TECHNISCHE UNIVERSITÄT
CHEMNITZ

Professur
Betriebssysteme

Embedded Software Lab

Lab 3 - RASPNet Layer 3

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In this lab, you will implement layer 3 of the RASPNet protocol. You need a complete implementation of layer 1+2 that allows one node to send message frames to itself.

Initial Remarks

The tasks should be solved in the given order. If you do not manage to solve all tasks in preparation of the next lab meeting, make sure that you solve them afterwards. Your final grade at the end of the semester depends on the availability of *all* solutions in your code repository.

The presentation of your results during the lab slot is oral. There is *no need for preparing slides* or any other kind of written material.

Be ready to answer questions. Have your code, positive and negatives experiences and according documentation available.

For the coding part, please avoid playing with the boot / read / write lock bits, playing with the Fuse bits or writing to the boot loader memory. Writing to EEPROM regions is also not needed at the moment.

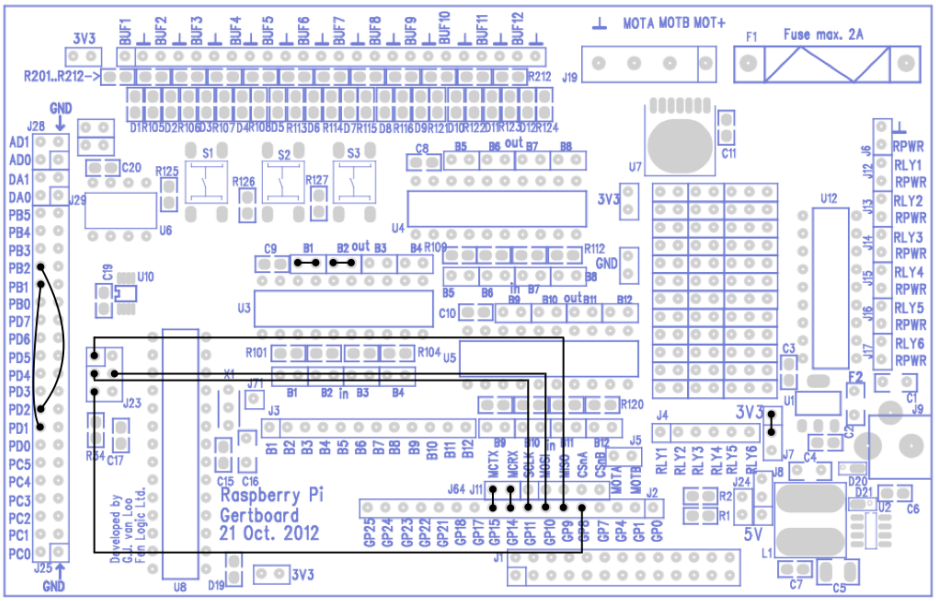

Figure 1: Gertboard wiring scheme for layer 3 development.

Task 3.1

Prepare the Gertboard wiring according to Figure 1. If a wiring already exists, check it for correctness.

Task 3.2

Discuss the general idea of network routing and answer the following questions:

- What is the relationship between cost factors, e.g. number of cables, and the topology approach (bus, tree, star, ring)?
- What is the relationship between the routing approach and the topology approach?
- What is the maximum travel time for a frame, in number of hops, depending on the number of nodes?
- What is offline vs. online routing? How does both approaches work in a ring topology?
- What is the difference between a routing strategy / policy and a routing mechanism?
- Is it possible to have different routing policies within one network? Name examples for popular routing policies.
- What information is needed for routing a package? What is receiver-based addressing, as in the *Internet Protocol (IP)*, and content-based addressing, as in the *CAN* protocol?

- In routing approaches, is there a guarantee that only sender and receiver can inspect a frame? What would it take to ensure that no other node can read the frame content beside these two?

Task 3.3

Implement Layer 3 of the RASPNet protocol [1]. Make sure that the implementations of Layer 1+2 and Layer are decoupled in a way that Layer 3 would be exchangable by just swapping source code files.

What happens in your implementation when the receiver of a message cannot be found in the network? What should happen?

How do you realize the demanded priorization scheme?

Note:

RaspNet implements a ring, therefore, a node has one next and one previous node. If a frame was received and the message has a different destination, then the node needs to relay the frame to the next node.

The unique node addresses should be configurable as constant value in your code. Use the number of your Pi board as default value.

Your routing mechanism must consider that there may be broadcast messages on layer 3. In such cases, it must be checked who was the sender of the frame to decide about the forwarding.

References

[1] Stefan Naumann. RaspNet - A simple realtime network protocol for microcontrollers. `https://osg.informatik.tu-chemnitz.de/lehre/emblab/raspnet.pdf`.