

Fundamentals of Communication

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Title:

Simulate a cluster-based network in NS2 / NS3 using underwater RF channel model

Objective:

- Form a cluster with fixed number of nodes (N)
- Select the cluster head (CH)
- Use TDMA based protocol to transmit the data from nodes to CH (hop 1)
- Aggregate the data at CH (encode it if possible) and transmit to base station (hop 2)
- Calculate the network life (in seconds) and throughput (in terms of successful packets transmitted to the base station)
- Compare the performance with direct communication (between node and base station)
- Vary the data rate and observe the above

Parameters:

K = data rate

d = distance

$e^{\alpha \cdot d}$; where $\alpha = 0.0203$

$$e_{amp} = 0.0013 * 10^{-12}$$

$$E_{tx} = k * E_{tx-el} + k * d^2 * e_{amp} * e^{\alpha * d}$$

$$E_{ch} = E_{tx-rs} + E_{rx-node}$$

$$E_{tx-el} = 10^{-12}$$

Methodology:

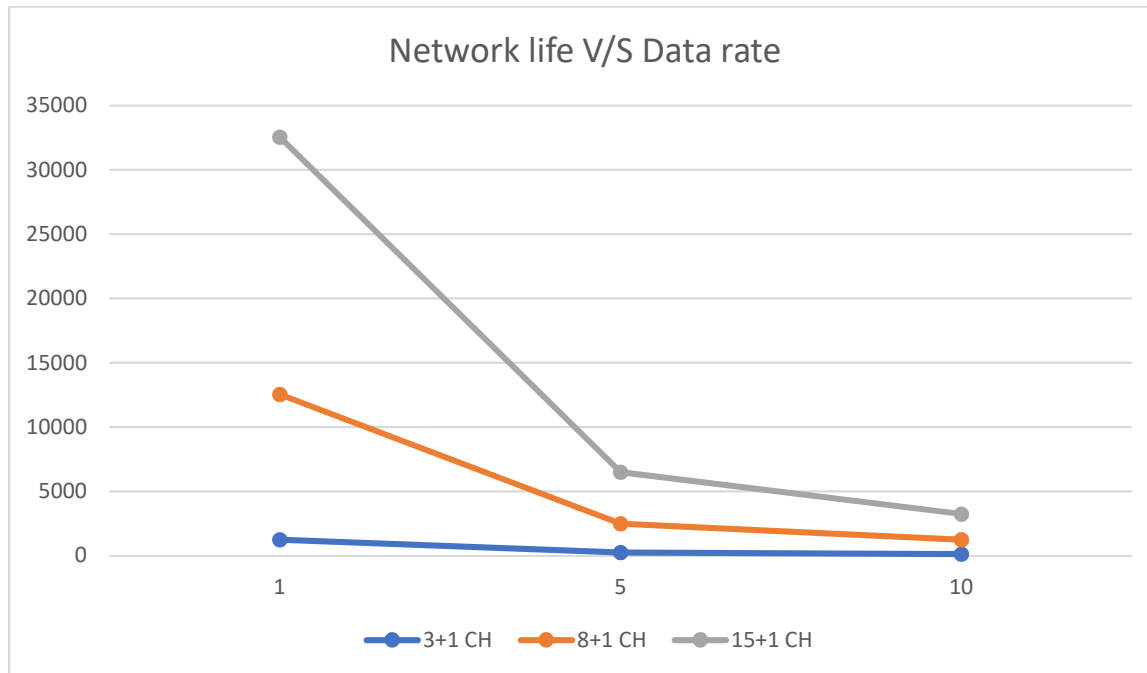
- First, we have created the nodes for our mesh, we have done it for 4, 9 and 16 nodes.
- For each of the nodes we have written different code as it was difficult to combine them all in one file.
- In each mesh the area of the cluster is fixed (100 X 100) and the cluster head in each of them are different according to the number of nodes. The cluster is so chosen that it is at least distance from each of the node i.e., near the centroid of the node.
- For 4 nodes we can take any one of the nodes as cluster head, for 9 nodes we have taken center node as the cluster head and lastly for 16 nodes we have taken cluster head as the 6 nodes in sequence.
- For each of the nodes we are making a TCP connection with the cluster head by using transport layer protocol TCP and then by using application layer protocol FTP to transfer the data between the node and the cluster head.
- All the nodes will transfer the energy to the cluster head (one at a time – for this we used TDMA).
- Once the energy from all the nodes is received to cluster head it is then send to base station.

Results:

Following table shows the observation from the project:

Nodes	Data Rate	Network Life
3 + 1 CH	10 Mbps	126
	5 Mbps	251
	1 Mbps	1251
8 + 1 CH	10 Mbps	1255
	5 Mbps	2509
	1 Mbps	12541
15 + 1CH	10 Mbps	3255
	5 Mbps	6509
	1 Mbps	32545

Graph:



Conclusion:

Thus, we conclude the following from the observations:

1. Increasing the number of nodes in any area, increases the network life of the cluster provided the cluster head has enough energy.
2. By increasing the data rate, the network life of the cluster decreases.
3. The energy of the nodes depends on the data rate as well as the nodes.
4. Direct communication consumes more energy than communication through cluster head.
5. Cluster head should be closer to the centroid so as to reduce the distance between the cluster head and the node.