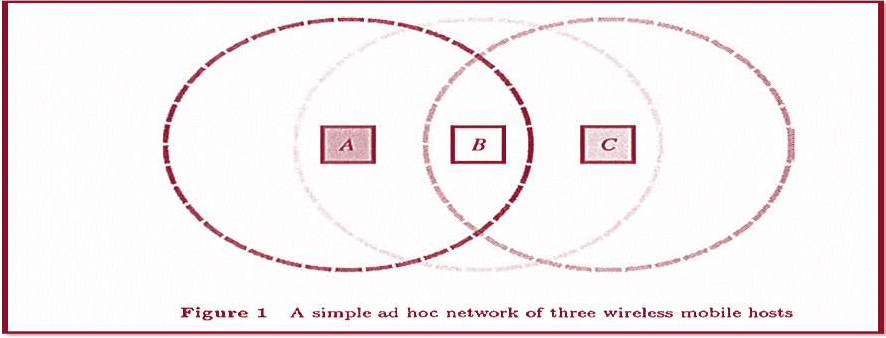


DYNAMIC SOURCE ROUTING IN AD HOC WIRELESS NETWORKS

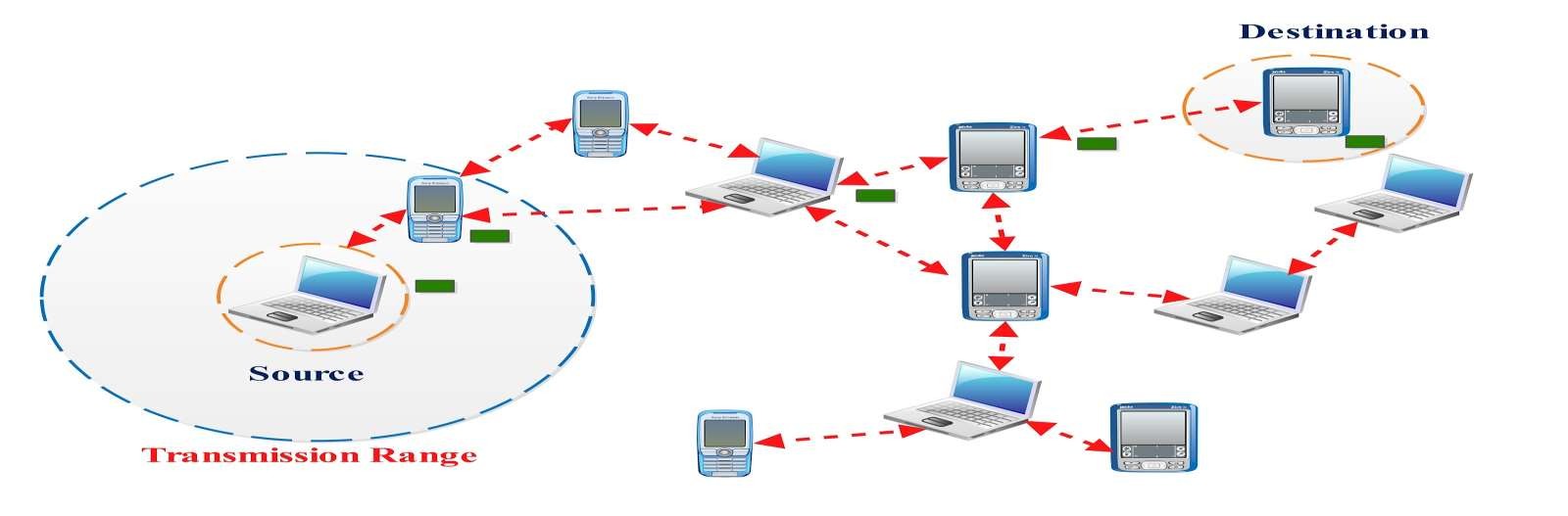
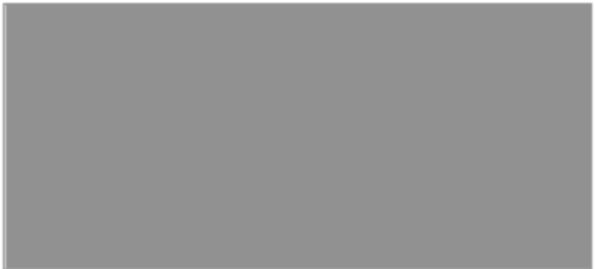


* An *ad hoc* network is a collection of wireless mobile hosts forming a temporary network without the aid

Introduction

of any established infrastructure or centralized administration.

* In such an environment, it may be necessary for one mobile host to enlist the aid of other hosts in forwarding a packet to its destination, due to the limited range of each mobile host's wireless transmissions.
* As shown in example (fig.1).



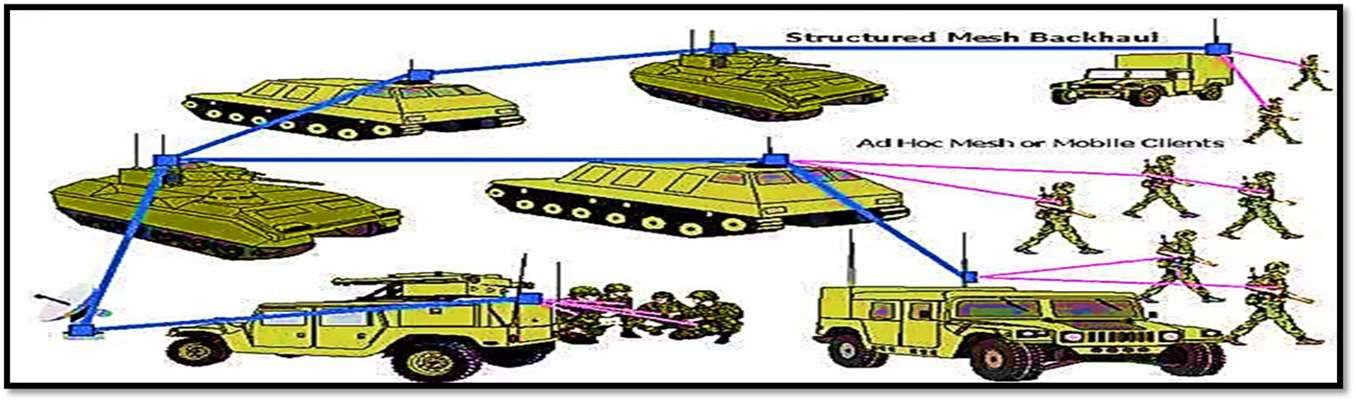
# Example:

Introduction (Cont.)

* + Routing protocols in conventional wired networks generally use either *distance vector* or *link state* routing algorithms, both of which require periodic routing advertisements to be broadcast by each router.
  + The basic distance vector algorithm has also been adapted for routing in wireless ad hoc networks.
  + \*Here the design and performance of a routing protocol for ad hoc networks that instead uses

*dynamic source routing* of packets between hosts that want to communicate , will be describe.

* + Source routing is a routing technique in which the sender of a packet determines the complete sequence of nodes through which to forward the packet; the sender explicitly lists this route in the packet’s header, identifying each forwarding "hop" by the address of the next node to which to transmit the packet on its way to the destination host.



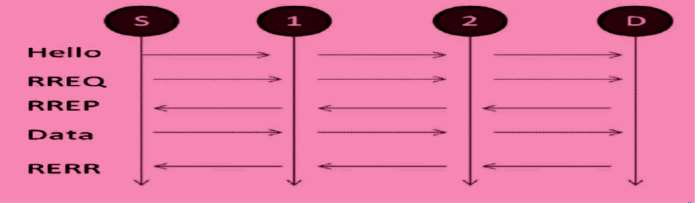
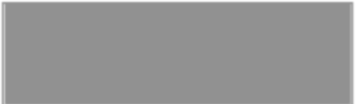
Ad Hoc Application example

Assumptions

* We assume that all hosts wishing to communicate with other hosts within the ad hoc network are willing to participate fully in the protocols of the network.
* In particular, each host participating in the network should also be willing to forward packets for other hosts in the network.
* We refer to the number of hops necessary for a packet to reach from any host located at one extreme edge of the network to another host located at the opposite extreme, as the *diameter* of the network. For example, the diameter of the ad hoc network depicted in Figure 1 is two.

Basic Operation

* To send a packet to another host, the sender constructs a *source route* in the packet's header, giving the address of each host in the network through which the packet should be forwarded in order to reach the destination host.
* The sender then transmits the packet over its wireless network interface to the first hop identified in the source route.
* When a host receives a packet, if this host is not the final destination of the packet, it simply transmits the packet to the next hop identified in the source route in the packet's header. Once the packet reaches its final destination, the packet is delivered to the network layer software on that host.



Each mobile host participating in the ad hoc network maintains a *route cache* in which it caches source routes that it has learned.

Basic Operation (Cont.).

When one host sends a packet to another host, the sender first checks its route cache for a source route to

the destination.

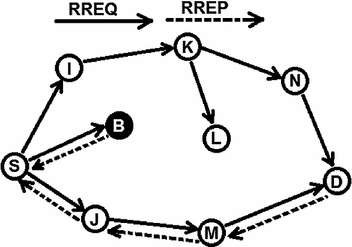
There are two basic operation :

* + route discovery .
  + route maintenance.

Route Discovery

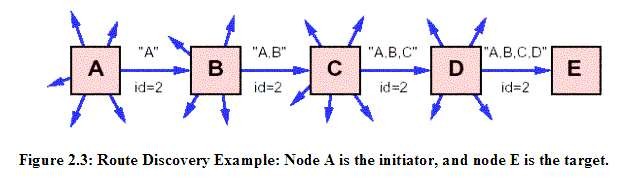
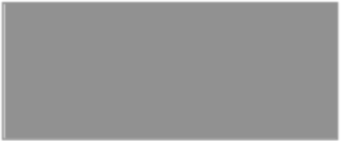
Route discovery allows any host in the ad hoc network to dynamically discover a route to any other host in the ad hoc network, whether directly reachable within wireless transmission range or reachable through one or more intermediate network hops through other hosts.

* A host initiating a route discovery broadcasts a *route request* packet which may be received by those hosts within wireless transmission range of it.
* The route request packet identifies the host, referred to as the *target* of the route discovery, for which the route is requested. If the route discovery is successful the initiating host receives a *route reply* packet listing a sequence of network hops through which it may reach the target.



Route Discovery (Cont.)

* In addition to the address of the original initiator of the request and the target of the request, each route request packet contains a *route record,* in which is accumulated a record of the sequence of hops taken by the route request packet as it is propagated through the ad hoc network during this route discovery.
* Each route request packet also contains a unique *request id,* set by the initiator from a locally- maintained sequence number, In order to detect duplicate route requests received, each host in the ad hoc network maintains a list of the (initiator address, request id) pairs that it has recently received on any route request.



Route discovery (cont.).

* When any host receives a route request packet, it processes the request according to the following steps:

1. If the pair (initiator address, request id) for this route request is found in this host's list of recently seen requests, then discard the route request packet and do not process it further.
2. Otherwise, if this host's address is already listed in the route record in the request, then discard the route request packet and do not process it further.
3. Otherwise, if the target of the request matches this host's own address, then the route record in the packet contains the route by which the request reached this host from the initiator of the route request. Return a copy of this route in a *route reply* packet to the initiator.
4. Otherwise, append this host's own address to the route record in the route request packet, and re-broadcast the request.

The route request thus propagates through the ad hoc network until it reaches the target host, which then replies

to the initiator.

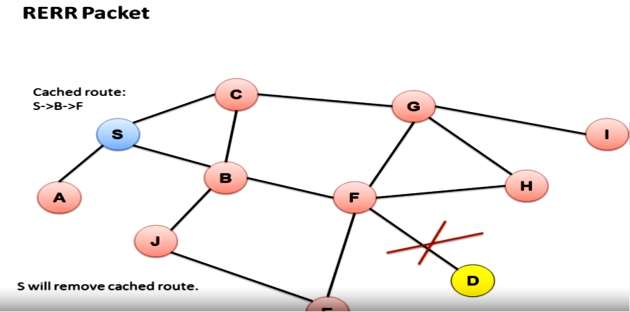
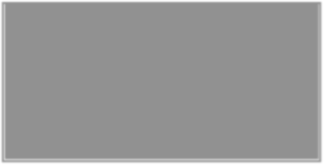
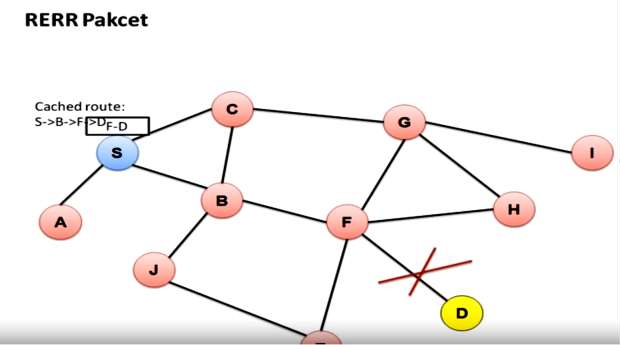
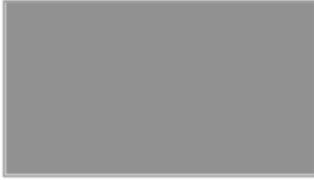
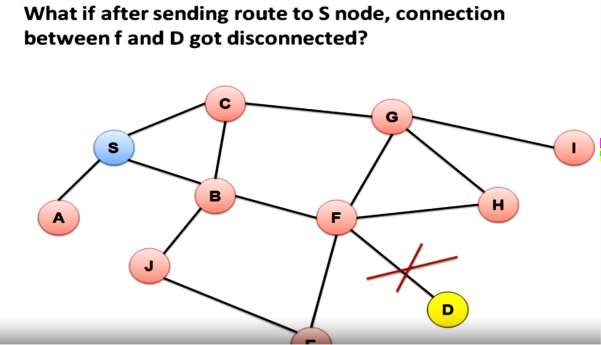
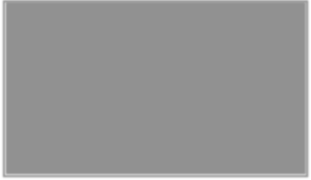


Route Maintenance

* Conventional routing protocols integrate route discovery with route maintenance by continuously

sending periodic routing updates.

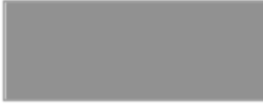
* , Since wireless networks are inherently less reliable than wired networks ,many wireless networks utilize a hop-by-hop acknowledgement at the data link level in order to provide early detection and retransmission of lost or corrupted packets.
* In these networks, route maintenance can be easily provided, since at each hop, the host transmitting the packet for that hop can determine if that hop of the route is still working. If the data link level reports a transmission problem for which it cannot recover (for example, because the maximum number of retransmissions it is willing to attempt has been exceeded), this host sends a *route error* packet to the original sender of the packet encountering the error.



Optimizations

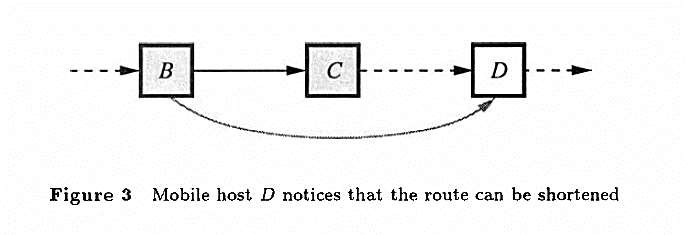
* A number of optimizations are possible to the basic operation of route discovery and route maintenance, that can reduce the number of overhead packets and can improve the average efficiency of the routes used on data packets. This section discusses some of those optimizations.





Reflecting Shorter Routes

* While two hosts are communicating with each other using cached routes, it is desirable for the hosts to begin using shorter routes if the hosts move sufficiently closer together. In many cases, the basic route maintenance procedure is sufficient to accomplish this, since if one of the hosts moves enough to allow the route to be shortened, it will likely also move out of transmission range of the first hop on the existing route.
* An improvement to this method of reflecting shorter routes is possible if hosts operate their network interfaces in promiscuous receive mode.(fig. 3)



Advantages of Dynamic Source Routing Protocol

* First, unlike conventional routing protocols, our protocol uses no periodic routing advertisement messages, thereby reducing network bandwidth overhead, particularly during periods when little or no significant host movement is taking place.
* Battery power is also conserved on the mobile hosts, both by not sending the advertisements and by

not needing to receive them.

* conventional routing protocols based on link state or distance vector algorithms may compute some routes that do not work. In a wireless environment, network transmission between two hosts does not necessarily work equally well in both directions, due to differing propagation or interference patterns around the two hosts.

Advantages of Dynamic Source Routing Protocol (Cont.).

* Wired networks are usually explicitly configured to have only one (or a small number) of routers connecting any two networks, but there are no explicit links in an ad hoc network, and all communication is by broadcast transmissions.
* Finally, conventional routing protocols are not designed for the type of dynamic topology changes that may be present in ad hoc networks. In conventional networks, links between routers occasionally go down or come up, and sometimes the cost of a link may change due to congestion, but routers do not generally move around dynamically.
* Our dynamic source routing protocol is able to adapt quickly to changes such as host movement, yet requires no routing protocol overhead during periods in which such changes do not occur.

