A PARALLEL DOWNLOADING STUDY OF LOCAL AREA NETWORK AT UNIVERSITI UTARA MALAYSIA

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ABSTRACT. This paper gives a study on parallel downloading of UUM's network performance. It considers the response time of the downloaded files from within UUM's local network to the outside Internet connection. In order to study the performance of downloading method, other methods will be used as a comparison. The other downloading methods that have been used are single connection (Internet browser using Firefox) and Network Neighborhood (NetBIOS). Download Accelerator Plus (DAP) is used to implement the parallel downloading method. Response time of each method is recorded from three different sessions which are at the morning, evening and night time. The result of this research will benefit all the Internet users within UUM's network to plan the time and the most suitable downloading method that can give the best performance.

Keywords: parallel downloading, Local Area Network, Internet browser, network neighborhood

INTRODUCTION

Nowadays, data and information on the Internet demands a fast and convenience way of downloading from Internet users. User's access to the Internet is varied either through a Local Area Network (LAN), Intranet and Extranet, wireless connection or direct line from anywhere. A lot of applications or software to improve downloading time, normally referred as download manager has been created such as Download Manager Accelerator, GetRight, Gozilla, Internet Download Manager and many more. It is due to the great demand and necessity from users.

There are advantages and disadvantages of using the downloading software to improve the downloading time. The main advantage is faster response time for the requested data or information. Besides that are the features of the downloading software. For example, the feature of automatic downloading can be scheduled easily, automatic resume function in case of connection failure happen, and other interactive features that attract Internet users to use the application. It is as an alternative compared to using the old method which downloads files directly using the Internet browser applications such as Internet Explorer, Firefox, Opera and etc.

Normally, Internet users take longer time when downloading large files from the Internet. Even though there are many download applications available with different methods of

downloading but not all the Internet users know the right application for their specific environment.

The scope of this research is limited within the University Utara Malaysia' LAN. Parallel downloading software used is Download Accelerator Plus (DAP) to download files. Other downloading methods for comparison are single connection, i.e. Internet browser using Firefox and Network Neighborhoods using NetBIOS. The file that is downloaded by each method is at the same website and size. Downloading process of the file will not be simultaneous for each downloading methods and will be downloaded at three different sessions which are morning, evening and night. The file also will be downloaded by one personal computer only and at the same personal computer port at UUM's LAN.

LITERATURE REVIEW

Information is a powerful tool if we know how to manipulate it wisely. With the Internet, searching and downloading contents for knowledge has become an easy task. However, not all the users know how to use the Internet in a smart way, especially when they are about to download files. It is important to use the right method to ensure that they can get the optimum performance when downloading any files with different sizes.

Parallel downloading is a technique used to fetch files from multiple sources. The sources can be web servers, web caches or peer-to-peer (P2P) nodes. There are several techniques of parallel downloading available for different occasions or different needs. One of it is a Novel BIB-Based parallel downloaded scheme that proposes from the view point of clients to propel the download speed. The required file retrieve is divided into several blocks depending on the number of servers based on a balanced incomplete block (BIB) design (Chih-Hung & Jung-Shian, 2004). Chih-Hung and Jung-Shian (2004) also stated that each block size can be determined a priori according to the requested file size. So that the merit of the proposed scheme are not only to improve download time, but also resist sufferings of a server fault or block loss caused by the network fluctuation to increase the success download probability.

There have been experiments showing that parallel downloading results in higher aggregated downloading throughput and therefore shorter downloading time experienced by the clients (Philopoulos & Maheswaran, 2001; Rodriguez & Biersack, 2002) at the expenses of more signaling due to the need to coordinate the servers.

With the wide deployment of content distribution networks (CDNs) and P2P networks, parallel downloading is expected to be more commonly adopted for file distribution, especially when the volume of a file is large (Koo, Rosenberg & Dongyan, 2003). There are also algorithms to improve the performance of parallel downloading for large file distribution as proposed by Haitao, Zhenghu, and Zunguo (2005) and Jin (2012).

Nebat and Sidi (2002) affirmed that each packet of a file is received from a single source, while different packets may be obtained from different sources. The basic idea is to obtain, before or during the reception process, statistics on the current rate of transmission for all the relevant sources and on the delays on the particular path that each source will use for transmission to the user. This can be achieved by using end-to-end measurements. Based on that information, specific packets are demanded from each source for fast reception of the entire file and for low reception time variance.

Loukopoulos and Ahmad (2004) revealed that they exploit the ability to explicitly distribute the Hypertext Transfer Protocol (HTTP) requests for embedded objects in order to decrease the retrieval time. The distribution is made offline by rewriting the HyperText Markup Language (HTML) part of a page, altering the Uniform Resource Locators (URLs) of

the embedded objects so that they point to multiple servers. Such a technique avoids some of the overheads related to redirection since the client addresses the requests directly to the additional servers. The method is applicable to objects that require a complete download before being presented at the client's browser and not for streaming media.

A work done by Funasaka, Takemoto, and Ishida (2007) regarding parallel downloading method using HTTP over UDP for high loss rate and delay networks, adopted UDP as a transport layer protocol instead of TCP. This guarantees perfect in-order delivery unnecessary for file downloading. The method outperforms the traditional method which adopts TCP. Another work by Funasaka (2009) gives a promising results for the evaluation of parallel downloading method using HTTP over UDP.

However, parallel downloading has an impact which can lead to another problem. Impact that caused by parallel downloading according to Gkantsidis, Ammar, and Zegura (2003) is that parallel downloading incurs additional overhead as a result of its use of more network connections, large-scale use of this technique can actually lead to overall degradation of the performance experienced by clients.

The Network Basic Input/Output System (NetBIOS) is an application programming interface (API) for data exchange between data sources and data sinks. It is a programming gateway to sets of services that allow computer applications and devices to communicate. NetBIOS services using specific command sequences. Hence, NetBIOS has explicit, though minimal, protocols associated with some of its services (Chutatape, 1996).

According to Schwaderer (1988), NetBIOS is situated high within the reference model hierarchy, so applications that program to the NetBIOS interface are largely isolated and essentially insulated from the precise way the lower layers interact with their peer and adjacent layers. Figure 1 illustrates the placing of NetBIOS in the Open System Interconnection (OSI) Reference Model (Schwaderer, 1988).

A LAN as defined by Forouzan (2000), is a data communication that allows a number of independent devices to communicate directly with each other in limited geographic area such as single department, a single building, or a campus. LANs are dominated by three architectures: Ethernet, token ring, and fiber distributed data interface (EDI).

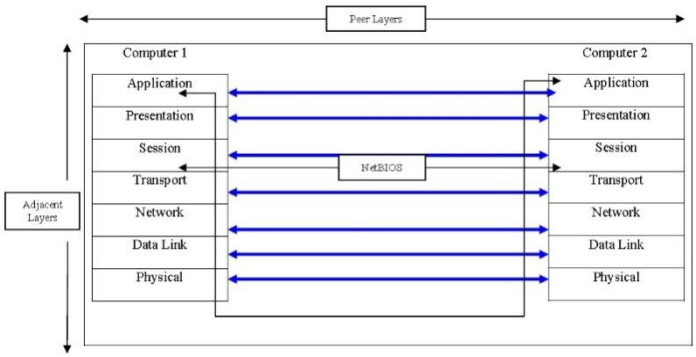

Figure 1. NetBIOS in OSI Reference Model

METHODOLOGY

The methodology for this research is adapted from the performance evaluation study by Jain (1991). According to Raj Jain, the performance is a key criterion in the design,

procurement, and use of computer systems, and anyone associated with computer systems should be able to state the performance requirements of their and should be able to compare different alternatives to find the one that best meets the requirements. The methodology adapted for the research is illustrated in Figure 2.

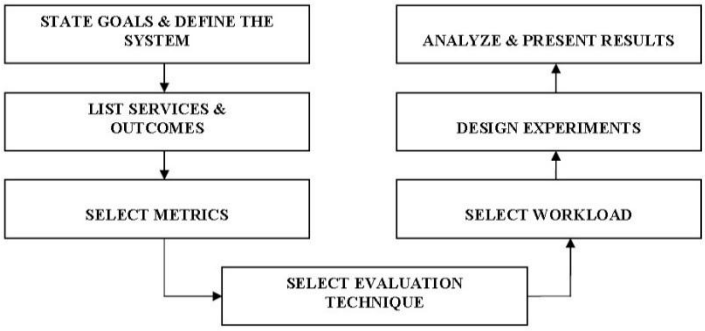

Figure 2. Adapted Methodology for this Research

Goals

The goal of this case study is to compare and analyze the response time between parallel downloading using download manager, downloading using Internet browser and downloading using Network Places, or Network Neighborhoods in Windows, i.e. NetBIOS, within the UUM's LAN.

List Services and Outcomes

The services chosen and outcomes for this case study depend on each downloading methods. Listed below are the services and the outcomes for this case study.

Parallel downloading (Download Accelerator Plus). Supports automatic resume, enable automatic schedule, and uses ten connections when downloading.

Single connection downloading (Firefox). Uses one connection only while downloading, blocks pop up from disturbing the downloading process, and supports resume feature.

Network Places/Network Neighborhoods (NetBIOS). Allows file sharing and downloading within the LAN.

Metrics, Evaluation Technique and Workload

The metric of this case study is the response time for each downloading method during certain time of the day. The metric is measured in terms of how long it takes to complete a downloading process. The metric is represented in the form of hours, minutes and seconds.

The evaluation technique chosen is the measurement technique. This study is executed on a real network system of UUM, not a simulation network. The data for each method of downloading is recorded and later is being presented in a form of graphs.

The workload is a 144.9 MB Java SDK file downloaded from www.sun.com/download.

Experimental design

The diagram as shown in Figure 3 illustrates the summary of the paths taken by the downloaded file starting from the users in UUM to the Internet.

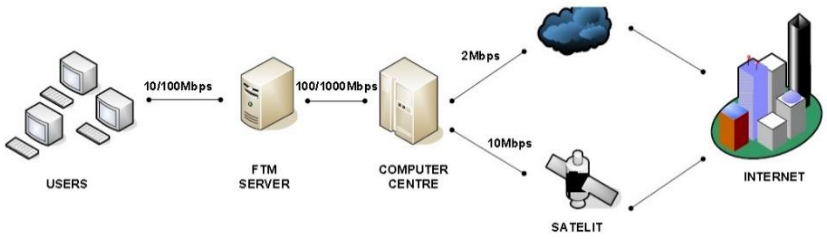

Figure 3. Illustrated summary of UUM's LAN

RESULT

Figure 4 shows the result of the experiment done for parallel downloading using NetBIOS, parallel and single connections.

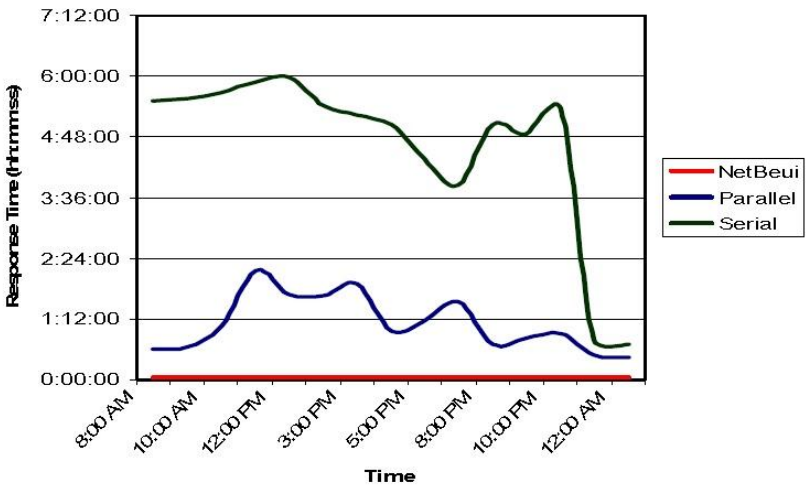

Figure 4. Response Time of all downloading sessions

NetBIOS Downloading

Downloading with NetBIOS has been proven during this research is the fastest downloading method of all the three methods, i.e. parallel, serial and NetBIOS downloading. However, NetBIOS is at the prime of its performance only in the domain of LAN. The performance of NetBIOS is not influenced by sessions of downloading. Any sessions reveal almost the same response time.

The analysis also proves the theory that response downloading time using NetBIOS are relatively fast because the NetBIOS is situated in the lower layer of OSI Reference Model, i.e. between session and presentation layer.

Parallel Downloading

Parallel downloading is the second fastest method of downloading. The difference between parallel downloading and NetBIOS is that it can be used during downloading files inside and outside the LAN. The performance of the parallel downloading is consistent for all sessions with the slowest response time is only two hours.

The download response time in the morning sessions from 8.00 a.m. to 10.00 a.m. is faster than downloading time from 10.00 a.m. to 12.00 afternoons. This is because of the number of users who are using the connections is less early in the morning.

In the evening sessions the downloading response time is inconsistently changing but becoming faster in the later evening between 5.00 p.m. to 7.00 p.m. because it is already after office hours, which is the peak time for most of the Internet traffic.

During the night sessions, the downloading response time is faster than the morning and evening sessions where downloading time is below one hour. The main factor that contributed to this factor is fewer users use the connection line during these hours.

The parallel downloading's connection lines are divided into 10 lines, thus resulting in faster downloading time. The fact that it is situated at the application layer of the OSI Reference Model does not influence the speed of downloading.

Single Connection Downloading

The single connection is the slowest method of all methods researched. It is not suitable for the morning, evening and early night sessions. After 11.00 p.m., the response time instantly changed. It nearly equaled the response time for parallel downloading.

Response time during night sessions showed a dramatic change. During 8.00 p.m. to 11.00 p.m., the response time still slow but starting from 11 p.m. to 12.00 a.m. the response time became faster and it is up to the performance of parallel downloading.

CONCLUSION

This study will help intranet or LAN users, as well as Internet users to know better on the downloading process and the most suitable download application to use in certain network environment. This study also shows the most suitable time for the Internet users to download files faster, the factor that determine the performance of parallel downloading, as well as the suggestions for improvements. This research also helps to determine the factors that can cause the poor performance of LAN parallel downloading performance. Future studies can be done on these factors that affect the performance of LAN in order to improvise for the sake of the users specifically and the whole organization generally.

As a conclusion, downloading using NetBIOS has the fastest response time but only suitable for downloading within the local network. It is recommended that large files having size more than 100MB to be downloaded once by using parallel downloading and store in the local server for easy and high performance response time. Staffs and students within the UUM's Intranet can easily download the needed files and have a better access.

In parallel downloading, users have the privilege of choosing various parallel download software such as Download Accelerator Plus, GetRight, Internet Download Manager and etc. These download software have the resume capability so that if the downloading process is suddenly disconnected, the users can resume the download easily. Single connection is

applicable to small-sized files, and from the research's point of view, it is not a practical method for downloading large-sized files because of longer time consumption.

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