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An Efficient Tree-based Self-Organizing Protocol for Internet of Things

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Abstract: *Tree networks are widely applied in Sensor Networks of Internet of Things . This paper proposes an Efficient Tree-based Self-organizing Protocol for sensor networks of IoTs. In ETSP, nodes are divided into two kinds all nodes. Network nodes can broadcast packets to their neighboring nodes. Non-network nodes collect the broadcasted packets while determine whether to join the network.*

During the self-organizing process, we are using different metrics such as number of child nodes, communication distance and residual energy to reach available sink node' the node with max weight selected as sink node. Non-network nodes turned into network nodes and when they join network successfully. Tree-based network can be obtained one layer by one layer and so more.

The topology adjusted dynamically to balance energy consumption and prolong network lifetime. Simulation results show that our proposed protocol can be construct a reliable tree-based network quickly. With the network scale increasing, average hop and packet loss ratio won't increase more. Furthermore, the success rate of packet in ETSP is much higher compared.

Introduction

Internet of Things (IoTs) enables objects to collect and exchange data using many network technologies, such as sensor networks, wireless communication, data etc.Sensor network is indispensable to IoTs. It used in localization , industrial automation, environmental monitoring and other applications. Sensor networks consist of a lot of low-cost, and low-power tiny sensor nodes which are randomly distributed. These nodes can communicate with each other to collect a data. With the scale increasing and devices updating, and the network system becomes more and more complex. The memory, energy and ability of computing are limited by network nodes . In order to maximize lifetime,and many researchers apply themselves to control network topology build better data transmission route and balance energy consumption of nodes.

Tree network is essentially a combination of bus network , star network, which can prolong the lifetime of network. Therefore, how to build a tree-based network with a maximum lifetime for sensor networks of IoTs has become a critical issue . But choosing a real maximum lifetime tree from all extended trees is a NP-complete problem so in order to meet the requirement of real-time, we need to choose a sub-optimal network. In this way , Zhu et al. have proved that a tree-based network cannot be built within a polynomial time. construct a spanning tree in polynomial time through subset division. Even in the worst case the tree can be constructed within an exponential time. WSTDO is a distributed data transmission technology based on spanning tree. It achieves a better performance in sparse networks else al. in have verified that without data aggregation the upper limit of all one-hop nodes' energy consumption is 98%. LBT can maximize the network lifetime. Authors take load-balancing and energy-efficient of one-hop nodes into account to construct the tree- based network. Algorithm LBT can preserve that the energy consumption of the tree-based network is close to the upper limit and oximately. Data aggregation technology isn't used in this ratures. So these methods increase the energy consumption and network load when data aggregation . In this paper we use the data aggregation technology in tree- based network to reduce the energy consumption.

In this paper, an efficient Self-organization Protocol in tree-based network is proposed. The network nodes are classified into three types: root node, sink node, sensor node. In the beginning of ETSP, there is only a root node whose hop is zero (not zero)root node searches child nodes by broadcasting packets. After receiving the broadcast packets, the neigh- boring non-network nodes record the topology information uses different metrics such as number of child nodes, communication distance and residual energy to reach available sink nodes' weight. Te node with max weight is selected as sink node. When non-network nodes join the network successfully, they will tured into ork nodes at once and proposed algorithm can build a tree-based network quickly. In addition, we adjust the topology dynamically, move the farthest child node to balance energy consumption and prolong the whole network lifetime.

2. Objective

To present an unstructured WSN network with rigorous performance guarantees to enhance packets efficiency and effectiveness

To progressively and effectively exploit the similarity of the peers by using packet passing

To clearly focus where the packets failure and where the packets pass, and also calculation total packets transmission time.

Monitoring energy consumption

3. Motivation

Our goal was to implement an accurate method for estimating the available bandwidth in a network end-to-end. From the results that I obtained, this implementation works pretty good.
By knowing the available bandwidth in real time, the simulation reflectors can route the streams on the best path possible, so enhancing the performances of the system.
To present an unstructured WSN network with rigorous performance guarantees to enhance packets efficiency and effectiveness
To progressively and effectively exploit the similarity of the peers by using packet passing
To clearly focus where the packets failure and where the packets pass, and also calculation total packets transmission time.
Monitoring energy consumption

4. Literature Survey

[1] Ning H, Liu H, Yang LT. Aggregated-proof based hierarchical authentication scheme for the Internet of Things. IEEE Trans- actions on Parallel and Distributed Systems 2015 ; 26(3):657-667.

Objective: In this paper, The Internet of Things (IoT) is becoming an attractive system paradigm to realize interconnections through the physical, cyber, and social spaces.
Limitation: In this paper, we have proposed an aggregated-proof based hierarchical authentication scheme for the U2IoT architecture. In the APHA, two sub-protocols are respectively designed for the unit IoT and ubiquitous IoT to provide bottom-up security protection.

[2] Zhang DQ, Zhao SJ, Yang LT, Chen M, Wang YS, Liu HZ. NextMe: Localization Using Cellular Traces in Internet of Things. IEEE Transactions on Industrial Informatics 2015 ; 11(2):302- 312.

Objective: The Internet of Things (IoT) opens up tremendous opportunities to location-based industrial applications that leverage both Internet-resident resources and phones' processing power and sensors to provide location information.

Limitations: As the penetration of IoT goes up rapidly, location-based telecommunication services are vital to telecommunication operators. In this paper, we have investigated the large-scale mobile traces from Telecom logs and introduced the social interplay that affects user short-term mobility .

5. Existing System:

Testing liveness of a network is a fundamental problem for ISPs large data center operators. Sending probes between every pair of edge ports neither exhaustive nor scalable . It suffices to find a minimal set of end-to-end packets traverse each link. Doing this requires a way of abstracting across device specific configuration fileger rating headers and the links they reach, and finally determining a minimum set of test packets .

Algorithms of existing system

Testing liveness of a network is a fundamental problem for ISPs , large data center operators and Sending probes between every pair of edge ports is neither exhaustive nor scalable . to find a minimal set of end-to-end packets that traverse each link. Doing this requires a way of abstracting across device specific configuration files and generating headers and the links they reach, and finally determining a minimum set of test packets.
To check enforcing consistency between the policy and the configuration

Energy Watcher:
ENb = EN–>b + Eb
ENb: Average Energy Cost.
EN–>b:Average Energy Cost of successfully delivering a data packet from N to its neighbour b.
Eb: Energy Cost for b

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6. Proposed System:

A simulation with Automatic Test Packet Generation framework that automatically generates a minimal set of packets to test the liveness of the underlying topology and the congruence between data plane state and configuration specifications. That simulation can also automatically generate packets to test performance assertions such as packet latency.

It can also be specialized to generate a minimal set of packets that merely test every link for network liveness.

To clearly focus where the packets failure and where the packets pass, and also calculation total packets transmission time.

Monitoring energy consumption

Algorithms of Proposed system

Dynamically adjust topology

In the following two cases we have to reconstruct network partially.

Case 1. Energy consumption.

The sink node not only gathers the data of its own sensor also aggregates data of all its child nodes, the energy consumption is quicker than sensor nodes. The farthest node will be deleted when the energy of the sinkt theode drops below *R%*. *R%* is based on the residual energy of last topology changing, and whichmeans the sink node adds or removes a child node. Removing a child node =sending packets to inform the child nodes to reelect sink node and at the same time delete the information of the child nodes from child node table. It is benefit to balance the energy consumption andif the farthest child node joins in other branches of the network. In order to compute we have to know the number of child nodes N . A simple example: we assume $N = 5$ at the moment $t0$ and residual energy is $E0$. certain time at $t1$ the residual energy is $E1$ and $E1 = 5E0/6$. For balancing energy consumption, delete the farthest child node. Here assume that the farthest child node joins branches of the network and the number of child nodes $N = 4$. and moment $t2$, the residual energy is $E2$ and $E2 = 4E1/5$, we need to adjust the topology again for energy balance.

Node6 reelects sink node is to balance the energy consumption of Node1 sink node not only gathers the data of its own sensor also aggregates data of all its child nodes, the energy consumption is quicker than sensor nodes. The farthest node deleted when the energy of the sinkt theode drops below *R%*. *R%* is based on the residual energy of last topology changing, which means the sink node adds or removes a child node. Removing a child node =sending packets to inform the child nodes to reelect sink node and at the same time delete the information of the child nodes from child node table. The sink node not only gathers the data of its own sensor also aggregates data of all its child nodes, energy consumption is quicker than sensor nodes. The farthest node will be deleted when the energy of the sinkt theode drops . *R%* is based on the residual energy of last topology changing, and which means the sink node adds or removes a child node. Removing a child node =sending packets to inform the child nodes to reelect sink node and at the same time delete the information of the child nodes from child node table.

In Figure 1, we assume that Node6 selects Node5 as its sink node. Node1 cannot work as a sink node. Node5 needs to reelect a sink node within one hop range there are no other nodes except for child nodes. Node5 broadcasts to inform all child nodes to reelect sink node.and child nodes can get the biggest weight of their available sink nodes based on Eq. 2 and then send the biggest weight

Algorithm 1 Selection best sink node

$i \leftarrow 0$, *max weight* $\leftarrow 0$, *sink index* $\leftarrow 0$
if i < *ava sink num* **do**
    calculate weight W
    optional sink[*i*].=*weight* $\leftarrow W$
    $i++$;
    if *max weight lessthanW* **then**
    sink index $\leftarrow i$
    max weight $\leftarrow W$
    else if *max weight* = W **then**
    if *optional sink*[*i*] is >=
    sink index $\leftarrow i$
    max weight $\leftarrow W$
    end if
    end if
end while
Output:*sink index*

Case 2. Link failure.

Child node sends data packets to its sink node periodically and sink node also periodically sends response packets to its child nodes to ensure the links are connected. If a sink node has not received any data packet from a child node in a certain period it judges the link is unsuccessful and removes the child node from its child node table. If a child node has not received any response packet from its sink node in a certain period it will judge the link is unsuccessful and re-select sink node.

7. Mathematical model& Algorithms of Project

- Let us consider S as a system for CONCEPT BASED USER.

S= {……
INPUT:
Identify the inputs
F= {f1, f2, f3 ....., fn| ‘F’ as set of file to execute packets.}
I= {i1, i2, i3…|’I’ sets of inputs to the function packets}
O= {o1, o2, o3….|’O’ Set of outputs from the function packets}
S= {I, F, O}
I = {File by the Sender, ...}
O = {File by Receiver,...}
F = {Functions implemented to get the Simulation,
LSB algorithm for packets encryption,
Clustering algorithm For packets assign}

LSB Algorrithm:
Packets in binary formated •
Lets example
0101000110001100110000011111
Make set 6 bit or 4 bit
010100 011000 110011 000001

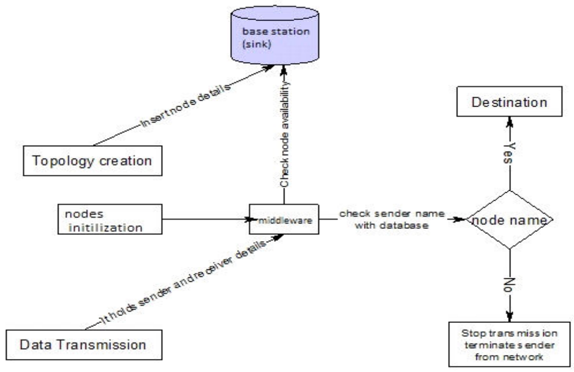
Replace last bit to first bit , doing that our code is encrypted format
001010 001100 111001 100000
For decryptetion just reverse process.

<u>Clustering Algorithm</u>

A step clustering algorithm is applied to the Assign Packets, Similarity function:

$$sim(x, y) = \frac{N_x \cdot N_y}{\|N_x\| \; \|N_y\|}$$

The advantage of the cosine similarity is that it can accommodate negative concept weights and produce normalized similarity values in the clustering process.
Creation of Packets considering positive and negative preferences :
Dealing with packets data from user file.
Creation of Node-Relationship.



In In this diagram we are simulate java simulation for data transmission. In this we proposing
new thing how to simulate simulation for data transmission.

Energy Watcher:

ENb = EN–>b + Eb

ENb: Average Energy Cost.
EN–>b:Average Energy Cost of successfully delivering a data packet from N to its neighbour b.
Eb: Energy Cost for b.
Trust manager is to get neighbor trust level from a neighborhood table

8. Methodology

1 - Adaptive Project Framework
In this , the project scope is a variable. Additionally, the time and the cost are constants for the project. During the project execution, the project scope is adjusted in order to get the maximum business value from the project.

2 - Agile Software Development
This methodology is for a project that needs extreme agility in requirements. The key features of agile are its short-termed delivery cycles dynamic team culture, less restrictive project control and emphasis on real-time communication.

3 - Crystal Methods
In crystal methodology, the project processes are given a low priority. Instead of the processes, method focuses more on team communication, team member skills, people and interaction.

4 - Dynamic Systems Development Model (DSDM)
This is the successor of Rapid Application Development methodology. This is also a subset of agile software development methodology and boasts about the training, documents support this methodology has. This method emphasizes more on the active user involvement

5 - Extreme Programming (XP)
Lowering the cost of requirement changes is the main objective of extreme programming. And XP emphasizes on fine scale feedback, continuous process, shared understanding , programmer welfare.

6 - Feature Driven Development (FDD)
In this methodology is more focused on simple and well-defined processes, short iterative and feature driven delivery cycles. All the planning execution in this project type take place based on the features.

7 - Information Technology Infrastructure Library (ITIL)
This methodology is a collection of best practices in project management and ITIL covers a broad aspect of project management which starts from the organizational management level.

9. Conclusion

In this paper, we propose an efficient self-organization pro- tocol for sensor networks of IoTs. ETSP saves more energy and has a longer network lifetime by constructing a tree-based network fast. We use the weight of nodes and including residual energy, number of child nodes and distance between the nodes, to determine whether the node can be a sink node. Thus the depth of tree is optimized by using ETSP(Efficient Tree-based Self-organizing Protocol)During the process of data transmission, the network topology changes. Each sink node will be dynamically reselected due to the energy consumption of sink nodes is faster than others. The simulation results show that ETSP is able to build reliable tree-based networks, reduces the energy consumption

10. Acknowledgement

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