Events

- Events are unique and represent an arrival of some new information into the system. For example:
  - Packet arrives from the link layer
  - Timer expires
  - Application generates a message
  - User closes an application
### Event Relationships

- Events have a defined position in time in relation to other events
  - **Causal Relationship**
    - One event cannot occur unless another event has already occurred
    - If Event A causes Event B, then A must precede B in time
    - If B, then A
  - **Random**
    - An event depends on nothing other than a probability distribution
      - A customer walks into a store
      - An application generates a request

### Delivery of Events

- All events are created as “future” events
- Based on event and perhaps current state, calculate a time at which the event will occur
- Insert event into a time-ordered queue
- Remove events from the head of the queue and deliver event:
  - Advance clock to event time
  - Call event handler method
  - Repeat until no more events on queue
### Event Generation

- After delivery of an event, call all random event generator:
  - If any random event is to happen, its generator will return an event and future time
- Event handlers can generate events. These are typically causal events
  - Example
    - your send() method is an event handler for the Event `SendApplicationMessage`
    - Your send method starts a timer which causes a `TimerEvent` to be put on queue with future time = now + timeout value

### PNSimulator Events are Atomic

- In PNSimulator, each event is fully handled before any new event handler is called
- This means that all of your handlers are *Threadsafe*
- This does not insure that your code can be shared however! That's your job
- What does this mean?
All context dependent variables must be allocated such that any invocation of a handler \( L \) for user \( N \) can retrieve \( \text{context}(L,N) \).

Usually in communications systems \( L \) is layer-specific.

For example, sequence numbers in TCP are distinct for each socket.

So you must keep your Node A variables distinct from your Node B variables.