

# 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** developed Uppaal models. Send by email a unique zip file “ac2-NN.zip”, where NN is your group number.

**To demo:** The result of Exercise 3.

**Deadline:** 5 May 2016 @ 14h (Thursday)

## 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 empty;
- 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.
- 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.

**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.
- 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.