## Modelling and Verification of Protocols for Wireless Networks Assignment 1

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Aim of the tutorials is to deepen the understanding of the material presented in the lectures. This is mainly done by exercises.

**Exercise 1 (Syntax)** Design a simple leader election protocol. That means all members of a network should agree on a single node that is the leader.

- give as formal specification in AWN
- does the protocol deadlock (w.r.t. the semantics given in the lecture?
- formalise at least one property that should be satisfied by the protocol

Exercise 2 (Semantics) Given the following "toy protocol"

$$\begin{split} & \texttt{X}(\texttt{ip},\texttt{data},\texttt{dip}) \stackrel{def}{=} \textbf{broadcast}(\texttt{mg}(\texttt{data},\texttt{dip})).\texttt{Y}(\texttt{ip}) \\ & \texttt{Y}(\texttt{ip}) \stackrel{def}{=} \textbf{receive}(\texttt{m}).(\texttt{[m=mg}(\texttt{data},\texttt{dip}) \land \texttt{dip=ip}]\textbf{deliver}(\texttt{data}).\texttt{Y}(\texttt{ip}) \\ & + \texttt{[m=mg}(\texttt{data},\texttt{dip}) \land \texttt{dip=ip}]\texttt{X}(\texttt{ip},\texttt{data},\texttt{dip})). \end{split}$$

- What does the protocol do, if a data packet appears?<sup>1</sup>
- Let us now look at three concrete scenarios. Assume a network of two nodes a and b (a, b ∈ IP).

First, assume that the nodes a and b are within transmission range of each other; node a in state X(a, d, a), and node b in Y(b). This is formally expressed as  $[a: X(a, d, a): \{b\} || b: Y(b): \{a\}]$ ; give a transition system of the system.

Second, assume that the nodes are not within transmission range, with the initial process of a and b the same as above; formally  $[a: X(a, d, a): \emptyset || b: Y(b): \emptyset]$ ; give again a transition system of the system.

For the last scenario, we assume that a and b are within transmission range and that they have the initial states X(a, d, b) and X(b, e, a).

<sup>&</sup>lt;sup>1</sup>In this small example, we assume that new data packets just appear "magically"; of course one could use the message newpkt(data, dip) instead.