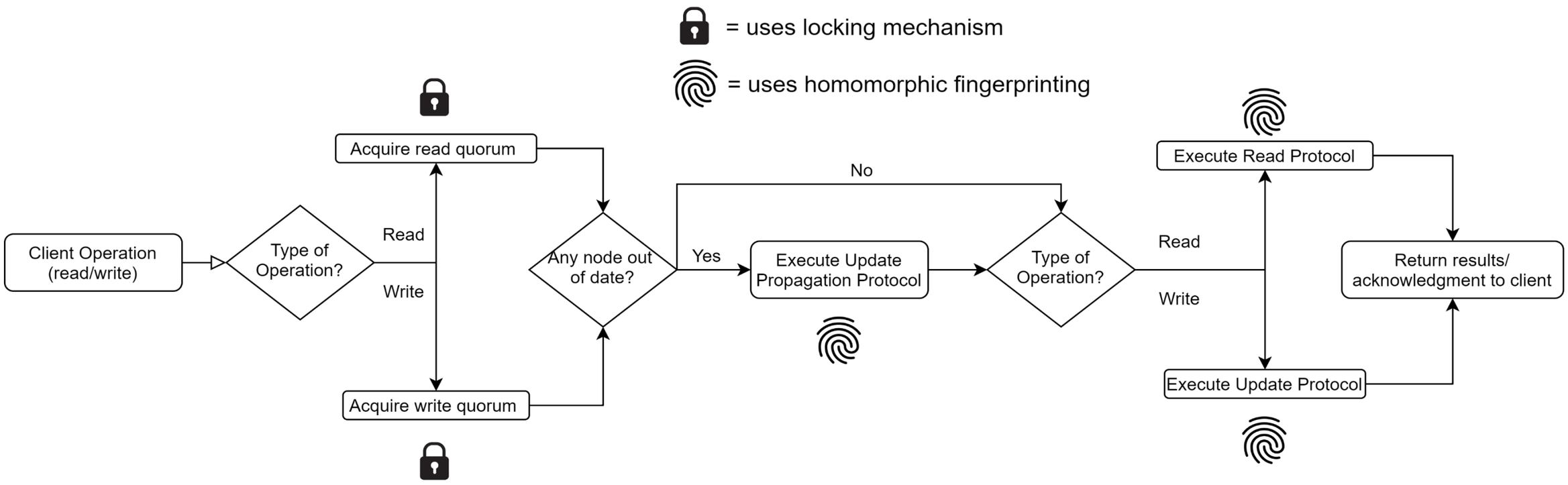
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

School of Computer Science and Engineering
College of Engineering

Achieving aRMW Semantics

over Byzantine Erasure-Coded Distributed Storage Systems

Student: Meenachi Sundaram Siddharth Supervisor: Assoc. Prof. Anwitaman Datta



Project Objectives: This project aims to fill the gap in the current state of research regarding the stringent atomic read-modify-write (aRMW) consistency semantics over an erasure-coded distributed storage system where a maximum specified number of nodes can experience Byzantine failures. The aRMW semantics is a prerequisite in settings where ACID-like semantics are required, such as in transactional databases, as well as in file systems, more recently. Hence, the proposed system will aid in designing such distributed file systems/databases.

Techniques Utilized:

1. **Quorum System** to facilitate multiple parallel read/write operations; achieved through locking mechanism
2. **Homomorphic Fingerprinting** to achieve efficient verification of distributed information; used in proposed dispersal, update and update propagation protocols

Methodology:

Depicted above is a high-level flowchart of how client requests are serviced. The sequence of operations combined with the careful design of the protocols achieves the aRMW semantics.

Results: The table below indicates that, as expected, with the increase in the number of Byzantine failures, f, the quorum size and the number of message transmissions increase.

f	No. of Data Messages		Quorum Size		
	Avg.	S.D.	Min.	Avg.	S.D.
0	546.08	110.82	6	10.66	4.21
1	709.68	137.02	7	12.2	4.84
2	741.76	86.82	8	12.63	4.56
3	873.54	68.06	9	13.785	4.82
4	1010.56	81.28	10	14.91	5.02