Network Architecture of Large Scale Enterprises

Masoud Karimi
University of Kurdistan, Iran
m.karimi@eng.uok.ac.ir

Abstract— In this paper, we will discuss a summary of TCP/IP Protocol Suite and each layer of the model. And we will also talk about how data communications and computer networks impact the business function. In this paper, we will elaborate more on Walmart as a large business and discuss the logical and physical connection. We also mention the security issues which is one of the big concerns for all large-scale organizations.

Keywords—Network architecture, LAN, Data Communication

I. INTRODUCTION

TCP/IP model is the conceptual model and set of communications protocols used on the computer networks. TCP/IP is also known as DoD(Department of Defense) model because the model was found by the US department of Defense in DARPA project. The TCP/IP provides standards how data should be packetized, addressed, transmitted and received through different layers. Communication is broken into a series of layers, which can work separately and process different pieces of information. The concept of having different layers has helped different vendors to design and implement their own application based on the business needs.

The Internet model has five layers[1]:

Layer 1 is the Physical Layer, which basically is the physical connection between senders and receivers. The role of this layer is to transfer electrical, radio, or signals through the circuit. The Physical Layer includes all the hardware devices for example modems and switches, cable, and satellites.

Layer 2 is the data link layer, which is responsible for transferring a message from one machine to another machine in the network meaning from the sender to the receiver. This layer is above the physical layer and controls it when to transmit messages.

Layer 3 is the network layer, which is responsible for routing in the network. In this layer, the address of the sender's machine will be located.

Layer 4 is the transport layer, which is responsible to link the application layer software to the network. The transport

layer is also responsible for splitting the long messages into smaller messages into both sides; receiver and sender.

Layer 5 is the Application Layer is the application software used by the users and It is the user's access to the network. This layer can be understood well by most people because in this layer users can see the messages and work with different software.

The summary of the model is shown in figure 1.

II. MULTI AGENT TECHNOLOGIES AND BIG DATA ARCHITECTURE

Multi agent architecture has been discussed in [11] and in order to address challenges in Big Data we need to consider the opportunities as well [10]

III. DATA COMMUNICATION IN A REAL ORGANIZATION

Large companies like Wal-Mart can get advantages of data communications if they can learn how to use it effectively implement it and uses the best practices to maximize the performance and at the same time security should be preserved. LAN is a group of computers which are located in the same area, for example, the branch in Ann Arbor Michigan.

Walmart has more than 2 million employees worldwide. So its branches are distributed in different countries. All branches of Walmart have free Wi-Fi for customers. This user should not have access to the highly sensitive data in other words the Wi-Fi network for customers should be physically separated from the local network and other computers of that specific branch such as computers of cashiers and managers.

The server that maintains the product's availability in the store. DMZ represents the demilitarized zone which means the servers with highly sensitive of data will be secured and protected by firewall [2].

Database for example which contains the information about the organization's products is protected against external users that have connected to the website by phone or their

laptops. So the process starts as follows: user opens the websites and for example looks for a specific product and checks the availability of it. The core router works as a mediator to return the search result to the user by deploying the query to the DMZ and database specifically and returns the results through the Internet to the user. DNS and domain controller and other services are all placed in DMZ zone behind the firewall [3]. The domain controller is responsible to control users and their access to the data across the network. So these applications also work in the application layer.

Local network as you can see in figure 2 shows the local computers and devices by the Walmart grocery including cashiers, assistants, and managers. Cisco switches and devices are working as a transport layer. Some applications on Cisco routers work in the transport layer for example filtering and bandwidth in layer 3. Cisco switches are considered as an access point or layer 2. Local systems all have a specific and unique address to be recognized by the network and will be assigned by a DHCP server which is also located in the DMZ zone.

In large businesses like Walmart, there is a hierarchy and distributed all over the world. But the idea will be the same as it is shown in figure 2. External users and customers will have access to the databases and web servers by the Internet and these servers will be protected by a firewall.

The logical diagram in figure 2 abstracts away the technical details of the business infrastructure and how data communication is done. The user is not aware how the network is implemented and where the databases and servers are located. The DNS which works in application layer handle the location of each server which each have a unique IP address. IP works in layer 4.

Third party applications, which are working on the application layer, should communicate together. One application could provide API and different vendors and applications can retrieve information through APIs.

In large businesses like Walmart there is a hierarchy and distributed all over the world. But the idea will be the same as it is shown in the figure 2. External users and customers will have access to the databases and web servers by Internet and these servers will be protected by a firewall.

The logical diagram in figure 2 abstracts away the technical details of the business infrastructure and how data communication is done. User is not aware how the network is implemented and where the databases and servers are located. The DNS which works in application layer handle the location of each server which each have a unique IP address. IP works in layer 4.

Third party applications, which are working on the application layer, should communicate together. One

application could provide API and different vendors and applications can retrieve information through APIs.

Security is one of the important issues that the company should allocate quality resources such as highly skilled experts in the network systems. In the design of the network of Walmart customers that have access to the free Wi-Fi should not be connected to the local network and they considered as external users.

IV. CONCLUSION

In this paper, we described the TCP/IP model and briefly describe each layer's responsibility and showed the hierarchy of the model. We also talked about how a hierarchical and actual business like Walmart can utilize this model and how the company should design its network to utilize the performance provided by this mode. Also we discussed some security issues and how by properly designing the network the company can achieve its goals.

REFERENCES

- [1] FitzGerald, J., & Dennis, A. (2007). Business data communications and networking. John Wiley & Sons.
- [2] O'Brien, J. A., & Marakas, G. (2005). Introduction to information systems. McGraw-Hill, Inc. Chicago
- [3] Bishop, M. A. (2005). Introduction to computer security.
- [4] Fall, Kevin. "A delay-tolerant network architecture for challenged internets." Proceedings of the 2003 conference on Applications, technologies, architectures, and protocols for computer communications. ACM, 2003.
- [5] Tavazoie, S., Hughes, J. D., Campbell, M. J., Cho, R. J., & Church, G. M. (1999). Systematic determination of genetic network architecture. *Nature genetics*, 22(3), 281-285.
- [6] Carpenter, G. A., Grossberg, S., Markuzon, N., Reynolds, J. H., & Rosen, D. B. (1992). Fuzzy ARTMAP: A neural network architecture for incremental supervised learning of analog multidimensional maps. *IEEE Transactions on neural networks*, 3(5), 698-713.
- [7] Koponen, T., Chawla, M., Chun, B. G., Ermolinskiy, A., Kim, K. H., Shenker, S., & Stoica, I. (2007, August). A data-oriented (and beyond) network architecture. In *ACM SIGCOMM Computer Communication Review* (Vol. 37, No. 4, pp. 181-192). ACM.
- [8] Clark, D. D., Shenker, S., & Zhang, L. (1992, October). Supporting real-time applications in an integrated services packet network: Architecture and mechanism. In *ACM SIGCOMM Computer Communication Review* (Vol. 22, No. 4, pp. 14-26). ACM.
- [9] Tennenhouse, D. L., & Wetherall, D. J. (2002). Towards an active network architecture. In *DARPA Active Networks Conference and Exposition, 2002. Proceedings* (pp. 2-15). IEEE.

- [10] Bagheri, H., & Shaltoolki, A. A. (2015). Big Data: challenges, opportunities and Cloud based solutions. *International Journal of Electrical and Computer Engineering*, 5(2), 340.
- [11] Bagheri, H., Torkamani, M. A., & Ghaffari, Z. (2013). Architectural Approaches for Self-Healing Systems Based on Multi Agent Technologies. *International Journal of Electrical and Computer Engineering*, 3(6), 779.
- [12] Frécon, E., & Stenius, M. (1998). DIVE: A scaleable network architecture for distributed virtual environments. *Distributed Systems Engineering*, 5(3), 91.
- [13] Karimi, Masoud. "Data Analysis Using Rapidminer". *Open Science Framework*, 16 Nov. 2017. Web.