Networking Systems & Standards

Client-Server Network

This model relates to a system where client computers connect to a server in order to send and receive data. Servers are centralised computers that store and serve data, process information, and connect to many clients (Lifewire.com, 2019). Servers are usually sets of computers distributed over many locations (Donohoe, 2015), although this isn't a requirement of the client-server model.

The Client-Server model is simple to implement compared to other networking systems, with the easy application of domain names and SSL certificates, allowing for simple connection and authentication, greatly benefiting security and reliability (Donohoe, 2015). As well as this, servers can be distributed or backed up frequently, protecting against data loss and downtime, along with providing additional disaster recovery options (Donohoe, 2015).

Since this model relies on servers for processing and interaction, with many clients connecting to few servers, overload and downtime can detract from the availability of services. This can be mitigated with cluster networks and distribution, however standard client-server models still experience this issue (Donohoe, 2015).

Cluster Network

As described with the standard client-server model, cluster networks involve distributed servers servers, or shards, designed to deal with load balancing. This system takes advantage of parallel processing in order to alleviate system load, as well as to improve scalability and availability. Disaster recovery is also impacted, with distributed servers allowing for redundant data storage and backups (wiseGEEK, 2020).

Cloud Network

The cloud model relates less to the overall network design, instead relating more to a business model and service delivery system that involves 'cloud hosting' and software as a service (SaaS). SaaS often relies on cloud computing, in that it relies on servers to host data, applications, and sometimes even to perform the processing for the software itself (Microsoft.com, 2019) (Griffith, 2016). This model again extends the client-server model, using servers and client connections to transmit data.

The cloud computing model can make software very accessible for a few reasons, one being that there are almost no storage requirements for end users compared with locally-hosted tools and software. Another way cloud software is more accessible is how some cloud software is web-based, which is a system with tighter regulations and better cross compatibility than desktop applications or mobile applications (Ibm.com, 2019).

This model suffers from the same disadvantages to standard client-server models, amplified due to the delivery system that cloud computing relies on. As well as this, the costs involved with cloud computing are much higher (Ward, 2016).

Peer-to-Peer Network

Differing from the other three models described, peer-to-peer (P2P) networks rely on connections between clients, rather than involving servers at all. It's because of this that P2P networks are decentralised (Lifewire.com, 2018). P2P networks rely on protocols similar to IRC and BitTorrent, using these protocols to identify peers and to transfer data (Cohen, 2017) (Ietf.org, 2020).

Due to being decentralised, P2P networks don't rely on server uptime or stability, with availability stability instead being based on the quantity and quality of available peers. Because of this, the cost of server hosting isn't a factor with P2P networks. Additionally, scalability from P2P networks is simply based on the quantity of peers, with storage and data rates and processing simply being based on the pool of available resources and peers (Richa, 2014).

Some disadvantages relate to security, with P2P networks involving direct IP connections between clients, which is negative for user security and privacy. As well as this, vulnerabilities in the protocol could allow for malicious usage, greatly impacting user security (Ietf.org, 2020).

OSI Model & TCP/IP Model

Both the OSI and the TCP/IP models relate to data transfer between computers, illustrating the conversion of application information into binary which flows over copper or fiber in the physical/network interface layer (Cloudflare, 2019) (IpCisco, 2019). These models both describe a similar system, with overlap between the two. This table shows the layers of each, along with the overlap of the different layers (IpCisco, 2019).

<table>
<tr><th>OSI Model</th><th>TCP/IP Model</th></tr>
<tr><td>Application Layer</td><td rowspan="3">Application Layer</td></tr>
<tr><td>Presentation Layer</td></tr>
<tr><td>Session Layer</td></tr>
<tr><td>Transport Layer</td><td>Transport Layer</td></tr>
<tr><td>Network Layer</td><td>Internet Layer</td></tr>
<tr><td>Data Link Layer</td><td rowspan="2">Network Interface Layer</td></tr>
<tr><td>Physical Layer</td></tr>
</table>

The TCP/IP model is known to be more reliable and simpler than the OSI model, with fewer layers and a simpler design philosophy allowing for better reliability and fewer points of failure (IEEE Spectrum, 2019). As well as this, the TCP/IP model was adopted as the accepted standard for internet communication in the 1990s due to the design philosophy used (IEEE Spectrum, 2019).

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