PERFORMANCE EVALUATION OF 802.11A/G WIRELESS NETWORKS WITH IP6HC

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ABSTRACT

The whole communication paradigm is anonymously moving ahead for the adoption of the next generation internet architecture abandoning the IPv4 address space. This occurs because of the exponential development of Internet use in the course of the most recent couple of years. Indeed, even the legislature has commanded that every one of the devices would be IPv6 enabled as the deferral in the sending of IPv6 would bring about the negative effect of future development and worldwide network of the internet. In this paper tunnel is a multihop tunnel over 802.11 a/g remote system. To accomplish our work we have compacted the IPv6 header of the tunneled packet to lessen the overhead. We have designed & implemented IP6HC protocol which is compressing the 40 bytes of IPv6 header up to 4 bytes. We are sending compressed data packets from one end and decompressing it at the opposite end of the system. This is end-to-end compression and the compressor/decompressor (C/D) entity is installed and stored at both the end of the dual stack routers which reduces C/D cycles. This protocol is tested over wireless 802.11 a/g network in the tunneling scenario for IPv6 transition. Simulations are done over Qualnet version 5.1 test system with different parameters like delay ,throughput, packet delivery ratio and jitter is been determined.

Keywords: IPv4, IPv6, IP6HC, Qualnet, Tunneling.

INTRODUCTION

With the enormous development of Internet advances it's practically difficult to support the Internet with conventional protocol IPv4 and this brought about the development of IPv6, the cutting edge Internet protocol. It offers numerous benefits over the legacy IPv4, yet at the same time the appropriation rate of IPv6 worldwide is exceptionally moderate. The main reason for moderate acceptance and usage of IPv6 is that the protocols incompatible with each other and the changes are hard and expensive. Both the protocols are having compatibility issues and IPv4 hosts and switches/routers won't almost certainly manage IPv6 traffic and the other way around (Chauhan, D., 2014). In this procedure of Internet advancement, the change from IPv4 to IPv6 has turned out to be unavoidable and genuinely earnest. IANA has at last depleted the worldwide IPv4 address space, which leaves the network no decision yet pushes forward the IPv6 progress process. IPv4 and IPv6 systems both will exist during the progress time frame, while the two are not compatible in nature. In this way it is essential to keep up the accessibility, just as to give the between correspondence capacity of IPv4 and IPv6. China has the greatest IPv6 network(CNGI-CERNET2). In the event that every one of colleges' server farm in CNGI-CERNET2 change to native IPv6 arrange and give IPv6 application benefits, the procedure IPv4 change to IPv6 will be quick (Sha, F., 2017).

Studies demonstrates that IP traffic is the most well-known in all the broadly utilized applications like web, messages, emails, informing administrations sound streams, video on interest and FTP. It creates the highest headers traffic as the as the biggest headers are IPv6

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and IPv4 headers with a size of 40 and 20 bytes, separately (Epstein, J., 2009). This high overhead could influence the system execution particularly over low transmission capacity joins where assets are restricted. This circumstance decays with the change to IPv6 from IPv4 arranges as the overhead bytes in IPv6 are bigger. This further deteriots when used with the tunneling mechanism for transitioning from IPv4 to IPv6 and vice versa (Chauhan, D., (2015). Also with the significant growth of internet, its applications and services which include high bandwidth consuming applications like Voice over IP (VoIP), audio and video streaming etc., it has become mandatory to enhance the Internet infrastructure for bandwidth efficiency and other resources. Different mechanisms have been adopted for the better utilization of these resources. Header compression is one of the way through which one can efficiently utilize the resources. It improves the Quality of Service by improving the link efficiency and thereby improving the overall performance of the network (Westphal, C., 2003).

Rest of the paper is structures as follows: Section 2 shows the literature review followed by the limitations of work already done, Section 3 presents the Proposed Methodology, Section 4 describes the Simulation Model and Scenario, Section 5 discusses Results & Discussions, Section 6 concludes the paper.

LITERATURE REVIEW

Author proposed a developing packet handling language P4 with which the client can depict how the bundles are to be prepared in an exchanging component (Da Silva, J. S., (2018). This paper introduces an approach to actualize complex operations that are not locally upheld in P4. (Fitzek, F. H., 2005) assessed the presentation of ROHC with the constant transmission of GSM encoded voice and H.26L encoded video over a remote connection. (Garg, R., 2018). Authors augmented a new protocol MIHC "Modified and Improved IPv6 Header Compression", a compression method for IPv6 header in 6LoWPAN network. Level of compression depends up on the relationship of various headers present in the packets which are being transmitted from a source to destination. (]. Karg, C., 2006). Proposed another methodology for header compression related to IP security system. Here the IPv6 convention header is compacted and the advantage is a decrease of the overhead brought about by IPSec tunnel mode as far as augmented datagram's. (Maturana Araneda, N. A., 2019). Authors tended to the issues with respect to the utilization of non IP Low Power Wide Area Networks, because of the use of IP on compelled devices. (Ayers, H., 2020) Examines the execution of 6lowpan in major installed and sensor systems administration working framework, in any case, they don't interoperate. i.e., for any pair of executions, one implementation sends 6lowpan packets which the other fails to process and get. Augments that ROHC is a fundamental part of numerous remote and especially cellular communication systems (Wu, W., 2017). The author plans to improve ROHC execution as far as payload effectiveness for U-mode pressure under poor remote channel conditions for which they proposed a Markov compression model suitable for realistic and proper unidirectional (U-mode) ROHC. Author analysed the effect of IPv4, IPv6 and Dual Stack Interface over Wireless Networks an examination is made on 802.11 a/g and 802.11 b gauges (Jain, V., 2018). Here various cases have been proposed considering every one of the conceivable outcomes of IPv4 and IPv6 systems.

PROPOSED METHODOLOGY

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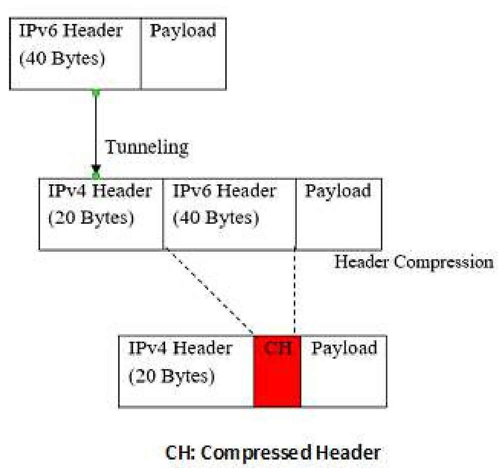
With the advancements in technology, its applications it is mandatory to adopt IPv6. The size of IPv6 header is 40 bytes, which is a big overhead for many applications with small payload like voice over IP, video audio etc. This size overheads result us for the motivation of its header compression. The philosophy behind the header compression works as follows-IPv6 Header Compression removes the redundant header information from tunneled IPv6 header by classifying the header fields into static, dynamic and inferred fields depending on their changing characteristics. These fields are classified, assigned to the static and dynamic chain of the compressed header packets. We have classified the header fields of IPv6 header into three categories as STATIC, DYNAMIC and INFERRED. Based on the classification the entire header table 1 shows the classification and its constitution in header.

TABLE 1: HEADER CLASSIFICATION

Protocol Fields	Size (Bits)	Classification	% Constitution
Version	4	STATIC	90%
Flow label	20		
Next Header	8		
Source Address	128		
Destination Address	128		
Traffic Class	8	DYNAMIC	5%
Hop Limit	8		
Payload Length	16	INFERRED	5%

90% of the information contained in IPv6 header is static i.e. there is no need to send static fields for a particular flow. 5% information is inferred which can be derived from other lower layer, no need to send such information along with the header. Only 5% information is dynamic which need to be sent with header. This header compression can result in better utilization of network performance parameters like improved throughput and packet delivery ration and reduced jitter and end to end delay especially for wireless networks where scarcity of resources like bandwidth is observed. IP6HC is a mechanism which carries only dynamic information (Traffic class & Hop limit) along with it and the remaining information is sent at the time of Context establishment. We have managed IPv6 protocol and named it as compressed header which is IP6HC the protocol suite shown in red colour in Figure 1

FIGURE 1: IP6HC SIMULATION ENVIRONMENT MODEL



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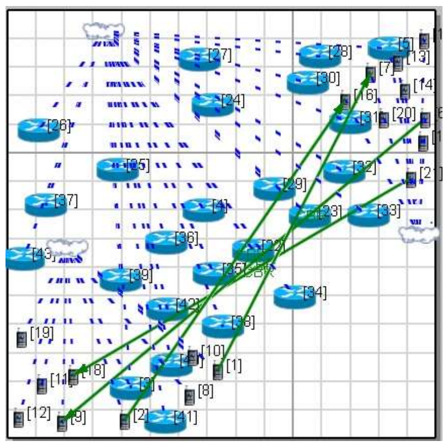
In order to compare and evaluate performance of the newly developed protocol we have done variation based on packet size under wireless network 802.11ag standard. 802.11a/g PHY is an extension to IEEE 802.11 PHY that applies to wireless LANs and provides up to 54 Mbps in the 5 GHz band. 802.11a PHY uses an orthogonal frequency division multiplexing encoding scheme (IEEE Computer Society LAN MAN Standards Committee. 1999). Comparison is done with the standard tunneling mechanism. Qualnet 5.1 simulator is used for configuring the scenario. A Field Configuration of 1500m x 1500m is used for the scenario. The following Figure 2 represent the scenario for wireless 802.11 a/g network.

FIGURE 2:
WIRELESS SCENARIO



Here MAC protocol for wireless network is 802.11. We have used 4 Constant Bit Rate (CBR) applications to generate the traffic in the network. The sending rate is 100 packets per second.

RESULT & DISCUSSIONS

In this case, we have varied the packet sizes of 64, 128, 256, 512, 1024, and 2048 bytes at the application layer. Analysis is carried out with the fact that what will be the impact of packet size over the newly developed IP6HC protocol. Results show that network models exhibit different behaviour for different packet sizes. We have considered four parameters-Throughput, End-to-End Delay, Jitter and Packet Delivery Ratio for our study.

FIGURE 3:
THROUGHPUT VS PACKET SIZE

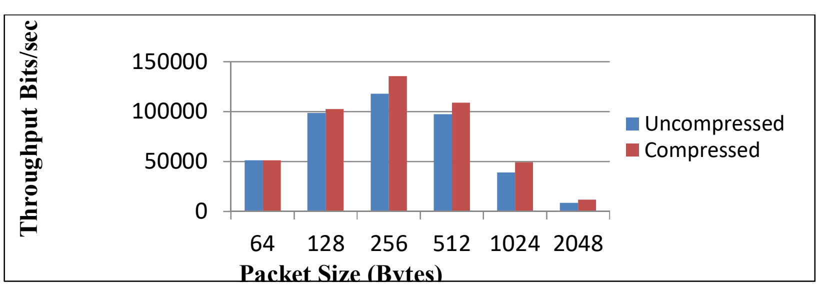


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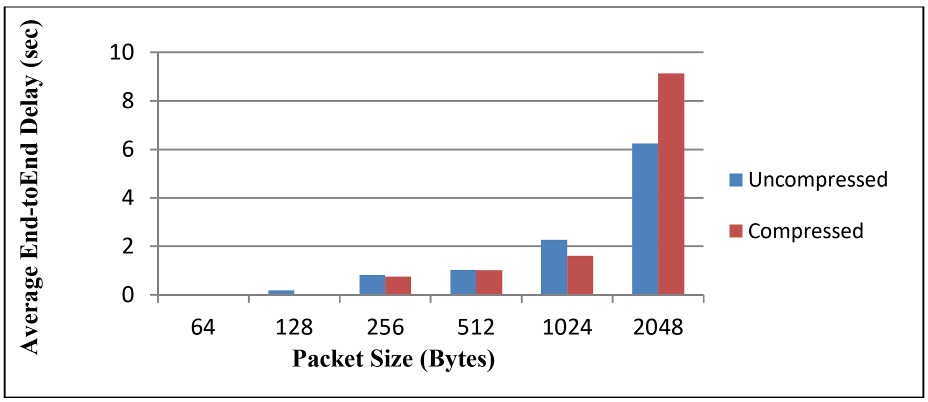
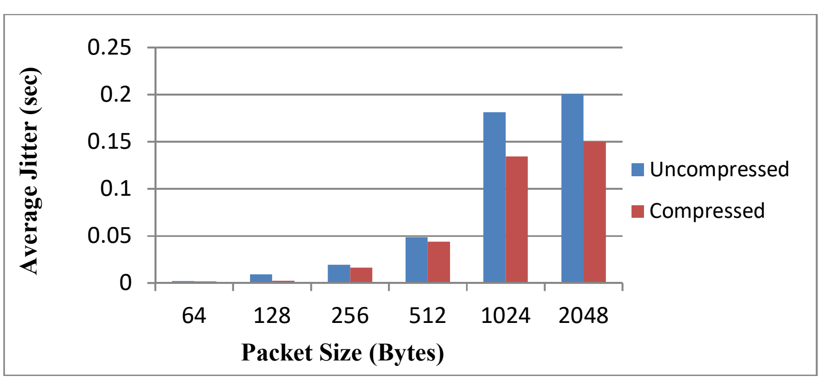
Figure 3 depicts that throughput increases for small packet sizes up to 256 bytes but as the packet size increases from 512 bytes, throughput decreases for both compressed and uncompressed networks. Still better throughput is obtained for compressed network since the number of bites transmitted is reduced, which in turn improves throughput. However, as the packet size increased from 512 bytes to 1024 bytes the throughput degrades because of wireless link capacity of the channel. However, an exceptional degradation of throughput is seen for packet size 2048 bytes, as packet loss is more in this case. This is because of wireless network where there is always scarcity of resources. As the packet sizes increases, more bits are transmitted over a link and hence due to congestion more packets are lost which results in reduced throughput. In this case, IP6HC protocol gives better throughput since bits transmitted are reduced, so the chances of packet drop are reduced.

FIGURE 4:
AVERAGE END-TO-END VS PACKET SIZE



It is evident from the Figure 4 that average end-to-end delay increases as packet size increases, due to the limited resource constraint in wireless network. Delay is exceptionally very high even for small packets since tunnel is a multihop wireless tunnel, because of multiple hops a data packet has to go through, the more time it takes to reach its destination node, and due to wireless nature resource is a constraint in wireless network. Such a high jitter is not tolerable in real network. Impact of packet size is directly proportional to delay, as packet size increases, delay increases.

FIGURE 5:
AVERAGE JITTER VS PACKET SIZE



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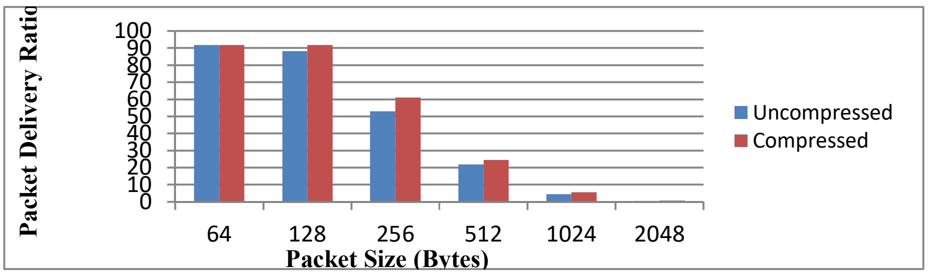
It is evident from the Figure 5 that jitter increases as packet size increases, and is at its maximum when packet size is 2048 bytes. Results show that jitter is negligible when packet is small i.e. for 64 and 128 bytes, but it significantly increases as the packet size increases to 256, 512, and 1024 and 2048 bytes. This is because tunnel is a multihop wireless tunnel and it exhibits the property of wireless network. We are experiencing less delay in case of compressed network, as we are reducing the overall size of the packet. Impact of packet size is directly proportional to jitter, as packet size increases, jitter increases.

FIGURE 6:
PACKET DELIVERY RATIO VS PACKET SIZE



It is evident from the Figure 6 that PDR decreases as packet size increases. Packet delivery ratio is high for small packet size, as packet size increases PDR decreases. Here the case is of wireless networks, packet loss is high because of limited resources and power constraints. But we are getting increased PDR in case of compressed networks, which results in better resource utilization. PDR is very less when the packet size is 512 and onwards. This is because due to large packet size, more bits are transferred over the link, which results in congestion. More packets are lost in the network and hence PDR decreases.

CONCLUSION

IPv6 is not the choice it's a compulsion which need to be adopted by internet community. In this paper, we have defined a novel IPv6 header compression mechanism (IP6HC) to compress the IPv6 header of the tunneled packets for IPv6 tunneling mechanism. The primary objective behind designing IPv6 header compression protocol is to provide a solution for reducing high header overhead due to multiple headers present in case of IPv6 tunneling mechanism. We have compressed the IPv6 header of the packet as it is of largest length of 40 bytes to 4 bytes. In general, IP6HC has shown better performance in all the metrics under different network conditions. From the above discussion, one can infer that this work will provide a different ways to improve the efficiency of multihop IPv6 tunnel using IP6HC, which results in better bandwidth utilization by reducing the header overhead, which improves the overall performance of the network. In future, we want to test this protocol for large-scale networks in real time networks.

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