Test and Verification 2012

Modelling Exercise

Group SW601f12

Exercise 1 (Elevator system)

We have chosen to model an elevator system. In this exercise, we construct models representing the movements of a number of elevators, as well as a number of people using these elevators.

The rules of the system are simple:

- The elevators can move to any floor, but they can not skip floors.
- When on a floor, people will use the elevators to go to other floors, by pushing buttons to call an elevator to go up or down.
- When in an elevator, a person will push a button, to indicate what floor he wishes to go to.
- An elevator will not stop until it has reached its target floor.

To do this, we have created 2 models, know as templates in Uppaal context; one for an elevator, and one for a person using the elevator.

The People template

The People template illustrates the behaviour of a person using an elevator.

The person starts on a floor, and will decide to use the elevator to get to another floor. He will push a button to call an elevator to his floor, and when it arrives, he will enter it, and push another button to indicate his desired destination.

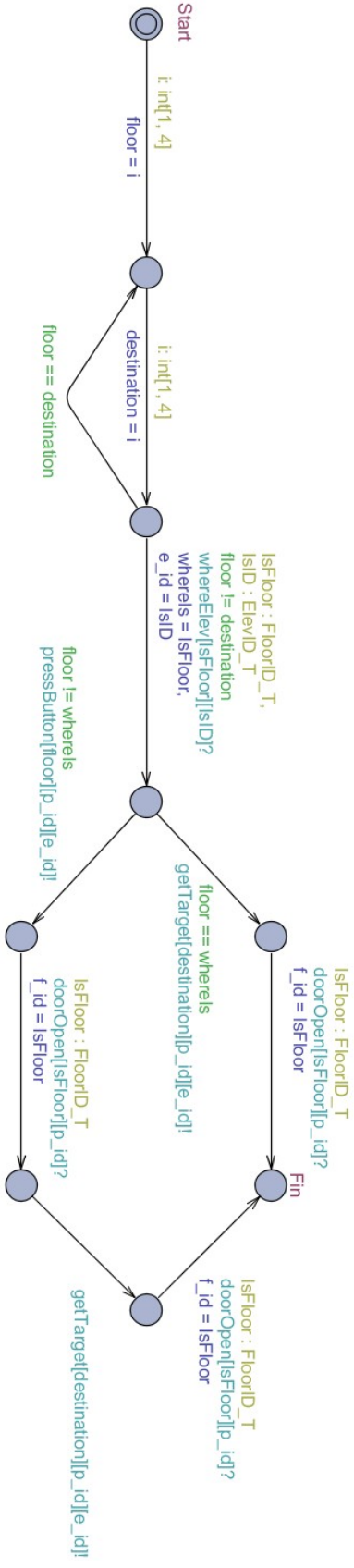
When the elevator reaches its destination, he will exit the elevator.

Looking at the People template, it starts by deciding what floor the person is on. After that, the person decides his destination, and if the destination is the same as the floor he is currently at,the model will loop until he has a destination that is different from his current floor.

We then note down the current position of the elevator.

If the elevator is currently at the same floor as the person, he can enter the elevator to go to his destination. If the elevator is not at his floor, he will push a button to signal that the elevator should

go there. When the elevator arrives, he can enter it, and indicate the floor he wishes to go to. When the elevator arrives at the person's desired destination, the person will exit the elevator through the open doors.



The Elevator template

The Elevator template illustrates the behaviour of an elevator.

The elevator starts on the first floor, with its doors open. It will react if a person enters it and pushes a button, or if a person on another floor pushes a button to call it to that floor.

The elevator can only hold one person at a time, and will transport that person to his destination, before it will respond to other persons who are pushing buttons on different floors.

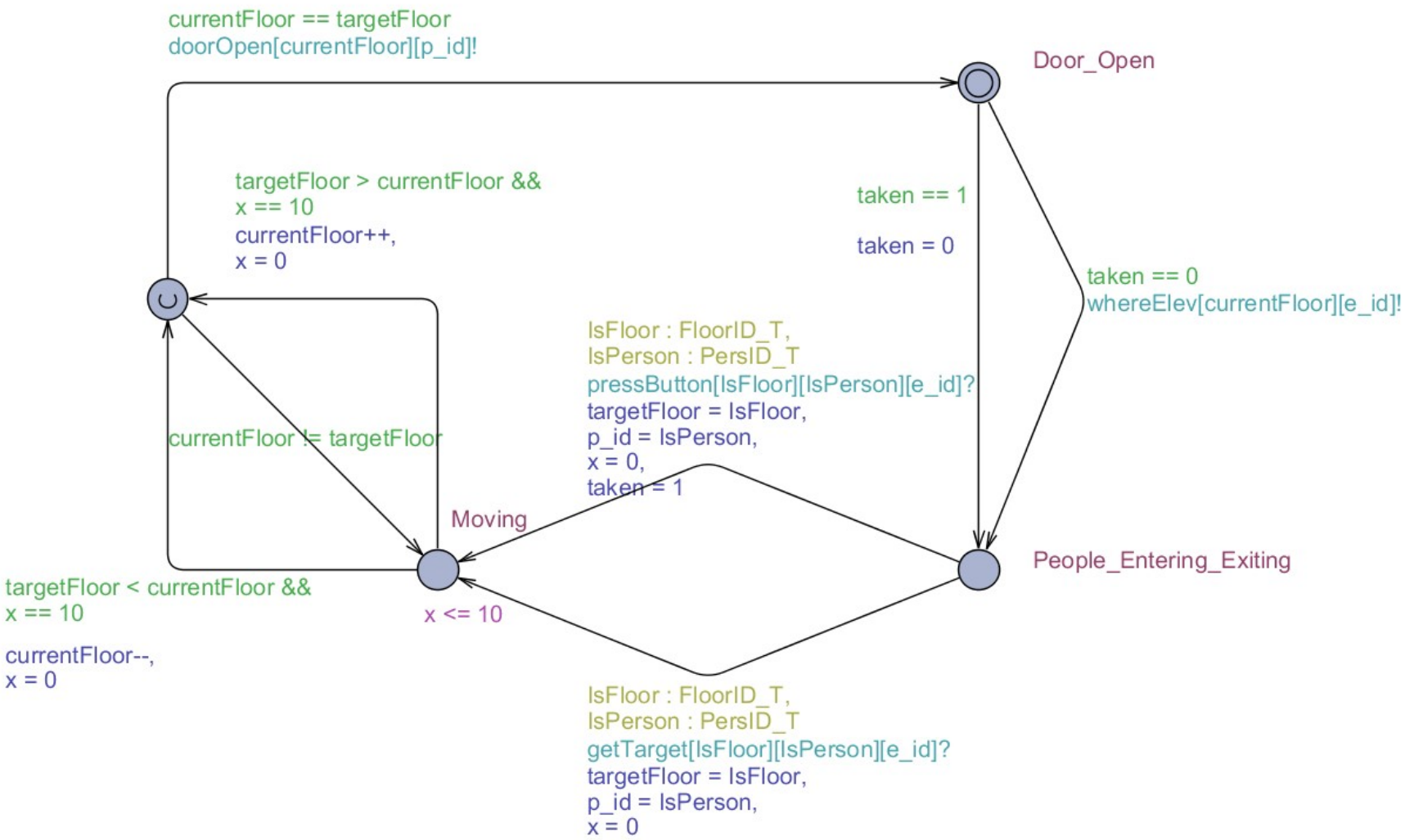
The elevator can only load and unload passengers when its doors are open, and will only go up or down with its doors closed.

Looking at the template, the elevtors start on the first floor with open doors. We then determine wheter or not the elevator is taken, which means that a person has summoned the elvator to his floor, which is the floor that the elevaotr is currently at. If the elevator is not taken, it informs the system of its current position. The elevator will then stay here until it is needed again.

The elevator is now ready for people to enter or exit it. From this point, two things can happen:

Either a person in the elevator pushes a button to indicate where he is going via the getTarget call, or a person on a different floor pushes a button to get the attention of an elevator that is not *taken*.

At this point, the elevater begins to move according to its direction, either up or down. Each of these moves takes 10 time units. It will continue to move this way, until the tager floor is reached. At this point, it will open the doors, restarting th cycle.


currentFloor == targetFloor
doorOpen[currentFloor][p_id]!
Door_Open
targetFloor > currentFloor &&
x == 10
currentFloor++,
x = 0
taken == 1
taken = 0
taken == 0
whereElev[currentFloor][e_id]!
IsFloor : FloorID_T,
IsPerson : PersID_T
pressButton[IsFloor][IsPerson][e_id]?
targetFloor = IsFloor,
p_id = IsPerson,
x = 0,
taken = 1
currentFloor != targetFloor
Moving
People_Entering_Exiting
targetFloor < currentFloor &&
x == 10
currentFloor--,
x = 0
x <= 10
IsFloor : FloorID_T,
IsPerson : PersID_T
getTarget[IsFloor][IsPerson][e_id]?
targetFloor = IsFloor,
p_id = IsPerson,
x = 0

Verification

For 2 elevators and 3 persons, we verified that that program will end up in a deadlock, when all the persons have been transported to their desired destination. This was as expected, as all of the models reached their target state.

We were able to simulate a building with 5 elevators and 50 people, all reaching their targets with no problems. We were not able to verify this however, as we lacked computing power to do so within a reasonable ammount of time.

Group SW601f12

Rasmus D.C. Dalhoff-Jensen
rdalho09@student.aau.dk

Christoffer Ilsø Vinther
cvinth09@student.aau.dk

Kim Arnold Thomsen
kath09@student.aau.dk

Jakob Jørgensen
jjo09@student.aau.dk