13.1 What are the differences between cellular and ad hoc networks?

Answer:

Cellular network model supports the needs of wireless communication by installing BSs as access points. Communications between two mobile nodes completely rely on the wired backbone and the fixed base stations. In an ad hoc network, no such infrastructure exists and the network topology may change dynamically in an unpredictable manner since nodes are free to move in an arbitrary direction with a random speed.

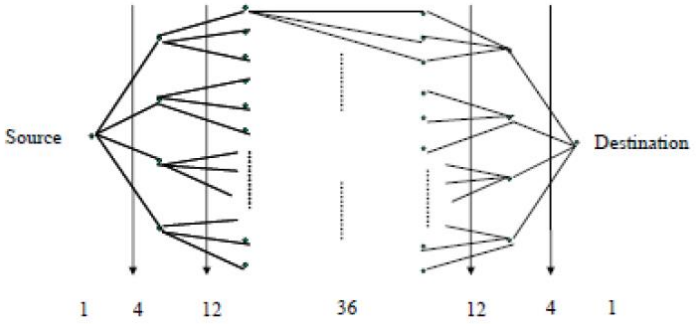
13.5 In Problem P13 .4, if the destination node is located at 5 hops apart from a given source node, what is the maximum possible value of

(a) tbe number of alternate paths of length of 5 hops?

(b) alternate disjoint paths of length of 5 hops?

Answer:

(a) Alternate paths means a source node S can take A-B-C to destination D, it also can take M-L-N to destination D if the formal link fails. If the destination node is located at 5 hops apart from a given source node, every node is connected to exactly 4 adjacent node, therefore, source can connect with four adjacent node, among these four adjacent nodes, every node mostly can connect with another 3 nodes, then from 4 nodes arrive to destination. Therefore, there would be 4*3*3*1*1 = 36 alternate paths (maximum).



(b) (b) For disjoint-ness, no intermediate node should be common among the paths. One simple way is to have a unique path between 12 nodes after 2 links from either source or destination, giving 4 x3x1x4 = 48 disjoint paths (maximum).

13.11 Consider an ad hoc network in which communication (message or packet transfer) is to take place from node X to node Y. The route has already been established, and a data packet is to be transferred over *n* hops. To transfer the packet, the kth node uses the following medium access protocol :

- **It waits for time *t(k)* after which the channel becomes free. *t(k)* = kαtime units.**
- **It transfers the data packet to the next hop. This takesαtime units.**
- **It receives an acknowledgment. This takes another α/2 time units.**

The time *t(k)* before the kth node actually transmits the data packet is given by *t(k)* = kαtime units.

(a) Find an expression for time taken for the data to cover *n* hops

(i.e., from node 1 to node n+1).

(b) If the time taken to traverse *n* hops is $T = 2n\sqrt{n\alpha}$, what is the value of *n*?

Answer:

(a) For node I, it waits for time t(i) = i *α time units, then it transfers the data packet to node (i+1), this takes α time

units. Then it waits for acknowledgement, which takes α /2 time units. Therefore: from node 1 to node n + 1, there would be

$(\alpha + \alpha + \alpha/2) + (2\alpha + \alpha + \alpha/2) + (3\alpha + \alpha + \alpha/2) + \ldots\ldots (n\alpha + \alpha + \alpha/2) = (n^2/2 + 2n)\,\alpha$

(b) n = 4

13.15 What are the advantages and disadvantages of reactive and proactive protocols? Which one would you prefer and why? Explain with specific conditions.

Answer:

Reactive protocols:

Advantages:

(a) The routing protocol is active only when data is required to be transmitted between nodes.

(b) Storage of all routes not required.

Disadvantages:

(a) Latency involved when data needs to be transmitted due to non-availability of routes.

(b) Useful Scenarios: Light traffic scenarios, where proactive protocols would incur high overhead. Attractive for large networks.

Proactive protocols:

Advantages:

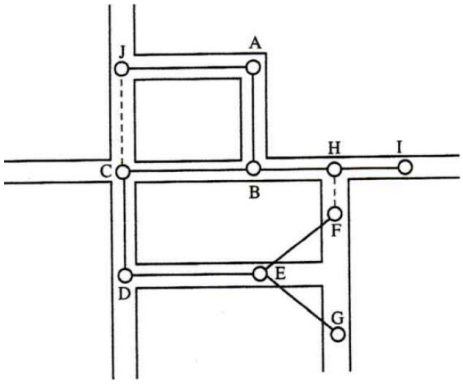
(a) Data does not face any latency due to route updates and can be sent fast.

Disadvantages:

(a) Protocol is active at all times, even when data is not being transmitted.

(b) Storage of all routes required.

13.21 A VANET in a city area is shown in Figure 13.15. What is the transmission path you would select to send a message from device G to device A?



Answer:

There are three possible solutions such as:

- G E F H B A
- G E D C J A
- G E D C B A