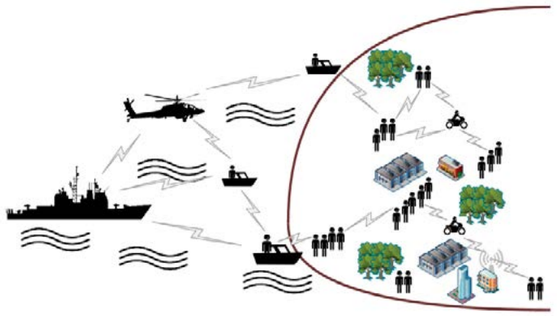
REMAR

DTN Networks for Emergency Communications

Remar improves the communication in navy scenarios by exploring the use of delay tolerant networks (DTNs) as the communication base to work with network fragmentation through store, carry and forward mechanisms. It is proposed a quality-based routing algorithm to select the best quality paths to forward the information and provide communication between the ships and between the ships and the shore.



PROJECT WEBPAGE URL
https://www.it.pt/Projects/Index/1871

Main Project Team

Susana Sargento	**NAP-Av**
Lucas Guardalben	NAP-Av
Tiago Almeida	NAP-Av
Deolinda Moura	NAP-Av
Rodrigo Almeida	NAP-Av
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Main Publications

T. Gomes, L. Guardalben, P. Salvador, S. Sargento, **Practical Approach To Simulation-Based Optimization Using Genetic Algorithms**, Ieee Global Telecommunications Conference (Ieee Globecom 2013), Atlanta (Ga, Usa), December, 2013

T. Almeida, L. Guardalben, S. Sargento, **A Quality-Aware Delay-Tolerant Approach For Navy Communications**, Ieee International Symposium On Computer And Communications (Iscc), Messina, Italy, June, 2016

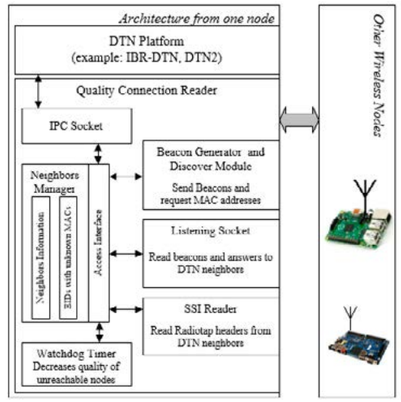

Fig. 1 Architecture Implementation.

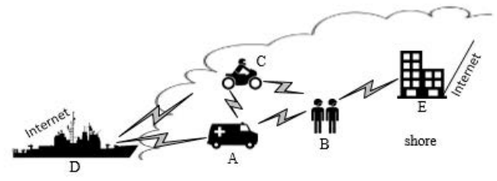

Fig. 2 Experimentation scenario.

GENERAL MOTIVATION AND OBJECTIVES

Usually the operations at the shore are ground recognition for population support. Independently of the operation, they are characterized by high mobility of the nodes, obstacles, reflections and interferences, which may create intermittent connections or even network fragmentation, which affect the navy communications. These constrains lead to low-quality communications that may be degraded due to bad routing decisions; this shall not happen because the communication is an essential factor that affects directly the success of the operations.

An efficient routing algorithm should be capable to work with the presented constrains and select automatically the best quality communication path, whenever possible. The navy is also interested in using the internet infrastructured accesses to communicate when they are present, be able to choose the best communication paths, and keep and store the information when no path is available.

CHALLENGE

The main challenges tackled by the project are the following. In navy scenarios their operations require high mobility of the nodes, and their communications are prone to obstacles, reflections and interferences, which may create intermittent connections or even network fragmentation. Although these constraints lead to low-quality communications, the main challenge is to use these communications with a DTN quality-based approach to improve the communication and provide feasibility for the navy scenarios through ad-hoc communications with a threshold on reliability for communication.

WORK DESCRIPTION AND ACHIEVEMENTS

This project proposed a delay-tolerant quality-based routing protocol where the objective is to route information taking into account the connection quality of the links to improve the navy communications.

To develop the quality-based routing protocol, it was necessary to evaluate the quality of the links, which is defined with a quality factor, as a function of two metrics: the signal strength indication (SSI) and the link stability (LStab). The obtained results show that these metrics allow a good sensitivity to the quality factor in all distances, since the SSI has good sensitivity in lower distances, and LStab has good sensitivity in higher distances.

The quality measurements are performed with an API to measure the quality of the surrounding neighbors. To calculate the quality factor, the API gathers the SSI, contained in the radiotap headers, and it implements a beacons system to calculate the LStab.

The quality-based routing protocol, our approach, Q-prophet uses the quality factor. This routing protocol was based on prophet, a well-known protocol developed for dtns. The Q-prophet was implemented and tested in a set of scenarios that emulate navy scenarios with the presence of intermittent connections. The obtained results show that q-prophet has better performance than prophet in terms of delivery ratio, end-to-end delay and packets transmission, which are critical parameters for the communication in navy operations. This shows that, for this type of scenarios, it is recommended to use routing algorithms based on the quality of the wireless links to perform routing decisions.

It was also concluded that it is a big challenge to emulate real conditions of intermittence, or maintain these conditions to perform several tests in the same conditions to obtain results with a small confidence interval, due to the fact that these scenarios are unstable, i.e. they vary their characteristics along the time.

Finally, this work allows to conclude that the quality-based routing protocols should be an investment to apply in dtns to work in scenarios with navy constrains. The Q-prophet proved that quality-based routing can indeed improve the results in networks with this type of constrains.