Übungen
zu
Drahtlose Kommunikation

Wintersemester 2015/2016

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Assignment 5

voluntary submission until Wednesday 2016-01-27

as PDF via mail to *vnuml@uni-koblenz.de*

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Exercise 1

Which disadvantage of the S-MAC protocol is resolved in T-MAC and which new problem occurs?

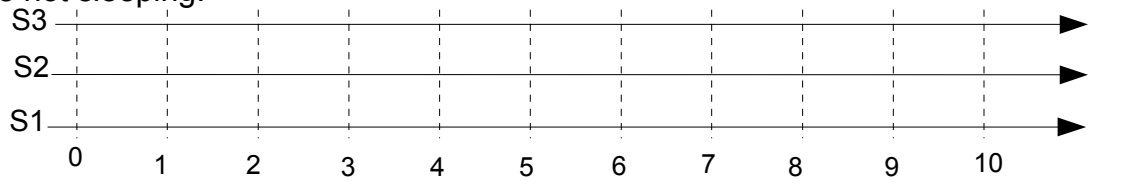
Exercise 2

Given are three sensor nodes S1, S2 and S3 with following energy consumption values:

Sleep mode per ms: 0,1 J
Receive mode per ms: 1 J
Data transmission per ms: 2 J

Node S1 wants to send a data packet to node S3. The transmission takes 2ms.
For each of the following MAC protocols and the given time period of 10 ms, draw into the diagrams, how long each node is transmitting data (T), in receive mode (R), sending the preamble (P), or in sleep mode (S). Then calculate the overall energy consumption (in Joule).

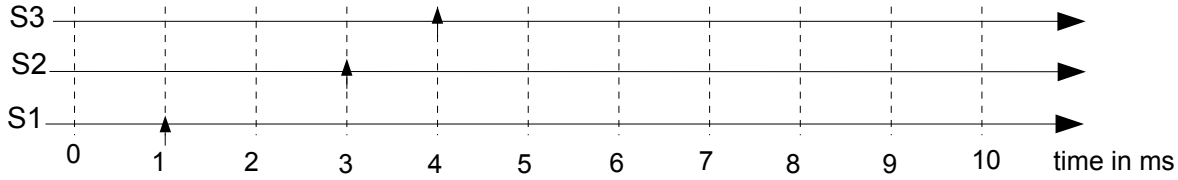
a)
Nodes are not sleeping:



Energy consumed: ____

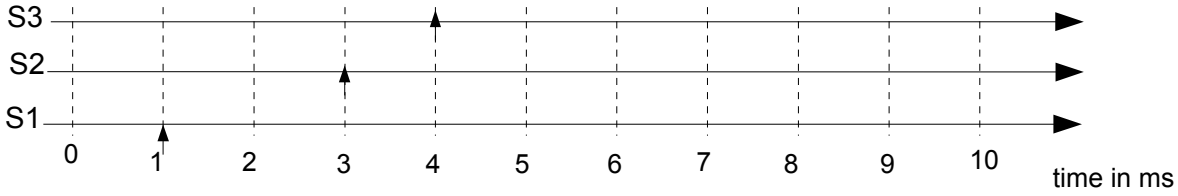
b)
For the following MAC protocols the sleep cycle of each node is 5 ms. The arrow ↑ indicates when the node wakes up from sleep mode for the first time.

1) All nodes are using the B-MAC protocol:



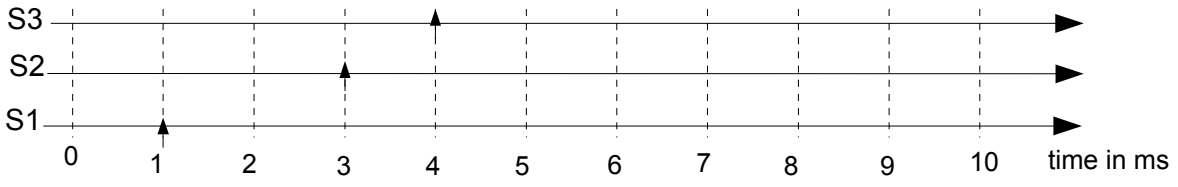
Energy consumed: ____

2) All nodes are using the X-MAC protocol:
Assume a simplified strobe and acknowledgment length of 0 ms.



Energy consumed: ____

3) All nodes are using the Wise-MAC protocol:
Assume that node S1 already learned the schedule of node S3. Assume a simplified preamble length of 0 ms.



Energy consumed: ____

Exercise 3

Assume a scenario where all nodes have a fixed sleep/wake cycle of Δ. How long is the preamble sent on average when using the following protocols?

a) B-MAC:

b) X-MAC:

Exercise 4

In the following, parts of the source code of a TinyOS program are shown that uses the components W, X, Y and Z. How many instances are created at runtime for each component? The main component is W.

```
configuration W
{
}
implementation
{
  components X;
  components Z;
  ...
}

configuration Z
{
}
implementation
{
   components X;
   components Y;
   ...
}
```

Exercise 5

Given is the following wiring in TinyOS that wires together the components A and B via an interface: `A -> B`

a) Can A call routines in B? If yes, which type?

b) Can B call routines in A? If yes, which type?

Exercise 6

a)

Are event handlers of timers synchronous or asynchronous?

b)

What is the impact of the runtime of a task on timers?

c)

Name two essential differences between a task and an event handler in TinyOS.