

MONET – Mechanisms for Optimization of hybrid ad-hoc and satellite NETWORKS

MONET will investigate solutions to the end-to-end optimization of resource management in a hybrid MANET-Satellite network with the objective of optimizing link availability and reducing cost and energy. The team is composed of entities from Portugal, Italy, United Kingdom, Spain, France and Slovenia.

At A Glance: MONET

Mechanisms for Optimization of hybrid ad-hoc and satellite NETWORKS



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Main Objectives

The concept of a hybrid MANET-Satellite network is a natural evolution of considering the problem of providing local and remote connectivity in a highly mobile, dynamic and often remote environment.

This combination raises significant challenges in terms of optimising network resources, link availability, providing Quality of Service (QoS) and Quality of Experience (QoE) and minimizing costs and energy. Issues such as the re-organisation of MANET to connect to satellite access points, re-organisation of the satellite access points, selection of which satellite access points to use, the use of satellite as a relay between two MANET, the adjustment of routing in accordance with the current network situation and the exchange of cross layer information to improve resource management will be investigated in MONET.

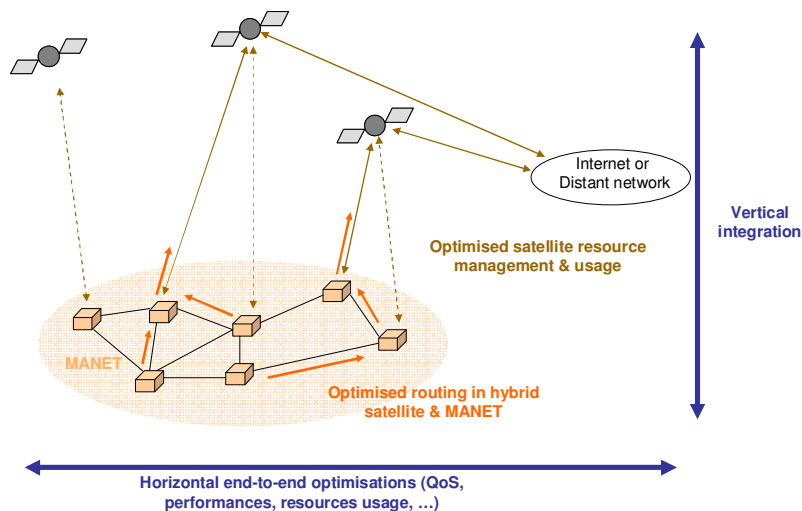
MONET will consider end-to-end as well as local optimization on each segment

Expected achievements and innovations

- Optimised resource management and usage in the overall system. End-to-end optimised mechanisms are considered as well as local optimisation on each segment.
- Routing Decisions taking into account satellite links, as well as other parameters (e.g. energy consumption, link quality)
- Taking into account of the specificities of the satellite segment in the wireless network routing decision.
- Managing the satellite resources in coherence with the MANET network topology and traffic.
- Enabling end-to-end (from the user point of view) QoS or management resources mechanisms.
- Providing broadband services through an integrated hybrid satellite-MANET network, seamlessly for the end-users.

Technical Approach

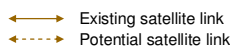
The first step in understanding such hybrid networks and associated challenges, is the perception of the possible applications and uses for these types of networks. This will be achieved through the study of a set of scenarios and development of a concept of operations for the network (WP2). Next, in order to understand the complexity of these heterogeneous, dynamic and distributed environments, the MONET team will investigate protocol, functional and network architectures using complementary top-down and bottom-up approaches (WP3). The most promising investigated mechanisms and solutions (WP4) will be developed (WP5), implemented (WP6) and subsequently validated through a field exercise representing a real life application (WP7) in Spain.



Key Issues

The movement of nodes that form a mobile ad-hoc network makes it likely that some partitions may occur in the wireless network without connectivity among them. Both geostationary/non-geostationary satellites can be envisaged as a "range extension" network. The challenge of how to provide connectivity between nodes in the same ad-hoc cluster; between nodes belonging to different ad-hoc networks with the added possibility of nodes using different equipment or technologies is an important one. The MONET approach proposes to address this through the investigation of mechanisms for the re-organisation of the MANET to connect to the access points on one hand, or the re-organisation of the access points themselves.

In multiple satellite and fixed backbone links within a MANET, the issues of how to organise them, choose between them, provide a higher QoE, minimize communication costs, minimize energy consumption to ensure higher network life become important ones. All of the issues mentioned above are closely related to routing, or how to adjust it in accordance with the current network situation, the availability and



characteristics of internet links, and the network usage requirements.

The lack of infrastructure often dictates the uses of distributed network management. However, the use of the satellite access links may require a centralized management entity that manages the access points and their organization and hand-overs between them. Therefore, the investigation of centralized versus distributed or mixed network management & re-organisation as well as determination of decision mechanisms (manual or automatic) constitutes another challenge to address. Other issues such as the connection/disconnection of satellite access points as well as the choice of satellite access points (horizontal handover) are counted among the key questions.

Expected Impact

The accomplishment of the proposed objectives will bring noteworthy added value to specific

application scenarios (some of them well known as MANET applications):

- Providing remote access and broadband to rural or remote areas (helping to bridge the digital divide; collaborative work and e-business; everyday operations of large field teams; health services and telemedicine);
- Providing on demand connectivity to Airports and aircraft;
- Public Safety (providing emergency communications during/after disasters; forest fires, floods and earthquakes and coastal monitoring);

Additionally, the approach proposed by MONET will provide a wide set of economic benefits that can be summarized in four main points:

- Communications cost optimization;
- Network setup and restructuring acceleration;
- Cost efficient communications for remote or isolated areas;
- Increased performance, efficiency and resilience for hybrid networks.