Assignment 2 Due date: 05.09.2003

Mobile IP

1. Could Mobile IP be replaced by DHCP?

At a very basic level both DHCP and Mobile IP try to provide the same functionality, i.e allow a MH to communicate when it moves from one network to another. The difference is that with Mobile IP an MH maintains its same IP address. (This is important for certain application such as SIP (session initiation protocol). Mobile IP allows reception and transmission of data from any address to any address. With DHCP, although the MH can transmit data to any address it can only receive data from within the new subnet (at least not without sending extra information to potential senders about its new address or recourse to dynamic DNS to update its ip to hostname binding).
The important issue is that dhcp does not provide transparency to the transport layer with mobility. Ongoing sessions are dropped when the MH moves from one network to another , whereas Mobile IP tries to make the handoff 's seamless.
In that sense, dhcp cannot replace Mobile IP.

2. Discuss the systemic issues related to HA and FA functionality placement (at router versus dedicated server).
   Part of this answer is from Jose's solution (a student from cupertino). Basically we look at different HA/FA functionalities and evaluate the right placement strategy

HA/FA Functionality	By Router	By dedicated server
Maintain Mobile Host list	Logical place but requires extra functionality to keep trackoff MH	Convenient to maintain
Maintain current MH bindings	Logical place to check bindings but requires additional work to keep track of updates. Also avoids having to send packets one additional hop to server and MTU and fragmentation issues	Can be readily used to maintain database for bindings. Requires some minimum routing functionality to forward data packets destined for MH
Accept packets on behalf of MH	Default router capability.	Requires routing capability to intercept packets destined for MH
Tunneling packets to CoA of MH and encapsulation	Easily adaptable.	Need to add additional functionality of router
Authentication of Mobile bindings	Not convenient to integrate this functionality	Can readily extend to handle this functionality
FA functionality, decapsulation, providing DHCP addresses etc	Can easily hand these tasks	Requires some router functions.

It is seen from the above table that most of the HA/FA functionality is common to routing functions and it may be better to include the functionality in the router instead of a dedicated server. Disadvantage of having the functionality in router is that routers will need to speak Mobile IP. This requires additional resources than basic routing capability.

3. Would you classify Mobile IP's mobility management as a hard- or soft-state

mechanism? Explain.

The location cache entry or visitor list entry is timed out after the lifetime negotiated by the mobile host and its foreign agent. Any registration with home agent or foreign agent, and any binding information is also timed out. The binding cache entries have a TTL after which they are updated/purged.
Hence Mobile IP' smobility management is soft state because the information has a lifetime associated with it and is periodically updated/deleted.

Unicast Routing

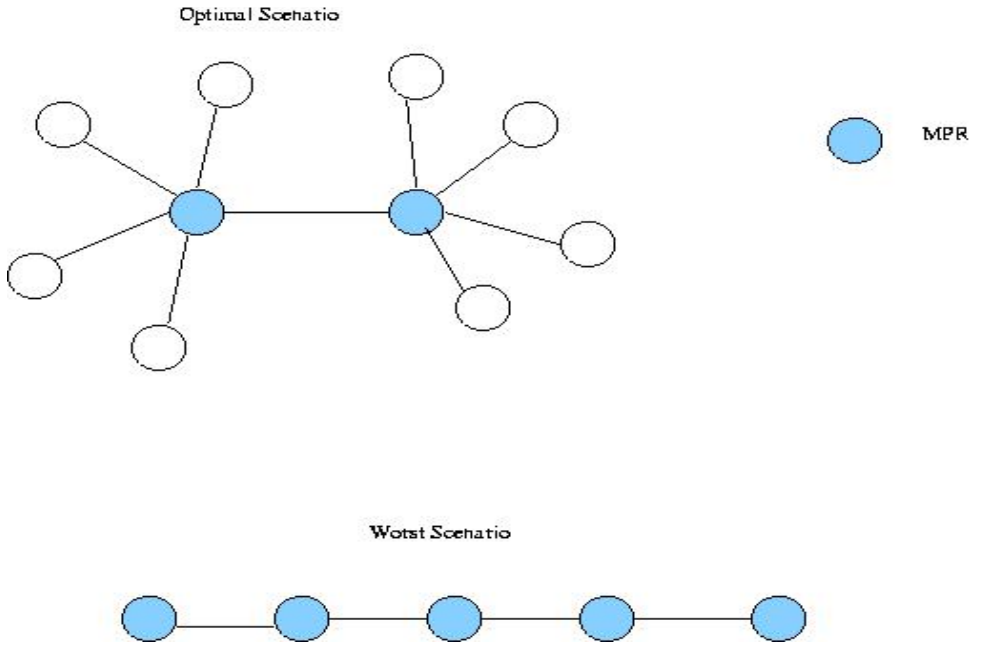
1. Based on the paper by Broc et al. "A Performance Comparison of Multi-Hop Wireless Ad-Hoc Network Routing Protocols" from the reading list, provide sample (qualitative) scenarios in which DSR performs better than AODV and scenarios in which AODV is the best performer. Discuss the reliability versus overhead trade-off. Explain your answer.

The performance is quantified by various parameters. We are mostly concerned with packet delivery and routing overhead (maybe number of hops & delay)
DSR performs better than AODV in low-medium mobility scenarios with small number of traffic flows and when destinations are close to the source. As seen in the paper , the pdr is higher and routing overhead (# of packets) is lower than aodv. This is because of DSR' s aggressive route caching.

AODV may perform better than DSR in high mobility scenarios when most destinations are max # of hops away from source. In case of link breakages, DSR will try to use alternate routes from its cache which can be stale due to the mobility. This may cause greater number of packet drops compared to packets that are lost during AODVs local recovery process. Also routing overhead in bytes for aodv will be lower since DSR uses source routing. (Note, there is another dimension here. Although routing overhead in bytes for DSR may be higher, the number of control packets transmitted is lower. We cannot really asses the cost in accessing the medium which may or may not be trivial when number of packets is considerably higher).

Reliability Vs Overhead Tradeoff.
Increased reliability is almost always obtained at the cost of increased overhead.
For both DSR, and AODV reliability can be increased by updating routes more frequently which of course increases the control overhead. (There is going to be a point beyond which reliability may decrease with increasing control traffic since data will have to contend with the control traffic)

2. Draw an optimal and a worse-case topology for OLSR. Explain.
   Optimal topology



In fig 1 data originating from any of the extreme nodes is forwarded only twice by the MPRs to reach all nodes in the network. OLSR generally performs well in dense networks with high node degrees.

In fig 2. All nodes are chosen as MPR and will have to forward data from one end to the other. For this topology this is similar to flooding.

3. Discuss the trade-offs in determining ZRP' s Routing Zone radius.

ZRP is a hybrid protocol which separates nodes into different routing zones based on the zone radius (specified in terms of # of hops). Within the zone (intrazone) the routing is proactive and for nodes outside (interzone) routes are established on demand. Increasing the zone radius requires maintaining proactive routes for a greater number of nodes which increases the overhead. The selection of zone radius depends on node mobility. For low mobility environments the zone radius could be large with proactive routes to a all possible destinations (reducing the route acquisition delay). For a highly dynamic network, it may be better to use a smaller zone radius since maintaining proactive routes to large number of destinations will result in many triggered updates due to link changes. The zone radius is also determined by the requirement for sources to maintain continuous routes to certain destinations in the network such as internet gateways. If nodes require regular access to the internet then its beneficial for those nodes to maintain proactive routes to the gateways. These nodes can specify their zone radius to encompass the gateway node and just maintain reactive routes to other destinations in the network.
In summary, the radius needs to be optimized based on the node density, node mobility and the possible destinations to which nodes have to continuously transmit data.