Chapter 7
Reorientation of Routing From IP to Link Layer for Path Selection in Multi-Hop Networks

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ABSTRACT

Routing uses a unique identifier of each participating node in the network to forward the information between two nodes. Traditionally, routing takes place at the network layer of a standard network layering architecture where it takes into account the local or the global network information, albeit, the local information uses a local-scope unique identifier. One of the prime objectives of any routing strategy at the network layer is to forward data from one end to another; however, the same objective can also be achieved at the data link layer by using the hardware address of each node as a unique identifier. This chapter discusses the key questions. (i.e., Why traditional routing is called IP-based routing? What if we reorient the traditional concept of routing on the data link layer? What are the positive and negative impact, to carry out routing at IP—or data link—layer?) This study may be helpful for researchers to understand the concept of IP-based routing and path selection at link layer regardless of the standard layering architecture and the type of IP address.

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INTRODUCTION

When two or more nodes with the capabilities of sending, receiving, and relaying information are connected through a wireless medium and located within the vicinity of each other, then they can directly share data/resources without the involvement of any central server. Such type of sharing is generally contemplated under peer-to-peer (P2P) network (Horn & Sampath, 2017) and the communication between such orientation is recognized as a single-hop communication (Loo, Mauri, & Ortiz, 2012). Traditionally, such type of communication is used in Wireless Local Area Network (WLAN), where each node communicate with other nodes through a central entity generally referred as an Access Point (AP). A P2P network (Horn & Sampath, 2017) (Horn, Sampath, O'brien, Yeap, & Lou, 2017) may provide either an ad hoc (temporary) or a permanent type of connection with the nodes deployed in the network and is usually used to connect computers and devices without being involved to configure a server. As creating a server for network resource allocation may become very expensive and difficult to manage; therefore, cheaper alternatives like P2P network solutions, are being developed and used. A P2P overlay network (Doval & O'Mahony, 2003) builds on the top of another network that offers robust and dynamically configured set of nodes to be connected via the Internet (i.e., using IP addresses). However, it comes with disadvantages of slow data dissemination, long latency and duplicate packets at certain point.

In contrast to this, when a node wants to send the information to a node which is not in its vicinity, then the intermediate nodes are used to forward the information to the desired destination. Such type of communication is generally known as a multi-hop communication (Loo et al., 2012). Where, nodes can share data directly to a suitable node based on the routing cost without the involvement of any central entity or AP. The intermediate nodes, which forward data on behalf of their neighboring nodes are called relays; such relaying nodes may help to increase the overall coverage area of a network based on the connectivity of nodes. Examples of multi-hop wireless networks with ad hoc nature are Wireless Sensor Network (WSN), Mobile Ad hoc Network (MANET), Wireless Mesh Network (WMN), Flying Ad hoc Network (FANET), and Vehicular Ad hoc Network (VANET). These ad hoc networks offer wide range of applications like health monitoring-and-management, traffic safety & management, commercial and eco-friendly applications.