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HYBRID CONSENSUS AGREEMENT ON CDS-BASED MOBILE AD-HOC NETWORK

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Abstract. *The reliability is an important research topic in the study of distributed systems. In order to achieve the fault-tolerant of distributed systems, the Byzantine Agreement (BA) problem needs to be paid attention. Under many circumstances, a healthy processor in a distributed system needs to reach a common agreement before performing some special tasks even if the faults exist. However, the traditional agreement problem is solved in the fully connected network, broadcast network and well-defined network. In this study, the agreement problem is revisited in the MANET (Mobile Ad-hoc NETwork) that is getting popular and its network topology is dynamic in nature. The MANET consists of wireless processors that communicate with each other in the absence of a fixed well-defined infrastructure and perhaps it is an unfully connected network. Besides, the dual failure mode on both processors and transmission media are considered in this paper. Our new protocol uses the minimum number of message exchanges to reach a common value while tolerating the maximum number of faulty processors in MANET.*
Keywords: Byzantine agreement, Distributed system, Fault-tolerant, Consensus, Mobile Ad-hoc network

1. **Introduction.** A distributed computing system consists of a set of processors, which can communicate with each other by exchanging messages. In order to provide a reliable computer system, a mechanism to allow a set of processors to agree on a common value is needed [4, 10, 19]. Some examples of such applications are commitment problem in a distributed database system [13], a clock synchronization problem [8] and a landing task controlled by a flight path finding system [2]. Such a unanimity problem was at first studied by Lamport *et al.* [10] and called a Byzantine Agreement (BA) [1, 2, 6, 10]. It needs a number of independent healthy processor to reach agreement when some of those processors might be faulty. A closely related sub-problem, the consensus problem, has been extensively studied [8, 15, 19] as well. The consensus problem has k initial values and subsequent achieve a common value even if certain processors failed [4, 8, 15]. Therefore, the consensus problem is similar to the BA problem such as executing k copies BA processes.

Traditionally, the BA problem was defined by Lamport *et al.* [10] as follows: (1) there are k ($k > 3$) processors, of which at most one-third of the total number of processors could fail without breaking down a workable network, (2) the processors communicate with each other through message exchange in a fully connected network (or well-defined