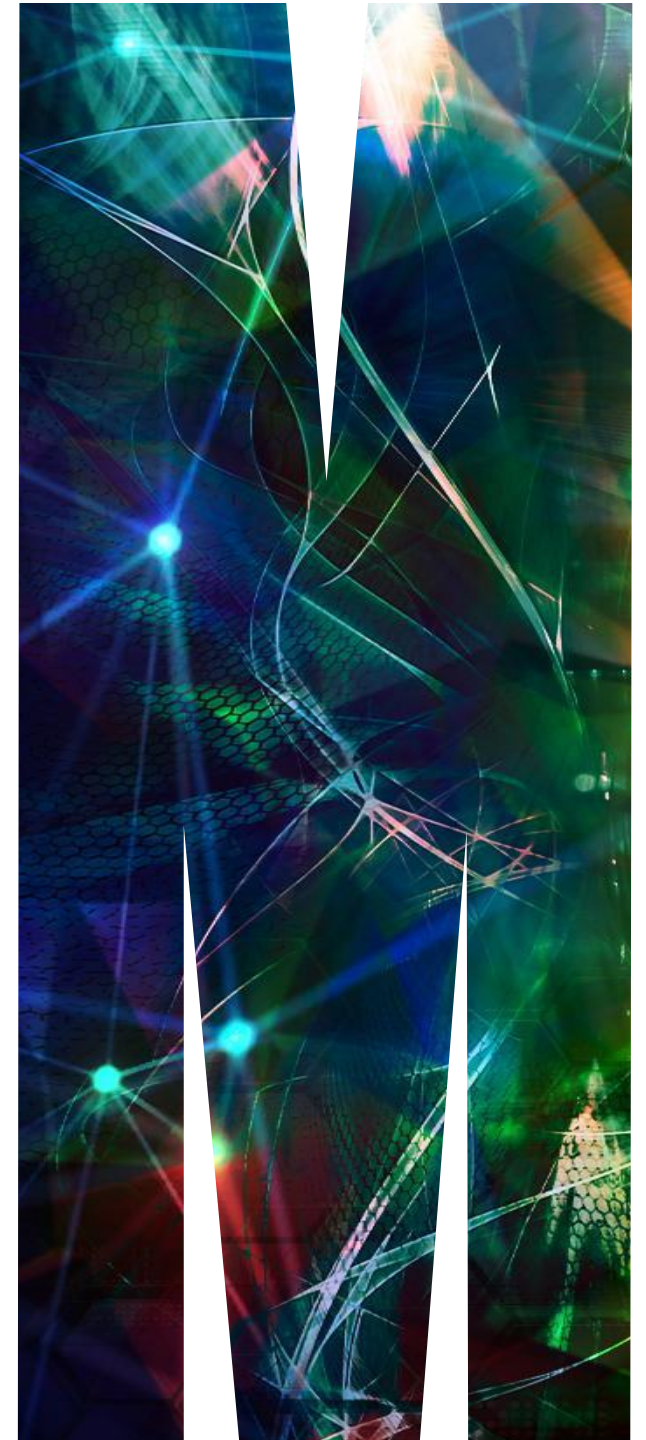


FIT2100 - OPERATING SYSTEMS

WEEK 11 - WORKSHOP 9

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CONTENT

WORKSHOP TOPICS

- Inter Process Communication (IPC)
 - o Signals
 - o Message Queues
 - o Shared Memory
 - o Stream-based IPC: Unnamed and Named Pipes
 - o Sockets
- OS Security Challenges (Week 12 content)

Week 11 Learning Objectives

Interprocess Communication - Part II

- Analyse and evaluate various strategies used by an operating system in managing the system resources and running applications efficiently.
- Analyse and identify parameters that can improve the performance of multi-programming operating systems.
- Apply synchronisation techniques in the development of applications, using operating system services.

RECAP TIME - IPC

MULTIPLE CHOICE / DISCUSSION QUESTIONS (10 mins)

PolLEV Time - Engage and Interact



INTER PROCESS COMMUNICATION

MESSAGE QUEUES (5 MINS)

Imagine two processes, Process A and Process B. Process A sends messages to Process B through a message queue. Each message has a size of 5 KB. If Process A sends 200 messages to Process B and Process B retrieves 50 messages from the queue, calculate:

- a) The total size (in KB) of messages sent by Process A.
- b) The total size (in KB) of messages retrieved by Process B.
- c) The size of the data remaining (in KB) in the message queue.
- d) How many more messages can Process B retrieve from the queue?

RECAP TIME - SHARED MEMORY

MULTIPLE CHOICE / DISCUSSION QUESTIONS (5 mins)

PolIEV Time - Engage and Interact



IPC - SHARED MEMORY

AVERAGE WAIT TIME CALCULATION (10 MINS)

You are developing a high-performance computing application for a research lab. You choose shared memory for inter-process communication due to its bandwidth advantages. To manage concurrent access to shared memory, you decide to implement a semaphore mechanism.

Your application will have 5 concurrent processes that want to access a shared memory segment of 1GB. Given that each process requests an average of 50MB at a time and holds onto the segment for about 10 milliseconds, how long would a process have to wait (including the holding time), on average, if each access is protected by a semaphore with an overhead of 0.5 milliseconds?

RECAP TIME - PIPES

MULTIPLE CHOICE / DISCUSSION QUESTIONS (5 mins)

PolLEV Time - Engage and Interact



IPC - PIPES

BUFFER CAPACITY (5 MINS)

You are working on a real-time data processing system that uses unnamed pipes for IPC. The system has a producer process that feeds data into the pipe and several consumer processes reading from the other end.

If the producer inserts data into the pipe at a rate of 100MB/s, and there are three consumer processes reading data concurrently from the pipe at rates of 40MB/s, 30MB/s, and 20MB/s respectively, after how many seconds will the pipe buffer fill up if the pipe's buffer capacity is 1000 MB?

RECAP TIME - STREAM ORIENTED IPC AND SOCKETS

MULTIPLE CHOICE / DISCUSSION QUESTIONS (7 mins)

PolIEV Time - Engage and Interact



IPC - STREAM ORIENTED IPC AND SOCKETS

STREAM ORIENTED IPC (5 MINS)

Your company is designing a distributed logging system for enterprise solutions. The system uses stream-oriented IPC, specifically sockets, to transmit logs from various applications to a centralised logging server.

Each log message has an average size of 2KB. If 500 applications send a log message every 2 seconds and the transmission overhead for each log message is 0.1KB, how much data (in MB) will the logging server receive every minute?

$$1\text{MB} = 1024 \text{ KB}$$

IPC - STREAM ORIENTED IPC AND SOCKETS

SOCKETS (5 MINS)

You're the lead developer for a chat application that uses UNIX domain sockets for IPC. The application runs on a server and allows clients to connect and communicate.

The server creates a socket mapped to a filename, and client processes connect to this socket. If each client sends and receives an average of 10 messages per minute, with each message being 5KB in size, and there are 1000 active clients, calculate the total data (in GB) transferred via the socket in one hour. Consider that the data is sent in both directions (from client to server and vice versa).

RECAP TIME - OS SECURITY

MULTIPLE CHOICE / DISCUSSION QUESTIONS (10 mins)

PolLEV Time - Engage and Interact



PROBLEM SOLVING ASSESSMENT 3

INSTRUCTION

- Conducted during the workshop
- You must attend the class you are allocated to
- Bring a handheld scientific calculator
- Attend the class on time, if you come late you will not get full time.

Structure of the assessment

- Assessment conducted on Moodle
- Questions will be related to workshop content
- 15-20 problem-solving tasks included
 - Multiple choice questions with single answer
 - Multiple choice questions with multiple answer
 - Calculation questions.
- 10 minutes for reading and 50 minutes for working
- Open book format
- No secondary device or online tools must be used
- Internet searches are prohibited; preparing a personal reference sheet is highly advised

Summary

- Topics covered
 - Inter Process Communication (IPC)
 - OS Security Challenges
- Next week
 - **Problem Solving Assessment 3**