NETWORK SIMULATION

1.1. Introduction

In a world of more and more data, computers, storage systems, and networks, the design and management of systems are becoming an increasingly challenging task. As networks become faster, larger, and more complex, traditional static calculations are no longer reasonable approaches for validating the implementation of a new network design and multimillion dollar investments in new network technologies.

Organizations depend more and more on new network technologies and network applications to support their critical business needs. As a result, poor network performance may have serious impacts on the successful operation of their businesses. In order to evaluate the various alternative solutions for a certain design goal, network designers increasingly rely on methods that help them evaluate several design proposals before the final decision is made and the actual systems is built.

A widely accepted method is performance prediction through ***simulation***. Therefore,

- ***Simulation*** is one of the most widely used techniques in network design and management to predict the performance of a network system or network application before the network is physically built or the application is rolled out.

- A ***Network Simulation*** is the attempts to imitate the real world behavior of a computer network or certain aspects of a computer network to analyze the captured information and transmitted data. This information can then be used to draw conclusion about the network.

- *A **Network Simulator*** is software that predicts the behavior of a computer network. Since communication Networks have become too complex for traditional analytical methods to provide an accurate understanding of system behavior network simulator are used.

- So simulation can be used as:

  1. Analysis tool for predicating the effect of changes of network parameters.
  2. Design tool to predicate the performance of new system (it is better to do simulation before Implementation of the new system).

1.2. When Simulation Is the Appropriate Tool

- Simulation enables the study of internal interaction of a subsystem with complex system.
- Informational, organizational and environmental changes can be simulated and find their effects.
- A simulation model helps us to gain knowledge about improvement of system.
- Simulation can be used with new design and policies before implementation.
- Simulating different capabilities for a machine can help determine the requirement.
- Simulation models designed for training make learning possible without the cost disruption.
- A plan can be visualized with animated simulation.
- The modern system (factory, wafer fabrication plant, service organization) is too complex that its internal interaction can be treated only by simulation.

1.3. When Simulation Is Not Appropriate

- When the problem can be solved by common sense.
- When the problem can be solved analytically.
- If it is easier to perform direct experiments.
- If cost exceed savings.
- If resource or time are not available.
- If system behavior is too complex(Like human behavior)

1.4. Systems and System Environments

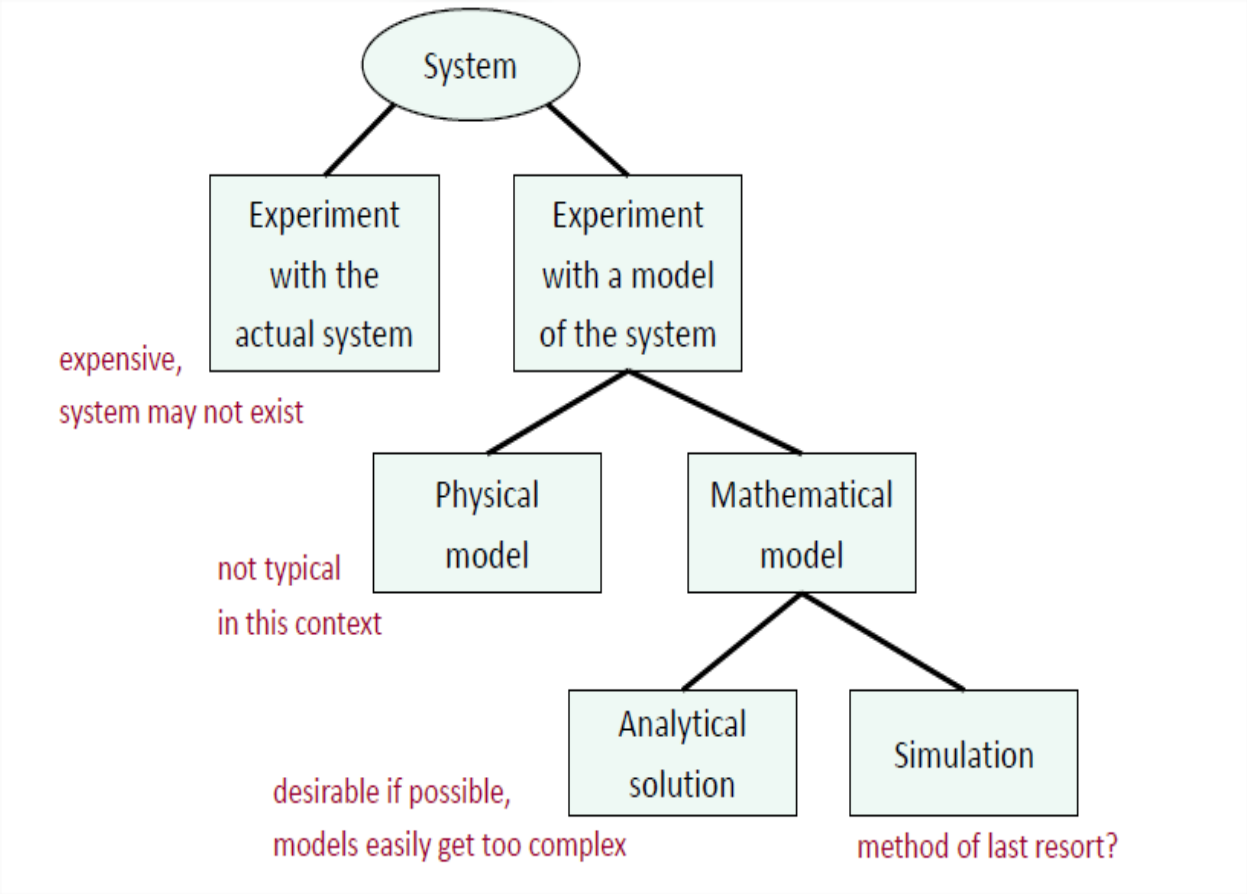
- A **system** is defined as a group of ***objects*** that are joined together in some regular interaction toward the accomplishment of some purpose.

- A system is often affected by changes occurring outside the system: **system environment.**

1.5. Components of a System

- An ***entity*** is an object of interest in the system.
- An ***attribute*** is a property of an entity.
- An ***activity*** represents a time period of specified length.
- The ***state of a system*** is defined to be that collection of variables necessary to describe the system at any time.
- An ***event*** is defined as an instantaneous occurrence that may change the state of the system.

1.6. Ways To Study A System



1.7. Why Network Simulations

1. Network Simulation is a very important modern technology. It can be applied to different types of networks and for different purposes.

2. Network simulators try to model the real world networks. The principal idea is that if a system can be modeled, then features of the model can be changed and the corresponding results can be analyzed.

3. Accomplish more reliability for network analysis.

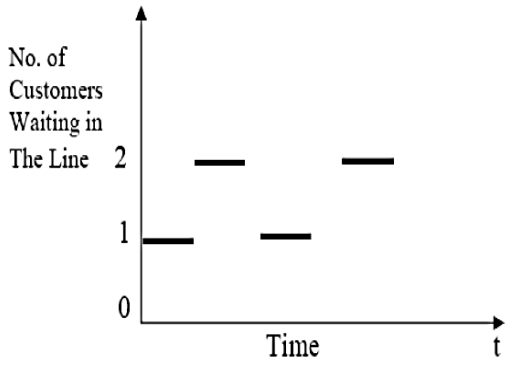
4. Less maintenance costs regarding the development of a new technology.

5. Different variables can be used to predict the behavior of the system.

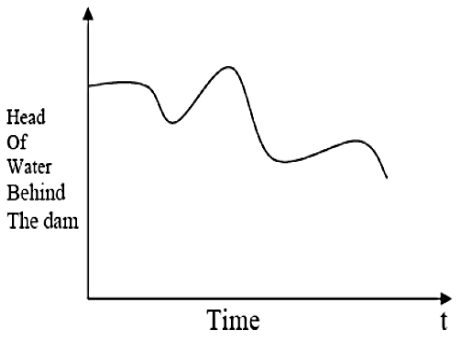
1.8. Types of Simulations

1. **Continuous simulations:** is one in which the state variables of the system change continuously over time real time is used: time increments as fine as possible to capture all state changes.

2. **Discrete simulations:** is one in which the state variables of the system change only at a discrete set of points in time system is observed at discrete times t0; t1; t2;…..



Discrete simulations



Continuous simulations