Service Driven Mobile Ad Hoc Networks Formation and Management

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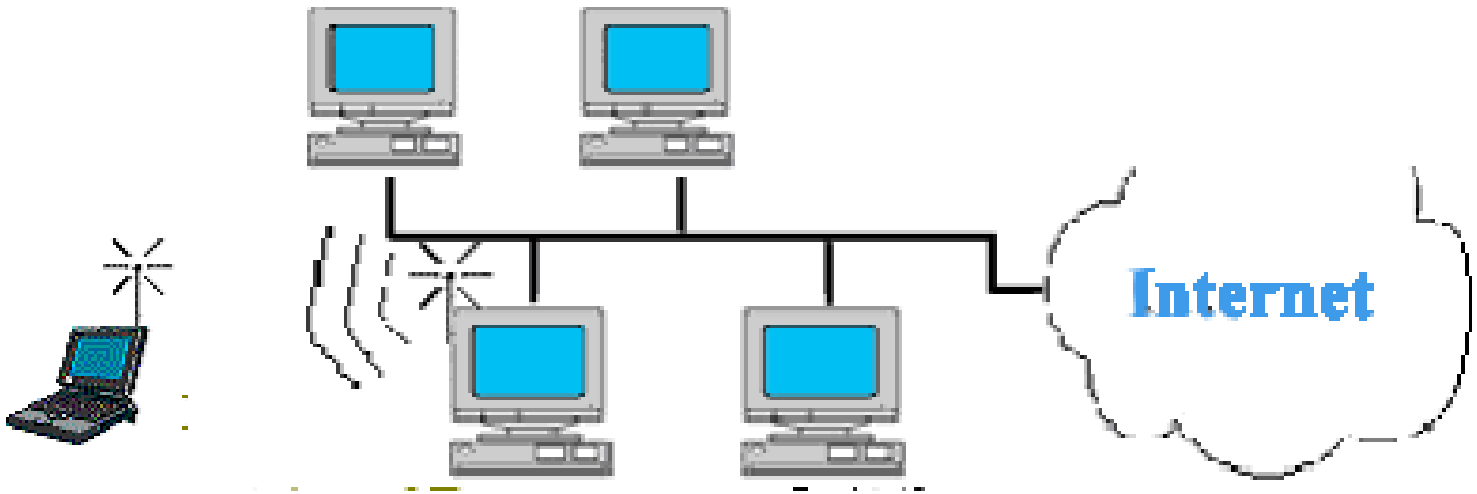
Context



Strategies for creating MANET

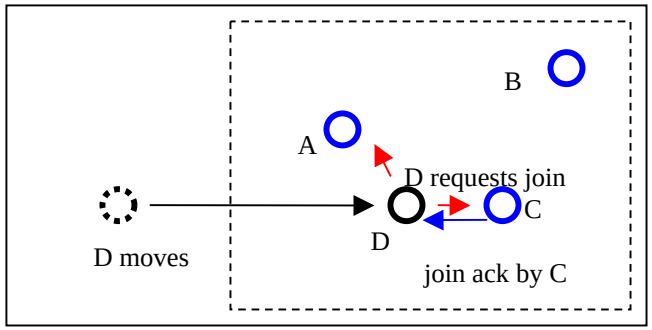
- IP based
  - Auto-configuration (Zero configuration)
    - DHCP server allocates one from the link-local range
    - The device chooses one itself and checks if it is unique
  - An existing node becomes proxy and provides the requestor with an IP address
- Proprietary – Bluetooth
  - 8 active devices, 255 parked devices
- Cluster head – elected by nodes
- Distributed hash tables

The Network Identity

- creates an administrative domain during the network lifetime – this limits the scope for network activity (service search, for example);
- allows routing intra and inter-domain;
- permits the evaluation of node mobility as the number of MANETs joined over a period of time.

Net_id

- net_id is a number computed by the device that creates the network and it is based on the device's unique id and other information like the date and time;
- it has a time to live, NetTTL, an estimation of the network existence life time;
- each member node receives and stores the pair {net_id, NetTTL};
- NetTTL is refreshed by messages exchanged by network's nodes


B
A
D requests join
C
D moves
D
join ack by C

Version A – the opportunist

Join:

start *join_timer*
send join message
while (not timeout) {
receive join message
if (net_id) ; first net_id received
adopt and store it
exit
start *delay_timer*
while (not timeout) {
receive join message with net_id
adopt net id} ; it is the first received
exit
if (no net_id) {
compute net_id
broadcast message with net_id}
exit

Version B – the greedy

Join:

```
start join_timer
send join message
while   (not timeout) {
            receive join messages
            check for net_id and store}
if (one net_id)
             adopt it
if (more net_ids)
             adopt them
if (no net_id) {
            start delay_timer
                    while (not timeout) {
                       receive join messages with net_id
                       adopt net_id}}
                       exit
            if (no net_id adopted) {
                       compute net_id
                       broadcast message with net_id}
exit
```

Simulation

- ns-2 and CMU's mobile node extensions;
- environments consisting of 4, 50 and 125 nodes moving around an area 1500m by 600m ;
- node movements are performed using the random waypoint mobility model - nodes select a destination and move towards it. Once reached, the node chooses a new destination and starts moving towards that;
- the speed of nodes range from 0 to 20 mps;
- simulations run for 250 s;
- the join timer is set to timeout after 10 s.
- The NetTTL is set to 90 s.

Version A. Formation of MANET

Nb of Nodes	Join Interval	Start Time	Lowest Time	Highest Time
4	0.5 s	36 s	1.03737 s	19.5321 s
50	0.5 s	36 s	0.641428 s	19.9554 s
125	1 s	36 s	0.710763 s	19.6338 s

Version B. Formation of MANET

Nb of Nodes	Join Interval	Start Time	Lowest Time	Highest Time
4	0.5 s	36 s	1.33449 s	17.3103 s
50	0.5 s	36 s	0.506621 s	19.9681 s
125	1 s	36 s	0.645025 s	19.8779 s

Version A. Joining existing MANETs

Nb of Nodes	Join Interval	Start Time	Lowest Time	Highest Time
4	0.5 s	145 s	0.01s	26.881s
50	0.5 s	145 s	0.008 s	20.297 s
125	1 s	145 s	0.710763 s	19.6338 s

Version B. Joining existing MANETs

Nb of Nodes	Join Interval	Start Time	Lowest Time	Highest Time
4	0.5 s	145 s	0.007 s	28.9522 s
50	0.5 s	145 s	0.008 s	0.368 s
125	1 s	145 s	0.023 s	20.297 s

Split

- one node or network lacking activity: the net_id will be cancelled as a result of the timeout associated with the network TTL;
- if networks are active, all of them will have the same net_id;
- getting connected to an AP requires a new net_id – this is computed by the gateway.

Merge

- the node that detects another network can broadcast this information to the entire network – it suggests a merge and to adopt the new net_id, or

- it simply joins the new network and acts like a gateway

Conclusions

- Our MANET mgmt service is simple and cost effective in terms of messages/battery power;
- It is focused on service discovery and use;
- Allows max flexibility in terms of split/merge.