

The Bridge

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1 Introduction

The bridge example has been developed by the UPPAAL team in order to demonstrate the application of TA to the solution of scheduling problems. This set of exercises is intended to help you to explore the example and to use it to develop your understanding of the use of TA in modelling real-time systems.

2 The Bridge

Four wounded Vikings are about to cross a damaged bridge in the middle of the night. The bridge can only carry two of the Vikings simultaneously and to find their way over the bridge the Vikings need to bring a torch. The vikings need 5, 10, 20 and 25 minutes (one-way) respectively to cross the bridge. Does a schedule exist which gets all four vikings over the bridge within 60 minutes? Figure 1 illustrates the problem.

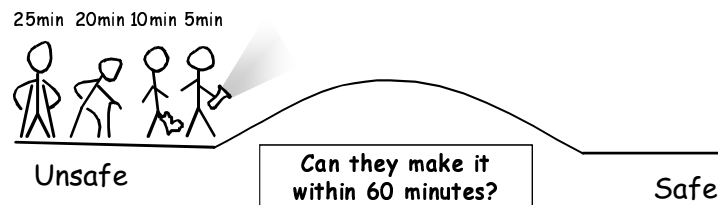


Figure 1: The bridge

3 Exercises

1. Download the bridge model from the module page.
Start up UPPAAL and open `bridge.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. Without using UPPAAL, try to calculate a schedule for the Vikings crossing the bridge that shows that all Vikings can reach the safe side within 60 minutes.
4. Now, construct a property specification in the verifier that checks that all Vikings can reach the safe side within the time limit.
5. Use UPPAAL to verify the property you specified (make sure that the diagnostic trace option is turned on for the verification).
6. Use the simulator to examine your diagnostic trace and write down the schedule which it suggests. Is this the schedule that you constructed for yourself? If not, where did you go wrong before?
7. Can you construct property specifications that allow you to place additional constraints on the schedule found? For example, can you determine if there is a schedule in which the slowest Viking becomes safe first? If there is no such schedule for the specified time limit (60 minutes), can you find the smallest time limit for which such a schedule does exist?
8. Modify the TA model to include an extra Viking who requires 15 minutes to cross the bridge. What is the shortest time in which all Vikings can become safe now?