



Timing Diagram

- The timing diagram is another view on the interaction model.
- Focus on conditions changing within and among Lifelines along a linear time axis.
- Used to show interactions when a primary purpose of the diagram is to reason about time.
- Describe compartments of both individual classifiers and interactions of classifiers.



Graphic Nodes

The following nodes and edges are typically drawn in a UML timing diagram .

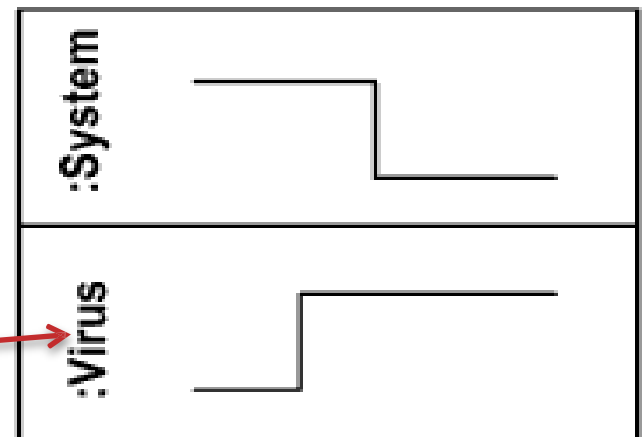
1. Lifeline
2. General value lifeline
3. State or Condition Timeline
4. Duration Constraint
5. Time Constraint
6. Destruction Event
7. Message

Lifeline

- Is a **named element** which represents an individual participant in the interaction.
- Represent only one **interacting entity**.
- See **lifeLine** from **sequence diagrams** for more details.
- Is represented by the **name of classifier** or the **instance** it represents. It could be placed inside diagram frame .

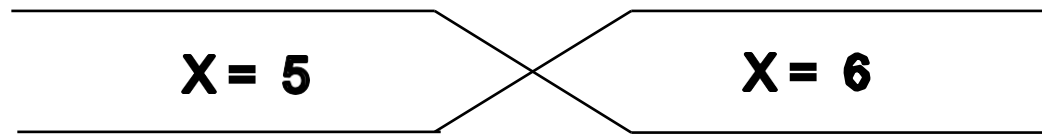
EX : Lifelines representing instances of System and Virus

Lifeline



General value lifeline

- Shows the value of the connectable element as a function of time.
- Value is explicitly denoted as text.
Crossing reflects the event where the value changed.

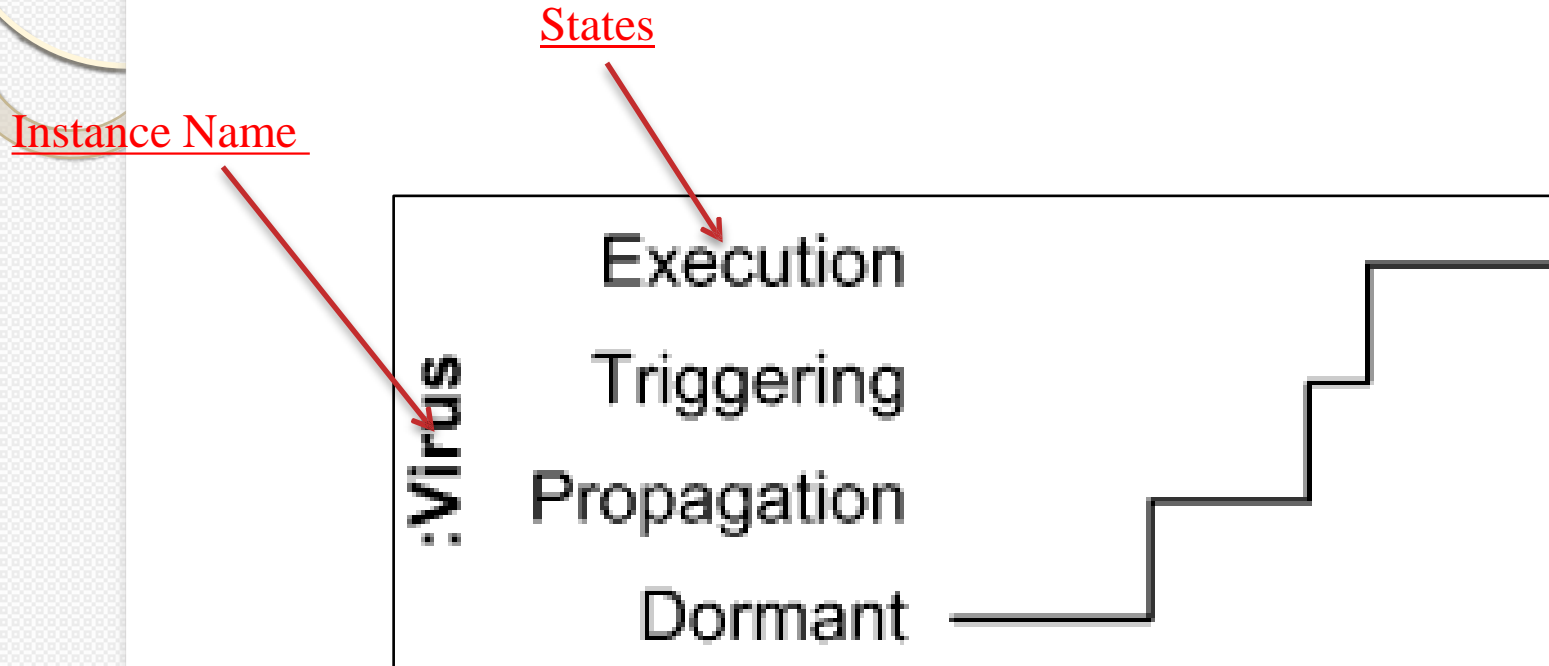




State or Condition Timeline

- This is the state of the classifier or attribute, or some testable condition, such as an discrete or enumerable value for attribute.
- It is also permissible to let the state-dimension be continuous as well as discrete.
- This is illustrative for scenarios where certain entities undergo continuous state changes, such as temperature or density.

State or Condition Timeline



Timeline shows Virus changing its state between **Dormant**, **Propagation**, **Triggering** and **Execution** state

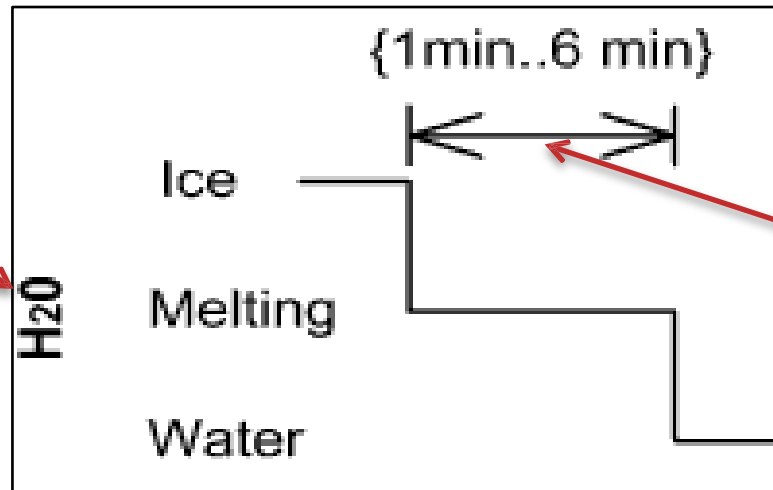


Duration Constraint

- Is an interval constraint that refers to a duration interval.
- The duration interval is duration used to determine whether the constraint is satisfied.
- The **semantics** of a Duration constraint is inherited from constraints.
- If constraints are violated, traces become negative which means that system is considered as failed.

Duration Constraint

Classifier Name



Duration Constraint

EX : Ice should melt into water in 1 to 6 minutes

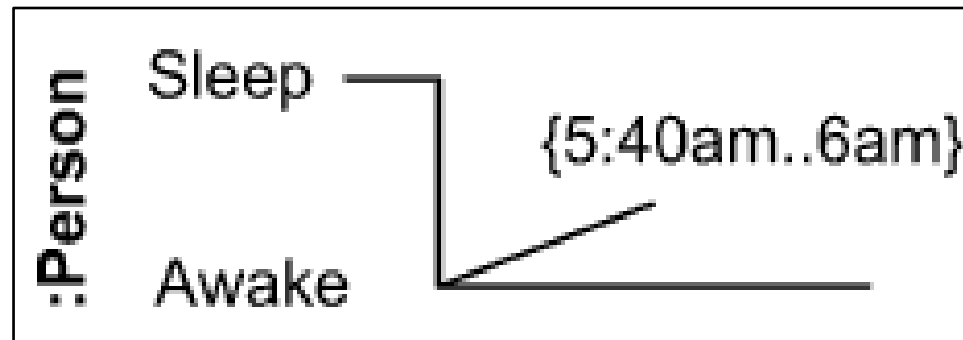


Time Constraint

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Time Constraint

- Time constraint is shown as graphical association between a **time interval** and the **construct** that it constrains.
- Typically this graphical association is a small line, between an occurrence specification and a time interval.



Person should wake up between 5:40 am and 6 am

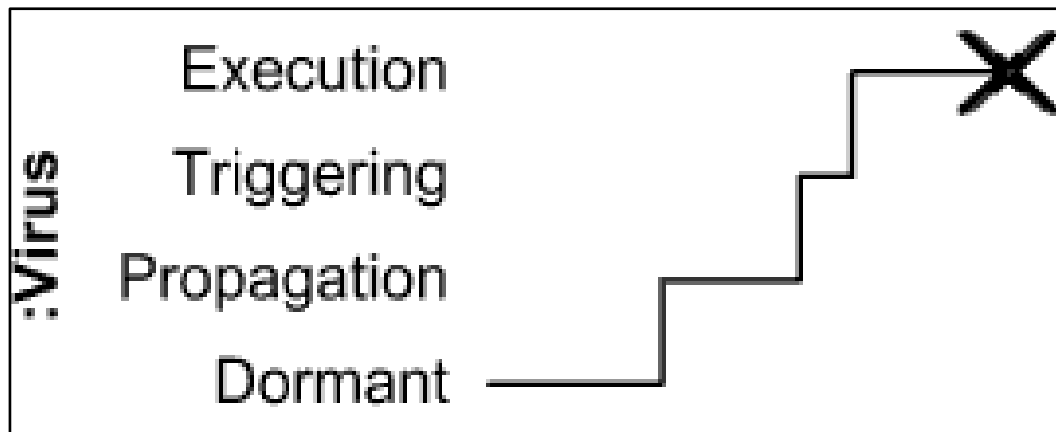


Destruction Event

- Is **event** which represents the **destruction** of the **instance** described by the lifeline. containing the Occurrence Specification that references the destruction event.
- It may result in the subsequent destruction of other objects that this object owns by **composition**.

Destruction Event

- The destruction event is depicted by a cross in the form of an **X** at the end of a timeline.

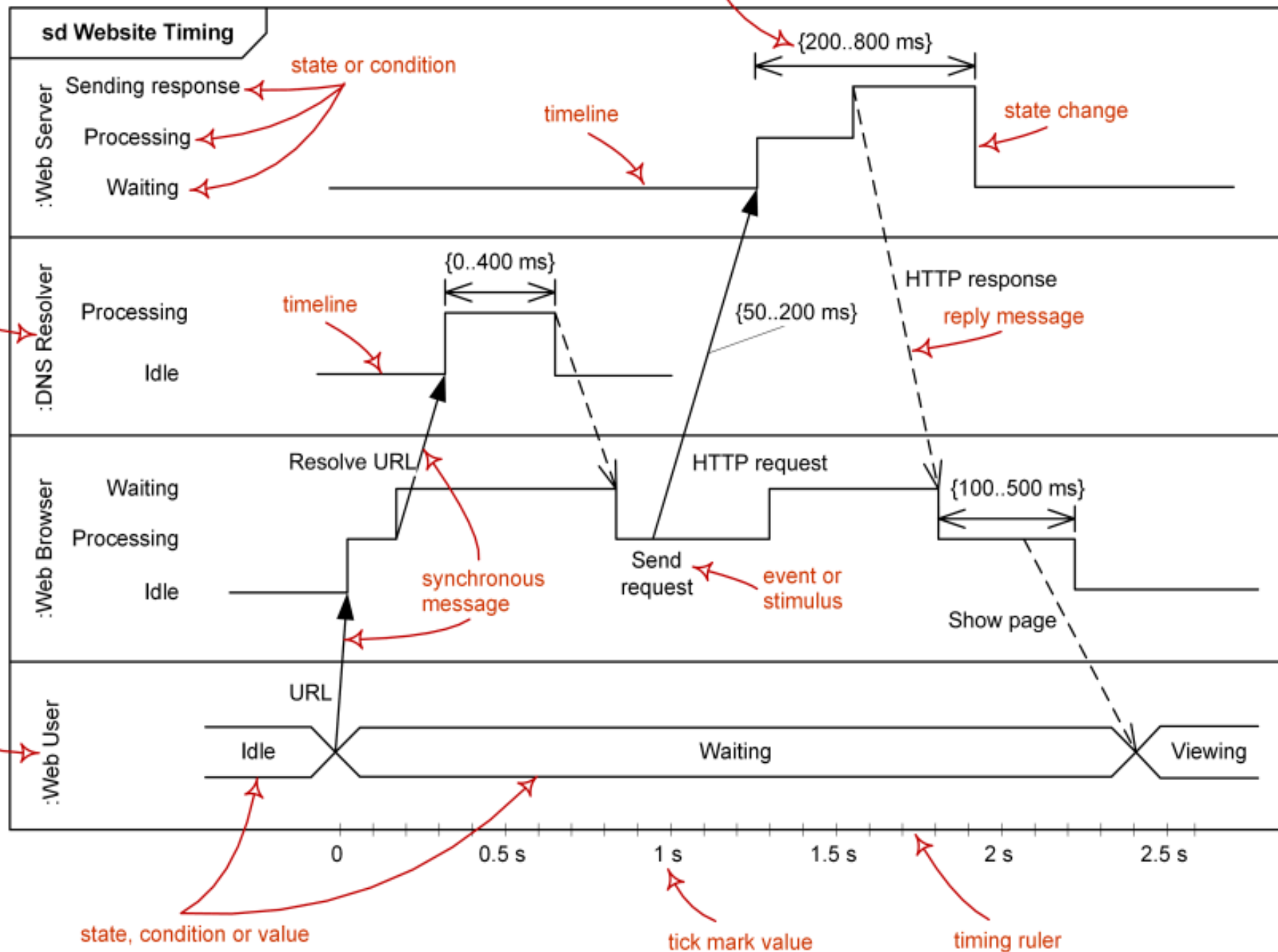


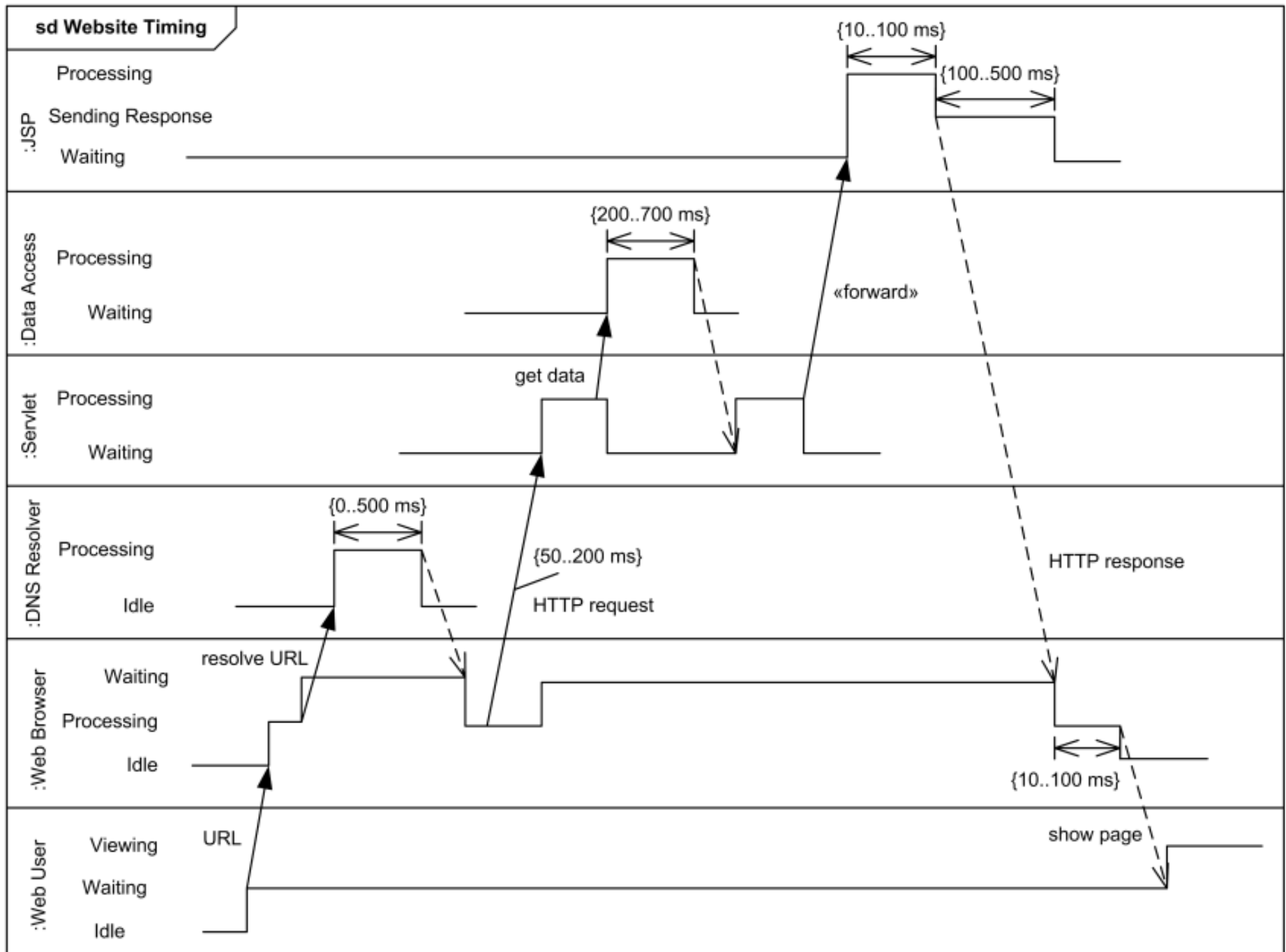
Virus lifeline is terminated



Examples :

- An example of timing diagram which shows some duration constraints for a fabricated website to evaluate how long web user should wait to see something rendered on his display.







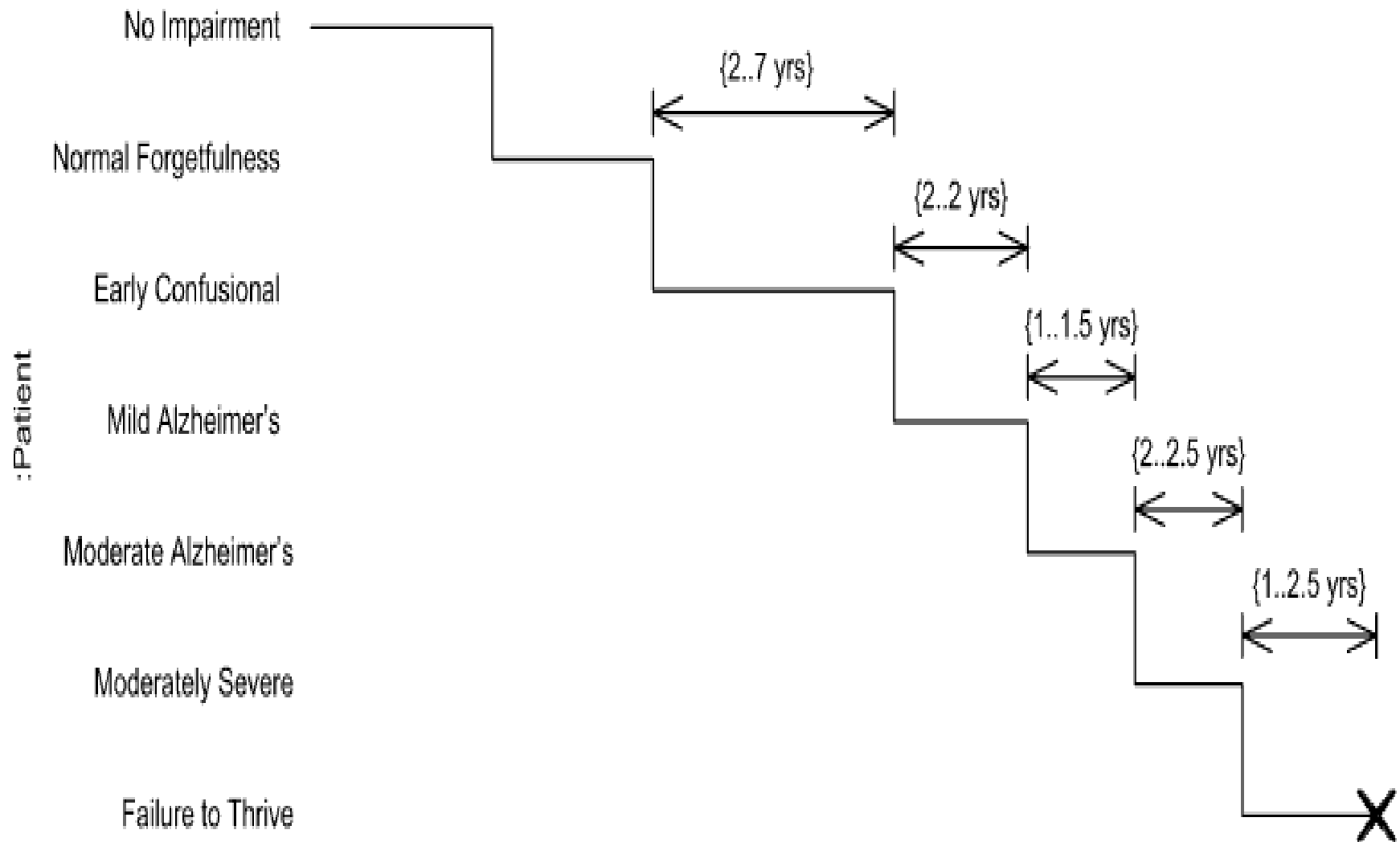
Stages of Alzheimer's Disease

- **Alzheimer's disease (AD)** is a progressive, ultimately fatal brain disease that causes loss of memory and intellectual abilities. The cause of the disease is unknown. AD has no cure and is one of the leading causes of death.
- For Alzheimer's disease doctor may use a diagnostic framework with three to seven levels (stages). Progression through these stages may last from 8 to 10 years, and in some cases up to 20 years from the time neuron changes start.

Seven stage Alzheimer's disease

- **No Impairment, Normal State.** Memory and cognitive abilities appear normal.
- **Normal Aged Forgetfulness.** Half or more of the persons over the age of 65 experience subjective complaints of cognitive and/or functional difficulties, e.g. they can no longer recall names as well as they could 5 or 10 years previously.
- **Early Confusional, Mild Cognitive Impairment.** Problems with word retrieval, planning, organization, misplacing objects, and forgetting recent learning affect home and work environments. Duration 2-7 years.
- **Late Confusional, Mild Alzheimer's.** Recent events and conversations are increasingly forgotten. Still know selves and family, but have problems carrying out sequential tasks, including cooking, driving, and home management tasks. Duration about 2 years.
- **Early Dementia, Moderate Alzheimer's.** No longer able to manage independently in community. Unable to recall personal history details and contact information. Frequently disoriented to place and or time. Duration about 1.5 years.
- **Middle Dementia, Moderately Severe Alzheimer's.** Total lack of awareness of present events and not able to accurately remember the past. Lost ability to dress and bathe independently. Lasts approximately 2.5 years.
- **Late or Severe Dementia, Failure to Thrive.** Severely limited intellectual ability. Communicate through short words or cries. Health declines considerably as body systems begin to shut down. Duration is 1 to 2.5 years.

sd Alzheimer's Stages





ATM Timing Diagram

- Participants
 - Customer
 - Card Reader
 - Bank System



ATM Timing Diagram

- States of participants
 - Customer
 - Card in Hand
 - Insert card
 - Enter PIN
 - Select Account
 - Select Amount



ATM Timing Diagram

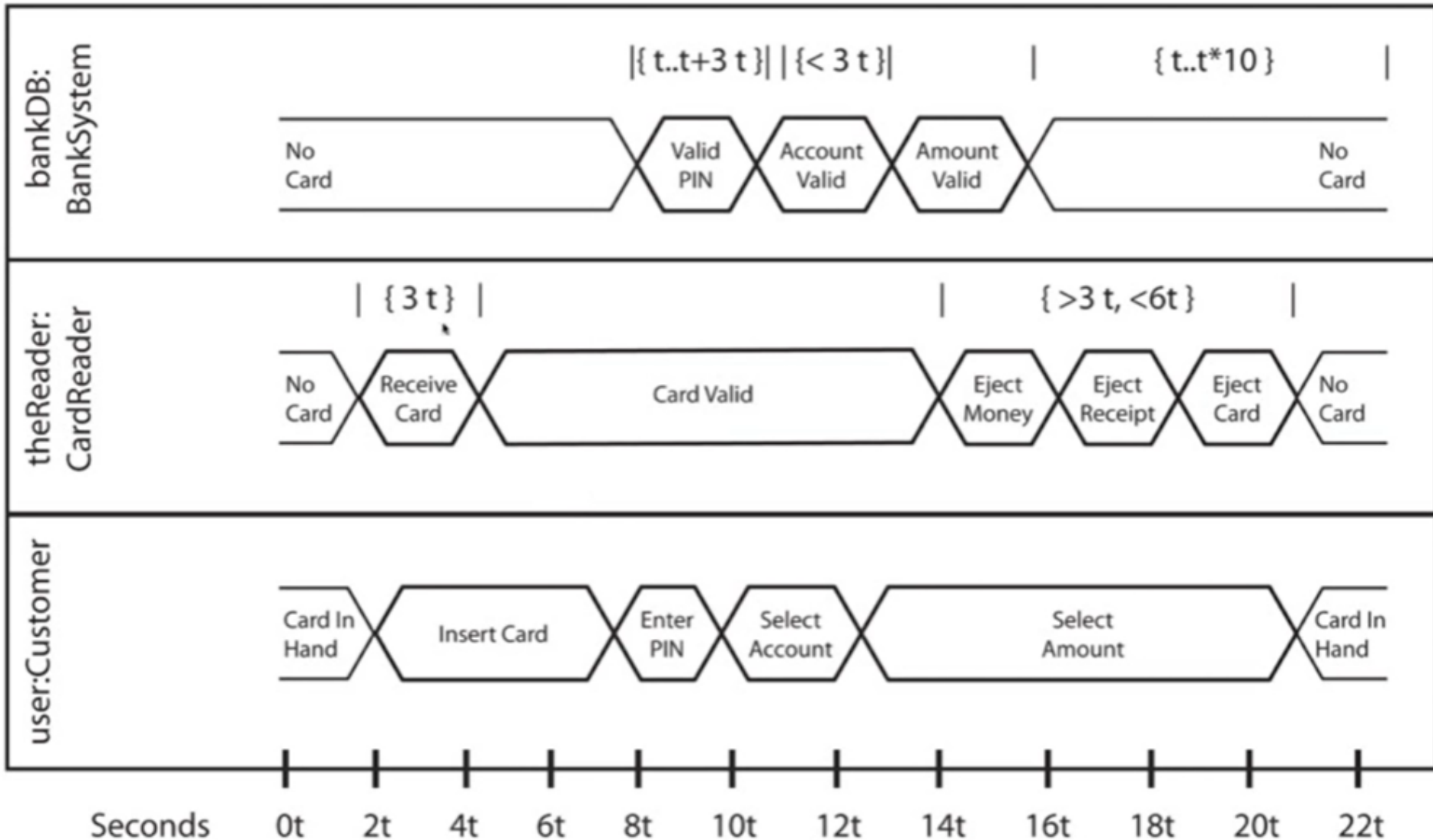
- States of participants
 - Card Reader
 - No Card
 - Receive card
 - Card Valid
 - Card Invalid
 - Invalid Amount
 - Eject Money
 - Eject Receipt
 - Eject Card

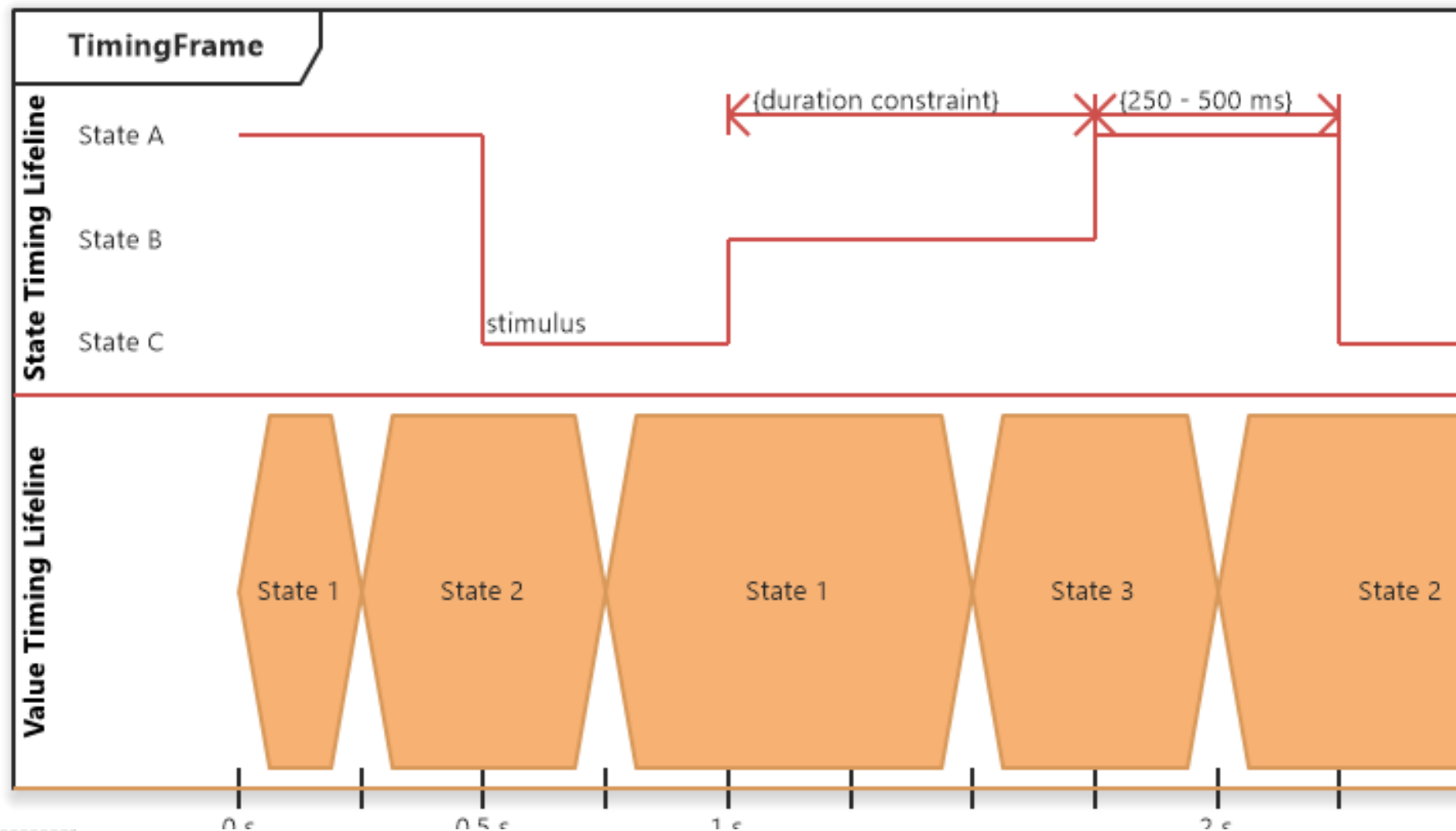


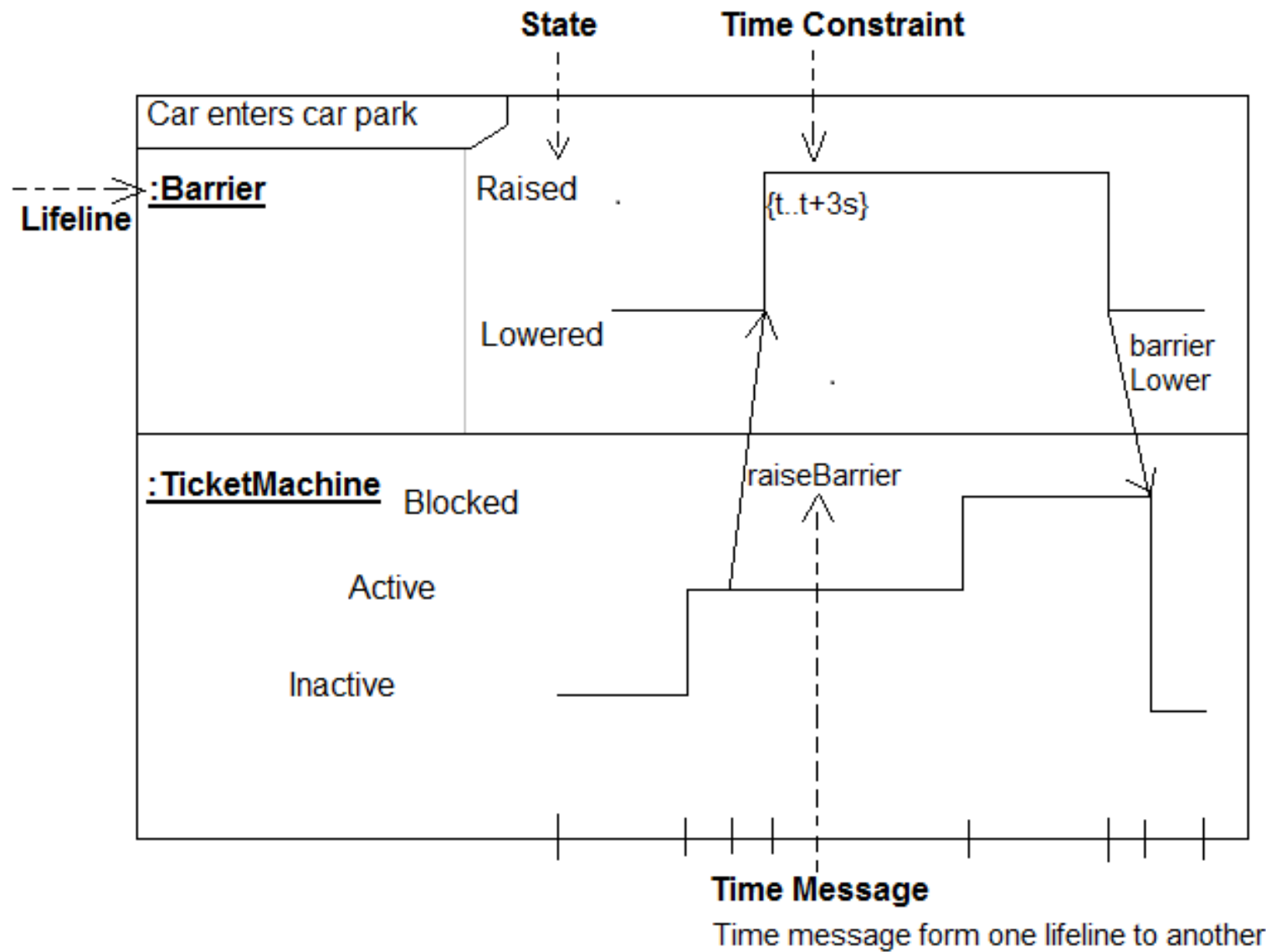
ATM Timing Diagram

- States of participants
 - Bank System
 - No Card
 - Valid PIN
 - Invalid PIN
 - Account Valid
 - Amount Valid
 - Amount Invalid
 - Account Invalid

ATM Timing Diagram

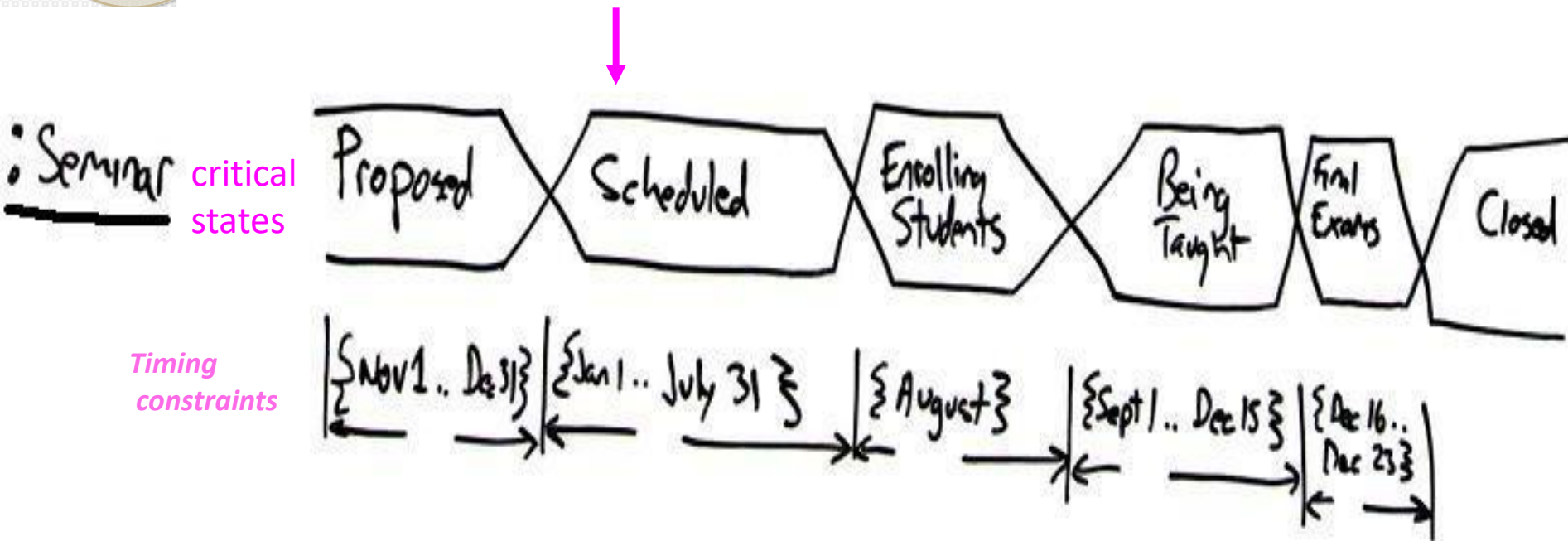






Interaction Diagram: Timing Diagram

- ❑ To explore the behaviors of 0..* objects throughout a given period of time.
- ❑ Two basic flavors: *concise* notation and robust notation

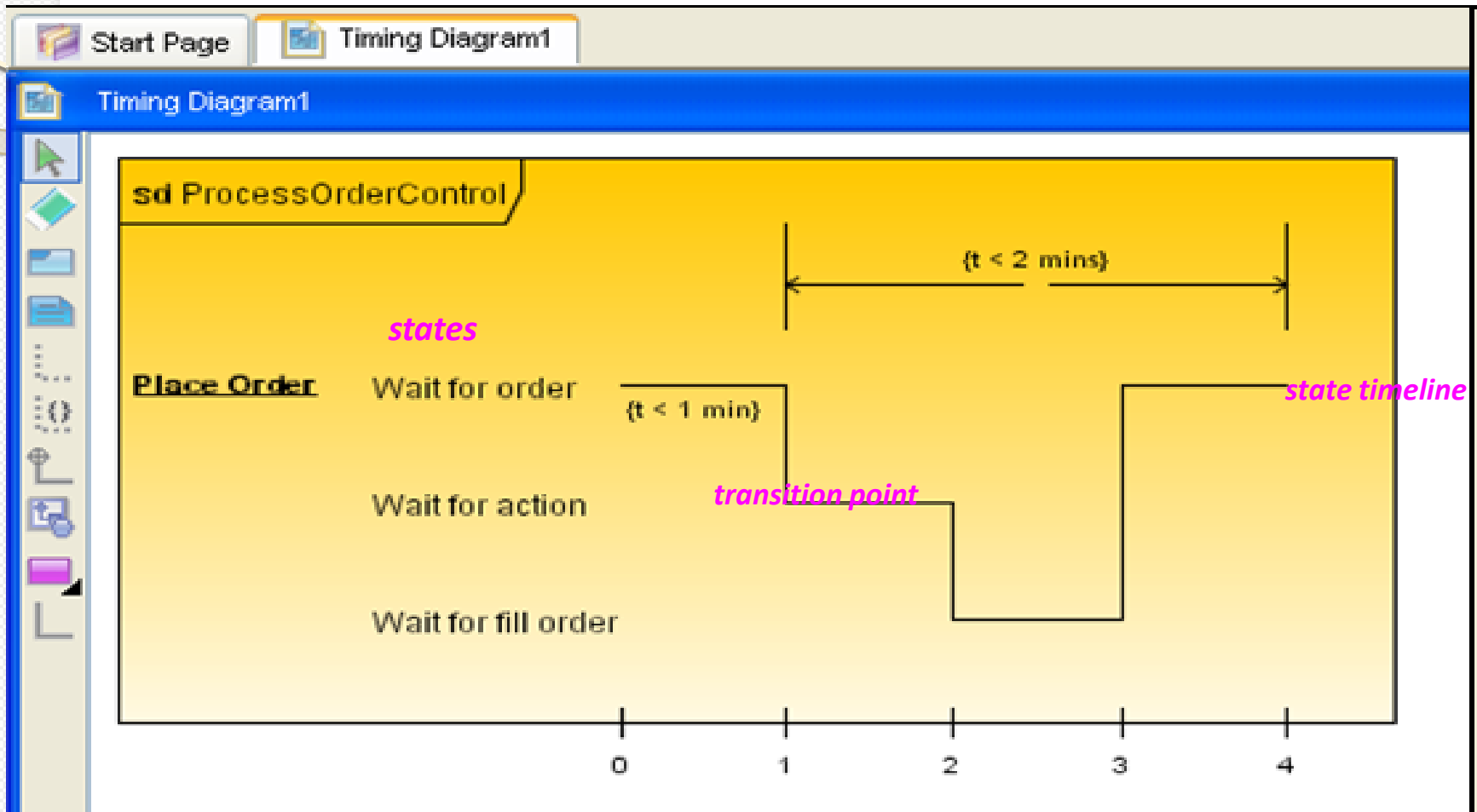


The lifecycle of a single seminar

- ❑ The *critical states* – Proposed, Scheduled, Enrolling Students, Being Taught, Final Exams, Closed
- ❑ The two lines surrounding the states are called a *general value lifeline*.
- ❑ When the two lines cross one another it indicates a *transition point* between states.
- ❑ *Timing constraints* along the bottom of the diagram, indicating the period of time during which the seminar is in each state.

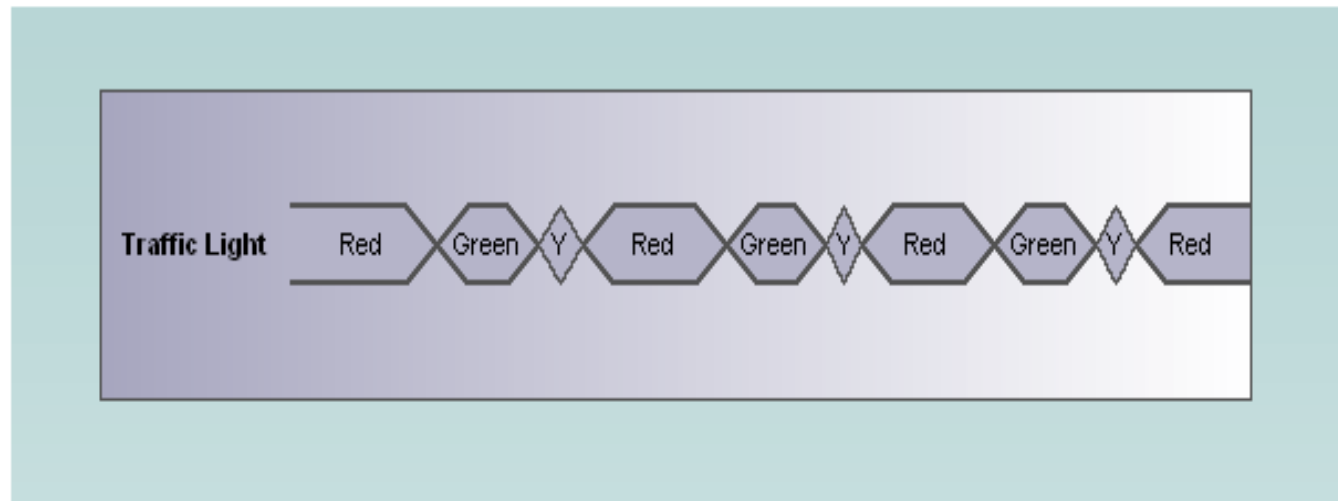
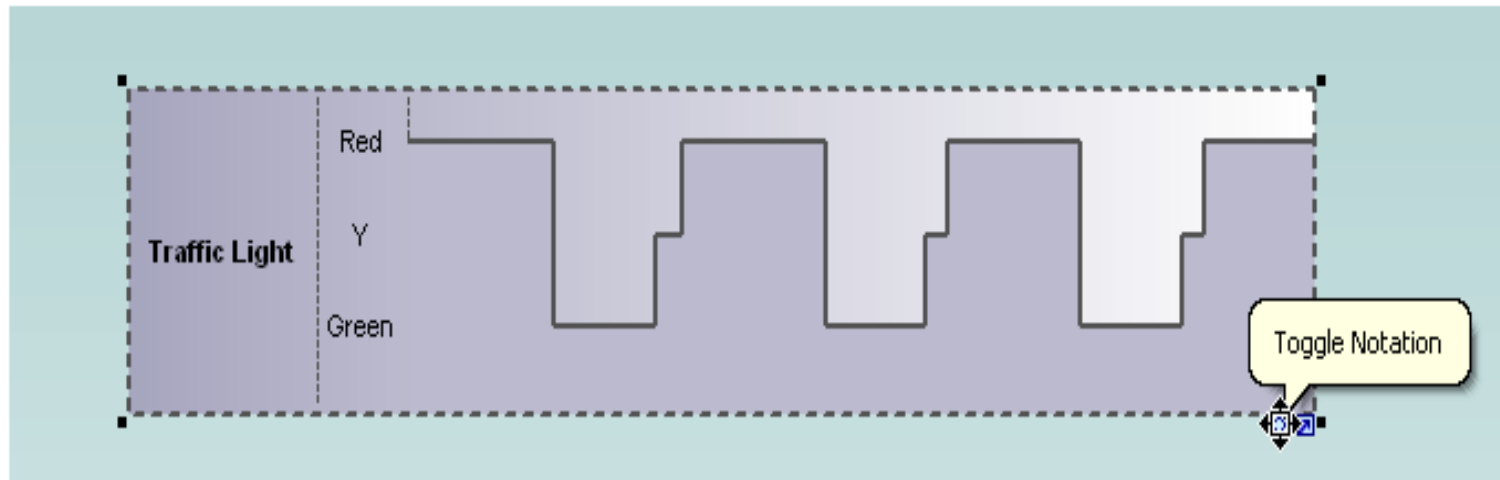
Interaction Diagram: Timing Diagram (robust notation)

<http://www.visual-paradigm.com/highlight/highlightuml2support.jsp>



timing ruler w. tick marks

Can you transform this into a concise notation?



[4] The different states of the traffic light are shown