Network Protocol Design and Evaluation

Exercise 1

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Exercise 1

1. *Clayton Tunnel protocol*
   Try to fix the Clayton Tunnel protocol so that the semaphore is not reset as long as there is a train in the tunnel.

2. *Lynch's Protocol*
   Try to fix the duplication problem in Lynch's protocol. When can a character be accepted though the two preceding messages transmissions were erroneous?
The Clayton Tunnel protocol

Entry

Exit

set

reset

train in tunnel

train clear

train in tunnel
Exercise 1, Task 1

Idea: count the trains in the tunnel

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Exercise 1, Task 1

- On the entry side the signalman maintains a counter for the trains that enter the tunnel.
- The signal will be reset to green only if enough corresponding “train left tunnel” messages arrived.
- It covers the situation that a train enters the tunnel though the signal is red (or the signalman waves the red flag).
- Drawback: If a “train left tunnel” message gets lost, the counter will not reach 0 and the signal will stay red.
Exercise 1, Task 2: Lynch’s Protocol (extended)

fake error message, sent by one of the terminals

Example for the duplication problem:

<table>
<thead>
<tr>
<th>Terminal A</th>
<th>Terminal B</th>
</tr>
</thead>
<tbody>
<tr>
<td>msg</td>
<td>error</td>
</tr>
<tr>
<td>[ERR]</td>
<td>ACK</td>
</tr>
<tr>
<td>a</td>
<td>ERR</td>
</tr>
<tr>
<td>a</td>
<td>OK</td>
</tr>
</tbody>
</table>
Solution with verify bit and alternating bit [Lynch 1969]

MSG(contents) = message(contents)
ERR = error message
CR = character received
CT = character to transmit
VR = verify bit (received)
VT = verify bit (to transmit)
AR = alternating bit (received)
AT = alternating bit (transmitted)
Exercise 1, Task 2

The alternating bit protocol
[Bartlett, Scantleburst, Wilkinson 1969]

Notation: ! = send, ? = receive,
“msg,0” = message with 0 bit appended
I/O = accept message, fetch new message

Terminal A

Terminal B
Exercise 1, Task 2

The alternating bit protocol
[Bartlett, Scantleburst, Wilkinson 1969]

Terminal A

I/O

?msg,0
?err

!msg,0

?msg,1
?err

normal operation

retransmit after error

Terminal B

I/O

!msg,1

?msg,1
?err

!msg,0

?msg,0
?err

retransmit after error