

# CS5239 Computer System Performance Evaluation

2011/12 - Semester 2



**Assoc Professor Teo Yong Meng**

Room: COM2, #04-39

Department of Computer Science

National University of Singapore

E-mail: [teoym@comp.nus.edu.sg](mailto:teoym@comp.nus.edu.sg)

[www.comp.nus.edu.sg/~teoym/cs5239-11/](http://www.comp.nus.edu.sg/~teoym/cs5239-11/)

# What I do?

## ◆ Teaching

- Parallel Computing
- Systems Modeling & Simulation
- Distributed Systems
- Applied Parallel Computing (joint teaching with MIT)
- Computer Systems Engineering (joint teaching with MIT)
- ....

## ◆ Research - parallel & distributed computing

- parallelism theory and many-core systems
- performance evaluation
- resource management
- composable parallel simulation
- fault tolerance & check-pointing in distributed systems

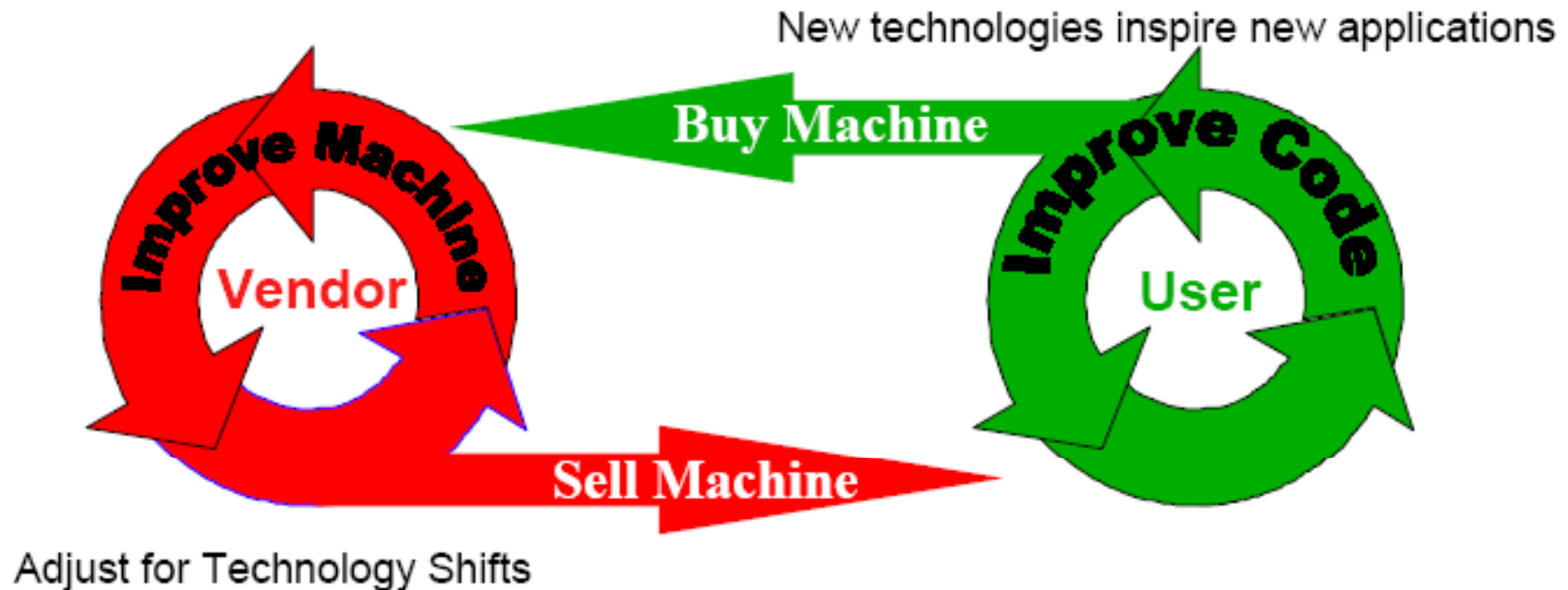
# Performance

How well a computer system performs a given job or activity.

What is hard?

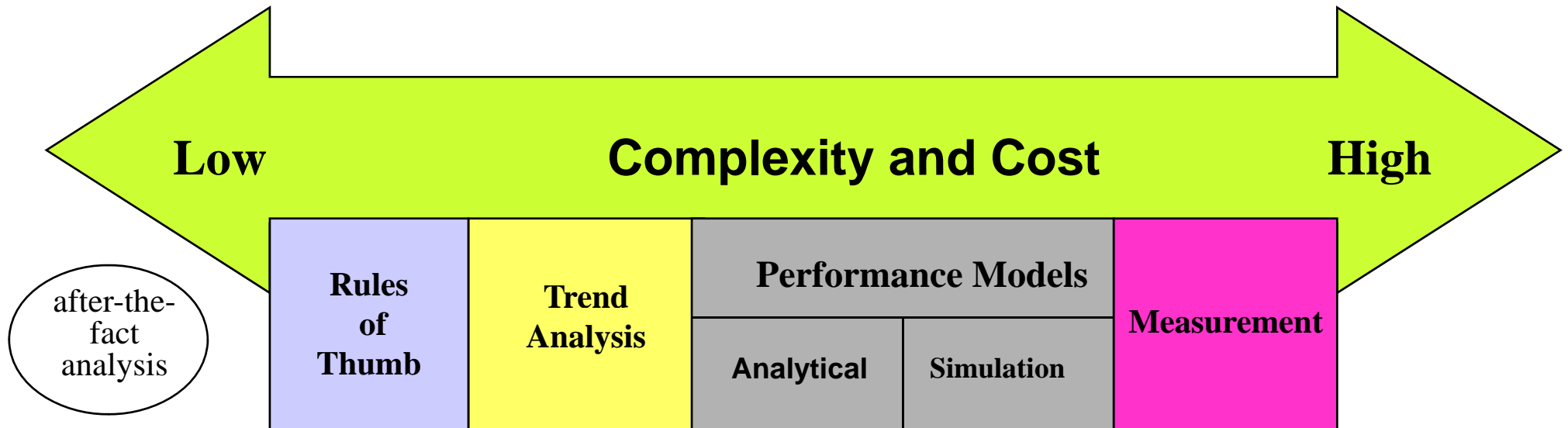
Performance of a computer system is multidimensional.

# Why Evaluated Performance?



Goal: advance the state-of-the-art of  
computer architecture

# Performance Evaluation

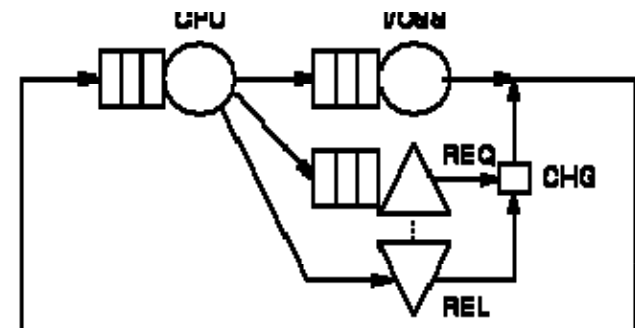


# Three Fundamental Techniques

◆ **Measurements** of actual systems

◆ **Simulations** using software models

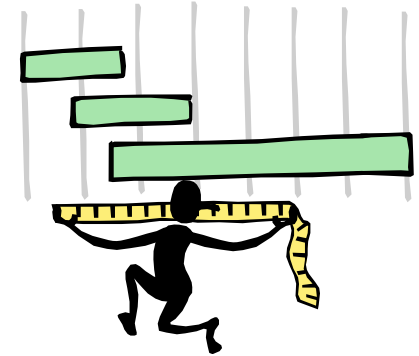
◆ **Mathematical modeling** using such techniques as queuing analysis



# Course Schedule

◆ [Click here](#)

# MEASUREMENT TECHNIQUES & TOOLS



L#03:  
Performance  
Metrics

L#04:  
Workload  
Modeling

L#05:  
Instrumentation &  
Representation of  
Measurement  
Data

**“Measurements are not to provide  
numbers but insights.”**  
*Ingrid Bucher*



# ANALYTICAL MODELLING TECHNIQUES

L#06:  
Introduction &  
Notation

L#07-09:  
Techniques

L#10:  
Performance Laws  
& Scalability

L#11-12  
Case Studies

L#07:  
Operational  
Analysis

L#08:  
Analysis of  
Single Queue

L#09: Analysis of  
Queuing Networks /  
Multiple Classes

- bottleneck analysis
- performance bounds

- System - open, closed, hybrid
- Component - fixed capacity, delay, load-dependent
- Workload - single, multiple classes

# Books

## Main Textbooks

- ◆ **The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation and Modeling**, R. Jain, John-Wiley, 1991.
- ◆ **Quantitative System Performance**, E.D. Lazowska et al., Prentice-Hall, 1984, <http://www.cs.washington.edu/homes/lazowska/qsp/>.
- ◆ **Measuring Computer Performance - A Practitioner's Guide**, D.J. Lilja, Cambridge University Press, 2000.

## Reference Books

- ◆ **Capacity Planning and Performance Modeling - From Mainframes to Client-Server Systems**, Daniel A. Menasce, et al., Prentice-Hall, 1994.
- ◆ **Capacity Planning for Web Performance – Metrics, Models and Methods**, D.A. Menasce, et al., Prentice-Hall, 1998.
- ◆ **Simulation Modeling and Analysis**, A.M. Law and W.D. Kelton, McGraw Hill, 3rd edition, 2000.
- ◆ **Introduction to Parallel Computing**, A. Grama, et al., Addison-Wesley, 2nd Edition, 2003.

# Module Assessment



## 1. Continuous Assessment (60%)

- ◆ Quiz (5%)
- ◆ Assignment 1 (15%)
- ◆ Assignment 2 (20%)
- ◆ Test (20%)

## 2. Open Book Exam (40%)

- ◆ 2 hrs



Everything should be made as simple as possible, but  
no simpler – attributed to Albert Einstein

# Problems



If you're not sure,  
don't guess...**ASK!**



- consultation hours – Wed, 9-11am, email, catch me after lectures ....