Assignment 2: Modelling with time

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To do: Develop Uppaal models as requested, and write a report using LaTeX. This report should include screenshots of the requested time automata and properties that you verify, and an explanation of the architectural scenario used for Exercise 3.

To submit: The *report* in PDF **and** the developed *Uppaal models*. Send by email a unique zip file "`ac2-N.zip`", where `N` is your group number.

To demo: The result of Exercise 3.

Deadline: 15 May 2016 @ 23:59 (Sunday)

Questions

Exercise 1. [Private airfield] Consider a small private airfield used by 2 planes, which can be either flying, parked, landing, or taking off. The landing field is a shared resource by both planes. Consider the following requirements:

- only 1 plane can use the field at a time;
- a Controller component receives requests to *land* or to *take off*, and replies with a *wait* signal when the field is not available;
- each plane sends requests to the Controller to *land* or to *take off*, and sends notifications when the field becomes *free*;
- the Controller has 5 time units to notify a plane to wait;
- after 5 time units from requesting access to the field and with no wait signal, the planes take another 5 time units to reach the field.
- each plane takes non-deterministically between 1-3 time units to take off, and between 4-6 time units to land and park.
- after taking off and after parking the planes notify the Controller with a *gone* signal.
- if a plane is told to wait, we assume it will take between 5-7 time units to reach the field.

Suggest a timed automaton model for the planes and the controller, and list 4 to 8 desired properties of the model and verify them using Uppaal.

Exercise 2. [MobilePay] A customer goes to a bar, and when the bill arrives it includes a QR code. The customer scans it with her Internet-connected smartphone, approves the payment of the bill, and leaves the restaurant.

Under the hood, the bar used a service we call *MobilePay* to handle the payment:

- the bar has a unique Virtual Cash Register, identified by a QR code.
- a MobilePay server receives invoices by the bar to be payed, requests for an invoice by customers (based on the QR code), and payment requests by the customers.
- the server, after 10 min of inactivity upon receiving an invoice and/or an invoice request, sends the bar a fail signal.
- if the bar sends an invoice while a previous one is being processed, the previous invoice is canceled and the new one becomes active.
- the server takes between 3 and 8 seconds between receiving an invoice and sending it to the customer (once both the request and the invoices are received).
- the server takes between 2 and 10 seconds to validate a payment and send a OK or a fail signal to the bar.

2.1. Model this scenario in Uppaal using timed automata. For simplicity, consider only a server, a bar, and a customer.

2.2. Propose an update to the requirements and to your model to support the possibility of sharing a single bill by multiple customers.

Demo

Exercise 3. Select an architectural style among the following: *Client & Server*, *Publish & Subscribe*, *Peer2Peer*, *Event-bus*, and *Table-driven*, and create an architectural scenario around the chosen style with time critical requirements. Develop a model in Uppaal. Discuss its design and try out a few variants.