Evaluasi Kinerja dan Optimisasi Sistem Komputer

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Performance Evaluation

Performance Evaluation

Defining Performance

- When you say one computer has better performance than another, what do you mean?
- Case study:

Airplane	Passenger capacity	Cruising range (miles)	Cruising speed (m.p.h.)	Passenger throughput (passengers x m.p.h.)
Boeing 777	375	4630	610	228,750
Boeing 747	470	4150	610	286,700
BAC/Sud Concorde	132	4000	1350	178,200
Douglas DC-8-50	146	8720	544	79,424

Response Time vs Throughput

- If you were running a program on two different desktop computers, you'd say that the faster one is the desktop computer that gets the job done first.
- As an individual computer user, you are interested in reducing **response *time***—*the time between the start and completion of a task*—also referred to as **execution time**.

Response Time vs **Throughput**

- If you were running a data center that had several servers running jobs submitted by many users, you'd say that the faster computer was the one that completed the most jobs during a day.
  - Data center managers are often interested in increasing **throughput**—*the total amount of work done in a given time*.

In most cases, we will need different performance metrics as well as different sets of applications to benchmark **desktop computers** versus **servers**, and **embedded computers** require yet other metrics and applications.

Response Time vs Throughput

- Do the following changes to a computer system **increase throughput**, **decrease response time**, or **both**?
  1. Replacing the processor in a computer with a faster version
     - ✓ Decreasing response time almost always improves throughput. Hence, both response time and throughput are improved.
  2. Adding additional processors to a system that uses multiple processors for separate tasks—for example, searching the World Wide Web.
     - ✓ No one task gets work done faster, so only throughput increases.

       If, however, the demand for processing in the second case was almost as large as the throughput, the system might force requests to queue up. In this case, increasing the throughput could also improve response time, since it would reduce the waiting time in the queue.

- In many real computer systems, changing either execution time or throughput often affects the other.

Measuring Performance

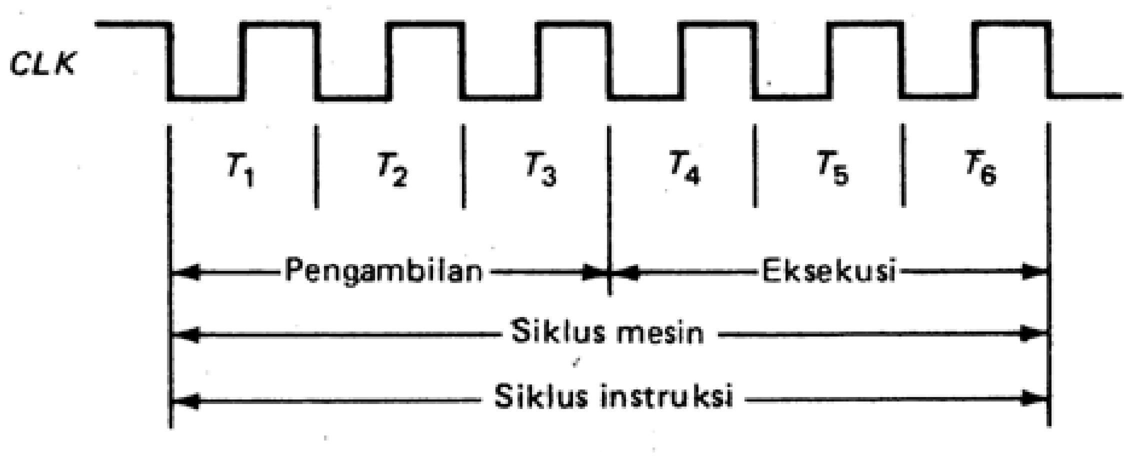
- In discussing the performance of computers, we will be primarily concerned with **response time** or **execution time.**
  - The total time to complete a task, including disk accesses, memory accesses, input/output (I/O) activities, operating system overhead—everything.
- **CPU execution time** or **CPU time** is the actual time the CPU spends computing for a specific task.

- CPU time = Instruction count x CPI x Clock cycle time
  - CPI : Clock Cycle per Instruction

Components of performance	Units of measure
CPU execution time for a program	Seconds for the program
Instruction count	Instructions executed for the program
Clock cycles per instruction (CPI)	Average number of clock cycles per instruction
Clock cycle time	Seconds per clock cycle

CPI : Clock Cycle per Instruction

- Case Study: Komputer SAP-1
  - Setiap instruksi membutuhkan satu siklus mesin.
  - Satu siklus mesin pada SAP-1 membutuhkan 6 clock.
  - Untuk SAP-1, CPI = 6



Relative Performance

- To maximize performance, we want to minimize execution time for some task.
- We can relate performance and execution time for a computer X:

$$\text{Performance}_X = \frac{1}{\text{Execution time}_X}$$

- For two computers X and Y, if the performance of X is greater than the performance of Y, we have:

$$\text{Performance}_X > \text{Performance}_Y$$

$$\frac{1}{\text{Execution time}_X} > \frac{1}{\text{Execution time}_Y}$$

$$\text{Execution time}_Y > \text{Execution time}_X$$

Relative Performance

- In discussing a computer design, we often want to relate the performance of two different computers quantitatively. We will use the phrase “X is n times faster than Y”:

$$\frac{\text{Performance}_X}{\text{Performance}_Y} = n$$

- If computer A runs a program in 10 seconds and computer B runs the same program in 15 seconds, how much faster is A than B?

$$\text{Performance}_X = \frac{1}{\text{Execution time}_X}$$