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Advanced Prediction Based Mobility Support for 6LoWPAN Wireless Sensor Networks

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***Abstract*—**Wireless Sensor Nodes (SNs), the key elements for building Internet of Things (IOT) have been deployed widely in order to get and transmit information over the internet. IPv6 over low power personal area network (6LoWPAN) enabled their connectivity with IPV6 networks. 6LoWPAN has mobility and it can find an extensive application space only if provides mobility support efficiently. Existing mobility schemes are focused on reducing handoff (HO) latency and pay less attention towards packet loss and signaling cost. In time critical applications under IOT, packet loss and excessive signaling cost are not acceptable. This paper proposes a scheme based on advanced mobility prediction for reducing extra signaling cost and packet loss that incurs due to connection termination in traditional schemes such as Proxy Mobile IPv6 (PMIPv6) handover. In our proposed scheme 6LoWPAN WSN architecture with IPv6 addressing is presented. Based on this architecture the mobility algorithm is proposed for reducing signaling cost, packet loss by buffering mechanism and HO latency in particular. In the algorithm layer 2 (L2) and layer 3 (L3) HO is performed simultaneously with prior HO prediction with no Care of Address (CoA) configuration which also reduces signaling cost to some extent. The proposed scheme is analyzed theoretically and evaluated for different performance metrics. Data results showed significant improvements in reducing packet loss, signaling cost and HO latency when compared to standard PMIPv6 in time critical scenarios.

***Index Terms*—**IP Mobility, PMIPv6 (Proxy Mobile IPv6), Handoff latency, Packet Loss, 6LoWPAN (IPv6 enabled low power personal area networks), IOT (Internet of Things).

I. Introduction

With the emergence of IOT [1] and machine to machine communication (M2M) [2], the connectivity of wireless sensor networks (WSN) to the internet has become very urgent. Wireless sensor nodes can sense physical parameters, gather information and transmit it on the network. IPv6 [RFC 4291] provides enough address space to locate these numerous resource constrained devices and 6LoWPAN [RFC 4919] enables their connectivity with IPv6 networks. 6LoWPAN has mobility and therefore it can find a wide application area if supported by an efficient mobility scheme. Mobility in 6LoWPAN WSN has been approached in different perspectives to target varied applications including healthcare, disaster management, security surveillance, military operations and intelligent transport system (ITS)

[3]. Mobility protocols have come over time with growth of mobile devices and find much interest in 6LoWPAN networks. These protocols are classified into the Host-Based Schemes [4] and the Network-Based Schemes [5]. In host-based schemes, Mobile Sensor Node (MSN) has to be involved in signaling process which includes exchange of Binding Update (BU) and Binding Acknowledgement (BA) messages for Care of Address (CoA) configuration [6,7]. On the other hand, in network-based schemes MSN is relieved from heavy mobility signaling, instead network components are responsible for detecting its movement and address configuration [8]. Researchers in the field have used both types of protocols with different perspectives to improve the HO performance in 6LoWPAN WSN. Most of the leading solutions in [9-13] are PMIPv6 based, focus on reducing HO latency only and pay less attention towards packet loss and signaling cost. The packet loss incurs due to heavy signaling cost and connection termination in PMIPv6-HO, is unacceptable in time critical applications [3]. During PMIPv6-HO, connection terminates and packets sent to Previous Access Router (PAR) are lost as MN moves to new domain before PAR gets notified about HO. The heavy signaling cost causes longer registration delay and packet loss which results in information loss. Although these mobility solutions improve HO performance in 6LoWPAN networks to some extent based either on L2 HO or L3 HO independently but do not combine them efficiently. Therefore, L2 HO is performed followed by L3 HO which results in degradation of HO performance to some extent.

To improve the mobility HO in 6LoWPAN networks, this paper proposes an advanced mobility prediction based scheme for 6LoWPAN networks with following contributions:

