CS553 Programming Assignment #1
Benchmarking
Design Document

This project aims at how to benchmark different parts of a computer system, from the CPU, memory, disk, and network. This assignment uses amazon AWS cloud ec2 t2.micro Linux operating system instances.

1. CPU :

   This assignment part benchmarks CPU by measuring the processor speed in terms of floating point operations per second (Giga FLOPS, 10^9 FLOPS) and integer operations per second (Giga IOPS, 10^9 IOPS).

   This program implemented in C programming language. Pthread library is used to measure the processor speed at varying levels of concurrency (1 thread, 2threads, 4 threads). This program take input from user such as number of thread to measure GFLOP and GIOP. flopFuntion() and iopFunction() are implemented to perform floating point operations and integer operations respectively. pthread_create() is used to create thread and Pthread_join() is used to implement synchronization of threads i.e. it waits till the execution termination of all threads. This program calls flopFunction() and iopFunction() $3*10^8$ times to calculate GFLOP and GIOP respectively. System clock() is used to calculate time taken to perform floating point operation and integer operation.
   Final result will be displayed in console in terms of GFLOP and GIOP.

2. Memory:

   This programming part measures the memory speed. The memory speed is calculated for different type of memory operations such as sequential, random read+write operations for varying block sizes such as 1 Byte, 1 KB, 1 MB with varying concurrency level using 1 thread or 2 thread. The memory speed is calculated in terms of throughput and latency. Throughput is speed of memory to perform read+write operation in terms of MB/sec. Latency is time taken to perform one read+write operation in terms of mili-second (ms).

   This part is implemented using C programming language. Pthread library is used to measure the memory speed at varying level of concurrency (1 thread, 2 thread). Memcpy() function is used to perform memory read+write operation. This program takes input from user such as number of thread such as 1 thread or 2 thread to implement concurrency and block size such as 1 B, 1 KB, 1 MB to perform read+write operation. This program is implemented for total size of 10MB data. In this program, Initially Buffer is initialized with 10 MB of data and other buffer is declared with same size of data, so memcpy() is used read from initialized buffer to other declared buffer of same size with varying block sizes such as 1 B, 1 KB, 1 MB.

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3. Disk:

This programming part measures disk speed. Different API are used to perform disk access operations such as sequential read, write, random read, write disk operations. Disk operations are performed for different data block sizes as 1B, 1KB, 1MB. Disk operations are performed with varying concurrency level using 1 thread, 2 thread. Disk speed is calculated in terms of throughput and latency. Throughput is amount of megabyte data can be performed in one second. Latency is time taken to perform one disk operation in second.

This program is implemented in C programming language. This program takes input from user such as number of thread to implement concurrency and data block size to perform disk operation. API such as fwrite(), fread(), fseek() are used to perform disk operation such as file write, file read. Pthread library is used to create threads to implement concurrency level. This program perform disk operation for total 10 MB data. Initially buffer is initialized with 10 MB of data and this data is used to write file on disk sequentially , randomly with varying data sizes and varying concurrency level.