ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 2, February 2013

Performance Enhancement in Congested Sensor Network using CAR and MCAR Protocol

Sonali Kolte[1], Pratiksha Chavan[2], Madhuri Kate[3], Shrutika Desai[4], Asmeena Mhate[5]

Student, IT, RMCET, Devrukh, India[1, 2, 3, 4]

Professor, IT, RMCET, Devrukh, India[5]

ABSTRACT - **Network congestion occurs when a link or node is carrying so much data that its quality of service deteriorates. The effects of network congestion are queuing delay, packet loss or the blocking of new connections. In order to recover packet loss some protocols retransmits packets, resulting in a stable congestive condition known as congestive collapse. The sensor is used to collect information and send it to destination. The protocol used to find all available paths in network are AODV, DSR, DVR.The CAR protocol which priorities the low and high priority data for reducing network traffic and efficient use of data-canter. According to priority, it will only forward high priority (HP) data and low priority (LP) data is routed out of the conzone. Working of a CAR protocol is partitioned into three parts which are: network formation, conzone discovery, and differentiated routing. MCAR is primarily a MAC-layer mechanism. It is used in conjunction with high priority data which is highly mobile. The sensors which are not fixed to particular area and continuously moving in such cases MCAR protocol is worth using because CAR does not deal with the sensors which are highly mobile in nature. A lightweight dynamic differentiated routing mechanism to accommodate mobile data sources used in MCAR.**

Keywords - Wireless sensor networks, congestion, differentiated service, CAR, MCAR

I. INTRODUCTION

Network congestion occurs when a link or node is carrying so much data that its quality of service deteriorates. The effects of network congestion are queuing delay, packet loss or the blocking of new connections. In order to recover packet loss some protocols retransmits packets, resulting in a stable congestive condition known as congestive collapse. It is nothing but a stable state of network which is responsible for happening of no useful communication.

A Wireless Sensor Network is a wireless network consisting of spatially distributed autonomous devices using sensors. Sensors are hardware devices that produce measurable response to change in physical condition. Sensors sense or measure physical data of the area to be monitored and gathered information about a physical object or process including occurrence of events such as temperature change, sound, vibration, pressure, motion or pollutants, at different locations. The size of a single sensor node can vary from shoebox-sized nodes down to devices the size of grain of dust, although functioning 'motes' of genuine microscopic dimensions have yet to be created. The cost of sensornodes is similarly variable, ranging from hundreds of dollars to a few cents, depending on the size of the sensor network and the complexity required of individual sensor nodes.Sensor network is very cost effective so sensors will be shared by multiple application to gatherer various types of data. All the data generated in sensor network will not equally important, some data may be important than other. Thus, differentiated data delivery is required in sensor network for higher priority and lower priority data.

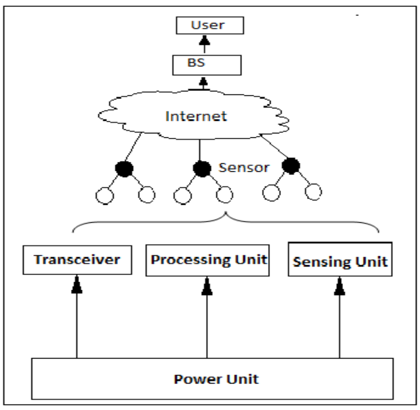

Fig 1. Sensor node components

Typical wireless sensor network and the components of sensor node are shown in the above figure 1.

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 2, February 2013

A. Sensing Unit:

The main functionality of the sensing unit is to sense or measure physical data from the area to be monitored. The analog voltage which is generated by the sensor corresponding to an ‘’event’’ is then digitized by an analog-to digital converter (ADC) and then delivered to the processing unit for more analysis

B. Processing Unit:

The processing unit plays a major role in managing collaboration with other sensors to achieve the predefined tasks. There are currently several families of this unit including microcontrollers, microprocessors, and field-programmable gate arrays.

The processing unit needs storage for tasking and to minimize the size of transmitted messages by local processing and data aggregation.Flash memory is widely used due to its cost and storage capacity.

C. Transceiver:

There are three deploying communication schemes in sensors including optical communication (laser), infrared, and radiofrequency (RF). RF is the most easy to use but requires antenna.

D. Power Unit:

Power consumption is a major weakness (problem) of sensor networks. Batteries used in sensors can be categorized into two groups; rechargeable and non-rechargeable. Often in harsh environments, it is impossible to recharge or change a battery.

II. ADHOC ON-DEMAND DISTANCE VECTOR (AODV) ROUTING PROTOCOL

AODV is a loop-free routing protocol for ad-hoc networks [1]. At each node, AODV maintains routing table. There are three fields in routing table, namely ‘a next hope node’, ‘a sequence number’ and ‘a hop count’.It is a reactive routing protocol, meaning that it establishes a route to a destination only on demand.

In AODV, the network is in passive mode until a connection is needed. At that point the network node that needs a connection broadcasts a request for connection. Other AODV nodes forward this message, and record the node that they heard it from, creates temporary routes back to the needy node. When a node receives such a message and already has a route to the desired node, it sends a message backwards through a temporary route to the requesting node. The needy node then begins using the route that has the least number of hops through other nodes. Unused entries in the routing tables are recycled after a time.

The advantage of AODV is that it creates no extra traffic for communication along existing links. Also, it is simple, and doesn't require much memory or calculation. However AODV requires more time to establish a connection, and the initial communication to establish a route is heavier than some other approaches explain latter.

III. DYNAMIC SOURCE ROUTING (DSR) PRITOCOL

It is a re-active protocol same as AODV that it forms a route on-demand when a transmitting computer requests one. It is a routing protocol for wireless mesh networks.DSR uses source routing rather than hop-by-hop routing. Thus, in DSR every packet to be routed carries in its header the order list of network nodes that constitute route over which the packet will be relayed. It eliminates the need for the periodic route advertisement and neighbour detection packets that are employed in other protocols. The demerit of DSR is larger overhead since each packet must contain the whole sequence of node comprising the route.

On-demand routing protocols have disadvantage that it has lower power consumption and demand less control signalling, however, end-to-end connection delay is increased, since upon generation of connection requests between two nodes, the connection needs to wait some time for the link between the nodes to be established.

IV. DISTANCE VECTOR ROUTING (DVR) PROTOCOL

Distance Vector Routing protocols is a table-driven routing protocol also called as pro-active protocol. Table-driven routing protocols aim to maintain consistent up-to-date routing information from each to all other nodes of the networks. Thus, each node maintains one or more routing tables which is used to store route from this node to all other nodes. When topological changes occur, the relating information is relayed to all network nodes in an effort to provide the nodes with up-to-date routing information. It has the advantage of reduced end-to-end delay, since, upon generation of network connection request, the route is already established. On the other hand the disadvantage is the fact that routing information is disseminated to all network nodes leading to increased signalling traffic and power consumption. Also the bandwidth for user is reduced and the operating time of battery-power mobile nodesis reduced.

V. CONGETION AWARE ROUTING (CAR) PROTOCOL

The problem scenario of critical field is shown in figure 2. The critical area is nothing but an important event having higher priority in one portion of a sensor

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 2, February 2013

field. This critical area consists of multiple nodes. In such a scenario, there is a data processing centre for collecting sensitive information from the critical area. Such data is assigned a higher priority than other data. There might also be several nodes collecting different types of Low Priority information from other parts of the network. In the presence of this background LP traffic, without differentiating between the two priority classes, congestion will degrade the service provided to High Priority data and this data may get dropped or delayed. Hence there is no use of data processing centre.

This problem is solved by using CAR protocol which priorities the low and high priority data. According to priority, it will only forward high priority (HP) data and low priority (LP) data is routed out of the conzone. This system having one limitation that it requires some overhead to finding out the conzone. While this overhead is reasonable, it may still be tooheavyweight if the more data is moving often in theconzone and conzone is changing more frequently or when the HP traffic is shortlived.Hence, for that CAR is worked for nearly static or static network with HP data having long-lived flows.

Working of a CAR protocol is partitioned into three parts which are: network formation, conzone discovery, and differentiated routing. The combination of these functions segments the network into on-conzone and off-conzone nodes. Only HP traffic is routed by on-conzone nodes and LP traffic is routed out of the conzone.

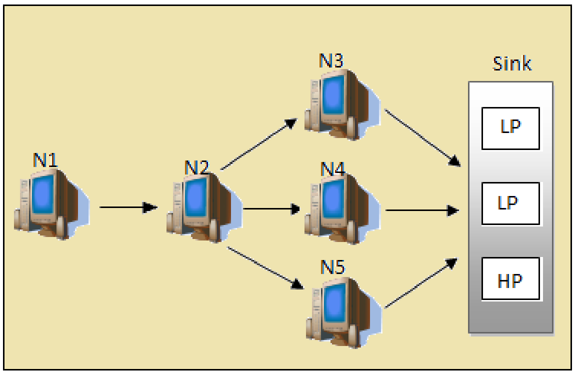

Fig 2. Network Formation in CAR

A) Network Formation:

In this phase of network formation all the nodes are connected to one another and accordingly depth is given to all this nodes. Initially that all nodes are in off conzone. Consider node N1 as a critical area node. Atthe end all connected nodes are connected to the sink. In sink there are three JPanels. Two JPanels for lower priority data and one JPanels for high priority data.

CAR forms a HP network, nodes forwarding HP data forms HP network, by dividing nodes in the network as congestion zone nodes and off-conzone nodes. Only on-conzone nodes will forward the HP data. LP data generated inside the conzone is routed out of the conzone.

B) Conzone Discovery:

In this module Nodes discover if they are on the Conzone by using the Conzone discovery mechanism. A Conzone must be then discovered from that neighbourhood to the sink for the delivery of HP data. To do this, critical area nodes broadcast "discover Conzone to sink" (to sink) messages. This message includes the ID of the source and its depth and is sent to all neighbours. When a node hears more than threshold There Alpha distinct To Sink messages coming from its neighbours, it marks itself as on-conzone and if it is not sink it propagates a to sink message with its ID and depth to its neighbours. If it is sink it will not broadcast to sink message simply it marks itself as it is in conzone.

C)Differentiated Routing in CAR:

Once the Conzone is discovered, in differentiated routing, HP data is routed in the conzone, and LP data is routed off the Conzone. LP data generated inside the conzone is routed out of the conzone. HP data is received from Sink in HP JPanels and LP data is received in either of two JPanels.

VI. MAC-ENHANCED CONGESTION AWARE ROUTING (MCAR) PROTOCOL

MCAR is primarily a MAC-layer mechanism .it is used in conjunction with high priority data which is highly mobile. The sensors which are not fixed to particular area and continuously moving in such cases MCAR protocol is worth using because CAR does not deal with the sensors which are highly mobile in nature. Though canzone discovery is dynamic in CAR, the overhead required to maintain the High network in such a dynamic environment may be too expensive. As a result, use a lightweight dynamic differentiated routing mechanism to accommodate mobile data sources used in MCAR. MCAR is based on MAC-layer enhancements that enable the formation of a conzone on the fly with each burst of data. The trade-off is that it effectively acquires the flow of LP data, thereby seriously degrading its service. Unlike CAR, MCAR does not form an HP network. Instead, HP paths are dynamically created, since the sources or the sinks or nodes are expected to be mobile.

The enhanced MAC-layer of MCAR uses a Request to send (RTS)/clear to send (CTS) protocol that is augmented to carry information about the priority level of the data being transferred. Each RTS and CTS packet is tagged with a priority level. During channel contention, if a node has HP data to send and overhears an LP RTS, it

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 2, February 2013

jams the channel with an HP CTS, causing nodes forwarding LP data to back off. Furthermore, if a node with LP data overhears an HP RTS or CTS, it will back off the channel, as described in the following section. The prioritized RTS/CTS messages in highly congested networks may be dropped. The extent of overhead experienced depends on the relative size of the RTS/CTS packets and the data packets. In sensor networks, data packet sizes are not large enough to justify the cost of RTS/CTS exchange to guard every packet.

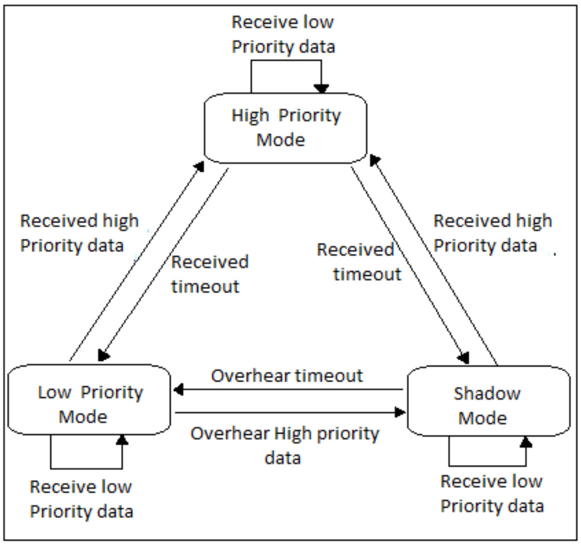

Fig 3. State transition diagram of MCAR

A. State Transition Diagram:

1) LP mode: In this mode, nodes forward LP data. All nodes in the network are initially in the LP mode. Upon receiving or overhearing an LP packet, nodes remain in the LP mode and, if appropriate, forward any data. If a node in the LP mode overhears an HP packet, it transitions to the shadow mode.

2) HP Mode: Nodes in the path of HP data are in the HP mode. Upon transitioning to this state, the node sets two timers: a received timer and an overhearing timer. The values for these timers should be on the order of twice the expected inter arrival delay of HP data. If a node in this mode receives an HP transmission, it begins channel contention by using our modified RTS/CTS protocol and forwards the data. It resets its received and overhearing timers and remains in the HP mode. Upon overhearing HP data, the node resets its overhearing timer only and stays in the HP mode.

*3) Shadow mode:*Nodes in this state are within theCommunication range of HP traffic but not on a forwarding path. Nodes in this state suppress LP traffic, thus preventing it from interfering with HP traffic in the network. Upon overhearing an HP packet, the node resets its overhearing timer and stays in this state. A node transitions to the HP modeupon receiving an HP packet itself. If a node in the shadow mode overhears an LP packet, it stays in the shadow mode and takes no action. If the node isthe intended recipient of the LP data, it silently discards thepacket and stays in the shadow mode.

CONCLUSION

In this project, we addressed data delivery issues in the presence of congestion in Wireless Sensor Networks. We proposed CAR, which is a differentiated routing protocol and uses data prioritization. We also developed MCAR, which deals with mobility and dynamics in the sources of HP data.

Compared to existing systems like AODV, CAR increase the fraction of HP data delivery and decrease delay and jitter for such delivery while using energy more uniformly in the deployment. CAR also routes an appreciable amount of LP data in the presence of congestion. MCAR maintains HP data delivery rates in the presence of mobility and the route setup and tear-down times associated with the HP flows are minimal. Both CAR and MCAR support effective HP data delivery in the presence of congestion. CAR is better suited for static networks with long-duration HP floods. For bursty HP traffic and/or mobile HP sources, MCAR is a better fit.

Because of the low jitter rates and maintainable delay, CAR appear suitable to real-time data delivery. To ensure quality of Service (QoS) for video streams, CAR can be used as a routing protocol. Our future work looks at the effectiveness of such techniques in Sensor Network Environments. Also, while MCAR merges multiple conzones naturally, future work can explore the interactions of differentiated routing and multiple conzones. Finally, future work can also explore the impact of different sizes and shapes of conzones on data delivery.

REFERENCES

[1] Raju Kumar, Riccardo Crepaldi, Hosam Rowaihy, Alber F.Harris, Guohong Cao, Michele Zorzi, Thomas F.La Porta, “Mitigating Performance Degradation in Congested Sensor Networks”, IEEE Transaction Paper on Mobile Computing, vol.7, pp.682-697, JUNE 2008.
[2] Charles E.Perkins, Elizabeth M.Royer, “Ad-hoc On-demand Distance Vector Routing”, IEEE Workshop Mobile Computing Systems and Applications, pp.90-100, FEB 1999.
[3] Andrew S.Tanenbaum, “Computer Networks”, 2005,Fourth Edition,Pearson Education. [d] Patrick Naughton, Herbert Schildt, “The Complete Reference Java 2”, Third Edition,Tata McGraw-Hill.
[4] Raj Kamal, “Mobile Computing”,2008, Oxford University Press.
[5]Peterson,Davie, “Computer Networks”, 2007, Fourth Edition, Morgan Kaufmann Publishers.
[6] International Journal of Computer Technology and Electronics Engineering (IJCTEE) Volume 2, Issue 2, April 2012.
[7] Mitigating Congestion in Wireless Sensor Networks

ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 2, February 2013

Bret Hull, Kyle Jamieson, Hari Balakrishnan MIT Computer Science and Arti_cial Intelligence Laboratory The Stata Center, 32 Vassar St., Cambridge, MA 02139 {bwhull, jamieson, hari}@csail.mit.edu.
[8] Mitigating Performance Degradation in Congested Sensor Networks Raju Kumar, Student Member, IEEE, Riccardo Crepaldi, Student Member, IEEE, Hosam Rowaihy, Student Member, IEEE, Albert F. Harris III, Member, IEEE, Guohong Cao, Senior Member, IEEE, Michele Zorzi, Fellow, IEEE, and Thomas F. La Porta, Fellow, IEEE.