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A Survey of Various Data Aggregation Schemes in WSN

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***Abstract*—Wireless sensor networks (WSNs) have significantpotential in many application domains such as agriculture,health, environmental monitoring, battlefield surveillance, andwild fire detection. They, however cannot be used in largegeographical areas due to the short communication range ofsensors.. In addition, sensor networks have been the lack ofavailable network management and control tools, such as fordetermining the degree of data aggregation prior to transforming**
it into useful information. Designing different networkmanagement tools such for routing, localization, and dataaggregation are, therefore, required in large scale WSNs. Only afew of the existing data aggregation methods have been developedfor a large scale WSN. In this paper we have do a review of some literature and techniques for data aggregation in large scale WSN.*

***Keywords*— WSN, Data Aggregation, Data Clustering**

I. INTRODUCTION

With advance in technology, sensor networkscomposed of small and cost effective sensing devices equippedwith wireless radio transceiver for environment monitoring have
become feasible. The key advantage of using these smalldevices to monitor the environment is that it does not requireinfrastructure such as electric mains for power supply and wiredlines for Internet connections to collect data, nor need humaninteraction while deploying. These sensor nodes can monitor theenvironment by collecting information from their surroundings,and work cooperatively to send the data to a base station, orsink, for analysis. **Clustering in WSN[6]**: The process of grouping the sensornodes in a densely deployed large-scale sensor network isknown as clustering. The intelligent way to combine andcompress the data belonging to a single cluster is known as dataaggregation in cluster based environment. There are some issuesinvolved with the process of clustering in a wireless sensornetwork. First issue is, how many clusters should be formed thatcould optimize some performance parameter. Second could behow many nodes should be taken in to a single cluster. Thirdimportant issue is the selection procedure of cluster-head in acluster. Another issue is that user can put some more powerfulnodes, in terms of energy, in the network which can act as acluster-head and other simple node work as cluster-memberonly.

II. DATA AGGREGATION

This is an address centric approachwhere each node sends data to a central node via the shortestpossible route using a multihop wireless protocol. The sensornodes simply send the data packets to a leader, which is thepowerful node. The leader aggregates the data which can bequeried.Each intermediate node has to send the data packets addressedto leader from the child nodes. So a large number of messageshave to be transmitted for a query in the best case equal to thesum of external path lengths for each node.

In-Network Aggregation: In-network aggregation is theglobal process of gathering and routing information through amulti-hop network, processing data at intermediate nodes with
the objective of reducing resource consumption (in particularenergy), thereby increasing network lifetime. There are twoapproaches for in-network aggregation: with size reduction andwithout size reduction. In-network aggregation with sizereduction refers to the process of combining & compressing thedata packets received by a node from its neighbors in order toreduce the packet length to be transmitted or forwarded towards sink. In-network aggregation without size reduction refers to theprocess merging data packets received from different neighborsin to a single data packet but without processing the value ofdata.

Tree-Based Approach: In the tree-based approach performaggregation by constructing an aggregation tree, which could bea minimum spanning tree, rooted at sink and source nodes areconsidered as leaves. Each node has a parent node to forward itsdata. Flow of data starts from leaves nodes up to the sink andtherein the aggregation done by parent nodes.

Cluster-Based Approach: In cluster-based approach, wholenetwork is divided in to several clusters. Each cluster has acluster-head which is selected among cluster members. Clusterheadsdo the role of aggregator which aggregate data receivedfrom cluster members locally and then transmit the result tosink.

III. RELATED WORK

Scalable and Unified Management And Control (SUMAC)is a large scale Wireless Sensor Network (WSN) architecturethat uses a medium range mesh network as a bridge betweengeographically dispersed sensors clusters and

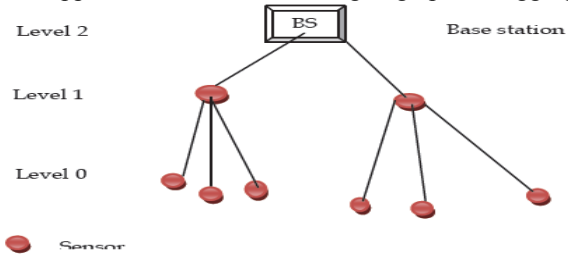
Internet andprovides users full data ownership and transmission of datawithin their own network. In SUMAC a high level setting (byusers) that triggers a background process to set a default dataaggregation level and also to determine rules and conditions to modify the default aggregation level is proposed. For instance,default aggregation level can be set to average most sensorsdata in a single cluster. When an event of interest occurssensors can automatically slide down the aggregation level toenable node to send raw sensor data. SUMAC aggregationcontains energy cost for path generation. Nodes share theirenergy consumptions, delay and buffer size with immediateneighbors. This method is coupled with a visual interface tocontrol the aggregation (static or dynamic) based on theassigned aggregation rules such as hop count, resolution,sensors value, sensor tags, and/or GPS coordinate. In staticaggregation, user selects nodes based on GPS coordinate, labelor ID and sets the selected node to aggregate or to forwardtheir data. Server statically sets the node aggregation level**.** Indynamic aggregation, aggregation level changes based on theevents of interest occur. For example, if the current aggregation level is 2 and any node at level 3 detects an eventof interest the aggregation level slides down to 4 so that data atlevel 3 are not aggregated. Users set the maximum/minimumthreshold for sensed values such as temperature or light. If thetemperature exceeds a defined threshold, for example, thesensor nodes automatically stop aggregating the packets andalso instruct neighbors to do so.In Directed Diffusion (DD) [3, 9], interest messages flow fromthe sink to the source using expensive flooding (Interestpropagation), then data messages flow from the source to thesink initially along multiple paths towards the sink (datapropagation). As time progresses, the sink reinforces only anumber of paths (depending on data quality) and hence thetotal number of nodes in transmission is reduced. To alleviateexpensive flooding for interest propagation in DD, clusteringapproaches are used, where interest messages are only sent tocluster head (CH) and gateways. Chatterjea S. and Havinga P.propose Clustered Diffusion with Dynamic Data Aggregation (CLUDDA) that improves energy and network efficiencyby integrating clustering into Directed Diffusion (DD) andallowing nodes to collect and aggregate data by includingentire query definition with interest message. The format ofinterest packet is significant in interest transformation,dynamic aggregation, and point formation. It also allows nodesto deal with unfamiliar queries. Interest packets contain notonly the query but also the entire definition of the query. Theyallow nodes to break down a query into its fundamentalcomponents and gather data for these individual componentsand process them using the query definitions, which in turnresults in data reduction. Ying Liang and HongweiGaopropose an Optimal Clustering Algorithm Based on TargetRecognition (OCABTR) that collects data periodically andhence, reduces transmission overload and energyconsumptions of sensor nodes. When clusters are formed,sensors reside in different clusters might represent the samegeographical area in terms of events to sense that increasesdata redundancy. It is also difficult to aggregate similar data in
different clusters. Hence, OCABTR uses genetic algorithm topartition nearby/adjacent nodes (to form cluster) that sensesimilar events into a cluster that improves the rate of dataaggregation. Data aggregation based on dynamic routing (DABDR) is another cluster based aggregation routingprotocol. DABDR creates tree structure where parents wait acertain time for child data. Data packets have a depth field that
ensures the direction of data flowing from a sampling node tosink and a queue length field that makes data packets flow tonodes with a long data aggregation queue so that data packetsare concentrated more to make the aggregation more energyefficient. Tiny Aggregation Approach (TAG) is also a dynamic data aggregation method where, each epoch or timeduration is divided into timeslots. Different levels of tree areassociated with different timeslots and nodes of each level can only send data in their specific timeslots. Hence,synchronization is achieved for sending and receiving data thatreduces energy consumptions. However, in this approach if anode does not receive the data for a child at its specifiedtimeslot the unused information of the whole sub-tree rooted atthat child will result an ultimate inaccurate data. Bidirectional Data Aggregation (BDA) adds a label to each query inaddition to the basic working principle of TAG.

IV. DATA AGGREGATION APPROACH IN WSN

Data aggregation process is performed by specific routingprotocol. Our aim is aggregating data to minimize theenergy consumption. So sensor nodes should route packetsbased on the data packet content and choose the next hopin order to promote in network aggregation. Basicallyrouting protocol is divided by the network structure, that'swhy routing protocols is based on the consideredapproaches.

Tree-Based Approach:

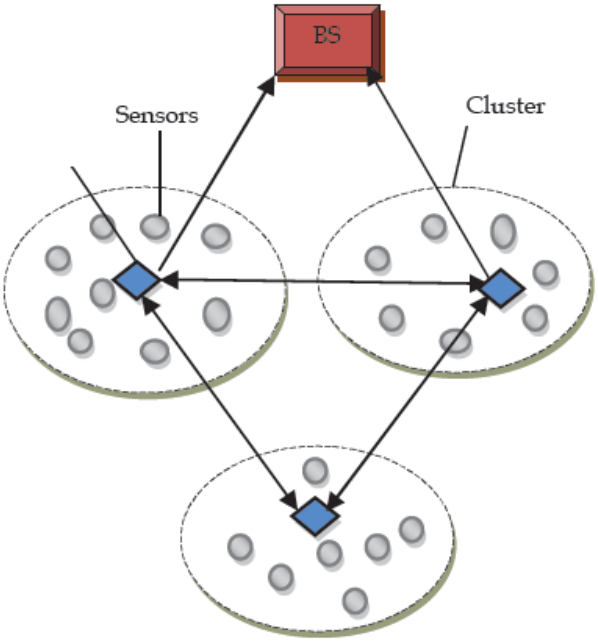
The tree based approach is defining aggregation fromconstructing an aggregation tree. The form of tree isminimum spanning tree, sink node consider as a root andsource node consider as a leaves. Information flowing ofdata start from leaves node up to root means sink(basestation).Disadvantage of this approach, as we know likewireless sensor network are not free from failure .in case ofdata packet loss at any level of tree, the data will be lost notonly for single level but for whole related sub tree as well.This approach is suitable for designing optimal aggregationtechniques'.



Tree based data aggregation

Cluster-Based Approach:

In energy-constrained sensor networks of large size, it isinefficient for sensors to transmit the data directly to thesink In such scenarios, Cluster based approach ishierarchical approach. In cluster-based approach, wholenetwork is divided in to several clusters. Each cluster has acluster-head which is selected among cluster members.Cluster-heads do the role of aggregator which aggregatedata received from cluster members locally and thentransmit the result to base station (sink). Recently, severalcluster-based network organization and data-aggregationprotocols have been proposed for the wireless sensor network. Figure shows a cluster-based sensor networkorganization.



Cluster based data aggregation

Multi-path Approach

The drawback of tree based approach is the limitedrobustness of the system. To overcome this drawback, anew approach was proposed by many researchers .inwhich sending partially aggregated data to single parentnode in aggregation tree, a node could send data overmultiple paths. In which each and every node can senddata packets to its possibly multiple neighbours. Hancedata packet flow from source node to the sink node alongmultiple path, lot of intermediate node between sourcenode to sink node so aggregation done in everyintermediate node. Using this approach we will make thesystem robust but some extra overhead.

Hybrid Approach:

Hybrid approach followed between tree, cluster based andmultipath scheme. In which the data aggregation structurecan adjusted according to specific network situation and tosome performance statistics.

V. CONCLUSION

In this paper we present wireless sensor network is consist alarge number of sensor node. And these nodes are resourceconstraint. That's why lifetime of the network is limited so the
various approaches or protocol has been proposed forincreasing the lifetime of the wireless sensor network. In thispaper we discuss the data aggregation are one of the important
techniques for enhancing the life time of the network. And security issues is data integrity with the help of integritywe reduce the compromised sensor source nodes oraggregator nodes from significantly altering the finalaggregation value.

REFERENCES

[1] KiranMaraiya, Kamal Kant, Nitin Gupta, "Wireless Sensor Network: A Review on DataAggregation", International Journal of Scientific & Engineering Research Volume 2, Issue 4, April -2011

[2] Lutful Karim, Nidal Nasser, HanadyAbdulsalam,ImadMoukadem, "An Efficient Data Aggregation Approach for LargeScale Wireless Sensor Networks."

[3] Sanjay EknathGawali, Prof. D. S.Mantri, "Lifetime Energy Efficient Optimization for WSN"

[4] PrakashgoudPatil, Umakant P Kulkarni, "ENERGY EFFICIENT AGGREGATION WITH DIVERGENT SINK PLACEMENT FOR WIRELESS SENSOR NETWORKS", International Journal of Ad hoc, Sensor & Ubiquitous Computing (IJASUC) Vol.4, No.2, April 2013

[5] Neeraj Kumar Mishra, Vikram Jain, Sandeep Sahu , " Survey on Recent Clustering Algorithms in Wireless Sensor Networks ", International Journal of Scientific and Research Publications, Volume 3, Issue 4, April 2013

[6] Karim Seada, Marco Zuniga, Ahmed Helmy, BhaskarKrishnamachari, "EnergyEfficient Forwarding Strategies for Geographic Routing in Lossy Wireless Sensor Networks"

[7] Xun Li, Geoff V Merrett, Neil M White, "Energy-efficient data acquisition for accurate signal estimation in wireless sensor networks", Journal onWireless Communications and Networking 2013

[8] Gyanendra Prasad Joshi, SeungYeob Nam and Sung Won Kim, "Cognitive Radio Wireless Sensor Networks: Applications, Challenges and Research Trends."

[9] Stefanos A. Nikolidakis, DionisisKandris, Dimitrios D. Vergados, Christos Douligeris, "Energy Efficient Routing in Wireless Sensor Networks Through Balanced Clustering"

[10] Wei Ye, John Heidemann, Deborah Estrin, "An Energy-Efficient MAC Protocol for Wireless Sensor Networks"

[11] Mohit Saini, Rakesh Kumar Saini, "Solution of Energy-Efficiency of sensor nodes in Wireless sensor Networks ", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 5, May 2013

[12] Mark Adam Perillo, "Role Assignment in Wireless Sensor Networks: Energy-Efficient Strategies and Algorithms"

[13] Shashidhar Rao Gandham, MilindDawande, Ravi Prakash, S. Venkatesan, "Energy Efficient Schemes for Wireless Sensor Networks with Multiple Mobile Base Stations."

[14] Eugene Shih, SeongHwanCho, Nathan Ickes, Rex Min, Amit Sinha, Alice Wang, AnanthaChandrakasan, "Physical Layer Driven Protocol and Algorithm Design for EnergyEfficient Wireless Sensor Networks"

[15] N. Akilandeswari, B. Santhi and B. Baranidharan, "A SURVEY ON ENERGY CONSERVATION TECHNIQUES IN WIRELESS SENSOR NETWORKS", ARPN Journal of Engineering and Applied Sciences, VOL. 8, NO. 4, APRIL 2013

[16] Neeraj Kumar, Manoj Kumar, and R. B. Patel, "A Secure and Energy Efficient Data Dissemination Protocol for Wireless Sensor Networks", International Journal of Network Security, Vol.15, No.6, PP.490-500, Nov. 2012

