The Relevance of Networks and Client-Server Computing in Institutional Development

Temitope Victor-Ime, Augustine O. Ugbari

xterakojede@gmail.com, *augustine.ugbari@uniport.edu.ng*

Abstract - In the past, centralized computing like IBM mainframe occupied a large market share of the computer business. Large transactions were performed on these centralized mainframes. Years after, micro computers were introduced. These computers were very cheap and fast in processing, that small businesses preferred them. On the flipside, the purchase of the mainframes became slower. Today, this client – server computing is the computing of choice for microcomputers. The corresponding network architecture built around this technology is the wave of the moment. This paper attempted to research the evolution of client –server computing, discussing in details what the concept is all about. In conclusion, the field of computing today has evolved and client-server computing is a major technology trend that will in the future open other areas in the information technology sector.

Index Terms – Client, CPU process, Database, LAN design, Mainframe, Network, Server.

I. Introduction

According to Tom Sheldon [1] computer architecture in which various aspect of the programming processes are shared between the server and client systems. Tom's opinion was that the concept of client/server computing was promoted in the 1980s as the efficiency of desktop improved by linking them to powerful back-end application servers and database via LAN. This architecture replaced the centralized architecture used in the early mainframe computers in which all processing was done at the server.

With the emergence of the internet, the client/server architecture, has evolved from a two-tiered architecture (a two-way relationship) to a three-tiered or multitier architecture. This model allows for the client machine to communicate with multiple serves, some of which may act as intermediate application server while perform a single typical task [1].

The client/server computing has a big advantage when compared to the classic mainframe computing in that it allows for large programs to be split amongst the client computer and multiple server computers (designed to perform specialized task) which are dispersed across the network. This approach greatly improved the performance and efficiency of the application, in such a way that the client computer processes the front-end of the program such as GUIs (Graphical User Interfaces), data validation, SQL query request, local resource management(monitor, keyboard, CPU, etc.) while the servers server executes the client computers request and responds with the corresponding results.

The objective of Client-Server Computing is to allow every Client and Server computer to be easily reached when needed by an application and also to allow all available hardware and software components, irrespective of the vendors are able to together.
Achieving these two objectives brings advantages in increased productivity, flexibility, cost savings, and resource utilization in a network.

2. Client/Server Computing Evolution and Background

Client/server computing was developed out of the for cooperate businesses requesting quick responds from computers in order to meet their ever increasing business demands as these demands where achievable with the centralized mainframe-based applications [2]. Another challenge with the mainframe-based applications was the development time for its application which was too slow, coupled with the fact that it was difficult tailoring the output to meet the individual requirements of the supported departments. This led to push to develop systems that work at departmental level, allowing them to have better control over their data usage and formatting standards.

The next phase of evolution was the move towards a two-tier, client/server system. The only real change here was that a true DBMS was substituted for the File Server. This database server is a computer that is responsible for database storage, access, and processing in a client/server environment. The client workstation here is responsible for managing the user interface, including presentation logic, data processing logic and business rules logic. It allows the users to have computing power and data under their control. Unfortunately, this environment did not lend itself to collaboration between workers. The database server is responsible for database storage, access, and processing. This allowed for a multi-user system that was very reliable which made it a good solution for many different problems. Unfortunately, this two-tier architectural solution came with its own problems as it does not scale wells business demands grows making it not suitable for enterprise computing because the Management overhead grows exponentially with the expansion of the system.

As a result of this, three-tier architectural systems were developed by adding an application server, to handle business and data logic, while a database server to have data storage and queries. This improvement provided more

power, reduced the need for software on the client and added more power and scalability at reduced support costs. Three-tier architecture has the database as the top tier, whose responsibility is to process data request coming from approved clients and servers.
At the middle tier applications server links the database and client computer like mediator, it processing requests originating from the client computer and negotiates queries from the database. It maintains a full-time connection to the database using either native drivers, open database connectivity (ODBC) or Java database connectivity (JDBC). The middle tier often has its own user login to make that connection. The database interaction all occurs at the middle tier, making it, in this model, logically aware of the presence of only one user accessing it. With this client-server database like MySQL, SQL Server and Oracle may facilitates thousands of client computers simultaneously but only detect the one user. At the bottom of the structure is a very thin "client" tier probably written in Java or a type of Web-based technology that allows it to be used within your browser. The connection from the client tier to the middle tier is carried out through technologies designed specifically to accommodate requests depending on the hardware platform and the development environment.

This type of technology has several advantages. First, the part of the software which must be transmitted to the user's terminal, can be quite small. Having a very thin client lets a limited amount of data load, this allows faster start-up times. In large businesses this kind of architecture provides a simple means of centralized configuration management. As this layer needs only to handle the results of the application, the thin client can easily handle a multi-platform environment. These improvements also came with some challenges as there are more potential points of failure. Also, having limited tools incorporated in its design, system performance may sometimes be impaired and the task of upgrading may seem momentous.

A typical example of the successful adaptation of a three-tier client/server system is the Internet which uses a general set of standards that allows various networks types to interconnect. The introduction of a separate Web server expands the power and use of the system. A mainframe can be brought into the system allowing the use of existing, legacy applications in a new context [3].
It is important to also note that with the continues increase in processing power and reduction in hardware cost of micro-computer has also promoted the evolution of Client-Server computer particularly with the availability of more reliable LANs (Local Area Networks) infrastructure.

The past decades have seen enormous leap in the micro-computer technology in both software and hardware. They are now more affordable for small businesses and organizations with great improvement on their performances and reliability.
The following are the improvements made by micro-computers:

1. Hardware: The speed of desktop microprocessors has grown exponentially, from an 8MHz 386-based processors to 4.8GHz-Core i9-8950HK based processors [4]. They are now produced as a more affordable rate yet more sophisticated than older mainframe and midrange computers. So also, the capacity of main memory in micro-computers has been quadrupling every three years. Typically, the most common RAM size is 8 Gigabytes which can be expand to 128 GB on a 64bit machine. Besides, the amount of backup storage and memory such as hard disks and CD-ROMs that are able to support micro-computers has also puts an almost unlimited amount of data in reach for end-users.

2. Software: The introduction and acceptance of GUIs (Graphical User Interfaces) such as Windows 3.1 which evolved to modern OS like Windows 10 has made the PC working environment more user-friendly. And the user more efficient in learning new application software in a graphical environment. Besides GUIs, the use of multithreaded processing, graphics processing unit (GPU) and relational databases has also contributed to the popularity of Client-Server Computing

3. The Relevance of a Network in Client-server computing

In a typical client- server computing model, as shown below in Fig 1.1 with a central computer acting as the server and other computers as the clients. A network is the bedrock or underlying platform for client-server computing to ride on. It performs these functions in many ways:

1. Connects all the computers together to aid communication; requests can be received by the server; request can be sent the server.
2. Enables so many clients/users to connect to applications running on the servers almost at the same time
3. Reduces the complexity associated with centralized computing
4. Allows heterogeneity of vendor hardware and application.

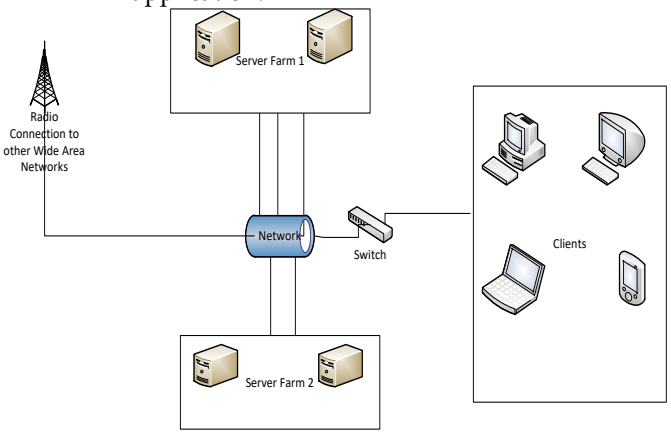

Figure 1 Client-Server Computing environment

Typically, a network consists of the following:

1. Two or more computers
2. A network interface card on each computer
3. Structured cabling or wireless connection
4. Data Points
5. Switch or Hub
6. Storage

These components of a network apply to different types of network which includes; peer to peer network, client – server networks.
The importance of this components contributes largely to the benefits of client-server computing. Describing in details the components, they are:

1. Two or More Computers – Basically the client is usually a pc or workstation that sends request, while a server is also a pc or workstation with advanced configurations to handle the requests from several clients.
2. A network interface card – This card is an electronic device located inside the computer that connects the computer to data points on the cabling. It gives the computer a unique IP address that identifies the computer on the network.
3. Structured cabling or wireless connection – Structured cabling is on-surface laying of CAT-5 or CAT-6 cables to connect the computers. A wireless connection connects two or more computers without the use of cabling but via standard rules or protocols.
4. Data Points – A data point is a socket plugged on the wall that connects a computer to the structured cabling via a network cable.
5. Switch or Hub – An electronic device that is used to connect the computers to the network. It helps in the transfer of information from the client to the server and vice versa.
6. Storage – A electronic media capable of retaining digital data. These could be local to the system such as hard disk drive (HDD) or network based such as Network Attached Storage (NAS).

4. Advantages of a network in a client-server computing environment

1. It is easier to include more than one computer to handle some of the task.
2. It enables communication.
3. Easier access to the server from a client via any other device on the network other than a computer
4. Improved security
5. Easy management of distributed applications
6. Easier administration of requests.

5. SUMMARY AND Conclusions

It is imperative to note that without a network, a client-server environment cannot suffice. Hence the advantages of running a client-server network; access, management, and timeliness of response to request.

Moreover, networks will contribute to the advancement of the concept of client-server computing. In institutions of higher education, students taking the computer-based examinations actually work on the network where the CBT applications run. Needless to say, this is also the scenario in other areas of business where information technology solutions are adopted.

References

[1] Tom Sheldon, "Client/Server Computing," Tom Sheldon and Big Sur Multimedia, 1 March 2001. [Online]. Available: http://www.linktionary.com/c/clientserver.html.

[2] W. Stallings and R. Van Slyke, Business Data, New York: Macmillan College, 1990.

[3] M. Nassirri, "Advanced Computer Networks," Islamic Azad University of Hamedan, Hamedan, 2010.

[4] A. Leather, "Intel Launches Most Powerful Laptop Processor Ever: 4.8GHz Core i9-8950HK Will Have Six Cores," 3 April 2018. [Online]. Available: https://www.forbes.com/sites/antonyleather/2018/04/03/intel-launches-most-powerful-laptop-processor-ever-4-8ghz-core-i9-8950hk-will-have-six-cores/#2a4d2d466960.

[5] Y. W. Albert and L. Y. Thomas , "Client/Server Computing for Senior IT Management," [Online]. Available: http://www.doc.ic.ac.uk/~nd/surprise_95/journal/vol4/wcy/report.html..

[6] A. Al-Sukairi, "Advanced Database Systems," King Fahd University of Petroleum & Minerals, Information & Computer Science, Saudi Arabia, 2004.

[7] T. Bakardjieva, Introduction to Computer Networking, Varna : Institute of Technology, Varna Free University "Chernorizec Hrabar", 2013.

[8] Webopedia, "Client /Server Computing," 01 March 2020. [Online]. Available: http://www.webopedia.com/Computer_Science/Client_Server_Computing.

[9] NSU Florida, "Client –Server computing," 5 May 2018. [Online]. Available: http://www.scis.nova.edu/~lloydjam/week08.html.

[10] D. J. Greer, "Client/Server, the Internet, and WWW," Robelle Solutions Technology Inc., 1 March 1996. [Online]. Available: http://www.robelle.com/www-paper/paper.html.

[11] J. Rider, Introduction To Client Sever Computing, J.W. Rider Consulting, 2004.

[12] V. Beal, "The 7 Layers of the OSI Model," 23 April 2019. [Online]. Available: https://www.webopedia.com/quick_ref/OSI_Layers.asp.

[13] Knowledge Systems Institute, "Establishing a Client Server Environment," 5 May 1997. [Online]. Available: http://pluto.ksi.edu/~cyh/cis370/ebook/ch08c.htm.