



# Url redirect links and its importance calculated using parallel programming to drastically reduced the execution time

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## Abstract

Web URL Redirect Utility validates the URL links and generates the reports with details like number of hops, status and its importance. URL Redirect Utility will help the development team to fix the issue as well do the profiling for the URL links. The Utility will find the performance bottlenecks of the url links with that can improve the performance of each web page. URL redirect Utility designed and developed using dotnet MVC framework with parallel programming approach. Considered test scenario with an 20000 number of URLs which will be validated less than 20 min(1,200,000 msec) by running the utility in parallel which traditionally(sequential) takes more than 28.45 hours (102,420,000 msec ) to complete the execution. Efficiency of the Utility execution is 100% and execution time has reduced to 98 to 99% effort.

**Keywords:** URL Redirect Links; URL Link Status; Redirecting; URL Forwarding; Number of Hops of URL Links; Summary Reports; Metrics.

## 1. Introduction

Any domain in the world is using the information technology for their development, which needs internet to run their business. In this IT world, most of the business carried over the internet. Any business needs different types of applications to achieve their specific tasks/transactions [1].

There are different types of application architectures, such as 2-tier, which is called as Client/Server, 3-tier Web based, 4-tier/n-tier distributed applications [2, 3, 4, 5]. There are different types of web applications, which are Static, Dynamic, and Transaction based. Online applications will have multiple web pages accessed via multiple URL links [2]. Each web page will consist of various components such as buttons, text box, text, hyperlinks, images, drop down box, radio buttons etc.

Domain.com is an umbrella for an organization. Domain has classified URL links and Web pages. Each URL link will have both internal and external links, which will point to the applications. Web pages is internal to the application, which will do the specific task for the organization.

URL consists of http://\_URL = "http:" "/" host [":" port] [ abs\_path [ "?" query ] ], http/https is protocol in application layer which connects through domain.com eg: abc.com. It is also called as DNS using IP address. Default port number 80 with web page/link [6]. Application web page URL link complete explanation as follows:  
http://www.mywebsite.com/sj/test?id=8079?name=sviergn&x=true#stuff

Scheme = http

Host = www.mywebsite.com

Path = /sj/test URL

Params = id=8079

Query String = name=sviergn&x=true

Anchor = stuff [14].

Http/Https status codes: status codes with 300, 301, 302, 303, 307 and 308 will represent the source and destination URL redirects. 304 status code not modified and 305 use the proxy are not redirect [6].

URL redirect and URL forwarding are two different functions. URL redirect, user sends request to the server. The server responds with status code as 3xx and contains the target URL of the request. URL link/web page either same or may be pointing to the different URL link. The user will receive response from the server with new url link. List of URL links are extracted using the Web UI utility from the web application, which is deployed in any environment, and application should be available online. (Web application can be developed using any technology) Web UI Utility extracted URL links and components are exported into spreadsheet/database [7].

URL forwarding is different from the URL redirect. URL forwarding, process of simply displays the requested details to the user. This entire process will be carryover from the server side [8]. User sends URL request to the server, which will create a cookie in the local system and these details stored in the DBMS. By using the Wrapper servlet extracting the URL details and cookie details which will have the information about the requested details of the user. URL request is forwarded to the application server, which will point to the original database using API connection [9] [10].

URL redirect, it is technique for creating/updating web pages/url links available in different URL address (Source and Target).

Web based Application has followed to develop using SDLC process, which follows different phases. While developing the application, development team will write code and will be tested that in unit and integration testing by creating Unit test cases and executing them. Unit test cases are automated using the Nunit, Junit tools those test cases are executed to minimize the number of defects in future to reduce the cost of the application [11].

As shown in the Fig (1) web application architecture is divided three stages as Frontend, Middleware and Backend. Frontend is the client where end user invoke the application through web browsers like IE, chrome, Firefox/Mozilla and Safari etc. Middleware has installed with web server like WebLogic, WebSphere and Tomcat etc.

## 2. Literature survey

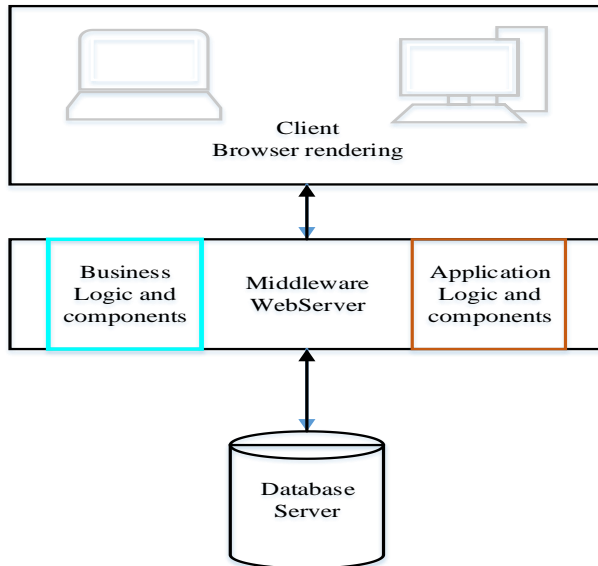


Fig. 1: Architecture of Web Application.

Application and Business logic code is deployed in the web server, which has considered as middleware. Backend has database has installed like oracle, MS Sql server, DB2 software's etc. to access the data of the application. Client/End user access the web application through browser, application components rendering in the frontend [13].

End User Netscaler Gateway Web applications are accessed through the Internet world. Organization will have 'n' number of multiple applications which needs to be secured from the intruders and hackers. In that, NetScaler Gateway and Firewall software were used to provide the security for the data which is available inside the network. These web application needs configuration settings to be set to provide the end users with secure remote access into secure corporate network [14] [15]. Each web application or web service is access by the internal and external consumers based on business requirement. These web applications are deployed in server which has IP address and access through port number, with these two parameters users would be able to access any applications(with valid credentials). There are different techniques used to secure the access through certificates with public and private keys combinations for authentication [16] [17].

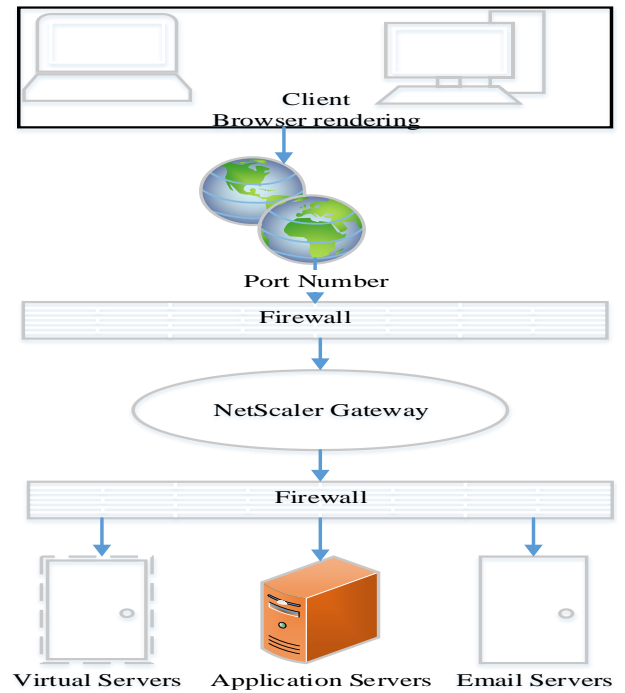


Fig. 2: Architecture of Web Application.

## 3. URL redirect utility evolution

An organization has 'n' number of web applications. Each LOB or portfolio has 'm' web application based on the business functionalities. These list of web applications where linked to the main application. All the web applications in an organization will inter-linked to the main application. These applications has critical URL links/web pages which needs to be validated on regular basis by the testing team to make sure all the URL links are working. IT Project development process will follow Software Development Life Cycle for any application. In that process, testing team needs to validate the URL links in different environments like Development, System(SIT) and User Acceptance(UAT) as well Non-Functional Testing i.e. Performance.

In 'n' Number of applications, 'X' number of critical URL links has been identified by the business team as well URL redirects also listed in the spreadsheet.

Frequency of URL link validation on each iteration i.e. considered 4 weeks per sprint. Each URL link/redirect link validation done by the testing team will take time 't'.

Execution Time for an year by the Testing team:  $T=X*12*t$

To reduce the number of URL link validation in time by using the Macros which has been developed through VBA. However, it is limitations like security [12] execution will be in serial so that execution time will be more. Later, developed a basic Utility to validate both URL links and URL redirect links in series which has took more than 24 hours for one iteration and its limitation is sometimes execution system gets hanged are slow. So we have come up with innovate method of execution using the parallel programming method. Web URL Redirect Utility execution time has reduced to mins i.e. execution time has reduced 99percent.

## 4. Architectural design

The Web URL Redirect Utility architecture is a Web Based application. With the help of GUI utility, extract the URL links of the web application i.e. by using the domain name [7]. Web URL Utility developed using the MVC 5.1, .net 4.5.2 and uses JQuery and bootstrap for UI, as well other assemblies likes Newtonsoft.Json, Microsoft.AspNet.Signalr. The structure of the code created based on the object oriented programming language or

functionality of the program to simplify for future enhancement. As shown in Fig.3 testers will execute the GUI utility to extract the URL links of the web application, which will be stored in database.

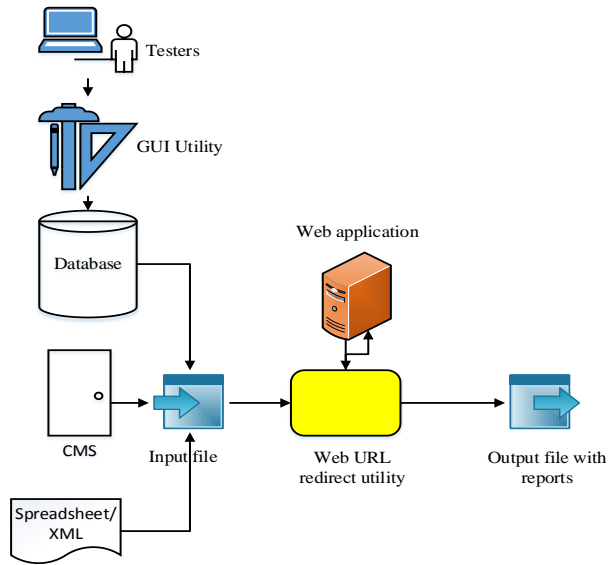


Fig. 3: Architecture of Web URL Redirect Utility.

Browse the input file from the different sources as database table or Spreadsheet or Content Management System (CMS) path for the list of URLs to be executed through URL Redirect Utility. Entire list of URL links, which are available in the database/spreadsheet/xml file, will be executed through the Web URL Redirect Utility.

This Web URL Redirect Utility has greater efficiency in updating the status codes and response time. Speed of the URL execution by the Utility is marvelous because of parallel processing which bulk test data which will be done in less than 10% of the time.

Execution of the URL links would be updated with status details, based on the results, metrics and charts will be generated through Utility for a better understanding to the higher management.

Web URL Redirect Utility will execute those URL links in parallel and generates the different metrics as well in graphical representation as charts. The test result can also be useful for SEO to find the URL that can be optimized.

Pseudo code of algorithm for Macro/Basic Utility

- 1) Start
- 2) Take input URL from Content Management for Database/Spreadsheet/XML files
- 3) Check URL links are greater than 0. If no then go to Step9
- 4) If yes then select environment
- 5) Now execute process.
- 6) Check result is greater than 0. If no then go to Step 9
- 7) If yes Display result
- 8) Display Metrics summary
- 9) Stop

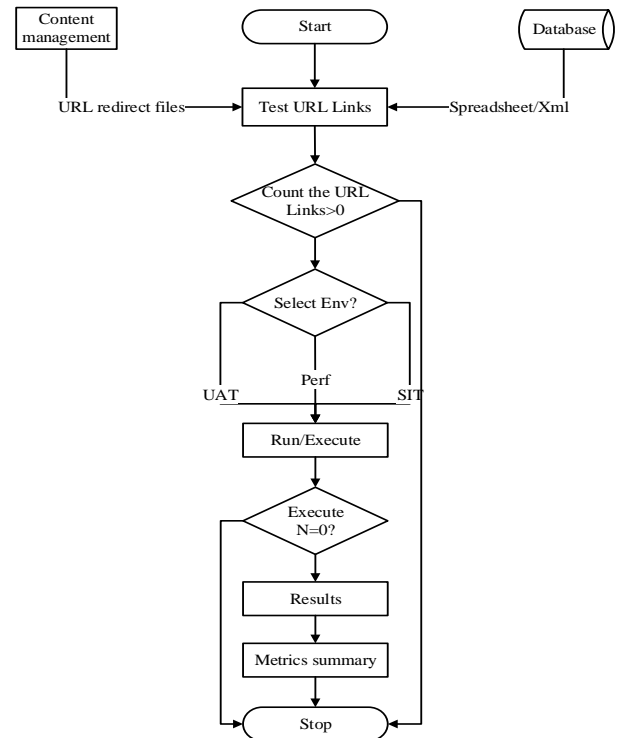


Fig. 4: Flowchart Diagram of URL Redirect Validation Using Macro/Basic Utility.

Pseudo code of algorithm for URL Redirect Utility

- 1) Launch a browser
- 2) Browse "urlredirect-utility.com" to open URL redirect Utility
- 3) Choose an option form the input format to feed the test inputs  
If "XML File" option is selected
- 4) Click on "Choose File" to upload an XML Document with test inputs

From the Environments option, select an environment against which the test should be executed

Go to step five

Else if "Database" option is selected

Input the Server name where the test data resides

Input the Table Name in the server

Input the Username to connect to the database

Input the password to connect to the database

From the Environments option, select an environment against which the test should be executed

Go to step

Else if "Spreadsheet" option is selected

Click on "Choose File" to upload an Excel Document with test inputs

From the Environments option, select an environment against which the test should be executed

Go to step [5]

Else if "Content management" option is selected

Input the CMurl to connect to the content manager server

Input the Pathofile in the CMS that has the test inputs

Input the Username to connect to the CMS

Input the password to connect to the CMS

From the Environments option, select an environment against which the test should be executed

Go to step five

Else

Go to step three

- 5) Click the "Execute" button to start the test.

- 6) Parse the input data from step 4

If parsing fails

Go to stop

- 7) Declare the variables n=0, N - total number of urls, RedirectHistory - Dictionary to store test result, StatusCode - Http/Https status code for the Http/Https Webresponse
  - 8) The parsed input looped and executed in parallel.
- If n<N-1 Create a HTTPWebRequest using the current URL  
 Get the HttpWebresponse from HttpWebRequest  
 Use Stopwatch to measure the Request timing  
 While StatusCode! = 200  
 Create a new HttpWebRequest using the URI, Host and Schema from HttpWebresponse and declare as newHttpwebRequest  
 Get the new HttpWebresponse from newHttpwebRequest and declare as newHttpwebresponse  
 Overwrite StatusCode with the status code from newHttpwebresponse  
 Use StopWatch to measure the Request timing  
 Add the results to RedirectHistory as New Internal Redirects

n = n+1

- 9) Final test results and metrics are prepared
- 10) The results are rendered on JqGrid on the browser.
- 11) If "Abort" button in browser id clicked between step 5-10 Go to stop
- 12) Click on "Export" button to Export the results in an Excel
- 13) Stop

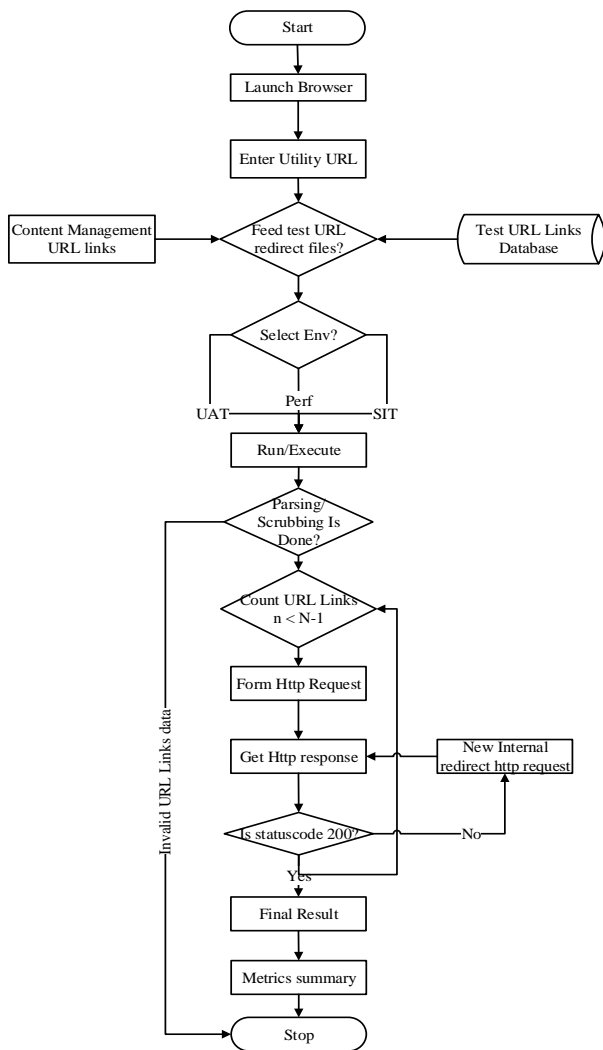


Fig. 5: Flowchart of URL Redirect Utility.

### 5. Web URL redirect macro

Macros are developed using the VBA code in Excel. Through macros URL requests are executed by passing the excel file as input and generated the test result in output file.

Input Spreadsheet file format consists for Domain Name, URL Link, Redirection Path, Expected URL, Indirect URL status and Direct URL status, Actual URL and Result.

Domain	URL Link	Redirection Path	Expected	Indirect	Direct	Actual	Redirected	URL	Result
Test.com	http://www.Test.co/								
Test.com	http://www.Test.co/insurance-plan-quotes/	AOALanding?SANID=1374646&isMarketpointAgent=true							
Test.com	http://www.Test.co/	http://response.Test.com/Your-Test-Sales-Representative/AbbieHundtLL8B20?cm							
Test.com	http://www.Test.co/insurance-plan-quotes/	AOALanding?SANID=1462698&isMarketpointAgent=true							
Test.com	http://www.Test.co/	about/company-profile/							
Test.com	http://www.Test.co/	accessibility-resources							
Test.com	http://www.Test.co/	about/careers/							
Test.com	http://www.Test.co/	http://apps.Test.com/marketing/documents.asp?file=2356731							
Test.com	http://www.Test.co/	http://apps.Test.com/marketing/documents.asp?file=2614638							
Test.com	http://www.Test.co/	http://apps.Test.com/marketing/documents.asp?file=2356991							
Test.com	http://www.Test.co/	accessibility-resources							

Fig. 6: Input Test Template of Macro.

Output file format as similar as input spreadsheet file.

Domain	URL Link	Redirection Path	Expected	Indirect	Direct	Actual	Redirected	URL	Result
Test.com	http://www.Test.co/	http://apps.Test.com/marketing/	301 - Mov	200 - OK		http://apps.Test.com/Pass			
Test.com	http://www.Test.co/	https://closethegap.Test.com/20	301 - Mov	200 - OK		https://closethegap.T Pass			
Test.com	http://www.Test.co/	https://www.marketplace.Test.co	200 - OK	200 - OK		https://www.marketq Pass			
Test.com	http://www.Test.co/		301 - Mov	200 - OK		https://www.Test.cor Pass			
Test.com	http://www.Test.co/	insurance-plan-quotes/AOALan	301 - Mov	200 - OK		https://www.Test.cor Fail			
Test.com	http://www.Test.co/	http://response.Test.com/Your-T	301 - Mov	200 - OK		http://response.Test. Pass			
Test.com	http://www.Test.co/	insurance-plan-quotes/AOALan	301 - Mov	200 - OK		https://www.Test.cor Fail			
Test.com	http://www.Test.co/	about/company-profile/	301 - Mov	200 - OK		https://www.Test.cor Pass			

Fig. 7: Output Testresult of Macro.

Macro's has limitations as Security, performance metrics, unable to collect other details for each URL and execution time will be more than 58 hours.

Web URL Redirect basic utility  
 Basic Utility

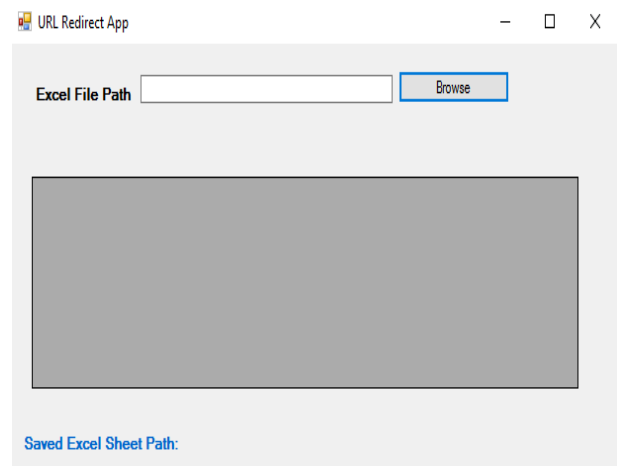


Fig. 8: Input Test Template of Basic Utility.

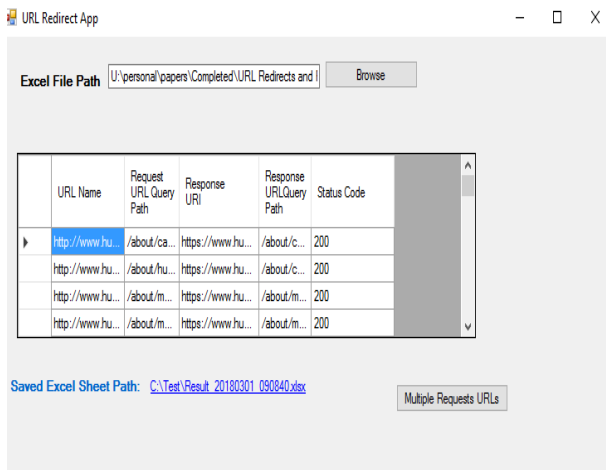


Fig.9: Output Test Result of Basic Utility.

Basic Utility has limitations as Unabel to collect perfomance metrics and execution time will be taking more than 38 hours.

## 6. Web URL redirect utility

### 6.1. Steps to execute web URL redirect utility

- 1) Enter the Web URL Redirect utility domain name
- 2) Browse the List of URL redirect links in XML format.
- 3) Select the Environment which Tester planning to execute
- 4) Click on Execute button which will load the XML file and execute the list
- 5) Web URL Redirect Utility validates the status of the each URL link and provides the details as number of hops, response time; In-direct URL link path details and success or failure of the each link.
- 6) Web URL Redirect Utility will provide the details of the metrics and generates reports for analysis.

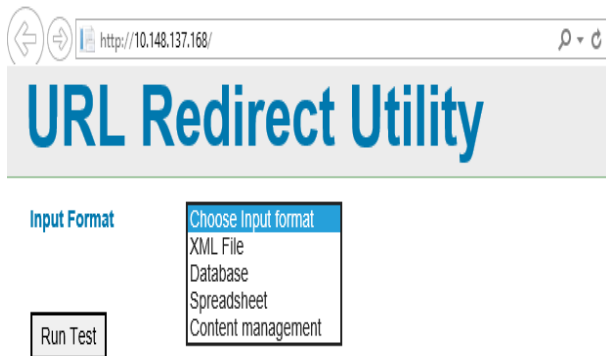


Fig. 10: Web URL Redirect Utility Input Types

As shown in the fig 6. URL Redirect Utility, process the input URLs through different paths like XML File, Database, Spreadsheet and Content Management System.

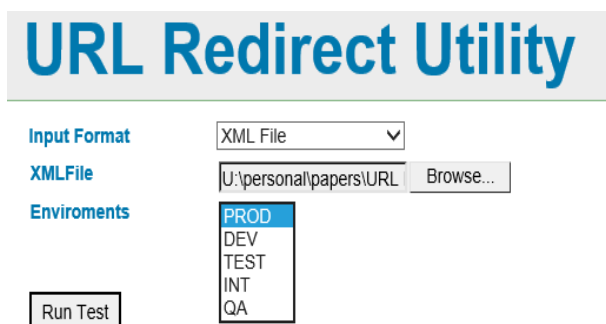


Fig. 11: Web URL Redirect Utility Input as XML File.

URL Redirect Utility, Considered XML file as input file browse the path of the XML file. Select the environment to execute the URLs listed in the XML file as in fig 7.



Fig. 12: Web URL Redirect Utility Input as CMS Path.

Considered Content Management System (CMS), Input the CMurl to connect to the content manager server, Pathtofile in the CMS, Valid credentials of the server username and password to connect to the CMS. As well, Environments option to be selected for execute.

### 6.1.1. The features of the URL redirect utility are as follows

- 1) Web Application, which can be accessed throughout intra-net.
- 2) Accepts multiple input formats
- 3) Environment on which the testing is performed.
- 4) Dynamic Progress message which tells the current pgress
- 5) Various parameters tracked for each test.
- 6) Generate the customized dashboard

The Input parameters are

- 1) Source URL
- 2) Expected URL
- 3) Domain Name

The Output parameters are

- 1) Domain – displays the domain name of URL under test
- 2) Source URL – displays the test URL list
- 3) Expected URL – Expected URL will be shown
- 4) Target URL – Actual/Target URL will be loaded for the source URL
- 5) Total Timespan (msec) – Response time taken to validate individual URL
- 6) Redirect Counts – displays the total server hits involved to load the final/expected URL[Minimum is better]
- 7) Http Status – displays the Final Http Status code [200,301,302,404,500 etc.]
- 8) Status – displays the test result in Pass/Fail
- 9) Internal Redirect – displays the entire URL redirect process involved to arrive at the final URL

Additional Features are explained in the below section.

- 1) Failed test results are highlighted in red for easy identification.
- 2) Filters applied on the results displayed on the screen based on the requirement.
- 3) Displays the total execution time taken to complete.
- 4) Export the summary results into spreadsheet.

Once the execution process starts the list of all the valid and invalid URLs are displayed, as well as the time it takes for the page to get loaded as shown in fig 9. Execution times are also displayed once the complete URLs are extracted.

Domain Name	Source URL	Expected URL	Target URL	Total Time	Redirect	Http Status	Status
test.com	http://www.hu/about/test-in/bx/4117-sou	https://www.test.com/about/537	https://www.test.com/about/537	3	X	200	Pass
test.com	http://www.hu/learning-center/health-anc	https://www.test.com/preve/577	https://www.test.com/preve/577	5	X	200	Fail
test.com	http://www.hu/about/company-profile/	https://www.test.com/about/597	https://www.test.com/about/597	3	X	200	Pass
test.com	http://www.hu/about/company-profile/	https://www.test.com/about/601	https://www.test.com/about/601	3	X	200	Pass

Fig. 13: Web URL Redirect Utility Output File with Parameters

Test Result of URL link with [5] hops (internal redirect)

Internal Redirect Set 1

{FromURL- http://www.test.com/100daydash/,ToURL- https://www.test.com/100daydash/,StatusCode- 301, Time Taken- 22ms};

Internal Redirect Set 2

{FromURL-https://www.test.com/100daydash/, To URL- http://www.test.com/ads/100-day-dash,StatusCode- 301,TimeTaken- 280ms};

Internal Redirect Set 3

{FromURL-http://www.test.com/ads/100-day-dash, To URL- https://www.test.com/ads/100-day-dash,StatusCode- 301, Time Taken- 10ms};

Internal Redirect Set 4

{FromURL-https://www.test.com/ads/100-day-dash, To URL- https://www.test.com/404?ItemNotFound&item=%2fads%2f100-day-dash&user=extranet%5cAnonymous&site=test\_com,StatusCode- 302, Time Taken- 35ms};

Internal Redirect Set 5

{FromURL- https://www.test.com/404?ItemNotFound&item=%2fads%2f100-day-dash&user=extranet%5cAnonymous&site=test\_com, To URL- https://www.test.com/404?ItemNotFound&item=%2fads%2f100-day-dash&user=extranet%5cAnonymous&site=test\_com,StatusCode- 404, Time Taken- 35ms}

Table 1: Comparison between Macros, Basic and Advanced Utilities of the Features

Description	Macros	Basic Utility	Advanced Utility
Input File Types	Spreadsheet	Spreadsheet/Xml/Text	CMS/XMI/Database Table/Spreadsheet
Number of Hops	NA	NA	1-5
Output Files Types	Spreadsheet	Spreadsheet	Spreadsheet/XML

Three Utilities compared between the input, number of hops and output file types as shown in table 1. Macros and Basic Utility version is designed and developed using VBA Macros and dotnet. Macros are executed on the existing spreadsheet which will be input file and output file will be created as instance as well generated on the same file. As per Symantic systems, security is concern because the VBA macros [12].

Basic dotnet Utility is used executed the n number of URL links with two different format input file systems like spreadsheet and XML files. Basic Utility execution will be in synchronous call, so the execution time was too high.

Web URL Redirect Link Utility is developed with new technologies and more user friendly and even business users are used for validating the URL links. It is easy to execute the Utility in any environment like Development, System, and Acceptance in way that is more efficient.

Table 2: Comparison between Macros, Basic and Adavnced Utilities on Performance

Environment	Number of URL links	Sequential Execution Time	Parallel Execution Time
Development	8801	22.98 hrs.	21min 39sec
System Integration	8801	26.46 hrs.	9min 44.4sec
User Acceptance	8801	38.57 hrs.	11min 13.8sec

Development Environment: Average response time for each link based on the calculation is 11.25289 sec.

System Integration Environment: Average response time for each link based on the calculation is 11.25289 sec.

User Acceptance Environment: Average response time for each link based on the calculation is 15.776 sec.

Once the execution is completed and all the URLs are extracted successfully through export button the data into Excel sheet.

Analysis findings

When the execution is complete, the result is displayed. The execution metrics is shown as summary report in bar chart as fig 14.

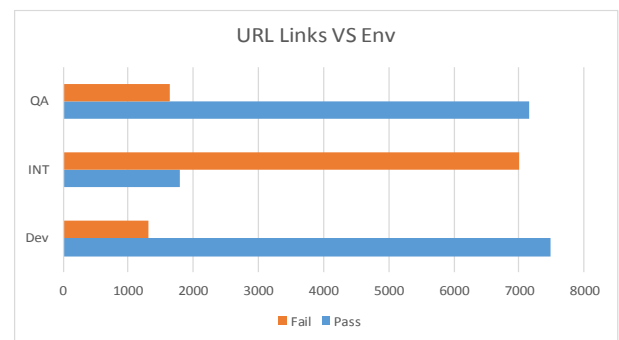


Fig. 14: List of URL links vs Environments.

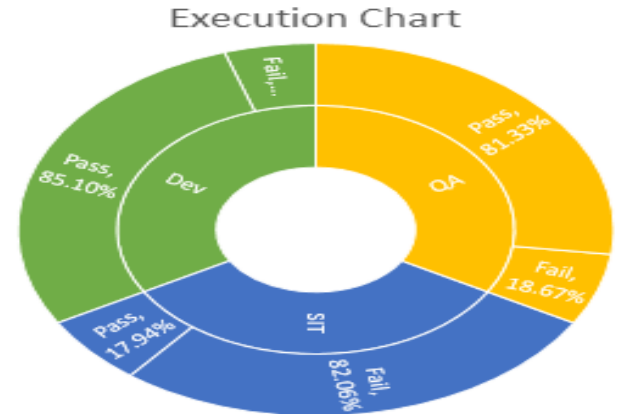


Fig. 15: Execution Status of URL Links.

Similarly, to the fig 14 the execution URL link status in the different environments is shown in the Fig 15. Which explains in detailed view with percentage values.

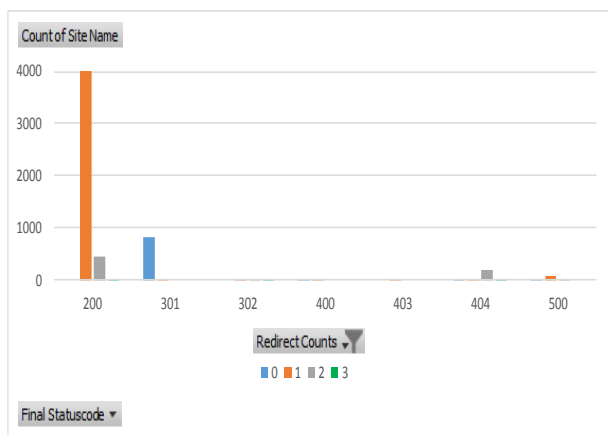


Fig. 16: Redirect Count vs Status Code.

A bar chart is created based on the analyzed the data as follows in the fig 16. In this number of hops has been identified for each URL link and its status code.

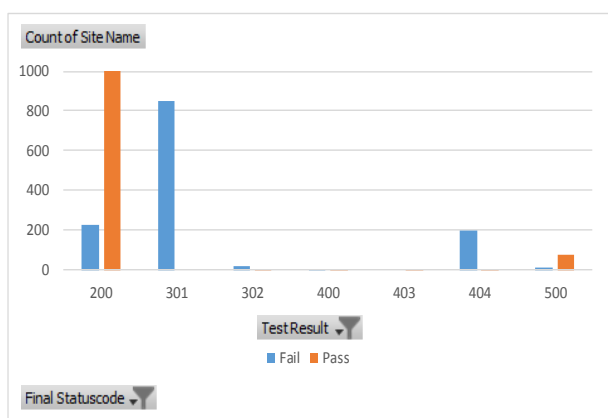


Fig. 17: Status Code vs URL Links.

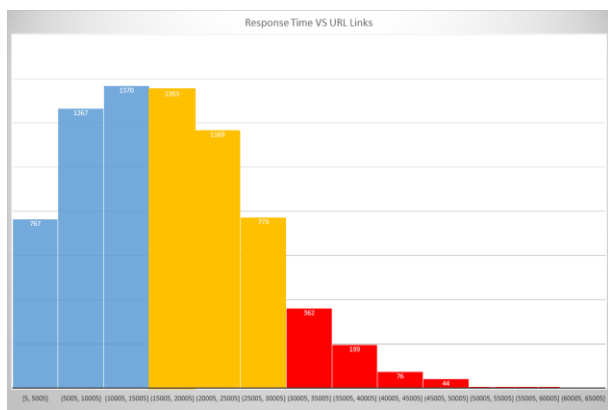


Fig. 18: Response Time vs URLS.

Number of URL links: 8801  
 Sequentially executed time in Dev/QA environments will take 22.98 hrs.  
 Parallel execution will take only 21.39 msec.  
 Based on the fig 18, URL redirect utility identifies the bottle neck URLS which needs analysis and take necessary actions to fix it by the concern teams. As shown in the Fig 18 three legendary colors are represented as blue, yellow and red. In that, red color URL link response time is too much due to various factors which needs the fix.

### Acknowledgement

We like to say thanks to the people who has supported us directly/ in-directly in sharing the information and reviewing the paper.

### 7. Conclusion

URL Redirect Utility executes the URL links from the input file in parallel process so that execution/validation time will be reduced drastically which is almost 99%. Validation of the URL redirect to find the number of hops, Response time and reason for down of the link will shared in the report.  
 Based on the test execution result from the Utility, Charts are generated which will display the performance bottleneck URLS, Response time, Most hops, Broken/Invalid URL links.  
 Generated customized reports are shared with the concern team manager for further recommendations to rectify the URL links which are taking more number of hops and delay in response time.

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