Methods and Algorithms of Capacity Calculation and Increase Throughput in Wireless Sensor Networks base of ZigBee: A Survey

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Abstract

Background/Objectives: Wireless sensor networks with IEEE 802.15.4 standard are one of the most important computer networks in information technology today. Wireless sensor networks with powerful base stations and a large number of sensor nodes with limited resources are formed. The network throughput and capacity calculation is very important. **Methods/Statistical Analysis:** To provide low data rate to cover short and long battery life, ZigBee wireless sensor network node is used and the ZigBee wireless sensor network used as a ZigBee sensor node. ZigBee wireless sensor node system is generally based on the IEEE 802.15.4 standard and protocol, ZigBee protocol stacks that are made. The Methods compared with calculation, capacity and throughput parameters in wireless sensor networks in ZigBee based. **Findings:** We organize a summary of different challenges that are found in wireless sensor network while working on the performance enhancement of ZigBee protocol. **Applications/Improvements:** The paper categorized the different techniques of increasing throughput and calculating capacity of wireless sensor network using ZigBee based.

Keywords: Capacity Calculation, IEEE 802.15.4, Throughput, Wireless Sensor Network, Zigbee Network

1. Introduction

New advances in the development of wireless sensor network communication are occurring. Sensor Networks showed a significant improvement over traditional sensors. The wireless communication technology made significant progress in many fields, such as industrial, medical, security, military, geology, and etc. have been achieved[1]. Sensors in wireless sensor networks have a variety of purposes, functions and capacity requirements. ZigBee[2] a network of communication with the IEEE 802.15.4 standard that can be used to build your personal network. ZigBee and ZigBee cluster tree is also known as topology and routing data rate of 250 kbps is moderate or intermittent, properly defined. ZigBee routing operation, energy saving and lightweight for managing MAC super frame structure supported.

In ZigBee network, three different types of devices are used:

- ZigBee Coordinator (ZC): It is at the root of the network and a high level of ZigBee network device that initiates network formation by assigning specific identification that identifies personal area network known as PAN ID. It can also act as a network router.
- ZigBee Router (ZR): This is the second level of ZigBee device. It could be a ZigBee coordinator or previous ZR communicates. For transmitting and receiving data, is used as well as a central system where routing functionality and retransmitting packets to specific routes used.
- ZigBee End Device (ZED): The final device, a device with the latest type of machine is low. It is not to communicate or participate in routing. It's like a kid parent device such as coordinator or router to provide dependent coverage.

IEEE 802.15.4[3] is a standard that is typically useful for ZigBee and this is mainly for low-power wireless personal area network is designed, in other words it can be said

that ZigBee standard. IEEE 802.15.4 is a standard that defines the physical layer and medium access control substrate for short-range wireless personal area network is used. IEEE 802.15.4 is a standard that is usually intended to save energy. This is a useful standard for low power sensor networks with two operation modes and the mode switch is turned on. In the bright, clear frames are sent periodically by the coordinator. Units operating in this mode are well coordinated. In contrast to the clear mode, and transmission nodes are clear, there is no alternate recipient must also constantly to get one frame at a time to wake up. Data collection, scheduling algorithm application guide[4] and with low coverage rates, the longest delay is a delay between the routers. A good solution for the deployment of stationary sensors does not provide. Once the system is reduced by using Cell Broadcast. To provide coverage of the sensor, the minimum numbers of sensors are deployed. When the flow is two-way device discovery process is done. To improve the performance of dynamic routing scenario header ZigBee[5] reduced. Packet loss will occur if the mesh network design and routing tree. Implementation of sensor networks to wireless ad hoc network method. Appropriate routing and data transmission, stable delivery/transportation package provides. Figure 1 shows the architecture of the IEEE 802.15.4[6].
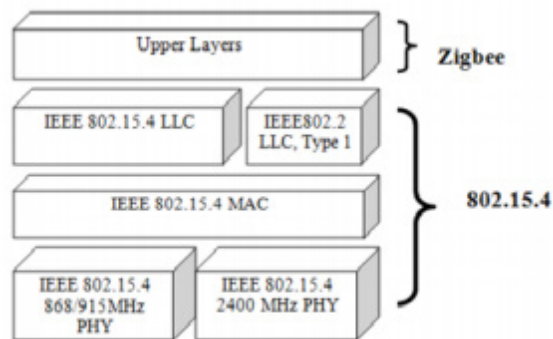

Figure 1. The architecture of the IEEE 802.15.4.

2. Capacity Calculation Methods and Algorithms

Different ways of calculating the capacity of wireless sensor networks include:

2.1 Performance of Mobility Method

Performance routing in mobile scenarios using ZigBee standards becomes clear that the first step is to perform in NS-2's first ZigBee network layer and in the second step to analyze the capacity of the current regulations and provide a huge collection of simulation results to determine if the efficacy of the standard is to address the mobility[7]. Packet loss does not occur when network in both fixed mesh and tree routing scheme work. Because ZigBee end devices will not be able to recover the router, a ZigBee router because their overhead is reduced. I talk about ZigBee protocol stack on the IEEE 802.15.4 standard PHY layer in which channel 27 and MAC layer to access the radio channel using CSMA/CA control them. Figure 2 shows ZigBee protocol stack[4].
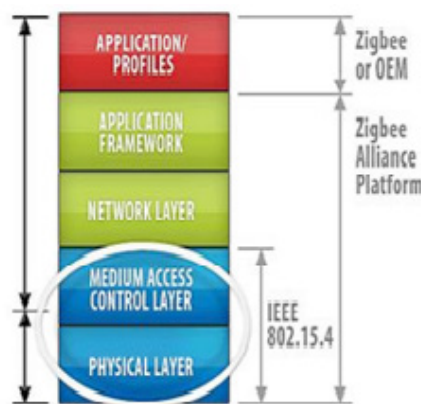

Figure 2. ZigBee protocol stack.

There are two types of framework to discuss them with Full Function Device (FFD) and Reduced Function Devices (RFD), and note that RFD can only communicate with FFD. ZigBee has three types of devices, the coordinator ZigBee, ZigBee routers and end devices is ZigBee. New ZigBee network coordinator who will participate in the final routing process started. There are two addresses and two routing in the network.

A 16-bit address for routing and data transmission and a fixed MAC address allocation scheme trees there. If the end device is out of range, it is difficult to find the router's main generator. The device discovery process in the application layer detection methods used track records. Once the error message is received, the data flow will be cut off. The tree routing application reduced efficiency.

The capacity receives up to 250 kbps. One of the important features of ZigBee multi-hop transmission, but

here when the message is lost in transit. The number of messages received will increase the number of hops.

ZigBee mesh routing tree is about to be discussed. When the error message is received by the source, the data flow is interrupted.

Cskip maximum sequential address specific hierarchical tree structure that you want. Coordinator, cluster tree routing algorithm checks the device. When generating router acquires new address them, routers child must change its address as children. Multiple appearance mobility[7] increased complexity in routing the tree.

2.2 Using the Capabilities of ZigBee Method

ZigBee[5] a PHY layer and MAC layer architecture based on form and based on the IEEE 802.15.4 low data rate. ZigBee mesh routing and tree used in one of two. There are two types of devices in the network, including: FFD (Full Function Devices) and RFD (reduced function devices). Architecture ZigBee, each layer next higher layer services through Service Access Points offers (SAPs). Data Entity (DE), the Management Entity (ME) are two types of service access points. The aim ZDO[8] supervising functions of the device as well as an interface to other ZigBee's many functions.

Self-healing capacity is one of the important characteristics of ZigBee mesh routing is done through. Here meshes routing recovery time is calculated. Using a 20 ms transfer period, a maximum delay of 126 milliseconds to find a new path. Here many tests prove that a lot of processing overhead message across layers resulting in increased latency and bandwidth reduction comes and shows that the acceptance rate less than the rate of transmission. For closed loop or ZigBee emergency plans is not much use. To make frequent use of the devices in the environment is needed libraries, the profile is created. ZDO[5] an interface between the application objects, specifications and APS is a layer. There is a plan for objects and to determine the ZigBee Cluster Library used. Both client and server implementations of the standard. Clusters are created as part of the ZigBee protocol and have a unique identifier for certain. The size of a message transmission rate increases that must be controlled to avoid further expense and delay. ZigBee for open-loop control, change the short operational consequences, register and download/upload properly.

2.3 Sustainable Mobility Method

Using mobility systems[7] to reduce the reconstruction of the road from the model used in the movement patterns of end devices are some guidelines to follow. To increase data delivery, mobility[7] and an efficient algorithm robustness has been introduced for tree made effective. The information gathered strength and mobility[7] based on the desire node is introduced. With this information, a tree and build a tree algorithm is used here consists of ZTG and FIX.ZTG search phase and Communication outlines the most powerful mobility[9] is added to the tree. Due to the very limits Lm Rm and there may be multiple trees instead create a single tree and all the integrated FIX phase. Based on the shortest route of delivery as given above.

2.4 Shortest Tree Routing Algorithm

The shortest tree routing used protocol in the remaining hops from the desired source (random) to be calculated using a hierarchical addressing scheme. A neighbor hop routing information to improve performance and reduce the routing overhead that provides best path routing.

First, the shortest tree routing solves ZigBee tree routing problems and difficult detour traffic congestion. Second hop 1 neighbor nodes by routing the shortest path tree routing improves effectively used. The third comparison is the shortest route tree, and to demand ZigBee tree routing. ZigBee tree routing scheme in the address block network address space available at each level of the tree is pre-assigned address space in a recursion to split up the tree. To solve the problem detour routing tree ZigBee, ZigBee specification defines direct transfer rule that a coordinator or a router to transmit a packet directly to the destination without making routing protocol to allow, if appropriate destination in the routing table defined. In addition to the problem of detour, ZigBee tree routing traffic trouble concentrating due to limitations links tree. Since all packets pass only through the link tree, especially around the root node, severe congestion and packet collisions on the tree of links focused. First, we calculate the shortest routing tree on us. Then, for each input neighbor, our neighbor hop remaining tree obtains input and calculated. Reduced traffic load on the link in the tree when it is hop neighbor information. So the transportation is very low and the shortest route tree saves half the amount counted. The shortest route tree, the tree

remaining hop from source to destination is calculated. Evaluate the performance of the hop count, based on end-to-end delay, packet delivery ratio. Productivity improved along with the neighboring done[15].

Finally, a resource or an intermediate node in the node's neighbors as the next hop, which has left at least hop tree to the next hop destination node is transmitting a packet.

2.5 Mobility Cluster-Based Method

The algorithm steps are as follows:
- Mobility[7] release of information "n" nodes, "t" time.
- Calculate the mobility criteria - relative mobility
- Making the initial cluster - the cluster, threshold.
- Integration of the cluster - join.
- Cluster[7] maintenance/restoration - relative mobility value should be less than the threshold.

This algorithm reduces the overhead routing and mobility management solutions can be effective. Distributed clustering algorithm has two families of algorithms lowest ID and algorithm highest degree of connectivity. So routing overhead is reduced and mobility management solutions[7] are very affordable. Figure 3 shows cluster network.
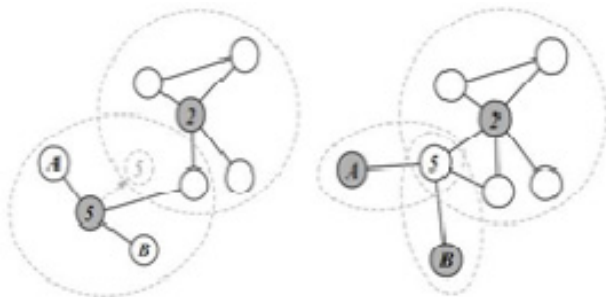

Figure 3. Cluster network.

2.6 Elastic Routing Table Algorithm

Elastic routing table for all peer networks is created. Details of the link maintain the routing table for each peer. The connection is not nothing but a number. The value of the number of connection to the peer is available with all counterparts. Details peer network connection whenever join regularly updated.

Dynamically elastic routing table[10] for further processing by connecting to the database is updated. The value of its connections with other nodes in the network node detects. Network connection degree calculation

process[10] of any peer in the routing table elastic[10] should be updated. According to the degree we are able to recognize that the best peer to peer transport packets in the network. This calculation is abandoned or added dynamically to a node in the network that has been done. Calculation capacity[10] only the value of the high-grade in order to avoid the same node[10] for the work done, as well as pressure and high temperature is added to the same node[10]. Figure 4 shows sample of inside and outside temperature[10].
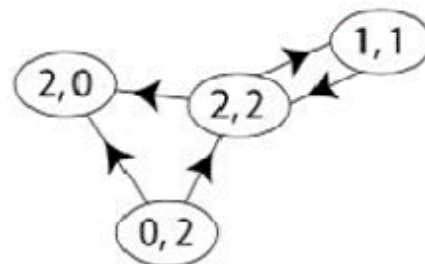

Figure 4. Sample of inside and outside temperature.

The steps of the capacity are as follows:

If node A in grade 4, node B 3, C 2 are node, node A first package to be selected as the temperature is a bit higher for the second pack. We have the capacity to below to Node A is in grade 4, but 1 way we calculate, we first closed after 4/3 capacity of 0.75 Node B is in grade 3, no packets have been sent so 3/3 it is the capacity of a node C, the capacity is equal to one. Therefore, in the second node B is decided because of the temperature[10] and high capacity. It has been proven that the routing table elastic[10] active transport to expand exponentially Search query processing time than the random motion leads. Figure 5 shows chart of inside and outside temperature.
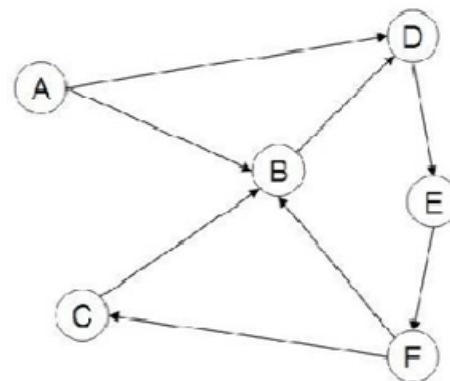

Figure 5. Chart of inside and outside temperature.

Web graph is a small sample. In this example, we have six pages labeled A through F. Page B in Grade 3 and Grade 1 is out. The example graph is strongly connected to the path of any of the pages B to F on page A does not exist. Elastic routing table[10] by making full use of capacity by allowing nodes to nodes within the boundaries makes them. In addition, the routing table elastic[10] in the dynamic[10] compatibility (A) and facilitate the shipping Search (F) to cope with the loss canopy allows network searches. Search delay is determined by two factors: the track and time search and the search process in each blade. Advantage compared with other techniques in network congestion control protocol is static. The effectiveness of the algorithm specified in the protocol module. This makes full use of capacity while load control node depends on its capacity. The search for effective search in DHT network latency improves.

3. Methods and Algorithms to Increase Throughput

There is a wide range of research on ZigBee cluster tree network. We use the ZigBee wireless sensor network standard. A number of obstacles or challenges to achieve higher throughput in wireless sensor networks exist. So to overcome these barriers various techniques with a variety of ways according to specific topology used in wireless sensor network is discussed below:

3.1 Distributed Algorithm[11]
When traffic increases, the proportion delivered from the source and destination are not done properly. Distributed algorithms[11] as well for the ZigBee standard to improve throughput and reduce traffic convenient and reliable in use. In addition, the algorithm[11] for producing a framework based on ZigBee cluster tree network to increase bandwidth without any additional message exchange used. Under the framework, the problem is formulated to maximize throughput, maximum flow is known as the top constraint problem. For low-cost, low-power wireless sensor networks, ZigBee cluster tree topology is useful in understanding the routing lightweight and energy saving operation support. The cluster tree topology ZigBee, IEEE 802.15.4 MAC super-frame structure is used for the management of energy-saving operation and a lightweight tree routing protocol

address assigned by a policy distributed by different parameters configured system.

3.2 Approach a Transmission Time Method[12]
The access plan for a transition period, except the coordinator of the PAN all nodes are grouped by level 1 routers. This method[12] also an important issue at a high level of throughput bottleneck placed PAN offers. In order to solve this problem, a new method for assigning active period in the above method[12] is presented. The method presented in it are guided PAN split into two pieces when. High level routers in two groups using the pieces of time so as to load balance traffic between the piece and made full use of the source when divided. Using the code of various length, collision between sub-networks Help frame disappears. In addition, each router to communicate with your half-time coordinator for PAN and PAN coordinator node for the other half will consume, these methods increase the network throughput performance and reduce energy consumption by between 2/1 It is up to 3/1. By dividing up the route into two groups using different time slice to access the PAN coordinator and the exercise of bar codes for each subnet, data packet collisions is reduced and throughput is improved. Figure 6 shows grouping nodes by one level routers[12].
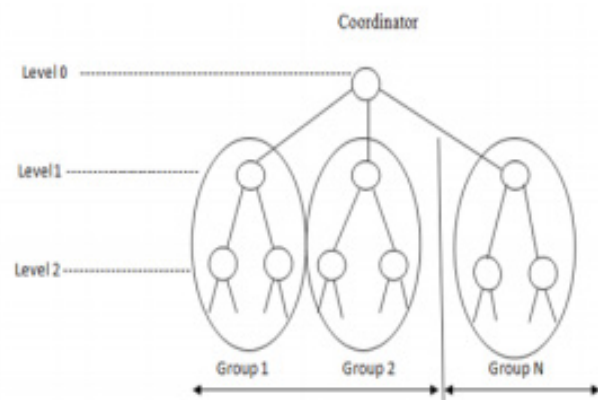

Figure 6. Grouping nodes by one level routers.

3.3. Versatility of IEEE 802.15.4 MAC Method[13]
This method[13] described the models that are ready to work for 802.15.4 led to a sense of access method CSMA/CA is in the account of the coordinator as well as the

burst nature of traffic. This approach is perfectly suited for 802.15.4 even if these are two fundamentally different access methods. According to the model, method[13] introduces ABE, which is a method of contention window for optimal values set to high network throughput with low-gain cycle time. The proposed method essentially ABE coordinator of a special law by a channel that can be seen is derived from his time, and the window of competition in the distribution of the devices.

The aim of this optimization method, high throughput, resulting in low power consumption to adjust the contention window to optimal values so that network to achieve high throughput with low cycle time, is using the mechanism of ABE, compliance procedures, which by performing the following steps:

- Coordinator nodes associated with using CSMA/CA for transmission during clashes access compete.
- Method CSMA/CA border of the next place to retreat and retreat random selection window competition.
- Node a retreat exponential shape.

In this way[13], the problem of optimizing the operation of IEEE 802.15.4 networks is checked. Extra parameters frame by a suitable combination of BO and SO, energy-efficient operation with low cycle time is assumed. IEEE 802.15.4 is a valid model and it is used to extract ABE with a different mechanism of adaptation that competition in the windows of active nodes and traffic patterns are changing. Moreover, ABE has been designed keeping in mind the explosive traffic conditions.

3.4 CoZi Method[14]

CoZi closed a distribution plan based on simple network coding at intermediate nodes to increase throughput and provide better bandwidth and more reliable connectivity with network overhead are the norm. The way to maximize the use of bandwidth and reduce transmission and communications based on end-to-end publication. Before data transmission every ZigBee router can be closed with a combination of network coding operations using a simple XOR operation to do. To increase the use of ZigBee sensor network bandwidth depending on the nature of data traffic, the above method[14] describes two strategies that can be encoded can be used at any node. The aim of the decision is coded maximum number of nodes should be able to decrypt the packets are encoded

in the output. The method[14], CoZi to increase the power of a cluster tree network is recommended. ZigBee sensor network nodes in wireless subscribers not exploit nature. Planning a distribution package using the Simple Network coding is used in the intermediate node. Using topology intervention in the decisions of the code is optimized to allow a greater range of ZigBee sensor network node decoding is performed according to the release. Figure 7 shows CoZi image queue system[14].
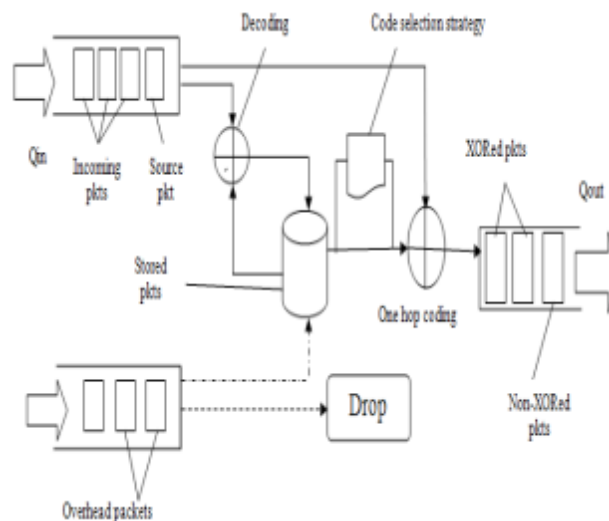

Figure 7. CoZi image queue system.

4. Conclusions

Wireless sensor network has a research area from past few years. In this paper, various methods and algorithms that are used to improve the throughput of ZigBee Cluster tree network and calculating the capacity of wireless sensor networks are discussed. Throughput is the amount of data moved successfully from one place to another in a specific time period. Performance of the throughput and capacity which plays a vital role in wireless sensor network is analyzed. On the other hand, we provide previously designed method with different research approaches. We organize a summary of different challenges that are found in wireless sensor network while working on the performance enhancement of ZigBee protocol. Thus paper categorized the different techniques of increasing throughput and calculating capacity of wireless sensor network using ZigBee based.

5. References

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