The Art of Workload Selection

Raj Jain
Washington University in Saint Louis
Saint Louis, MO 63130
Jain@cse.wustl.edu

These slides are available on-line at:

http://www.cse.wustl.edu/~jain/cse567-11/

Overview

❑ Services Exercised
  ➢ Example: Timesharing Systems
  ➢ Example: Networks
  ➢ Example: Magnetic Tape Backup System
❑ Level of Detail
❑ Representativeness
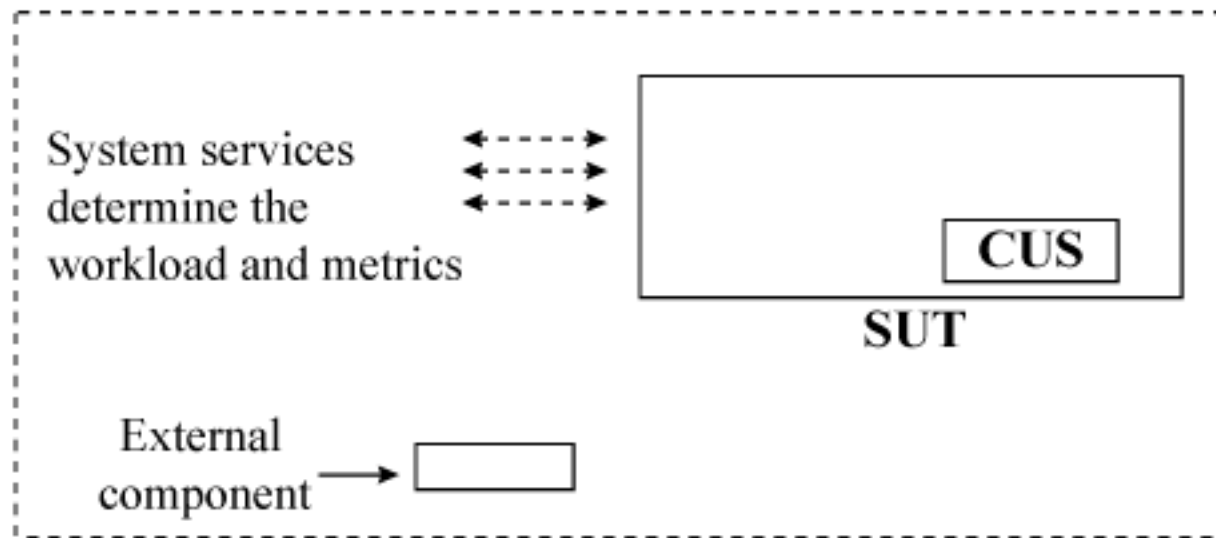❑ Timeliness
❑ Other Considerations in Workload Selection

The Art of Workload Selection

Considerations:

❑ Services exercised

❑ Level of detail

❑ Loading level

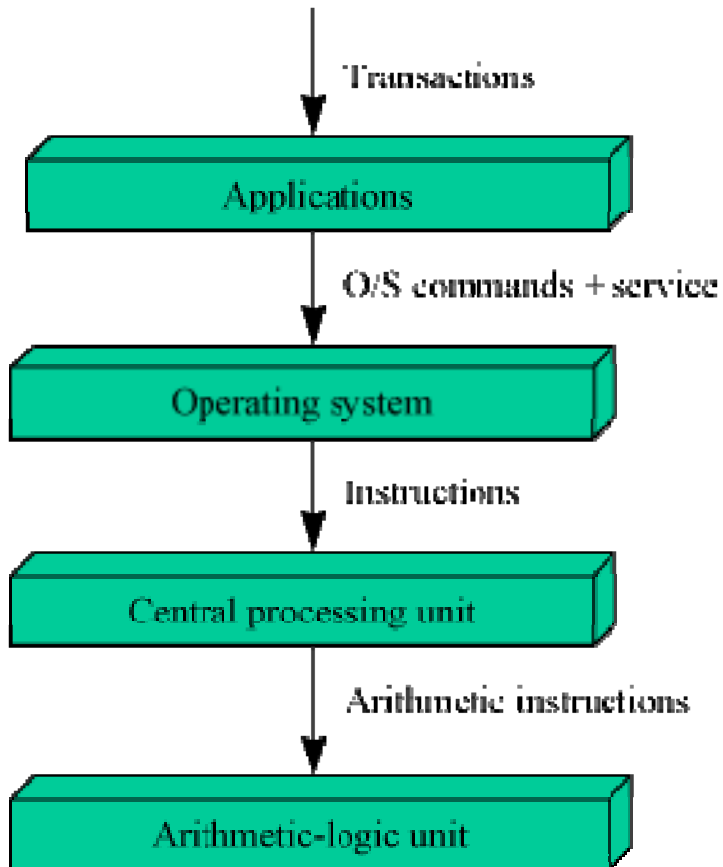❑ Impact of other components

❑ Timeliness

Services Exercised

- ❑ SUT = System Under Test
- ❑ CUS = Component Under Study

Services Exercised (Cont)

❑ Do not confuse SUT w CUS

❑ Metrics depend upon SUT: MIPS is ok for two CPUs but not for two timesharing systems.

❑ Workload: depends upon the system.

❑ Examples:
  ➢ CPU: instructions
  ➢ System: Transactions
  ➢ Transactions not good for CPU and vice versa
  ➢ Two systems identical except for CPU
    ❑ Comparing Systems: Use transactions
    ❑ Comparing CPUs: Use instructions
  ➢ Multiple services: Exercise as complete a set of services as possible.

Example: Timesharing Systems

Transactions

Applications

O/S commands + service

Operating system

Instructions

Central processing unit

Arithmetic instructions

Arithmetic-logic unit

❑ Applications
  ⇒ Application benchmark

❑ Operating System
  ⇒ Synthetic Program

❑ Central Processing Unit
  ⇒ Instruction Mixes

❑ Arithmetic Logical Unit
  ⇒ Addition instruction

Example: Networks
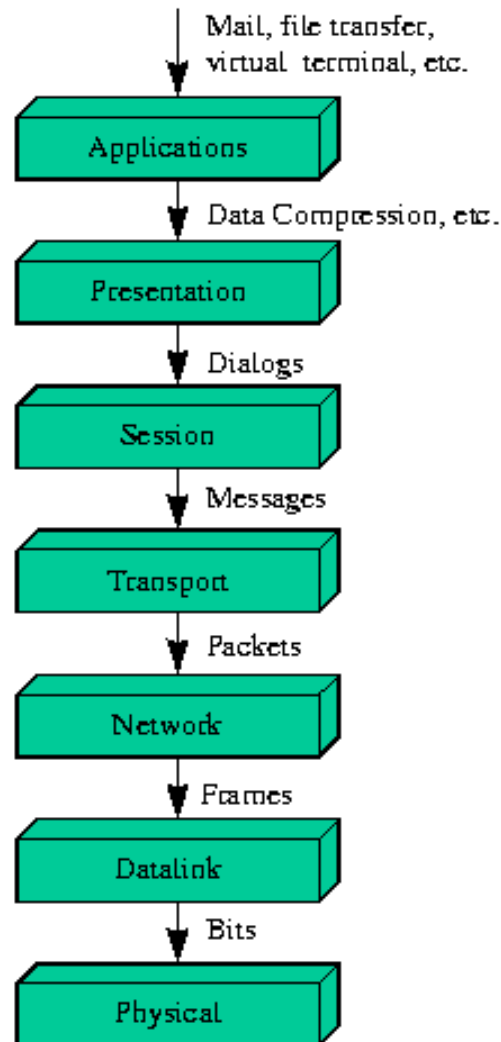
Level of Detail

❑ Most frequent request:
  ➢ Examples: Addition Instruction, Debit-Credit, Kernels
  ➢ Valid if one service is much more frequent than others
❑ Frequency of request types
  ➢ Examples: Instruction mixes
  ➢ Context sensitivity $\Rightarrow$ Use set of services
  ➢ History-sensitive mechanisms (caching) $\Rightarrow$ Context sensitivity
❑ Time-stamped sequence of requests
  ➢ May be too detailed
  ➢ Not convenient for analytical modeling
  ➢ May require exact reproduction of component behavior

Level of Detail (Cont)

❑ Average resource demand

  ➢ Used for analytical modeling

  ➢ Grouped similar services in classes

❑ Distribution of resource demands

  ➢ Used if variance is large

  ➢ Used if the distribution impacts the performance

❑ Workload used in simulation and analytical modeling:

  ➢ Non executable: Used in analytical/simulation modeling

  ➢ Executable workload: can be executed directly on a system

Representativeness

The test workload and real workload should have the same:

❑ Elapsed Time

❑ Resource Demands

❑ Resource Usage Profile: Sequence and the amounts in which different resources are used.

Timeliness

❑ Users are a moving target.

❑ New systems $\Rightarrow$ new workloads

❑ Users tend to optimize the demand.

❑ Fast multiplication $\Rightarrow$ Higher frequency of multiplication instructions.

❑ Important to monitor user behavior on an ongoing basis.

Other Considerations in Workload Selection

❑ Loading Level: A workload may exercise a system to its:

  ➢ Full capacity (best case)

  ➢ Beyond its capacity (worst case)

  ➢ At the load level observed in real workload (typical case).

  ➢ For procurement purposes $\Rightarrow$ Typical

  ➢ For design $\Rightarrow$ best to worst, all cases

❑ Impact of External Components:

  ➢ Do not use a workload that makes external component a bottleneck $\Rightarrow$ All alternatives in the system give equally good performance.

❑ Repeatability

Summary
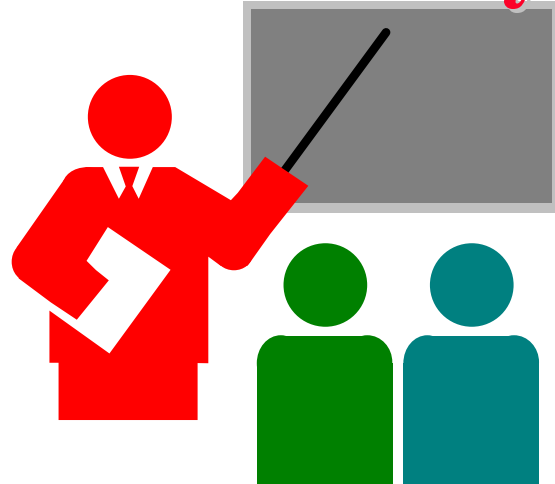
- Services exercised determine the workload
- Level of detail of the workload should match that of the model being used
- Workload should be representative of the real systems usage in recent past
- Loading level, impact of external components, and repeatability or other criteria in workload selection

Exercise 5.1

❑ What metric and workload would you choose to compare:

a. Two systems with similar functionality: IBM PC versus MAC

b. Two systems for very different applications: PC versus Workstations

c. Two systems with identical functionality: IBM PC versus Dell PC

d. Two versions of the same operating systems: Windows 98 vs Windows XP

e. Two hardware components: Two floppy drives

f. Two languages: C vs. Pascal

One metric and one workload is sufficient

Exercise 5.2

❑ Select an area of computer systems, for example, databases, networks, processors, and so on. Prepare a table identifying increasing levels of services, components, factors, and workloads.

Homework 5

❑ Read chapters 4 and 5

❑ Submit answer to Exercise 5.1