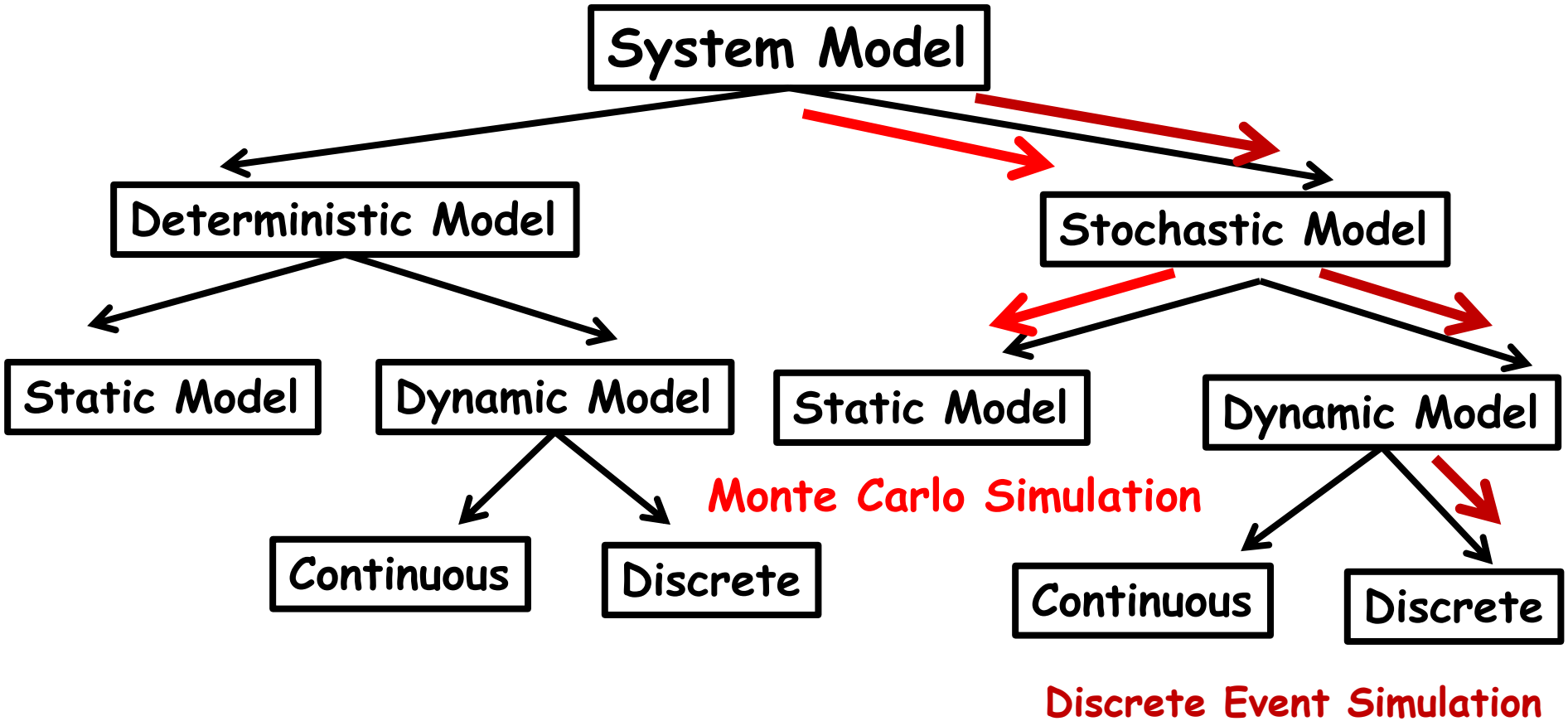
Discrete Event Simulation

Event Graphics

DES

- Introduction:
  - System
  - Models
  - Discrete event simulation and
  - Continuous simulation
- Discrete Event Simulation:
  - Time-Advance Mechanisms
  - Event Modeling of discrete dynamic systems
  - Single-Server Single-Queue Model
  - Event graphics
  - Monte Carlo Simulation

Models Taxonomy



Event Graph

is a way of

graphically representing DES models,

uses nodes and edges

to depict DES models.

Event Graph

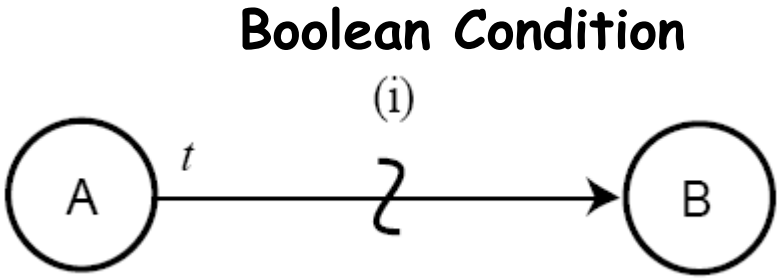
Nodes: denote events.

Edges: are used to schedule other events with two optional parameters:

a Boolean condition and/or

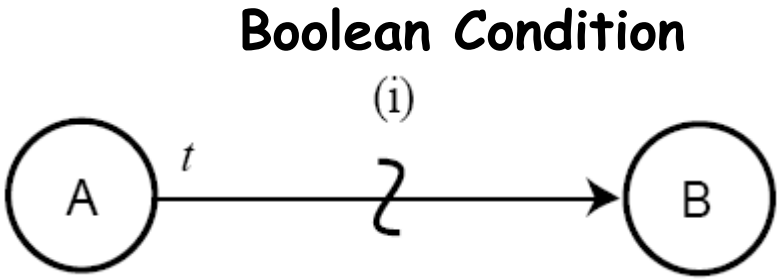
a time delay.

The Figure 1 given below shows the basic construct for event graphs.



Fundamental Event Graph Construct

Event Graph



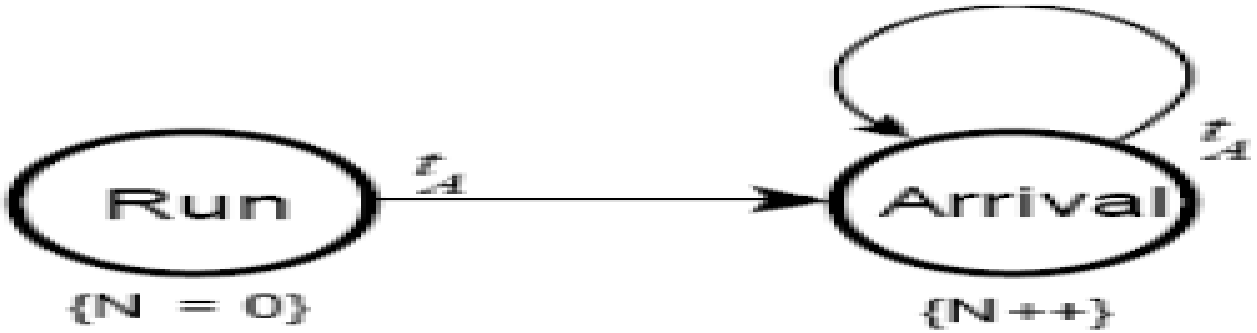
Fundamental Event Graph Construct

Figure 1 is interpreted as follows:

When event A occurs, event B is scheduled to occur at time t *if the condition i is true.*

Example: Event Graph

Arrival Process in Queuing Theory



We can interpret Figure as follows:

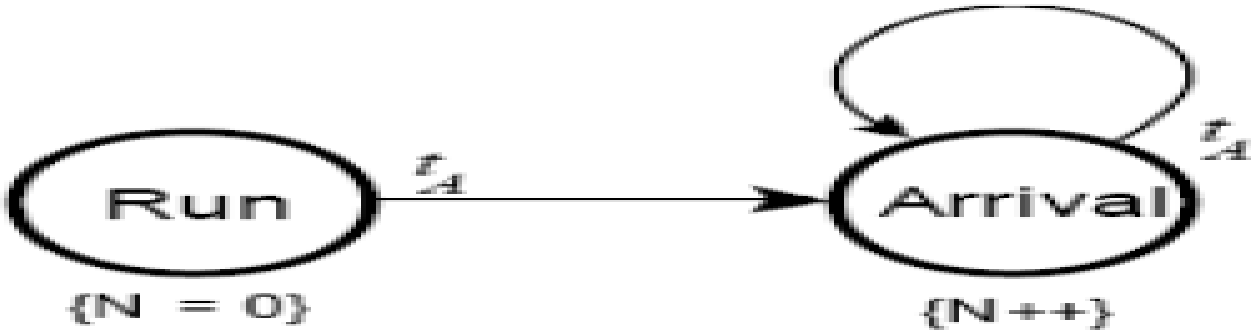
A Run event is scheduled to occur at simulation time 0.0.

With the occurrence of the Run event, first simulation time is set to 0.0 and the state variable N is set to 0.

Then an Arrival event is scheduled to occur at time t_A.

Example: Event Graph

Arrival Process in Queuing Theory



We can interpret Figure as follows:

In the same way, for each Arrival event that is run,

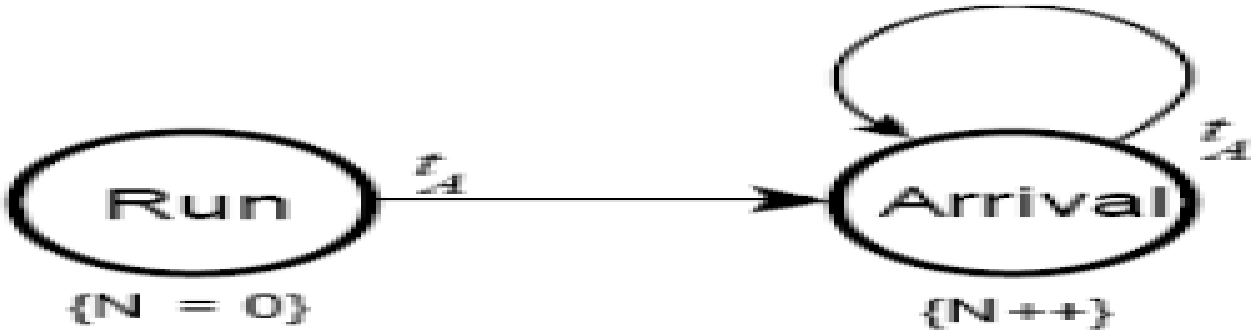
first the simulation time is updated to the time of the Arrival event, then

state variable N is incremented by one and

another Arrival event is scheduled to occur at time t_A.

Example: Event Graph

Arrival Process in Queuing Theory



We can interpret Figure as follows:

At the start of the simulation,

a **Run event** both initializes the state variables and schedules the initial events on the **Event List**.

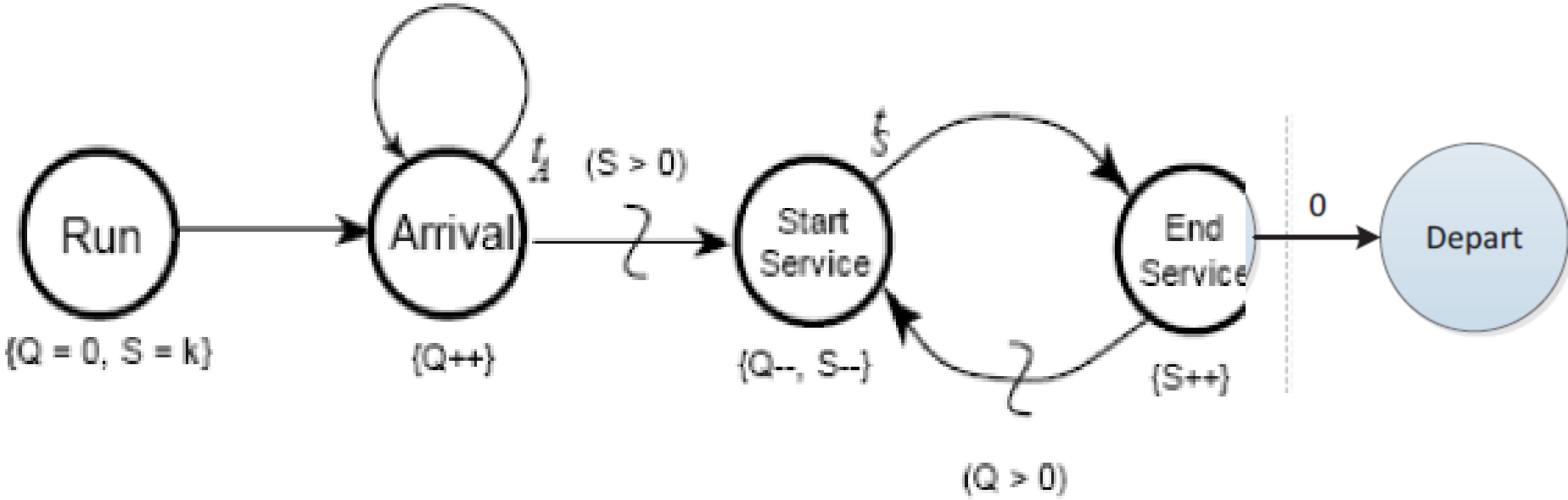
In the model, there exists single state variable,

numberArrivals (N), which counts the cumulative number of arrivals since time 0.0 and it is incremented by one upon the occurrence of each Arrival event.

Example: Event Graph

Arrival Process in Queuing Theory

the Multiple Server, One Queue case:



State variables and parameters for the model in Figure are:

- Q = # of customers in queue,
- S = # of available servers,
- t_A = inter-arrival times,
- t_S = service times,
- k = total number of servers.