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ROUTING INFORMATION PROTOCOL FOR WIRELESS SENSOR NETWORKS

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Abstract - *A routing algorithm is a method for determining the routing of packets in a node. For each node of a network, the algorithm determines a routing table, which in each destination, matches an output line. The algorithm should lead to a consistent routing, that is to say without loop. This means that you should not route a packet a node to another node that could send back the package. Our contribution in this paper is e3D, diffusion based routing protocol that prolongs the system lifetime, evenly distributes the power dissipation throughout the network, and incurs minimal overhead for synchronizing communication. We compare e3D with other algorithms in terms of system lifetime, power dissipation distribution, cost of synchronization, and simplicity of the algorithm.*

Keyword: *Routing Algorithm, OSPF, RIP, LSP, Authentication*

INTRODUCTION

In this paper, we attempt to overcome limitations of the wireless sensor networks such as: limited energy resources, varying energy consumption based on location, high cost of transmission, and limited processing capabilities. Besides maximizing the lifetime of the sensor nodes, it is preferable to distribute the energy dissipated throughout the wireless sensor network in order to minimize maintenance and maximize overall system performance. For more in depth understanding of the problem statement and proposed algorithm, we refer the reader to the full length version of this paper [1].

Any communication protocol that involves synchronization between peer nodes incurs some overhead of setting up the communication. We attempt to calculate this overhead and to come to a conclusion whether the benefits of more complex routing algorithms overshadow the extra control messages each node needs to communicate. Obviously, each node could make the most informed decision regarding its communication options if they had complete knowledge of the entire network topology and power levels of all the nodes in the network[2]. This indeed proves to yield the best performance if the synchronization messages are not taken into account. However, since all the nodes would always have to know everything, it should be obvious that there will be many more synchronization messages than data messages, and therefore ideal case algorithms are not feasible in a system where communication is very expensive. For both the diffusion and clustering algorithms, we will analyze both realistic and optimum schemes in order to gain more insight in the properties of both approaches[3]. The benefit of introducing these ideal algorithms is to show the upper bound on performance at the cost of an astronomical prohibitive synchronization costs.

RIP (ROUTING INFORMATION PROTOCOL)

RIP is the most widely used protocol in the TCP / IP environment to route packets between the gateways of the Internet. It is a protocol IGP [4] (Interior Gateway Protocol), which uses an algorithm to find the shortest path. y the way, refers to the number of nodes crossed, which must be between 1 and 15. The value 16 indicates impossibility. In other words, if the path to get from one point to another of the Internet is above 15, the connection can not be established. RIP messages to establish the routing tables are sent approximately every 30 seconds. If a RIP message does not reach its neighbor after three minutes, the latter considers that the link is no longer valid; the number of links is greater than 15 [5]. RIP is based on a periodic distribution of states network from a router to its neighbors. The release includes a RIP2 routing subnet, message authentication, multipoint transmission, etc.

OSPF (Open Shortest Path First)

OSPF is part of the second generation of routing protocols. Much more complex than RIP, but at higher performance rates, it uses a distributed database that keeps track of the link state. This information forms a description of the network topology and the status of nodes, which defines the routing algorithm by calculating the shortest paths. The algorithm allows OSPF, from a node, to calculate the shortest path, with the constraints specified in the content associated with each link. OSPF routers communicate with each other via the OSPF protocol, placed on top of IP[6]. Now look at this protocol a bit more detail. The assumption for link state protocols is that each node can detect link status with its neighbors (on or off) and the cost of this link. We must give to each node enough information to enable him to find the cheapest route to any destination. Each node must have knowledge of its neighbors. If each node to the knowledge of other nodes, a complete map of the network can be established. An algorithm based on the state of the neighboring requires two mechanisms: the dissemination of reliable information on the state of the links and the calculation of routes by summing the accumulated knowledge of the link state [7]. One solution is to provide a reliable flood of information, to ensure that each node receives his copy of the information from all other nodes. In fact, each node floods its neighbors, which, in turn, flood their own neighbors. Specifically, each node creates its own update packets, called LSP (Link-State Packet), containing the following information

Identity of the node that creates the LSP.
• List of neighboring nodes with the cost of the associated link.
• Sequence Number.
• Timer (Time to Live) for this message.

two information is needed to calculate routes. The last two aim to make reliable flooding. The sequence number allows putting in order the information that would have been received out of order. The protocol has error detection and retransmission elements [8]. The route calculation is performed after receiving all the information on the links. From the complete map of the network and costs of links, it is possible to calculate the best route. The calculation is performed using Dijkstra's algorithm on the shortest path. In the acronym OSPF (Open Shortest Path First) Open the word indicates that the algorithm is open and supported by the IETF. Using the mechanisms outlined above, the OSPF protocol adds the following additional properties

AUTHENTICATION OF ROUTING MESSAGES

Malfunction can lead to disasters. For example, a node that, following the receipt of wrong messages, intentionally or not, or a striker messages modifying its routing table, calculates a routing table in which all nodes can be achieved at a cost zero automatically receives all network packets. These problems can be avoided by authenticating issuer's messages. Early versions had a OSPF authentication password of 8 bytes. The latest versions have much stronger authentication.

NEW HIERARCHY

This hierarchy allows for better scalability. OSPF introduces another level of hierarchy by partitioning the areas into eras (area). This means that a router within a domain does not need to know how to reach all the networks in the field. Just that he knows how to reach the right age. This results in a reduction of information to be transmitted and stored.
There are several types of OSPF messages, but they all use the same header, which is shown in Figure.

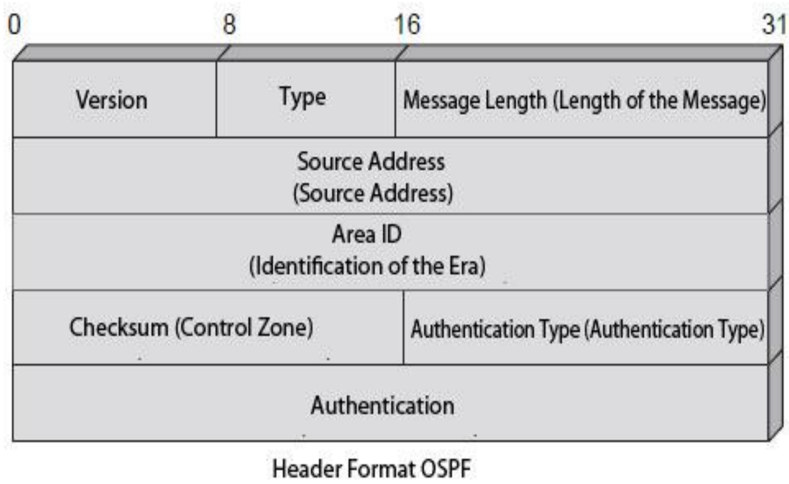

Fig: OSPF messages

The current version is 2. Five types were defined with values from 1 to 5. The source address indicates the sender of the message. The identification of the era indicates the era in which lies the sending node. The authentication type has the value 0 if there is no authentication, 1 if the authentication password and 2 if an authentication technique is implemented and described in the following 4 bytes.

The five types of messages have the Hello message as Type 1. This message is sent by a node to its neighbors to tell them that it is always present and not broken. The four other types are used to send information such as

queries, shipments or acquittals LSP messages. These messages mainly carrying LSA (Link-State Advertisement), that is to say, information about link state. A message can contain several OSPF LSA.

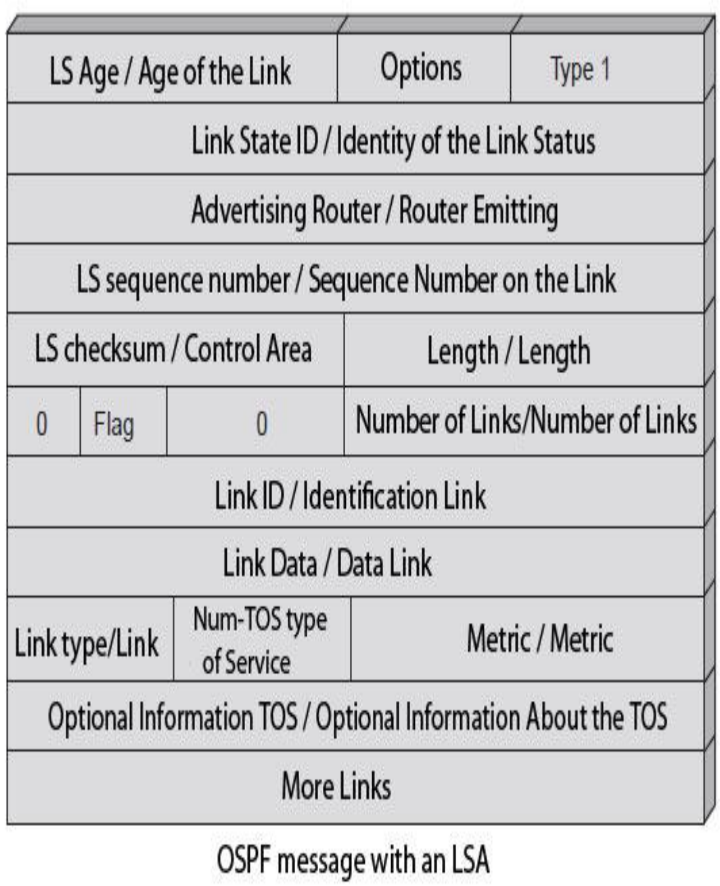

Fig: type of OSPF LSA carrying a message

e3D: EXPERIMENTAL RESULTS

We introduce a new algorithm, e3D, and compare it to two other algorithms, namely directed, and random clustering communication. We take into account the setup costs and analyze the energy-efficiency and the useful lifetime of the system [10]. We compare the algorithms in terms of system lifetime, power dissipation distribution, cost of synchronization, and simplicity of the algorithm. Our simulation results show that e3D performs only slightly worse than its optimal counterpart while having much less overhead. Therefore, our contribution is diffusion based routing protocol that prolongs the system lifetime, evenly distributes the power dissipation throughout the network, and incurs minimal overhead for synchronizing communication. In our simulation, we use a data collection problem in which the system is driven by rounds of communication, and each sensor node has a packet to send to the distant base station [11]. The diffusion algorithm is based on location, power levels, and load on the node, and its goal is to distribute the power consumption throughout the network so that the majority of the nodes consume their power supply at relatively the same rate regardless of physical location. This leads to better maintainability of the system, such as replacing the batteries all at once rather than one by one, and maximizing the overall system performance by allowing the network to function at 100% capacity throughout most of its lifetime instead of having a steadily decreasing node population.

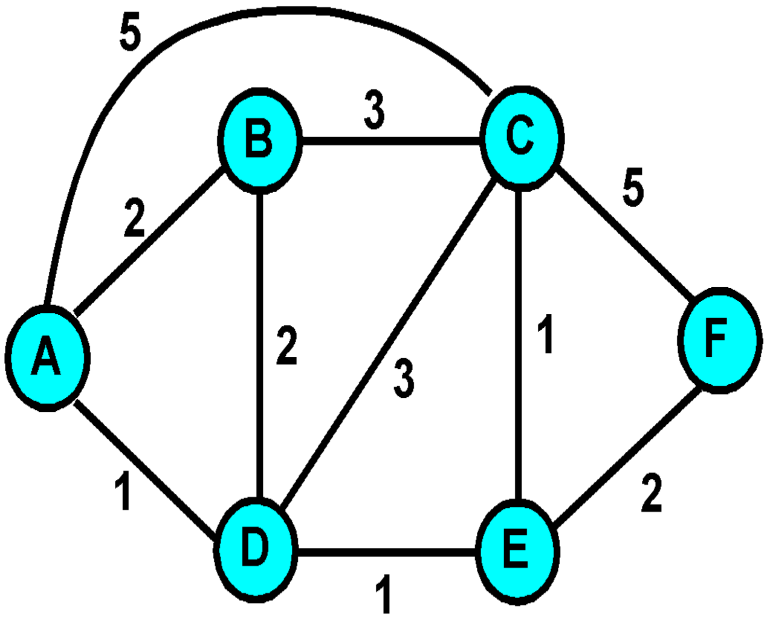

Fig: Time to Compute Path vs Number of Node in Final Path

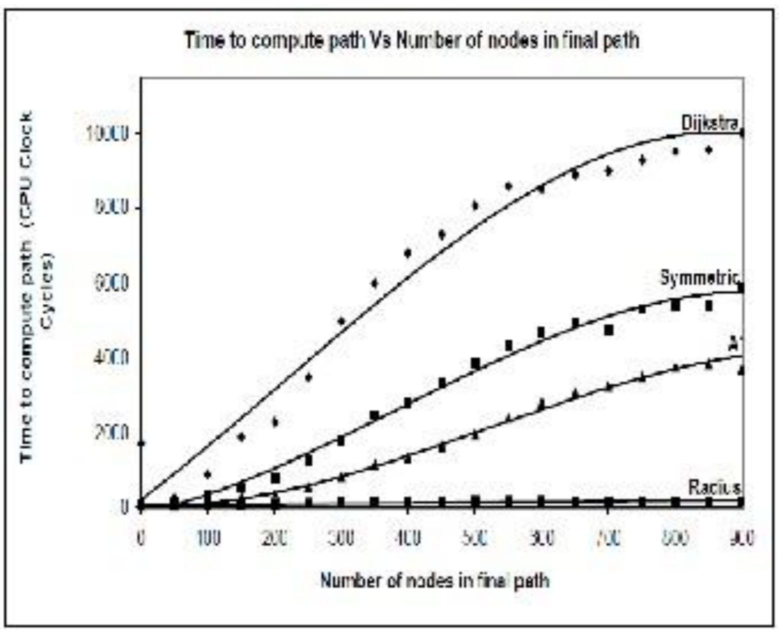

Fig: Routing Graph

CONCLUSION

In summary, we showed that energy-efficient distributed dynamic diffusion routing is possible at very little overhead cost. The most significant outcome is the near optimal performance of e3D when compared to its ideal counterpart in which global knowledge is assumed between the network nodes. We therefore conclude that complex clustering techniques are not necessary in order to achieve good load and power usage balancing. Previous work suggested random clustering as a cheaper alternative to traditional clustering; however, random clustering cannot guarantee good performance according to our simulation results.

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