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Performance Analysis of Differential Services Architecture for MANET'S

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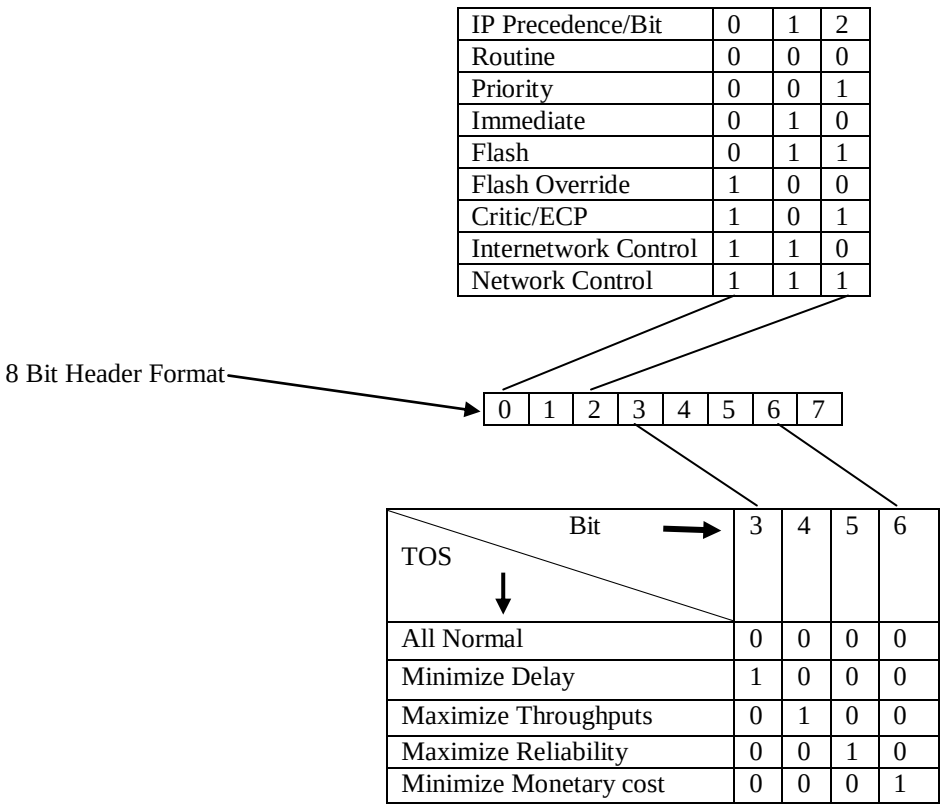
Abstract: ***Differential Services are play important role in the MANET's Quality of Services. It improve the overall quality of network with the help of different services classes. These classes are designed and assigned according to their services and precedence. It is like real time services scheduling in the internet services. In this paper we provides the brief architecture of DiffServ protocol likes meter, marker and conditioner. We analyzed and compare different services classes (AF, EF and BF) on QualNet simulator.***

Keywords: IntServ; DiffServ; AF; BF; EF; Meter; Marker; Conditioner; QualNet.

I. INTRODUCTION

Mobile Ad-hoc networks is the growing field in this era. A lots of mobile communication network using this technology, where there are not centralized control. And to provide a desired services for every user is became a challenging task. Because internet is became a parts of live of new generation. They required high speed, huge Bandwidth, VoIP and Quality of services. Bandwidth is common requirements for every internet services and every services provider want to design a network with number of service class [1, 2, 24].



IP Precedence/Bit	0	1	2
Routine	0	0	0
Priority	0	0	1
Immediate	0	1	0
Flash	0	1	1
Flash Override	1	0	0
Critic/ECP	1	0	1
Internetwork Control	1	1	0
Network Control	1	1	1

TOS \ Bit	3	4	5	6
All Normal	0	0	0	0
Minimize Delay	1	0	0	0
Maximize Throughputs	0	1	0	0
Maximize Reliability	0	0	1	0
Minimize Monetary cost	0	0	0	1

Fig. 1 Mapping of IP Header [1]

All services class are controlled, when one class is not sending any data (unused) then its bandwidth will be transferred for those classes whose are overloaded. A lot of quality of services architecture has been developed by IETF [25] for internet services i.e. integrated services and Differentiated services are the QoS architecture that are mainly used in now a days

Integrated services architecture has working on the resource reservation policy or signaling protocol. In this architecture we have assumption that every resource are reserved and managed. Integrated services are applicable only in single service module. It provides the best effort and RSVP Service scheme end-to-end QoS guarantees for per flow [13,20], it used two type of services classes, guaranteed service and controlled load service or also called real time service and current non real time services. Every node in this architecture use the resource reservation algorithm mechanism for admission control and packet forwarding for per flow. It's a wonder full architecture for small network. And provided guaranteed best effort service. But major drawback of this architecture is when we scale the network its performance has become very poor and this architecture is not working in the mobile ad-hoc networks. Solution of this problem is evolved in the form of differentiate services architecture [16].

II. MANET'S QOS/DIFFERENTIAL SERVICE (DIFFSERV)

Whenever, we talk about the quality of service then it is agreement between user and service provider to provide the minimum level of services. Differentiate services (DiffServ) is a one of the most popular and maximized used QoS architecture for mobile ad-hoc networks. It's a mechanisms to provide assurance QoS for un-centralized control architecture. DiffServ works on IP packets header of IPV4 and IPV6. It is the IP packet based technology that's contains different class of IP traffic for different user.

DiffServ architecture are classified into two types, edge router (egress node and ingress node) and core router (simple node) both are assigned with PHB (per-hop behavior) according to DSCP [3,4,7]. Every packets enter through edge router in DiffServ architecture. Edge router done marking, classifying, conditioning and shaping/dropper the packets with same types of different classes that's called Behavior Aggregate (BA) classifier and Multi field (MF) classifier. Meter is used to shaping and sending the packets to different queue. The Multi field classifier is composed of three parameters.

A. TRAFFIC CLASSIFIER

Traffic classifier classify the traffic according to its destination address of the packets, source node id of the internet protocol header, DS field values, source port of the packets, destination port port of the packets, protocol header of the IP packets, incoming interface and condition class unique positive integer value identify the class[8,9].

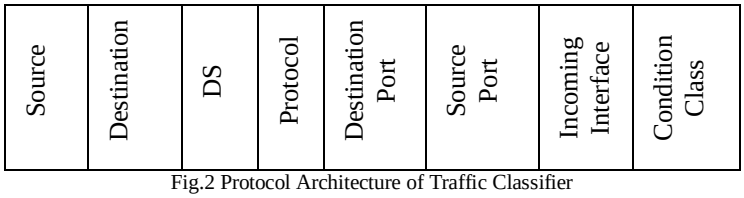


Fig.2 Protocol Architecture of Traffic Classifier

B. TRAFFIC METER

Traffic Meter define the bandwidth and burstiness character that are allowed for a give traffic class it used five type of meter single and two rate three color meter with color aware [6], time sliding window with two color meter and three color meter [9] and token buckets [5]. In the traffic meter header six field are defined, Condition Class which we define above, Traffic Meter which is one of the above five meters, data rate for packets and last three bits are used for passing different argument according to different meters [10].

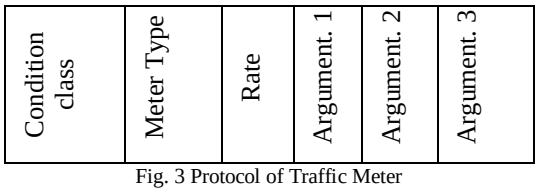


Fig. 3 Protocol of Traffic Meter

C. TRAFFIC CONDITIONER

Traffic conditioner drop and marks the packets on the basis of condition class and assign a DSCP value [11]. After assigned the DSCP it sent the packet to the scheduler. The traffic conditioner is three bit header format which contains condition class, action (marks or drop packets) and if packets is marks in action field then assigned a unique DSCP value [17]

Condition Class	Action(Mark/Drop)	DSCP

Fig. 4 Protocol architecture of Traffic conditioner

III. PRE-HOP BEHAVIOUR (PHB)

This special treatments with the packets also called the per-hop behavior. For this DS field is used to select the PHB and DSCP code point, DS is a 8-bit code, which bits 0 to 5 is used for assign three IP precedence called DSCP value, these 6 bits can select 64 (26) different behavior aggregated classes and bits 6 -7 are reserved.

Same bits are used for PHB (fig 1 shown the mapping between TOS, DSCP and PHB), bit 0-2 used for PHB value, bit 3-4 used for PHB class selector and bit 5-7 are reserved.

Per-hop behavior as we discussed earlier that in PHB special treatment is applied at that time policy and priority are applied the different class. Every classes are defined how these are handled by DiffServ core architecture node. Goal of applying PHB to provide the minimum number of resource to a particular marked PHB class. Per hop behavior is categorized into three class default PHB class, Expedited forwarding PHB class and Assured forwarding PHB class

A. Default PHB Class is a class in which packets are not marked with any class selector and all packets are arrived with the marking values 000000 bits [12].

B. Expedited forwarding PHB is the premium services at the end point its look like point to point service or leased line. In expedited forwarding class packets are assigned low latency, low jitter and high throughputs and assured bandwidth. EF PHB is likes IntServ RSVP protocol which provided guaranteed bandwidth services. EF PHB application on VoIP, video Conferencing and critical service where low packets loss are required. EF is also implemented in the priority Queue [14].

C. Assured forwarding PHB have contain three drop probability of marked packets. Each drop probability is category into four different classes, called class selector (CS1, CS2, CS4 and CA5). Drop probability are low drop, medium drop and high drop. It does not assured the guaranteed QoS of services. Given in table (1) [20, 21]. Assured forwarding working with two different quality of services function likes queuing and congestion avoidance. Class selector is working like queuing and congestion is avoided through the three drop policy. We can convert any assured forwarding class into DSCP equivalent decimal value by the formula 8x+2y (AF33= 8*3+2*3= 24+6=30) [15, 18, 19].

IV. EXPERIMENTAL SETUP AND RESULT ANALYSIS

In the simulation topology we take the 12 nodes, which are connected to the wireless link in IPv6 Protocol. CBR is applied to the node 1, 3, 7, 12 to the node 11 and node 1, 7, 12 to the node 2. In the CBR we applied the different packet size 256bps, 512bps and 1024bps. We compare DiffServ different services classes applied the parameter average jitter, end-to-end delay and throughputs. We are take the four seed for all packet size and calculate the average result of the four seed for 3minuts simulation time. Common simulation parameter is applied for all scenario is given in table (1)

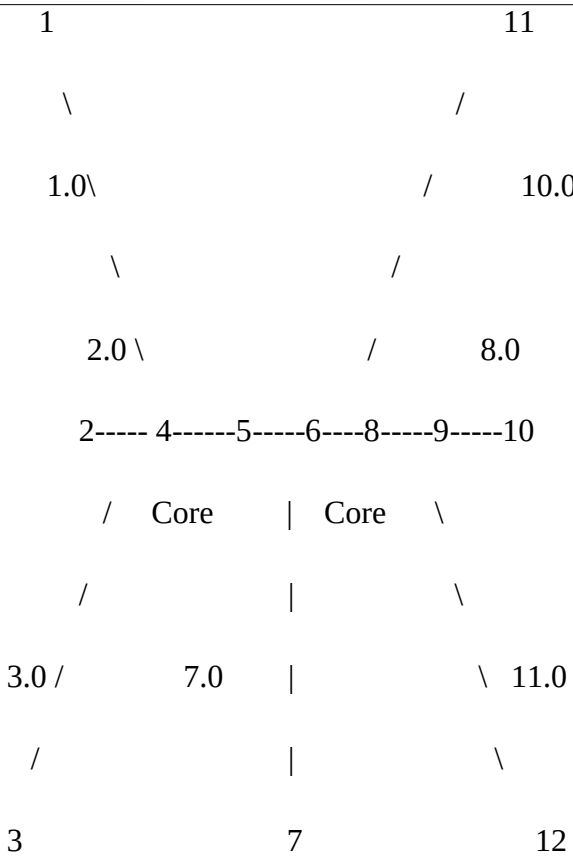


Fig. 5 Simulation Topology

We change in the scheduler and queue option in the network layer parameter for all scenarios. In the network layer the schedulers is applied in the output scheduler and take the result for the different packet size. In the DiffServ scheduler we are applied two scheduler one for in bound scheduler and other is out bound scheduler as we discuss in upper section there is two scheduler is required for DiffServ scheduler. In the queue option we take the 6 different queue in which 3 queue are FIFIO and applied the weight due to take the weighted fair out bound scheduler(DS Scheduler) as literature the weighted fair scheduler is best for the low jitter, delay and high throughputs[25,26].

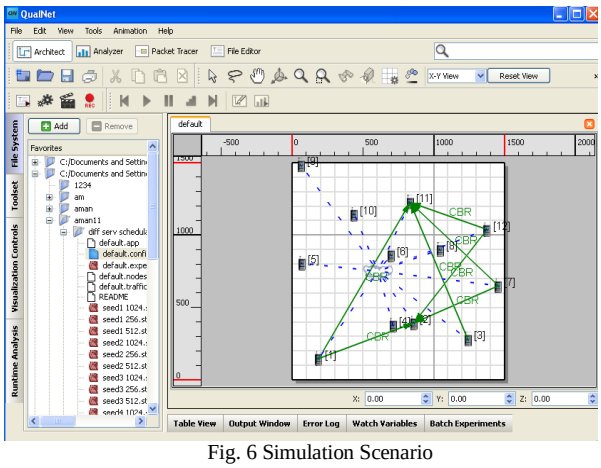


Fig. 6 Simulation Scenario

In the DiffServ topology we are take the two DS Domain in that node 4, 5, 6 belong to one DS Domain node 4and 6 is the edge router where we applied the traffic conditioner file for identifying, classifying, marking the packet. Node 5 is the core router which is used simple for transmission the packet to the next hop. Nodes 8, 9, 10 are belonging to another DS domain. In this Domain node 8 and 10 are the edge router and node 9 is the core router. CBR is applied for DiffServ module.

CBR 1 11 0 1000 0.00004S 20S 50S DSCP 46

CBR 3 11 0 1000 0.0006S 070S 150S DSCP 18

CBR 7 11 0 1000 0.0055S 090S 180S DSCP 34

CBR 12 11 0 1000 0.0004S 30S 140S DSCP 10

CBR 1 2 0 1000 0.0005S 15S 60S DSCP 10

CBR 12 2 0 1000 0.0005S 120S 170S DSCP 26

Parameter's	Value's
Mobility	Random Way Point Mobility
Channel Frequency	2.4 GHz
Radio Type	802.11b
Data Rate	2mbps
Transmission Power	15/4 dBm
Packet Reception Model	Phy802.11b
Short Packet Transmission Limit	7
Long Packet Transmission Limit	4
MAC propagation Delay	1 micro second

Table 1 Parameter

Real-time traffic (RTT) in internet required Quality of services guarantee for every packets. For this several traffic classes were created and assigned different values for each class i.e. called DSCP, according to their forwarding treatment or service class. Real-time and non-real-time multimedia traffic were recognized and assigned/marked according to its precedence/priority. In the result, response time was improved based on created service classes that are based on differentiated service (DiffServ) model [21, 22, 23].

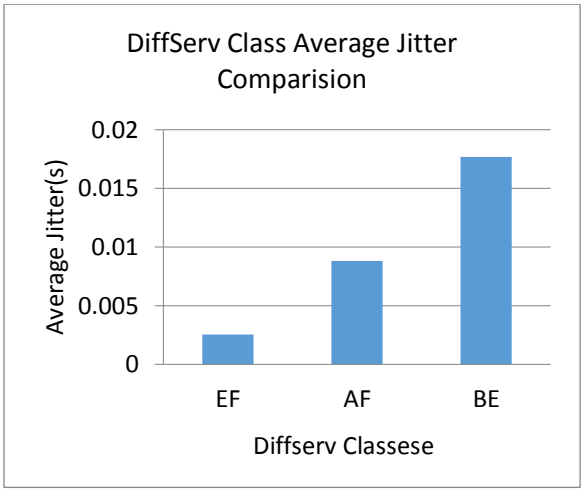


Fig. 7 DiffServ Class Average Jitter

The DiffServ services class Expected forwarding (EF), assured forwarding (AF) and Best-Effort (BF) services as our analysis the EF forwarding is deal with the low-jitter, low-Delay and high throughputs.

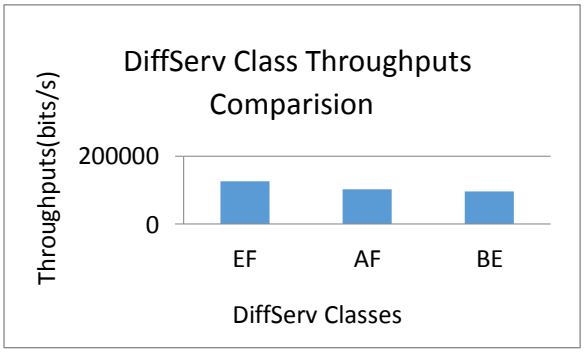


Fig. 8 DiffServ Class throughputs

The AF class is also the low delay and high throughputs. AF1>=AF2>=AF3>=AF4 in the form of low Delay and AF4>= AF3>= AF2>= AF1 in the way to gain high throughputs. Best effort services is not deal with the quality of service it send all the data in Best-effort.

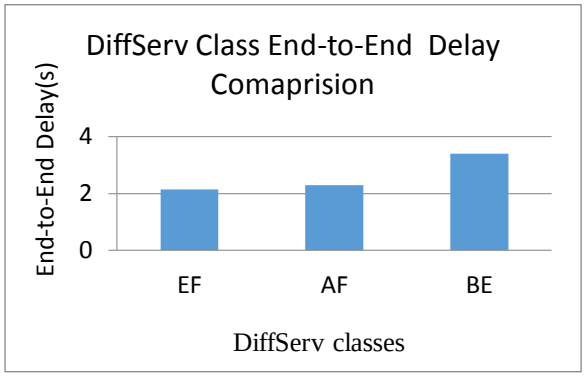


Fig.9 DiffServ End-to-End Delay

V. CONCLUSION

DiffServ classes are very important to improve the quality of mobile Adhoc network. It provides real time scheduling and service level agreements to the user. DiffServ enhanced the overall services of the network by using the meter, marker and conditioner in the type of serves of internet protocol architecture. It used different services class for different type of data. Overall conclusion is show that to improve the throughput and overcome the delay and jitter DiffServ is very best mechanism.

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