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Multicasting in Diffserv Domains

Dan Galatchi, Ph.D.[1], Roxana Zoican, Ph.D.[2]

Abstract - In this paper we identify and analyze the main problems that occur when combining the DiffServ approach with the multicast in ordinary networks and mobile networks. Based on this we motivate our proposed solutions and the needed modifications on some of the characteristics and configurations in the DiffServ and Multicast architectures.
Keywords: multicasting, DiffServ, QoS

I. INTRODUCTION

The heterogeneous characteristic of the multicast group is one of the biggest problems for establishing the multicast sessions in DS domains. When the multicast group members have different SLAs and respectively different expected QoSs. the complexity of the transport "mission" on the DiffServ networks significantly increase. Therefore, few optional solutions can be proposed.

II. CHANGES IN DIFFSERV AND MULTICAST ARCHITECTURES

In the first proposal case, the multicast session can be spread in DiffServ sub-trees only with the same QoS as the sender. Then the replications will be easier and the traffic will be fast-forwarded. But, as a consequence, the different downstream reservations will be ignored because the required DSCPs are not relevant. If we consider the heterogeneous required reservations of the receivers, then we can assume that a RP or a core node must spread and remark the multicast session with the desired DSCP. In this situation to support a multicast traffic the DiffServ border and core nodes must be configured with new functions and characteristic. At the same time it is necessary to specify the required QoS of the receiving multicast session. From the knowledge obtain in the previous chapters, we conclude that this signalling information can be provided in two manners:

• If a group member wants to receive a multicast session with guaranteed QoS, it must reserve the required resources from the RP to itself. The reservation message going to the BB can be support by the RSVP protocol. The BB will take a decision and will configure the RP and the egress border node. In this case the DiffServ region will be prepared for the transmission with the desired QoS. A drawback can be present, when a lot of receivers book DiffServ links for the same multicast session but using many "private" copies with different QoS. Obviously that is not suitable for the transport network, because of the traffic load.

• The next proposed for the describing a desired QoS is with the help of the IGMP multicast join message. We suggest defining a QoS field in this protocol, which will be filled by the join member with the desired PHB. As a result, the QoS information will be forwarded with the multicast group and receiver addresses to a node, which have the possibility to spread the desired session. Then in each router the multicast group table needs to be modified. It will include a column for the desired DSCP.

Figure 1 shows an example of the modified multicast routing table. In this solution the join member specifies the required QoS, but if the DiffServ network has problems with the available resources the traffic QoS can be decreased. Considering the replication problems in the DiffServ core nodes, we recommend the EF QoS class not to be used for the transmissions of the multicast sessions.

[1] POLITEHNICA University of Bucharest, Electronic and Telecommunication Faculty, Telecommunication Department Iuliu Maniu 1-3, Bucharest 6 dg@elcom.pub.ro
[2] POLITEHNICA University of Bucharest, Electronic and Telecommunication Faculty, Telecommunication Department Iuliu Maniu 1-3, Bucharest 6 roxana@elcom.pub.ro

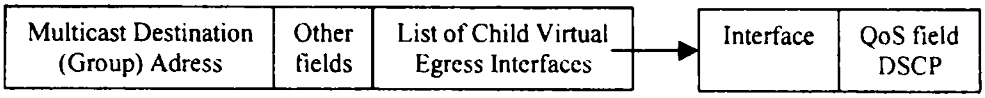

Fig. 1. An example of the modified multicast routing table

In the following section we will discuss our proposed configuration of the DiffServ router supporting multicast functions.

First, considering the not standardised DiffServ architecture we will assume some basic specifications on the nodes.

• Usually, the leaf node will be configured with a MF classifier, metering and a full TCB including marking, shaping and policing.

• The border node (sometimes referred as boundary or edge node) will have BA classifier, metering, re-marking, shaping and policing specifications.

• The core node, which purpose is to fast forward the packets, will be configure with BA classifier, metering, shaping and dropping functions. One idea is to ignore the remarking function from the core node specification resulting in faster forwarding.

But in our case when the core nodes support multicast sessions the MF classifier and the remarker are necessary.

• Communications between the BB and the border or leaf nodes will be necessary.

On the basis of these presumptions, the following router approach has been done. Figure 2 shows the proposal for the Diffserv router architecture supporting multicast functions.

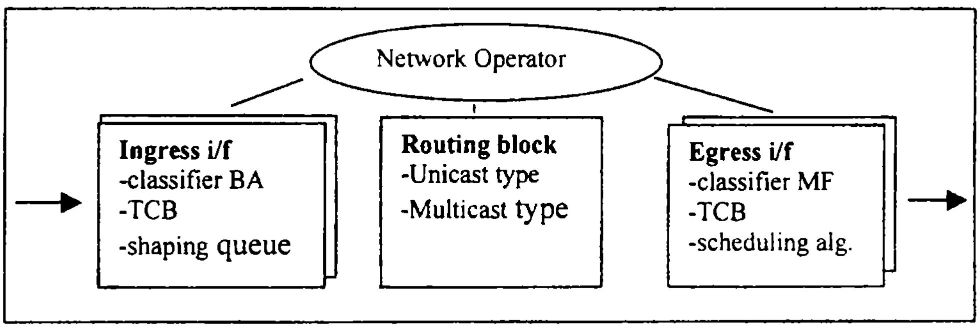

Fig. 2. An example for the architecture of the DiffServ core router supporting multicast

The block diagram illustrates the ingress and egress routing interfaces and also the routing block. The data packets come into the router through the ingress interface, which is configured with BA classifier, traffic conditioning block and a shaping queue. The next component is the routing tables and specifications, which forward the packets to the appropriate interfaces. The routing tables are different for the unicast and the multicast traffic. Later in this chapter, we will describe more in details this block. The packets coming into an egress interface will be MF classified. To classify the packets based on their IP header fields must be done in reason to be identify the multicast streams from the unicast streams. The traffic conditioning functions after the metering are differently specified for the unicast and the multicast traffic. The DiffServ architecture defines the shaping and dropping functions in the core nodes as action elements about non-conforming unicast packets. The multicast copies inside the transport domain produce new packet streams, which requires more resources. These resources are not planed into the end-to-end characteristic of the DiffServ networks. If the multicast packets do not conform the traffic profile they can be shape, drop, and if it necessary remarked in order to fit in the traffic link profile.

Figure 3 illustrates a block diagram example for the different data paths through an egress interface. Our proposal is that the multicast replications must be done in the core nodes, which do not have communication with the bandwidth broker. However, the router will upgrade its routing tables and the links information through specific protocol messages between it, the network operator and the adjacent nodes.

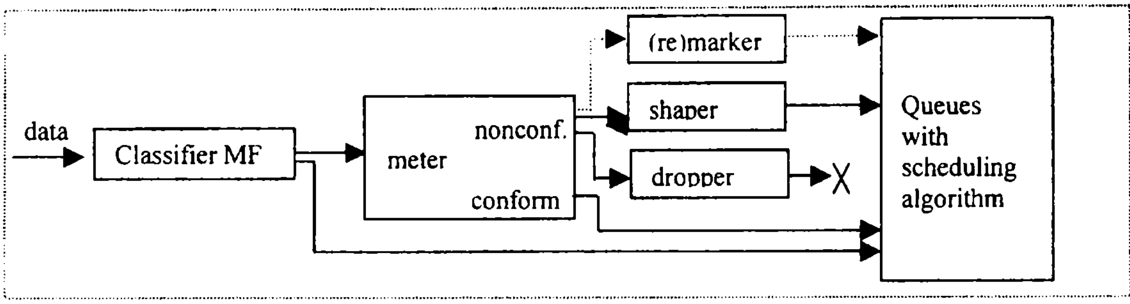

Fig. 3. An example of egress traffic conditioning block, where it is possible to have remarking

Our main problem is how to support multicast sessions with different required QoS? This process can be implement in the routing block as it is proposed in figure 4. The algorithm steps can be described as followed. The incoming packets from the ingress interface will be first classified in different paths depending if they are from unicast or multicast traffic type. The unicast data will be routed in an ordinary way of the unicast routing block. The multicast packets will be forwarded in certain steps, where the decisions depend on the current information in the multicast routing table. The first step is to check if is necessary to copy the packets of a multicast group. The replication must be done if more than one egress interface shall receive this multicast session.

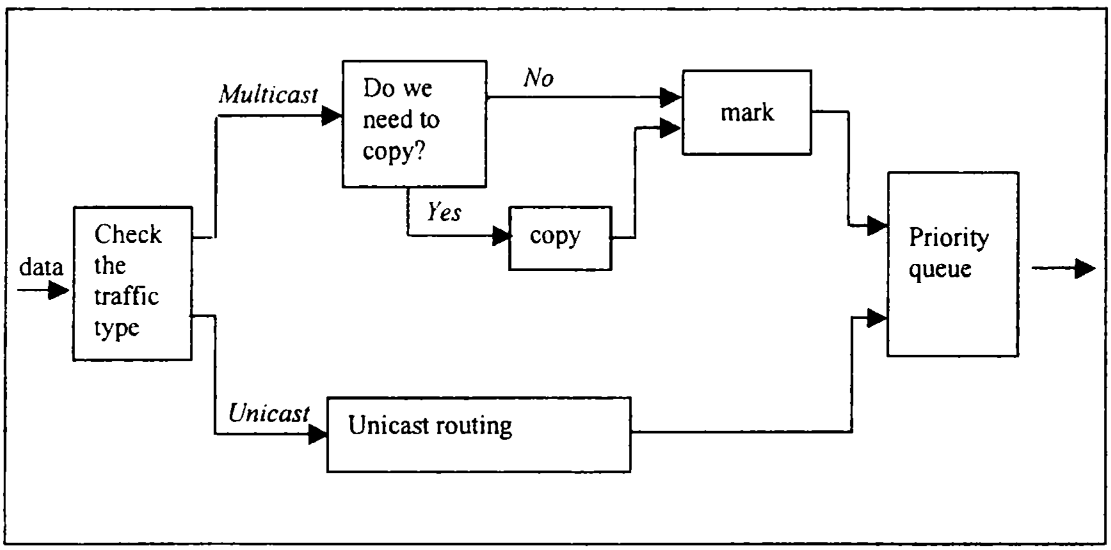

Fig. 4. Routing algorithm for a DiffServ router supporting multicast traffic

Then the packets must be marked with the required QoS. This information is available in the multicast routing tables. If we consider the case when the core node is a RP of the multicast tree, then the marking function will be done for packets. After this process the configured multicast packets must be aggregated with the unicast traffic before it is sent to the egress interfaces. Do we need to priority on one of the traffic types? If we consider that the unicast traffic carries important information, like EF packets, it would be necessary prioritise unicast packets. But on the other hand, a lot of users can be members of a group and expecting the multicast packets, which would imply that multicast should have a higher priority than unicast. The last block of the diagram illustrates this process.

III. REMARKS

As a result from our analysis, we suggested the multicast shared tree as a suitable solution for setting the QoS, where the receivers and the senders will have the possibility to directly request to the RP. Moreover, we believe that in the future the heterogeneous multicast distribution trees must be supported by DiffServ and Multicast architectures. From these characteristics, the most consistent advanced multicast protocol is the PIM-SM. However, the next step is to extend this protocol allowing the transmission of multicast sessions through DiffServ networks. As a proper modification, we proposed the inclusion of a QoS field in the IGMP multicast join message, where the joining members will specify the desired PHB. Furthermore, a modification in the multicast routing tables was proposed.

Consequently, several modifications on the DiffServ architecture are required as well. The core nodes must be configured with new functions, such as the MF classifier and the remarker in order to support multicast streams.

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