Mobile IP for Ad Hoc Networks

Abstract:

Mobile ad hoc networks are temporary networks, with varying network topologies. They communicate beyond transmitter range and are supported by multi hop communication through IP routing. Since Mobile Ad Hoc Network is a roaming network, where the host may be connected through various means to the Internet other than it's fixed-address domain space, it becomes important for the host to have dynamic network identification.

This paper talks about the Mobile Ad hoc networks and how Mobile IP is assigned to the various nodes in the network and their routing strategies. It compares and contrasts the various means used by mobile nodes to get network identification and the best means in terms of avoiding disconnection and quality of service.

Introduction:

A Mobile ad hoc network consists of mobile platforms (e.g., a router with multiple hosts and wireless communications devices)--herein simply referred to as "nodes"--which are free to move about arbitrarily. There may be multiple hosts per router. A Mobile ad hoc network is an autonomous system of mobile nodes. The system may operate in isolation, or may have gateways to and interface with a fixed network. In the latter operational mode, it is typically envisioned to operate as a "stub" network connecting to a fixed inter network. Stub networks carry traffic originating at and/or destined for internal nodes, but do not permit exogenous traffic to "transit" through the stub network. Mobile ad hoc network nodes are equipped with wireless transmitters and receivers using antennas, which may be omni-directional (broadcast), highly directional (point-to-point), possibly steer able, or some combination thereof. At a given point in time, depending on the nodes' positions and their transmitter and receiver coverage patterns, transmission power levels and co-channel interference levels, a wireless connectivity in the form of a random, multi hop graph or "ad hoc" network exists between the nodes. This ad hoc topology may change with time as the nodes move or adjust their transmission and reception parameters. Some salient features characterize Mobile Ad Hoc networks:

1. They have *Dynamic Topologies* , since the network is a temporary network, the topology (usually multi-hop) keeps changing as nodes keep joining and leaving the network. So the Mobile ad hoc network should be resistant to such topology changes.
2. A significant concern for a wireless network is *bandwidth* ; they have lesser capacity than wired networks.
3. Most Wireless nodes rely on batteries or exhaustible energy source that is a concern for mobile hosts.
4. *Physical security issues* , since the systems are mobile, the threat to their physical security is greater than it is for a wired network, system. Concerns that need to be addressed are eavesdropping, spoofing, denial-of-service attack. The decentralized nature of the Mobile ad hoc network is a good method to wade of some of these attacks.

Routing in Ad Hoc Networks:

In a mobile ad hoc network, the nodes communicate without making use if an underlying infrastructure, each node acts as a router and can forward packets to it's neighbor. The network being fully autonomous can be setup anywhere. So it becomes imperative to have a robust and adaptive algorithm for such a dynamic network. In other words, a real benefit to using IP-level routing in a Mobile ad hoc networks is to provide network-level consistency for multi hop networks composed of nodes using a *mixture* of physical-layer media; i.e. a mixture of what are commonly thought of as subnet technologies. A Mobile ad hoc networks node principally consists of a router, which may be physically attached to multiple IP hosts (or IP-addressable devices), which has potentially "multiple" wireless interfaces--each interface using a *different* wireless technology. Thus, a Mobile ad hoc networks node with interfaces using technologies A and B can communicate with any other Mobile ad hoc networks node possessing an interface with technology A or B. The multi hop connectivity of technology A forms a physical-layer multi hop topology, the multi hop connectivity of technology B forms *another* physical-layer topology (which may differ from that of A's topology), and the *union* of these topologies forms another topology (in graph theoretic terms--a multi graph), termed the "IP routing fabric", of the Mobile ad hoc networks. Mobile ad hoc networks nodes making routing decisions using the IP fabric can intercommunicate using either or both physical-layer

topologies simultaneously. As new physical-layer technologies are developed, new device drivers can be written and another physical-layer multihop topology can be seamlessly added to the IP fabric. Likewise, older technologies can easily be dropped. Such is the functionality and architectural flexibility that IP-layer routing can support, which brings with it hardware economies of scale.

Mobile IP :

Since Mobile Ip was designed primarily for wired networks, when used for ad hoc networks, some issues do arise. For the wireless network Mobile IP was designed to have foreign agent and the visiting node on the same link. When Mobile ad hoc networks have link-layer connectivity, packets to the visiting node are forwarded by the foreign agent using the link-layer address to the visiting node. In an ad hoc network, the foreign agent visiting node might not have link-layer connectivity, but instead have to use multi hop communication. Thus, when applied to an ad hoc network, Mobile IP must rely on the network routing protocol used in the ad hoc network for *routing* packets between the foreign agent and the mobile node.

Another problem with ad hoc networks is that broadcasts are much more costly in Multi hop ad hoc network than on a single link. A link-local broadcast is received by all hosts on a link, e.g., all hosts within wireless LAN cell, but none of the recipients need to forward it further. A broadcast in an ad hoc network on the other hand floods the whole network, i.e., is both received and transmitted by every node in the ad hoc network. Such flooding costs a lot of bandwidth and energy, which are both typically limited re-sources in an ad hoe network. Hence, it is desirable to reduce the number of broadcasts.

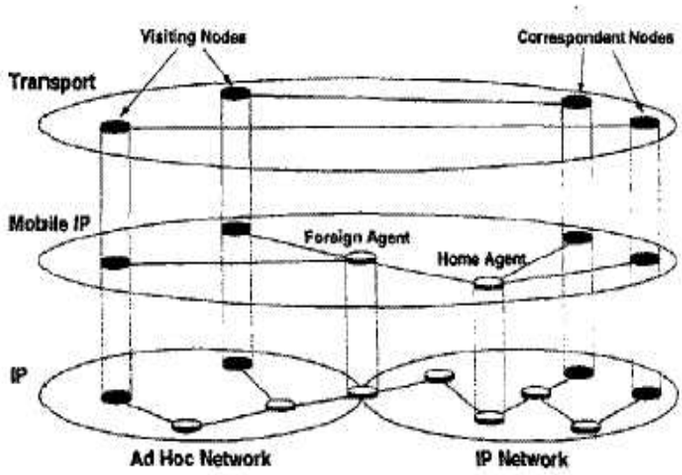

Fig. 1. A conceptional view of MIPMANET

Conclusion

References:

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