Session 12: Mobile Ad Hoc Networks

Chairmen: F. Meyer auf der Heide and U. Rückert

Mobile Ad Hoc Networks (Manets) are autonomous systems of mobile, energy-constrained devices connected by wireless links. Such networks have limited physical security of communication between devices, no central control or static infrastructure such as base stations. They are envisioned to have dynamic, sometimes rapidly-changing, random, multihop topologies which are likely composed of relatively bandwidth-constrained wireless links. Further information can be found at the web page of the IETF Manet working group: http://www.ietf.org/html.charters/manet-charter.html.

Due to their mobility and self-organizing properties, Manets present great challenges for research. Research on Manets is a relatively young discipline and only few projects approach this topic. The goal of our session is to survey the present state of research on Manets, mainly from a European perspective. Authors from Germany, India, Spain and Switzerland have contributed their work to this session covering different aspects of ad hoc networks, such as routing, security, energy consumption and even introduce a new approach to Manets.

In the first paper of this session, S. Tripathi and R. K. Ghosh examine the performances of four heuristics for enhancing the Ad hoc On Demand Distance Vector (AODV) routing protocol. These are: the utilization of location information to localize flooding during a route discovery, the utilization of route caches at intermediate nodes for route discovery, the maintenance of alternative paths to the destination (also advantegous for QoS support), and a local repair scheme for reestablishing a broken route. Three of them are analyzed by using the ns/2 network simulator. Their simulations show that location information can lead to a better packet delivery and lower latencies for low and moderate mobilities. Routing caches can increase the packet delivery fraction at the expense of higher latencies and routing loads because source routing techniques are used for maintaining the caches. The authors also show that the presented local repair scheme improves the packet delivery fraction and the average delay while increasing the routing load.

Security aspects in ad hoc networks are addressed in the second paper. S. Buchegger introduces a scheme for detecting and isolating misbehaving nodes, that is, nodes that do not relay packets for other nodes, thus sabotaging this fundamental mechanism in ad hoc networks. By analyzing the experienced, observed or reported routing and forwarding behavior of other nodes, trust relationships are established and routing decisions are made. Malicious nodes are excluded from routing if they misbehave (e.g. by not forwarding packets or by showing unusual traffic attraction). Following the introduction to the special security issues in mobile ad hoc networks, an overview of the components in each node is given in order to implement the scheme. It is also shown how to extend the Dynamic Source Routing (DSR) protocol to incorporate the proposed scheme.

In the third paper of this session, J.-C. Cano presents a scheme to reduce the energy consumption in the Intra Cluster Data-Dissemination Protocol (Icdp) for data broadcasting. The protocol builds clusters among the mobile nodes with a continuously elected cluster leader. This scheme enables the cluster leader to buffer data packets for other nodes while they are in the sleep mode. J.-C. Cano has performed simulations that compare the Icdp to a classical IEEE 802.11 scheme for constant and variable bit rate traffic and show that energy savings of 30% are possible without sacrificing latencies and packet loss rates.

An interesting new approach to Manets which employs directed communication and space multiplexing techniques is presented by K. Volbert. Here, the space around a node is divided into a fixed number of sectors, in each of which independent communication with variable transmission power is possible. Thus, the space can be reused more efficiently, promising less interference, higher network capacities and less energy consumption. K. Volbert uses the Spanner graph (from the computer graphic domain) as the underlying communication model. This possesses interesting properties for routing purposes. He has also developed a simulator based on this model for the evaluation of different routing strategies. The work concludes with two strategies that can be employed in these kinds of networks.

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