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A Survey on Performance Evaluation of AOMDV Routing Protocol for Internet of Things

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Abstract— Internet of things (IOT) is derived from two words i.e. "Internet" which is a global system of interconnected networks and "Things" which shows some objects. IOT is conceptually defined as a self configured, dynamic global network infrastructure based on standard and interoperable communication protocols where virtual and physical things having identities, virtual personalities, and physical attributes, use intelligent interfaces and are seamlessly integrated into the information network. We had gone through various dissertations adopted by various authors in the study of Internet of things (IOT). All the dissertations studied works on the comparative analysis on performance of networks with Internet of things.

Keywords— Internet of things, Routing, Protocols, AOMDV, AODV, Ad-hoc Network, Mobile Network, MANET, Wireless Network.

INTRODUCTION

1.1 Wireless sensor networks (WSNs)

Wireless sensor networks (WSNs) consist of a huge number of small devices that sense and gather information from their immediate environment. The gathered data is transmitted hop-by-hop through the network and then to the sink node where these data are analyzed. These types of networks pose many challenges because of their limited energy, low computational capabilities, low memory, unattended operation, and dynamic environmental changes [3].

WSN monitoring network includes various components:

a) WSN hardware - Typically a WSN hardware node contains sensor interfaces, processing units, transceiver units and power supply. They comprise of multiple analog to digital converters for sensor interfacing and recent sensor nodes have the ability to communicate using one frequency band making them more versatile.

b) WSN communication stack - The nodes are likely to be deployed in an adhoc manner for most applications. Nodes in a WSN need to communicate among themselves to transmit data in single or multi-hop to a base station. Designing a suitable topology, routing and MAC layer is critical for scalability and longevity of the deployed network. When the node drop outs the consequent degradation in the network lifetime are common. The communication stack at the sink node should be able to communicate with the world via the Internet to operate as a gateway to the WSN subnet and the Internet.

c) WSN Middleware - A method to combine cyber infrastructure with a Service Oriented Architecture (SOA) and sensor networks to give access to various sensor resources in a deployment free manner and is based on the idea of isolating resources so as to be used by several applications. A platform independent middleware for developing the sensor applications is required, for example an Open Sensor Web Architecture (OSWA). OSWA is designed on a uniform set of rules, operations and standard data representations as stated in the Sensor Web Enablement Method (SWE) by Open Geospatial Consortium (OGC).

d) Secure Data aggregation – A secure and efficient data aggregation method is required to extend the lifetime of the network as well as ensuring reliable data gathered from sensors. As node failures are a common characteristic of WSNs, the network topology should have the capability to heal itself. Ensuring security is critical because the systems are automatically connected to actuators and protecting the systems from intruders is very important [8].

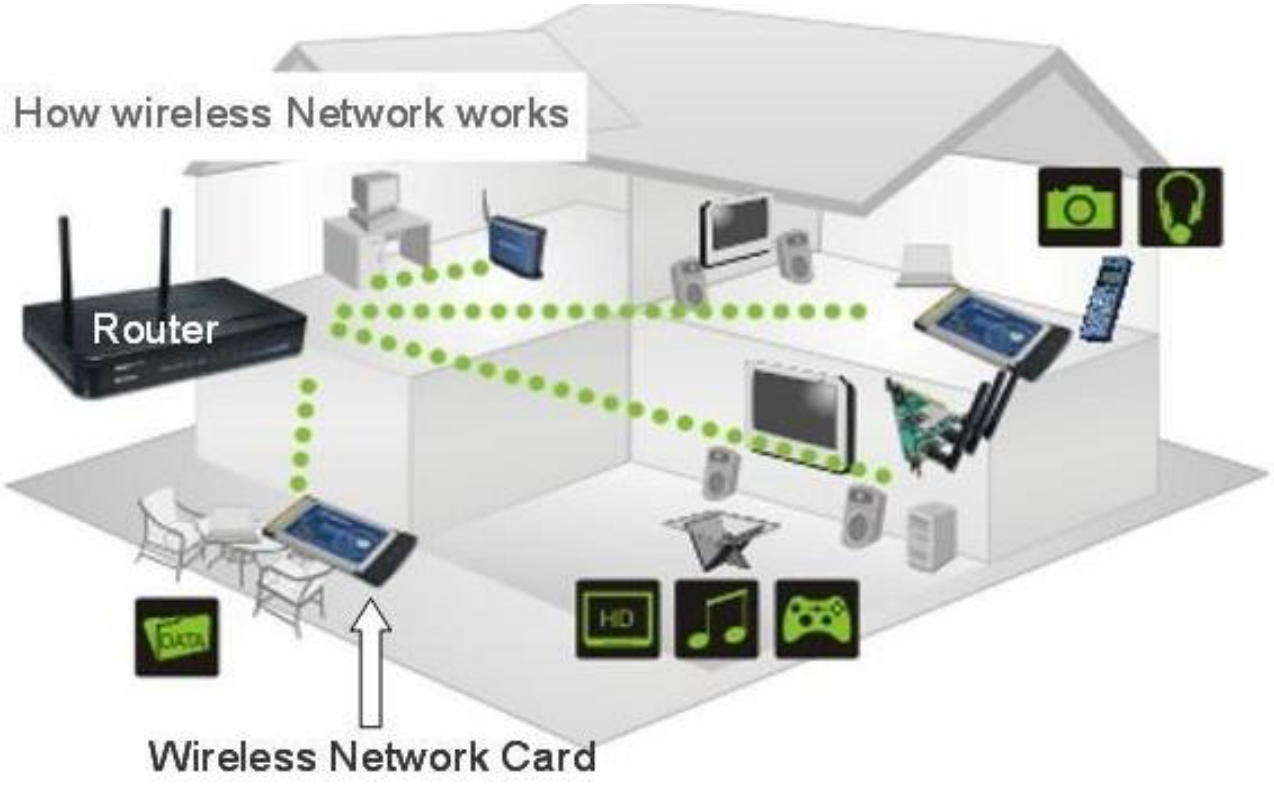

Figure 1: How wireless network works

1.2 Mobile Ad hoc Network (MANET)

Mobile Ad hoc Network (MANET) is a self-organizing and infrastructure-less multi-hop network which contains several wireless mobile nodes, such as Personal Digital Assistants (PDAs), laptops, etc. Each node in MANET is both a host and a router, a source node therefore can reach the destination node directly or by intermediate nodes [5].

1.3 Internet of Things (IOT)

IOT is derived from two words i.e. "Internet" which is a global system of interconnected networks and "Things" which shows some objects. IOT which is also known as Internet of Objects is the networked interconnection of daily objects, uniquely addressable, based on standard Internet protocol suite (TCP/IP). It is a self-configuring wireless network of sensors whose idea would be to interconnect everything [1] [6].

Nowadays the world is entirely dependent on the information provided on internet, which is captured by taking images or through text. This needs the major involvement of a human being for collection of the information but problem is that people have limited time and less accuracy, which leads to inappropriate and inconsistent data. Hence, such a system is needed which can automatically collect the data and transfer it to the internet without any human to machine interaction [6].

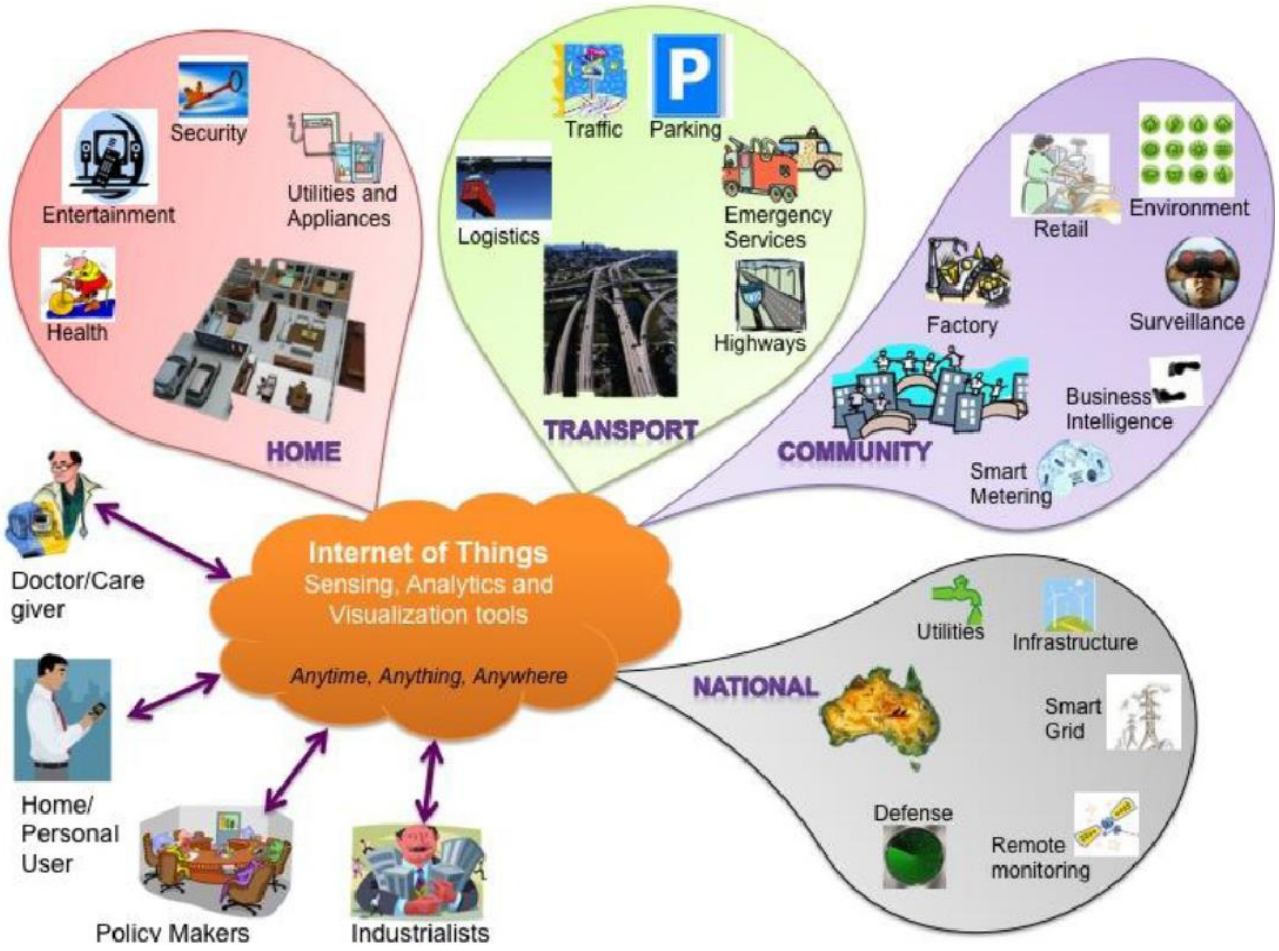

Figure 2: IOT Schematic showing the end users and application areas based on data.

Internet of things is a scenario in which all the objects/things are connected to the internet. The information sensing devices connect things with the purpose of intelligent identification and management. Wireless technology and the internet is used majorly in the making of IOT. IPv6 plays a very important role in IOT, by using its large address space through which one can easily assign a unique IP address to things on this planet and could transfer the data over network [6].

IOT is conceptually defined as a self configured, dynamic global network infrastructure based on standard and interoperable communication protocols where virtual and physical things having identities, virtual personalities, and physical attributes, use intelligent interfaces and are seamlessly integrated into the information network. In the IOT, smart objects/things are active participants in information, business and social processes where they are enabled to communicate and interact among themselves and also with the environment by interchanging data and information sensed about the environment, while reacting autonomously to the physical/real world events and effects IOT by running processes that have trigger actions and create services with/without human intervention directly [2].

By the smart usage of IOT, it would be possible to discover when the things need to repair, recall or replace without the human interference; which greatly reduce the waste and loss of the things [6].

There are many similarities between IOT and MANET [1].

•Both the network structure is horizontal. Each node has the same priority and there is no sink node like wireless sensor network, so energy consumption is steady and avoiding energy hole effect happens.

•The nodes there can move randomly so that the network needs some methods to create connection quickly and steadily. Moreover, the movement of nodes leads to the routing table updated frequently, therefore, link costs may disturb the normal data transportation and some algorithm should be designed to minimize the routing costs.

•With the development of microchip technology, nodes are becoming more and more powerful, so nodes are based on IP address and their main compute unit can process more command in a time unit. As a result of that, we can design a more complex routing algorithm to lower the link costs and make the network more efficiency.

In some extent, IOT is the evolution of MANET, but there are lots of differences between them. One of the greatest differences is that IOT will connect to the Internet, IOT is not only a local interconnected network, through the connection to the internet, several internet of things can make up a great IOT global interconnected system [1].

LITERATURE SURVEY

Yicong TIAN, Rui HOU (2010) In this paper designed a routing method that can take function as routing destination not just nodes. Compared with AOMDV in the internet of things, simulation results demonstrate that AOMDV-IOT achieves enhanced performance in average end-to-end delay, packet loss and discovery frequency. This proposed work improvement proves to be more suitable for the use in internet of things [1].

Marie-Aurelie Nef et al. (2012) In this paper focus is on possible WSNs integration approaches in the IoT while providing QoS and which best practices to adopt. Regarding QoS requirements, this paper also defines service models for the IoT and expose their feasibility through a categorization of IoT applications [2].

Monika Grajzer et al. (2014) This paper mainly focus on the provision of new services based on the interconnection of smart devices into the IPv6-based Internet of Things (IoT) calls for offering the possibility of automated, unsupervised network configuration and operation. This aspect is important for mobile ad hoc networks as a key enabling technology for IoT. The mechanisms of Stateless Address Auto configuration goal is to provide basic self-configuration capabilities to the IPv6 networks, though they are still not enough to offer full support for MANET networks. To deal with this challenge the paper has proposed the Neighbor Discovery++ (ND++), an extended IPv6 Neighbor Discovery protocol for efficient Duplicate Address Detection in MANETs. This paper presents the simulation results verifying the ND++ behavior in the NS-3 simulation environment. [4].

Hou Songfan, Wu Muqing, Liao Wenxing, Wang Dongyang (2015) This paper presents an investigation with a goal to compare the performance of two characteristic routing protocols, AODV and DSR, in real multi-hop environment. Apart from testing the end-to-end packet loss, delay and routing path parameters, the performance of DSR and AODV routing protocols with factors of some applications based on Internet of Things (IoT), such as Radio Frequency Identification (RFID) service, voice service and temperature monitoring service are also tested [5].

Mayuri A. Bhabad, Sudhir T. Bagade (2015) The paper is mainly focusing on the concept of IOT, architecture and security issues with suggested countermeasure and suggested further areas of research needed. Internet of things (IOT) is a widely distributed network of interconnected things/objects in which all the information is routed to the internet with the use of sensing devices and Radio Frequency Identification (RFID) tagging system. As IOT does not need any human to machine interaction, hence security is needed. But the rapid development of IOT has evolved with the challenges in terms of security of things [6].

Vellanki et al. (2016) This paper propose a novel node level energy efficient (NLEE) routing protocol to enhance the energy efficiency. The validation of NLEE algorithm is confirmed using an IoT environment with discrete C ++ platform. Internet of things (IoT) involves connecting devices that forms the networks which work based on our surroundings, and can make our lives healthier, faster and safer. This paper is going to deliberate and explain energy issues that emerge while using Internet of Things [7].

Jabir et al. (2012) This dissertation proposed an enhanced architecture for SPMIPv6 called Clustered SPMIPv6 (CSPMIPv6). In the proposed architecture, the Mobility Access Gateways (MAGs) are grouped into clusters, each having a

distinguished cluster Head MAG (HMAG). The HMAG is designed to decrease the load on Local Mobility Anchor (LMA) by performing intra-cluster handoff signaling and providing an optimized path for data communications. The architecture proposed in this paper is evaluated analytically, and the numerical results demonstrate that the proposed CSPMIPv6 outperforms both protocols (PMIPv6 and SPMIPv6) in terms of LMA load, local handoff delay, and transmission cost performance metrics. [3].

ear	Title	Objective/Approach	Findings
010	An Improved AOMDV(Ad-hoc On demand Multipath Distance Vector) Routing Protocol for Internet of Things	Designed a routing method that can take function as routing destination not just nodes.	Improvement of AOMDV-IOT, which can select the stable internet transmission path dynamically through regular updating the internet connecting table.
012	Enabling QoS in the Internet of Things	Possible WSNs integration approaches in the IoT while providing QoS.	Summarized the service models and the performance analysis of the IEEE 802.15.4 also presented the best ways to integrate WSNs in the IoT providing QoS.
014	Performance evaluation of Neighbor Discovery++ protocol for the provisioning of self-configuration services in IPv6 mobile ad hoc networks	Simulation results verifying the ND++ behavior.	ND++ is a promising solution for provisioning of self-configuration services for the needs of the Internet of Things.
015	Performance Comparison of AODV and DSR in MANET Test-bed Based on Internet of Things	Compare the performance of two typical routing protocols, AODV and DSR, in real multi-hop environment with factors packet loss rate, time delay and routing path.	DSR performs better performance indoors while AODV can better adapt to outdoor complex electro-magnetic environment.
015	Internet of Things: Architecture, Security Issues and Countermeasures	Concept of IOT, architecture and security issues with suggested countermeasure and suggested further areas of research needed.	Security issues of IOT and some countermeasure for required security parameters.
016	Node Level Energy Efficiency Protocol for Internet of Things	Proposed a novel node level energy efficient (NLEE) routing protocol that improves energy efficiency based on some factors i.e. Expected transmission count, residual energy of nodes, and hop count of nodal paths.	An improved efficient usage of nodal energies. It also provides the shortest path in the network while routing setup delay is increased. As a result, the routing success probability is decreased.
012	A cluster-based proxy mobile IPv6 for IP-WSNs	An enhanced architecture for SPMIPv6 called Clustered SPMIPv6 (CSPMIPv6). In this architecture, the Mobility Access Gateways (MAGs) are grouped into	CSPMIPv6 performs better than the basic PMIPv6 and the SPMIPv6 in terms of LMA load, handoff latency, and the transmission cost.

		clusters, each with a distinguished cluster Head MAG (HMAG). The HMAG reduce the load on LMA by performing intra-cluster handoff signaling and provide optimized path for data communications.	

CONCLUSION

A theory of an improved AOMDV (Ad-Hoc On Demand Multipath Distance Vector) routing protocol for internet of things designed a routing method that can take function as routing destination not just nodes. A theory of enabling QoS in the internet of things designed the possible WSNs integration approaches in the IoT while providing QoS. A theory of performance comparison of AODV and DSR in MANET test-bed based on internet of things compares the performance of two typical routing protocols, AODV and DSR, in real multi-hop environment with factors packet loss rate, time delay and routing path. A theory internet of things architecture, security issues and countermeasures defines the concept of IOT, architecture and security issues with suggested countermeasure and also suggested further areas of research needed. A theory based on node level energy efficiency for internet of things improves energy efficiency based on some factors i.e. Expected transmission count, residual energy of nodes, and hop count of nodal paths. A theory based on cluster-based proxy mobile IPv6 for IP-WSNs provides an enhanced architecture for SPMIPv6 called Clustered SPMIPv6 (CSPMIPv6). In CSPMIPv6 architecture, the Mobility Access Gateways (MAGs) are grouped into clusters, each with a distinguished cluster Head MAG (HMAG). The HMAG reduce the load on LMA by performing intra-cluster handoff signaling and provide optimized path for data communications.

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