# The Evaluation of Performance in Flow Label and Non Flow Label Approach Based on IPv6 Technology

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## ABSTRACT
In this paper, we want to evaluate the performance of two broadcasters with Flow label and Non flow label approach. Experimentally we have presented that the throughput utilization for each broadcaster with Flow Label approach which is implemented in MPLS Routing Technology is 89,95%. This result is better than Non Flow Label approach which is evaluated at 92,77%. The aim of this paper is to present that MPLS Routers performance is better than IP routers especially in Throughput Utilization, Low Level of Drop Packet Rate and time delay. The second technology is implemented in IP routing. Experimentally we have generated some video stream packets between 2 broadcasters with an arrange of router nodes. Experiments are performed by using ns-2 simulator.

## Keywords
MPLS technology, IP routing technology, throughput, flow-label approach, ns-2 simulator

## 1. INTRODUCTION
As we know IPv6 is a recent technology of communication and it gives a lot of improvements compared to IPv4 [5], [2], [3]. These improvements based on features upgraded by the Internet Engineering Task Force (IETF), for example, the increase of the address space from 32 bits to 128 bits or the increase of some significant QoS conditions. By using the recent multimedia applications technologies [7], internet providers, companies, subscribers and the researchers will take some benefits. The Internet Protocol (IP) is considered to be a best effort service, so in the future, the TV broadcasters will use the IP address for communication. In other words, there will be a convergence of the broadcast network with the IP to form the Internet Protocol Television (multimedia with IP) under the recent development.

There are built some policies based on flow-labels to manage the routing of the packets (channels) to the nodes (subscribers)during the transmission with IP-multimedia approach.

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For example, a broadcaster can tend to utilize the full bandwidth from the network manager, but meanwhile the network manager asks fairness in distributing packets to the remaining broadcasters [5], [6]. As it know throughput is one of the important feature of QoS Routing, because the management of throughput offers a better QoS performance. It is interesting to mention that IPv6 not only overcomes the shortcoming problems in the IPv4, but also it takes the benefits in Quality of service (QoS). QoS in IPv6 plays an important role in the Stream Model Approach between broadcasters [1], [4]. In [3] the packet's traffic on channel is organized without flow label technology. Flow label technology means that instead of router nodes (fig 1) based on IP routing we can use MPLS routers. MPLS technology has some advantages, but the most one is speed routing. Based on some executed tests we can present that bandwidth utilization is another good feature compared with IP routers technology.

The objective of this paper is to highlight our simulation results in terms of two attributes which are the Throughput and Time Computation Performance based on IPv6 technology with flow label packets technology in Multi-channel Stream Approach. Than we want to compare the results of our simulation with non-flow label packets technology in Multi-channel Stream Approach.

The rest of the paper is organized as follows: section 2 briefly discusses the comparison between MPLS and IP routing section 3 presents the experimental analysis and results, in section 4 are given some conclusions and future works and finally are presented the references.

## 2. COMPARISON BETWEEN MPLS ROUTING AND IP ROUTING

1. IP routing uses hop-by-hop destination-only forwarding paradigm. When forwarding IP packets, each router in the path has to look up the packet's destination IP address in the IP routing table and forward the packet to the next-hop router [8].
2. MPLS uses a variety of protocols to establish Label Switched Paths (LSP) across the network. LSPs are almost like Frame Relay or Asynchronous Transfer Mode (ATM) permanent

virtual circuit (PVC), with two major differences: they are unidirectional and they can merge (all LSPs toward the same egress router could merge somewhere in the network).

3. MPLS is faster than IP routing because it is based on label.
4. MPLS is in 2,5 OSI Layer and IP is in 2 OSI Layer.

# 3. EXPERIMENTAL ANALYSIS DESIGN AND RESULTS

In this section, we want to test the Throughput and Time Delay based on IPv6 technology with *non flow label packets technology* and *flow label packets* technology in Multi-channel Stream Approach. As we presented above we have used IPv6 technology because it offers more flexibility and QoS features than IPv4

## 3.1 Experimental Analysis

In the Multi - Stream Approach we have tested up to 10 nodes for 2 broadcasters as end-users. We have used ns2 simulator since it is considered to be powerful, efficient and flexible for simulation. The 10 nodes were tested sequentially starting from 1 node, 2 nodes, 3 nodes, … , 10 nodes, respectively. We have simulated for both broadcasters Video Stream Packets with 1.4 KB packet length, Rate Video Stream is 1.5 MB/sec and Bandwidth is 5 MB. Network topology is BUS. In NS2 simulator we configure RIP version 2 Routing Policy. We have choosen approximately characteristics with real environment [3].

The maximum Video Packet supported by Maximum Transmission Units (MTUs), which include the Maximum Segment Size (MSS) plus the 40-byte header, within TCP/IP traffic. We'd like video packets (which include a smaller header, apparently) to be around 1400 bytes to fit within acceptable limits and eliminate the possibility of broken packets.

Initially, the first broadcaster generate video stream packets to second one by httperf tool. In the first broadcaster we have installed client machine and in the second one we have installed server machine. In server machine we have built Apache Web Server. So the client is sending video packet request by using http protocol to the server machine. On the other hand second broadcaster can generate http video request to the first one. At this moment client machine is transform in server machine and vice versa. Thus at the same time one machine will utilized as client and server by installed Apache Web Server (Apache2 on CENTOS 5.5 OS)

For every experimental phase (by 2, 3 ,4 …10 nodes), we have calculated the throughput , then we have compared the throughput of the nodes into both broadcasters. Previously we have performed experiments with router nodes which are based on IP technology (non flow label technique). We have repeated this experiment with MPLS routers (flow label technique).

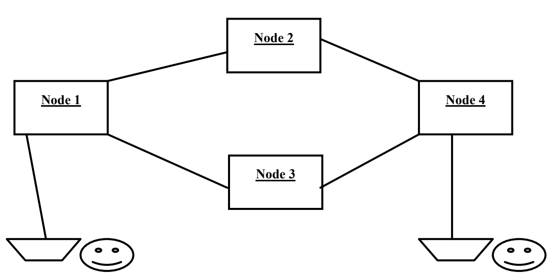


**Figure 1: Two broadcasters and 4 nodes. The broadcasters generate video packet traffic between nodes.**

As it look from figure 1 two broadcaster generate video-stream packets at the same time. All these packets are routing on these nodes based on RIP v2 policy.

In [3] the throughput for a determined broadcaster and the number of nodes is calculated as in the following equation:

$$Throughput = \frac{Num(SBW) - Num(RBW)}{Num(SBW)} \times 100\% \qquad (1)$$

Throughput: The amount of the non-lost received bandwidth.
Num. (SBW): The amount of the bandwidth provided by the network manager. Packets should be sent to all nodes of the determined broadcaster.
Num. (RBW): The amount of the bandwidth that is received from the determined broadcaster. This amount should get different value than SBW, because some packets have to lost during routing.

## 3.2 Simulation Results

In order to evaluate our method, the main attribute is the Throughput between the nodes and their broadcasters. We did compare the throughput behavior of each broadcaster with their nodes starting from 1 node and increasing the size to 10 nodes, based on IP routing protocol. The experiment presents that the total throughput for the 2 broadcasters with 10 nodes with IP routing technology is 92.77% . If we use the Non-Flow Label Technique which means that we can replace the IP routers with MPLS routers, with the same policy routing (RIP) with 2 broadcasters which generate the same packet traffic, the total throughput utilization for each broadcaster is decrease to 89,95%. This means that one broadcaster can use the same number of video stream packet generated with smaller utilization bandwidth. All router nodes in figure 1 are configured with IPv6 address. The total number of packets generated from each broadcaster is 1000. As it looks from table 1 and table 2, if the number of nodes is increased the total throughput utilization for each broadcaster is decreased linearly. The number of dropped packets increased linearly if the number of nodes increased too (table 3,4). Each node can introduce drop packets (the reason are buffer, architecture of routers etc). In this paper we compared the percentage of dropped packets and time delay between 2 technologies, non-flow labels packet and flow labels packet as it shows in table 3-6.

**Table 1: The throughput results for each broadcaster and a defined number of nodes without flow labels technology (IP)**

| Nr of Nodes | Throughput |
|---|---|
| 1 | 94.401% |
| 2 | 94.227% |
| 3 | 94.055% |
| 4 | 93.901% |
| 5 | 93.607% |
| 6 | 93.414% |
| 7 | 93.243% |
| 8 | 93.134% |
| 9 | 92.998% |
| 10 | 92.777% |

**Table 2: The throughput results between 2 broadcasters and number of nodes with flow labels technology (MPLS)**

| Nr of Nodes | Throughput |
|---|---|
| 1 | 91.015 % |
| 2 | 91.012 % |
| 3 | 91.007 % |
| 4 | 91.004 % |
| 5 | 90.452 % |
| 6 | 89.970 % |
| 7 | 89.967 % |
| 8 | 89.961 % |
| 9 | 89.960 % |
| 10 | 89.957 % |

**Table 3: The percentage of dropped packets between 2 broadcasters and nodes with non-flow label packet (IP)**

| Nr of Nodes | Drop Packets |
|---|---|
| 1 | 1.025 % |
| 2 | 1.142 % |
| 3 | 1.272 % |
| 4 | 1.444 % |
| 5 | 1.652 % |
| 6 | 1.876 % |
| 7 | 2.067 % |
| 8 | 2.261 % |
| 9 | 2.480 % |
| 10 | 2.631 % |

**Table 4: The percentage of dropped packets between 2 broadcasters and nodes with flow label packet (MPLS)**

| Nr of Nodes | Drop Packets |
|---|---|
| 1 | 1.024 % |
| 2 | 1.140 % |
| 3 | 1.271 % |
| 4 | 1.441 % |
| 5 | 1.652 % |
| 6 | 1.875 % |
| 7 | 2.067 % |
| 8 | 2.260 % |
| 9 | 2.480 % |
| 10 | 2.630 % |

**Table 5: Time delay in Multi-Stream Approach with non-flow label packet (IP)**

| Nr of Nodes | Time delay |
|---|---|
| 1 | 2,16 ms |
| 2 | 3,44 ms |
| 3 | 5,99 ms |
| 4 | 8,32 ms |
| 5 | 9,99 ms |
| 6 | 11,39 ms |
| 7 | 14,22 ms |
| 8 | 17,86 ms |
| 9 | 21,62 ms |
| 10 | 26,55 ms |

**Table 6: Time delay in Multi-Stream Approach with -flow label packet (MPLS)**

| Nr of Nodes | Time delay |
|---|---|
| 1 | 1,66 ms |
| 2 | 2,56 ms |
| 3 | 3,77 ms |
| 4 | 6,20 ms |
| 5 | 8,52 ms |
| 6 | 9,98 ms |
| 7 | 11,04 ms |
| 8 | 12,56 ms |
| 9 | 14,24 ms |
| 10 | 14,89 ms |

We have presented graphically, throughput utilization and time delay (figure 2 and figure 3) based on the flow-label technology. In figure 3 time delay increases linearly when the number of nodes increased too, because each router nodes introduce a slight delay. In figure 2 throughput utilization is decreased when the numbers of nodes is increased. As we mentioned above the reason is increasing of data rate lost for each node. We have a sensitive reduction of throughput utilization, between node 4 and node 6. This was happen because in those nodes the ratio of drop packets is bigger than 3 nodes. After 6 nodes the drops of packet are stabilized.

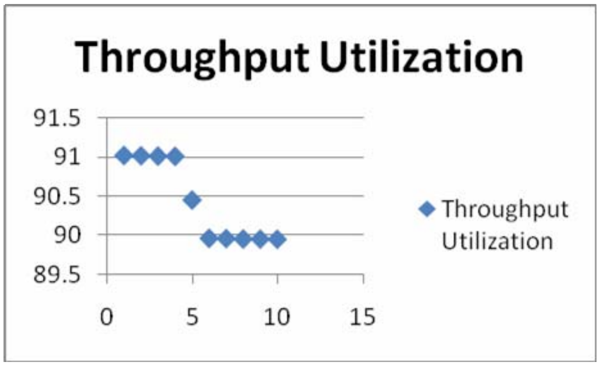


**Figure 2: Throughput results between 2 broadcasters.**

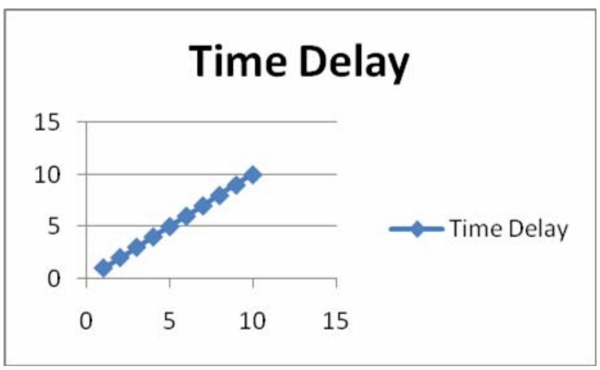


**Figure 3: Time delay between 2 broadcasters.**

## 4. CONCLUSIONS AND DISCUSSIONS

1. As it look from table 3 and table 4 the drop packets rate are similarity for both methods (flow label and non-flow label). This is because both routers have the same buffers, so it doesn't affect the performance of drop packets routing.
2. If we compare table 5 and table 6 the difference of time is visible. This is because MPLS routers characterized from a fast routing technology. The reason is routing packet which are based on labels, not in IP. This is an important feature of the best throughput utilization in flow label technology, descripted in table 2 compared with non-flow label technology in table 1.

In the future we will increase the number of broadcasters and routers. Also we will generate the dynamic length of video stream packets in order to evaluate the throughput utilization performance and time delay in WAN.

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