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ATM Forum Document Number: ATM Forum/98-0293

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Title: Proposed appendix on sample ABR point-to-multipoint algorithms

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Abstract: We propose to move the living list text on sample point-to-
multipoint ABR branch point algorithms to the baseline.

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amend or modify the statements contained herein.

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In the February'98 meeting at Anaheim, the group adopted some text on
sample point-to-multipoint ABR branch point algorithms. The group
concensus was that the text should be placed in the living list at
least for one meeting before moving it to the baseline. With this
contribution, we are requesting to move the text to an appendix of
the baseline.

While moving the text to the baseline from living list item 97-003
[3] (pages 43-44), we also propose to make it more concise while
maintaining the same content.

[Motion 1] Informative Appendix I.9 for TM Specifications

A subsection dealing with ABR multipoint in Informative Appendix I
(which gives ABR implementation examples) be added as follows.

I.9 Sample Branch Point Algorithms for Multipoint ABR Flow Control

A branch point replicates cells from the root to each branch in the

responding state and consolidates their feedback. One method of consolidating information from BRM cells is to assign the ER field in returning RM cells to the minimum of the ER values indicated by the branches, the CI to the OR of the indicated CI values, and the NI to the OR of the NI values. In the sample algorithms given next, we show the assignment of the ER value; CI and NI values can be assigned in a similar manner.

In a sample point-to-multipoint ABR algorithm [19, 21, 16]1, the minimum explicit rate indicated by the BRM cells received from the branches each iteration is maintained, say as MER. Whenever an FRM cell is received at a branch point, it is multicast to all branches, and the algorithm sets a flag indicating the receipt of the FRM cell. When a BRM cell is received from a branch, it is passed back towards the source (using ER = min (MER, ER)), only if the flag was set. The flag is then reset and MER set to PCR. If the flag was not set, MER is updated to min (MER, ER in BRM cell) and the BRM cell is discarded.

Consolidation noise can occur when feedback from some leaves is not always received in a timely fashion at the time when the RM cells need to be returned by the branch point. To reduce consolidation noise, the BRM cell can only be passed back towards the source when BRM cells from all branches have been received after the last feedback. This can be done by maintaining a separate flag for each branch to indicate if a BRM cell has been received from the branch after the last BRM cell was sent. It is important to handle the possible non-responsiveness of a branch in this algorithm. The slow transient response in this algorithm, caused by waiting for feedback from possibly distant leaves, can be avoided when a severe overload situation has been detected (fast overload indication). In this case, the algorithm can avoid waiting for feedback from all the branches, and overload information can be immediately indicated to the source [6]. In the cases when the branch point is itself a switch and queuing point, the branch point can invoke the switch scheme to compute the new ER value whenever a BRM is received, and not only when a BRM is being sent. Hence, overload at the branch point itself can be detected and indicated according to the fast overload indication idea.

The fast overload indication may increase the BRM cell overhead, since the ratio of source-generated FRM cells to BRM cells received by the source can exceed one. One method to alleviate this problem is to increment a counter (maintained for each multipoint VC) whenever a BRM cell is sent before feedback from all branches has been received. When feedback from all branches indicates underload, and the value of that counter is more than zero, this particular feedback can be ignored and the counter decremented [6].

CURRENT TEXT FOR LIVING LIST ITEM 97-003:

A branch point replicates cells from the root to each branch in the responding state and consolidates their feedback. Sample consolidation algorithms are given next.

One method of consolidating information from BRM cells is to assign the ER field in returning RM cells to the minimum of the ER values indicated by the branches, the CI to the OR of the indicated CI values, and the NI to the OR of the NI values.

In a simple point-to-multipoint ABR algorithm [14] (references may be removed in the specifications), the minimum explicit rate indicated by the BRM cells received from the branches is maintained, say as MER. Whenever an FRM cell is received, it is multicast to all branches, and a BRM is returned using the MER value for the BRM explicit rate. MER is then set to PCR. A simple enhancement to reduce noise in this algorithm is to only generate the BRM cell if a BRM has

been received from at least one leaf after the last BRM was sent by
the branch point [16].

To reduce the complexity of the algorithm, some of the backward RM
cells generated by the destinations can be forwarded, instead of
turning around the RM cells at the branch points. Whenever an FRM
cell is received at a branch point, the algorithm simply sets a flag
indicating the receipt of the FRM cell, and multicasts it to all
branches. When a BRM cell is received from a branch, it is passed
back to the source (after using the minimum allocation), only if the
flag was set. The flag and the MER register are then reset [10].

To reduce consolidation noise, the BRM cell can only be passed back
when BRM cells from all branches have been received after the last
feedback. This can be easily implemented by maintaining a separate
flag for each branch to indicate if a BRM cell has been received from
the branch after the last BRM cell was sent. It is necessary to
handle the possible non-responsiveness of a branch by implementing
timeouts in this algorithm. In addition, the transient response of
this algorithm may be slow due to waiting for feedback from possibly
distant leaves. This delay should be avoided when a severe overload
situation has been detected. In this case, there is no need to wait
for feedback from all the branches, and the overload should be
immediately indicated to the source [4]. In the cases when the
branch point is itself a switch and queuing point, the branch point
can invoke the switch scheme whenever a BRM is received, and not just
when a BRM is being sent. Hence, overload at the branch point itself
can be detected and indicated according to the fast overload
indication idea.

The fast overload indication idea may increase the BRM cell overhead,
since the ratio of source-generated FRM cells to BRM cells received
by the source can exceed one. To alleviate this problem, a counter
(maintained for each multipoint VC) can be incremented whenever a BRM
cell is sent before feedback from all branches has been received.
When feedback from all branches indicates underload, and the value of
that counter is more than zero, this particular feedback can be
ignored and the counter decremented [4].

DIFFERENCES BETWEEN THE CURRENT TEXT IN LIVING LIST ITEM 97-003 AND
THE PROPOSED TEXT:

1. Remove the sentence "Sample consolidation algorithms are given
next" from the first paragraph since it is unnecessary.

2. Add the sentence "In the sample algorithms given next, we show the
assignment of the ER value; CI and NI values can be assigned in a
similar manner." to the first paragraph. This clarifies how the
algorithms can
 be used to consolidate feedback in the form of the CI and NI bits.

3. Remove the third paragraph and incorporate the information from
that paragraph into the following paragraph for conciseness. Clarify
that MER is reset to PCR in the fourth paragraph. Remove the sentence
"To reduce the complexity of the algorithm ..." from the fourth
paragraph.

4. Add one sentence that defines consolidation noise to the beginning
of the fifth paragraph.

5. In the fifth paragraph, remove the phrase "by implementing
timeouts" from the sentence "It is necessary to handle the non-
responsiveness of a branch" so as not to preclude implementations
that handle non-responsive branches using RM cell counts.

6. In the sixth paragraph, rephrase the 2 sentences for conciseness. The content is unchanged.

7. In the last paragraph, replace "To alleviate this problem" by "One method to alleviate this problem" to emphasize that this is simply a sample method.

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All our papers and ATM Forum contributions are available through http://www.cis.ohio-state.edu/~jain/