

to maintain the required synchronization accuracy for the network. The basic operation of the NTP is time stamping of data packets transferred between the server and the client.

The client stamps the time when he sends an NTP request packet to the server.
The server stamps the time when the NTP request packet is received from the client.
The server stamps the time when he sends the NTP reply packet back to the client.
The client stamps the time when this NTP reply packet is received.

So, an NTP packet consists of 4 timestamps. The client uses these timestamps to determine the difference between its



The degree of server accuracy is dependent upon the choice made from the list above. The degree of client synchronization to a server is dependent primarily on network latency. Anything that adds latency, such as hubs, switches, routers, or network traffic, will reduce accuracy. Under good conditions on a LAN without too many sources of network delay, synchronization accuracy is typically within the 1-2 millisecond range. In other words, all clients on the network will be synchronized to UTC and to each other to within 1-2 milliseconds. The synchronization accuracy on a WAN is typically within the range of 10-100 milliseconds. For the Internet, synchronization accuracy is unpredictable, so special attention is needed when configuring a client to use public NTP servers. The final achievable accuracy of each client depends on the accuracy of the time server used, the network latency, and the symmetry of the network paths to and from the time server. Obviously, no client can be more accurate than its server.

NTP is founded on the UDP protocol. As such, it is highly susceptible to IP spoofing. The NTP protocol uses UDP port 123. Blocking this port at the firewall is a minimum requirement for network perimeter security. This prohibits a client from obtaining time from a public NTP server on the Internet. Security is maximized when the time server is installed within the network firewall. The time server acquires time from the

GPS, WWV, or CDMA system, via an antenna, or from a local time server.

at the firewall. This system

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