Peer to Peer Cooperation for Caching in Wireless Networks

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Abstract-- Some recent studies have shown that cooperative cache can improve the system performance in wireless P2P networks such as ad hoc networks and mesh networks. All these studies are at a very high level, leaving many design and implementation issues unanswered. In this project, design and implementation of cooperative cache in wireless P2P networks is considered, and solutions to find the best place to perform caching is proposed. A novel asymmetric cooperative cache approach is proposed, where few nodes need to cache the status of the nodes in their vicinity. This solution reduces the overhead of all nodes caching status of all other nodes. The results show that the asymmetric approach outperforms the symmetric approach in traditional 802.11-based ad hoc networks by removing most of the processing overhead.

Keywords—Wireless Networks, P2P networks, cooperative cache.

I.INTRODUCTION

In wireless networks, the nodes are unaware whether the other nodes are active are not. When a node wish to transmit some data to other node, a shortest possible path is found and intermediate nodes along the choosen path need to forward the data from source to destination. But if any intermediate node along the path is not active, the source node is unaware of this and sends the data. But the data is not received by the destination node.

To overcome this, a solution is proposed in which the nodes cache the status of other nodes in the network. This can be done by maintaining cache layer by the nodes. Due to this every node in the network caches the status of other nodes. The source node knows the status of intermediate nodes along the choosen path and send data if all are active. But in real time, it is not possible for all nodes to cache status of all other nodes. To overcome this, an asymmetric approach is proposed. In this, only few nodes are choosen to cache the status of other nodes in its vicinity. All nodes can refer this caching node while sending data to others. The results show that the asymmetric approach outperforms the symmetric approach in traditional 802.11- based ad hoc networks by removing most of the processing overhead.

II.BACKGROUND

Cooperative caching was implemented in wireless p2p networks to cache the data. It was based on asymmetric approach. In asymmetric approach to cache the data, a layered design was considered. Cooperative cache is designed as a middleware lying right below the application layer and on top of the network layer (including the transport layer). In asymmetric cooperative cache approach, the data requests are transmitted to the cache layer on every node, but the data replies are only transmitted to the cache layer at the intermediate nodes that need to cache the data. This solution not only reduces the overhead of copying data between the user space and the kernel space, it also allows data pipelines to reduce the end-to-end delay.

III. DESIGN AND IMPLEMENTATION OF COOPERATIVE CACHING

In this project, cooperative cache is used for caching status of the nodes. In wireless networks the nodes are unaware whether the other nodes are active are not. When a node wish to transmit some data to other node, a shortest possible path is found by using DSR or AODV routing protocols depending on the network whether it is wireless adhoc network or wireless mesh network and intermediate nodes along the choosen path need to forward the data from source to destination. But if any intermediate node along the path is not active, the source node is unaware of this and sends the data. But the data is not received by the destination node. To overcome this, a solution is proposed in which the nodes cache the status of other nodes in the network. This can be done by maintaining cache layer by the nodes .as shown below

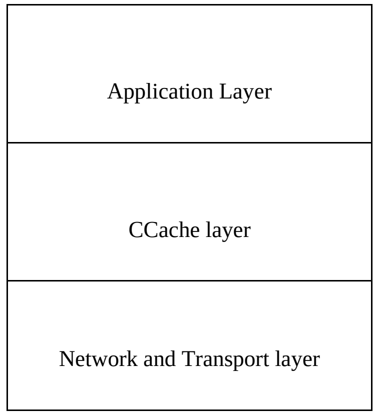

Fig.1.A caching node

Due to this every node in the network caches the status of other nodes. The source node knows the status of intermediate nodes along the choosen path and send data if all are active. But in real time, it is not possible for all nodes to cache status of all other nodes. To overcome this, an asymmetric approach is proposed. In this, only few nodes are choosen to cache the status of other nodes in its vicinity. Among the nodes within same transmission range, the centroid is found and the node nearer to the centroid is taken as the caching node. All nodes can refer this caching node while sending data to others.
Centriod for n points is calculated as follows:

$X = (x1+x2+\ldots\ldots+xn)/n$ and

$Y = (y1+y2+\ldots\ldots+yn)/n$

Nearest node to the centriod is taken as cache cluster head. This can be done by calculating Euclidean distance for each node in the transmission range and centriod and updating cache cluster head. Euclidean distance between two points (x1,y1) and (x2,y2) is calculated as follows:

$ED = [(x2- x1)2 +(y2- y1)2]1/2$

Algorithm for asymmetric approach:

1. Initialize Cache cluster heads and gateways by finding centriods for different transmission ranges.
2. Centriod for n points is calculated as follows:

   $X = (x1+x2+\ldots\ldots+xn)/n$ and

   $Y = (y1+y2+\ldots\ldots+yn)/n$
3. Cache the status of the nodes by updating cache tables maintained by Cache cluster heads.
4. Choose source and destination nodes.
5. Find shortest path from source to destination by using DSR or AODV
6. Transmit the data if the nodes on the choosen path are all active by retrieving status from Cache cluster heads.

IV.RESULTS

The following are the screen shots of the system

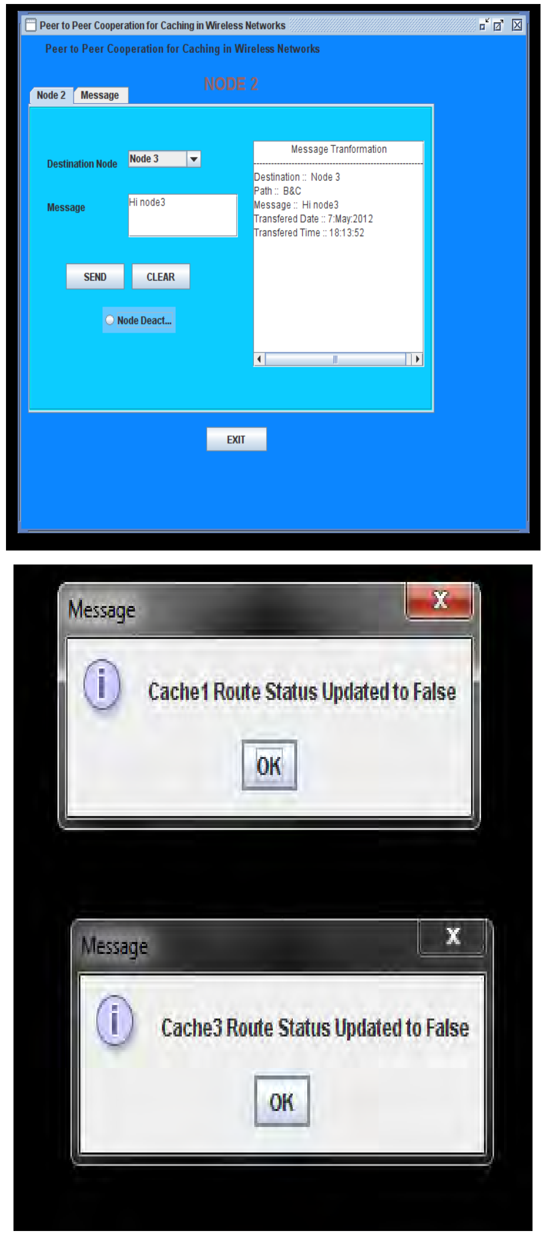

Fig 2.Status of the node captured into the Cache

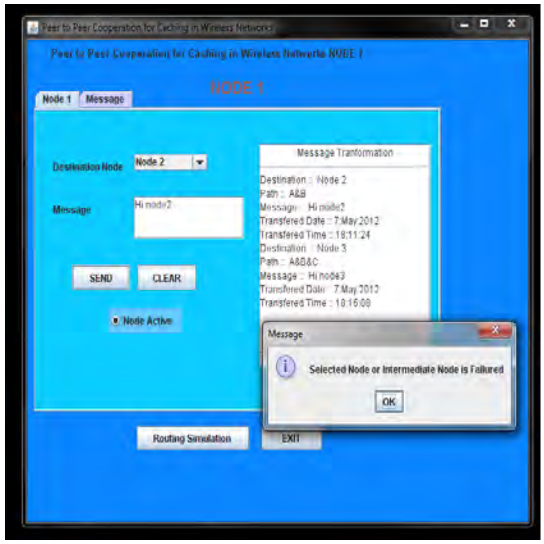

Fig 3.Message showing node failure

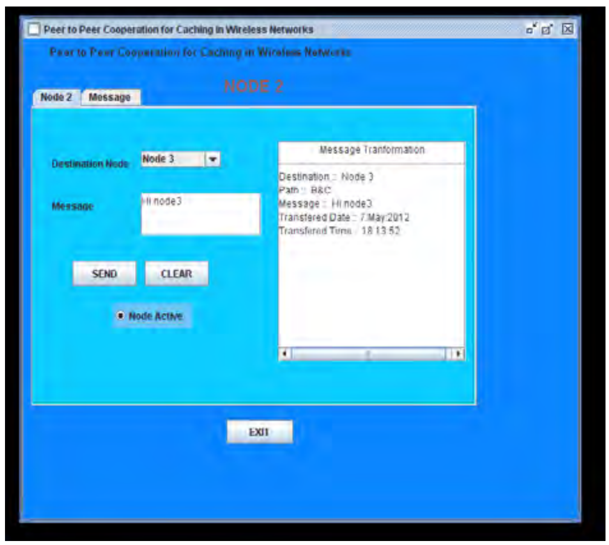

Fig 4.After recovery from failure

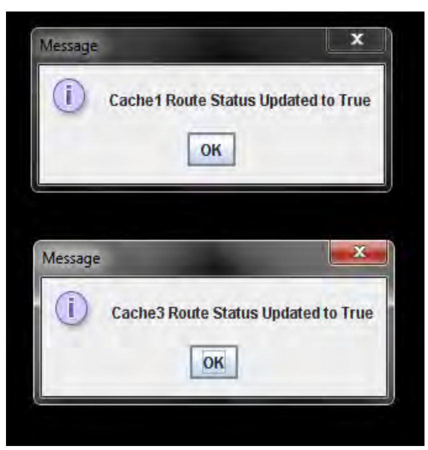

Fig 5.Status of the node updated in the Cache after recovery

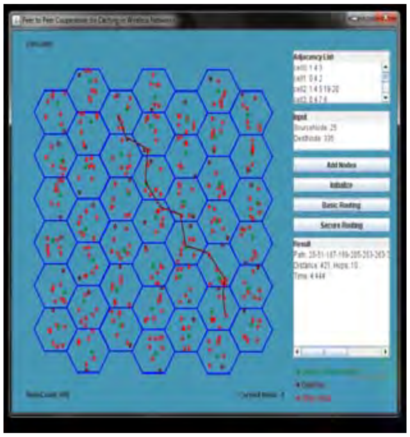

Fig 6. Basic Routing

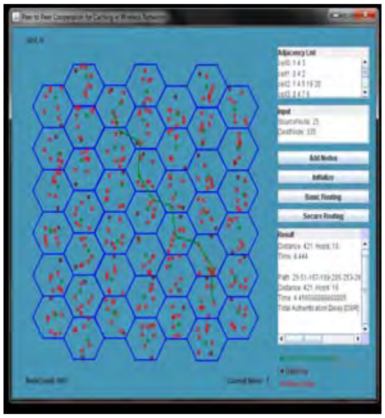

Fig 7. Secure Routing

V.CONCLUSION

In this project, I implemented cooperative cache in wireless peer to peer networks. I even proposed solution to find best place to perform caching. I evaluated my design for a large-scale network through simulations. An asymmetric approach is proposed. In this, only few nodes are choosen to cache the status of other nodes in its vicinity. All nodes can refer this caching node while sending data to others. The results show that the asymmetric approach outperforms the symmetric approach in traditional 802.11- based ad hoc networks by removing most of the processing overhead. In the future enhancements, I can choose to find another node which maintains a backup of cache table maintained by Cache cluster heads. This node can take over responsibility of the Cache cluster head in case of its failure. Due to this, the system can be prevented from hanging.

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