Modified Algorithms for Multilevel GRSB Protocol

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***Abstract*— GRSB - Guaranteed, Reliable, Secure Broadcast - is a protocol that provides reliable and secure broadcast / multicast communications [1,2]. It can be implemented in many types of networks - local area networks, wide area networks, as well as satellite communications. The methodology used in this protocol is surprisingly simple. Three logical nodes are enforced in the network - a Central Retransmiter, a Designated Acknowledger, and a Playback Recorder(s). Through the coordinated service of the three nodes, every user node can be guaranteed to receive all broadcast messages in the correct temporal order. A fourth logical node, the Security Controller, can be added to the protocol to provide security-related services such as user authentication, message encryption, etc. In this paper, we have proposed a multilevel broadcast model of GRSB (Guaranteed, Reliable and Secure Broadcast) protocol , where 1st level broadcast mostly maintains the traditional GRSB model. 2nd level broadcast has two types of nodes where nodes of 1st kind i.e. nodes that are directly connected with the attachment nodes, can be temporarily in 'not alive' condition and hence follow the traditional GRSB model as well. On the other hand, nodes of 2nd kind i.e. nodes that are not directly connected with the attachment nodes, must be 'alive' all the time and have to follow two phases to finish the broadcast.** *(Abstract)*

Keywords- data dissemination; GRSB; attachment nodes; multilevel broadcast model; designated acknowledger; playback recorder; security controller central retransmitter (key words)

I. INTRODUCTION

Data communication amongst data processing stations can be classified into the four categories, in the order of their complexity: one-to-one, many-to-one, one-to-many, and many-to-many. The first two classes have been well studied and successfully implemented. The last two classes, the so-called broadcast or multicast, although common in local area networks, wide area networks. as well as satellite communications, are still under research and development. Simply speaking, broadcast is the delivery of a message to all possible destination addresses, while multicast is the delivery of a message to some subset of the possible destinations. Early research on broadcast and multicast techniques centered on point-to-point computer networks and inter connected networks, or internets. Later, some broadcast research was extended for investigating group multicast techniques.

In general most existing broadcast technology (computer network, radio, TV, etc.) has the following drawbacks:

(1) The sender and receivers must be turned on during the period of broadcast. If a receiver is having hardware problems, busy doing something else or turned off, it will miss the broadcasted messages.

(2) There is no guarantee that a receiver receives all messages correctly. Even if a receiver is turned on and ready to receive, electrical noise could cause loss or distortion of messages.

(3) The sender must broadcast the messages slowly to cater to the slowest receiver. Most computer networks consist of some fast and some slow computers. If the broadcast must cater to the slowest possible computer in the network, the resulting system will not be efficient.

Not only does this GRSB protocol overcome all the above mentioned drawbacks, it also guarantees the reception of all broadcast messages in exactly the same sequence by all nodes in the network. By serializing the broadcast messages, it provides new techniques in distributed database updates. Parallel information retrieval, fail-safe systems and many others. Therefore, the its applications include Backup, Computer Conference, Parallel Information Retrieval, Hot Standby, Distributed Databases and Sales Support Systems.

II. LIMITATIONS OF GRSB PROTOCOL

1) The requirement of dedicated "multipoint broadcast" line(s) of arbitrary (possibly very large) length in GRSB [1,2] implementation seems impractical due to the limitations of wired-line capacity.

2) Efficiency of GRSB [1,2] module (in quality and quantity) should be in accordance with the effectiveness i.e. whether it is broadcast or group/multicast.

III. APPROXIMATE SOLUTIONS TO THESE PROBLEMS IN THE MULTILEVEL BROADCAST MODEL

Nevertheless, the multilevel GRSB model discussed here has the following approximate achievements.

1) Broadcasting in temporarily disconnected network(s) is resolved by the coordinated service of Central Retransmitter and Playback Recorder of GRSB [1,2] as implemented in this modified multilevel GRSB model.

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2) The length(s) of dedicated "multipoint broadcast" line(s) may be reduced locally and therefore globally, as shown in the following figure. Also the number of points in this line is now in finite form.

IV. Modified Algorithms for the Attachment Nodes

In this hierarchical model, the Designated Acknowledger (DA), Playback Recorder (PR) and Security Controller (SC) (possibly optional) play almost the same role(s) as in the GRSB [1,2] model. But in addition to these, the residual Global/Local Central Retransmitter (GCR/LCR) adds Source Local Network Identifier (SrcNetID) with the main broadcast message ***m*** and requires some 'not the least' modification(s) as described in the following.

A. *Algorithm for GCR (for level 2 implementation)*

1) *Step 1:* *Wait until* ***m*** *(sent from any* LCR_i*) is available*

2) *Step 2:*

a) Broadcast ***m*** *to all active* LCR_j*s other than sender* LCR_i

b) Wait and Tell GPR to store ***m*** *until all* $AckLCR_j$***(m)*** *(for all* LN_j*s other than corresponding* LN_i*) are received*

*c) Send AckGCR**(m)*** *to the sender* LCR_i *(to let start local broadcast in corresponding* LN_i*)*

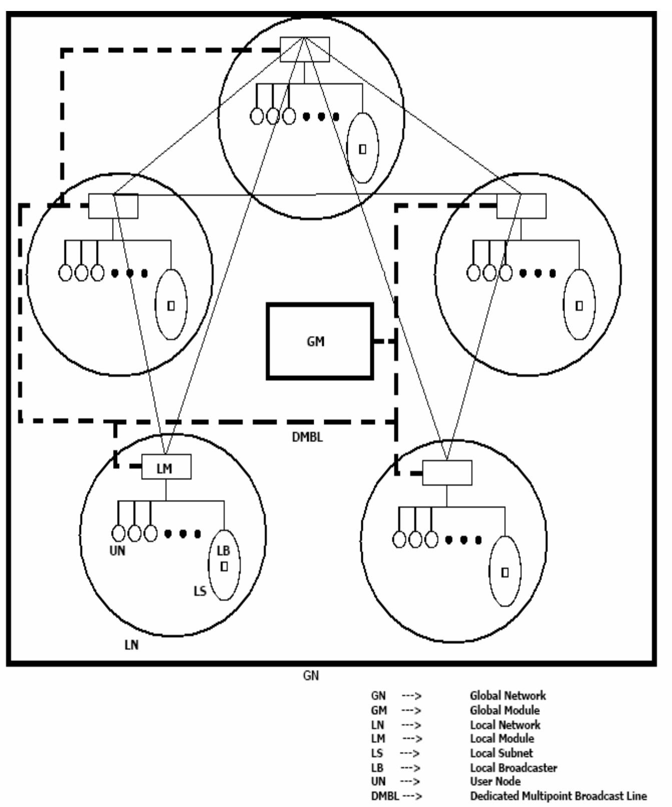

Figure 1. Multilevel GRSB model

B. *Algorithm for* LCR_i *(for level 1 implementation)*

1) *Step 1:* *Wait until* ***m*** *is available*

2) *Step 2:*

*a) If SrcNetID(**m**) =* ***nil*** *then*

*SrcNetID(**m**)* $\leftarrow$ *NetID(**LCR_i**)*

Send ***m*** *to GCR*

*Wait until AckGCR(**m**) is received*

b) Broadcast ***m*** *to all* UN_j*s, where* $UN_j \in LN_i$

c) EnQueue ***m*** *in* ***Queue(LPR_i)*** *and tell* LPR_i *to store* ***m*** *at least* ***k(D+2)T*** *times, where* ***k*** *is QueuePos(**m**) in* ***Queue(LPR_i)***

3) *Also tell* LDA_i *to send* $AckLCR_j$***(m)*** *to GCR if SrcNetID(**m**)* $\neq$ *NetID(**LCR_i**)*

C. *Algorithm for* LPR_i *(for level 1 implementation):*

If ***Queue(LPR_i)*** $\neq$ ***empty*** *then*

1) ***m*** $\leftarrow$ *DeQueue(**Queue(LPR_i)**)* *and send* ***m*** *to* LB_i *to broadcast* ***m*** *using RESPONSE Protocol [3] almost as fast as hardware speed*

2) *Wait for* ***(D+2)T*** *times*

D. *Algorithm for* LB_i *(for the implementation of RESPONSE Protocol in Local Subnet):*

1) *Step 1:* *Wait until* ***m*** *is available*

2) *Step 2:*

*If SrcNetID(**m**) =* ***nil*** *then*
select ***m*** *(one of* ***m****s in case of collision) for higher level i.e.* LCR_i*'s signature for broadcast*
Else
select ***m*** *for broadcast according to the RESPONSE Protocol [3]*

E. *Algorithm for each Node in* LS_i *(for the implementation of RESPONSE Protocol):*

1) *Step 1:* *Wait until* ***m*** *is available.*

2) *Step 2:*

*If SrcNetID(**m**) =* ***nil*** *then*
select ***m*** *(one of* ***m****'s in case of collision) to possibly forward upto* LB_i
Else
select ***m*** *(even in case of collision) to possibly broadcast according to the RESPONSE Protocol [3]*

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