

UW group's brainstorming: proposals for field experiments using DESERT Underwater
(12th Underwater Group's meeting, 21st of June 2012)

presenter: Beatrice

brief: Suggestion for the design of UW field experiments. Proposed classification to properly target the objectives of the field experiments to design: A) proof of concepts; B) performance evaluation; C) collection of statistics.

see: bea_presentazione_uw21.pdf (slides)

comments: The proposed classification is very useful to both ideate and practically realize the design of our field experiments. We should put some efforts in order to identify our proposals according to such classification so that we can better understand what we need to plan and prepare the corresponding field experiments.

presenter: Giovanni

brief:

- *AUV bridging for hole coverage* (Scenario 1): proof of concept for adapting connectivity by exploiting an AUV as temporary relay in case of node failure;
- *Relay positioning* (Scenario 2): collection of statistics to determine the best position (in terms of, e. g., depth, orientation and relative distances as regard its neighborhood) of a relay;
- *Power control vs relaying* (Scenario 3): performance evaluation to compare power control techniques against the deployment and/or exploitation of additional relays (possibly in the perspective of realizing an automatic and adaptive mechanism able to choose among the two solutions up to the environmental conditions).

see: giovanni_scenario_proposals.pdf

comments:

- Scenario 1 is appealing because in this scenario AUVs must accept and provide command from/to the network. It is however difficult to realize in an autonomous fashion in less than two years (need to access to the code that command the AUVs, design the way in which the DESERT libraries can interact with it, implement such solution); the “man in the loop” would be a possible solution (namely, we can mimic the AUV behavior using a boat, on-board of which there is someone able to read the messages received from the network and that moves the boat accordingly);
- Scenario 2 requires a lot of effort in order to collect meaningful statistics that can be consider representative for, at least, a given kind of scenario. Also the overall goal of such activity maybe is not properly focused on what we are looking for;
- Scenario 3 can be very interesting even though maybe challenging for the actual realization of the foreseen automatic mechanism.

presenter: Matteo

brief:

- *Routing recovery after node failure* (Proposals A.1): proof of concepts for testing the path recovery capabilities of SUN when different node failures in the network are forced;
- *T-Lohi test* (Proposal A.2): proof of concept for testing the functioning of T-Lhoi when multiple underwater nodes are trying to access simultaneously the channel;
- *UW-DTN (bridging)* (Proposal B.1): proof of concept to test the DTN paradigm in an hybrid network. Here, an AUV can put in communication two cluster of nodes by traveling from one to the other and vice-versa;

- *Routing with a mobile sink* (Proposal B.2): proof of concept to test the adaptability of SUN by means of the dynamic set up of new routes when a mobile sink is moving throughout a static network;
- *Routing in a mobile network* (Proposal C.1): performance evaluation to determine the impact of mobility in a network made of mobile nodes only;
- *Double MAC* (Proposal D): simple scenarios to implement and test a gateway able to put in communication two devices using different MAC protocols (e.g., CSMA-ALOHA and UW-Polling).

see: matteo_scenario_proposal.pdf (slides) and matteo_scenario_proposal.pdf

comments:

- Proposal A.1 and B.1 are very similar to the ones we are already going to propose to EvoLogics (see document SUNwithEvoLogics_proposal.pdf), but can be modified/extended for further or diverse collaborations;
- Proposal A.2 is interesting provided that we can use hardware able to generate both data packet and tones since just pretending that shorter packets are tones has already been done;
- Proposal C.1 can maybe be proposed as a feasibility test since a similar performance evaluation can be easily and better realized through simulations (let us think, e.g., to the difficulties of making AUVs redo several times the same paths).

presenter: Saiful

brief:

- *Intruder detection* (Proposal 1): exploiting a network of fixed nodes which are aware of their positions, performance evaluation of concurrent solution to detect and localize possible intruder nodes;
- *High-throughput network* (Proposal 2): performance evaluation of different metrics usable to build routing path with the objective of maximize the network throughput;
- *AUV motion controller via networking* (Proposal 3): driving an AUV by means of messages exchanged between it and a network of fixed nodes;

see: saiful_proposal_uwgroup_meeting.pdf

comments:

- Proposals 1 and 2 are interesting but mainly doable in a fixed test-bed remotely accessible weakly for several months (i.e., they are not really suitable for experiments limited to one or few days);
- For Proposal 3, see the comments done for Scenario 1 of Giovanni.

presenter: El Hadi

brief:

- *Intruder detection in RACUN*: modifying according to our need the scenarios proposed in the RACUN project to detect an AUV passing through a deployed network of fixed nodes;

see: elhadi_RACUN_SCENARIOS.ppt

comments:

- See the comments done for Proposal 1 of Saiful and for Scenario 1 of Giovanni.

presenters: Federico & Ivano

brief:

- *Underwater pipeline* (Scenario 1): feasibility test to collect data via, e.g., UW-Polling from a network of fixed nodes deployed according to a line topology (to monitor, e.g., an underwater

oil pipe) and with a mobile sink (AUV);

- *Dense clustered-networks and relaying* (Scenario 2): feasibility test to exploit simultaneously different MAC, one to communicate within dense clusters of nodes and a second to communicate among different cluster exploiting few relays (both fixed and mobile);
- *MAC stress* (Scenario 3): performance evaluation of different MAC protocols when stressed (i.e., several nodes that want to access to the same channel at the same time);
- *AUV data retrieval* (Scenario 4): feasibility test to exploit simultaneously different MAC, one to communicate within dense clusters of nodes and a second to allow one or more AUVs to gather data from these clusters;

see: FedericoIvano_DESERT_scenarios.pdf

comments:

- Scenario 1 is inspired from an application envisioned in CLAM;
- Both Scenario 2 and 4 are interesting; however, it may be difficult to have enough nodes to deploy dense clusters and the overall scenarios and experiments are maybe too complex to be realized at once (i.e., they can be scaled down to simpler scenarios as the Scenario D of Matteo to test two MACs simultaneously or Scenario 1 to retrieve data from sensor nodes via an AUV);
- Scenario 3 is definitely interesting but it may be very difficult in practice to obtain meaningful results (as the experience of Matteo at WHOI though us, when, with just five nodes communicating at the same time the whole network got stucked ...).

presenter: Paolo

brief:

- *USR and fixed routes* (Experiment 1): feasibility test of our protocol Underwater Selective Repeat in a fixed network. Possible comparison with other methods;
- *UW-DTN (mobile)* (Experiment 2): feasibility test of the Underwater DTN paradigm. Two or more mobile devices (AUVs) follow some per-determined or randomized paths to fulfill given mission (e.g., monitoring). When these mobile nodes meet, they can exchange informations. Overall aim is to exploit these exchange of communications and the mobility to delivery data to a fixed network infrastructure where also the sink is placed;
- *UW-Polling* (Experiment 3): proof of concept for our protocol UW-Polling, having an AUV moving in circle around a fixed network whose nodes have data for the AUV.

see: paolo_experiments_NURC.pptx (slides) and paolo_NURC.pdf

comments:

All the experiments of above have been presented at NURC and are mainly intended as feasibility tests.

presenters: Riccardo

brief:

- *Mission Scheduler* (Proposal 1): feasibility test for a new application module of DESERT. This module should contain two kind of nodes: those in charge of fulfill diverse missions and those needed to command the first ones. Packets should be generated in the network from both kind of nodes so that to provide evidence about the possibility of scheduling and aborting different missions (e.g., indicated with given IDs);
- *UW-DTN (circular)* (Proposal 2): feasibility test of the Underwater DTN paradigm. An AUV follows a circular route passing by three or more separate (from the coverage point of view) clusters of nodes thus connecting them.
- *Cross-layer competition* (Proposal 3): comparison (performance evaluation) between SUN and AUV polling to retrieve data from a sensor node field;

- *Heterogeneous network* (Proposal 4): proof of concept to connect two clusters of nodes having different phy layers, i.e., set of nodes that use different modems (e.g., the Evologics modems and the FSK WHOI MM). Exploiting our interfaces and the possibility of adding multiple modules at the same layer (maybe, in a similar manner than what done with T-Lohi) we may realized a gateway able to communicate with both modems and therefore able to bridge the two clusters.

see: riccardo_UW_field_exp_proposals.pdf

comments:

NOTE: it would be nice if we start to think also about how to link all the proposals we did with one real application (or more) for which that particular experiment may be of interested (because, e.g., it tests a mechanism which is useful or inherent with that kind oft application as for the case of the Underwater oil pipeline, see Scenario 1 of Federico & Ivano).