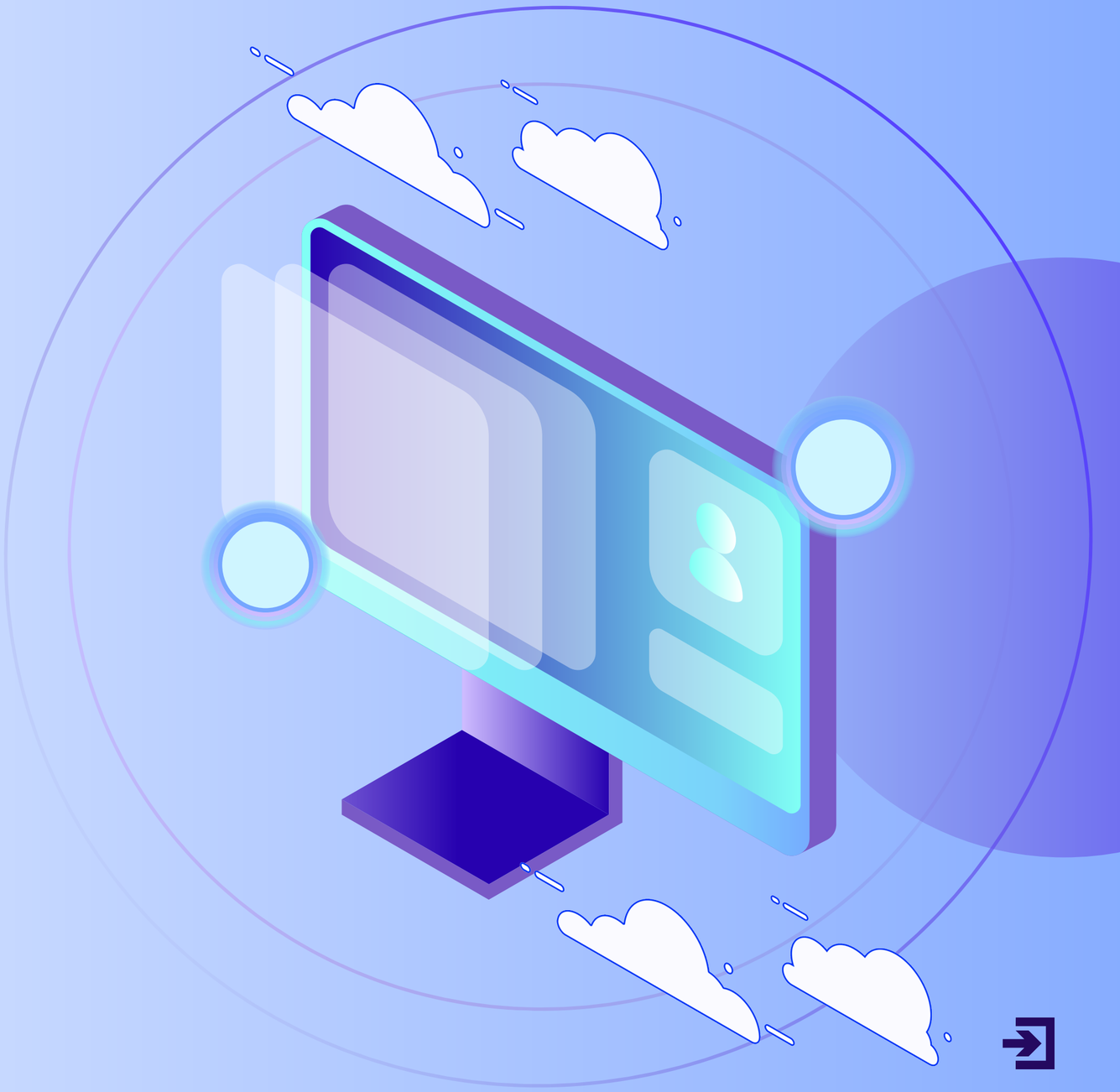
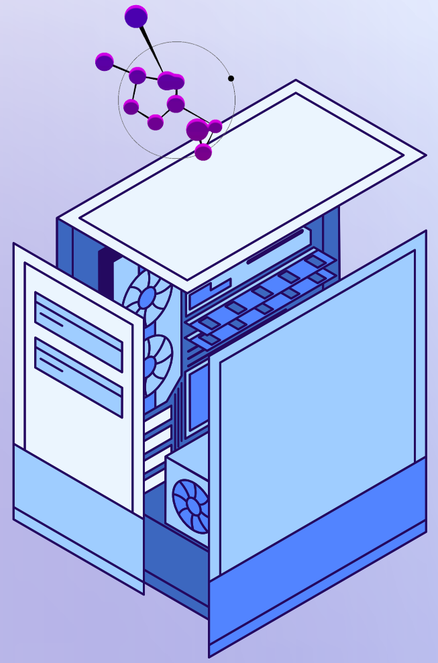
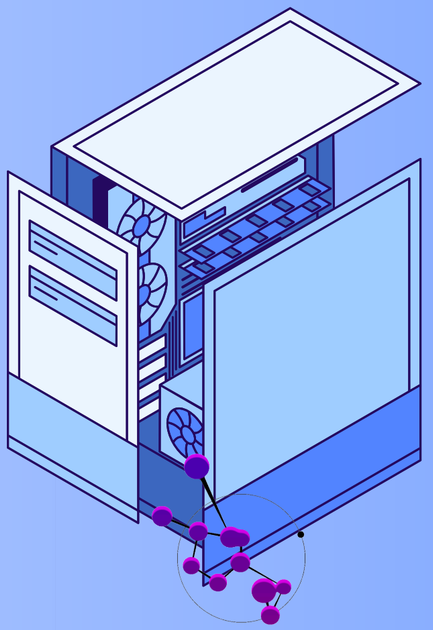
MAEKAWA'S ALGORITHM



MAEKAWA'S ALGORITHM FOR DISTRIBUTED MUTUAL EXCLUSION





- Subject: Distributed Systems
- Topic: Mutual Exclusion
- Prepared by: group 5

INTRODUCTION

Distributed systems consist of multiple independent processes that share resources.To avoid conflicts, only one process must be allowed to enter the critical section at a time.
Mutual exclusion ensures safe and consistent access to shared resources.Maekawa’s algorithm provides a decentralized solution without using a central coordinator.

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NEED FOR MAEKAWA'S ALGORITHM

Why Maekawa's Algorithm?

Traditional algorithms like Lamport and Ricart–Agrawala require communication with all processes.

This increases message overhead as the system size grows.

Maekawa's algorithm reduces communication by using a quorum-based permission system, making it more scalable for large distributed systems.

BASIC CONCEPT

- Each process is assigned a small group of processes called a voting set or quorum.
- To enter the critical section, a process must obtain permission from all members of its quorum.
- Any two voting sets must intersect at least at one common process.
- This intersection guarantees mutual exclusion.

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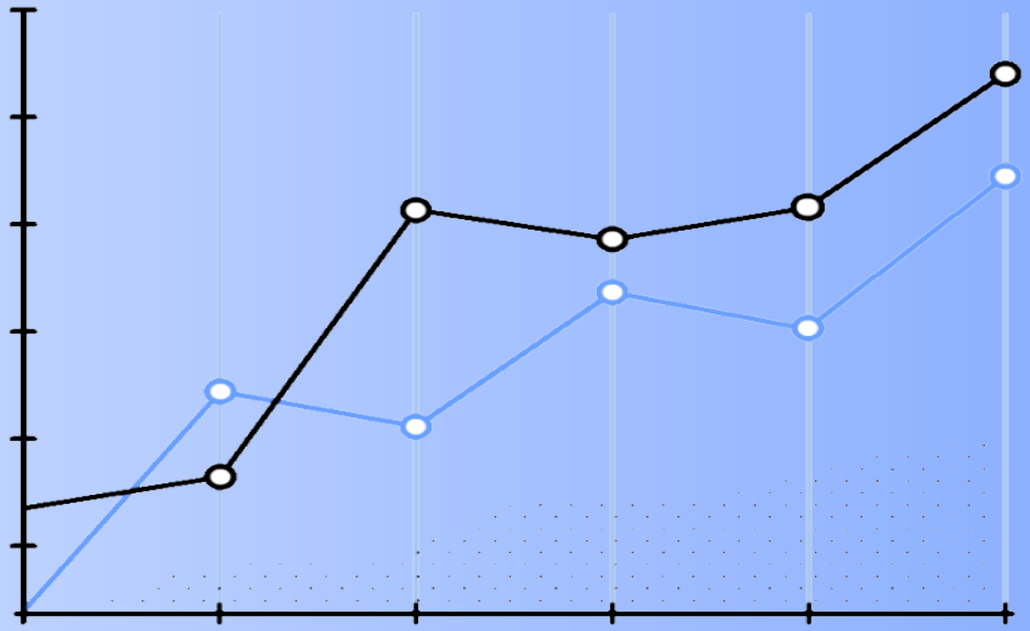
QUORUM PROPERTIES

- For a system with N processes, each quorum contains approximately √N processes.
- Every voting set intersects with other voting sets.
- Each process participates in multiple voting sets,
- ensuring that no two processes can enter the critical section simultaneously.



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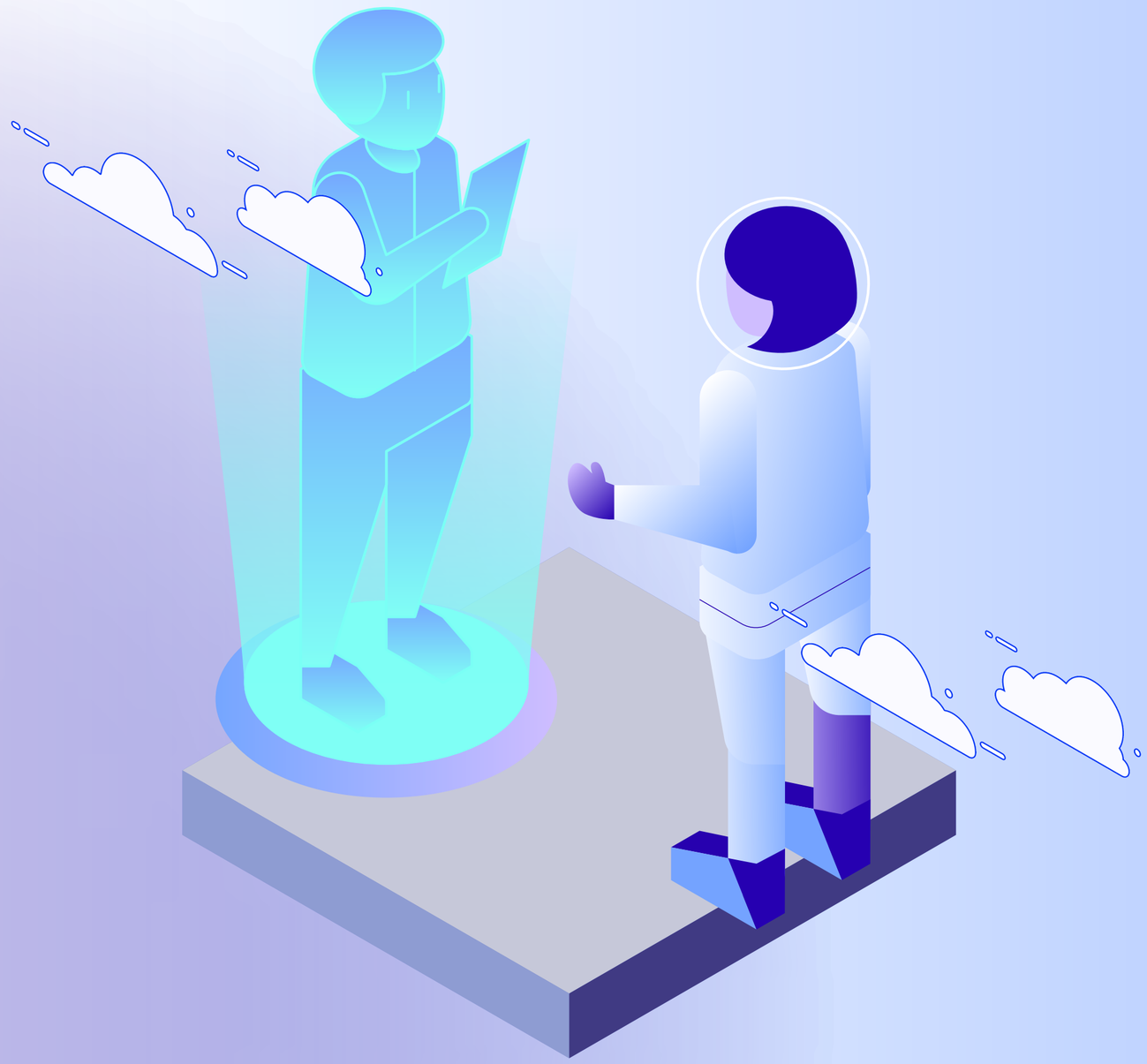
MESSAGE TYPES

Request is sent to ask permission to enter the critical section.

- GRANT is sent when permission is given.
- FAILED indicates the vote is currently unavailable.
- RELEASE is sent after exiting the critical section.
- INQUIRE and YIELD are used to resolve deadlocks.



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REQUEST PHASE

- When a process wants to enter the critical section,
- it sends REQUEST messages to all members of its voting set.
- Each request carries Each request carries a timestamp to determine priority.timestamp to determine priority.
- A process can grant permission to only one request at a time.

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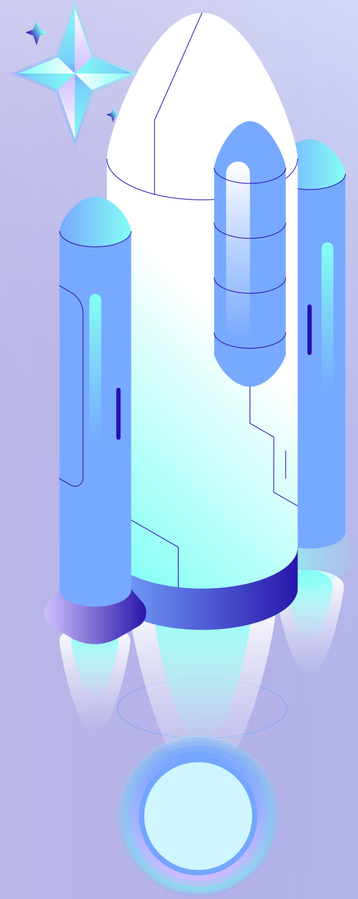
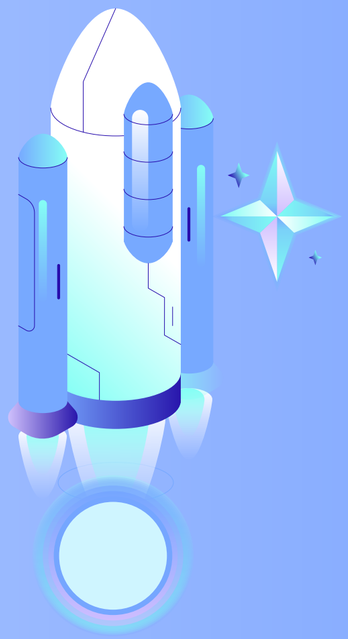
GRANTING RULES



- If a quorum member is free, it sends a GRANT message.
- If it has already granted permission to another process,
- It sends a FAILED message and queues the request
- Priority among requests is decided using timestamps.



THANK YOU