

**Pings and Pongs:**  
**A Journey with Networks, Their Hosts**  
**and Their Routes**

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# **Pings and Pongs: A Journey with Networks, Their Hosts and Their Routes**

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## **Introduction**

In this paper, discussion topics include Networks and what they are, tracing programs and what they do, using a software that will assist in identifying the path of hosts used to ping to devices located over 2000 miles, in ten different scenarios, and finally a thorough comparison of these pings.

## **Background – Networks**

You can think of a network as a graph, a collection of edges and vertices. In laymen terms edges are otherwise known as lines and vertices as nodes. Networks are made up of nodes that represent locations and lines that represent both physical and virtual communication lines. These lines interconnect computers to routers to web servers and vice versa, forming a matrix of networks that allow humans to communicate via numerous hardware devices. Figures 1 can help you visualize these connections in a very basic sense.

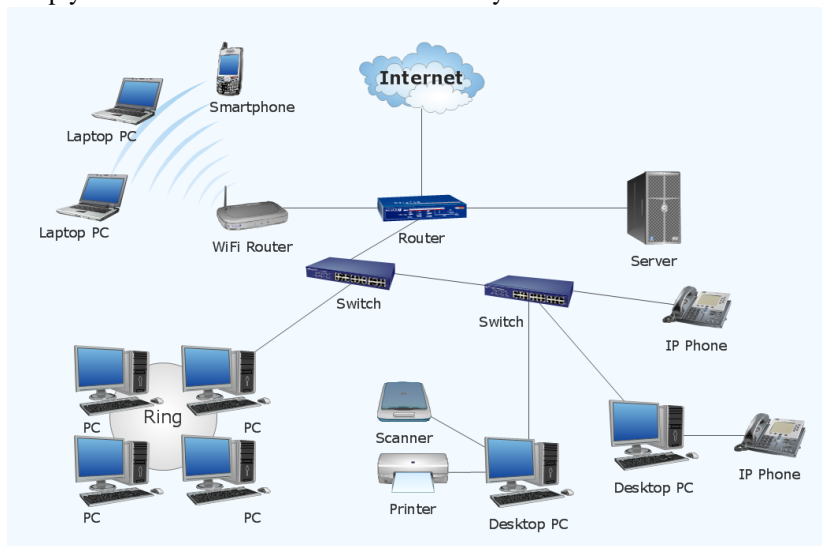


Figure 1 - (Source: <http://www.conceptdraw.com/How-To-Guide/network-diagram>)

These networks allow for us to exchange and share data, communicate and socialize, and offer services and resources. Take web surfing for example, thousands of web pages are located in different databases and are hosted by a myriad of servers (the program that facilitates communication). The user uses a device to send data through the browser to these servers using a Hyper Text Transfer Protocol (HTTP) request. These servers then recognize this request and retrieve information in relation to the data requested. They then send this information back to the user allowing them to view a web page. In this example the user is utilizing the network to retrieve information that is provided as a service. These locations where the data is accessed are referred to as DNS (domain name system) root servers. DNS servers function is to carry and transmit data from one computer to another.

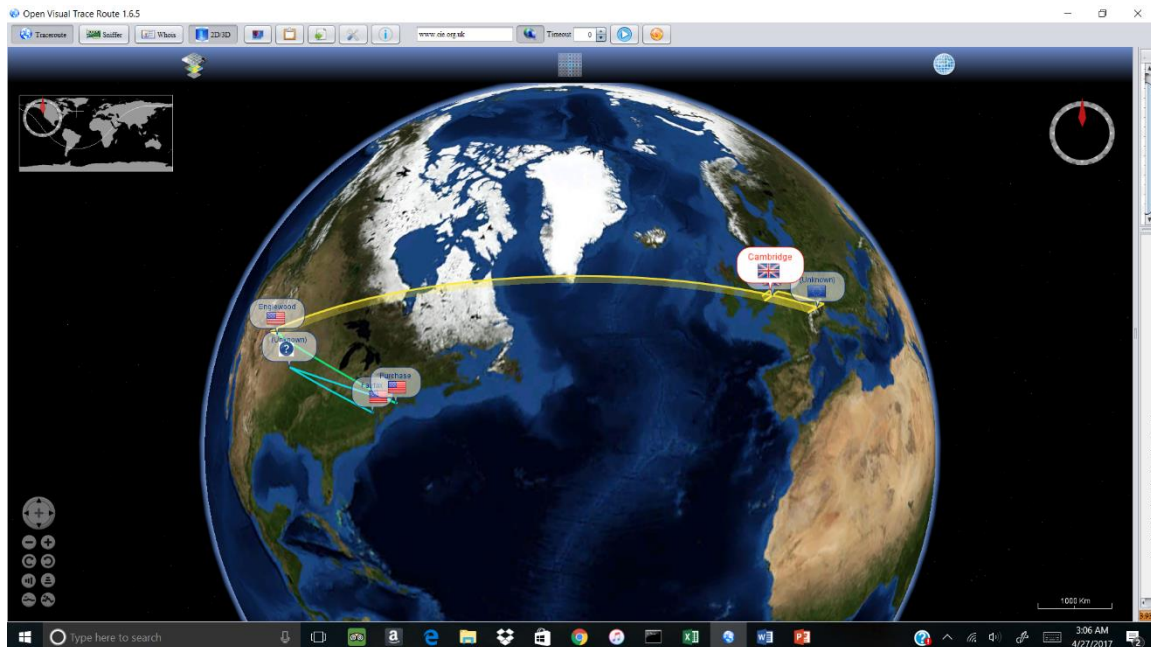
The DNS is a database that houses all the information pertaining to IP (Internet Protocol) addresses and domain names online. Internet Protocol addresses can be thought of as identification numbers commonly represent by a series of digits referred to as IPv4. These numbers are separated by periods (i.e. 192.165.5.148). These Protocols are standards set by organizations to keep standardized formats for data in a variety of forms. As people soon realized, IP numbers were very difficult to memorize and therefore, domain names otherwise known as website names (i.e.



graph showcasing the latency time of each ping and the DNS lookup for each host. Latency refers to how long it takes one packet to get from source to destination. As mentioned earlier, DNS stands for domain name system, which is the database responsible for storing all of the information pertaining to IP addresses and domain names online. DNS lookup in this graph represents the time it takes in milliseconds for a DNS record to be returned from a DNS server. This software gives a good summarization about the ping route. In the following section a further analysis of the ping routes will be done.

## Results and Discussion– Comparing Pings

The traceroutes collected were sampled back to back in this experiment. Based on the 10 different data sets collected the average number of hops for each ping was eighteen. The average route length for each trace was 20,019 kilometers. Out of the 10 pings the average time taken for a trace route completion was 115.22 seconds. As seen in the diagram below these pings utilized a mesh network to send the packet to the correct destination. A network topology refers to the architecture and design of the network. In a mesh network each node relays data and works together with other nodes to distribute this data effectively with the end goal of reaching the destination node. Mesh networks relay messages using a flooding technique or a routing technique. In a routing technique the message propagates along a path by hopping node to node until it finally reaches its destination. In a flooding technique instead of following a specific route from one node to another node, the message is propagated to all nodes in the network, this includes unintentional nodes [8]. We can see that here the routing technique is used.



What's interesting about this diagram produced by the software Open Visual Trace Route is that you see the ping traversing its path multiple times. Due to the distance between the source and the destination node the ping has to take more hops in order to reach its destination. It is important to note that more hops translates to a higher possibility of failure, reduced bandwidth/bottlenecks and higher latency [9].

## Conclusions

In this paper networks were introduced at a very high level. A discussion on networks then pursued, on how and for what purpose they operate and also how traffic flows in a network. We used the software Open Visual Trace Route to help administer methods that involved pinging a website ten times, that was located over 2000 miles away. This was conducted in order to see the path in which the message traveled. A thorough analysis was conducted on each individual ping and results were compared with other ping results. Based on our results we can conclude that the topology used in this instance is a mesh topology.

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