Assignment 2: Modelling with time

José Proença
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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.