

Broadcasting Protocols

What is a Broadcast?

Sending a packet from a source node to all other nodes in the network – (one-to-all operation).

Use of Broadcast

- Fundamental Networking Operation.
- Used for destination discovery (i.e. finding routes)
- Used for service discovery
- Even used for actual data transmission
 - Sending alarm signal to all the nodes in the network

Broadcast in Wired Networks

Sending a packet from a source node to all other nodes in the network – (one-to-all operation).

Key:

Three departmental LANs interconnected with a switch.

Broadcast in Ad hoc Wireless Networks

Sending a packet from a source node to all other nodes in the network – (one-to-all operation).

(a)

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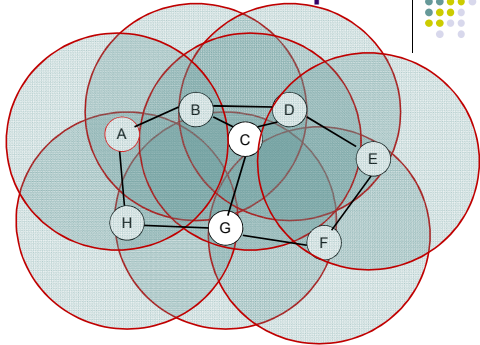
Broadcast in single hop is a free-feature in Wireless Medium

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How to solve it in multi-hop?

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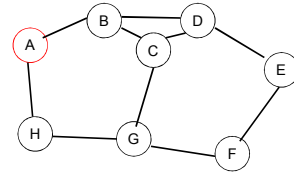
How to solve it in multi-hop?



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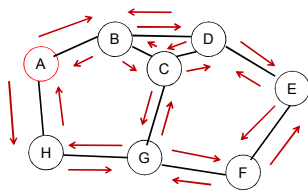
How to solve it in multi-hop?



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Naïve Solution: Flooding

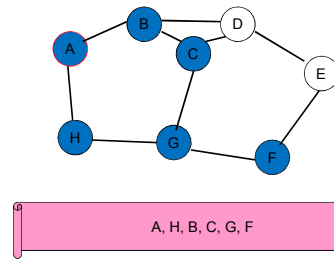


8 transmissions!!

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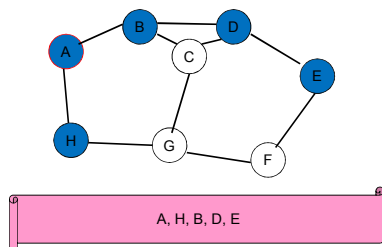
Better Solution



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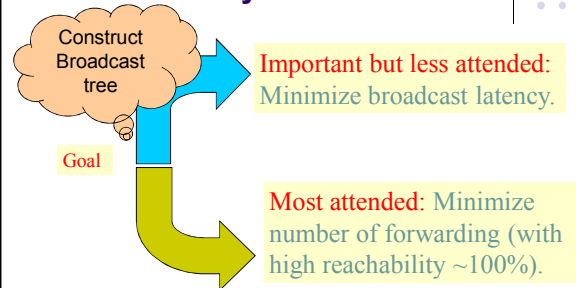
Even Better Solution



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How efficiency is defined?



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Minimizing delay

Construct shortest path tree

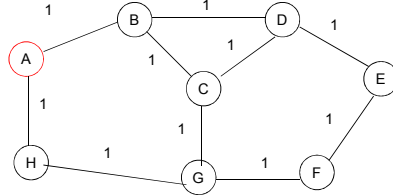
First goal:

Minimize broadcast latency.

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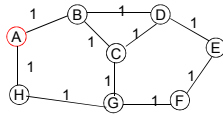
Shortest path tree (Source A)



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Shortest path tree (Source A)

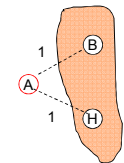
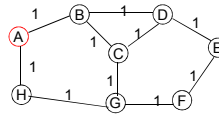


A

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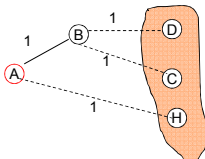
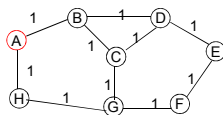
Shortest path tree (Source A)



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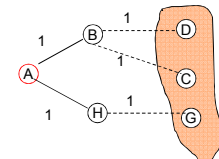
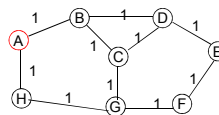
Shortest path tree (Source A)



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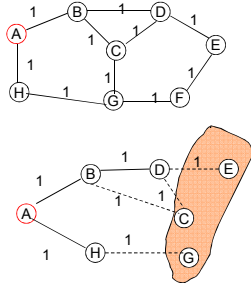
Shortest path tree (Source A)



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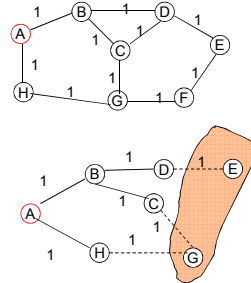
Shortest path tree (Source A)



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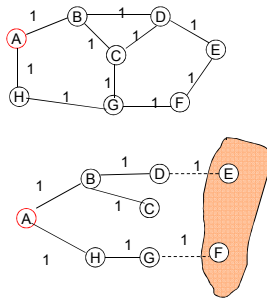
Shortest path tree (Source A)



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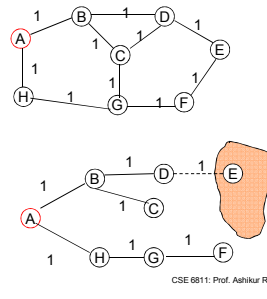
Shortest path tree (Source A)



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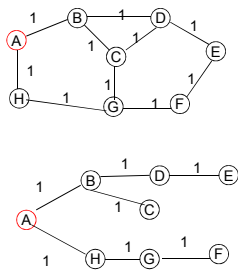
Shortest path tree (Source A)



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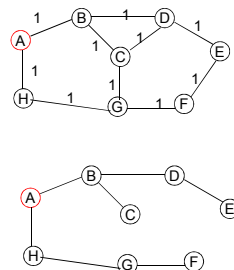
Shortest path tree (Source A)



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Finally (Source A)

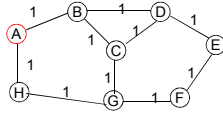


Only non-leaf nodes will rebroadcast

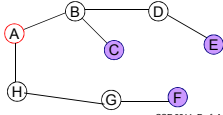
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Broadcast strategy



Only non-leaf nodes will rebroadcast



Solvable in polynomial time!

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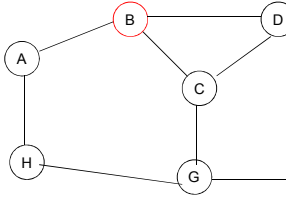
Second goal:

Minimize number of forwarding (with high reachability ~100%).

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Minimize number of forwarding (Second goal : Source B)

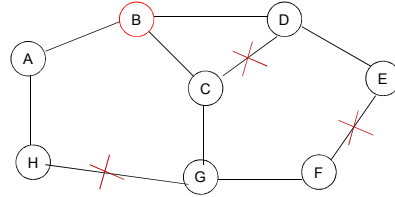


Construct Broadcast tree

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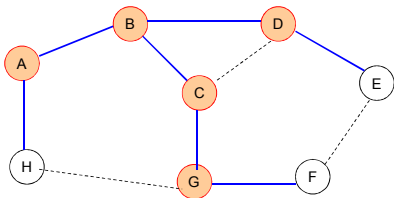
Minimize number of forwarding (Source B) Break Cycles, create tree



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Minimize number of forwarding (Source B) Break Cycles create tree

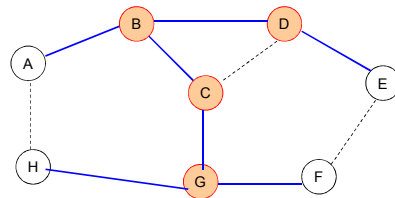


5 broadcasts

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Another way of breaking cycles

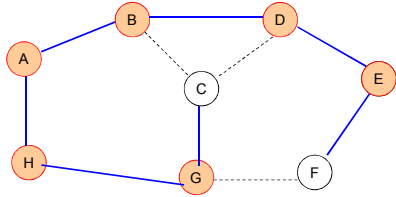


4 broadcasts

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Minimize number of forwarding (Source B)



6 broadcasts

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Solved

Minimizing number of forwarding



Minimizing number of non-leaf nodes

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Solved

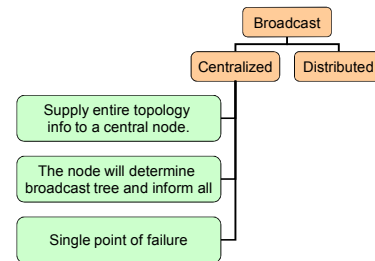
- 1) Find all possible broadcast tree keeping source as root
- 2) Let $T_1, T_2, T_3, \dots, T_n$ are found.
- 3) Find T_{\min} with minimum non-leaf nodes

Finding spanning tree with maximum terminal nodes is an NP-Complete problem.

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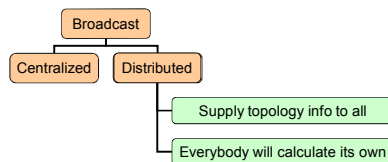
Broadcasting approaches



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Broadcasting approaches



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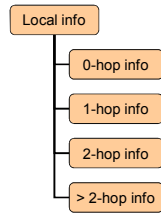
Which approach for MANET?

- Of course distributed
- Should we supply the entire topology?
 - Large overhead
 - Mobile environment
 - Frequent topology changes

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Partial info



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