Proposal for the field experiments for the SUN routing protocol

In this proposal we present four possible field experiments aimed at testing the SUN routing protocol using the DESERT Underwater libraries .
To this end, we assume to have 6 nodes available for the experiments; accordingly, we consider two topologies of 6 nodes, each suitable to run all the 4 proposed experiments. In case 6 nodes will not be available, we can fall back to a topology made of 4 nodes.
In the following, we first briefly introduce the four proposed experiments, then we present the considered topologies and illustrate in detail the designed experiments.
Finally we report some open questions that, in our view, should be answered to better organize the field experiments and the related preparation activities.

Experiment description

Experiment 1 (NODE FAILURE)
This experiment aims at testing SUN when a route must be recovered after the failure of a relay node.

Experiment 2 (SINK FAILURE)
This experiment aims at testing SUN when a route must be recovered after the failure of a sink node, and when multiple sink nodes exist.

Experiment 3 (SINK DETECTION)
This experiment aims at testing the behavior of SUN when an additional SINK (possibly placed in a more convenient position) shows up.

Experiment 4 (MOBILE SINK)
If feasible, this experiment aims at observing the disruption of old routes and building of new ones whilst a mobile sink node is moving around the area where one or more transmitters are placed.

Metrics to measure

For all the above experiments we are interested in measuring the following metrics:

1. Throughput (ratio between the overall number of packets correctly received by the sink over the experiment time);
2. Packet Error Rate, PER (for each directional link, ratio between the overall number of packets correctly received by the receiver over the total number of packets generated in the network);
3. Packet Delivery Ratio, PDR (for each directional link, ratio between the overall number of packets correctly received by the receiver over the total number of packets generated in the network);
4. Delay per packet (for each directional link, the mean delay experienced by a packet sent over that link)

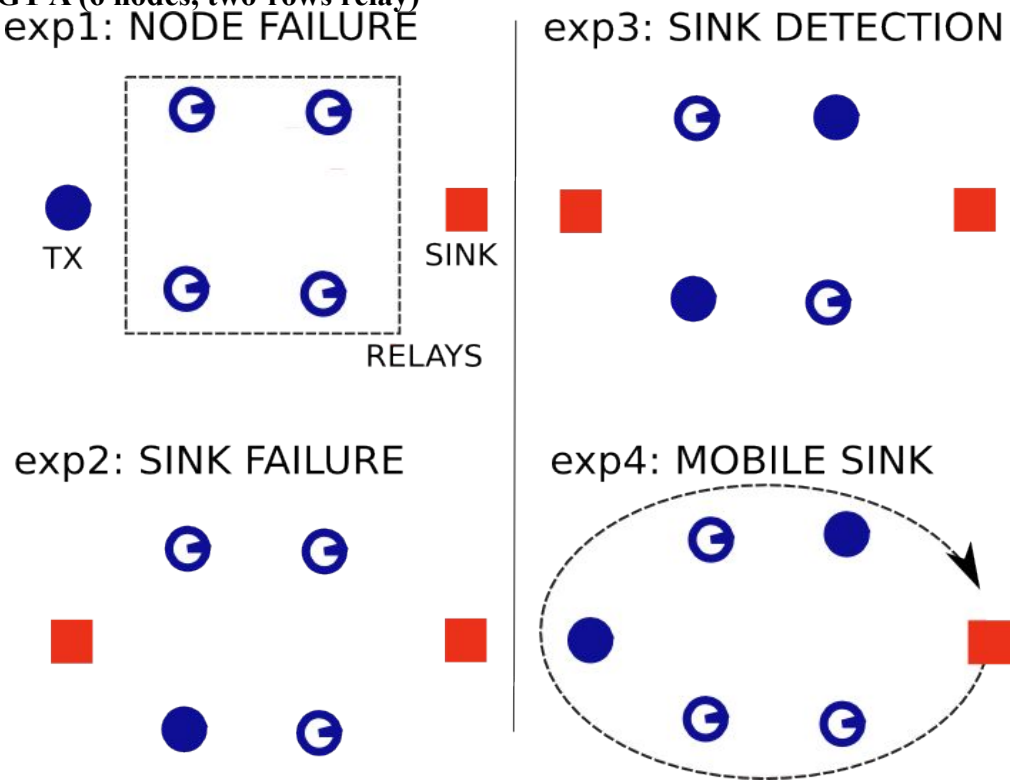
NOTE: Metrics 1, 2 and 3 can be computed from the NS-Miracle trace-files during data post-processing; the same is true also for metric 4, provided that the node clocks (as well as the simulation starting times) are initially synchronized, and that their relative drifts are negligible.
Other quantities of interest would be:

5. The recovery time in case of route failures as, e.g., in experiments 1 and 2;
6. The time needed to set up a more convenient route in case of detection of a new sink, e.g., as in experiment 1, or because the sink is moving, e.g., as in experiment 3.

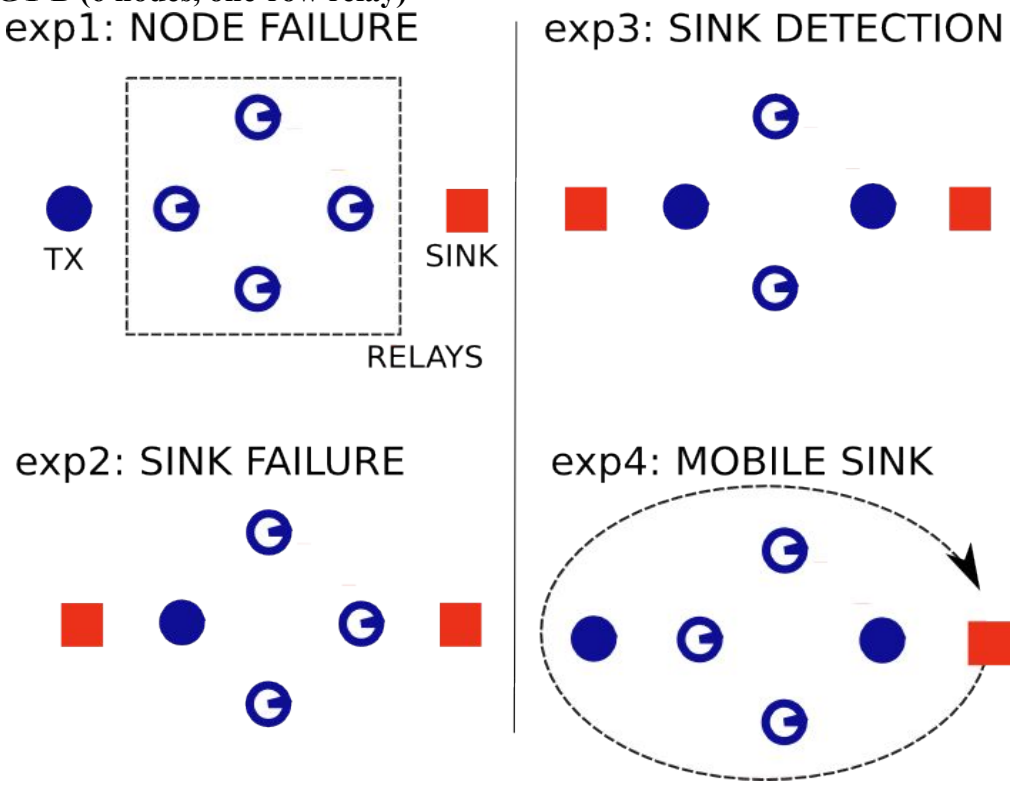
Proposal for topologies

In the following we consider three different topologies to test the above experiments. For the field-test, we foresee to pick one of the topologies below (according to the node availability and the experiment logistic issues) and keep it fixed along all the experiments, so to avoid node re-deployment.

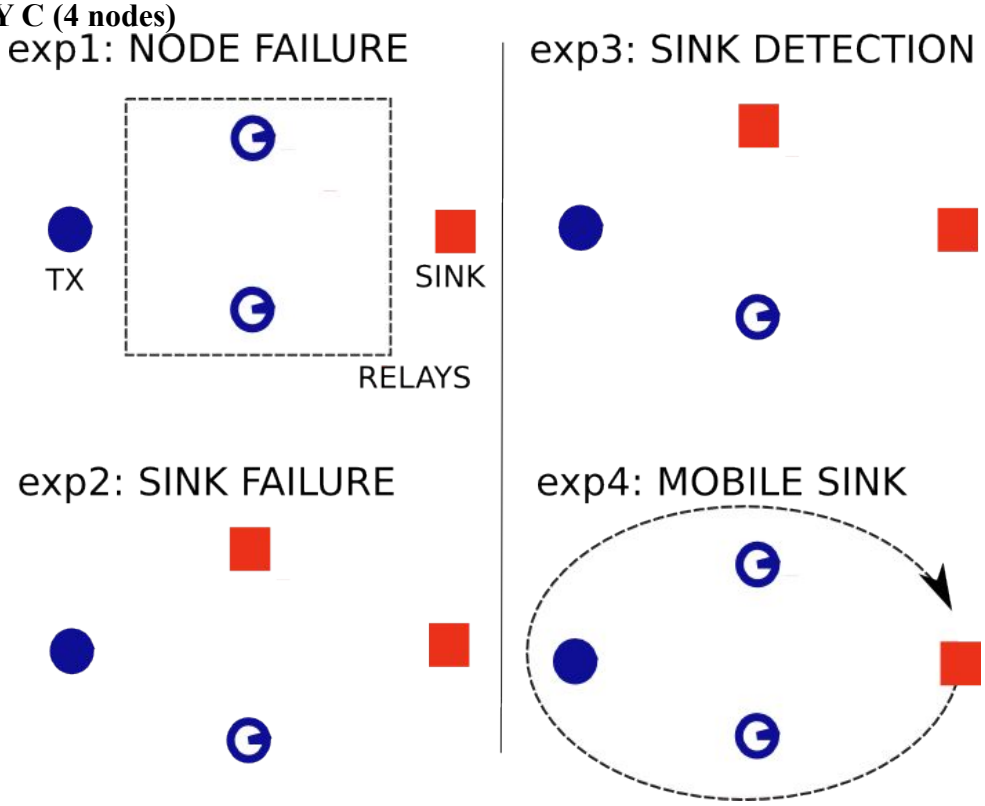
TOPOLOGY A (6 nodes, two-rows relay)



TOPOLOGY B (6 nodes, one-row relay)



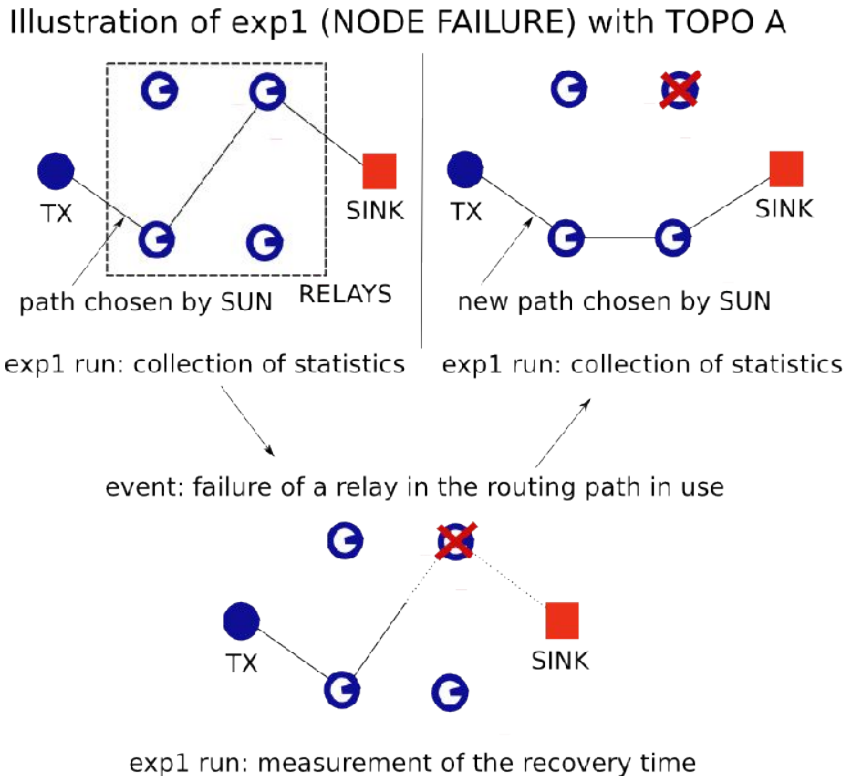
TOPOLOGY C (4 nodes)



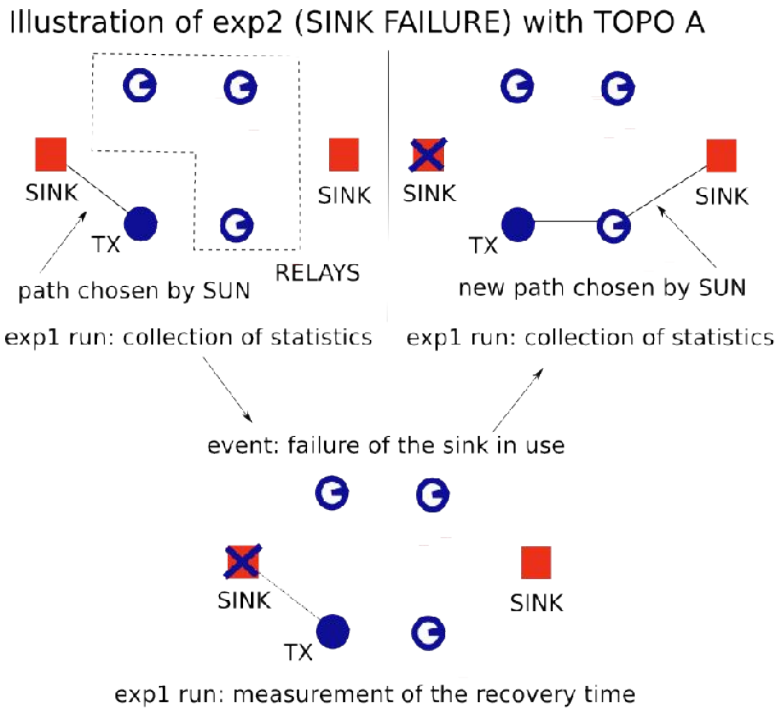
Experiment illustration

Referring to topology A above (in the following called "TOPO A"), we now illustrate in more detail experiments 1-3.
Concerning experiment 4 (mobile sink), if doable, we are thinking to the possibility of pulling the sink from a boat following the path depicted in the pictures of above. The paths to deliver the information from the sink should change according to the sink position and should be inferred from the NS-Miracle trace-files.

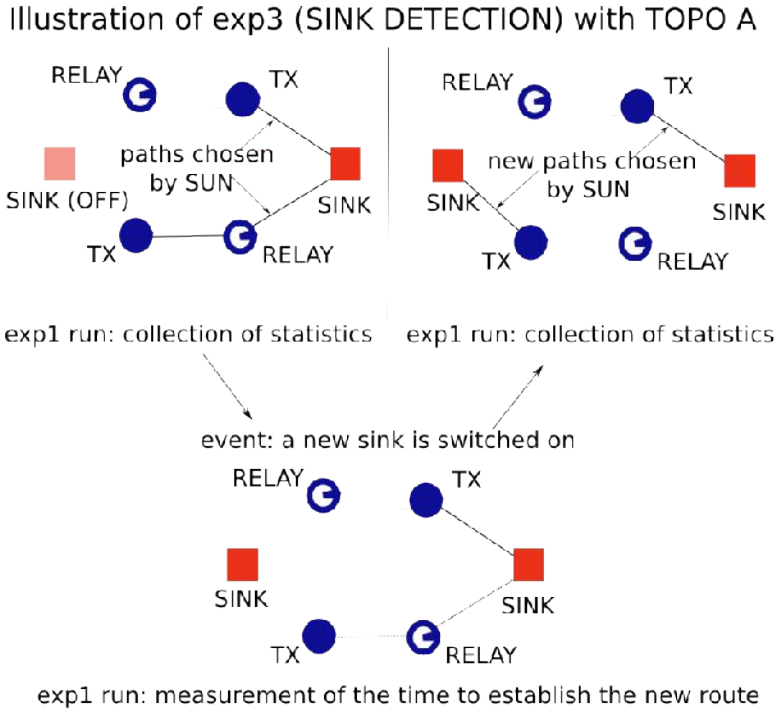
Experiment 1



Experiment 2



Experiment 3



Open problems and questions (incomplete list...)

1. How will we deploy the nodes? Where?

2. How deep is the water?
3. How many boats do we have?
4. How can we design the experiments so that they run automatically?