

The Timed Token Protocol

David Kendall

1 Introduction

The timed token protocol is a medium access control (MAC) protocol which is widely use in high bandwidth real-time networks, e.g. FDDI, IEEE 802.4, SAFENET etc. These exercises explore a simple model of the protocol with a view to analysing the effects of its key parameters.

2 Model of the Protocol

The major component templates of the protocol are shown in Figures 1 and 2:

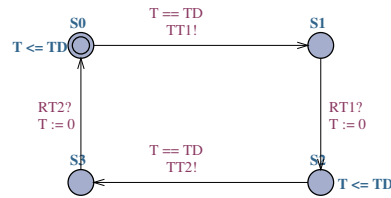


Figure 1: The Ring

3 Exercise

1. Download the TTP model from the module page.
Start up UPPAAL and open `ttp.xml`. Familiarize yourself with each of the process templates and the various declarations.
2. Apply the simulator to the model and observe the behaviour.
3. How does the model of the ring represent the *transmission delay*?

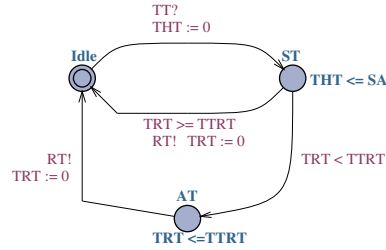


Figure 2: A Node

4. How can you express the transmission delay as an *interval* rather than a point, e.g. the delay is between 35 and 40 rather than the delay is exactly 40?
5. How can you express *node-specific* transmission delays, i.e. a different transmission delay when passing from node 1 to node 2 than when passing from node 2 to node 1?
6. What is measured by *THT* ?
7. How can you model a node that *must* use its *full* synchronous allocation?
8. What is measured by *TRT* ?
9. State and check a property that a node never waits for more than some well-specified time between starting its synchronous transmissions. Relate the specification of the period to the target token rotation time (TTRT). *Hint: the time between synchronous transmissions may need to be some multiple of the TTRT.* Is your property satisfied for the existing parameters? If not, adjust the parameters so that it is satisfied. If so, adjust the parameters so that it is not satisfied.
10. State and check a property that two nodes are never transmitting simultaneously. How are things affected if a node must use its full synchronous capacity?