Analysis of Catching Strategies & Emergence of Information Density in Mobile Ad hoc Networks

Abstract - Caching in wireless networks means where the nodes may be mobile and exchange information in a peer-to-peer method with large and small-sized caches. For large-sized caches, devise a strategy where nodes, independent of each other, decide whether to cache some content and for how long and small-sized caches, aim to design a content replacement strategy that allows nodes to successfully store newly received information while maintaining the good performance of the content distribution system. Under these conditions, each node takes decisions according to its perception of what nearby users may store in their caches and with the aim of differentiating its own cache content from the other nodes'. Our system propose a novel asymmetric cooperative cache approach, where 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. Another objective of this project is to propose AODV and DSR algorithm for the novel asymmetric cooperative cache approach and to evaluate the two proposed routing protocols namely, AODV and DSR, for wireless ad-hoc networks based on performance and compare them with other caching schemes, showing that our analysis succeeds in creating the desired content diversity, thus leading to a resource-efficient information access.

Keywords – Mobile Adhoc Networks, Estimation, DAPRPA, AODV

INTRODUCTION I

World-wide web has been developed for more than forty years recently many researchers are studying networks based on novel communication techniques, especially wireless communications which allow hosts to roam without the constraints of wired connections. People can deploy a wireless network easily and quickly. Hosts and routers in a wireless network can move around. In the recent years Mobile Ad- hoc network has found applications especially to overcome the limitation of Bandwidth in wireless communication. Difficulties in MANET (Mobile Ad hoc Network) is the routing problem, which is aggravated by frequent topology changes due to node movement, radio interference and network partitions. The proactive approaches attempts to maintain routing information for each node in the network at all times [2] [3], where as the reactive approaches only find new routes when required [5] and other approaches make use of geographical location information for routing [8]. The biological swarms like ants or honeybees often contain thousands of individuals. They perform extraordinarily complex tasks of global optimization and resource allocation using only local information.

Wireless Ad Hoc Networks research has been ongoing for decades. The history of wireless ad hoc networks can be traced back to the Defense Advanced Research Project Agency (DAPRPA) packet radio networks (PRNet), which evolved into the survivable adaptive radio networks (SURAD) program [1]. Ad hoc networks have play an important role in military applications and related research efforts, for example, the global mobile information systems (GloMo) program [2] and the near-term digital radio (NTDR) program [1]. Recent years have seen a new spate of industrial and commercial applications for wireless ad hoc networks, as viable communication equipment and portable computers become more compact and available. There are currently two variations of mobile wireless networks: infrastructured and infrastructure less networks. The infrastructured networks have fixed and wired gateways or the fixed Base-Stations which are connected to other Base-Stations through wires. Each node is within the range of a Base-Station. A "Hand-off" occurs as mobile host travels out of range of one Base-Station and into the range of another and thus, mobile host is able to continue communication seamlessly throughout the network. Example applications of this type include wireless local area networks and Mobile Phone. A mobile ad-hoc network (MANET) is a network formed without any central administration which consists of mobile nodes that use a wireless interface to send packet data. With current technology and the

Prof Pradeep Kumar Puram, Mogulla Archana, Jakkala Ravichandra Reddy, Ganta Raju
/International Journal of Engineering Research and Applications (IJERA)
ISSN: 2248-9622   www.ijera.com
Vol. 2, Issue 1,Jan-Feb 2012, pp.532-537

increasing popularity of notebook computers, interest in ad hoc networks has greatly peaked Future [4] advances in technology will allow us to form small ad hoc networks on campuses, during conferences and even in our own homes. Each MANET node can serve as a router, and may move arbitrary and dynamically connected to form network depending on their positions and transmission range. The topology of the ad hoc network depends on the transmission power of the nodes and the location of the MNs, which may change with time.

SECTION II

2.1. MANETS with Dynamic Routing Protocol -

Cache routing in DSR protocol is a incomplete Error Notification, No Expiry, and Quick Pollution. Based on these problems they have been developed three mechanisms namely Wider Error Notification, Timer- Based Cache, and Negative Cache. 1) Wider Error Notification is based on the fast and wide propagation of Route Error (RERR) packet to increase the speed and the size of (RERR) packet, route error propagation packets are transmitted as broadcast packets at the MAC layer. When a node receives a (RERR) packet that containing link failure information, a node updates its cache route so that all source routes the contained link failure are truncated at the point of failure. There are two disadvantages of using this mechanism, first, a node that detects link failure does not

know which neighbors have cached the link and cannot notify all nodes that need to be notified. Second, this mechanism is [10] based on broadcast technique, which can introduce overhead to the node that does not cache a

broken link, and some of the nodes cached a broken link but might not receive a notification because broadcast in unreliable. In addition, these three mechanisms were considered static timeout scheme in which

a fixed time value assigned same value to every link. After a link stays for specific time, it is deleted from the link [13] cache. However, the weakness of static timeout scheme that it cannot adapt to the network changes rapidly in the topology of the network.

Adaptive Link Cache Scheme to remove the stale routes in the cache of

DSR protocol and compare it with path cache structure. Adaptive Link Cache Scheme is a combination of link cache and adaptive timeout policy. The main concern of using Adaptive Link Cache Scheme is to track the optimal link lifetime with different node mobility levels situations. Through their results, it shows that with high load traffic network, Adaptive Link Cache mechanism outperforms the path cache and the stale routes are removed from the cache. This mechanism uses heuristics with ad hoc parameters to predict the lifetime of a link. However, heuristics cannot accurately estimate timeout of the link because topology changes are unpredictable.

Distributed Adaptive Cache Update Algorithm. The main goal of this algorithm is to update the route cache of DSR protocol by using proactive cache update instead of adaptive timeout mechanism in link cache structure to remove the stale routes in the cache and to collect the extra information

about how the routing information distributed through the network. In the Distributed Adaptive [11] Cache Update Algorithm, four fields where added to the path cache structure in each node, for each route a node maintains the information about these four fields. First and second fields represent the source and the destination node for current route. Third field represents the number of data packets that delivered to the

destination node by using current route to know how the routing information is synchronized among all the nodes on the route. Finally, the field "Routing Table" that represents each node maintains the routing information about which neighbor has learned for this route. However, Distributed Adaptive Cache Update [14] Algorithm is based on the path cache, which cannot effectively utilize all of the routing information that a node learns about the state of the network. In addition, cache timeout is not used, but in some cases, mobile nodes can be unreachable [15] and they do not remove the stale route from their caches.

2.2. Analysis of Mobile Adhoc On-demand Distance Vector Routing Protocol -

 AODV shares the DSR's[8] on-demand characteristics in that it also discovers routes on as-needed basis by flooding the network with route request broadcast (RREQ) packets. Each node receiving an RREQ [6] rebroadcasts it, unless it is the destination or it has a route to the destination in its route cache. Such a node replies to the RREQ with a route reply (RREP) packet that is routed back to the original source. However, AODV adopts a very different mechanism from DSR to maintain routing information. It uses traditional routing tables, one

Prof Pradeep Kumar Puram, Mogulla Archana, Jakkala Ravichandra Reddy, Ganta Raju
/International Journal of Engineering Research and Applications (IJERA)
ISSN: 2248-9622   www.ijera.com
Vol. 2, Issue 1,Jan-Feb 2012, pp.532-537

entry per destination. This is in contrast to DSR, which can maintain multiple route cache entries for each destination. Without source routing, AODV relies on routing table entries to propagate an RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops [7]. These sequence numbers are carried by all routing packets. An important feature of AODV is the maintenance of timer-based states in each node, regarding utilization of individual routing table entries. A routing table entry is expired if not used recently. A set of predecessor nodes is maintained for each routing table entry, indicating the set of neighboring nodes which use that entry to route data packets. These nodes are notified with RERR packets when the next-hop link breaks. Each predecessor node, in turn, forwards the RERR to its own set of predecessors, thus effectively erasing all routes using the broken link. In contrast to DSR, RERR packets in AODV are intended to inform all sources using a link when a failure occurs. Route error propagation in AODV can be visualized conceptually as a

tree whose root is the node at the point of failure and all sources using the failed link as the leaves. The recent specification of AODV [7] includes an optimization technique to control the RREQ flood in the route discovery process. It uses an expanding ring search initially to discover routes to an unknown destination. In the expanding ring search, increasingly larger neighborhoods are searched to find the destination. The search is controlled by the Time-To-Live (TTL) field in the IP header of the RREQ packets. If the route to a previously known destination is needed, the prior hop-wise distance is used to optimize the search. This enables computing the TTL value used in the RREQ packets dynamically, by taking into consideration the temporal locality of routes.

SECTION III

3. Problem Definition - Mobile Adhoc networks nodes exchange information items in a peer-to-peer technique, data caching is a fully distributed scheme where each node upon receiving requested information determines the cache drop time of the information or which content to replace to make for newly arrived information. These decisions are made depending on the perceived presence of the content in

the nodes proximity, whose estimation does not cause any additional overhead to the information sharing system. Consider both cases of nodes with large and small-sized caches. For large-sized caches, we devise a strategy where nodes, independent of each other, decide whether to cache some content and for how long. In the case of small-sized caches, we aim to design a content replacement strategy that allows nodes to successfully store newly received information while maintaining the good performance of the content distribution system. Under both conditions, each node

takes decisions according to its perception of what nearby users may store in their caches and with the aim of differentiating its own cache content from the other nodes.
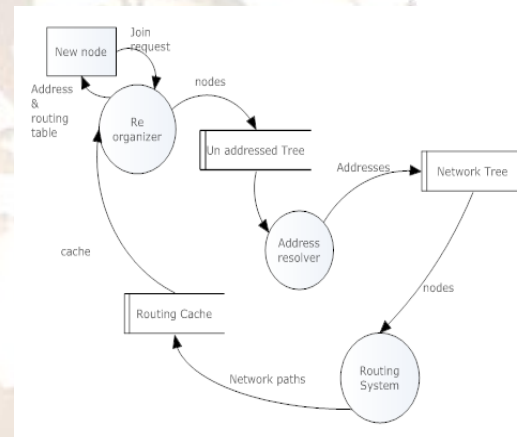

Figure 1 is a model of caching Mobile Ad hoc

3.1. Cooperative Caching Module: Suppose node N1 requests a data item from N0. When N3 forwards di to N1, N3 knows that N1has a copy of the data. Later, if N2 requests di, N3 knows that the data source N0 is three hops away whereas N1 is only one hop away. Thus, N3 forwards the request to N1 instead of N4. Many routing

algorithms (such as AODV and DSR (Dynamic Source Routing) provide the hop count information between the source and destination. Caching the data path for each data item reduces bandwidth and power consumption because nodes can obtain the data using fewer hops. However, mapping data items and caching nodes increase routing overhead
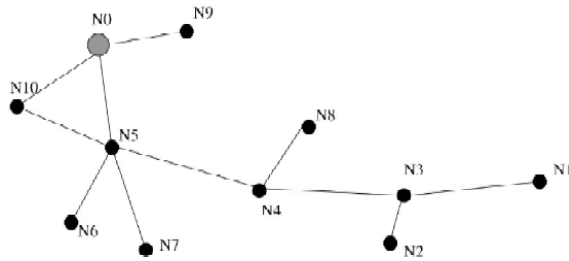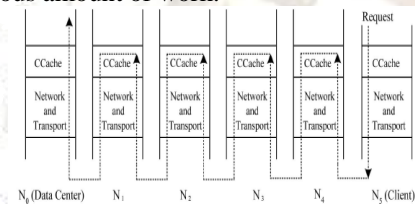
Prof Pradeep Kumar Puram, Mogulla Archana, Jakkala Ravichandra Reddy, Ganta Raju
/International Journal of Engineering Research and Applications (IJERA)
ISSN: 2248-9622   www.ijera.com
Vol. 2, Issue 1,Jan-Feb 2012, pp.532-537

Figure 2 shows the Caching Network

3.2. Cache and routing module:

There is node facto routing protocol for wireless P2P networks currently. Implementing cooperative cache at the network layer requires these cache and routing modules to be tightly coupled, and the routing module has to be modified to add caching functionality. However, to integrate cooperative cache with different routing protocols will involve tremendous amount of work.

(a) The request Data flow

(b) the reply Data flow**.**

There are two options for the layered design. One naïve solution uses cross-layer information, where the application passes data request to the routing layer, which can be used to match the local cached data. However, this solution not only violates the layered design, but also adds significant complexity to the routing protocol which now needs to maintain a local cache table.

3.3. Asymmetric Approach Module:

Asymmetric caching approach has three phases
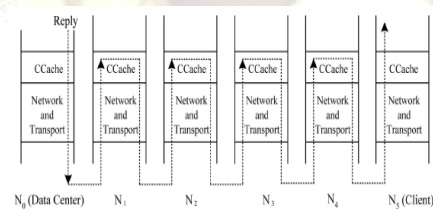*1: Forwarding the request message.*

After a request message is generated by the application, it is passed down to the cache layer. To send the request message to the next hop, the cache layer wraps the original request message with a new destination address, which is the next hop to reach the data server (real destination). Here, we assume that the cache layer can access the routing table and find out the next hop to reach the data center. This can be easily accomplished if the routing protocol is based on DSR or AODV this way packet is received and processed hop by hop by all nodes on the path from the requester to the data server.

2: Determining the caching nodes

When a request message reaches the data server the real data center or the intermediate node that has coached the requested data, the cache manager decides the caching nodes on the forwarding path, which will be presented in . Then, the ids of these caching nodes are added to a list called Cache List, which is encapsulated in the cache layer header
3: Forwarding the data reply. Unlike the data

Request for the data reply only needs to be processed by those nodes that need to cache the data. To deliver the data only to those that will cache the data, tunneling techniques are used. The data reply is encapsulated by the cache manager and tunneled only to those nodes appearing in Cache List.
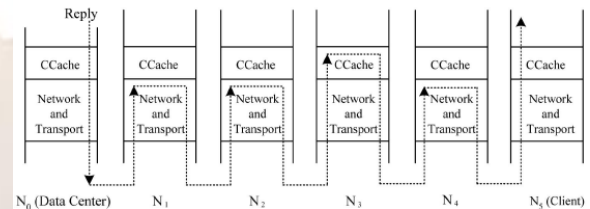

Figure 3 is Caching List

SECTION IV

4.1. Routing Cache Simulation: many routing techniques we have but consider two routing protocol techniques are

Ad-hoc On-demand Distance Vector routing Protocol
Dynamic Source Routing

The data server needs to measure the benefit of caching a data item on an intermediate node and use it to decide whether to cache the data. After an

intermediate node Ni caches a data item node (Ni) can serve later requests using the cached data, instead of forwarding the requests to the data server save the communication overhead between node (Ni) and the data center. However caching data at node (Ni) increases the delay of returning the data to the current requester because it adds extra processing delay at Ni and the data reassembly at node Ni may affect possible pipelines.

4.2. Comparative Study: The novel applications such as mobile multimedia are likely to overload the wireless network as recently happened to AT&T following the introduction of the iPhone.

It is thus conceivable that a peer-to-peer system could come in handy, if used in conjunction with cellular networks, to promote content sharing [9] using ad hoc networking among mobile users.

For highly popular content, peer-to-peer distribution can, indeed, remove bottlenecks by pushing the distribution from the core to the edge of the network.

In the caching strategies based on information density estimation in Mobile Ad Hoc Networks (MANET), uses Flooding type Routing protocol, which faces several disadvantages.

It is very wasteful in terms of the networks total bandwidth. While a message may only have one destination it has to be sent to every host. This increases the maximum load placed upon the network.

Messages can also become duplicated in the network further increasing the load on the networks bandwidth as well as requiring an increase in processing complexity to disregard duplicate messages.

A variant of flooding called *selective flooding* partially addresses these issues by only sending packets to routers in the same direction. In selective flooding the routers don't send every incoming packet on every line but only on those lines which are going approximately in the right direction.

We address the issue of disadvantages faced in flooding routing protocol, using DSR and AODV protocol. The advantages of our system are:

Efficient caching strategies can be achieved using DSR and AODV protocol. Where our proposed system uses a reactive approach which eliminates the need to periodically flood the network with table update messages which are required in a table-driven approach. In a reactive (on-demand) approach such as this, a route is established only when it is required and hence the need to find routes to all other nodes in the network as required by the table-driven approach is eliminated. The intermediate nodes also utilize the route cache information efficiently to reduce the control overhead.

CONCLUSION V

Our proposed work which is a caching strategy for ad hoc networks whose nodes exchange information items in a peer-to-peer method is Hamlet fully distributed scheme where each node, upon receiving a requested information, determines the cache drop time of the information or which content to replace to make room for the newly arrived information. These decisions are made depending on the perceived "presence" of the content in the node's proximity, whose estimation does not cause any additional overhead to the information sharing system. We showed that, due to Hamlet's caching of information that is not held by nearby nodes, the solving probability of information queries is increased, the overhead traffic is reduced with respect to benchmark caching strategies, and this result is consistent in vehicular, pedestrian, and memory constrained scenarios. Conceivably, this paper can be compare existing analysis and our current. The procedure for information presence estimation that was developed in Hamlet can be used to select which content should be replicated and at which node (even if such a node did not request the content in the first place).

Reference

[1] J. A. Freebersyser and B. Leinerr, "A DoD perspective on mobile ad hoc networks," in *Ad Hoc Networking*, C. E. Perkin, Ed. Addison-Wesley, 2001, pp. 29–51.

[2] B. Leiner, R. Ruth, and A. R. Sastry, "Goals and challenges of the DARPA GloMo program," *IEEE Personal Communications*, vol. 3, no. 6, pp. 34–43, December 1996.

[3] Y.-C. Hu and D. B. Johnson. Implicit source routes for on-demand ad hoc network routing. In Proceedings of the 2001 ACM International Symposium on Mobile Ad Hoc Networking & Computing (MobiHoc'01), pages 1– 10, Long Beach, California, Oct. 2001.

[4] D. Johnson, D. Maltz, Y.-C. Hu, and J. Jetcheva. The dynamic source routing protocol for mobile ad hoc networks (DSR). IETF Internet-Draft, draft-ietf-manet-dsr-07.txt, Feb. 2002.

[5] D. B. Johnson and D. A. Maltz. Dynamic source routing in ad hoc wireless networks. In T. Imielinski and H. Korth, editors, Mobile Computing, volume 353. Kluwer Academic Publishers, 1996. Management, vol. 11, no. 1, pp. 3-30, Jan./Feb. 2001.

[6] M.S. Corson and A. Ephremides, "A Distributed Routing Algorithm for Mobile Wireless Networks," Wireless Networks, vol. 1, pp. 61–81, Feb.1995.

[7] C.E. Perkins and P. Bhagwat, "Highly Dynamic Destination-Sequenced Distance-Vector Routing (DSDV) for Mobile Computers," in Proceedings of the SIGCOMM '94 Conference on Communications Architectures, Protocols and Applications, pp. 234–244, Aug.1994.

[8] D.A. Maltz, J. Broch, J. Jetcheva, and D.B. Johnson, "The Effects of On-Demand Behavior in Routing Protocols for Multi-Hop Wireless Ad Hoc Networks," IEEE Journal on Selected Areas in Communications, Special Issue on "Wireless Ad Hoc Networks," vol. 17, pp. 1439–1453, Aug. 1999.

[9] Marco Fiore, Claudio Casetti, and Carla-Fabiana Chiasserini, "Caching Strategies based on information density estimation in Wireless Ad Hoc Networks", IEEE Transactions on Vechicular Technology, Vol. 60, No.5, June 2011.

10] M.K. Marina and S.R. Das, "Performance of Route Caching Strategies in Dynamic Source Routing," in Proceedings of the 2nd Wireless Networking and Mobile Computing (WNMC), pp. 425-432, Apr. 2001.

[11] W. Lou and F. Yuguang, "Predicative Caching Strategy for On- Demand Routing Protocols in Wireless Ad Hoc Networks," Wireless Networks, vol. 8, pp. 671-679, 2002.

[13] Xin Yu, "A Distributed Adaptive Cache Update Algorithm for the Dynamic Source Routing protocol," IEEE Transactions on Mobile Computing, vol. 5, pp. 609-626, Jun. 2006.

[14] Y. He, C.S. Raghavendra, S.Berson, B. Braden, "Active Packets Improve Dynamic Source Routing for Ad Hoc Networks", Proceeding IEEE Conference on Open Architectures and Network Programming (OPENARCH), 2002.

[15] Jiaxu Chen, Yazhe Tang, Dian Fu, and Heng Chang, "On the Improving Strategies upon the Route Cache of DSR in MANET," Springer, vol. 6406, pp. 445–458, 2010.

Prof Pradeep Kumar Puram B.E M.Tech (Ph.D) having several years of experience in Academic & Industry. Currently he is the Professor & Head of Department for Computer Science & Engineering at Vivekananda Institute of Technology & Science, Karimnagar, he has guided many UG & PG students. His research areas of interest are Software Engineering, Data mining & Data Warehousing, Information Security, Web Technologies

Mogulla Archana pursuing M.Tech CS from Vivekananda Institute of Technology & Science, Karimnagar B.Tech CSE from Vijay Rural Engineering College Nizamabad. Her research areas includes Network Security, Cryptography & Web Technologies currently focusing on Information estimation on Wireless Networks.

Jakkala Ravichandra Reddy pursuing M.Tech CS from Vivekananda Institute of Technology & Science, Karimnagar B.Tech CSE from IETE, New Delhi B-Level MCA from DOEACC New Delhi. His research areas includes Network Security, Cryptography & Web Technologies currently focusing on Information estimation on Wireless Networks.

Ganta Raju pursuing M.Tech CS from Vivekananda Institute of Technology & Science, Karimnagar Master of Computer Applications from JNTU Hyderabad. His research areas include Programming in JAVA, Security, Cryptography & Web Technologies currently focusing on Information estimation on Wireless Networks.

.