OPTIMIZATION OF BANDWIDTH USING BY USE OF A PROXY SERVER

By

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Master of Science in Data Communication

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A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE MASTER OF SCIENCE IN DATA COMMUNICATION OF FACAULTY OF COMPUTING AND INFORMATION MANAGEMENT AT KCA UNIVERSITY

NOVEMBER, 2013

DECLARATION

I declare that this Research project is my original work and has not been previously published or submitted elsewhere for award of a degree. I also declare that this Research project contains no material written or published by other people except where due reference is made and author duly acknowledged.

Student Name: **Meshack Mwiti** Reg. No. **11/0742**

Sign: _____ Date: _____

I do hereby confirm that I have examined the master's Research project of
Meshack Mwiti

AND have certified that all revisions that the Research project panel and examiners recommended have been adequately addressed.

Sign: _____ Date: _____
Prof. Francis Kimani Gatheri

ABSTRACT

Recently there has been a tremendous increase in network traffic caused by several reasons amongst them being an increase of internet users. The increasednetwork traffic has really affected many other network bandwidth factorssuch daily up rise latency, very high response time for users and of course very low network bandwidth. This leads to a quick need of designing techniques that will help in optimizing available network bandwidth, ease latency, and reduce the response time for users.

Therefore, there is an importance to understand various characteristics web traffic. Majority of researchers who have invested in this area of research mostly have been focusing on the problem of content aliasing in the proxy servercaches. Aliasing in proxy server caches is said to have occurred when the similar content iscached and deposited in a cache repeatedly. This storing of similar content in cache repeatedly occurs when several requests are made to several different websites but contains the same content. These websites that has the same content are referred to as mirrors. Mirroringhelps in increasing efficiencywhose in return optimally increases cost of storage space in cache.

In most cases, content aliasing in a proxy server consumes an enormous storage in cache.Several techniques such as abstracting common content from various websites across different domainsand websitemirrors can be used to optimally used to partially solve the problem of content aliasing in favor of proxy server caches. In contrast to other techniques I will not only devise a technique tocheck the cache contents for redundancyto reduce network latency and traffic,but also, to indirectly completely enhance the optimization of the network bandwidth. My technique shall find a solution to the problem of redundancy in content aliasing in proxy server caches and shall make a contribution to the open source community.

ACKNOWLEDGMENTS

Though the effort that I put towards this project, I wouldn’t have achieved all this without the support, guidance, and motivation from several people. First let me extend my gratitude to everyone whohave really supported me to successfully complete thisproject.I highly thankProf. Ddembe Williams and Prof.F.K.Gatheri for theirgreat support, guidance, and help.

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TERMS AND DEFINITIONS

Proxy server

A proxy server is a server (a computer system or an application) that acts as an intermediary for requests from clients seeking resources from other servers.

Mirroring

Mirroring is storing numerousreplicas of the web content on totally distinct servers by the use of dissimilar domain names.

Web Caching

Web caching, is generally a technique that is used to store/keep regularly accessed webpages on a local server in order to be able to access them locally instead of accessing them from main server(s).

Content Aliasing

These are web pages which belong to a specific institution/organization with similar objects or content entrenched in them which are common to several other documents.

Payload

Payload in my research will be referring to the data transmitted in the body of an HTTP response packet. In my solution, I will be considering only full body responses.

Cache

Cache will be referring to several collected sites that have been duplicated from the main data is warehoused somewhere else maybe where the authenticated data is regarded as a very expensive aspect to salvage from the main web server.

CHAPTER ONE

1.1 INTRODUCTION

In web server management field, several researchers have been focusing on content aliasing ina proxy server caching. Web caching deals with storing most frequented referred objects to a caching server instead referencing to original server, to help web servers toutilize available network bandwidth by reducing the access workload on servers as well as to improve theresponse time for the users. Aliasing is givingdifferent names to the same thing.Aliasing occurswhen the same content is stored in cache repeatedly. A proxy server is generally behaves like are free between the original servers and the clients (Workstation). In the internet fraternity, aliasing mostlyoccurswhen any of the clientsin a network attempt to makemore than one request and the request are of the same payload.

At presentbrowsers are performing cachelookups by use ofURLsto identify each and every content on the web. Aliasing alwaysleads toa repetition when it comes to data transfers even if the most current requisitions have been stored under adissimilar URL.Websites which have same content are referred to as mirrors. Mirror is a failover or standby mechanismconfigured in several web servers across the internet infrastructure in order to serve and store for webpages faster and easier retrieval, but this technology is said to be very expensive when it comes to cache space. As internet and web traffic is increasing each and every day, there is a need of a mechanism to efficiently utilize anetwork bandwidth which is becoming inadequate. To come up with a solution we need to carry out an analysis of webtraffic to enable us understand its dynamic characteristics in order to optimize the available networkbandwidth, to minimize latency, and more so improve response time for users.

Commercial browsers developers are now developing browsers which are friendly to aliasing in proxy servercaches, and therefore, website designers are encouraged to make cache friendly webpages that may avoid aliasing. However, majority of website designers and administrators are not aware about the effects of content aliasing and how it can cause repetition in transfer of the samepayload.In this project, In my implementation, I intend to have a different approach whereby I will store the cached content in such a way that browsers shall not issue requests of the same content from multiplewebsites if the content(s) is already in the cache. In my implementation I will be storing the cached contents in the memoryby extracting first the content key and name key. A namekey will point to a set of content keys.

1.2 CAUSES OFBANDWIDTH PROBLEM

There are several things which have led to insufficient bandwidth amongst them being;

Increased number of internet users daily

Currently the Internet users worldwide is standing at approximately 2.27 billion, almost twice what it was in 5 years ago, which was 1.15 billion. Internet is big, but with this kind of growth in relation to bandwidth puts internet into a problem. The Internet population has been swelling rapidly since the arrival of the World Wide Web (which rests firmly on top of the foundation provided by the Internet).

Its human nature to become used to changes, so most of us have a habit to forget how quick the world has changed, and still keep changing. As the Internet population is growing it is not the same rate as the internet bandwidth is growing. Though there are several innovations taking place to counter the massive growth on users in favor for bandwidth, it has not been able to muscle the rapid growth and users. From the table below which I *extracted fromwww.internetworldstats.com*shows that as from the year 2000, there is anincredible growth in internet users.

WORLD INTERNET USAGE AND POPULATION STATISTICS AS OF 30thJune, 2012			
World Regions	Population(2012 Est.)	Internet UsersDec. 31, 2000	Internet UsersDec. 31, 2012
Oceania / Australia	35,903,569	7,620,480	26,286,909
Middle East	223,608,203	3,284,800	90,000,455
North America	348,280,154	108,096,800	273,785,413
Latin America	593,648,628	18,098,909	253,915,735
Europe	820,918,446	105,096,093	518,512,109
Africa	1,053,380,825	113,314,000	1,056,691,059
Asia	3,922,068,967	4,519,400	157,325,696
WORLD TOTAL	7,007,856,932	363,955,482	2,415,528,476

Table 1.1

Increased number of devices using internet bandwidth

As the internet users soars the same as the devices attached to internet bandwidth soars. Traditionally, the internet devices were fixed in one place e.g a PC in an office. In modern days the PCs are being overtaken by event being replaced by wireless small and portable gadget whose an internet user can use from anywhere.

This hasan negligible impact to internet bandwidth which as to be addressed.From a research Publication dated March. 19, 2013 by Brian Kersey shows that in the United States, there are more than 500 million devices connected to the Internet. This has been due to a rapid increase in smartphone and tablet ownership, a publication shows that the Internet-connected devices include tablets, video-game consoles, smartphones, laptops, PCs, , HDTVs, Blu-Ray players and more.

The analysis indicates that in the last 3 months more than 9 million people moved up from regular cell phones to smartphones and 18 million more consumers have purchased a tablet device, Slash Gear reported Tuesday" This is an indication that internet bandwidth consumption is on rapid increase that requires a counter measure .

Dynamic content transmitted via the internet

The internet has really evolved from an information service to an infrastructure which we have underpinned our lives and economies. But the current Internet infrastructure and architecture may not be capable of meeting much kind of requests much longer. Responding to this expansions demand and being ready to meet future needs will require more than a just an upgrade of the network.

The state of the Internet has evolved from so called Web 1.0 which consisted of static pages. In this, the consumer was merely a receiver and user of content dictated and created by someone else. The producer usually had the technical knowhow of programming and bit of software development.

The second and current Internet state is referred to as Web 2.0. In this state, the difference between the producer and consumer of content is no longer there. Many new applications are able nowadays to allow any end user to come up with his/her own content on the Internet without knowing any programming languages code. This has enhanced new ways of communicating using the old technologies and therefore referred to as a social rather than a technological innovation (Fuchs et. 2010).

1.3 DEFINITION OF KEY TERMS

Proxy server

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1.4 PROBLEM STATEMENT

In order to utilize properly the diminishing resources, there has to be a clear solution on how to utilize the resource optimally. Several researchers have come up with many ways to address the problem of network bandwidth optimization.

Lately there has grown in number the users of internet as well as the internet content has changed from plain text in 90s to today's real time video streaming amongst many more. This has greatly affected the bandwidth in the world and this need to be addressed to reduce network latency, congestion and higher response time. Bharat and Broder in their investigation on mirroring in a large crawler data set,reported that in an estimation 10% of popular hosts are mostly mirrored. Although they proposed some sophisticated measures of

document similarities, they reported that most clusters of similar documents in a large crawler data set contain only identical documents.

1.4.1 PURPOSE OF THE RESEARCH

The proxy server has several roles in a network some of them being; controlling All outgoing and incoming traffic first to pass through it after the router and act as a your connection to the outside world. A proxy can also serve as a central intermediary for logs or Internet trafficfiltering. You may route all traffic through a proxy in order to stop network users from having access to some restricted sites. From the above understanding of a proxy server, it shows that it is a powerful idea that can transform the entire network bandwidth into good use. For my solution I will use proxy server which I will implement four components namely Caching component, Hash component, Page replacement component and a graphical user interface component. The four component will help in the bandwidth optimization by use of content aliasing on name key and content key.

1.4.2 SPECIFIC OBJECTIVE

Main objective is to come up with a concept, implement it in a proxy server to optimize existing internet bandwidth in an organization.

1.4.3 OBJECTIVES

- Demonstrate the use of proxy in bandwidth optimization
- To explain optimization concepts which will be applied in proxy
- To implement a an optimization concept in a proxy server to optimize the bandwidth
- To test the implemented proxy server for bandwidth optimization.

1.5 JUSTIFICATION OF THE RESERACH

From Keith Fowlkes publication dated March 13, 2013 asked how long can we feed the bandwidth monster? This question was as a result of in adequate Internet .it has been a problem since 1990s whereby it was traditional to increase bandwidth whenever someone felt that internet is slow. Now it has reached a point and ask ourselves whether increasing more bandwidth is really worth the trouble and expense.

Keith Fowlkes says that “since the early 1990s with all sorts of network problems answers, First, we created more problem to bandwidth by coming up with filtering tables, thenshapers of packets, currently we have bandwidth equalizers amongst many more. But still the problemhasnot been solved for long as the newest disruptive technology clogs our pipes”.

The problem cannot be solved due to applications such as Skype, Ovoo, badoo, Xbox amongst many more that are coming up.More disruption is knocking with the wake of several mobile devices applications coming up every day.

Keith Fowlkes answering to the bandwidth problem question said it is not possible but hopeful that technology innovations such as the solution that am researching on to optimize the current bandwidth in our organizations will keep us a step ahead of growing demand of internet bandwidth.

CHAPTER TWO

LITERATURE REVIEW

2.1 CURRENT REVIEWS

System for Web Caching

In a web caching system, most content is cached at the level of a proxy, client or even a server. Whena page is requested by a user, the request first goes to the browser. Ifthe browser on the user's client has no have a requested copy of the page, the request isforwarded tothe cache of the proxy server. If the requested copy of a webpage is not stored in a proxy server cache, therequest will be forwarded to the original server. Several factors which include cache architecture, proxy placement, caching contents, cache replacementis very important to consider themain order to make the cache system work properly.

Some of the measuring performance for any bandwidth includes; Fastresponse, Lownetwork latency, scalability, transparency, higher availability, robustness, quick adaption to various network architectures,no single point of failure,simplicity, and how easy it is to implement amongst many othersof which majority are most important featurein a web caching technology.

Caching Architectures

Architecturesin cachingarerealways either categorized, distributed, orcombination of both. In the architectural of the hierarchical, the cache will be storedin various levels such asdownwards,regional wise, institutional, national etc. On the other hand, distributed caching architecture, there is no intermediate cache levelsincethetrafficable ways flows through a lesser congested network levels. For hybrid it combines both cache architectures.

Web Caching Algorithms

A perfect caching algorithmics are supposed to serve all the user's whenever they are sending any request there and then without reloading the requested data. But this is cannot be allowed to happen ifat allthe future data requisition are notcompletely known before, and therefore this is assumedthat each and every requisition in any arrangementof facts type are stored in the available space in the cache. The pronounced calamity in this type of scenario is the size of memorycache since it is limited. One of the most crucial factorswhichimpact the

successfulness of this type of scenario of cache is the replacement, which its yields shall be the *ht*ratio.

There are many different cachereplacement algorithms, e.g. greedy dual-size,greedy dual, commonly, most of algorithms which deals with web cachingto help in pagereplacement, first intercept the data first before they cache the pages. If request data by user is not in the cache, then there will be no need of cache replacement algorithms since the requested content will be fetched from origin server. If the requested data is more than the space in cache, a cache replacement algorithmis called upon to evict data from main memory cache. There is need of understanding a strategy that helps in removing of unrequired data from the main memory cache, mostly referred to as page replacement scheme simply since it helps when it comes to selecting of an algorithm to perform page replacement.A scheme to act as a page replacementmust remove data which is no longer in need of access or data which can be reloaded very easily. Several algorithms used in web caching, such as greedy dual, randomizing proxy, greedy dual size amongst many other caching are used for more effective webcaching.

The Greedy Dual Algorithm

The greedy dual algorithm, was first introduced by Young, and he stated that the algorithm always has to maintain an evaluation value*Hwhich has to be in an* association with each and every page *H(p).* He also stated that it has also to maintain the cost value denoted as , *C(p),* which has an associationwith the document being cached. Whenever there is a wish to evict any document or to replace, always document withlowestvalue*H(p)* will be evicted. Immediately when a document is removed from the cache, theactual*H*value of the documentwhichremains in the cache will be reduced with the equal value as that of *H* evicted document. Contrary,the*H* value of a document which will be requested later on it will be reset to *C(p).*

The Greedy Dual Size Algorithm

Irany andCao made some modification to the greedy dual algorithm in order toput the actual consideration of the actual capacity/size ofthe document being worked on alongside its value cost. Thus, this algorithm puts the*H* value ofanydocument to be done by just a calculation of its value throughvaluing at thecost valueand size in terms of Mbps of the document. The dual greedy algorithm,in the above paragraph, the algorithm does not considerthe any of document size. Inthe above algorithm, when caching of document occurs or the cached

document isread more than twice, the valueH of the document is changed to *c(p)/s(p)* where *c(p)*denotes *an* estimated value cost of the cached documentand*s(p)*representactual capacity of the cacheddocument. By use of greedy dual sized algorithm, it helps in improving the efficiency and effectiveness of memory usage as it will be demonstrated later, is that whenmore than one document is stored, the largest document insizewill be the first one to be evicted instead of the smaller document. As good as thealgorithmmay sound, it has its limitation which is thecostthat is incurred when it comes to maintenance of the data structures which helps tracking of erased or request of the documents with higher value. The answerdevisedin solutionthis kind of problem willgenerally to applya proxy serverto randomly use an algorithm that can evict documents in random manner.

However, thealgorithmis believed to be using memory effectively and inefficiently since documents are ejectedin a random manner. A Randomizing Proxy caching Algorithm doesn't keep any data structures becauserandom eviction of the documents. Anything good has also some limitations. Major limitation of this scheme it doesn't consider the usefulness of the document. This translates to most useful documents being evicted based on random process. PsounisandPrabhakarproposed a new way of combining both greedy dual andgreedy dual size algorithms for web caching additionally are for the randomization in an algorithm applied in a proxy.

Intheactual new replacedstructure a subgroup of cache (size K) is maintained. There will be no changes if nocached is document deleted from the cache. But in the case of adocument needed to beelected the subgroupwilloccasionallyfill with the documents which may berandomized in from the majorcache. In this algorithm only the assumed document no needed will be deleted from the subset randomly.

MD5 Algorithm

MD5,was developed by Ron Rives in the year 1992, as anevaluation cryptographic algorithm to hashand later succeeded the MD4 algorithm. MD5is capable of accepting an input whichever length and can create an MD5 code of 128 bits in lengthwhich is equal to 32 characters.Since MD5 usesthe similar algorithm each and anytime it runs, a certain string of data is generated usingthe similar MD5 hash all the time it runs.MD5 is more advanced than its predecessor MD4 with several advantages tagged in it and all its rival such as, SHA and SHA-1.

Some of the advantages of MD5 over MD4 and others are initiation of cryptographic hash, it can accommodate inputs irrespective of their length in whose it generates an output with fixed length. It is faster, and chances of two different strings hash into the same digest.Additionally, by using MD5 not at any particular time thattwo you will find strings which are different being hashed to similardigest.

Decoding MD5 Hash

MD5 doesn't give an effective and efficient way of achieving the actual input in form of stringsupplied from the préciswhich wasdone purposely to it. Brute force attackis the most operativemethods of reversing engineering on MD5 digest.

Static Caching

Static caching may be a new approach to net cache as a result of it uses yesterday's log to assist in predicting today's traffic. Contrary to dynamic caching, where by cached documents are of times updated even up to quite once on a daily basis. Static caching is completed just one occasion. This kind of caching is alleged to be less complicated to use, as a result of it imposes terribly low C.P.U. overhead. Moreover, it significantly counted on rising cache performance through use of assorted cache compression techniques. This suggests that stable websites is well compressed so as to cut back their sizes. This compression directly saves area within the cache. The performance of Cache servers is usually depends on 2 major metrics particularly computer memory unit hit magnitude relation and hit magnitude relation. Hit magnitude relation is really the share of all accesses that are cached totally within the cache; whereas, computer memory unit hit magnitude relation is that the range of hit rate in regard to the entire range of bytes cached.

The main aim of the static caching is to assist in predicting the longer term of traffic AN estimation of the worth of the document. The rule is only supported logs of the server to predict future documents by use of the very fact finding approach. Once creating these predictions, the rule continuously uses each the cached and non-cached documents. Terribly dynamic documents and enormous sized documents can't be cached as a result of frequent dynamic documents modification perpetually and in huge changes, and since the price hooked up with caching the documents are high. Once the rule is thru with calculative future traffic, it'll then estimate the worth of every document. Then it'll cache the documents with higher calculable values. The foremost crucial goal of the rule is to relinquish terribly high

hit magnitude relation. Static caching rule predicts future traffic supported the idea that future is going to be possibly almost like the past. However, once predicting times will vary, and so, this rule adopts a twenty four hour amount.

The static caching rule outlines a set of URLs and this is often done by analyses of the logs from the previous periods. Then it calculates the worth of the distinctive address which is able to depend upon the worth, URLs are continuously organized within the descending order, and therefore the address with the best price is chosen. This is often sort of address is noted as operating set. Once missive of invitation is created by the user concerning a document, and therefore the document is on the market within the operating set, the request is consummated direct from the cache. Else if, the user request is rewarded from the origin server.

2.2 STATE OF PRACTS

There are several states of practs on this area of research. This shows this an area of research which several researchers has shown interest in it. Some of the case studies that has been ever done on this area are the accelerators case study of 2001 and KENET bandwidth management case study, 2009.

The Accelerators Case Study, 2001

A business case for network bandwidth optimization over bandwidth upgrades which was done 2001 by Don Ryan who was the Vice President of the organization. He advised the organization that instead of keeping upgrading the bandwidth whenever a new branch is opened, instead the organization to embark on bandwidth optimizationby utilizing the current bandwidth. This organization implemented bandwidth accelerator as an optimization tool which has four components for optimization. In return the organizations bandwidth improved tremendously and organization.

KENET Bandwidth Management Case Study, 2009

KENET connects educational institutions and research centers in Kenya with the goal of distributing knowledge throughout the country and making sure that the research and education communities have access to the Internet. Currently, there are over 8 member institutions who are directly connected to the main node, which is in the capital city of Nairobi, and more than 40 additional member institutions that participate in the network by way of copper leased lines that are made available by Telkom Kenya. Since the internet

bandwidth is insufficient to connect all the learning institutions, Mr.Chegeadvised KENET to come up with a way on how to optimize the bandwidth to make sufficient. He proposed to deploy bandwidth optimization techniques such as proxy severs amongst many other techniques.

2.3 TECHNOLOGICAL ADVANCES IN BANDWIDTH OPTIMIZATION

In this area of my research, there are several technological advancements that have been achieved. There are several tools that have been developed to help in this situation. Some of the tools include;

Hardware compression

Generally, compression refers to any of the mathematical pattern analysis or string substitution techniques that helps in analyzing traffic contents and replaces longer patterns or strings with slightly shorter ones. Mostly, they're obtained by golf stroke numerous coding techniques that will get to eliminate repetitions in knowledge blocks and replace the perennial components with shorter ones. Pointers to original content facilitate in an exceedingly method such the simplest way that it reduces the quantity of information that transits to a WAN link. Once this type of volume is reduced it\'s handled by device hardware that runs quicker, and this explains why hardware compression is mostly thought-about obligatory in state of the art WAN optimization devices.

Compression image Dictionaries

Compression dictionaries are collections of random long strings (or even entire files) that are put in on every finish of a WAN link that has to exchange once, when that they'll be related to short, peerless symbols which will be sixty four to 256 bits long. once the dictionaries of a try of devices are synchronic, as revenant patterns content are detected in traffic going out, then they 'll get replaced with a particular image that references the first info in an exceedingly lexicon that is uncompressed, then it's sent across the WAN link. On receiving the content the device on receiving finish can replace every and each image it acknowledges from incoming traffic with it’s a duplicate copy of the first info so as to revive the content to its original type. This WAN information measure optimization helps in eliminating the necessity to send duplication files or strings across a WAN link, that's why is often known as First State duplication.

Object caching

This type of net caching involves managing and exchanging of hold on collections of varied code objects between some pairs of devices to represent in a different way so as to change implementation of image dictionaries and shared compression. in addition, this approach typically associates with some reasonably refreshing intervals or session timeout or age out info with objects within the cache in order that it will enforce refreshing whenever similar intervals expire.

Traffic shaping and management

WAN improvement devices could apply to any or all reasonably traffic by shaping and managing techniques to enhance on speed, time or latency sensitive packets out whereas assignment time or latency insensitive packets to accessible information measure that will go unused over time. once applying traffic shaping a group of packets that is termed a flow, it's going to impose an extra delay on some packets to adapt to a group of predefined constraints noted as traffic contract or generally referred to as traffic profile. This enhances routers to manage the quantity of information measure traffic passes across a link over a selected amount of your time is thought as information measure suffocation or the utmost speed at that traffic could taste a link that is thought as rate limiting. Sometimes, advanced regimes may be applied, like the generic cell rate algorithmic rule accustomed form traffic on ATM networks.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

In every problem that exists, there has to be a need to come up with a solution that helps in solving that problem. From my research there is a need to come up with a solution to optimize network bandwidth and utilize it properly in order toreduce network latency and eventually improve user response time. I will implement my solution by coordinating and implementing thefour components namely graphical user interface, caching, page replacement and MDH Hashing.

3.2 CURRENT, TECHNIQUES AND TOOLS USED

Several techniques and tools are widely used in bandwidth optimization whereby some have been of great improvement in addressing this issue while others have been critiqued and above all proposed enhancement have come up. Some of the widely used techniques and tools are;

Protocol substitution or protocol proxy

Any chatty protocol i.e a protocol that involves plenty of to and from electronic communication between shoppers, peers, or shoppers associate degreed servers generally doesn't behave alright once an extension of link across wide space network. wherever outright protocol substitution isn't viable, several wide space network information measure improvement devices terminate protocol connections for things like Common web classification system (CIF) domestically, then substitute another efficient protocol to encapsulate key traffic components across wide space network links. for example, a thirty MB file transfer might take as long as seven minutes across a large space network link victimization CIFS, however those delays is feasible to be reduced to below a 1 minute victimization Riverbed's wide space network file service (WAFS) instead.

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explains why hardware compression is usually thought of necessary in state of the art WAN improvement devices.

Compression/symbol dictionaries

Compression dictionaries square measure collections of random long strings (or even entire files) that square measure put in on every finish of a WAN link that has to exchange once, when that they will be related to short, unmatched symbols which will be sixty four to 256 bits long. once the dictionaries of a try of devices square measure synchronous , as continual patterns / content square measure detected in traffic going out, then they're going to get replaced with a particular image that references the first data in an exceedingly wordbook that is uncompressed, then it's sent across the WAN link. On receiving the content the device on receiving finish can replace every and each image it acknowledges from incoming traffic with it's a duplicate copy of the first data so as to revive the content to its original kind. This WAN information measure improvement helps in eliminating the requirement to send duplication files or strings across a WAN link, that's why is generally referred to as American state duplication.

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Genetic formula for optimizing information measure in wired network

In 2012, Dams, Kanpur and Lucknow came up with genetic algorithms that with a provision of a target-hunting random search and improvement technique. It uses probabilistic transition rules to guide the search. All generalized greedy and gradient descent search techniques suffers from obtaining stuck on native best purpose, this formula overpowers this limitation by providing a better best answer in precisely many iterations.

Dynamic channel allocation formula.

Abhishek Roy and Sajal K. Das 2009 developed a dynamic channel allocation formula to assist in rating a scale of stratified video from numerous multiple sources within the background of a wireless video distribution system. but this doesn't neither perform nor optimize information measure allocation. This was any advanced by Lai-Tee Cheok and AlexandrosEleftheriadis in 2011 World Health Organization was simply a category behind Abhishek Roy and Sajal K. Das. They once and for all increased a dynamic information measure allocation theme that mechanically adjusts the number of reserved resources, whereas guarantying the desired QoS. The formula doesn't contemplate the impact of delaying and time taken for every transmission.

3.3 EVALUATION OF EXISTING METHODOLOGY /TECHNIQUES.

Technique/methodology	**comparison**	**preferred**
Web caching	Constitutes of four components namely User interface, page replacement, Hashing and caching components caches pages after checking the content and URL	preferred for my project
Traffic shaping and management	Helps WAN devices control the volume of traffic sent across a link over a specific period	
Genetic Algorithm for optimizing bandwidth in wired network	It uses probabilistic transition rules to guide the search.	
Dynamic allocation Algorithm	The algorithm does not consider the impact of delay and the time taken for each transmission.	

Table 3.1

3.3 THE PROPOSED METHODOLOGY

My projected resolution is net caching formula, that optimizes network information measure utilization, reduces network latency, and improves user interval, can comprise of 4 components:

- Graphical computer program element,
- Caching element,
- Page replacement element
- Hashing element.

In my resolution, the four parts can facilitate in storing contents of the net pages supported their name key and content key. The name key are the MD5 hash for the address, while the content key are the MD5 hash for the content in individual objects of the address. a reputation key can purpose to a collection of content keys.

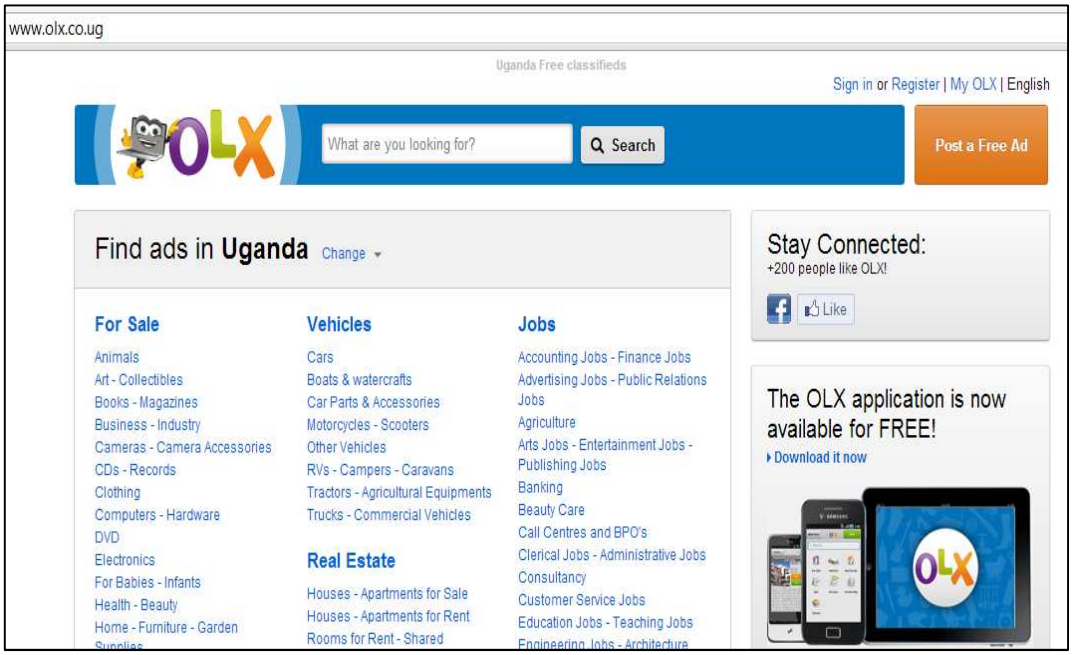


Fig 3.1

as an example, the web site ww.olx.com, as shown in Figure below, provides its users content supported regional domains like World Wide Web.olx.co.ke and www.olx.co.ug

www.olx.co.ug – web page for Uganda domain

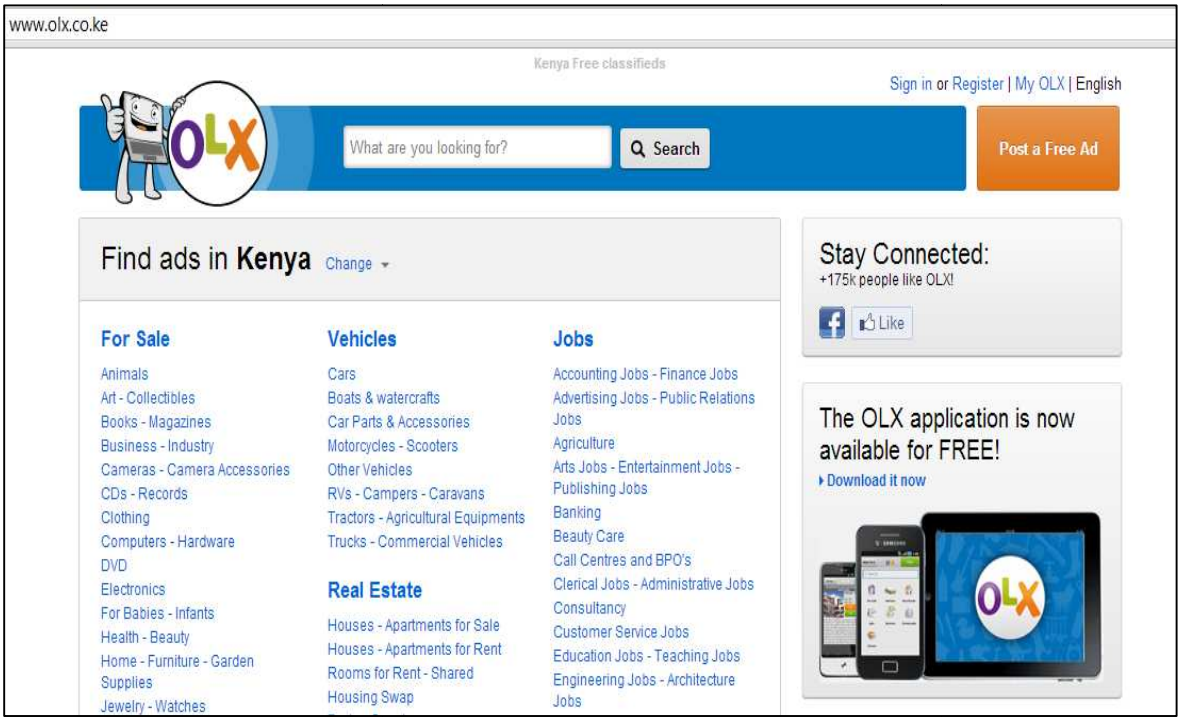


Fig 3.2
www.olx.com – web page for Kenya domain

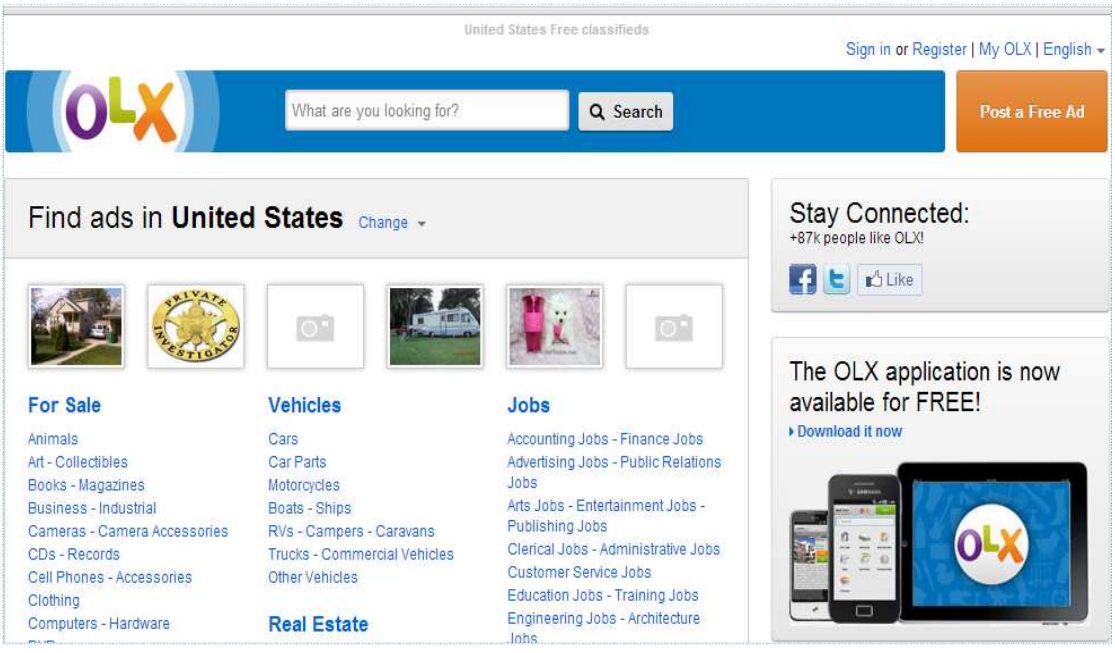


Fig 3.3
www.olx.com web page for USA domain.*Sources: Adapted from olx.com, olx.co.ug and olx.co.ke* "Homepages," 2013. Retrieved 13th June, 2013. Logos are registered trademarks of OLX Inc.

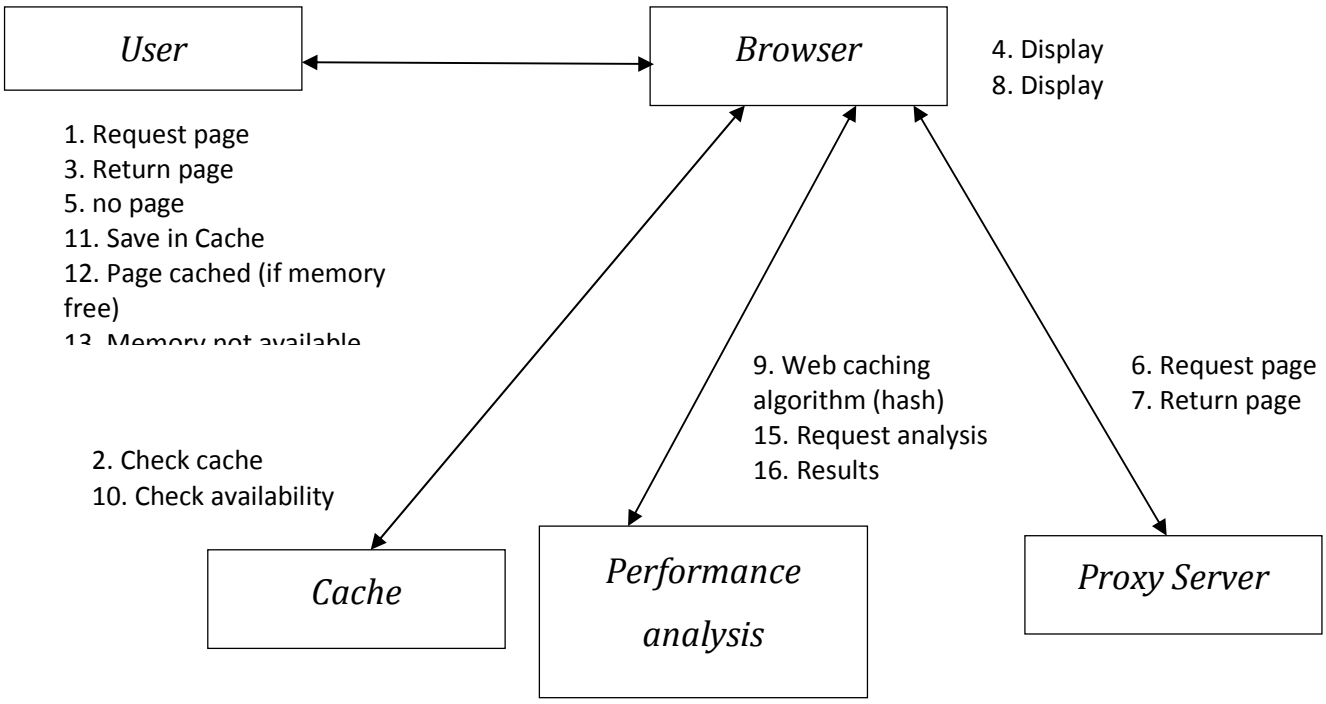
Most of the static content classes on these regional domains' websites which has purchasable, vehicles, Jobs, real estates amongst several area unit identical. Exploitation of information aliasing, will cache the common content, however retrieve the distinctive (not common across regional domains) content from the initial server. During this setup, asking can comprise of collective content from the cache and distinctive content from the initial (main) server. I'll additionally use mirroring together with content aliasing to stay the cache consistent and updated with the contents of the initial server. so as to meet the requests, the cache might need a relentless with cheap information measure reference to the initial server.

When a browser requests an online page, my resolution can check each name keys (URL) and content keys, and so, can avoid the matter of duplicate contents within the cache.

Relationships between the parts

The user, through the request operate, requests a page from the browser. The Browser performs fetch page to urge the page requested by the user from the server or cache. The Browser then checks the particular availableness of the page in cache with the check cache operate. If the page is out there within the cache, then the browser displays the page; and if the page isn't accessible within the cache the browser requests the page from the server and displays the page exploitation the result operate. The cache then stores the page, counting on whether or not or not area is out there within the cache. If spare cupboard space isn't accessible, then my resolution uses the replacement operate to evict one or a lot of pages that are not any longer required, and saves the new page.

3.4 CHARACTERISTICS OF THE PROPOSED METHODOLOGY TO BE USED



The methodology has the subsequent characteristics that revolve round the four parts.

The user can send missive of invitation through a URL through the browser. The browser successively can send the request of the requested page demand it from cache. The cache can check if the requested page is accessible in its memory. If the provision of the page has been according within the cache, then the requested page are availed to the browser. The browser can receive the found page and can show the page before the user. However, if the users request is came inaccessible from the cache, the requested page shall be sought-after from different main servers. The main/original server can come back the user's requested page to the user's browser and currently the browser can show provides a show of the page to the user. once user's request is consummated the page are sent to the caching element subject to the provision of the cache memory. If meager area is according by the caching element, the page replacement element are known as upon to change the eviction of unwanted pages from the cache. The browser can send missive of invitation to the analyst element for analysis and also the analysis element can come back the results of analysis.

CHAPTER FOUR

FIELD STUDY AND CONCEPTUAL MODEL

4.1 CONCEPTUAL MODEL

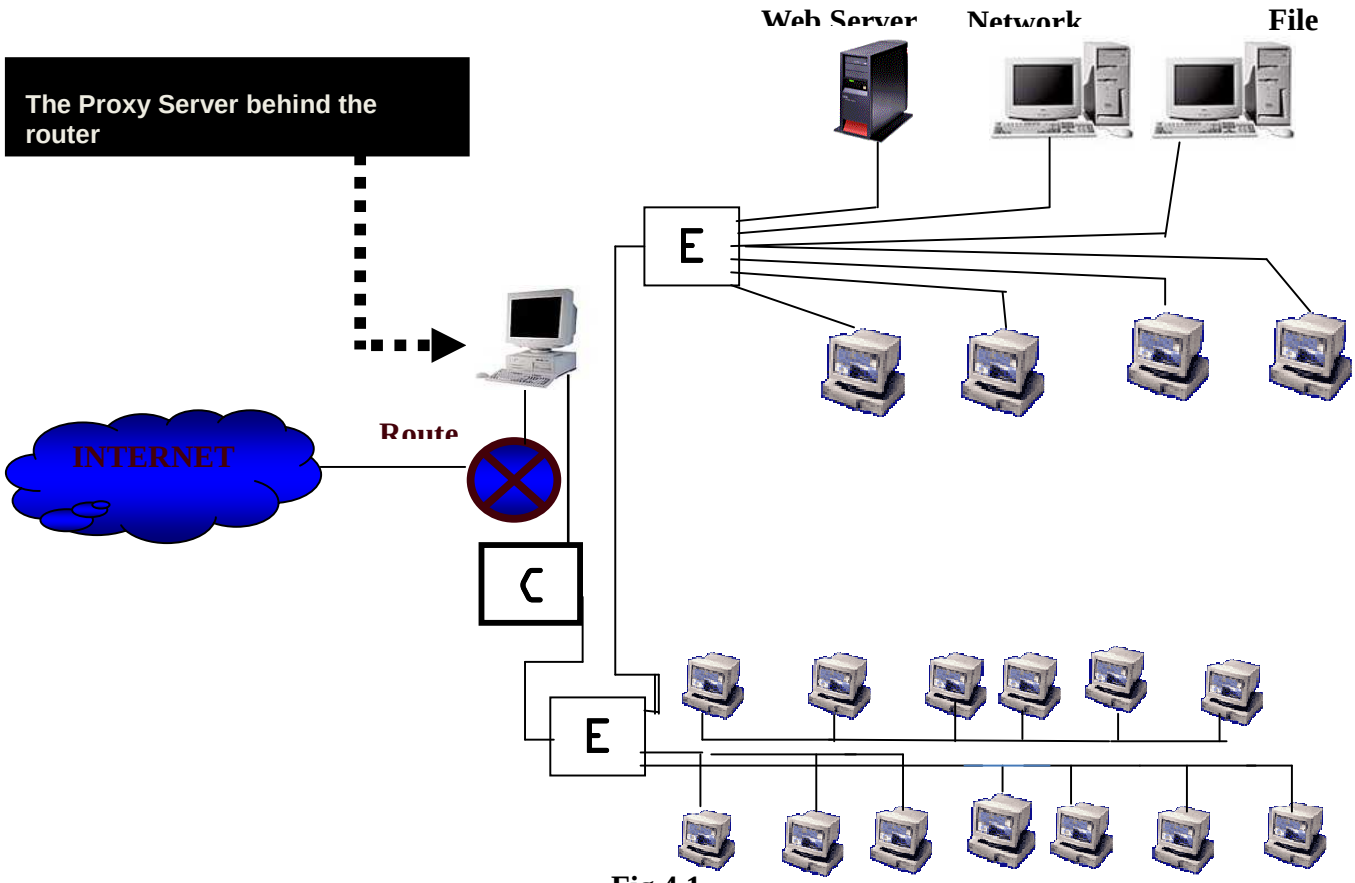


Fig 4.1

In my conceptual model, the internet connectivity will be provided by the Internet Service provider (ISP). It will be terminated at residential router with a public IP assigned on the outside interface and the inside interface assigned a private IP corresponding to the subnets in my LAN. From the router, the connection will terminate at the proxy server. All cisco edge switches will connect direct to the layer 3 core switch whose connects to the proxy server and all clients will be connected to the cisco edge switches. For any client within the network to send or receive anything outside the network it has to pass through a proxy server, router and then to the internet and vice versa.

4.2 IMPLEMENTATION MODEL

I represent a sequence diagram of my resolution in Figure below. A user can request a universal resource locator via the browser, the browser can send the request to the page from the proxy server cache. If the page requested is offered the requested page is came to the browser, and also the browser displays the page to the user. If the page isn't obtainable within the consumer cache, the request is send to the proxy server. The proxy server can then send the request to the webserver. The webserver returns the page to the proxy server and proxy server returns the page to browser, and also the browser displays the page to satisfy user request.

The browser sends the uncached page to the be analyzed on content and universal resource locator. The analysis is then sent to proxy server whereby if the content of the online page and universal resource locator haven't been cached then the page is cached with the assistance of MD5 hashing formula. My formula resolution can compare the universal resource locator name of the online page additionally because the content of the requested universal resource locator before it's cached. The page are going to be cached subject to accessibility of cache area else, If the cache doesn't have comfortable area obtainable, then, victimization the page replacement module, the area for the page in cache created.

CHAPTER FIVE

IMPLEMENTATION

Most of net caching algorithms square measure full of the matter of inefficient use of network information measure, hyperbolic latency, and poor reaction time for users. during this chapter, I gift my net caching algorithmic program that uses content aliasing to handle of these issues. My resolution is formed from four elements, and that i discuss every of those elements however they're going to be enforced.

5.1 HARDWARE AND Software Package Necessities

My resolutions are running on the pc processor to be a minimum of a Pentium four two.4GHz with one GB primary memory and 250GB secondary memory. My resolution conjointly needs basic I/O devices like mouse, keyboard, and a monitor. I need that the pc system be equipped with an {area neighborhood} area network (LAN) card, with a CAT five UTP cable. My resolution features a capability to run either on Windows or UNIX system platform, and will need a one.5 version of the Java Development Kit.

As mentioned earlier my resolution are comprised of 4 parts: the graphical interface component, the caching part, and therefore the page replacement part and Hashing part.

5.2 Graphical Interface Part

My solutions' graphical interface (GUI) part may be a made-to-order browser, as shown in Figure below. it'll give all the practicality that a standard browser provides. it's associate degree address bar, and may support ActiveX objects for motion graphics. once a user clicks on the "GO" button, the browser can establish a TCP/IP association withtheproxy server initial. Figures below demonstrate my graphical interface with a cached page and un-cached page.

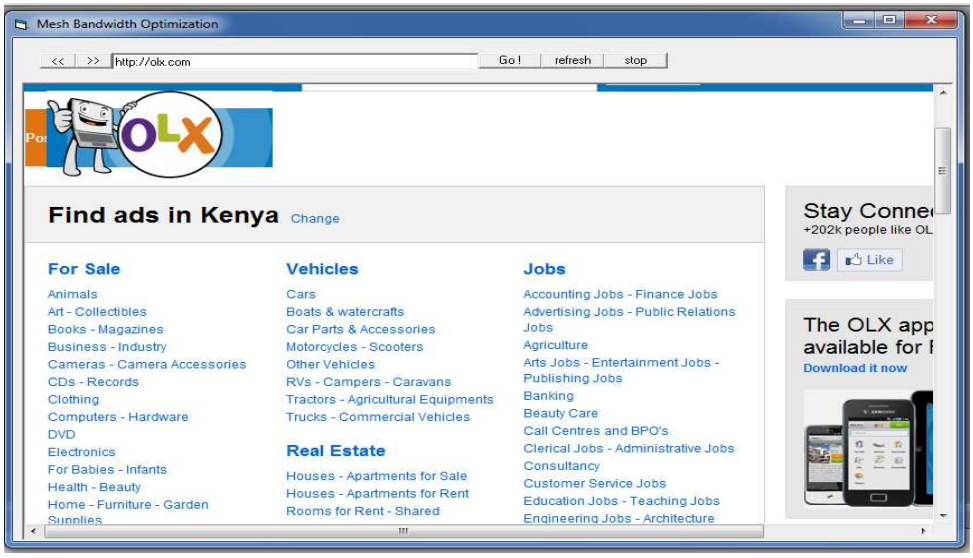
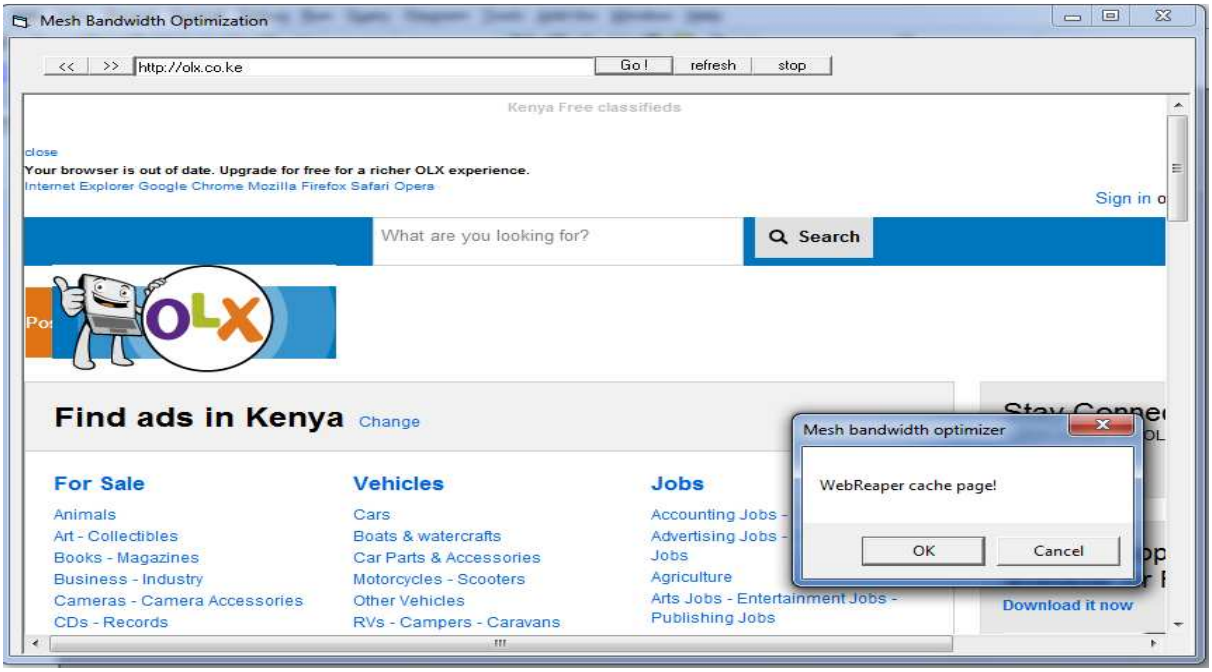


Fig 5.1

My graphical user interface



Graphical user interface (GUI) component of my solution contacting web reaper to cache the page.

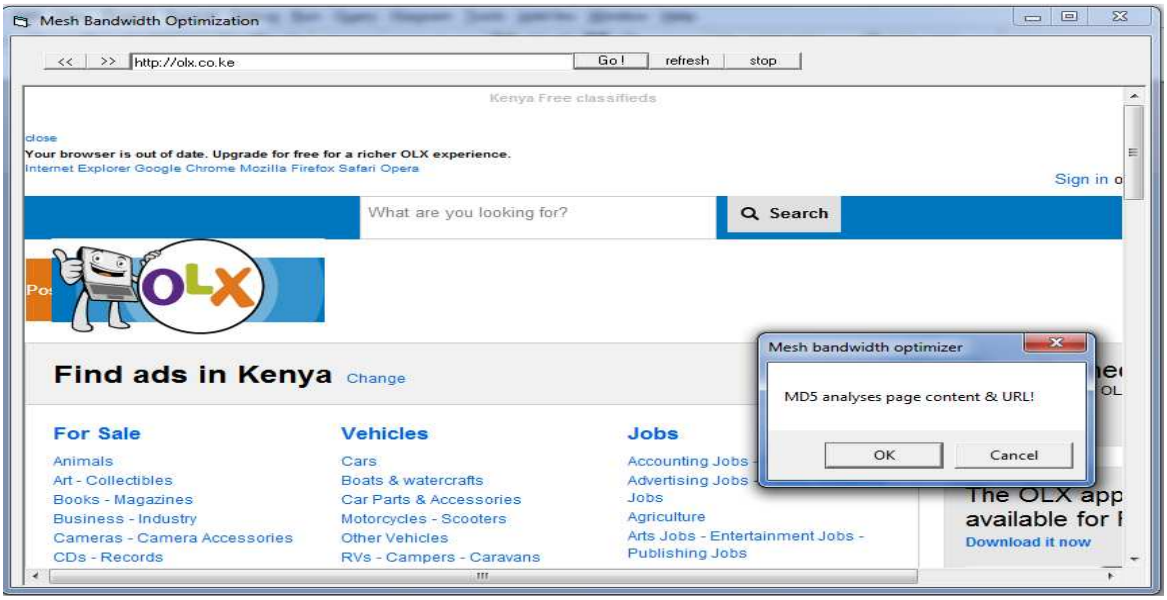


Fig 5.2

My GUI contacting MD5 for analysis of URL and page content for caching

5.3 CACHING COMPONENT AND PAGE REPLACEMENT

Caching is one of vital component in my solution. This solution will be creating a cache memory and it will be represented as a folder on file system and it will act as a local server which I will use to store the cached web pages. According to my solution, Caching will be done on secondary memory because it is bigger in size and more permanent in storage nature than primary memory.

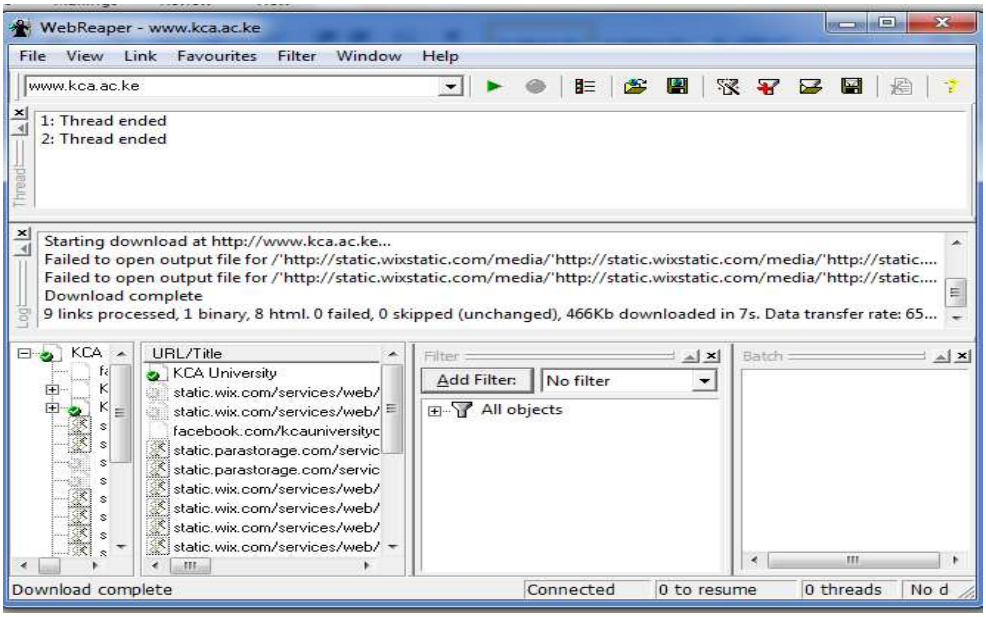
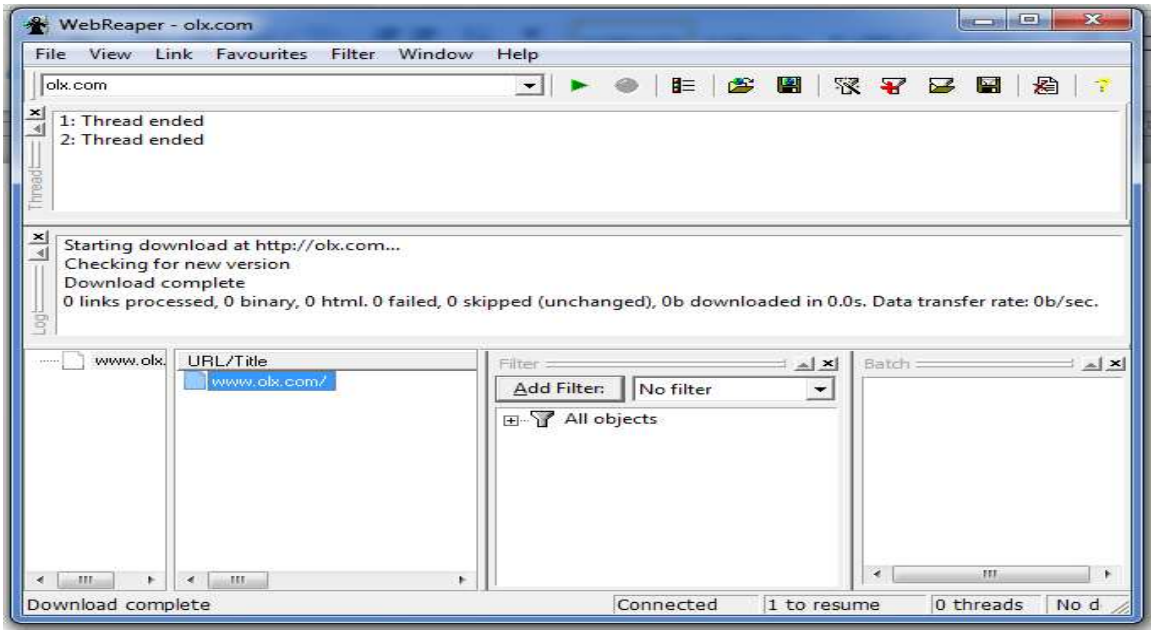


Fig 5.3

Reaper caching new web pages from kca.ac.ke



Reaper try to cache already cached web pages from olx.com

5.5 HASH COMPONENT

MD5 hashing has played a very importantfunction in the implementation of my solution. I use MD5 algorithm to help in generating a hash value of 32 bit of any given URL of a web page. In my a URL of a web page I refer to it as a name key. I will also hash the contents of a web pagecontentand I will refer to it as a content key. When a page is requested, my solution will compare the URL of the web page as well as the content of the web pages in the requested URL. In this solution this is a very useful in the case of mirrored sites when comparing both the content of the web page and URL so that web pages with duplicate contents are not cached. Since in mirrored sites, although the URL's are different, the contents are more or less the same likeww.olx.com,www.olx.co.ke, www.olx.co.ugand so on.

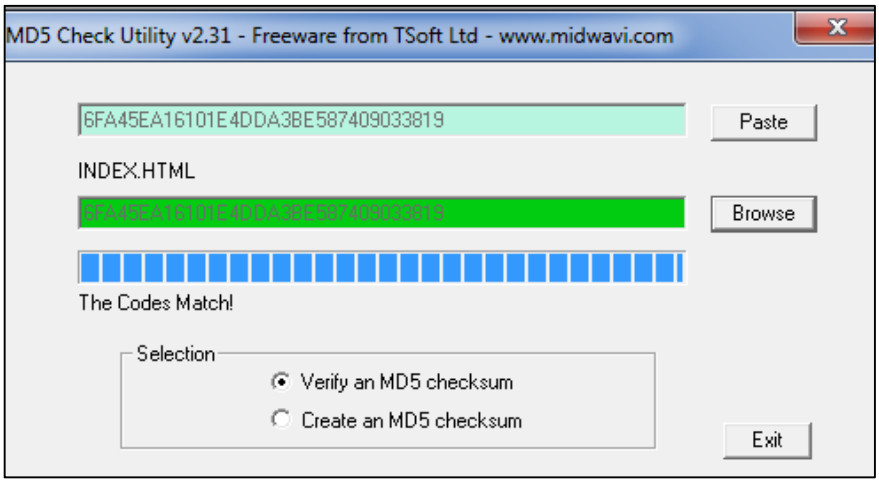
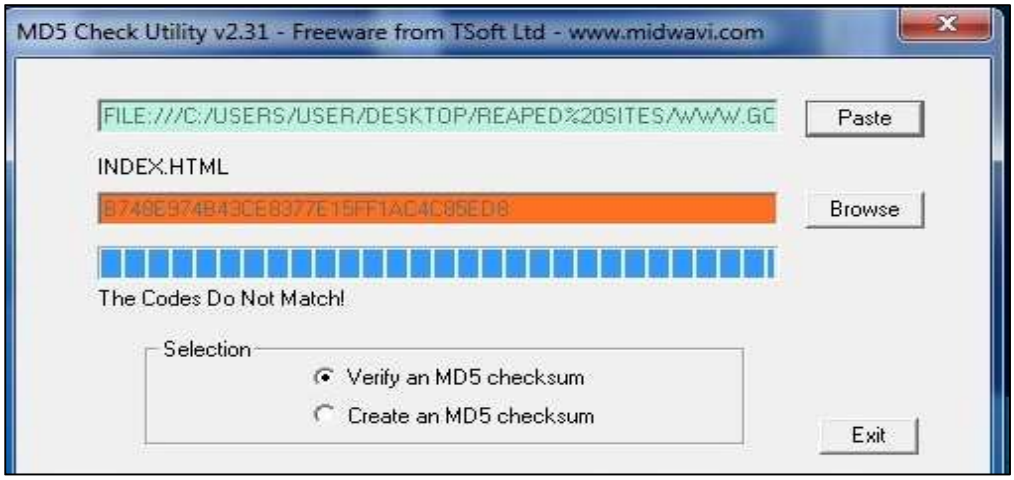


Fig 5.3

From the figure above, Md5 checks and finds the content matches the cached content



From the figure above, Md5 checker checks and does not find the content nor the URL matching the cached content hence sends to web reaper for caching

CHAPTER SIX

DISCUSSION OF RESULTS, CONCLUSIONS AND RECOMMENDATION

6.1 INTRODUCTION

I can't talk of results without including testingbecause for any software solution has to be tested very well.

My test exposes each module of my solution to testing, and records the results. Unit testing focused on each and every component separately and then tested components together to ensure that information flows correctly in and out of all modules. I used integration testing to test compatibility between different components namely Page Replacement, Graphical User Interface, Hashing and Caching.

6.2 DISCUSSION OF RESULTS

My results shows that the web pages requested by a user via the browser is forwarded to the hashing component (MD5 algorithm) to check the page content of the page if it has ever been cached. The hashing of the content and URL is done by this component by compressing the content to save space. Then it is passed on to the caching component (WebReaper) which downloads all the pages and before the pages are saved the page replacement (MRU) finds if the space in cache is available to accommodate the page. If the space is insufficient, the MRU will evict other pages in order to accommodate the newly cached page..

Integration testing was done to ensure that the software works correctly even after the various unit tested modules are integrated together to perform more complex tasks, such as, hashing of URL, content and MRU Replacement component. I tested integrated testing to test compatibility between different modules like replacement, and Hashing.

6.3 CONCLUSIONS

There has been a need for higher and higher bandwidth and massive connectivity speed is of recent become a necessity. My solution has demonstrated in a big way on how web proxy caching may improvebandwidth performance in terms of traffic reduction, reduced latency, low response time, and optimally utilization of the existing bandwidth.

My solution shows that an organization can optimize its bandwidth by implementing this solution. Out of my own research at Kenya Law Reform Commission shows that mostly accessed websites by different employees 70% are actually the same websites. This means that with my solution this organization may optimize their bandwidth maximally since all

web pages accessed once shall be cached into the proxy server. Any updates to be done will be little and require less bandwidth.

My solution also shall save storage space by caching any web page by analyzing URL and web page content. Since it will not only check the URL of the web page in order to cache it but only the content of the page. If a Web Page has been mirrored several times with different URLs but same content, my solution will cache it just once and map the same content to different URLs which has the same content.

My solution has demonstrated that even if the internet link is down, users will never realize because most of the accessed webpages have been cached into the proxy server which is within the LAN.

6.4 FUTURE RESEARCH

I have left my research topic open to everyone for more research and I encourage advancement to higher and great extent by providing greater benefits on how to improve bandwidth optimization. My solution can be enhanced by the further research on the following:

Dynamic Pages: To improve so that it can be able also to accommodate dynamic pages, this frequently changes.

Mobile WAP: My application is completely limited to work on a network connected computer systems my research is open to further the work on how to accommodate mobile web application programs.

Reducing costs: If my solution is implemented on large scale it can cut cost

Add More Features: Add more features on MD5 algorithm and improve caching component (webReaper) to cache flash and databases within the websites.

6.5 RECOMMENDATIONS

Many organization experiencing difficulties in are struggling with the problem of bandwidth optimization which led to higher traffic, latency and response time to users. Most organizations are each and every day requesting for bigger bandwidth from ISPs which is becoming too expensive and non-cost effective to the firm. In order to address this, if my solution could be enhanced properly can solve this issue of bandwidth.

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