

Load Balancing Technique for Distributed and Specialized Nodes using Multipath Approach in Wireless Sensor Network

Tejal D. Irkhede

M.E.IIIrd SEM in Wireless Communication and Computing

Department of Computer Science & Engineering
G.H. Raison College of Engineering
Nagpur, India

B. N. Mahajan

Asst. Prof.

Department of Computer Science & Engineering
G.H. Raison College of Engineering
Nagpur, India

ABSTRACT

Wireless sensor network is collection of nodes organized in cooperative network. Due to unbalanced task allocation in WSN results in overloading and under loading of nodes. By keeping in mind parameters such as topology, number of nodes, delay, data traffic, transmission, energy consumption and packet distribution, load balancing can be achieved and congestion can be avoided. The multipath routing and shortest path selection decision in network layer has an important impact on the performance of wireless sensor network. So, load balancing is of great importance in WSN. This paper focuses on selection strategies for managing load among a number of available nodes. The main objective of this paper is to analyze existing schemes for load balancing in WSN.

Keywords

Load balancing, wireless sensor network, multipath routing, and cluster.

1. INTRODUCTION

A single base station, called as sink node, performs data collection which creates a converging traffic pattern from the number of sensor nodes to the sink node. Routing protocols should avoid replication and broadcasting packets from sensor nodes on optimistic links since they undergo heavier workload than their peers, and other routes must be chosen to relay traffic that generated by source sensor nodes. For wireless sensor networks, there has been recent attention on routing (also, called a data dissemination) from sensor nodes to a sink node. Flooding can lead to a situation called broadcast storm which is like congestion in network [6].

Roughly speaking, the aim of congestion control is to optimally decide on the volume of traffic routed under a fixed set of routes. The aim of load balancing is to optimize these routes, assuming that the traffic requirement of all nodes are predetermined, and not subject to optimization.

In WSN network life time is an important factor of design. Routing protocol in network layer has an important impact on the performance of WSN. Currently number of protocols have been designed to extend the network life time. Nodes in WSN are battery operated and once WSN is deployed it is very difficult to replace battery so energy consumption is also an important issue.

In WSN load can be balanced by using hierarchical clustering algorithm. Cluster formation and cluster election is very important for data gathering.

There are many clustering protocols exist for example LEACH, DCHS, E-LEACH which introduces residual energy as an important parameter in WSN for calculation of cluster head.

In single routing, only a single route is used between source and destination node. AODV and DSR are on demand protocols. All the transmission between source and destination is through this path only. Multipath routing algorithms allow at most 'p' paths between source node and destination node [4].

Rest of the paper is organized as follows, section 2 describes the existing method or algorithm for load balancing in WSN. Section 3 concludes the paper.

2. ALGORITHMS FOR LOAD BALANCING

2.1 The Distributed Load Balanced

Routing (DLBR) Protocol

In DLBR is based on routing algorithm which aims to establish the best routing path for variety of traffic in network. In DLBR traffic is divided into two types: high priority and low priority. Multimedia traffic is considered as high priority and normal traffic as low priority.

Working: In DLBR algorithm during establishment of best routing path link load is taken into consideration. For link load this algorithm first calculates the cost metrics on the basis of load on the link.

Phases:-

- A. Its first aim is to calculate the link cost function for class-I traffic i.e. for high priority traffic.
- B. Then calculate link cost function for Class-II traffic i.e. low priority traffic.
- C. After we assign cost to each link using the above formula, Dijkstra's shortest path algorithm is then used to compute the least-cost path as the path. If the least-cost path has a cost of infinity, then the demand is blocked [14].

- D. Using distributed routing algorithm compute the optimum path for high and low priority traffic and in each step it record the routes and bandwidth information.
- E. Next is the route discovery process by implementing needed changes by using DLBR algorithm in the well known on demand AODV routing protocol.
- F. The route which is having minimum cost is selected by the source. The DLBR does not require any major modification in the basic AODV. A simple calculation module is included which is used in decision making step just to decide whether to forward or reject the RREQ packet during route finding phase [14].

DLBR algorithm is used for real time traffic. The main objective of this algorithm is to minimize the end to end delay and balanced the load in network. It gives the more aggregated bandwidth as compare to AODV protocol. DLBR algorithm only considers two type of traffic multimedia and normal traffic not consider voice over IP traffic [1].

2.2 Inovel Routing Protocol for Load Balancing:

Congestion of traffic in WSN is an important issue. In WSN each node has limited buffer place and limited resources available, if buffer overflow result in congestion at transport layer of the ISO model. In WSN data transmitted from source to sink through intermediate node. INOVEL routing protocol address the issue of congestion occur at neighboring node. The aim of neighboring node is to forward the data and it received data packet more than its capacity and its result is large number packet loss. INOVEL protocol find out the congestion affected node and then established multipath routing protocol which aim to use the available free spaces of intermediated node and select the best route in network.

The first objective of INOVEL protocol is distribute the node of congested affected node and achieved load balancing. The second objective is to make maximum use of free node and their buffer space. Third is to minimize end to end delay. The INOVEL used on-demand routing protocol to maintain routing information from each node to every other node in WSN [2].

2.3 Cluster and Leveling Disjoint Multipath Algorithm

Cluster and leveling disjoint multipath algorithm is combined the concept of clustering, leveling, directional flooding and disjoint multipath routing algorithm to achieved the reliability of data transmission and averaged energy consumed.

In cluster and leveling disjoint multipath algorithm WSN is divided in to level on basis of energy level. Level 1 means it is very nearest to base station and base station used minimum energy for transmission. For level 2 BS increases power level and send level 2 signal. Leveling is done internally without used of any other technique such as GPS.

Clustering is the second step for the election of cluster. Node decided to become a cluster head to collect the data from cluster member. Node select the cluster which is closest from that node. Cluster pick up the data packet , compress it and send to the sink node.

In directional flooding data transmission is directional. For directional flooding this algorithm considers the one

assumption: "Every node know their location and sink node location information".

In each cluster data transmission takes place by using directional flooding. Routing is very efficient by using direct link between neighboring node and cluster head and also reduced the delay.

Each time it form new graph and cluster find its neighbor by using neighboring algorithm. Once the neighboring node is selected routing table is create and set up the disjoint multipath algorithm to transfer the data towards the base station. Along with disjoint multipath directional flooding is done. If data packet reached at neighboring node which has greater level number then it is discarded. In this way data packet is transmitted from sink node to base station in WSN [3].

2.4 K-path Splittable Traffic Flow Scheme:

In single path routing there is only one path between source and destination. All transmission is occurring only through this path.

By using k-path splittable routing at most k-path between source and destination. The main objectives of this scheme are load balancing in balancing is important in WSN because of limited resources like bandwidth between nodes. In this scheme is traffic is fragmented among at most k path that avoid the congestion.

It discovers the route between source and destination by sending request (RReq). RReq find the available routes between source to destination. RRep is decided what is source route is. Once route is found the traffic is allocated policy is used for how data is distributed among all the available route. k-path model setup k parallel path . It first form sub-graph in network. Its graph size is depend upon distance between source and destination and node density.

Traffic is allocated among all maintaining several route for each and every source and destination pair and balanced the load across the network [4].

2.5 E-leach Algorithm

In sensor networks, the sensor network can be grouped in to small clusters by their physical proximity to achieve better performance, and each cluster may elect cluster-head to coordinate the node in the cluster. E-LEACH (Low energy adaptive clustering hierarchy) improves the performance of basic LEACH protocol which aim is to elect the cluster-head on the basis of remnant energy of sensor node in WSN. Cluster head is collect the data from all common node of their range.

E-LEACH protocol is routing protocol for energy conservation of sensor node (cluster head).Cluster-head is responsible to send the data to base station for this required more energy.

E-LEACH has the same concept as of LEACH protocol [5]. Difference between LEACH and E-LEACH is that in E-LEACH protocol include additional parameter one is residue energy and second is consumed energy. There are two phases in E-LEACH as same in LEACH first phase is cluster set up phase and second is steady-phase.

In cluster set up phase form cluster head on the basis of round time as same LEACH protocol. The main improvement in cluster head selection algorithm is to avoid the lower

energy residual energy node and elect the higher residual energy node.

In second phase i.e. steady state phase each intermediated node send the data during its own TDMA time slot. E-LEACH used minimum spanning tree between cluster heads and send the data to sink node. Again go for next round by broadcasting the information throughout network [5].

2.6 Traffic Splitting Protocol

The aim of multipath routing in WSN has great important for extend the network life span. Extend the life span of WSN result of evenly distributing traffic on all discovered routes. This is due to used single route in a WSN would reduced the energy resources of participated nodes. This would cause death of most participated node decreases life span of network.

Traffic splitting protocol addresses the issue of load balancing on most participated node. Traffic splitting protocol is used for multipath routing in WSN. Traffic splitting protocol distribute the traffic among evenly on all discovered route between source to destination. TSP consists two method. The first method is route assignment method and second is load sharing method. Route assignment method uses the information collected about each route to calculate weight for route.

Second method i.e. load sharing method select particular route for individual data dynamically at real time. Also, it keep the actual traffic allocated to each route relevant to the weight assigned to the route.

TSP introduced four factor network size factor, network routing factor, network connectivity factor and network hopes factor [6].

3. CONCLUSION

In this paper we have studied a different existing load balancing schemes used to improve the performance of Wireless Sensor Network. As compared to AODV protocol, DLBR protocol provides the better efficiency in bandwidth and delay. E-LEACH protocol is used in WSN it extend the life of network by keeping in mind the evaluation of metric energy consumption as compared to existing routing protocol LEACH. k-path split able routing scheme provides appropriate load balanced in network by distributing the traffic among the k-path.

Common WSN experience shows that link congestion, node failure frequently occur. This would cause the load balancing. Hence to avoid this problem use multiple nodes for multiple task. Allocate one task to one particular node. By using this approach load is distributed evenly among the network and no node is overloaded. If we talk about multipath routing technique the discovered multiple path between nodes and use those path which have multiple routes from particular node that reached to destination and use the shortest path.

4. REFERENCES

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