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Bandwidth Allocation for ABR Service in Cellular Networks

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***Abstract*—**Available Bit Rate Service (ABR) is the lower priority service and the better service for the transmission of data. On wire-line ATM networks ABR source is always getting the feedback from switches about increase or decrease of bandwidth according to the changing network conditions and minimum bandwidth is guaranteed. In wireless networks guaranteeing the minimum bandwidth is really a challenging task as the source is always in mobile and traveling from one cell to another cell. Re establishment of virtual circuits from start to end every time causes the delay in transmission. In our proposed solution we proposed the mechanism to provide more available bandwidth to the ABR source by re-usage of part of old Virtual Channels and establishing the new ones. We want the ABR source to transmit the data continuously (non-stop) inorderto avoid the delay. In worst case scenario at least minimum bandwidth is to be allocated. In order to keep the data flow continuously, priority is given to the handoff ABR call against new ABR call.

***Keywords*—**Bandwidth allocation, Virtual Channel (VC), CBR, ABR, MCR and QOS.

I. Introduction

ATM forum has defined the parameters for ABR service for wireline ATM networks. In wireless ATM networks, since the source is always in mobile state, and traveling from one cell to another cell, it is difficult to allocate and maintain the bandwidth for ABR source. According to [1] bandwidth reservation based upon incoming and out going handoff calls is specified. Bandwidth reservation scheme for multimedia is proposed in [2]. In [3] online bandwidth reservation scheme is proposed. Keeping the sources in respective queues for long will increase the delay in data transmission. In wireless networks re-establishment of VCs has to be done faster as the mobile node travels from one cell to another so that delay can be avoided.

II. Bandwidth Allocation in ATM Cellular Networks

Presently available solutions for the bandwidth allocation in wireless networks are not really efficient. Inorderto utilize the maximum available bandwidth there must be certain mechanism is required to avoid the wastage of bandwidth Solutions available for wire-line cannot be applied to wireless networks. If the bandwidth is not properly allocated to the source then data transmission will be delayed, and wastage of resources is loss of revenue. ABR service is the lower priority service and the maximum available bandwidth has to be allocated to this service.

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III. Proposed Solution for Bandwidth Allocation to ABR Service

In our proposed architecture the cells are connected together through their base stations like road topology. Each base station has four directions for data transfer. All base stations communicate to each other about their bandwidth and routing information. If any mobile node in one cell wants to send data to another mobile node in another cell, Virtual Channels (VCs) will be established through any one available path for sending the data.

In our proposal we are using the part of old existed VCs for connection establishment along with the new VCs. VCs will be created dynamically based upon the information available at base stations. Every base station maintains its rooting table along with bandwidth information and updates frequently. Two solutions are proposed for two scenarios. 1. Bandwidth allocation, when the mobile node is traveling in the same cell. 2. Bandwidth allocation when the mobile node handover to another cell.

IV. Bandwidth Allocation when then the Mobile Node is Traveling in the Same Cell

Let the ABR mobile node is moving in cell 11, wants to send data to the mobile node in cell 10, Virtual Channel will be established between cell 11 and cell 10 through available paths, we consider here the available paths are cell 12, cell 13, cell 8, cell 9. The established VC is VC(11-12-13-8-9-10) as shown in fig.1. For example if the bandwidth available from BS8 to BS10 through BS3, BS4, BS5 and BS11 to BS8 through BS12 and BS 13 is more than the bandwidth utilized in paths from BS8 to BS10 through BS9. Then new VC from BS8 to BS10 through BS3, BS4 and BS5 will be created and added to the part of old VC, which is from BS11 to BS8 through BS12 and BS13. The new VC will be VC(11-12-13-8-3-4-5-10).

Mn is the set of ABR mobile nodes in Cell 11 transmitting the data with the rate of Rn to the destination nodes in Cell 10.

Freely available bandwidth in Cell 11 = Cf
Cf > 0
Mn = [M1, M2, M3,………………Mn]
Rn = [R1, R2, R3,………………....Rn]
VC Established = VC (**11-12-13**-8-9-10)

Possibility of data rate increment
New rate for Mn = (NRn)

Bandwidth increment for ABR mobile nodes can be done, with any one of the following two conditions must be satisfied.

(1). NRn <= [Cf + Rn]
(2). NRn > Rn

New VC = (Part of old VC + Newly created VC)

New VC = VC (**11-12-13**-8-3-4-5-10).

VC Established ← New VC

First condition will be followed inorderto avoid the congestion.

Also non follow-up of the second condition will decrease the data rate, which is of no use.

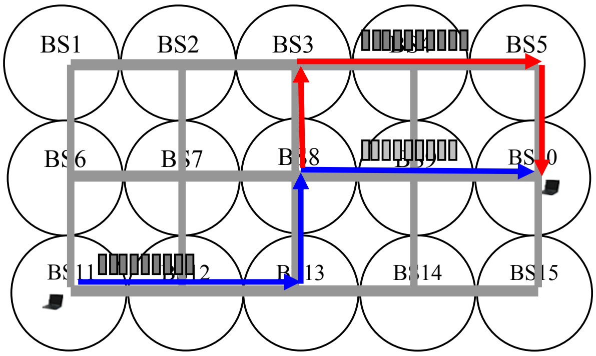

Fig. 1 Bandwidth Allocation to ABR mobile node when the node is traveling in the same cell

V. Bandwidth Allocation when the Mobile Node Handover to Another Cell

When the mobile node is traveling from one cell to another cell, if the bandwidth is available then handoff will takes place. Priority will be given to the handoff mobile node against locally generated node.

For example if the mobile node is traveling from Cell 11 to Cell 6. First the availability of bandwidth will be checked. If at least the minimum rate (MCR) is available then that bandwidth will be reserved. The base station BS6 in cell 6 will contact all the nearest base stations who are already in part of the old VC to the destination node. Where ever the maximum bandwidth is available for the whole path the new VC will be established. This new VC will be added to the part of the old one. The final new VC will be used for transmission of data. As soon as the new VC is completely established the remaining part of old one which is not required is terminated. If necessary all the data cells buffered will be send to the handover base station.

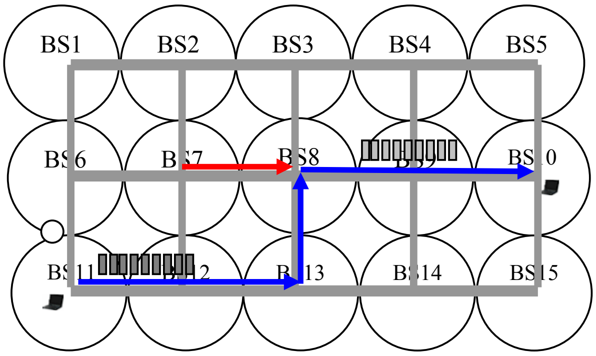

Fig. 2 Bandwidth Allocation to ABR mobile node when the node handover to another cell

Bandwidth allocation for handover mobile node will be done in the following three scenarios.

The mobile node is sending the data from BS11 to BS10. The VC established is VC (11-12-13-8-9-10).

1. When a mobile node M1 is traveling to Cell 12, it will be accepted as the node is on the same VC, handover will be done quickly. Buffered data cells will be forwarded from BS 11 to BS 12. new VC will not be created. Part of the old VC from BS 11 to BS 12 which is not necessary will be terminated. The new VC becomes VC (12-13-8-9-10).

2. When a mobile node M1 is traveling to Cell 6, if the bandwidth is available, call will be accepted and handover will take place. Base Station BS 6 will establish the VC from BS6 to BS 11 to and adds to the old VC (11-12-13-8-9-10). The new VC will be VC(6-11-12-13-8-9-10).

3. When the mobile node handover to Cell 7, BS7 will first contact the nearest base stations BS8 and BS12 as they hold its previous VC. If the capacity is available at any one path then VC from BS7 to BS8 or BS7 to BS12 will be established and will be added to the part of old one. The new VC is to be either VC (7-8-9-10) or VC (7-12-13-8-9-10). Part of old VC (11-12) will get terminated. If bandwidth is not available then BS7 will contact other nearest neighbor for VC establishment.

To increase the bandwidth further the same procedure specified in the last section (Section IV) will be followed.

VI. Proposed Algorithm for Bandwidth Allocation to ABR Service

If the available bandwidth >= mcr then
Establish the VC.

If the mobile in the same cell

Check for available bandwidth in neighbouring cells
If the available bandwidth > current then

Establish the new VC.
Add the new VC to the part of the Old VC.
Teminate the uncessary part of the Old VC.

If the mobile node handover to neighbouring cell

Check for available bandwidth in the neighbouring cells.

The base station will check whether the current cell is part of the old vc

If it is part of the old VC then it will terminate the unnecessary part of the old vc

Else

If the current cell is not part of the old VC then

It will establish a new VC along with adding to the existing old VC

Else
If the current cell is not part of the old VC then

It will check the nearest cell which holds its previous VC

If available then
Establish the new VC and add to old one

Else
Establish complete new VC.
Implement the procedure given in the scenario of same cell.
End.

VII. Conclusion

In this paper we proposed the bandwidth allocation to ABR service. We try to provide maximum available bandwidth to the lower priority service by creating the new VCs and adding to the part of old ones. Here we reduced the complete VC establishment time. With this solution in worst case at least minimum bandwidth will be allocated. Bandwidth will keep on upgrading by this VC change method. Also cell loss can be minimized and continuous flow of data will help improving the QOS.

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