



Networking without Dynamic Host Configuration Protocol server in Ethernet and Wireless Local Area Network

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ABSTRACT

A Dynamic Host Configuration Protocol (DHCP) server is a well-known server deployed at a network to manage Internet Protocol (IP) addresses temporarily rentable to hosts in the network. Besides, a DHCP server provides hosts with important network information such as the subnet mask and the gateway IP address. However, a DHCP server has many drawbacks and should not be considered necessary in each network. If no DHCP server exists in a network to serve hosts and no network administrator helps users manually configure the hosts, currently no practical solution can make the hosts access networks.

In this paper, Automatic Host Configuration Mechanism (AHCM) is proposed to make a host access Ethernet and Wireless Local Area Network (WLAN) without a DHCP server. AHCM can automatically locate IP addresses usable to hosts and find network information in a transparent way without any user interference. Working like protocol software inside an Operating System (OS), AHCM has high compatibility because of neither modifying any application nor deploying a third party server in a network. Most importantly, AHCM does not have drawbacks in a DHCP server. AHCM is implemented in the protocol stack on Windows XP and tested in several experiments to identify its overheads and performances.

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1. Introduction

A Dynamic Host Configuration Protocol (DHCP) (Droms, 1997) server is a well-known server deployed at a network to manage Internet Protocol (IP) addresses temporarily rentable to hosts in the network. Besides IP addresses, a DHCP server can provide hosts with important network information such as the subnet mask and the gateway IP address so that hosts can configure their network adapters to access networks. Moreover, a DHCP server can provide hosts with other network information, e.g. the IP address of a Domain Name System (DNS) (Mockapetris, 1987) server, which is probably helpful for hosts to access networks. Furthermore, a DHCP server can support certain management functions such as allocating an IP address to a host according to the hardware address (i.e. Media Access Control (MAC) address) of network adapter in the host. A DHCP server allows a host residing at the network or a mobile host visiting the network to acquire an IP address and network information via DHCP. A DHCP server can free users from the task of manually configuring their hosts to access networks if they enable DHCP clients in their hosts.

Although a DHCP server nowadays is widely used to manage IP addresses in a network, a DHCP server has many drawbacks. First, a DHCP server is a cost to pay for constructing a network, e.g. buying a computer to set up a DHCP server or using a network device with a built-in DHCP server. Second, a DHCP server needs to be managed by a dedicated network administrator, especially for serving a large-scale network or implementing a complex management policy. Third, a DHCP server needs continuous power supply in order to serve hosts that may appear to request services at any time. Fourth, if a DHCP server dies, users have to ask the network administrator for IP addresses and network information, and then manually configure their hosts in order to access networks. Fifth, if a DHCP server malfunctions or is maliciously configured (usually happening to networks where other DHCP servers in computers or network devices are enabled accidentally without configured), hosts may fail to access networks because of acquiring incorrect IP addresses and network information. Sixth, a DHCP server does not actively reclaim IP addresses rented to hosts before expiration (even if they are mobile hosts just visiting the network, acquiring IP addresses, and quickly leaving there later), so IP addresses can be easily exhausted to prevent other hosts from acquiring IP addresses to access networks; a DHCP server never rents an IP address occupied by a host to another host if the IP address is not expired or released explicitly by the host. Seventh, a DHCP server has no

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