**INTRODUCTION**

The standard EIG (Exponential Information Gathering) protocol for Byzantine Agreement requires exactly \( t+1 \) rounds for achieving consensus between \( n \) processors where \( n \) is the total number of processors and \( t \) is the upper bound on the total number of faulty processors. Each processor maintains its copy of EIG tree, i.e., \( F_i(0) = \emptyset \) for every nonfaulty processor \( i \).

**THE PROTOCOL**

The \( \Delta \)-EIG protocol(2) for a single instance of \( \Delta \)-agreement is based on some components like it operates on an EIG tree of depth \( t+1 \). A node \( v \) is committed to \( v \) if and only if the processor that \( v \) is rooted at has already detected \( v \) as faulty. By \( \Delta \)-agreement, each nonfaulty processor \( i \) has a fixed set \( F_i(0) \) of processors. If all \( n \) processors start with an initial value \( v \), then all processors that \( i \) receives \( t+1 \) values of \( \sigma \) and a set \( \{0,1\} \) and a set \( \sigma \) of initially disabled processors. If all \( n \) processors start with an initial value \( v \), then \( v \) is committed to \( v \) if \( F_i(t) = v \) for all processors \( i \) in round \( t \). The \( \Delta \)-agreement is based on some components like it operates on an EIG tree of depth \( t+1 \). A node \( v \) is committed to \( v \) if and only if the processor that \( v \) is rooted at has already detected \( v \) as faulty.

**FAULT DETECTION**

- **FD0:** sends ill-formatted message in round \( r \).
- **FD1:** By end of round \( r \), processor \( i \) receives \( \geq t+1 \) values of \( \sigma \), and \( z \) from distinct processors \( j \).
- **FD2:** By end of round \( r \), some node \( \sigma \), that was not closed in tree, by end of round \( r \) is committed to both 0 and 1 in tree.
- **FD3:** By end of round \( r \), some node \( \sigma \) is committed to \( v \) in tree.

**RESULTS**

This protocol in addition to saving in communication also allows a processor to detect failures based on data received by it and also estimate the number of disabled processors.

**FUTURE WORKS**

Since, it needs to relay values in the subtree rooted at \( \sigma \) for at least 2 rounds after \( \sigma \) is closed in tree, thus, \( \Delta \)-EIG protocol can be further modified to obtain an early stopping protocol called \( \Delta \)-Es protocol. This protocol would lead to further decrease in number of nodes in tree.

Applying \( \Delta \)-Es protocol, sliding-flip protocol together with monitor voting(3) would lead to fully polynomial Byzantine agreement for \( n > 3t \) in \( t+1 \) rounds.

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**REFERENCES**