

# Lezione 1

## Introduction

### What is a discrete event system?

A system whose state changes based upon the occurrence of discrete events.

The state of the system is driven by two factors:

- Time  
Depends on time and physical parameters (eg. gravity, velocity, ...), basically changes every moment and how it changes depends on the parameters
- Event  
The state does not change unless there's an event, such as a customer doing something on a barber shop.

### What is a Deterministic system?

A system where no randomness is involved to the changes.

### What are discrete events?

When something changes at a distinct time and one or more state variables change.

How long do we have to observe the system?

- Discrete time  
Observing the system at predetermined moments, usually evenly spaced, such as a time tick (every second, minute, etc...).
- Continuous time  
Such models consider the system at the time of each event so the time parameter in such models is conceptually continuous.

## Performance modelling

Description, analysis and optimization of the **dynamic behavior** of a system.

It's used to understand the aspects of a system that are sensitive to performance modifications.

This type of modelling tries to be **fair** and also **efficient** i.e. giving the resources to every user as they need it (not too much or too little).

Initially, models were based on a **queue**.

Performance **DOES** matter, the response time of a system can make or break some deals (eg. amazon buying).

While modeling a system there can be many challenges, such as:

- Physical distance -> Modelling time and network latency, **which representation of time?**
- Partial failures of a system -> Need randomness and probability in the system. **Which model is to be used? Can we have no uncertain?**
- Workload scale -> Need to quantify the number of the users. **Can we escape the state-space explosion problem? (i.e. a linear change in number of variables means a exponential change in size of space model)**
- Resource sharing -> Need to quantify the percentages. **How do you model fractions of processes?**

## Qualitative modelling

When a system is modeled to verify its correctness, the variables are abstracted away.

## Quantitative modelling

Variables are used to model the performance of a system, we must take in account the value of the time variable and probabilities. This last one is also used to represent random actions, such as the user count.

(Performance modeling slides... 28-- fine)