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A Comment on "A Total Ordering Multicast Protocol Using Propagation Trees"

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Abstract—In this paper, we reevaluate the message cost of Jia's multicast mechanism. Our analysis shows that its message cost should be $(D + k + 1)$ instead of $(D + 2)$, where D is the depth of the subtree and k is the number of metagroups containing the destination multicast group.

Index Terms—Multicast protocols, group communication, message ordering, distributed systems, process synchronization.

1 Introduction

JIA [1] proposed a multicast mechanism using propagation trees to guarantee the total ordering of messages in multiple groups. He claimed on p. 625 of his paper that the number of network messages required to multicast a message to all group members is $(D + 2)$, which includes: one message from the sender to the primary manager (PM) of the destination group, D messages from the PM to the managers of the deepest metagroups in the subtrees, and another message from the manager to the members of the deepest metagroup. Taking the factors of message cost, latency time, and load balancing into consideration, he concluded that his multicast mechanism performs better than centralized mechanisms, two-phase based mechanisms, and Garcia's propagation tree method.

However, the statement of the message cost of his mechanism is incorrect. The message cost should be $(D + k + 1)$, instead of $(D + 2)$, where D is the depth of the subtree and k is the number of metagroups containing the destination multicast group. The message cost includes one message from the sender to the PM of the destination group, D messages to the managers of the deepest metagroups in the subtree, and another k messages to the members of the k metagroups containing the destination multicast group.

As an example, consider the propagation tree in Fig. 1 (the same as Fig. 5 in Jia's paper). To multicast a message to group C, we need to send one message to <*ABC*>, which is the PM of C, two messages to the deepest metagroups in the subtree, and five more messages to the members of the metagroups <*ABC*>, <*C*>, <*AC*>, <*BC*>, and <*CD*>. Therefore, in total, eight messages are needed to multicast a message to all members of group C.

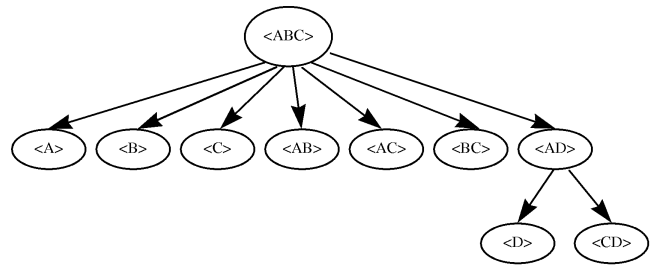

Fig. 1. The propagation tree.

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Reference

[1] X. Jia, "A Total Ordering Multicast Protocol Using Propagation Trees," *IEEE Trans. Parallel and Distributed Systems*, vol. 6, no. 6, pp. 617-627, June 1995.

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