Internet of things Technology
Assignment-II

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1. Explain working of IP as the IOT network layer?

* The Business Case for IP: The section discuss the advantages of IP from an IOT prospective and introduces the Concept of adoption and adaption.
* The need for optimization: This Section also does looks at into the challenges of Constrained nodes and devices when deploying IP. This Section is also looks at the migration from IPV4 to IPV6
* Optimizing IP for IOT:- This Section Explores the Common protocols and technologies in IOT networks utilizing IP including 6LOWPAN, 6TISCH and RPL.
* Profiles and Compliances:- This Section provides a Summary of some of the most significant organization and standards bodies involved with Ip Connectivity and IOT.

In fact protocols and technologies from these chapters are often paired together and developed with their pairing in mind for example 802-15-4 and 6LOWPAN are a Combination that is paired together frequently for many application
So by therefore we can say that Ip is Standard in many areas of IOT.

2. Explain the key advantages of Internet protocol?

a) Open and standards based:- operational technologies have often been delivered as turn key features by

vendures who may have optimized the communication through closed and proprietary networking solutions, the IEE is open standards body that focus on the development of the internal protocol suite and realised internal technologies and protocol.

b) Versatile: A large spectrum of ocean technologies is available to offer connectivity of 'things' in the last mile, additional protocols and technologies are also used to transport IoT data through backhaul links and in the data centre.

c) Ubiquitous:- All recent operating system releases, from general-purpose computers and servers to lightweight embedded systems (Tiny OS, Contiki, and so on), have an integrated dual (IPV4 and IPV6) IP stack that gets ~~and~~ enhanced over time.

d) Scalable: As the common protocol of the internet, IP has been massively deployed and tested for robust scalability millions of private and public IP infrastructure nodes have been operational for years.

e) Manageable and & highly Secure:- Communication infrastructure requires appropriate management and security capability for proper operations one of the benefits that comes from 30 years of operation IP network is well understood network management and security protocols mechanism and tools by that are widely available.

f) Stable and resilient:- IP has been around 30 years and it is clear that IP is workable solution. IP has a large and well-established knowledge base more importantly it has been used for years in

Crystal Infrastructure

9) Consumer market adoption :- When developing IoT solution and products targeting the Consumer market vendors know that Consumers access to applications and deserver will occur predominantly.

10) The innovation factor :- The last two decades have largely established the adoption of IP as a basis for increased innovation, IP is the underlaying protocol for applications ranging from file transfer and e-mail to the world wide web, e-commerce, Social networking, mobility and more

3. What role on business Can for IP ?

Data flowing from a to "things" is Consumed Controlled. & monitored by the data center Servers either in the cloud & in locations may be distributed & centralized dedication applications on them Run over & virtualized or traditional operating systems & on network edge platform (for example fog Computing) These lightweight applications Communicate with the data center Servers. Therefore, the System Solutions Combining various physical and data link layers Call for an architecture approach with a Common layer(s) independent from the lower (Community) and / & upper (application) layers. This is how and why IP Stack started playing a very architectural role in early 1990's, IP was not only preffered in the IT markets but also for the OT environment.

4. Discuss the need for optimization?

The Internet of things will largely be built on the Internet protocol Suite. However challenges still exist for IP in IOT Solutions. In addition to coping with the limit at the device and network levels that IOT often imposes therefore optimization are needed at various layers of the IPS stack to handle the restrictions that are present in IOT network.

The following Section take a detailed look at why optimization is necessary for IP. Both the nodes and network itself can often be Constrained in IOT Soutions also. IP is transitioning from version 4 to version 6, which can add further Confinements in IOT space

5. Describe application protocols for IOT?

TCP & UDP are utilized in most Cases when transpering IOT application data. The transpat layer of IOT network support the TCP/IP protocol architecture.

a) Transmission Control Protocol (TCP)

This Connection oriented protocol measures a Session to get established between the Source and distination before exchanging data you can viewer or an equivalent to a traditional telephone Conversation, in which two phones must be Connected and Communication link, established before the power Can talk.

b) User Datagram protocol (UDP):

With this Connectionless protocol, data can be quickly sent between source and destination, but with no guarantee of delivery. This is analogous to the traditional mail delivery system in which a letter is mailed to the destination. Confirmation of the reception of their letter does not happen until another letter is sent in response.

In contrast UDP is most often used in the context of network services, such as domain name system (DNS), Network time protocol (NTP), Simple network management protocol (SNMP) and dynamic host control protocol (DHCP) or for real-time data traffic, including voice and video over IP. In these cases performance and latency are more important than packet retransmissions because re-sending a lost voice or video packet does not add value, when reception of packets must be guaranteed error free, the application layer protocol take care of that function.

5- Discuss the various methods used in IoT application transport?

Because of the diverse types of IoT application protocols there are various means for transporting these protocols across a network. Sometimes you may be dealing with legacy and industrial IoT protocols that have certain requirements, while other times you might need to consider the transport requirements of more modern application layer protocols.

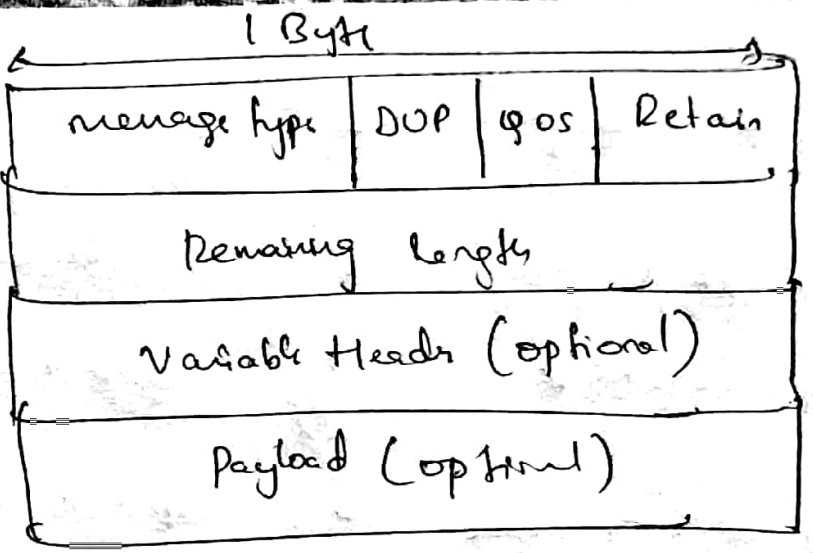
* Application layer protocol not present:-
In this case, the data payload is directly transported on top of the layer lower layer. No application layer Protocol is used.

* Supervisory Control and data acquisation (SCADA)
SCADA is one of the most common industry protocol in the world but it was developed long before the days of IP and it has been adapted for IP networks.

* Generic web-based protocols:
Generic protocols, such as Ethernet, Wi-Fi and 4G/LTE are found on many consumer and enterprise-class IoT devices that communicate over non-constrained networks.

* IoT application layer protocols:
IoT application layer protocols are devised to run on constrained nodes with a small code footprint and are well adapted to the network bandwidth constraints on Cellular or satellite links or constrained 6LOWPAN networks. message queuing telemetry transport (MQTT) and constrained application protocol (COAP) covered layer.

7. Explain MQTT message format?



Fixed Header
Present on all
MQTT Control packets.

Variable Header
present in some
MQTT Control packets

Payload, present in
some MQTT Control
packets

Compared to Coap message format MQTT contains a smaller header of 2 bytes compared to 4 bytes for CoAP, The fast MQTT field in the header is message type, which identifies the kind of MQTT packet within a message. Fourteen different types of control packets are specified in MQTT version 3.1.1 Each of them has unique value that is coded into the message type field, 0 & 15 are reserved.

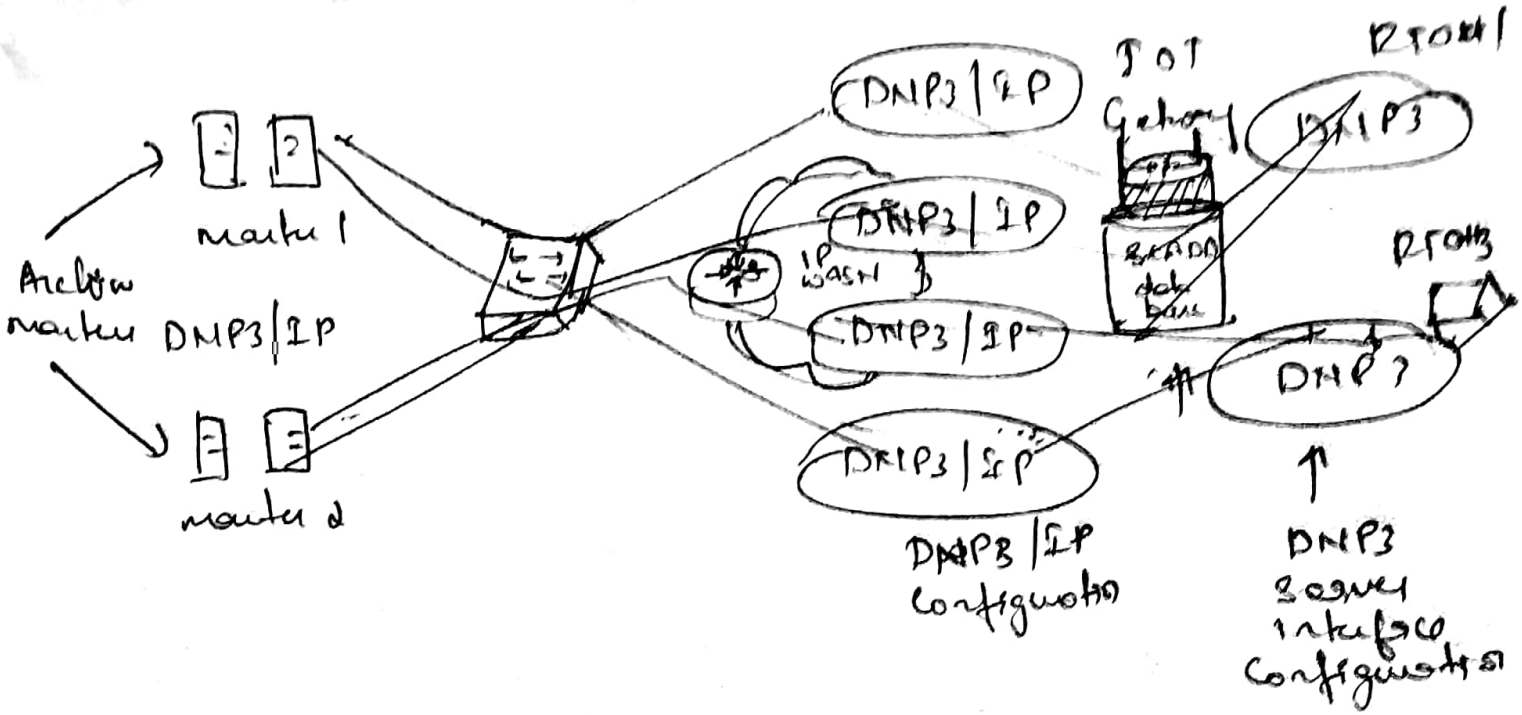
Ex.

Message type	Value	Flow	Description
1. Connect	1	client to Server	Request to Connect
2. CONNACK	2	Server to client	Connect acknowledgment
3. PUBLISH	3	client to Server Server to client	Publish message
4. PUBACK	4	client to Server Server to client	Publish recieved
5. PUBREL	6	client to Server Server to client	Publish realse

6. PUBCOMP	7	Client to Server Server to client	Publish Complete
7. SUBSCRIME	8	Client to Server	Subscribe request.
8. SUBACK	9	Server to client	Subscribe acknowledgent
9. UNSUBSCRIBE	10	Client to Server	Unsubscribe request
10. UNSUBACK	11	Server to client	Unsubscribe acknowledgent
11. PINGREQ	12	client to Server	Ping request
12. PINGRESP	13	Server to client	Ping response

8. Explain DNP3 protocol translation?

As mentioned earlier, an alternative to a Raw Socket Connection for transparing legacy Serial data across an IP network is protocol translation with protocol translation, the legacy serial protocol is transfered to a Corresponding IP version. For ex shows two serially connected DNP3 RTUS and two master applications Supaing DNPS over IP that Control and pull data from the RTUS. The IoT gateway in this figure perform a protocol translation function that enable Communication b/w the RTUS and Server.



DNP3 Protocol translation.

By running protocol translation, the IOT gateway connected to the RTOS's in figure as shown is implementing a computing function close to the edge of the network adding computing function close to the edge helps scale distributed intelligence in IOT network than can be accomplished by offer computing resources of IOT gateways or routers.