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Performance Evaluation of Proactive Fisheye Routing Protocol in Hilly Terrains with 802.11b MAP for various Battery models in VANET using Qualnet

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Abstract : *The modern world is VANET world where speed and Quality of Service (QoS) are the real characteristics. In VANET so many functions like gaming, internet etc. has been added leading to fast CPU clock speed hence more battery consumption. There is an increase in demand for wireless sensors and portable electronic devices in VANET. Hence wireless devices are becoming ubiquitous; batteries are used to power these devices. However, batteries are not durable and have to be replaced periodically. Choosing a right battery model is the key of above problem up to certain extent. In this paper we studied proactive Fisheye source Ad hoc routing protocol taking in to consideration various VANET parameters like speed, altitude etc. in real traffic scenario. The scenario is designed in such a way that it undertakes the real traffic conditions. Here two busy roads of Dalhousie city, Himachal Pradesh, India at an altitude of 1970m has been taken The Proactive Fisheye source routing protocol is compared for battery models Duracell AA(MX-1500), Duracell AAA(MN-2400),Duracell AAA(MX-2400), Duracell C-MN(MN-1400) standard using Qualnet as a Simulation tool. Since Energy conservation is main focus area now days. Hence performance of the protocols with various battery models along with FIFO and residual battery parameters counts and helps to make a right selection of battery model. Varying parameters of VANET shows that in the real traffic scenarios Duracell AA (MX-1500) and Duracell AAA (MN-2400) performs more efficiently for energy conservation.*

Keywords : *VANET, Ad hoc Routing, FIFO, 802.11b, battery models, Qualnet.*

1. INTRODUCTION :

Vehicular Ad hoc Network (VANET) is a new communication paradigm that enables the communication between vehicles moving at high speeds. There is an increase in demand for wireless sensors and portable electronic devices in VANET. Hence wireless devices are becoming ubiquitous; batteries are used to power these devices. However, batteries are not durable and have to be replaced periodically .It has been found in the last decade so many functions like gaming , internet etc has been added leading to fast CPU clock speed hence more battery consumption. It is known that power consumption is proportional to frequency of operation. In order to improve QoS and energy conservation in fast moving vehicles various light weight routing protocols needed to be studied in Physical and data link layer. So that Right selection of the protocol can be made with respect to . There are mainly three types of routing protocols, Proactive [1], Reactive [2], Hybrid [3].The fisheye state routing protocol studied here is proactive in nature. Proactive routing protocol continuously updates the routing table, thus generating sustained routing overhead. These protocols are having different criteria for designing and classifying routing protocols for wireless ad hoc network. The Mobile Ad hoc Network (MANET) working group of the Internet Engineering Task Force (IETF) [4] develop standards for routing in dynamic networks of both mobile and static nodes. The protocols in focus now days are Hybrid protocols[5,6] and others [7]. Its use in the context of VANET's along with reactive and proactive has always been area under investigation. Routing protocols are always challenging in the fast moving nodes as their performance degrades and such type of network is difficult to manage as fast handoff, signal quality, Interference maximizes along with other geographical factors[8-11]. It must be noted that the battery capacity is tripled only in the last few years whereas amount of data transfer is increased from few Kbps to Several tens of Mbps. Hence designing of right scenario, Choosing energy efficient protocol and selection of right battery model is the need of the hour.

In this work, The scenario is designed in such a way that it undertakes the real traffic conditions. Here two busy roads of Dalhousie city, Himachal Pradesh, India at an altitude of 1970m has been taken the feasibility, the performance, and the limits of ad hoc communication using the Fisheye routing protocol is evaluated as per battery models Duracell AA (MX-1500),Duracell AAA(MN-2400), Duracell AAA(MX-2400), Duracell C-MN(MN-1400)[15,16]],and Potentials for optimizing the deployed transport and routing Protocols is investigated. Special care is taken in to provide Realistic scenarios of both road traffic and network usage. This is accomplished by simulating a scenario with the help of simulation tool Qualnet [12].A micro simulation environment for road traffic supplied vehicle movement information, which was then fed in to an event-driven network simulation that configured and managed a VANET model based on this mobility data. The protocols and their various parameters of the transport, network, data link, and physical layers were provided by well-tested implementations for the networks simulation tool, while VANET mobility is performed by our own implementation. The Qualnet[12] is used as a simulation tool because of its wide applications and potential to give results nearly similar to that of real world.

2. AD HOC ROUTING PROTOCOLS :

Routing protocol is a standard that controls how nodes decide how to route the incoming packets between devices in a wireless domain & further Distinguished in many types. There are mainly three types of routing protocols. Ad-hoc on demand vector distance vector (AODV), Dynamic MANET On demand (DYMO) and Dynamic source routing (DSR) are the examples of reactive routing protocols whereas Optimized Link State Routing (OLSR) and Fisheye state routing (FSR) are the examples of proactive routing protocols. Hybrid routing protocols is the combination of both proactive and reactive routing protocols, Temporary Ordered Routing Algorithm (TORA), Zone Routing Protocol (ZRP), Hazy Sighted Link State (HSLS) and Orderone Routing Protocol (OOPR) are its examples. In our work the chosen protocol is Fisheye State routing Protocol and its Queuing parameter is also considered.

A. Fisheye State Routing

Fisheye State Routing (FSR)[1-5] is built on top of GSR. The novelty of FSR is that it uses a special structure of the network called the ‘‘fisheye.’ ’This protocol reduces the amount of traffic for transmitting the update messages. The basic Idea is that each update message does not contain information about all nodes. Instead, it contains update information about the nearer nodes more frequently than that of the farther nodes. Hence, each node can have accurate and exact Information about its own neighbouring nodes. The following example explains the fish eye state routing protocol.

In FSR, the network is viewed as a fish eye by each participating node. An example of this special structure is shown in Fig.1 Here; the scope of fish eye is defined as the set of nodes that can be reached within a given number of hops from a particular centre node. In the figure, we have shown three scopes with one, two, and three hops. The centre node has the Most accurate information about all nodes in the white circle and soon. Each Circle contains the nodes of a particular hop from a centre node. The advantage Of FSR is that, even if a node does not have accurate information about a destination, as the packet moves closer to the destination, more correct information about the route to the destination becomes available.

B. FIFO (First-In-First-Out)

A queue in which the first item in is the first item out is called FIFO [5-7]. In this a packet waits in a buffer (queue) until the node (router or switch) is ready to process them. If the average arrival rate is higher than average processing rate, the queue will up and new packets will be discarded. Note that a FIFO queue holds the packet .if the traffic consists of fixed size packet (e.g. cells in ATM networks) ,the process removes a fixed number of packets from the queue at each tick of the clock. If the traffic consists of variable-length packets, the fixed output rate must be based on the number of bytes or Bits.

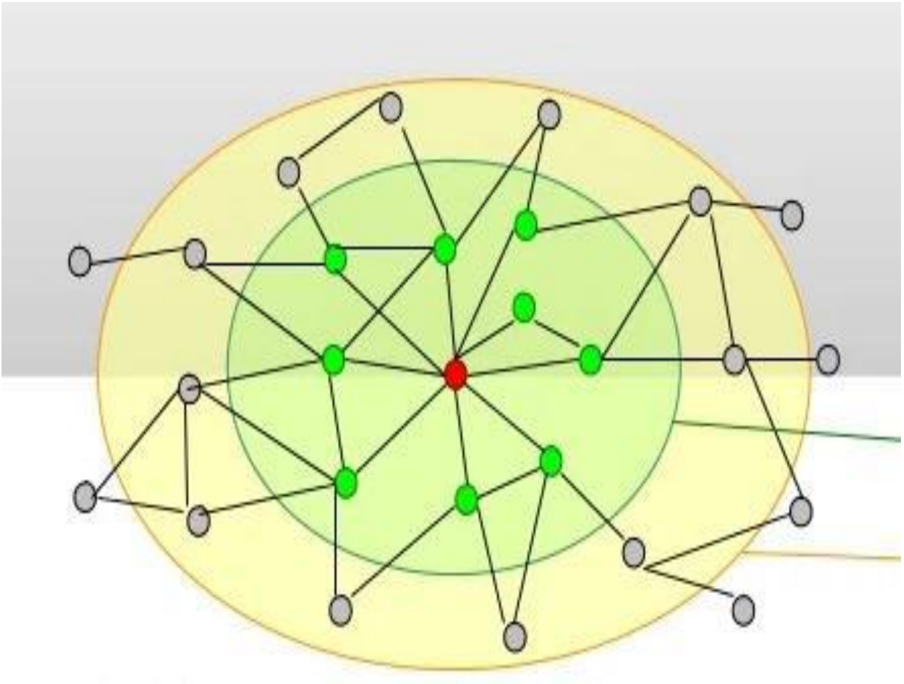

Figure 1. Fisheye Structure

3. BATTERY MODELS

Since batteries continue to power an increasing number of electronic systems, their life becomes a primary design consideration. Figure 2 illustrates a widening battery gap between trends in processor power consumption [11] and improvements in battery capacity [15,16]. Bridging this gap is a challenge that system designers must face for the foreseeable future. The need to improve battery life is in large part has driven the research and development of low power design techniques for electronic circuits and systems [13, 14]. Low power design techniques were successful in reducing the energy drawn from the battery and improving battery life. By understanding both the source of energy and the system that consumes it, the battery life can be maximized.

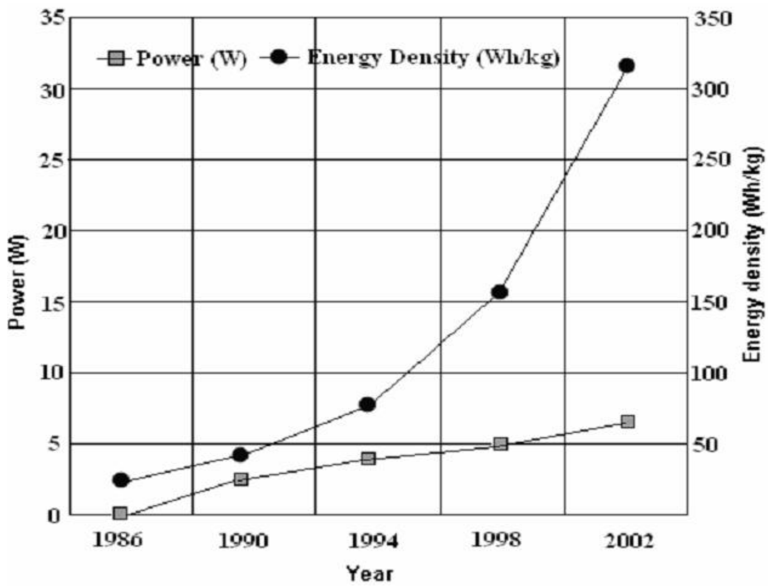

Figure 2. A widening battery gap between trends in processor power consumption.

Basically the zinc/potassium hydroxide/manganese dioxide cells, commonly called alkaline[15] or alkaline-manganese dioxide cells, have a higher energy output than zinc-carbon (Leclanche) cells. Other significant advantages are longer shelf life, better leakage resistance, and superior low temperature performance. In comparison to the zinc-carbon cell, the alkaline cell delivers up to ten times the ampere-hour capacity at high and continuous drain conditions, with its performance at low temperatures also being superior to other conventional aqueous electrolyte primary cells. Its more effective, secure seal provides excellent resistance to leakage and corrosion.

The use of an alkaline electrolyte, electrolytic ally prepared manganese dioxide, and a more reactive zinc powder contributes to a higher initial cost than zinc-carbon cells. However, due to the longer service life, the alkaline cell is actually more cost-effective based upon cost-per-hour usage, particularly with high drains and continuous discharge. The high-grade, energy-rich materials composing the anode and cathode, in conjunction with the more conductive alkaline electrolyte, produce more energy than could be stored in standard zinc carbon cell sizes The product information and test data included in this section represent Duracell's newest alkaline battery products. Note that these battery models have some common battery parameters.

A. Duracell AA(MX-1500)

Nominal Voltage:	1.5 V
Operating Voltage	1.6 - 0.75V
Impedance:	81 m-ohm @ 1kHz
Typical Weight:	24 gm (0.8 oz.)
Typical Volume:	8.4 cm 3 (0.5 in.3)
Storage Temperature Range	-20ºC to 35ºC
Operating Temperature Range: & Terminals:	-20ºC to 54ºC Flat
ANSI: & IEC:	15A & LR6

B. Duracell AAA (MN-2400)

Nominal Voltage:	1.5 V
Operating Voltage	1.6 - 0.75V
Impedance:	250m-ohm@ 1kHz
Typical Weight:	11 gm (0.4 oz.)
Typical Volume:	3.5 cm 3 (0.2 in.3)
Storage Temperature Range	-20ºC to 35ºC
Operating Temperature Range: Terminals:	-20ºC to 54ºC Flat
ANSI: & IEC:	24A & LR03

C. Duracell AAA (MX-2400)

Nominal Voltage:	1.5 V
Operating Voltage	1.6 - 0.75V
Impedance:	114 m-ohm @ 1kHz
Typical Weight:	11 gm (0.4 oz.)
Typical Volume:	3.5 cm 3 (0.2 in.3)
Storage Temperature Range	-20ºC to 35ºC
Operating Temperature Range: Terminals:	-20ºC to 54ºC Flat
ANSI: &IEC:	24A & LR03

D. Duracell C-MN (MN-1400)

Nominal Voltage:	1.5 V
Operating Voltage	1.6 - 0.75V
Impedance:	136 m-ohm @ 1kHz
Typical Weight:	139 gm (4.9 oz.)

Typical Volume:	3.5 cm 3 (0.2 in.3)
Storage Temperature Range	-20ºC to 35ºC
Operating Temperature Range: Terminals:	-20ºC to 54ºC Flat
ANSI: & IEC:	13A & LR20

4. SIMULATION TOOL

The adopted methodology for the results of this research work is based on simulations near to the real time packages before any actual implementation. Hence many parameters of VANET are taken.

Qualnet[12] is a fast, scalable and hi-fidelity network modelling software. It enables very efficient and cost-effective development of new network technologies. Qualnet is network modeling software that predicts performance of networking protocols and networks through simulation and emulation. Using emulation and simulation allows to reproduce the unfavourable conditions of networks in a controllable and repeatable lab setting. Qualnet enables users to Design new protocol models, Optimize new and existing models, Design large wired and wireless networks using pre-configured or user-designed models, Analyze the performance of networks and perform what-if analysis to optimize them. Qualet [12] is the preferable simulator for ease of operation. So, we found Qualet be the best choice to implement our scenarios as we do not need every feature possible, just those for the token passing and message routing. Qualet is a commercial simulator that grew out of GloMoSim, which was developed at the University of California, Los Angeles, UCLA, and is distributed by Scalable Network Technologies [12]. The Qualet simulator is C++ based. All protocols are implemented in a series of C++ files and are called by the simulation kernel. QualNet comes with a java based graphical user interface (GUI).

Table 1. Simulation Parameters

Simulator	Qualnet Version 5.o.1
Terrain Size	1500 x 1500
Simulation time	3000s
No. Of Nodes	20
Mobility	Random Way Point Pause time= 0s
Speed of Vehicles	Min.=5m/s Max.=20m/s
Routing Protocols	Fisheye Source Routing
Medium Access protocol	802.11b, Tx Power=150dbm
Data size	512 bytes
Data Interval	250ms
No. of sessions	5
Altitude	1970m
Weather mobility	100ms
Battery models	Duracell AA(MX-1500),Duracell AAA(MN-2400), Duracell

	AAA(MX-2400), Duracell C-MN(MN-1400),

5. DESIGNING OF SCENARIO :

The scenario is designed in such a way that it undertakes the real traffic conditions. Here two busy roads of Dhalousie city, Himachal Pradesh, India has been taken We have chosen 20 fast moving vehicles in the region of 1500X1500 with the random way point mobility model. There is also well defined path for some of the vehicles, so that real traffic conditions can also be taken care of. It also shows wireless node connectivity of few vehicles using CBR application. The area for simulation is Hilly area with altitude of 1970 meters. Weather mobility intervals is 100ms.Pathloss model is two ray with max prop distance of 100m.Here the data sizp]-
L';,e is 512 bytes and transmission power is 150dbm. The speed of the vehicles varies from 5m/s to 20m/s. The data intervals choosen here is 250ms and the number of sessions is five.

6. RESULTS AND DISCUSSION :

The simulation result brings out some important characteristic differences between the various Battery models. It has been found at high altitude with high weather mobility the residual battery capacity for Duracell AA (MX-1500) and Duracell AAA (MN-2400) is quite high as compared to other two. This is because they offers low impedance of 81 m-ohm @ 1kHz and 250 m-ohm @ 1kHz as compared to 114 m-ohm @ 1kHz and 136 m-ohm @ 1 kHz for Duracell AAA (MX-2400) and C-MN(MN-1400).Moreover ANSI values are 15A and 24A for Duracell AA(MX-1500) and Duracell AAA (MN-2400) as compared to 13A and 24 A for both Duracell C-MN (MN-1400), Duracell AAA (MX-2400).The Typical weight values also mend for consideration. The FIFO Peak Queue size also shows the better performance of Duracell AA(MX-1500) and Duracell AAA (MN-2400).Moreover the weight differences are also considerable for performances

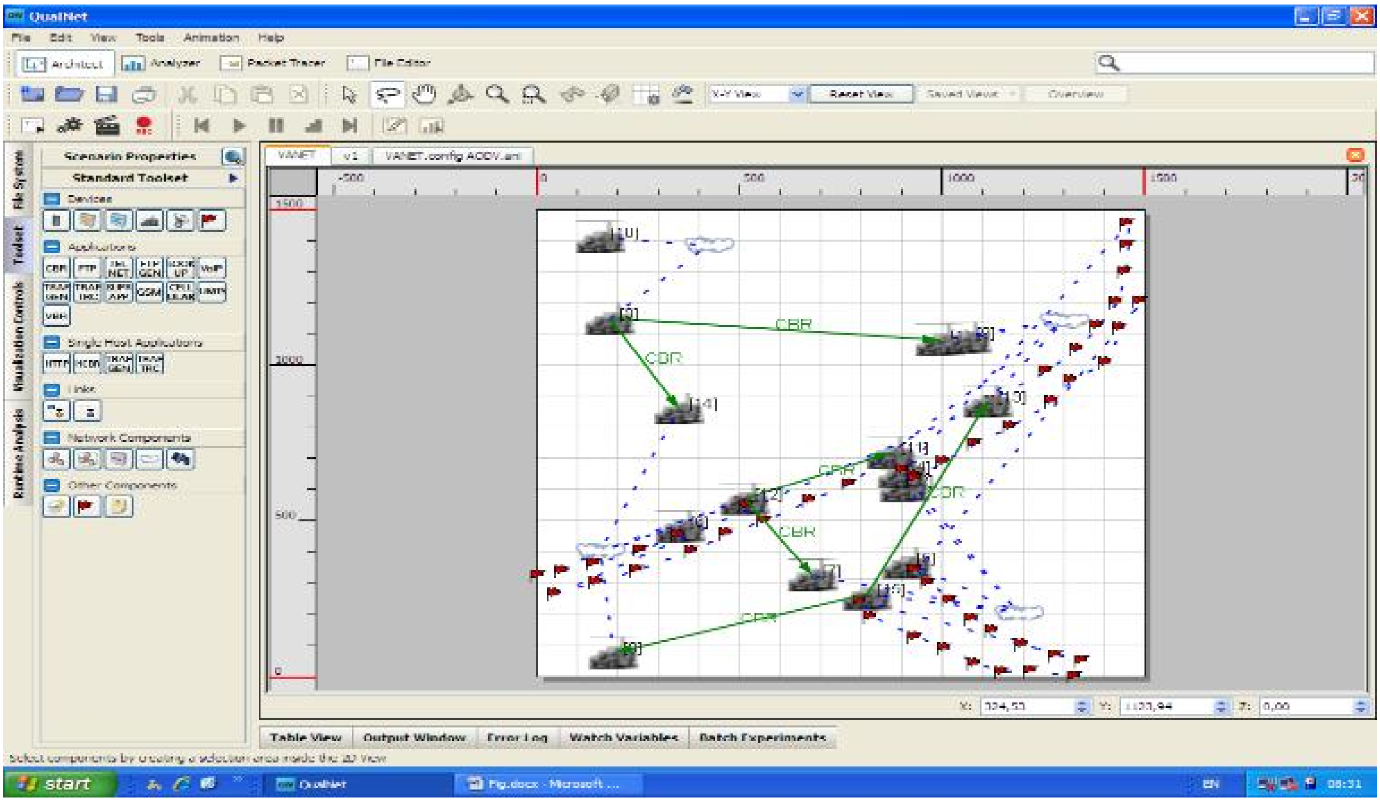

Figure 3. Qualnet VANET Scenario

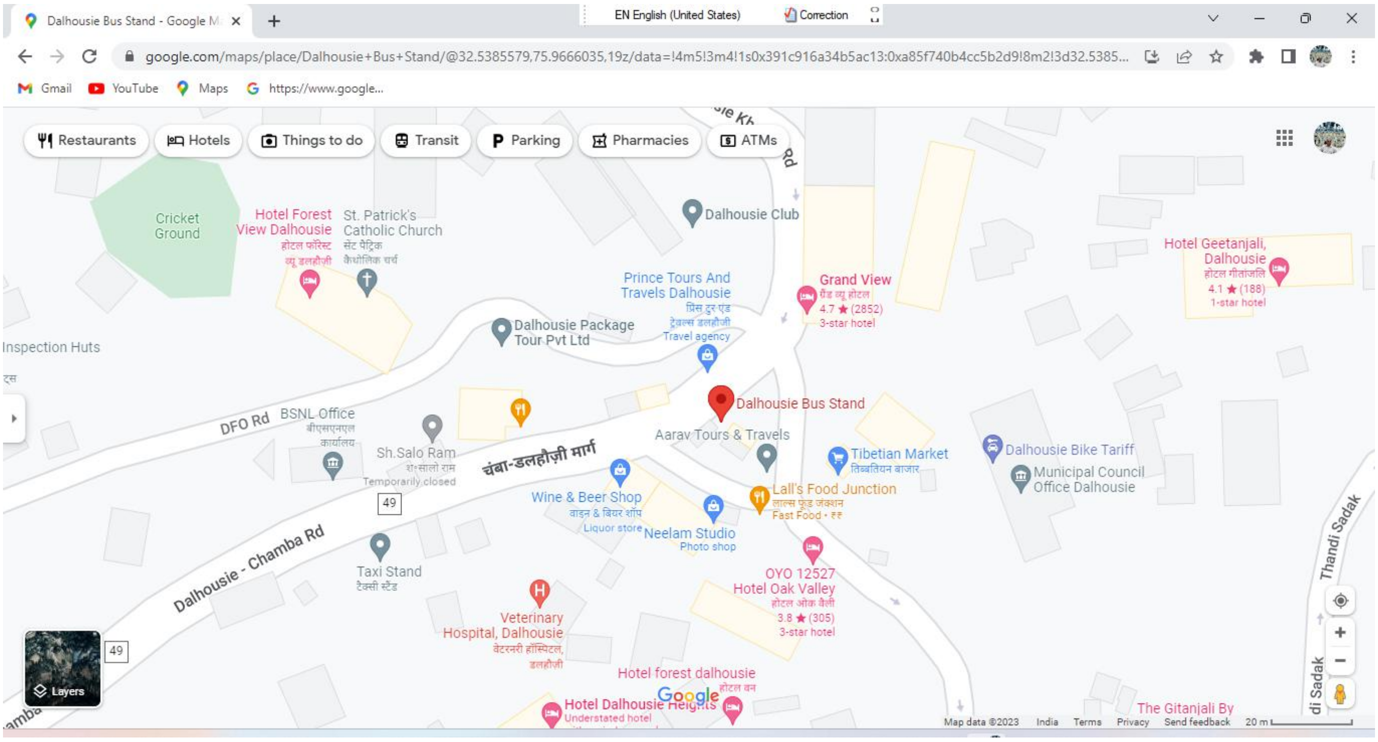

Figure 4. Real Traffic Scenario

7. CONCLUSIONS :

Evaluation of the feasibility and the expected quality of VANETs operated as per various battery models, shows significant results. It has been found that the battery models depending upon their impedance, volume, weight, various temperature operating range shows significant variations in performance. Since energy conservations is most required now days. Hence its study leads to solutions to many problems. As we know battery capacity has been increased three times only as compared to data transfer rate from few kbps to several tens of mbps. In future many parameters like longitude, latitude, geographical location, traffic, no. of nodes can also be considered for the exact results to real world.

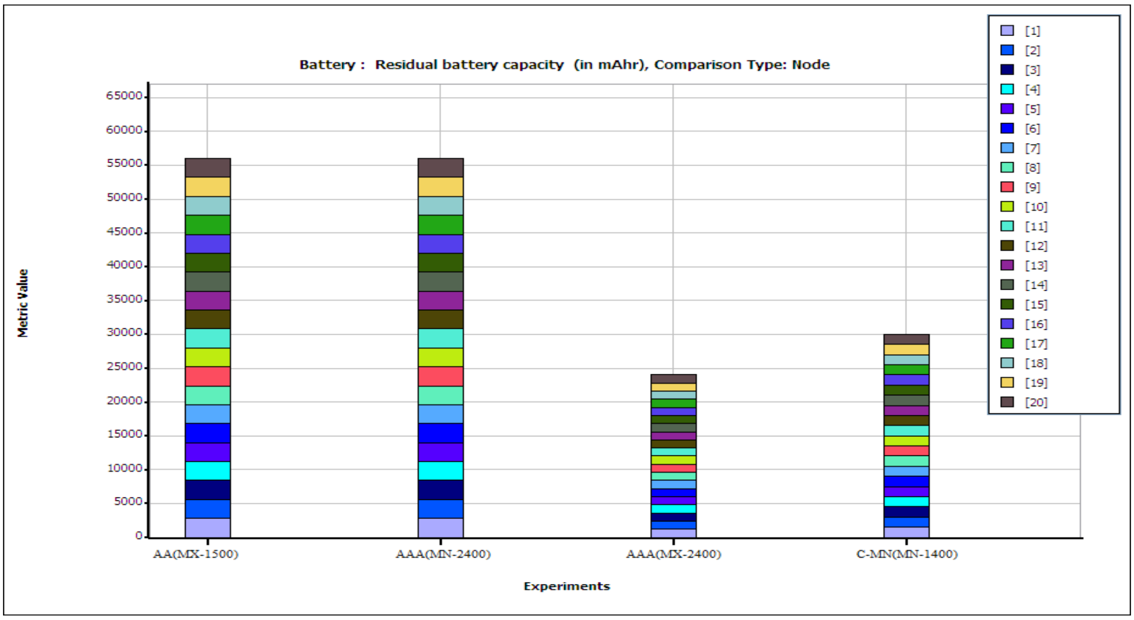

Figure 5. Residual Battery Capacity for Fisheye Routing

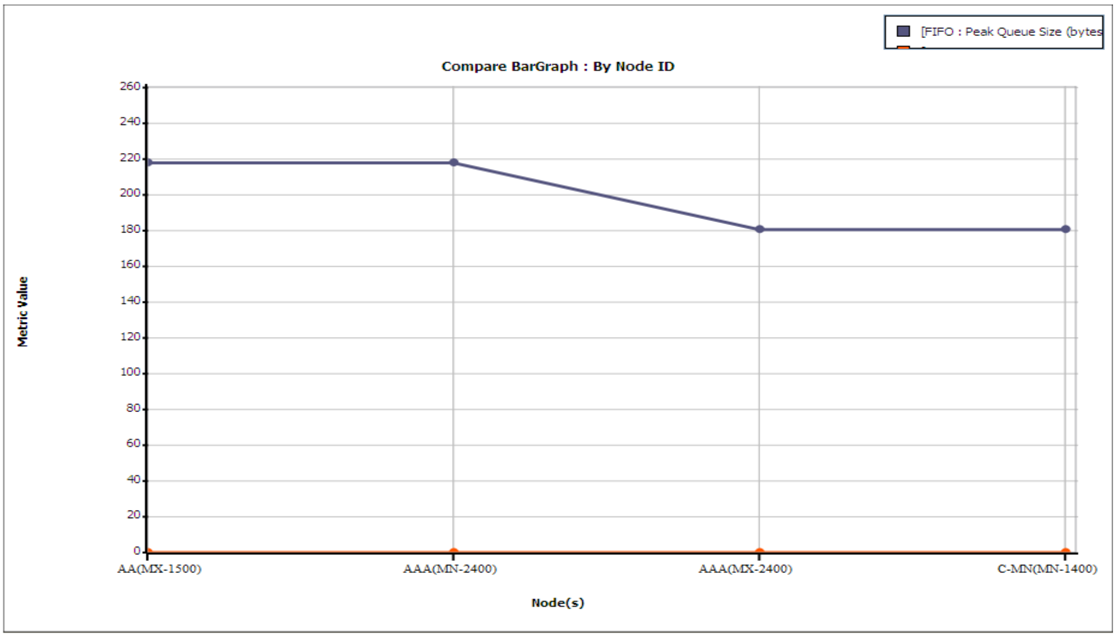

Figure 6. FIFO Peak Queue Size for Fisheye Routing

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