



What-if analysis

Strategy

- ▶ Decision makers need to evaluate beforehand the impact of a strategic or tactical move
- ▶ But some process are just “too complex”
 - ▶ Mathematical models is too abstract
 - ▶ Building real systems with multiple configurations is too expensive
- ⇒ Simulation is a good compromise



Simulation

Simulation is the process of designing a model of a real system and conducting experiments with this model for the purpose either of understanding the behavior of the system or of evaluating various strategies (within the limits imposed by a criterion or set of criteria) for the operation of a system

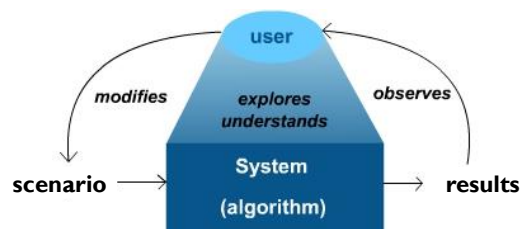
– Shannon

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What-if analysis

- ▶ A data-intensive simulation whose goal is to inspect the behavior of a complex system under some given hypotheses (called “scenarios”)
- ▶ What-if analysis \neq Forecasting



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Disadvantages

- ▶ Simulation can be expensive and time consuming
- ▶ Each model is unique
- ▶ Managers must choose solutions they want to try in scenarios
- ▶ Overfitting vs. non-repeatability

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Simulation tools

- ▶ Spreadsheets
 - ▶ Excel
 - ▶ Calc
 - ▶ Numbers
- ▶ Ad-hoc
 - ▶ Applix TMI
 - ▶ Powersim
 - ▶ QlikView
 - ▶ SAP BPS
 - ▶ SAS Forecast S.
 - ▶ ...

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Simulation tools

- ▶ **Write your own simulator!**
 - ▶ from scratch
 - ▶ in Java



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Taxonomy

- ▶ **Deterministic or Stochastic**
 - ▶ Does the model contain stochastic components?
- ▶ **Static or Dynamic**
 - ▶ Is time a significant variable?
- ▶ **Continuous or Discrete**
 - ▶ Does the system state evolve continuously or only at discrete points in time?

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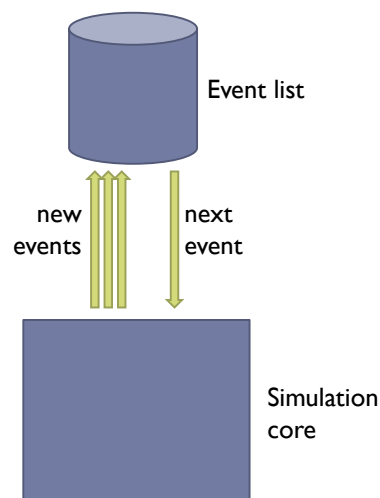
Discrete Event Simulation (DES)

- ▶ Discrete event simulation is dynamic and discrete, it can be both deterministic or stochastic
- ▶ Changes in state of the model occur at discrete points in time
- ▶ The model maintains a list of events (“*event list*”)
 - ▶ At each step, the scheduled event with the lowest time gets processed (i.e., the event list is a *priority queue*)
 - ▶ The event is processed, new events are scheduled

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Discrete Event Simulation (DES)

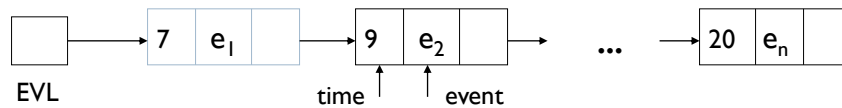


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The event list

- ▶ **An event contains at least two fields of information**
 - ▶ time of occurrence (timestamp): time when the event should happen
 - ▶ what the event represents



- ▶ Simulation terminates when the event list is empty
- ▶ Conceptually endless simulations, like weather, terminates at some arbitrary time

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The simulation core






- ▶ **Manager**
 - ▶ Process events
 - ▶ Defines the strategy
- ▶ **Additional data structures**
 - ▶ Auxiliary tasks

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