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A Methodology for an Efficient and Reliable M2M Communication

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***Abstract*—M2M is a new advent in technology where uncountable machines can share their information between other homogenous or heterogeneous machine. It is very similar o IOT.M2M is going to be a stimulation force for current Market scenario with large area of application like Smart warrior system, Real-Time Agriculture System-health ,Home Automation and many more This paper addresses the research issues related with the deployment of M2M with architecture of M2M Communication .In this paper we have tried to introduce all research issues and efforts have been made propose a Energy Efficient and Reliable (EER)M2M Communication.**

***Index Terms*-M2M, IOT**

I. INTRODUCTION

M2M is the abbreviated form of Machine to Machine Communication; M2M is a state of art Technology in the field of communication as emergence of next generation technology. M2M communication is an advanced form of Machine to Machine Communication where large number of similar or dissimilar devices not only sharing information but also making efficient decision and controlling devices with the help of wired or wireless network.

Perhaps the most basic way to describe M2M is shown in figure 1.1 .The role of M2M is to establish the conditions that allow a device to exchange information with End-user application via a communication network, so that the device and/or application can act as the basic of this information exchange. In many cases M2M involves a group of similar devices interacting with a single application. Fleet management is an example of such an application, where devices are, for example, trucks, and the communication network is mobile network. In some cases the devices in the group may not directly interact with the application owing to having only limited capacities. In this scenario, the relationship is mediated by gateway that collects information and forwarding it in efficient way. Smart metering is an example of such an application where devices are smart meters and the communication network can be mobile network or public internet.

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It is easy to monitor and control, ones number of machine/device but it is really very difficult to connect and control millions and billions of machines together without any human intervention .The concept where billions or trillions of devices connecting, sharing information and making collaborative decision is lead to the new name in communication and is nomenclature as Machine to Machine Communication. Many technical issues may crop up as billion of machines will get connected together .In order to get acceptance of M2M communication technology worldwide, lot many technical issues have to be resolved on a large scale.
Despite the real –time application and lots of benefits, research in M2M communication still in its infancy and faces many technical challenges. These challenges include M2M Architecture, M2M communication's Green issues, M2M cost effectiveness, M2M reliability, M2M Privacy, Persistency, Security [1].

II. ARCHITECTURE

High–level architecture provides an overview of the components of a system, as well as the relationship between the individual description components. It provides the starting point for a stepwise approach to the functional architecture. M2M architecture has adopted the following high-level system architecture which allows for a common understanding of the system that is under standardization .

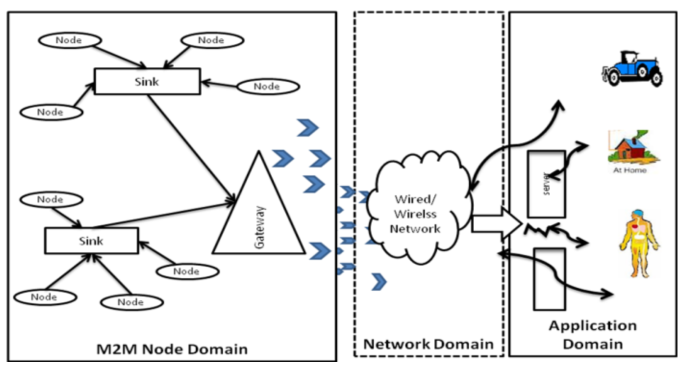

Fig.1 .Architecture of M2M Communication

This High level M2M architecture fully indorses the need for M2M service capabilities that are exposed towards applications, be it in network, the device or in the gateways. One important aspect of this architecture is that it provides end to end representation of an M2M system. The M2M high level architecture includes the concept of the M2M device domain, as well as network and application domain. The M2M device domain

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is composed of following elements:
M2M device domain: - M2M device domain is composed of efficient and intelligent homogenous or heterogeneous sensor node. In the node domain, an area network is potentially formed by a large number of sensor nodes {N0, N1 …} and an Gate Way (GW). Each node Ni is a very flexible and smart device equipped with some specific sensing
technology for real-time monitoring. Once monitoring data are sensed, sensor nodes will make intelligent decision and transmit the sensory data packets to the GW in single-hop or multihop patterns..
The Gateway GW is an integrated device. After collecting the packets from nodes, it is able to intelligently manage the packets and provide efficient paths for forwarding these packets to the remote back-end server (BS) via wired/wireless Networks.
Network Domain: Network domain provides cost-effective and reliable channels for transmitting sensory data packets from the Sensor domain to the application domain.
Application Domain: Application domain is the last part of the architecture. In the application domain, BS is the key component for the whole M2M communication paradigm, which not only forms the data integration point for storing all sensory data from the M2M sensor domain,
M2M device is a device that runs M2M application using M2M service capabilities and network domain functions.M2M device can connect to the M2M core in the following manner:
DIRECT CONNECTIVITY : The M2M node device is equipped with a WAN communication module and accesses directly the operator access network .Example of such devices include a smart meter that is directly connected to a
GATEWAY CONNECTIVITY: The M2M device connects to the network and application domain via a M2M gateway.M2M gateway is an intelligent device that collects the information from M2M node domain using M2M area network and provide these data to proper path.
M2M area network: A generic term referring to any network technology providing physical and MAC layer connectivity between different M2M devices connected to the same M2M area network or allowing an M2M device to gain access to a public network via router/gateway. Examples of M2M area network includes wireless personal area networks, such as IEEE 802.15.x,Zigbee,Bluetooth etc .,or local networks such as PLC(power line communication) or Wi-Fi. While other wireline based technologies are also being considered.
GSM/GPRS- infrastructure. In this case, the M2M device performs procedures such as registration .authorization, manage, and provisioning with the network and application domain

III. EFFICIENCY AND RELIABILITY IN M2M COMMUNICATION

Although many current and rapidly growing M2M communication system may have unique features ,most M2M communication systems are generally organized in a similar architecture to that shown in fig(1). With the following common characteristics: a large no of M2M nodes deployed in M2M domain to collect the sensed useful information and transmit these sensed information to the Application domain via network domain. These common characteristics can benefits the users from fast growing M2M communication system: however yield the requirement to fulfill the criteria for Energy efficiency, Security, privacy, Cost-effectiveness and reliability. For successfully deployment of M2M communication these requirement must be satisfied. In this paper we have discussed requirements of Energy efficiency, Reliability, Cost effectiveness on node level, network Level and efforts has been made to propose a Methodology for an Efficient and Reliable M2M communication.

A. Energy Efficiency

We need Energy-Efficient system in order to protect our environment cope with global warming and facilitate sustainable development .However telecommunication data volume Increases approximately by an order of 10 every five years, Which result in increase of the associated energy consumption by approximately 16-20 percent per annum [2] For instance in Japan N/W power consumption in 2025 is predicted 15 times the 2006 level .Especially due to anticipated increase in traffic volume with broadcast services and machine to machine communication bursty traffic originating from cloud computing [3].Information and Communication Technology usages has grown at a staging rate worldwide with an estimate 6 billion users in 2007[4]. Every year ,120.000 new base station are deployed servicing 400 million new mobile subscribers around world [5].The impact is compounded by the incredible growth of M2M Communication in the developing world turns to wireless as a medium to leapfrog past traditional Communication .Remote sites prevent in developing regions often rely on insufficient disel generators for power ,expanding communication’s carbon footprint at an at an even higher rate .A low power urban cell site requires 3KW of power (70-80 KWH of energy for 24-hour operation) and generates an estimated 11 tons of carbon dioxide[6].
Currently 3 percent of the worldwide energy is consumed by the ICT infrastructure
--Which causes about 2 percent of world wide CO2 Emission by airplane i.e. through the Aviation industry or ¼ of the world- wide CO2 emission by cars
-By Axel Hansmann, vice president, strategy and marketing,cint-2010
The last report by ABI research estimates an M2M projected compound annual growth rate (CAGR) of over 25 percent per year with 232.5 million cellular M2M connections by 2014[7] since there are currently 50 billion machines in the world that would benefit from M2M activity ,market growth is expected to accelerate while we would like to say that zero carbon foot print is a major contributor to growth, the reality is the significant environmental benefits of M2M are often fortunate side effects in smart technology .Recently the term “ Green M2M Communication” has been marketed and sloganized as a solution to addressing the growing cost and environmental impact of M2M Communication system.

B. Reliability

To achieve Energy Efficient and Reliable M2M communication individually is not a difficult job .However,when Energy Efficiency and Reliability requirements are considered as a whole, the issues become complicated .Reliability is a critical issue for Green M2M communication , Because unreliable transmission of data cause false monitoring data reports, long delays, and even data loss ,which would reduce people's interest in M2M Communication. Therefore High Reliable M2M Communication is demand for the next generation communication. Till now research have been investigated and invented many efficient method to develop Energy efficient environment for Node Domain [8]. To use different type of sleeping algorithm .Some research paper has been investigated the power consumption of wireless sensor node regarding size of cell area as reducing the cell size reduces the cell ECR (Energy consumption ratio) as desired while increasing the capacity density but the overall RAN energy consumption remain unchanged .In order to trade the increase in capacity density with sensor node area w/o degrading the cell capacity provision ,a cluster sleep mode is proposed [9].

Now let us discuss the Efficient and Reliability issues in M2M communication by surveying several potentially useful solutions as a new beam of light towards research line. First we discuss Energy Efficiency and reliability requirement at M2M domain level then at Network domain, Transmission and sensing level.

C. Energy Efficiency And Reliability at M2M Node Domain

M2M communication system is dependent upon the massive sensor nodes to intelligently collect monitoring data in the M2M domain. It is also dependent on the wired/wireless network to relay the collected sensory data to the BS in the network domain, and on the BS, to support various M2M applications on the network in an application domain. This is because a massive number of devices are involved in M2M. -the Energy Efficiency is one of the major concern in M2M Node. Several Energy Efficient MAC protocols [9-11] and Energy Efficient algorithm [12-13], have been proposed and implement at sensor node level to get an Energy Efficient Environment in Wireless sensor network.

The aim of these algorithms is to decrease the energy consumption by using sleep schedules. The basic concept is to make some part of sensory node to sleep, when it does not receive or transmit data instead of keeping the sensor node in idle mode. To do so, works in [9-11] suggested wake-up scheduling schemes at the MAC layer to activate sleeping node when it is not needed. The Energy Efficiency (green) becomes a challenging issue especially In the M2M sensor domain and at Network layer since at a time large packet of data will be transferred through applicable networks. M2M Communication dominates energy consumption. Energy Efficiency can be increased by wisely minimization of energy consumption at node level transmission power , by using the efficient protocol at physical layer of OSI and carefully applying algorithms and distributing computing techniques to design efficient and reliable communication protocols (e.g., routing protocols, sleeping algorithm) . In [8] an activity scheduling scheme is proposed for sensing coverage. This scheme requires time to be slotted, and activity scheduling is then done in rounds. In each round, a node selects a random timeout and listens to messages from neighbors before it expires. These messages contain the activity decision (i.e., whether to be active or not) of their senders. The scheme involves local communication only and generates a very small number of control messages, thus being Energy Efficient. Simulations based on ideal and realistic physical layers reveal its advantages over other similar algorithms. Therefore, the scheme can be applied to achieve Green communication in the M2M domain.[1].We have referred many research paper definitely satisfied our criteria to achieve Green M2M at node level. However, the Energy Efficient and Reliable Environment must be achieved while respecting the reliability requirement of M2M node, such as maximum tolerable time to report a sensed event. For getting the Efficient and Reliable M2M communication environment we have investigated and proposed SC-MAC algorithm [14] for the deployement of M2M communication.

In this regard, the spatial performance matrices in sensor node and the Av. time required to report reliably an event. In[11,13] the energy consumption and data delivery reliability problem has been investigated between Energy Efficiency and Reliability[15].The main advantage of the proposed algorithm is that the required Reliability could be maintained even if number of active reporting node N is less the minimum bounded Nmin obtained[16].The 2nd advantage of this method is E(Nop) <E(Nmin)1 which shows that the proposed algorithm introduce more flexibility but also enables further energy conservation and possible enables shorter latencies to report reliably the detected events.

In SC-MAC-M2M node ni(i=1,------,Ntot) sensed and transmits its event record to sink. All of its correlated neighbors (within a radius Rcorr) enter a sleep mode. In each correlation region a M2M node domain responsible to record and event reporting. It keeps transmitting reports until receiving a final acknowledgement frame (ACK_FIN) from the sink node. For the sake of simplicity- in the initial phase i.e called startup phase ,when the event occurs, all M2M node contend for medium by sending RTS frame within the event radius, it becomes reporting node of its correlation area, here neighboring node is denoted as ni and distance between node ni and nj(neighboring node) is d(i,j).Based on distance d(i,j) ,node nj identifies if it belong or node the correlation area managed by n:e.Especially ,if d(i,j)≤Rcorr(N),the nodeNj dumps its queue and enters immediate into sleep node for a period of time equal to

Tsleep=Tremain+Tsm

Tsm-optional time

Trem-estimation or remaining time needed by network to report reliably an event

In the next phase of steady state –when M2M node receive and ACK_FIN frame instead of ACK frame when desired event reliability, corresponding to predefined tolerable information distortion Dmax is reached .in this algorithm considering and efforts made to resolve the avoidance mechanism[11,18] problem.

For evaluation and simulation of proposed algorithm following steps have been implemented. In this mode using NS2 simulation software, consider 40 mobile sensor nodes randomly in a 500 x 500 m2 sensor field. The event source is represented by a mobile node that generates events periodically. To do the study of network during both the startup and steady phase. Comparing with the other types of MAC protocols fig. compare energy consumption generated by each of the three protocols.- a basic MAC protocol without any node selection mechanism ,CC-MAC protocol[16] and SC-MAC .Then will focus on latent ,packet drop rate and reliability matrices.(consider Tsm=100s)

Fig.12 shows the minimal energy consumption according to the optimal setup of the number of reporting nodes for SC-MAC and CC-MAC protocols (i.e Nopt for SC-MAC and Nmin for CC-MAC) from this graph we can see that in node selection scheme in CC-MAC protocol and in SC-MAC protocol to achieve high energy saving which justify their usefulness .

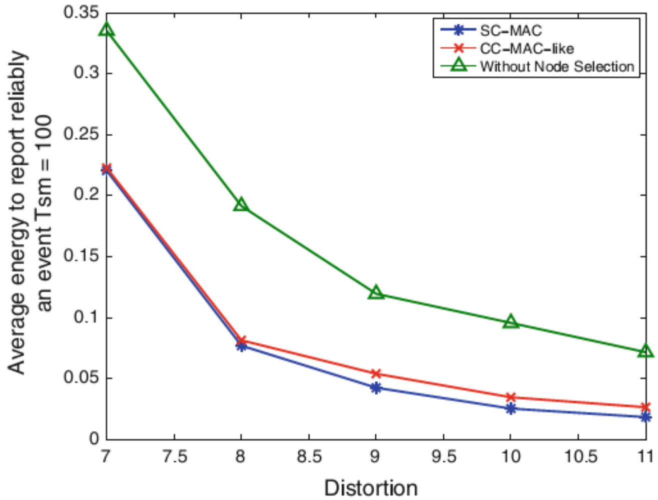
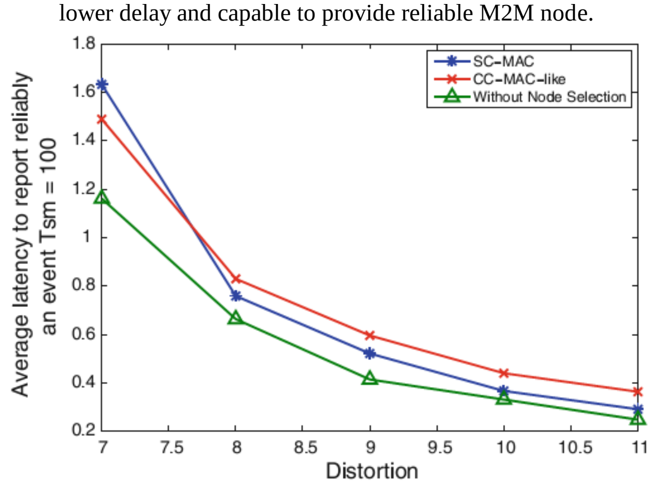


Fig 23 shows SC-MAC outperforms also CC-MAC by achieving lower delay and capable to provide reliable M2M node.



D. Efficient and Reliable M2M Network Domain

Very few computer network protocols lasted as long as the IPV4 protocol. even if ,at the outset ,IP was never designed to become the universal protocol we know nowadays, it was made versatile enough to evolve and cover and ever – increasing number of applications. At first glance the success can only be linked to Metcalf's law stating that the value of the network (i .e the benefits that users get from technology) is the square of the numbers of users. Even if [16] tempers this formula to------(where n is the no. of users),this leads to a mitigated virtuous circle : on the one hand ,the network becomes more attractive .While other ,resistance to deploying new protocols or new forms of behavior also increases. For general public ,the Internet is synonyms with the service offered by the network ,but for network engineer the internet can be viewed as protocol stack defined by IETF with RFC 79[10] at layer 3,some transport protocols such as TCP,UDP ,and more recently SCTP or DCCP and finally some applications such as DNS.

Another definition can be based on the actual name itself since it is composed of interconnection and network and sometimes the motto "the network of network " is used .This more general definition does not take in to account that the fact that and protocol leads to a more " philosophical" approach .this definition is more accurate for M2M communications. Protocols developed for the current Internet do not fit well when exposed to M2M constraints. Energy constraints are not taken into account .Internet protocols are sometimes very talkative or require states that are not available in an upgrade environment .Auto-configuration for regular services or for bootstrapping are needed since these items of equipment do not necessarily have a keyboard or a massive deployment of devices ,nor do they allow manual or managed configuration .internet evolution for supporting M2M and wireless sensor network(WSN) requires more than just a few simple changes in the routing protocols. It is a very important and needful requirement to fulfill the requirement of Green Internet [19] to achieve Efficient and Reliable Machine to Machine communication. In the proposed algorithm we have tried to propose an algorithm at physical layer of OSI for optical fiber networking. In recent years. The research community has recognized that the importance of internet's energy consumption with ever increasing demand for bandwidth ,connectivity of M2M devices require more device such as amplifiers, routers, storage devices and communication independent of load and reaches hundred of KW for multi – self configuration[10,11,12]ks. The power consumption of IP routers and line cards is almost These components tends to increase the cost of energy of the Internet .green information communication technology (ICT) is focused on saving the networking industry $ 800 billion in annual energy cost by 2020(smart 2020) [13].The study of energy efficiency strategies for optical networks is important as they are backbone networks for present day internet. The growth of M2M users and the higher bandwidth services at application layer have determined an increase of the Internet traffic, which, in turn, requires more transmission and switching equipments with more capacity, causing higher energy consumption. The energy consumption is becoming a key issue also in Information and Communication Technologies (ICT) environment [19], which is responsible of a power consumption varying from 2% to 10% of the worldwide power consumption [20].A number of studies raise the issue of whether the energy consumption can be more constraining than the capacity of optical and electronic technologies [11]–[21-25] for the growth of Internet. Several works, in fact, evaluate the power footprint of network devices: in [26], an experimental study about the dependence of IP router power consumption from

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attached interfaces and treated traffic is presented, while in [26-28]. M. Murakami and K. Oda, “Power consumption analysis of optical cross-connect equipment for future large capacity optical networks,” presented at the ICTON 2009, Azores Islands, Jul], several photonic and electronic node architectures for both circuit-switched and packet-switched networks are examined, and the power consumption of each architecture is evaluated for different values of the installed capacity. Results show that photonic technologies can improve the scalability of network nodes in terms of power consumption: in [29].There is a growing interest in deploying WDM (Wavelength Division Multiplexed) systems to meet the high bandwidth needs of Internet traffic, especially for networks of the scale envisioned for nationwide or global ISPs (Internet Service Providers). WDM is a mechanism to multiplex signals on different wavelengths using optical technology. In its simplest form, it is a point-to-point transmission technology that allows a service provider to increase the transmission bandwidth of a fiber with dense WDM (DWDM) multiplexers/demultiplexers, This is the efficient technique to provide a Reliable M2M environment at Network Domain. Many vendors have equipment that can multiplex 80-100 channels on a single fiber, and new advances promise to increase these numbers even higher. Besides multiplexers and demultiplexers, other WDM components include fixed and tunable lasers, and continuous-mode and burst-mode receivers. According to Bolla et al .[29] ,the increase in volume of the network traffic follows Moore’s law ,doubling every 18 months; while silicon technologies improve their efficiency according to Dennard’s law ,by a factor of 1.65 every 18 months. Thus there is a constant increase in power consumption related to communication networks ,which corresponds to 2 percent to 10 percent of world current power consumption and this is expected to increase in coming years .In recent past ,the research community has recognized the importance of the internet energy consumption .With ever increasing demand for bandwidth ,for device connectivity at application domain require more devices such as amplifiers, routers, storage device and communication links. These components tend to increase the cost of internet exponentially.

In this paper, we have given a proposed algorithm to achieve Energy efficient and Reliable M2M system the“Green Allocation with Zones Algorithm” (GAZA) for energy-efficient and dynamic traffic grooming in WDM networks. The algorithm is based on auxiliary graph that limits the solution space and captures the additional energy consumption to establish new connections. Results derived via simulation on different topologies and under different conditions show that this algorithm provide the energy efficient for M2M network domain and that it is able to produce blocking ratio which are close to and, in certain cases, better than the values produced by algorithms oriented to the reduction of blocking as increase the reliability of M2M network domain.

The proposed algorithm uses Zones, which represent a partially the network topology , and consequently ,are represented by reduced auxiliary graphs .Specifically ,the zone Based with neighbor Expansion (ZWNE) algorithm is employed[30] Auxillary graph Upon the arrival of a connection request r=(r,d,b), an auxillary graph G’(U, L) is built ,where U is subset of V is a set of nodes and L is a set of existing and allocable lightpaths. Initaially, the vertices of this auxiliary graph are those along the shortest path between s and d computed using the original topology graph (V,E), with the cost of the edge given by:

$$C(e) = \begin{cases} A_e \times P_o^{AM} & , \\ A_e \times P_o^{AM} + P_o^{OS} \end{cases} \qquad (1)$$

Where e is member of E is an edge that represent a fibber link, A_e is the number of Amplifiers on e, P_O^{AM} and P_O^{OS} are respectively .The overhead due to electronic and optical switching and signal conversion operations at nodes s and d are not considered in the cost of the edge because it is the same for all paths from s to d, therefore,it does not influence the selection of path with least energy overhead.

Green Allocation based on Zones Algorithm (GAZA):

Before discussing the GAZA algorithm ,some assumption is introduced: P0(s,d) is a path from s to d)RWA(s,d) is the route and wavelength assignment solution for the pair (s,d) obtained by a traditional Fixed-Alternate Routing with 5 alternative routes and the First-Fit wavelength assignment ,and NPT(U) is the set of vertices neighboring those vertices in the physical topology.

A psedo-code of GAZA[31]is presented in Algorithm 1.Simulation was performed to access the effectiveness of GAZA. Results obtained by GAZA are compared with Single –hop approach and multi-hop approach[32].The RWA algorithm used by single-hop and multi-hop was the same used by GAZA.: a conventional Fixed-Alternate Routing with 5 alternative routes and First-Fit wavelength assignment. The maximum no of expansion I and the maximum no of selected neighbors K to GAZA and multihop were set to 5 and to |P0(s,d)|,respectively[2]. For the simulation purpose mesh NSF topology with 16 nodes , and 25 bidirectional links with lengths in fig.3

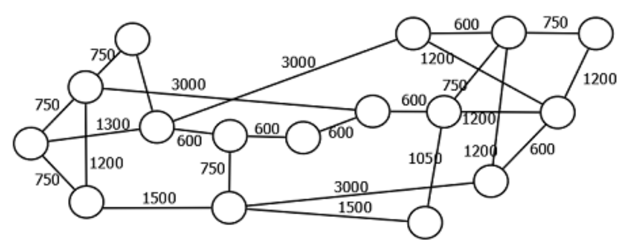

Fig.3.NSF topology considered

The number of in-line amplifiers for each link is given by [Se/80-1]+2[32],where S, is the length of the link e in kilometers.Connection requests are uniformaly distributed among all pairs of nodes, and the number of connections per connection type follows the distribution OC-1:20 OC -3:10 OC-12:10 OC-48: OC-192:1 that is close to bandwidth distributions in typical backbone networks[33].For calculating the power consumption in proposed algorithm considered values of P_T^{ES}=18.4 ,P_T^{OC} = 9.2,P_T^{TX}=10, P_T^{RX}=0.5,

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P_T^{EO} =1.3, P_T^{OE} =1 and P_T^{AM} =0.07 (ES-Electronic switching, ES-Optical switching, OE-Optical –electronics conversion ,TX-transponder transmission, RX-transponder reception and AM-signal amplification) for wavelength capacity of OC-192[34].The main of this algorithm to calculate the power consumption per bandwidth (PCB) corresponds to the ration of the total power consumed by the network by the amount of bandwidth accepted for different traffic PO/PT.

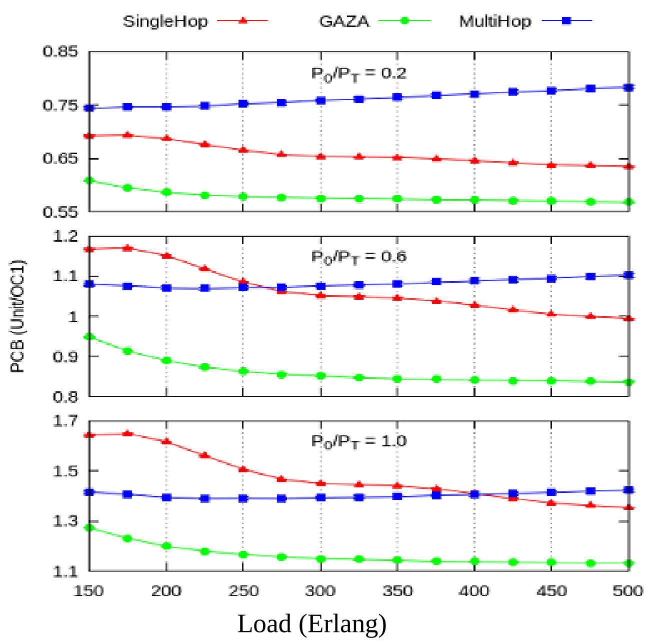

Fig:4 PCB over the network load overhead ration of 0.2 and 0.6

From the result of simulation fig 4 shows the power consumption per bandwidth as a function of network load for overhead values of 0.2 ,0.6,0.1 and found that proposed algorithm produces the lowest power consumption.

I. Reliability in M2M communication

For achieving Green M2M communication, since not all sensor nodes are expected to simultaneously be active in the M2M domain, Reliability is a challenging issue. In order to improve the Reliability of M2M communication, exploiting redundancy technologies, including information redundancy, spatial redundancy, and temporal redundancy, can be an efficient approach for M2M communication. In the following, we discuss three major Reliability issues in M2M communication with different redundancy technologies.

II. Reliability in Sensing And Processing

Due to component faults and so on, a single M2M communication node may not be sufficient to accurately sense and process monitoring data. Therefore, a majority vote in green M2M communication is desirable to improve reliability. In [10], a local vote decision fusion (LVDF) algorithm is presented, which can be directly applied in M2M communication. In LVDF, each M2M node Ni first independently senses, processes, and makes an initial single-bit decision di ∈{0, 1} on some event in a specific M2M application, and shares the decision di with its neighbors NB(i). Given a set of decisions {di :j∈NB(i)}, node Ni adjusts initial decision di →zi∈{0, 1} based on the majority voting strategy. In the end, all updated decisions zi are communicated to the GW, which again uses majority voting to make a decision based on zi. Since LVDF is a corrected decision strategy, it can improve the sensing and processing reliability in M2M Communication with additional information and temporal redundancy.

III. RELIABILITY IN TRANSMISSION

Consider that there are n total positive monitoring data on the same event in the M2M communication domain, and the GW will report the decision to the BS only if it can collect more than k distinct monitoring data packets. These positive monitoring data can first be aggregated and then forwarded to the GW together for achieving communication efficiency. However, in green M2M communication, not all nodes are active, which may result in unreliable transmission in the M2M communication domain.

To improve transmission reliability, spatial redundancy technology can be adopted [36]. Specifically, each monitoring data packet is independently transmitted to the GW. Assume each transmission has equal transmission reliability p in the M2M COMMUNICATION domain, where 0 < p ≤1. Then the reliability of more than k out of n packets can reach the GW for making the correct decision, ni=k (nk) pi(1 – p)n–i. Obviously, at the cost of redundant transmissions, the reliability in this strategy is higher than that in the aggregation transmission.

IV. RELIABILITY AT BS

The BS receives sensory and decisional data packets from the GW. These are processed one by one in the application domain and only one server is used to process them as this saves energy (power). But when there is considerable increase in the data packets, which may happen during peak hours, one single server is not adequate to deal with the situation. In such a case, reliability and QoS degrade. Therefore, to solve this issue a pair of servers, i.e. a primary and secondary server is deployed at the application domain. (Shown in Fig. 3) So, when there are a large number of data packets, the second server will automatically be activated.

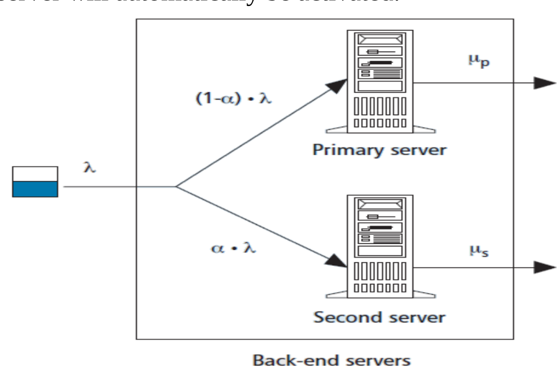

Fig: 3. The deployment of primary and second servers to achieve reliability [1].

We model both the primary and second servers as M/M/1 queuing systems, where the means of service time are 1/μp and 1/μs, respectively. Let λ be the arrival rate at the BS. If λ is small, all packets will be served by the primary server for energy saving. However, when λ increases, a fraction λ, where0 ≤ α <λ, of the packets will be served by the second server, and the rest, 1–α packets, will still be served by the primary server for guaranteeing the QoS in terms of average service delay. Therefore, the total average delay can be expressed as

E (D) = α/(μs- λ.α) + (1- α)/ [μp-(1- α) λ]

Where μs–λ .α > 0 and μp – (1 – α) λ>0

By calculating the derivative

$$\frac{dE}{d\alpha} = 0,$$

We have

$$\alpha = \frac{\sqrt{\mu_p}\,\mu_s + \sqrt{\mu_s}\,\mu_p}{(\sqrt{\mu_p} + \sqrt{\mu_s})\lambda} \qquad (1)$$

Which indicates that

$$\lambda > \mu_p - \sqrt{\mu_p \mu_s}$$

All packets are served by the primary server; when

$$\lambda \le \mu_p - \sqrt{\mu_p \mu_s}$$

The second server will be adaptively active, and serve a fraction α of packets. Therefore, the reliability issues in M2M communication can be addressed by redundancy technologies; however, they will incur additional redundancy costs. How to balance greenness and reliability in M2M communication needs further exploration.

V. CONCLUSION

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

REFERENCES

[1] Rongxing Lu " GRS: The Green, Reliability, and Security of Emerging Machine to Machine Communication" IEEE Communication Magazine" April 2011.

[2] H.Zang, "Keynote speech: cognitive radio for green communication and green

[3] M.Kakemizes and A chugo, " Approach to Green Networks ,' Fujitsu scientific and Technical journal (FST),Vol.45,no.4,Oct 2009,pp.98-109

[4] The world communication /ICT Indicators database ",International Telecommunication Union.

[5] H.H.sistek, " Green- tech base station cu+disel by 80 percent", In CNET news green Tech, 2008.

[6] J.Walko, " Green issues challenge Base station power",EE times Europe 2007[online]).

[7] ABI research C\October 2010 http://www/abi research ,com/press /3518 cellular + Mlna + onnectivity +mShoot+steady+grown +to=TDP+ 297+million+in+2011C.

[8] I.Stojmenovic, "Localized Network Layer Protocols in Wireless Sensor Networks based on Optimizing Cost Over Progress Ratio," IEEE Network, vol. 20, no. 1,2006, pp. 21–27.

[9] B.Badic. "Energy Efficient Radio Acess Architectures for Green Radio: Large versus Small Cell size Deployement.2009,IEEE.

[10] Miller, M., & Vaidya, N. (2005). A mac protocol to reduce sensor network energy consumption using a wake-up radio. IEEE Transactions on Mobile Computing, 4(3), 228–242.

[11] Ye, W., Heidemann, J., & Estrin, D. (2004). Medium access control with coordinated adaptive sleeping for wireless sensor networks. IEEE/ACM Transactions on Networking, 12(3), 493–506.

[12] Van Dam, T., & Langendoen, K. (2003). An adaptive Energy Efficient MAC protocol for wireless sensor networks. In Proceeding of ACM Sen Sys 2003 (pp. 171–180). Los Angeles, CA.

[13] Chang, J., & Tassiulas, L. (2004). Maximum lifetime routing in wireless sensor networks. IEEE/ACM Transactions On Networking, 12(4), 609–619.

[14] F.Bouadallah & N.Bouabdallah,.(2012) "Efficient reporting node selection-based MAC protocol for wireless sensor networks"Spinger.

[15] Cristescu, R., Beferull-Lozano, B., & Vetterli, M. (2004) on network correlated data gathering. In Proceedings IEEE INFOCOM Rhee, I., Warrier, A., Aia, M., & Min, J. (2005).

[16] Vuran, M. C., & Akyildiz, I. F. (2006). Spatial correlation-based collaborative medium access control in wireless sensor networks. IEEE/ACM Transactions On Networking, 14(2), 316–329.

[17] Ye, W., Silva, F., & Heidemann, J. (2006). Ultra-low duty cycle MAC with scheduled channel polling. In Proceeding of SenSys'06. Boulder, Colorado, USA.

[18] Singh, S., & Raghavendra, C. S. (1998). PAMAS: Power aware multi-access protocol with signaling for ad hoc networks (pp.5–26). New York: ACM Computer Communication, Review. .

[19] M. Gupta and S. Singh, "Greening of the internet," in Proc. SIG-COMM'03: Appl., Technol., Arch., Protoc. Comput. Commun., Karlsruhe, Germany, 2003, pp. 19–26.

[20] (2007). Global Action Plan Report, "An inefficient truth," [Online]. Avail-able: http://www.globalactionplan.org.uk/.

[21] K. J. Christensen, C. Gunaratne, B. Nordman, and A. D. George, "The next frontier for communications networks: Power management," Elsevier Comput. Commun., vol. 27, pp. 1758–1770, Jun. 2004.

[22] J. Baliga, K. Hinton, and R. S. Tucker, "Energy consumption of the Inter-net," presented at the COIN/ACOFT, Melbourne, Australia, Jun. 2007.

[23] J. Baliga, R. Ayre, K. Hinton, and R. S. Tucker, "Photonic switching and the energy bottleneck," in Proc. Photon. Switching, San Francisco, CA, Aug. 2007, pp. 125–126.

[24] J. Baliga, R. Ayre, W. V. Sorin, K. Hinton, and R. S. Tucker, "Energy consumption in access networks," presented at the Opt. Fiber Commun. (OFC)/Nat. Fiber Opt. Eng. Conf. (NFOEC), San Diego, CA, Feb. 2008.

[25] R. S. Tucker, R. Pathiban, J. Baliga, K. Hinton, R. W. Ayre, and W. V. Sorin, "Evolution of WDM optical IP networks: A cost and energy perspective," J. Lightw. Technol., vol. 27, no. 3, pp. 243–252, Feb. 2009.]W. D. Doyle, "Magnetization reversal in films with biaxial anisotropy," in 1987 Proc. INTERMAG Conf., pp. 2.2-1–2.2-6.

[26] R. S. Tucker, "The role of optics and electronics in high-capacity routers," J. Lightw. Technol., vol. 24, no. 12, pp. 4655–4673, Dec. 2006–

[27] S. Aleksic, "Analysis of power consumption in future high-capacity net-work nodes,"J. Opt. Commun. Netw., vol. 1, no. 3, pp. 245–258, Aug.2009.

[28] M. Murakami and K. Oda, "Power consumption analysis of optical cross-connect equipment for future large capacity optical networks," presented at the ICTON 2009, Azores Islands, Jul.

[29] Bolla, R., Davoli, F., Bruschi, R., Christensen, K., Cucchietti, F., and Singh, S. (2011).The potential impact of green technologies in next-generation wireline networks: Is there room for energy saving optimization? IEEE Communications Magazine, 49(8):80–86.

[30] Drummond, A. C. and da Fonseca, N. L. S. (2010). Fairness in zone-based algorithms for dynamic traffic grooming in WDM mesh networks. J. Opt. Commun. Netw., 2(6):305–318.

[31] xxx-Brazilian symposium on computer networks and distributed system J.

[32] Drummond, A. C. and da Fonseca, N. L. S. (2010). Fairness in zone-based algorithms for dynamic traffic grooming in WDM mesh networks. J. Opt. Commun. Netw., 2(6):305– 318

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[33] Huang, S., Mukherjee, B., and Martel, C. U. (2008). Survivable multipath provisioning with differential delay constraint in telecom mesh networks. In INFOCOM, pages 191–195
[34] Xia, M., Tornatore, M., Zhang, Y., Chowdhury, P., Martel, C. U., and Mukherjee, B.(2011). Green provisioning for optical WDM networks. IEEE Journal of SelectedTopics in Quantum Electronics, 17:437–445.
[35] Shen, G. and Tucker, R. S. (2009). Energy-minimized design for IP over WDMnetworks. Journal of Optical Communication and Networks, 1(1):176–186.
[36] W. Lou et al., "Spread: Improving Network Security by Multipath Routing in Mobile Ad Hoc Networks," Wireless Networks, vol. 15, no. 3, 2009, pp.279–94.