COMP 190-088: Systems Performance Analysis

Evaluation Techniques

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Evaluation Techniques

- Tracing a real system in operation
- Measurements on a prototype
- System simulation
- System modeling

Tracing a Real System

- Need
  - To get approval of operators
  - To instrument the system for measurement
    - End-to-end metrics and component-wise metrics
    - Non-interference with servicing of user requests
      - Low overhead
    - Instrumentation should be able to keep up with system load
- ☺:
  - Most accurate estimation of metrics
- ☹:
  - Lack of control over parameters/workloads
  - Non-repetitive measurements
  - No insights into "future" operation/design

Measuring a Prototype

- Need
  - A prototype
  - To instrument the prototype for measurement
    - End-to-end metrics and component-wise metrics
    - Non-interference with servicing of user requests
      - Low overhead
  - To design and generate workload
  - To select/tune system parameters
- ☺:
  - Accurate estimation of metrics
  - More control over parameters and workload
- ☹:
  - No insights into "future" system designs

System Simulation

- Need
  - A simulator
    - Programming skills, right level of detail
  - To design and generate workload
  - To select/tune system parameters
- ☺:
  - High control over parameters and workload
  - Possible to incorporate future system designs as well
    - Takes effort though
- ☹:
  - Less accuracy
  - Large effort

System Modeling

- Need
  - A model
    - Probabilistic and statistical modeling skills
  - To design and generate workload
  - To select/tune system parameters
- ☺:
  - Least effort
  - High control over parameters and workload
  - Relatively easy to incorporate future system designs as well
- ☹:
  - Least accurate
    - Unrealistic assumptions

Common mistake in selecting techniques

- Use of wrong technique
  - Analysts prefer technique they are comfortable with
  - Use it to solve every performance evaluation problem
    - A model that they can best solve, not one that can best solve the problem
  - Should have basic knowledge of all four techniques
- Always use two or more techniques
  - Do not believe models till validated by simulation
  - Do not believe simulation till validated by measurement
  - Do not believe measurement till predicted by model or simulation

Be aware of limitations of each technique!

Comparison of techniques

Technique Criterion	Modeling	Simulation	Measurement	Tracing
When? (stage)				
Time required				
Tools				
Accuracy				
Tradeoff-evaluation/ Forecasting Ability				
Environment Control				
Cost				
Saleability				

Comparison of techniques

Technique Criterion	Modeling	Simulation	Measurement	Tracing
When? (stage)	Anytime	Anytime	Post-prototype	Post-deployment
Time required	Small	Medium	Usually less than simulation	Less than measurement
Tools	Analysts	Programming languages	Instrumentation	Instrumentation
Accuracy	Low	Moderate	fn(env. params)	High
Tradeoff-evaluation/ Forecasting Ability	Easy	Moderate	Difficult	Very difficult
Environment Control	High control	High control	Low control over inputs to sub-components	Little control
Cost	Small	Medium	High	High
Saleability	Low	Medium	High	Highest

Course Outline

- Selection of metrics
- Performance Evaluation Methodologies
- **Workload selection**
- Measurements tools
- Analysis of measured data
- Visualization of results
- System Modeling
- Simulations
- Case studies
- Distributed monitoring infrastructures
- PA in the Research and Industrial communities