Bilkent University
Department of Computer Engineering

CS 342 - Operating Systems
Spring 2024

Project 1

Bahadır Günenc - 22003672
Emir Tuğlu - 22003165

Table of Contents

Introduction

In this report, the results of the experiments that are performed on the command server-client programs will be discussed. The server and client programs are the processes that are running on the same host. In the experiments, the effect of the number of clients that are connecting to the server concurrently and the WSIZE value is manipulated to observe their effect on the time elapsed. Elapsed time is the time between the client sending the request and the time between it receiving the response.

Experiments with Different Number of Clients

To measure the effect of the number of clients running concurrently on the elapsed time, a shell file was used. In the shell file, the command needed to run a client is repeated as the number of clients tested. So, when the bash file was run, clients were created concurrently. Tests were made in the batch mode rather than the user interactive mode to make different clients run at the same time. In this way, the effect of the time passing while the user enters the command is eliminated.

```
# Sample bash file to run 3 clients concurrently
./comcli /mqname -s 124 -b commands.txt &
./comcli /mqname -s 124 -b commands.txt &
./comcli /mqname -s 124 -b commands.txt
```

Number of Clients	Time Elapsed (ns)
1	8873905
2	14047978
3	18580544
4	16365827
5	17765815
6	20375839

Table 1: Time elapsed for each number of clients

The results demonstrate that the elapsed time increases as the number of clients sending concurrent requests to the server increases. This is an expected result since each client connecting to the server adds more workload to the host. As more processes are created, the competition for system resources increases. This causes the

OS to perform more context switches between processes and this is reflected as an increase in time elapsed in the table. However, it is notable that the increase in the elapsed time is not linear with respect to the number of clients. In other words, the time elapsed for handling the requests of 6 clients is much less than the time passed for handling the request of a single client multiplied by 6. The reason behind this is that the server creates a child process for each client connecting. The creation of child processes enables the CPU to handle requests coming from different clients concurrently. In this way, the client sending the last request does not wait for other clients to terminate. In short, as the number of clients increases, the time elapsed also increases due to competition for system resources, however, this increase is not dramatic because of the parallelism obtained by creating child server processes for each client.

Experiments with Different WSIZE Values

To measure the effect of different WSIZE values on the time elapsed, a large text file was created. Then, clients were run with different WSIZE values and the contents of the same text file were printed in all of them using the “cat” command. The time elapsed between sending the request and getting the full response was measured.

WSIZE value	Time Elapsed (ns)
24	29890763
124	13230813
224	7730024
324	6353348
424	6051201
524	5881176
624	5711507
724	6083129
824	5880825
924	5813415
1024	5556191

Table 2: Time elapsed for each value of WSIZE

According to the results, the time elapsed for the same command being run with different WSIZE values decreases as the WSIZE value increases. WSIZE value determines the maximum message size transferred via the named spaces. This means that the smaller the value of the WSIZE, the more the server needs to split its output into multiple messages and send them via sc pipe. The client also needs to combine the data part of the messages which are split on the server side. These extra operations add more workload to the system thus, increasing the time elapsed. However, it can be observed from Table 2 that the decrease in the time elapsed slows down as the value of WSIZE increases. The reason for it is, the number of messages created is calculated with the formula of (output size) / WSIZE. So, increasing WSIZE when it has a small value affects the elapsed time significantly. However, for large values of WSIZE, increasing it in the same quantity has much less effect on the number of messages created. To conclude, incrementing WSIZE has a decreasing effect on the time elapsed, but this effect gradually diminishes as the value of the WSIZE increases.