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# Introduction

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# Modeling (1)

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- Desirable performance characteristics of modern computer and communications systems
  - High throughput
  - Fast response time or transmission delay for users
  - High utilization of components

# Modeling(2)

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- Why modeling & performance evaluation?
  - It is hard for a complex system to be understood without proper tools
  - High cost of computing/communication systems
  - Irrevocability of certain design decisions



# Modeling (3)

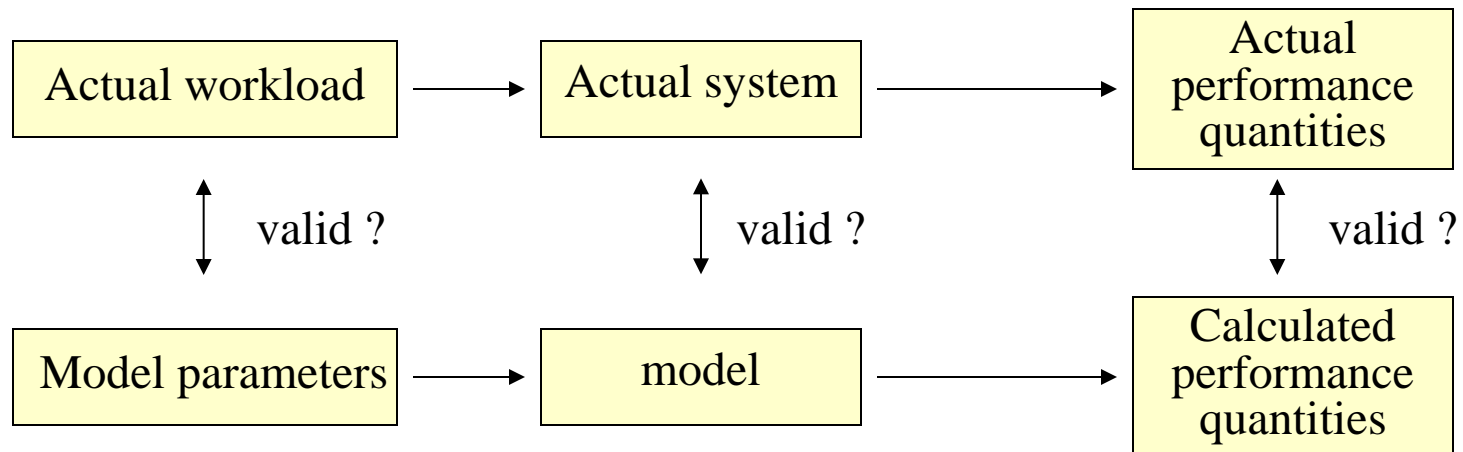
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- Model of a system
  - A representation of a system with consists of a certain amount of organized information about that system
  - A number of different models can be constructed for a system
  - All of the models represent the same system but either look at it from different standpoints and different purpose or contain different amount of details

# Modeling (4)

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- Usage of models
  - Calculation of performance measures
  - Consistency checking of performance measures
  - Prediction of performance measures
- Validation



# Performance Measures

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- A descriptor to represent some aspects of a system performance
- User-oriented
  - QoS (quality of service)
  - response time, delay, etc.
- System-oriented
  - Utilization
  - Throughput
  - Capacity

# Performance Evaluation Techniques (1)

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- Measurement technique
  - Performance monitoring: improvement, upgrade
  - Model validation
  - Model parameter specification
  - Job accounting
  - Etc.

# Performance Evaluation Techniques (2)

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- Analytic technique
  - Solution technique that leads to a functional relation between system parameters and a performance index, in terms of equations that are **mathematically solvable**.
  - **Least expensive method** for evaluating performance over a wide range of choices in system parameters
  - Relatively **hard to solve**



# Performance Evaluation Techniques (3)

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- Analytic technique
  - Probability model
    - Based on Probability & Queuing theory
    - A most important tool in system-level performance evaluation
    - Use unrealistic/untestable assumptions
    - The validation of model and parameters is needed

# Performance Evaluation Techniques (4)

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- Simulation technique
  - when the system is too complex to be solved mathematically
  - when the system does not exist
  - for the validation of an analytic model
  - Event-driven simulation program