

# Distributed Mutual Exclusion Algorithms: A Comparison of Central Server, Ring Token and Multicast

COMPSYS 725: Distributed Cyber-Physical Systems

Matt Eden

*Department of Electrical, Computer and Software Engineering*

*University of Auckland*

*Auckland, New Zealand*

mede607@aucklanduni.ac.nz

***Index Terms***—central server, ring token, multicast, mutual exclusion, distributed systems

## I. MUTUAL EXCLUSION ALGORITHMS

### A. Overview

Mutual exclusion is generally concerned with preventing interference and ensuring consistency with resource access. For operating systems, this can be managed with relative ease. However, distributed systems do not have the shared variables or facilities that would be supplied by a single local kernel, so a different approach is required. This is where distributed mutual exclusion algorithms come into play, and a few of these are discussed in the following subsections.

There are a few key assumptions made in this report that should be acknowledged. The system being considered is comprised of  $N$  processes  $p_i$  with  $i = 1, 2, 3 \dots N$ . These process do not share variables, but access common resources. These resources are contained within a single critical section, and the system as a whole is asynchronous. The failure of processes is not considered, with message delivery being reliable so that any message sent is guaranteed to be delivered eventually and delivered exactly once. No message loss or duplication occurs.

### B. Central Server

### C. Ring Token

### D. Multicast

L<sup>A</sup>T<sub>E</sub>X does not work by magic. It doesn't get the bibliographic data from thin air but from .bib files. If you use L<sup>A</sup>T<sub>E</sub>X to produce a bibliography you must send the .bib files.

## II. COMPARISON OF ALGORITHMS

There are a few requirements for mutual exclusion, such as:

- Safety
- Liveness
- Fairness

Of these, *Safety* and *Liveness* are considered essential requirements. Performance of any one algorithm is evaluated against a set of fixed criteria, defined as follows.

- Consumed Bandwidth
- Client Delay
- Effect on Throughput

TABLE I  
TABLE TYPE STYLES

Table Algorithm	Table Column Head		
	Bandwidth	Client Delay	Throughput
Central Server	More table copy		
Ring Token	More table copy		
Multicast	More table copy		

<sup>a</sup>Sample of a Table footnote.

## ACKNOWLEDGEMENT

This report acknowledges the teachings of Dr. Avinash Malik and Ms. Jesin James in the course COMPSYS 725: Distributed Cyber-Physical Systems taught at the University of Auckland in Semester Two of the year 2020.

## REFERENCES

- [1] George F. Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, "Distributed Systems: Concepts and Designs", 5th ed, Boston, Massachusetts, Addison-Wesley; Pearson Education, 2011, pp. 41-49.