Graphical Systems Modeling
with UML / SysML

State machine diagrams

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**Perspectives - views:**

**architecture**
- class diagram
- object diagram
- composite structure diagram
- package diagram

**behavior**
- sequence diagram
- activity diagram
- state machine diagram
- interaction overview diagram
- communication diagram
- timing diagram
- package diagram

**Logical view**

**Use case view**
- use case diagram
- package diagram

**Dynamic View**

**Deployment View**
- deployment diagram
- package diagram

**Implementation View**
- component diagram
- package diagram

**system scope & functionality**
- use case diagram
- package diagram
State machine diagram

- state - a situation during which some condition holds
  - static or dynamic

- state machine - behavior of a single object
  - sequence of states it goes through - in reaction to events

- state machine diagram - graphical representation of states and transitions
  - directed graph

- states
- transitions
- events
- actions
- guard conditions
State machine diagram

- **state**
  - a situation during which some condition holds
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- **state machine**
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- **state machine diagram**
  - graphical representation of states and transitions
  - directed graph

- **examples:**
  - switch: on/off
  - washing machine: prewash, wash, rinse, spin, dry
  - ATM: idle, active, out-of-service
  - project: submitted, evaluated, accepted, rejected, monitored, audited, finished, delayed
State machine diagram

- **state** - a situation during which some condition holds
  - static or dynamic

- **state machine** - behavior of a single object
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- **symbol**: rounded rectangle
- **name**: capital letter
- **nouns**: Washing, Drying
- **adjectives**: Idle, Active, Processed, etc.
COMPARTMENTS
State machine diagram

- sections / compartments:
  - name
  - internal activities - entry / exit / do
  - internal transitions
  - decomposition
Example - fax machine

- state parameters
- entry / exit / do actions
- transition
Example - mobile phone

• composite states
• transitions
• guard conditions
Example - mobile phone

- composite states
- transitions
- guard conditions
Example - ATM

- high level behavioral diagram
STATES - SIMPLE & COMPOSITE
States

- **simple** - no sub-states
  - no regions

- **composite** - divided into two or more substates - sequential or concurrent

- **substates / submachine states**
HISTORY
History

- **shallow** - come back to the most recent active substate
- **deep** - come back to the most recent active configuration
PSEUDOSTATES
Pseudostates

- abstract
- activity diagrams $\rightarrow$ state machine diagrams
  - forks / joins
  - decisions
  - junctions
  - entry / exit points
TRANSITIONS
Transitions

- notation:

```
<triggers> [ <guard conditions> ] / <behavior expressions>
```

- **trigger** - events that may induce state transition:
  - signals
  - calls
  - time events
  - change events

- **guard conditions** - must be met for transition to be triggered

- **behavior expressions** - operations, attributes, actions sequence etc. performed during transition
SUMMARY
State machine diagram

Steps:

1. identify objects that need state diagrams
2. identify their states
3. define hierarchy of states, substates, orthogonal regions
4. link states and substates with transitions
5. add pseudostates
6. specify details of states and transitions using complete and appropriate notation