T E A C H I N G

D0020E PROJECT IN COMPUTER SCIENCE 2022/2023 LECTURE 7.1: MODELING

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AS YOU CAN CLEARLY SEE IN SLIDE 397...
GAAAAH!
"POWERPOINT" POISONING.
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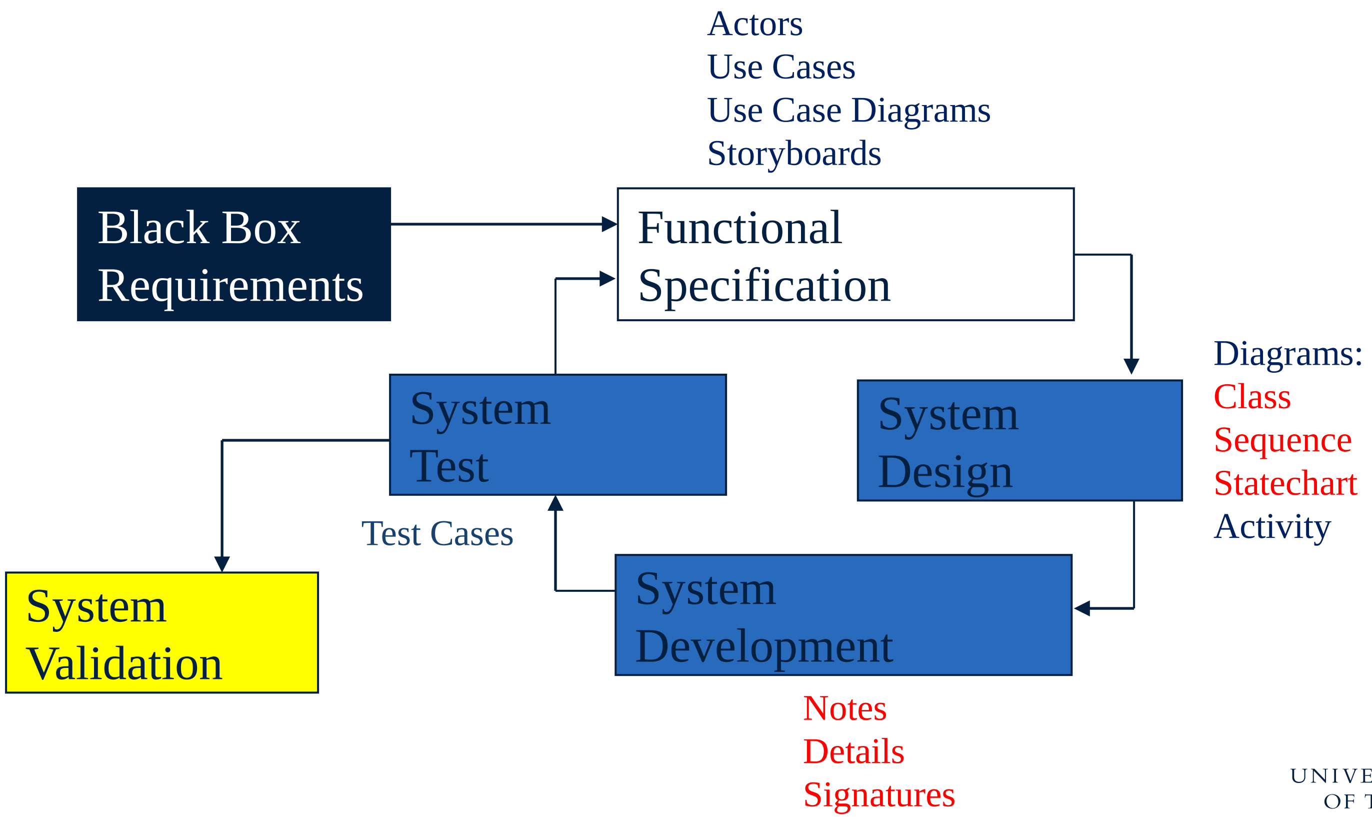
Recap : UML artefacts



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Today

- Modeling the run-time view!
- Software Design
  - Metrics
- Classification
- Code Review

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Modeling using UML

Diagrams are the main artefacts of UML.
(These are not a sequence of steps!!!!)

- Use case diagrams
  - Functional behavior of the system as seen by the user.
- Activity diagrams
  - Dynamic behavior of a system expressed as a flowchart.
- Class diagrams
  - Static structure of the system: Objects, Attributes, and Associations.
- Sequence diagrams
  - Dynamic behavior between actors and system objects.
- Statechart diagrams
  - Dynamic behavior of an individual object.
- …

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Use Case Example

Name: `Purchase ticket`

Participating actor: `Passenger`

Entry condition:

- `Passenger` standing in front of ticket distributor.
- `Passenger` has sufficient money to purchase ticket.

Exit condition:

- `Passenger` has ticket.

Event flow:

1. `Passenger` selects the number of zones to be traveled.
2. Distributor displays the amount due.
3. `Passenger` inserts money, of at least the amount due.
4. Distributor returns change.
5. Distributor issues ticket.

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Sequence diagrams

- How do we design the flow for coders?
- What information do they need?

Example

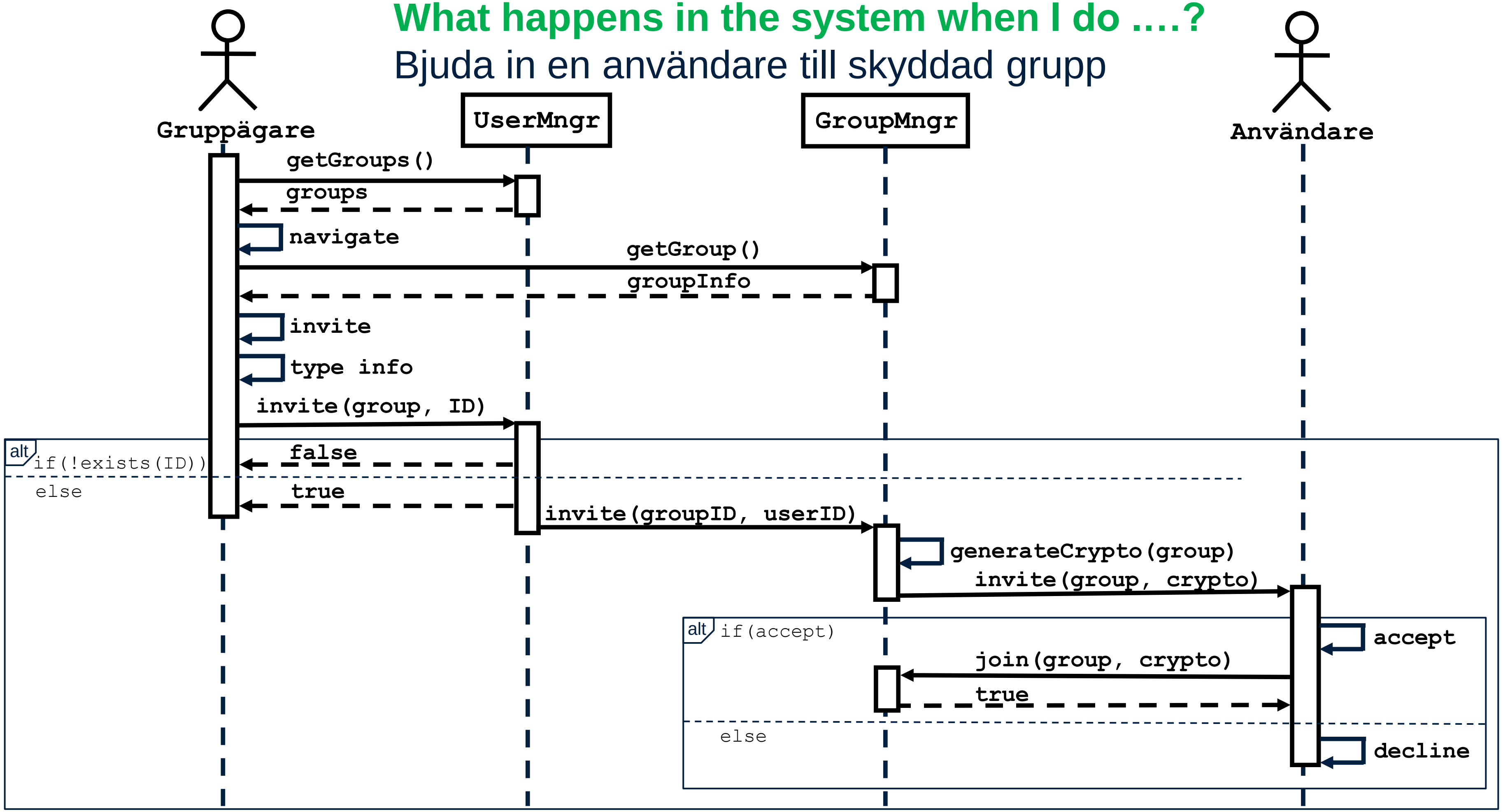
- A group communication app
  - Which categories of users exist?
  - What functions should exist?
  - How do I achieve ….?
  - What can I do with the app when I am at ….?
  - What happens in the system when I do ….?
  - How is …. Implemented?

Användarfallsbeskrivning

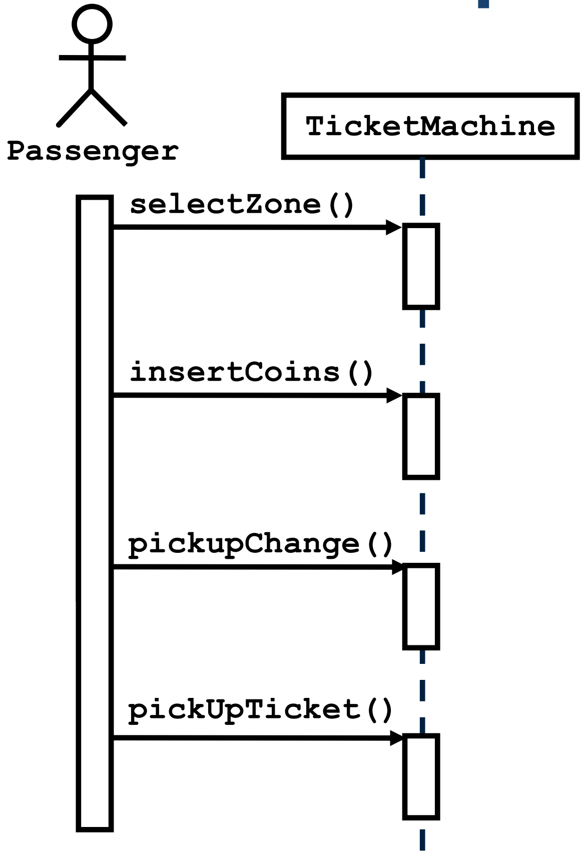
- Användarfall: Bjuda in en användare till skyddad grupp
  - Aktörer: Gruppägare, Användare
  - Start: Gruppägaren är inloggad och är på startvyn
  - Händelser:
    - Välj ”Groups”
    - Navigera till rätt grupp
    - Press ”Select”
    - Press “Options”
    - Press “Add/invite”
    - Skriv in kontaktinformation
    - Användaren får notis om inbjudan
      - Användaren väljer “accept”
  - Avslut: En ny användare har bjudits in till gruppen

What happens in the system when I do ….?

Bjuda in en användare till skyddad grupp

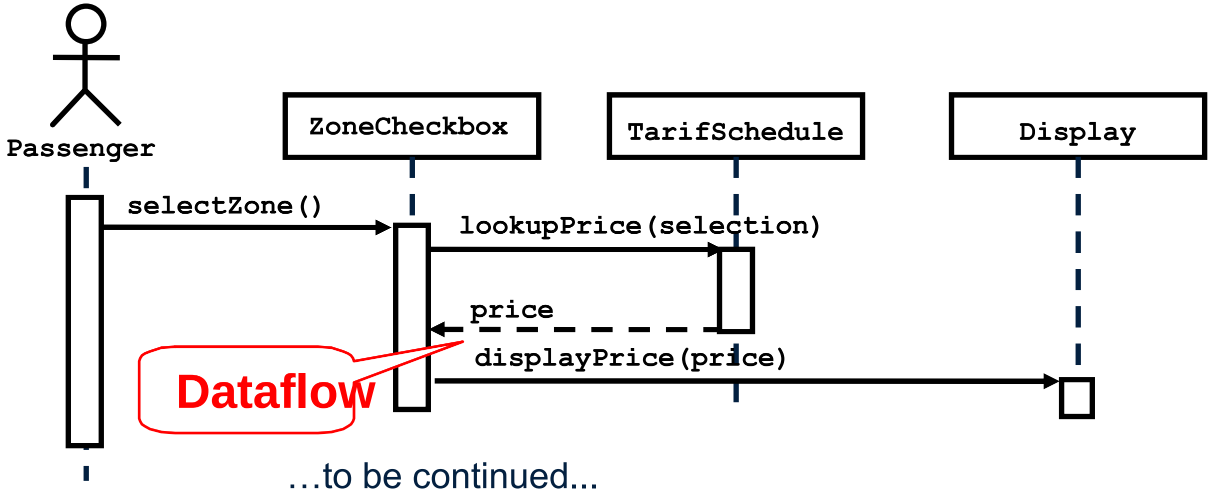


UML Sequence Diagrams



- In requirements analysis
  - To refine use case descriptions
  - to find additional objects (“participating objects”)
- In system design
  - to refine subsystem interfaces
- Columns = classes
- Arrows = messages
- Narrow rectangles = *activations*
- Dashed lines = lifelines

UML Sequence Diagrams: Nested Messages



…to be continued...

- The source of an arrow indicates the activation which sent the message
- An activation is as long as all nested activations

Sequence Diagram Observations

- UML sequence diagram represent **behavior** in terms of **interactions**
  - ***Run-time view***
- They complement class diagrams, which represent **structure**
  - ***Compile-time view***
- Very useful for **finding participating objects**
- Time-consuming to build but worth the investment where interactions are complex

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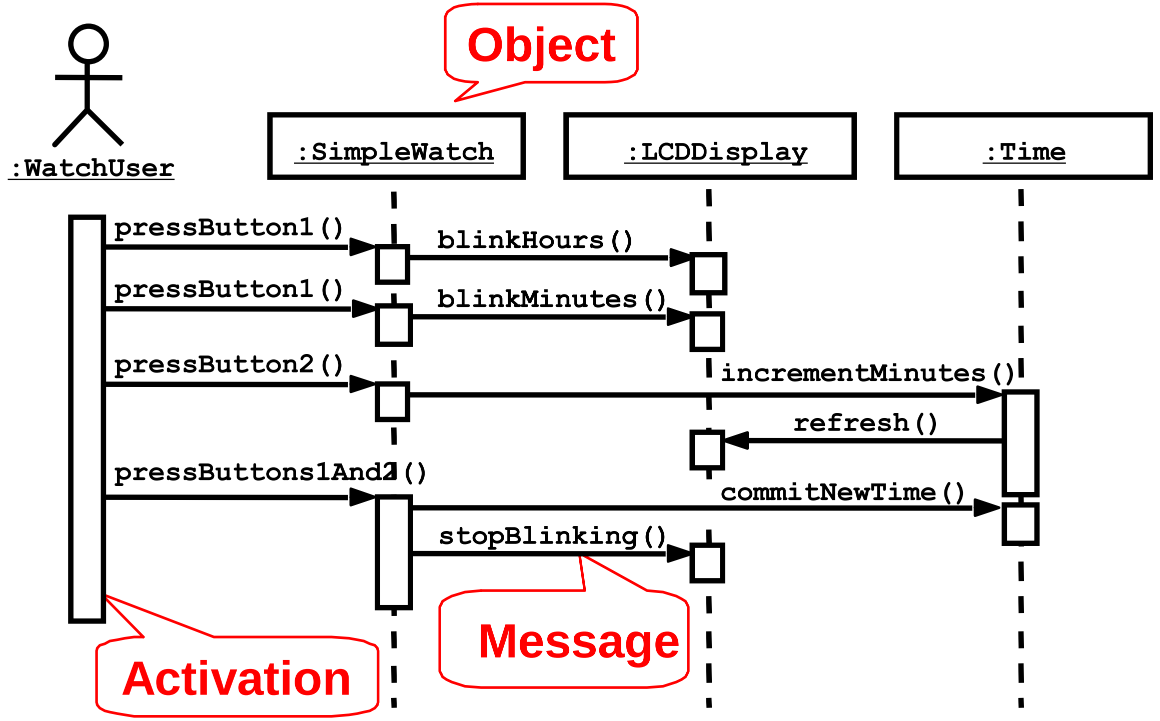
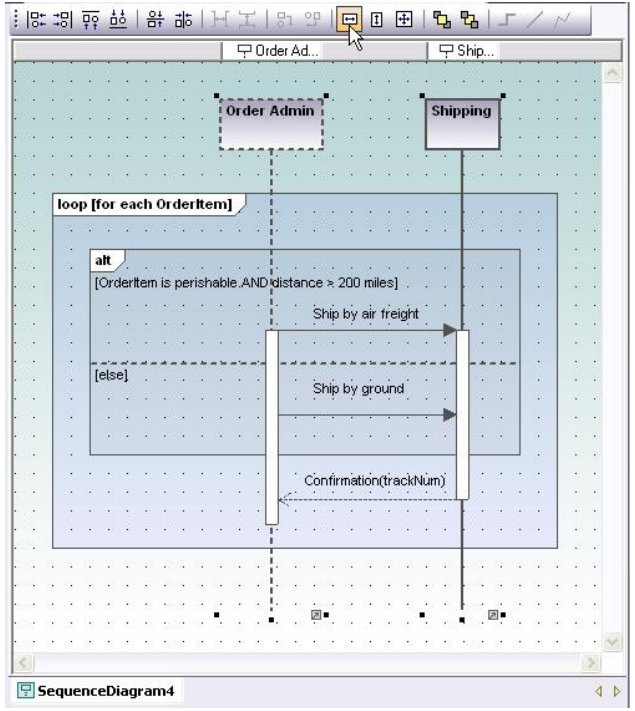
Sequence Diagram



Sequence Diagrams – Interaction Frames

- alt (conditional)
- opt (optional)
- par (run in parallel)
- loop (iteration)
- region (one thread)
- neg (invalid)
- ref (reference: defined in another diagram)



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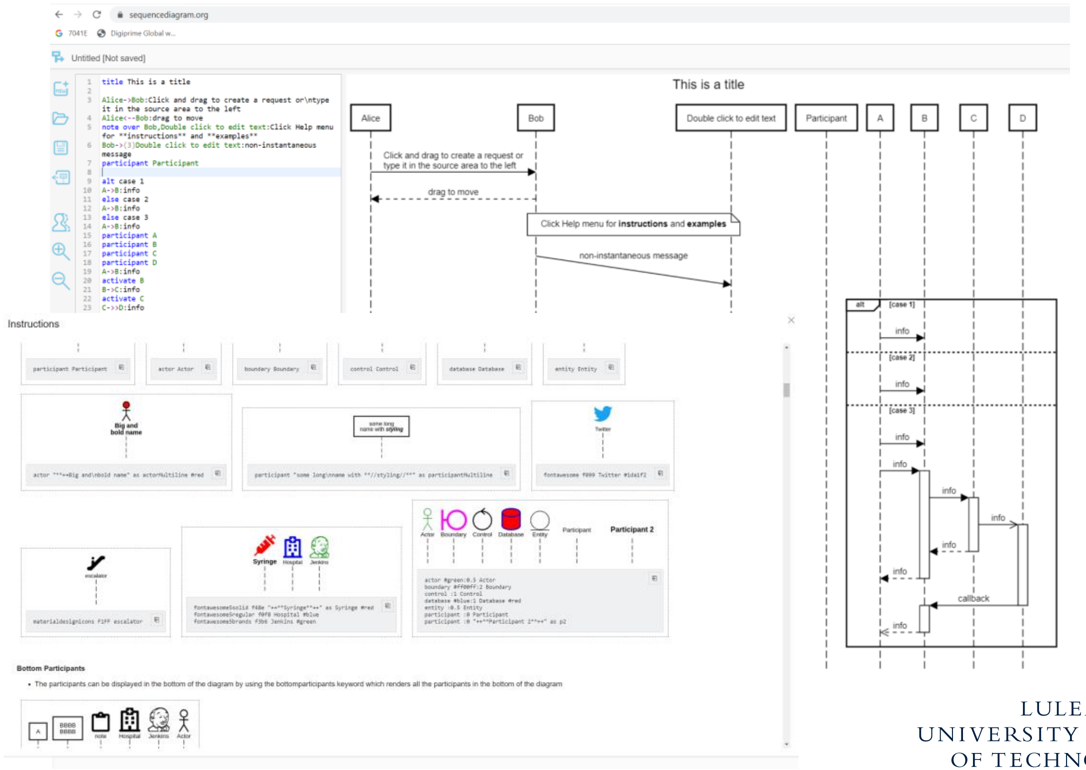
Sequence Diagrams – Tools

- **Sequencediagram.org**
- Lucidchart
  - Flow chart diagram
  - Sequence diagram
  - Class diagram
  - **State chart (premium)**
  - *Gantt chart*
  - *Roadmap*
- Visual Paradigm online
  - Most (all?) UML diagrams
  - UML State chart (machine) Diagram
- *and more…*



```
title This is a title

Alice->Bob:Click and drag to create a request or\ntype it in the source area to the left
Alice<--Bob:drag to move
note over Bob,Double click to edit text:Click Help menu for **instructions** and **examples**
Bob->(3)Double click to edit text:non-instantaneous message
participant Participant

alt case 1
A->B:info
else case 2
A->B:info
else case 3
A->B:info
participant A
participant B
participant C
participant D
A->B:info
activate B
B->C:info
activate C
C->>D:info
```

```
participant Participant
```

```
actor Actor
```

```
boundary Boundary
```

```
control Control
```

```
database Database
```

```
entity Entity
```

```
actor "**++Big and\nbold name" as actorMultiline #red
```

```
participant "some long\nname with **//styling//**" as participantMultiline
```

```
fontawesome f099 Twitter #1da1f2
```

```
materialdesignicons F1FF escalator
```

```
fontawesome5solid f48e "++**Syringe**++" as Syringe #red
fontawesome5regular f0f8 Hospital #blue
fontawesome5brands f3b6 Jenkins #green
```

```
actor #green:0.5 Actor
boundary #ff00ff:2 Boundary
control :1 Control
database #blue:1 Database #red
entity :0.5 Entity
participant :0 Participant
participant :0 "++**Participant 2**++" as p2
```

Bottom Participants

- The participants can be displayed in the bottom of the diagram by using the bottomparticipants keyword which renders all the participants in the bottom of the diagram

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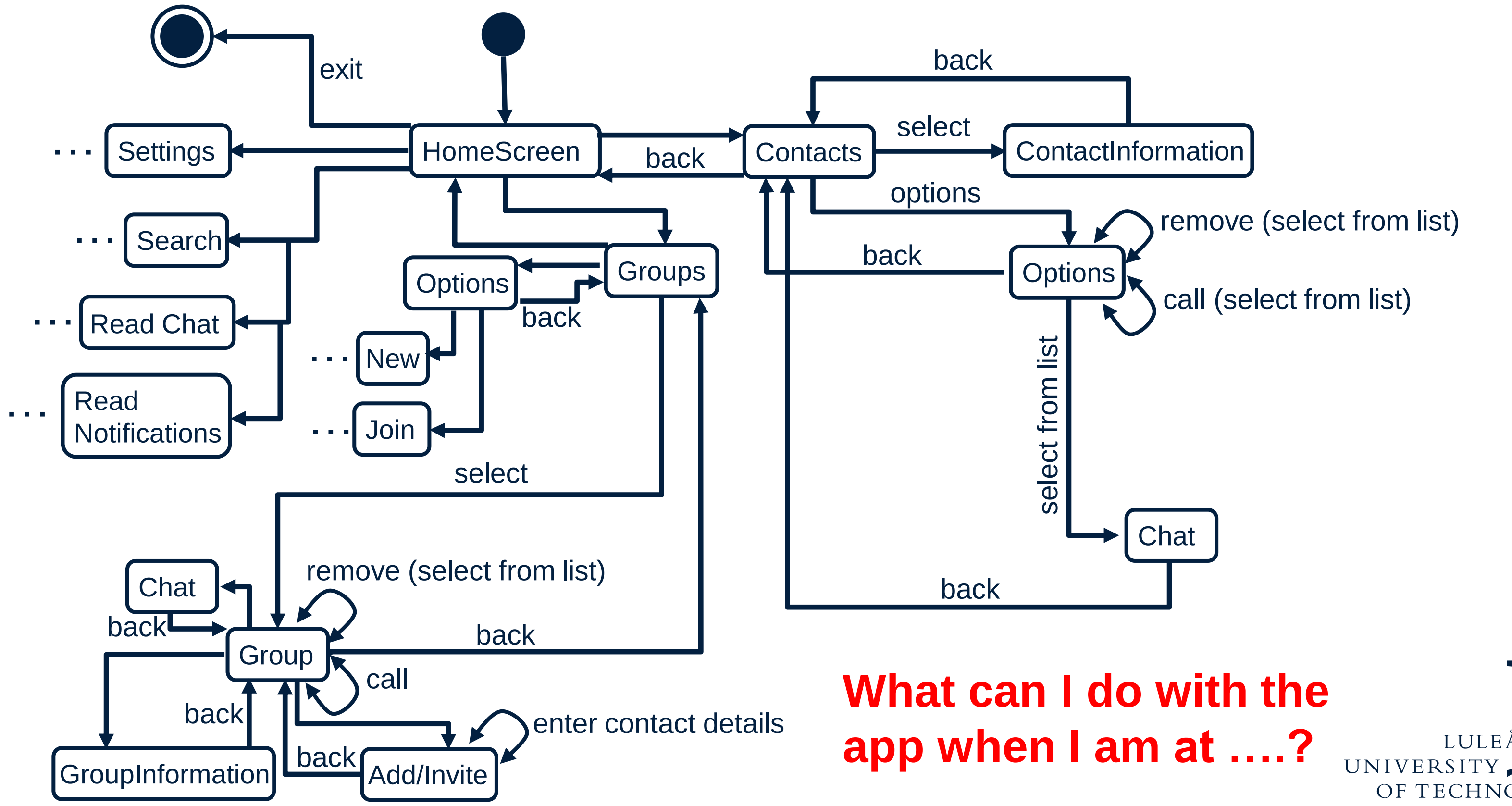
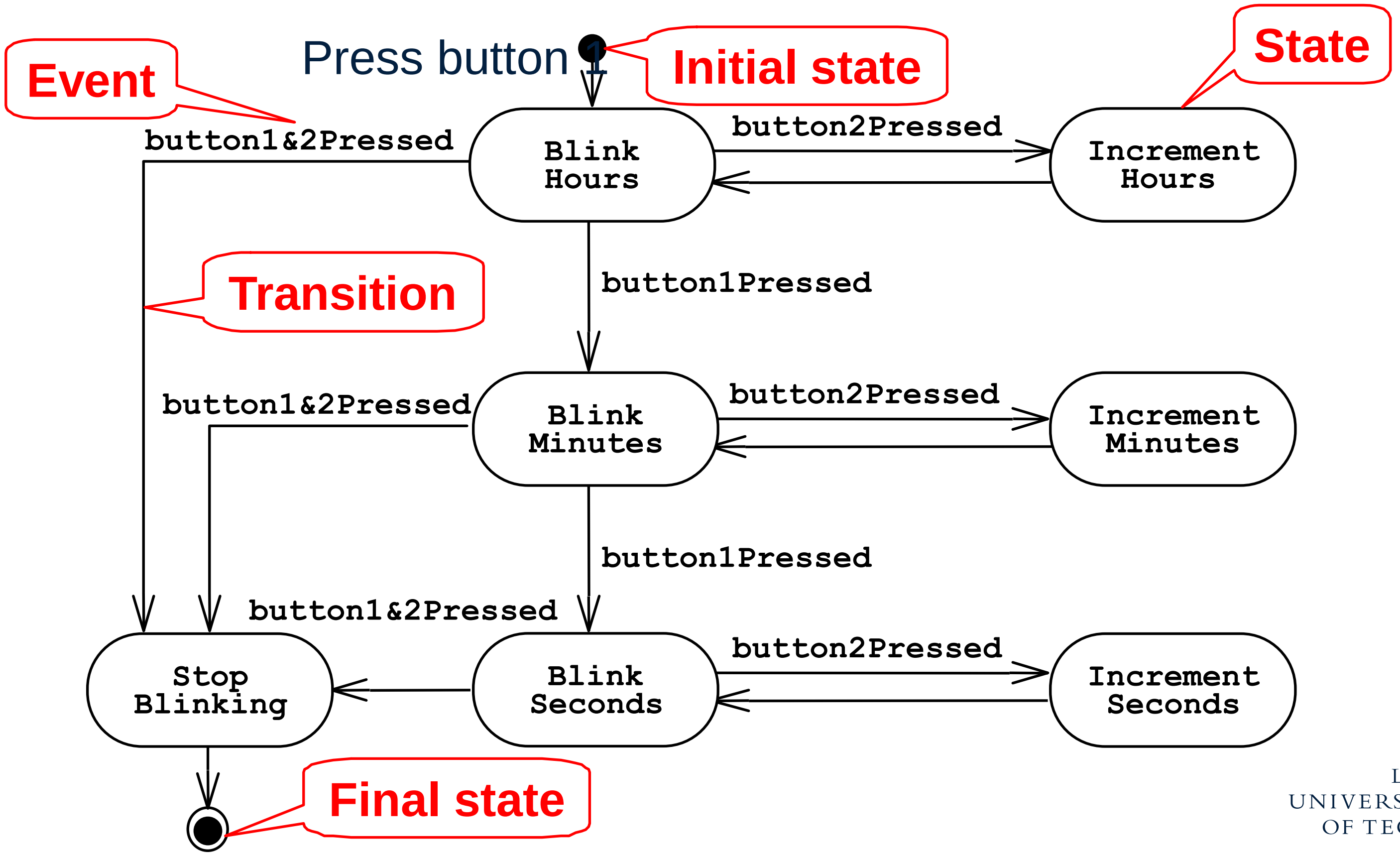
State chart (machine) Diagrams



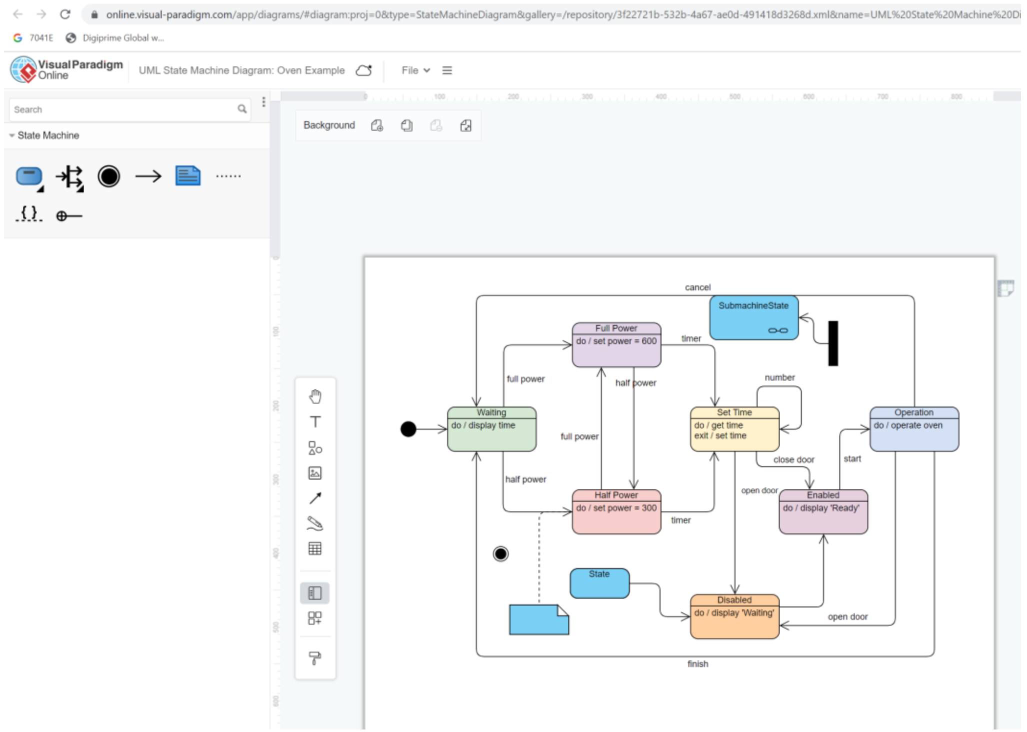
What can I do with the app when I am at ….?

State chart (machine) Diagrams



State chart (machine) Diagrams – Tools

Visual Paradigm:



Simple diagram goes far, do not overdo it with advanced tools…

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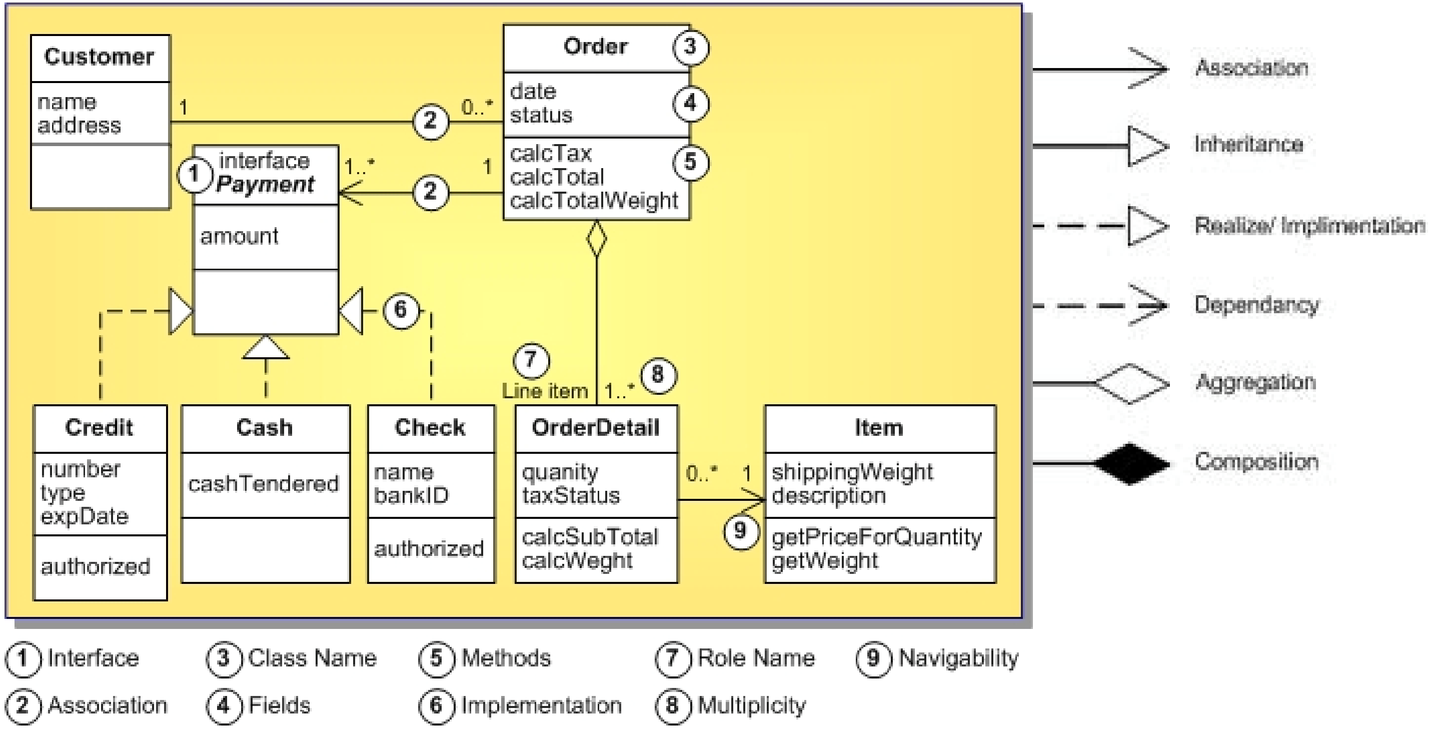
Class diagram



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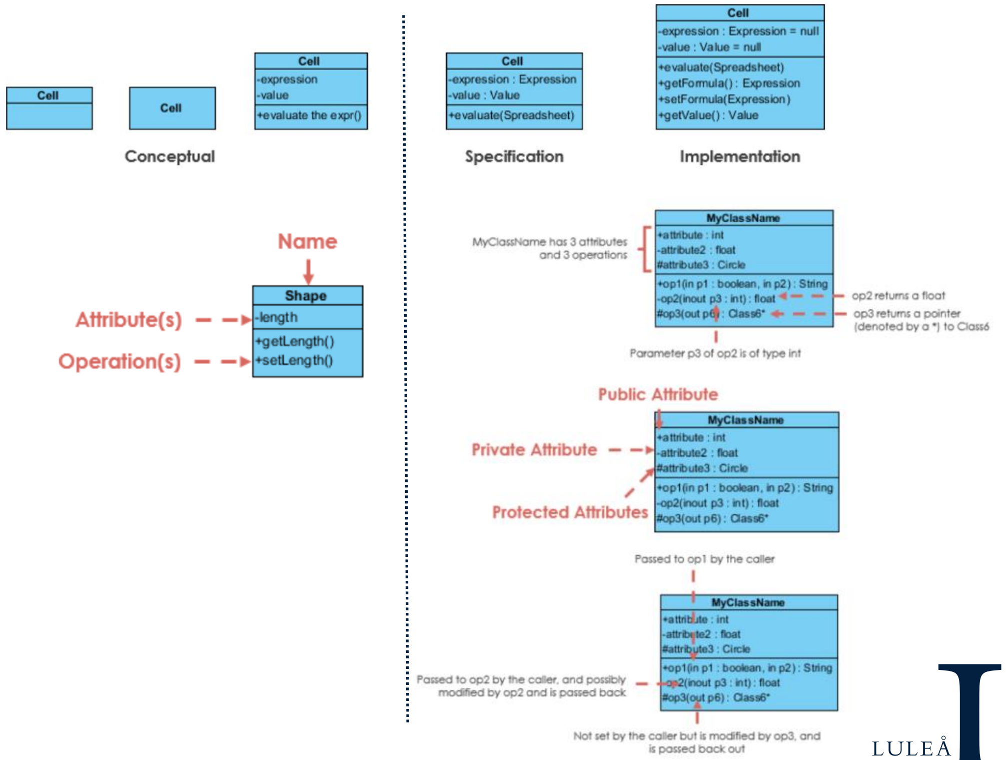
Class diagram – usage and example

Perspectives (abstraction)

- Conceptual
  - Represents the concepts in the domain
- Specification
  - Focus is on the interfaces of Abstract Data Type (ADTs) in the software
- Implementation
  - Describes how classes will implement their interfaces



* Visual Paradigm, UML Class Diagram Tutorial. URL (accessed 2022-11-22): https://www.visual-paradigm.com/guide/uml-unified-modeling-language/uml-class-diagram-tutorial/

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Summary

- UML provides a wide variety of notations for representing many aspects of software development
  - Powerful, but complex language (keep it simple!)
  - Can be misused to generate unreadable models (automatic generators)
  - Can be misunderstood when using too many exotic features (KISS!)

- We concentrate only on a few notations:
  - **Functional model**: **use case diagram**
  - **Object model**: **class diagram**
  - **Dynamic model**: **sequence, state chart, and activity diagrams**

- UML is not a methodology, but some textbooks describe a methodology that <u>uses</u> UML

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BREAK

IT'S TIME WE TAKE A BREAK.
YOU'RE RIGHT. LET'S GO WORK FOR A LITTLE WHILE.
POITRAS

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