A Survey on Efficient Broadcast Protocol for the Internet of Things

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Abstract

Internet of Things is a collection of entities which can be physical devices, animals, people ,electronic devices etc. If they are connected through a network they can exchange data without any human - human or human - computer interaction. 2011 hype cycle says that there is IoT for more than 10 years .So the need of an efficient protocol is of greater importance. Analysis says that there will be 20 billion connected devices in the year 2020. So these devices should be connected so that we can call them as smart devices. IoT can be imagined as a wireless network IoT(T,n) in which T denotes the communicating entities in the network and n denotes the data that is to be distributed in between them. The importance of routing in IoT is that each information should be distributed to corresponding devices in the network .This paper is a survey on different protocols through which we can implement the IoT concepts.

Keywords:IoT(T,n,),CoAP,PSA,NLEE

1.Introduction

IoT will occupy a prominent place in day- to- day life. However, the design of protocols to control them in order to achieve a common goal is a challenging task. Everyday we hear about changes that happening in the field of IoT. The field of IoT is changing at a sudden pace and the impact it will have on everything around us is likely to be profound.It has to face the following challenges.Massive volume of data in motion which is flowing continuously, high velocity stream data have to get collected and data enrichment blending.IoT is providing a connecting network of potential objects for to interact each other on the internet with all security. It makes our world as possible as connected together. IoT brings a paradigm shift in our everyday life . In December of last year IoT included as top 10 tech trends by IEEE. World aims at greater connectivity.So IoT is now becoming a vital instrument to interconnect devices. Internet of Things (IoT). Communication over the internet has grown from user - user interaction to device – device interactions these days. The IoT concepts were proposed years back but still it's in the initial stage of commercial deployment. IoT can be used to provide a platform for smart garbage management.IoT is often known to be a connection between machine to machine ,man to machine, or machine to mobile.The technical component of IoT includes hardware elements like sensors, actuators.IoT has wide range application which depends on network type, scale,coverage.In contrast many companies have a deep vision on IoT .We can call IoT as "Internet of Everything".

It is a global infrastructure for information society. It is going to have a large impact on home automation, building automation in which all convenience will be taken care of by the devices which are connected through Internet of Things. . The problem of permutation routing is involved when each node in the network needs to receive information from other nodes. More precisely, the node cannot decide or do its task, because information that allows it to know what to do or decide are localized at the memory spaces of other nodes. Each node has to send what it has in its local memory to allow its neighbors progress. Thus, the nodes permute their information between them to solve the problem, while minimizing the total number of retransmissions.

2 .Literature Survey

The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services. Building a general architecture for the IoT is hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a system.

In [1][2] Andrea Zanella describes a smart city vision specifically to an urban IoT system that in fact, are designed to support the Smart City vision . This paper provides a comprehensive survey of the enabling technologies, protocols, and architecture for an urban IoT. Furthermore it present and discuss the technical solutions and best-practice guidelines adopted in the Padova Smart City project. Major design issues involved here are structural Health of Buildings ,waste management ,traffic congestion ,smart parking , noise monitoring It provides a reference protocol architecture for the urban IoT system that entails both unconstrained and a constrained protocol stack.. Data Format used here is eXtensible Markup Language (XML).Large size and parsing difficulty by CPU restricted devices made to think about EXI (Efficient XML Interchange)

In the application and transport layers the verbosity and complexity of native HTTP make it unsuitable for a straight deployment on constrained IoT devices. HTTP typically

Moreover, initially, I[i] = vi is the only input value known by pi. Each process can use an instance of the broadcast abstraction to send its input value to all other processes. Then, each process can compute the function F(I) as soon as it has obtained the full input vector I. The system is made up of n processes, denoted p1, ... pn. The integer i, which is called the identity and the fact that no two processes have the same identity. The set of identities is not required to be structured by an order relation. The processes communicate by sending, receiving messages through links. The set of current neighbors of a process pi is defined by the graph Gx that currently models the structure of the system

relies upon the TCP transport protocol that, however, does not scale well on constrained devices, yielding poor performance for small data flows in lossy environments. The CoAP protocol overcomes these difficulties by proposing a binary format transported over UDP, handling only the retransmissions strictly required to provide a reliable service Moreover, CoAP can easily interoperate with HTTP .In the network layer huge address space of IPv6 makes it possible to solve the addressing issues in IoT; on the other hand, it introduces overheads that are not compatible with the scarce capabilities of constrained nodes. This problem can be overcome by adopting 6LoWPAN, which is an established compression format for IPv6 and UDP headers over low-power constrained networks. In between the communication between constrained and unconstrained IoT gate ways can be used for the protocol translation purpose.

Michel Raynal,Julien [3] explained another innovative approach for IoT implementation .Which is a simple broadcast algorithm for recurrent dynamic systems . A fixed-process dynamic system is a system made up of a fixed number (n) of processes that communicate by sending and receiving messages through a point-to-point communication network whose structure varies with time. This paper focuses on the broadcast communication problem, namely, a process has to disseminate a data to the whole set of processes. This is a very basic problem whose solution allows the processes to compute any function F defined on their inputs. More precisely, each run has an input vector I[1..n] where I[i] represents the input value vi of the process pi.

Papers [4][5][9][10][11][13][14] describes . IETF protocol suite IoT .Firstly it describes a lower layer protocol which is IEEE 802.15.4 – Radio technology standard for low power low data rate applications with a radio coverage of only a few meters.data rate is 250 Kb/s .It specifies both physical layer and MAC layer.Application layer protocol – CoAP for networks.Since IPV6 cant directly deployed in IoT system a compression format of IPV6 that is IPv6 over Low- Power WPAN (6LowPAN) is used. Specifically, the CoAP protocol specified by the IETF CoRE Working Group, is a specialized web transfer protocol for resource constrained nodes and networks .

CoAP conforms to the REST style. It abstracts all the objects in the network as resources. Each resource corresponds to a unique universal resource identifier (URI) from which the resources can be operated stateless, including GET, PUT, POST, DELETE, and so on. The paper describes some for properties of the defined protocols. This survey provides a brief overview of the IETF protocol suite proposed to support the Internet of Things. Taking each layer in the protocol in turn, we have presented the technical challenges and opportunities that exist.

In [6] Gabriele Ferrari describes a A Data-driven IoT-oriented Dual-network Management Protocol . which leverages on the presence of two IP-addressable radio interfaces on the same node: one with low energy consumption (and throughput) and one with high throughput (and energy consumption). The low-power network acts both as an independent data plane and as a control plane for the high throughput network, which is turned on whenever necessary to support multimedia streaming. The LPLT radio interface is managed by an IP-based communication In paper [7] Samia Allaoua Chelloug explained an approach which is "Energy-Efficient Content-Based Routing on PSA(Publisher Subscriber Architecture).In PSA publisher publish the message without any knowledge of subscribers there may be. Similarly subscribers express interest in one or more events , and only receive message that are of interest without any knowledge of any publishers .In between them there is as event bus also known as a broker acts as an intermediary that collects all messages and forward to subscribers based on the interest. Since this is a content based model the events are classified according to the properties of the notifications. Subscribers announce their interest by describing their properties of event. Concept of message grouping is not used here. But the problem with this approach is the potential loss of message and message delivery is not guaranteed.

In [8] Vellanki M, Kandukuri SPR [12] introduced a Node Level Energy Efficiency Protocol .The Algorithm considers residual energy of its one hop neighbour nodes and the average value of residual energy of all nodes in the

protocol, denoted as RPlow. DNMP exploits RPlow as a control plane protocol to setup one or more specific routes, from a given source to an intended destination, using the HPHT interface which, in turns, is managed by a data plane protocol, denoted as RPhigh. The DNMP control plane, according to user application needs, RPlow allows to switch on and off HPHT interfaces in order to create a RPhigh overlay that can be exploited to perform transmissions with high throughput requirements (e.g., multimedia streaming), which are not suited to LPLT interfaces.

According to DNMP, each node keeps a counter, referred to as COUNThigh, of the number of RPhigh routes that require its HPHT interface to be active to ensure end-to-end communication between the requesting source/destination pairs. LOCK and UNLOCK messages are used, respectively, to increment and decrement each involved COUNThigh by 1. The value of a node's COUNThigh depends on the number of concurrent routes that can be setup: more precisely, if a node is needed for n different routes, its COUNThigh value is network. For this we need to consider two factors first: assumed that each node knows the average value of residual energy of all nodes in network calculated by network controller using periodically receiving info about residual energy from each node. Second, each node knows the residual energy of its one hop neighbor no des from the hello packets which are periodically broadcasted by each node in order to indicate the existence and hop location of the node with respect to source and destination.

This helps us to forward packets using minimum number of hops between source and destination. As each intermediate node consumes considerable amount of energy while forwarding a packet. This approach ensures low energy consumption at node level. Figure 1 is an example of NLEE. When source node needs a routing path for forwarding the packets, it broadcasts the route request (RREQ) packet at its 1-hop neighbourhood to compute the hops from source to destination. Then, when a forwarder node receives the RREQ packet that calculates forwarding probability using its residual energy and expected transmission count value in the NLEE algorithm. , However,

the node compares the average value of residual energy of all the nodes with the predetermined residual energy threshold. If an average energy of the node is higher than node's threshold energy, the node regards that the network is in a better energy condition. Hence, it is not required to set the forwarding probability greater. Thus, a node computes the forwarding probability. If an average energy is shorter than threshold energy of node. As, a result, network

3 Conclusion

This survey has been performed for collecting the details of different protocols   mechanisms for implementing IoT .Since The Internet of Things (IoT) is one of those methodologies which transforms internet communication to M2M basis. It completely transforms connectivity from "any-time, any-where"for"any-one"into "any-time, any-where" for "any-thing" .For IoT. Infrastructure Simplification , Holistic security , trust ,guarantee of message delivery,easy to adopt are the crucial requirements for IoT . None of the mechanism satisfies all these requirements in single hand. This survey helps in identifying different mechanisms for IoT.

References

[1]John A. Stankovic (2014) " Research Directions for the Internet of Things", IEEE INTERNET OF THINGS JOURNAL, VOL. 1, NO.

[2] Andrea Zanella, Nicola Bui, Angelo Castellani, Lorenzo Vangelista,and Michele Zorzi (2014) "Internet of Things for Smart Cities",IEEE Internet of Things Journal, Vol. 1, No. 1Things", IEEE Wireless Communications 1536-1284/13/3 IEEE

[3] Michel Raynal,Julien Stainer,Jiannong Cao, Weigang Wu (2014) ," A Simple Broadcast Algorithm for Recurrent Dynamic Systems", IEEE 28th International Conference on Advanced Information Networking and Applications

[4] Zhenguoo Sheng, Shusen Yang, Yifan Yu,Athanasios V. Vasilakos (2014) "A survey on IETF protocol suite Internet of Protocols and Standardization initiatives in IOT", COMSWARE 2008., IEEE, 2008, pp. 791--798

[5] Ronak Sutaria , Raghunath Govindachari (2014)" Making sense of interoperability: Protocols and Standardization initiatives in IOT", COMSWARE 2008., IEEE, 2008, pp. 791--798.

[6]Gabriele Ferrari, Paolo Medaglianiy, Simone Cirani, Marco Picone and Gianluigi Ferrari(2014) "A Data-driven IoT-oriented Dual-network Management Protocol" , Annual IEEE Int. Conf. on Local Computer Networks

[7] Samia Allaoua Chelloug (2013)" Energy-Efficient Content-Based Routing in Internet of Things", Journal of Computer and Communications, 2015, 3, 9-20

[8] Vellanki M, Kandukuri SPR and Razaque A (2015) , " Node Level Energy Efficiency Protocol for Internet of Things",J Theor Comput Sci Volume 3 Issue 1 1000140

[9] D.P.F. Moeller, H. Vakilzadian, (2014)," Middleware for Internet of Things: a Survey" , IEEE International Conference on Electro/Information Technology (EIT) , vol., no., pp.602,607,5-7

[10] Yuang Chen, Thomas Kunz (2015),"Performance Evaluation of IoT Protocols under a Constrained Wireless

is referred as lower energy network. In this situation, forwarding probability is made higher by executing our proposed algorithm. In this algorithm Node Level Energy Efficiency ,Residual Energy of Nodes are considered with greater importance . NLEE protocol selects shortest path to reduce energy consumption during data transmission especially in highly distributed networks used by IoT..Energy conservation can be obtained

Access Network", International Conference on Selected Topics in Mobile & Wireless Networking (MoWNeT)

[11] W. Lia , F. C. Delicatob, P. F. Piresb, Y. C. Leea, A. Y. Zomaya, C.Micelib, L. Pirmezb (2014)," A SURVEY ON IOT ARCHITECTURES, PROTOCOLS", Journal of Parallel and Distributed C omputing Volume 74, Issue 1, ,Pages 1775-1788

[12] S. Distefanoa, G. Merlinoc, A. Puliafitoc,(2015) A Link-Correlation-Aware Cross-Layer Protocol for

IoT Devices", Journal of Pervasive and Mobile Computing, Volume 20,Pages 127-144,

[13] Arbia Riahi, Enrico Natalizio, Yacine Challal, Nathalie Mitton, Antonio Iera (2013) "A systemic and cognitive approach for IoT security" , ISBN 978-0-387-70992-5, Springer,

[14] Bing-Qing Han, Guo-Fu Feng, and Yi-Fei Chen (2015) ," Security analysis of IoT protocols: A focus in CoAP ",Hindawi Publishing Corporation International Journal of Distributedcomputing

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