. 4G MANET Implementation

Main concepts influencing the progress of wireless network technology toward the 4G portrays the future society living in utopia of constant access to all kinds of information through wireless communication.

However,unlike commercial environment, 4G implementation and secure constant connectivity may require tremendous work in the military environment. The next generation of wireless technology requires the understanding the future of warfare: the 4GW. 4GM@4GW is the idea of implementing the fourth generation of the wireless technology into mobile ad-hoc network in the next generation military environment.

The history of warfare can be divided in the four generations. The first generation of warfare is characterized by significance of man power; the winner had onlyl more soldiers. The second generation focused on the firepower. During World War I, armies were staying on the line, shooting toward each other, and the winner was the one who could survive the hell by having access to even more artillery. Focusing on the speed and coordination, the idea of highly mobile military introduced by the Nazi Germany during World War II as flash war illustrating the third generation where "attack relied on the infiltration to bypass and collapse the enemy's combat forces rather than seeking to close with and destroy them" The news coming from Iraq and Afghanistan show examples of the fourth generation of warfare known as 4GW, which is characterized by vanishing line between peace and war, and no existence of battle front .The 4GW "includes all forms of conflict where the other side refuses to stand up and fight fair." Additional technological key components of 4GW question the success of 4G MANET in military environment. 4GW is not only the new way of moving army forces using new artillery, but also the worldwide real-time information revolution, supported by all kinds of new technology, with cyber and the net wars In the world of priceless information, the transmission medium of data becomes a target of attack during any kind of the conflict. It is a misconception that addition of efficient and unbreakable cryptography to 4G supported by MANET's routing protocols will enough to create professional wireless communication for army. The first significant point of the 4GM@4GW is to aware about the wide spectrum of terrorist technological activity by an enemy and to indicate the possible actions done by the enemy that can prevent to successful implementation of future wireless networks in military environment. 4GM@4GW will be supported by 4G using increased mobility, range and bandwidth, single terminal connectivity with all already existing military equipment, possibility of using any present technology maintaining the communications on the territory of action, and supported by MANET's mobile mesh routing in case of lack infrastructure. At the same time, 4G(M@W will be twisted by technical limitations, natural-geographical constraints, possible breakings of encryption code, and DoS attacks.

Technological limitations defined as physical constraints in terms of bandwidth, memory, and power,

are the first significant point on the list of the issues in 4GM@4GW. Currently accessible on market different kinds of memory allow us to assume that the sufficient and low cost memories, such as flash drives, should fit into military environment. But, the important issue arises from supplying military mobile electronic devices by sufficient amount of power that is dependent on: how 4G is going to be implemented, what routing protocol will be applied, in what urban geographical environment missions will take place, and finally the duration of missions. Natural geographical constrains are another issue that can influence 4G(M@W). By increasing range and bandwidth, 4G lowers the possibility of existence of the routing problems between nodes in MANET network, such as hidden terminal interference and signal's fading. , the shape of the land may limit the benefits of using 4G. For example, 4G in military environment will achieve different results when used on the deserts of Iraq, in Afghanistan Mountains, or in some very urban city with metal-concrete and any electric barriers. In 4GW where army forces have to be ready to combat in any time and in any place all over the world it would be critical to use one single model of a device that will be able to provide the sufficient communication during military action without major dependencies on the shape of land. Comparing to the implementation of 4G in the civil environment, 4GM@4GW is also constrained by enemy's action preventing the successful communities of army forces and technological devices left on the battle field by enemies for the purpose of disrupting the wireless communication. Such an activity does not have to focus on decrypting information that is sent through air, but simply on preventing information to reach the soldiers by using DoS attacks. In many cases, successful DoS can be more important that decrypting information because of its immediate influence on army's condition

Power Challenges of 4G MANET

When processing speed doubles, another significant component of wireless devices limits their usage in the military environment - a battery. The fourth generation of wireless technology offers increased bandwidth, mobility and the signal's range. Increasing the signal power, a device requires more electrical power that will be consumed during the signal transmission. The amount of energy currently stored in batteries needs to be increased to utterly benefit from the fourth generation of mobile wireless network implementation and also manet nodes are much energy constrained. Wireless nodes require also a lot of computational power. Although the processors speed increases and its they turn into lower power consumption by introducing nanometer processor technology, the software requirements become more and more complicated requiring faster hardware and more electrical energy. two kinds of batteries are available for mobile devices:

1) Rechargable and, 2) Non-rechargable batteries.

Rechargable batteries, such as nickel-cadmium, nickel iron, nickel metal hydride, lithium ion polymer, lithium ion, and lead-acid, are characterized by the ability to restore their energy through application of electrical energy. Disposable batteries like: alkaline, thermal, lithium, are used once and discarded. However, when disposable batteries are unused they can lose less than 5% of their energy during one year, whereas rechargeable may lose over 90% of stored energy just after the 100 days.

While a military action becomes organized and prepared, technical equipment, stored in the magazines, awaits its usage. During this time, it is critical to ensure that once military equipment get prepared and stored, it will keep its ability to the rapid usage for long period of time. To allow rapid ready to mission state of all mobile devices, it is important to ensure that batteries will last for more than 100 days while stored on the shelf. The important aspect of 4G MANET in military environment is the fact that soldiers will become the independent units where everybody will be able to communicate between themselves as well as with the headquarter using all possible means of wireless low infrastructure communication. Increased soldiers' mobility as well as quality of communication increases the total weight of equipments that soldiers have to carry with them on the battlefield. The increased amount of technology increases the minimum amount of electrical power that has to be provided during military action for each soldier. Whereas 4G mobile devices implemented for military environment should not significantly increase the soldier's weight, batteries weight might do so.

Imagining that 4G MANET implementations, as well as all necessary military technical equipments were provided during a military action presents in two situations that might take a place. In one situation, a soldier will be required to carry out overwhelming amount of batteries that will significantly decrease his mobility. On the other hand, unacceptable weight of batteries was solved by introducing rechargeable batteries. However, in this case, the soldiers' mobility becomes limited as well. The presented two scenarios show two extremes that never be acceptable as real life implementations of the 4G MANET technology in military environment. However, the increased quality of communication and mobility, achieved by the fourth generation of wireless technology, can paradoxically be abandon in the military environment because of consuming Enormous amount of electrical energy.

1) The new batteries designs and wireless technology that will lower the power consumption. Power aware micro architecture, maximization of power efficiency, and management of heat, that is produced as a result of increased computational power, are the issues that current chip leaders, like Intel, have to consider while designing their products.

2) Coming up technologies such as designed by mPhase nano batteries, which are disposable. Nanobatteries' revolutionary design uses the "super hydrophobic characteristics of nanotexture circuses to control battery's internal reaction" and preserves energy for over 15 years by separating electrolyte from reactive metal when are stored .Its small and flexible size

supports the nano batteries candidacy for the military scenario.

Conclusion:-

The fourth generation of the cellular system will provide single interface to all kinds of wireless networks allowing participating nodes to access to the network through cellular, wireless LAN networks, and new protocols such as IEEE 802.20 and WiMAX. But, successful and safe implementation of the fourth generation of the wireless technology into the mobile ad-hoc network for the next generation military environment might face tough challenges. It also can be interrupted due to significant differences between the civil and military environment. Physical and technological constraints, geographical limitations and DoS attacks are some of foreseeable challenges. By putting all possible technological advances together from the 4G and MANET, this has set an example for future battle-field. The era of the new wireless communications is very challenging. Eventually it will penetrate into daily life just like many technological breakthroughs whose original research came from military needs. Automatic highway of traffic control system where vehicle equipped with sophisticated embedded communication chips can enter and leave from the infrastructure dynamically will be one example among many potential applications from 4G and MANET combined scenario. The future work includes: defining physical constraints for military mobile devices, simulates the effectiveness of MANET's routing protocols in 4G environment to find the most optimal protocol for the 4GM@4GW.

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7] Wen jing Lou Department of Electrical and Computer Engineering,Worceester Polytechnic Institute,Worceester, MA 01609,Wei Liu Yuguang Fang Wireless Networks Laboratory (WINET) Department of Electrical and Computer Engineering University of Florida, Gainesville, FL 32601SPREAD: Enhancing Data Confidentiality in Mobile Ad Hoc Networks