Identifying the Efficiency of OpenID By Simulation Design

Lung-Hsing Kuo, Fong-Ching Su, Hung-Jen Yang

***Abstract*—**Fruitful on-line learning resources had been promoted since 1998 in Taiwan. The purpose of this study was to identify the OpenID service efficiency of on-line learning servers. The key concept of OpenID is to manage only one ID for user convenience. The account circulation performance should be maintain equally, otherwise, the on-line learning resources supported by different servers might be chosen under biased ways. There were three service selected for evaluation. Those service are supported by the government funding and the ministry of education promotes those sides to our young leaners. By simulating design the HTTP requests generated by multiple simultaneous users, the OpenID service performance under normal loads to collect data for statistical procedure, one-way ANOVA. It was found that there exists significant OpenID efficiency difference among servers. It was concluded that on-line learning entry experience might be twisted, learners might not choose on-line learning resources freely, and on-line resource chosen behavior might be affected by the OpenID performance.

***Keywords*—**simulation design; efficiency of OpenID; On-line Learning resource

I. INTRODUCTION

The world's first large-scale on-line learning program launched in Canada in 2008. The United States three major MOOC (massive open on-line course) institutions, including edX, Coursera, Udacity were established in 2012[1]. The Ministry of Education in Taiwan has promoted the integration of cloud learning resources and services project in the campus cloud environment construction project in accordance with the 2012 Education Cloud Application and Platform Services. In 2014, the establishment of education cloud portal, the integration of county (city) government, subordinate organizations (institutions), universities and civil and other digital resources and services[2].

There were many on-line learning resources in Taiwan and services should be used fairly. This study analyze account circulation technology, the status of education units, learning materials more abundant development including protocol times for all users, server and user bandwidth, transferred data, system memory, cup load, average click time. Which into the average click time for SPSS statistical analysis.

In theory, using OpenID have the same performance. In Practice, free choice behavior is changed, websites of efficiency were still significant difference.

A. Background and Motivation

Information and Communication Technology (ICT) has become a cornerstone for social and cultural development, creating a revolutionary impact on future learning trends.

ICT has significantly enhanced the quality and quantity of learning tools, which, in turn, have brought about improvements in many areas of education, including innovation in teaching and learning methods, increases in accessible and user-friendly learning resources, and greater feasibility for ubiquitous learning approaches. To take advantage of the opportunities provided by such changes, many countries are actively designing masterplans or white papers on the role of ICT in education, which are intended to serve as roadmaps and guidelines for policy makers, local educational agencies, school leaders, and education practitioners. The ultimate goal of these plans is to empower students to use ICT effectively in learning and problem-solving and to foster students' positive attitudes and behaviors towards ICT use[3].

Internet Information Services (Online Resources and Database) The Ministry of Education has set up an international education internet information services platform for resource sharing and exchange with regards to[4]:

- information exchange and communication
- a public channel for updates relating to international education policies and information
- a global information pool
- an international education database
- an NGO and private organization international education network
- a communication website regarding e-learning and long-distance communication for schools, teachers and administrators, which will serve as a global community platform

MOE announced the Implementation Regulations Regarding Distance Learning by Universities to loosen the total number of e-learning credits to half of the credits required for graduation, and to allow particular college and university departments to

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trial master's programs using e-learning by 2006[5].

- 86 colleges and universities implemented Distance Learning Courses, with 1,300 e-learning curriculums gave in one academic year, and 102,000 students enrolled.
- MOE holding different kinds of training courses to enhance teachers' e-learning teaching ability.
- Encourage colleges and universities to share teaching resources. By the end of 2011, 704 open course wares given with 27 schools.

Taiwan's Ministry of Education had set up many on-line learning resources for learning. Under education policy and environment ambience, teachers began to make extensive use of on-line resources to guide students to learn. Multiple learning sites require more than one account and account management difficulties affect students' willingness to use. Account integration circulation problems and identifying the efficiency of OpenID used on-line learning are urgently needed to be resolved. Contains account circulation technology, the status of education units and learning materials more abundant development understand on-line Education Software in Taiwan.

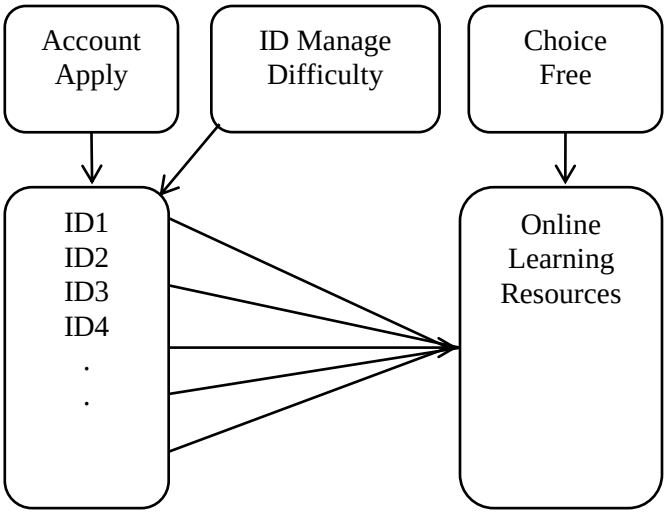

Fig. 1 Account management

Taiwan's Ministry of Education has installed the OpenID mechanism in 22 counties and cities in Taiwan[6]. OpenID is an open standard and decentralized authentication protocol. Promoted by the non-profit OpenID Foundation, it allows users to be authenticated by co-operating sites (known as Relying Parties or RP) using a third party service, eliminating the need for webmasters to provide their own ad hoc login systems, and allowing users to log into multiple unrelated websites without having to have a separate identity and password for each[7].

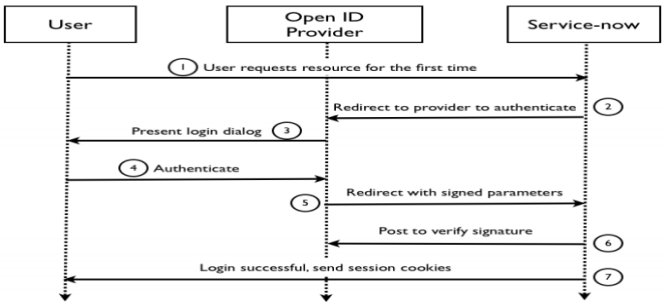

Fig. 7 How OpenID works
Source: OpenID Service Counseling Advisory Team

Identify the efficiency of OpenID use on-line learning in Taiwan for study topics, education cloud to provide seven categories (learning shot, education market, education encyclopedia, education media audio and video, teaching treasure, campus e-mail) and other 32 applications. Those study were cloud-assisted teaching, in pre-class, class, after school, to create an unrestricted learning garden for students to have a direct correlation [8].

It was mentioned that the OpenID main concept is to minimize a number of identities the user manages. The OpenID chooses a URL to uniquely identify a web user. This means that the user was aware of the resources. Also, this means the end users involved in the authentication mechanism [9]. OpenID is one of the ways to implement Single Sign-On technology. Single Sign-On is the user with a set of account password, you can quickly log on multiple site systems. OpenID can solve the user in the use of different services, and then enter the account password and other authentication information, the site-based certification agreement, applicable to the network services.

B. Research Goal

The goal of this study was to identify the OpenID efficiency of selected on-line learning resources under following scenario.

1. Three targeted Open ID services of on-line learning resource
2. The evaluation would conducted from school field
3. By simulating the OpenID requests generated by thirty simultaneous users

C. Research Concept

Although online resources developed and promoted, the on-line learning required user with account for record. Although most learners believe in ICT enhanced their learning, they are stopped by or met bottle neck by account applying.

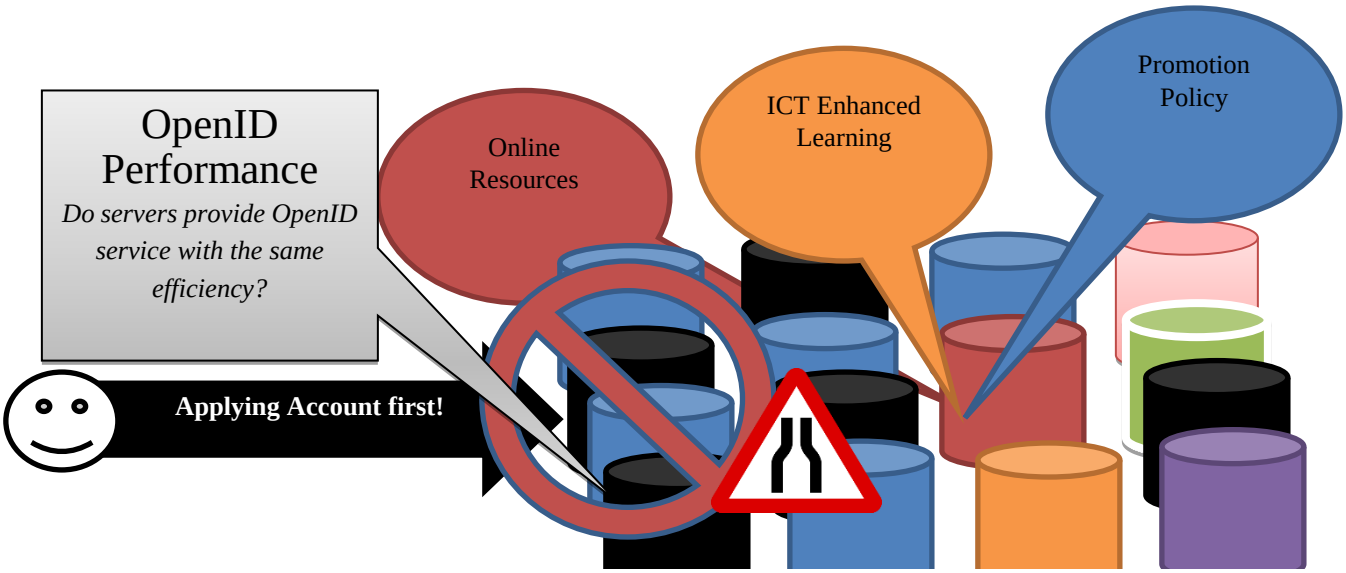

Fig. 8 Research concept

For response to the research goal, the research problem of this study was presented: Whether the OpenID efficiency of selected on-line learning resource are the same? In Fig. 3, the concept of research was illustrated.

II. Methodology

This study was conducted by a simulation experiment design. The purpose of this study was to identify the efficiency of OpenID used on-line learning in Taiwan. The research framework, research procedure, research object, research tools, and research data process would be presented in the following sections.

A. Research Framework

In this study, efficiency is the dependent variable. The independent variable is selected OpenID service web site. In Fig. 4. Research framework is presented.

Dependent Variable	Independent Variable
Sites of On-line resource (3)	Performance evaluation: average click time (ms) Transfer volume (Bytes) Speed (Kbit/s)

Fig. 4 Study Framework diagram

B. Simulation Design

For reach the research goal, the research was conducted by three major procedures. In the first procedure, the simulation experiment design would be identified and created in a selected campus. For eliminate extra noise, all thirty users were simulated on one computer and then accessing the OpenId service simultaneously. Simulation experiment design can be broken down into several activities, the simulation design flow chart is shown in Fig.5

In the second procedure, the simulating OpenID service requests generated by multiple simultaneous users, the OpenID service performance under normal loads to collect data for the next procedure.

In the third procedure, those collected data would be analyzed by using one-way ANOVA to test the mean difference.

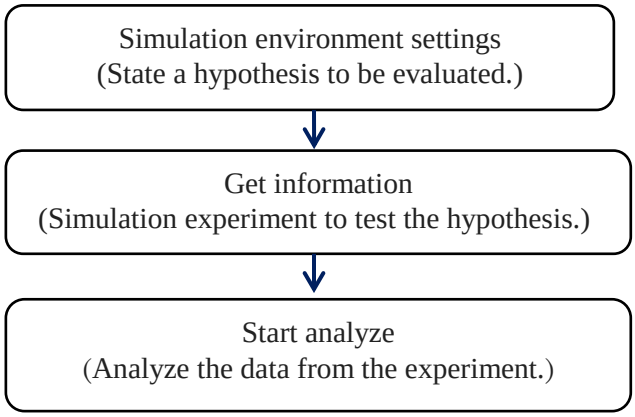

Fig. 5 Simulation flow chart

C. Research Population and Sampling

The purpose of this study to identify the OpenID service efficiency of on-line learning servers. The population of this study would be those on-line learning service servers which provides OpenID account circulation function. Based upon reality purpose, the most promoted on-line learning recourses by junior high school in Taiwan were selected. The purposively sampling procedure was adopted in this study. Selected service were e-game, dr-go and reader-quiz websites. The importance of three websites would be reported in the followings according

to their learning functions.

e-game: Exploring Computational Thinking (ECT) is a curated collection of lesson plans, videos, and other resources on computational thinking (CT). This site was created to provide a better understanding of CT for educators and administrators, and to support those who want to integrate CT into their own classroom content, teaching practice, and learning[10].

dr-go: Assist teachers and parents accompanied students learning platform, this learning platform provided students with learning backwardness and learning difficulties to be remedied, and lack of motivation for students to learn independently[11].

reader-quiz: This learning platform improved students' reading ability, you can use the direct online assessment after reading, class and students will compete with each other[12]. (http://happyread.kh.edu./readerquiz/)

D.Research Tools

In this study, two different kinds of tool were applied for both service simulation purpose and data processing purpose. Both tools would be reported in the followings.

Table 1
Simulation environment settings

Item	Description	Study set
Time	tests that run for a specified number of minutes.	
Number of Users	Webserver Stress Tool should simulate. This is the number of users that simultaneously use your website	30 users
Click Delay	you have to enter the Click Delay time for the simulated users. The lower the delay time between clicks, the greater the level of stress on your webserver.	20 seconds

The purpose of a stress test is to estimate the maximum load that the OpenID server can support. Webserver Stress Tool can explore the traffic thresholds of OpenID web server and how it will respond after exceeding its threshold. The simulation would be based on estimated load of 30 users and clicking the OpenID link every 20 seconds to 90 page views/minute (to 5,400 page views/hour). The number of students selected is based on the maxima students in a class[13].

In Table 1, the simulation environment settings are listed.

E. Data Processing

One-way ANOVA procedure was applied in this study. The SPSS statistical software package was used. The One-Way ANOVA procedure could be used to test the hypothesis that the means of two or more groups are not significantly different.

One-Way ANOVA also offers:

- Group-level statistics for the dependent variable
- A test of variance equality
- A plot of group means
- Range tests, pairwise multiple comparisons, and contrasts, to describe the nature of the group differences

The null hypothesis will be that all population means are equal, the alternative hypothesis is that at least one mean is different.

- H0: $\mu1 = \mu2 = \mu3$
- H1: Means are not all equal.

First, descriptive statistics were computed. Next, Analysis of was calculated. This paper mainly discusses the relationship between the Dependent variable of the continuous data type and the independent variable of the type data type .

(1).SST（total sum of squares），$SST = \sum(Xi - X)2$

(2).SSW (sum of squares within) ，$SSW = \sum(Xi - Xk)2$

(3).SSB (sum of squares between) ，$SSB = \sum Nk(Xk - X)2$

(4).Post Hoc test，The number of samples in each group is the same Use LSD or Tukey test

Table2 N, Mean, Std. Deviation, & Std. Error of Avg. Click Time, Bytes, & Kbit/s for all three selected server

		N	Mean	Std. Deviation	Std. Error
Avg. Click Time (ms)	E-game	30	4.0000	.00000	.00000
	Dr. Go	30	4.0000	.00000	.00000
	Reader Quiz	30	3.9000	.30513	.05571
	Total	90	3.9667	.18051	.01903
Bytes	E-game	30	39.8667	39.05587	7.13059
	Dr. Go	30	41.3333	40.80005	7.44904
	Reader Quiz	30	40.9667	40.13467	7.32756
	Total	90	40.7222	39.55625	4.16960
Kbit/s	E-game	30	3730.4967	2845.88600	519.58532
	Dr. Go	30	3633.6130	2692.02622	491.49449
	Reader Quiz	30	3664.3797	2747.27912	501.58225
	Total	90	3676.1631	2731.55073	287.93073

III. FINDINGS

In this section, statistical procedure results would be reported according to both descriptive statistics, and verification statistics.

A. Descriptive Statistics

The service efficiency was evaluated by three value, Avg. click time in ms, Bytes, and Kbit/s.

In Table 2, N, Mean, Std. Deviation, & Std. Error are listed

for each efficiency value according to three servers, E-game, Dr. Go, and Reader Quiz.

In Table 3, confidence interval for mean, minimum & maximum are listed for each efficiency value according to three servers, E-game, Dr. Go, and Reader Quiz.

Table 3 Confidence interval for mean, minimum, & Maximum of Avg. Click Time, Bytes, & kbit/s for all three selected server

		95% Confidence Interval for Mean			
		Lower Bound	Upper Bound	Minimum	Maximum
Avg. Click Time (ms)	E-game	4.0000	4.0000	4.00	4.00
	Dr. Go	4.0000	4.0000	4.00	4.00
	Reader Quiz	3.7861	4.0139	3.00	4.00
	Total	3.9289	4.0045	3.00	4.00
Bytes	E-game	25.2830	54.4504	10.00	103.00
	Dr. Go	26.0983	56.5683	10.00	105.00
	Reader Quiz	25.9801	55.9532	10.00	104.00
	Total	32.4373	49.0071	10.00	105.00
Kbit/s	E-game	2667.8254	4793.1680	474.15	8481.11
	Dr. Go	2628.3939	4638.8321	318.34	7614.68
	Reader Quiz	2638.5288	4690.2305	444.04	7587.75
	Total	3104.0509	4248.2753	318.34	8481.11

In Fig. 6, protocol times were presented. An HTTP request consists of several stages. First, the webserver name has to be resolved into an IP address using DNS (Time for DNS), then an IP port is opened on the server by the client to send the request header (Time to Connect). The server then answers the request (Time to First Byte) and sends all data. When all data is transferred, the request is finished (Click Time).

Also in this graph a line is shown for the "time for local socket" which is the time that simulation Tool needed to acquire an open socket from the IP stack of the machine it runs on. x –axis showed time start of test(s), y –axis showed time (ms). Red line indicated click time, green line indicated time to first byte, gray line indicated time to connect, blue line indicated click for DNS, orange line indicated click time for local socket.

For usual test this value should always be in the Webserver Testing Using Webserver Stress Tool Analyzing Graphical Results The average value of these five readings are displayed in this graph:

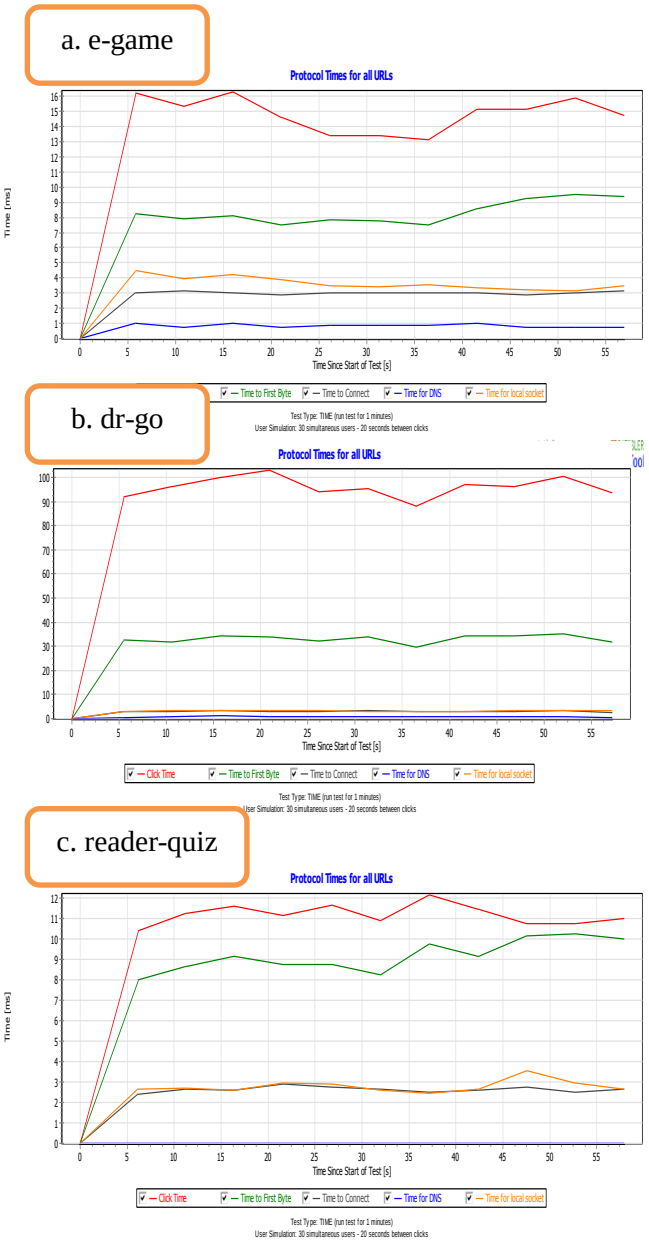

Fig. 6 protocol times for all users

In Fig. 6, the bandwidth of server and users were illustrated. The graph displays the bandwidth the server was able to deliver (as a total) as well as the average bandwidth that was experienced by the simulated users, x –axis showed time start of test(s), y –axis showed Blue line indicated server bandwidth(Kbit/s) and Red line indicated average user bandwidth(Kbit/s) . In this graph we can see that the average bandwidth available. In the 30 users login test, dr-go website site and user bandwidth performance is the best. Reader-quiz and e-game website site and user bandwidth performance is the worst.

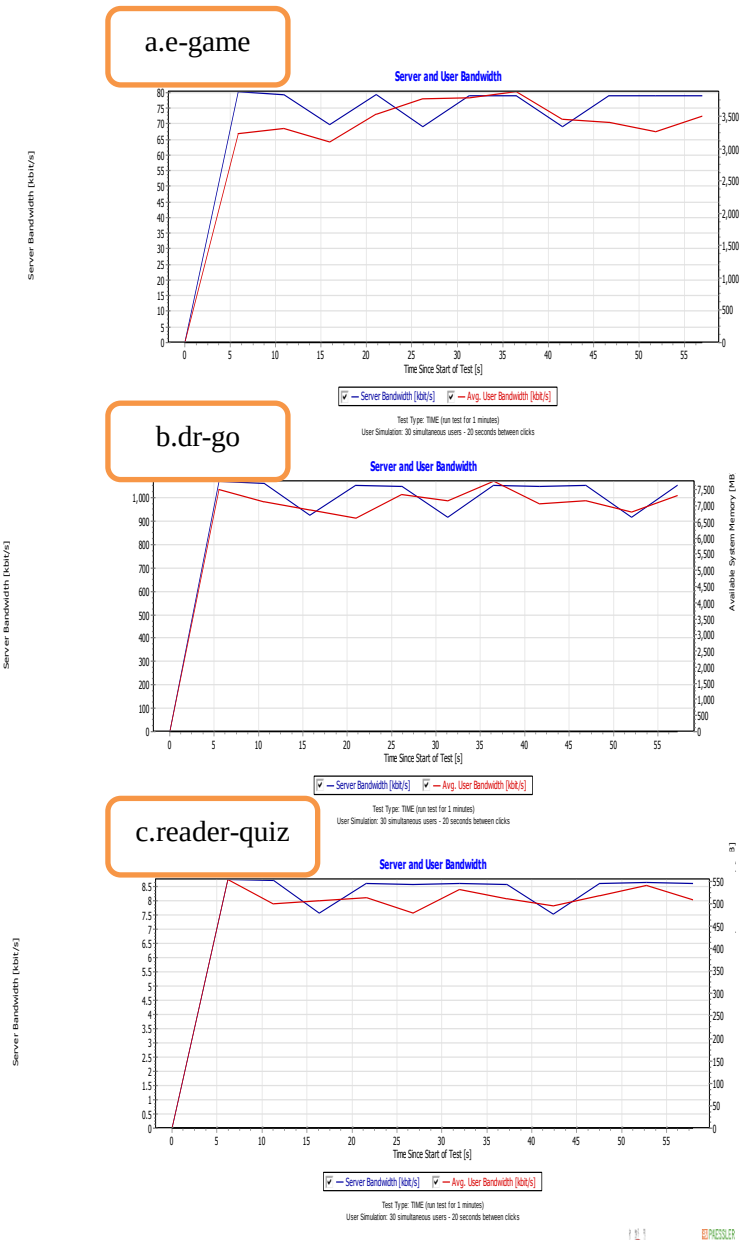

Fig. 7 server and user bandwidth

In Fig. 8, the transferred data, system memory and cpu load were illustrated. For this last graph Webserver Stress Tool constantly measures vital parameters of the machine it runs on. It can be helpful to find out if the limits of the test client have been reached.

Especially the line for the CPU Load (pink) should be well below 100%. If you constantly hit values above 90% for the CPU load the test results may be incorrect. Also the network traffic (blue line) should be below the physical limits of your connection to the server, x –axis showed time start of test(s), y –axis showed Blue line indicated transferred data (Kbit/s),Red line indicated available system memory(MB) and pink line indicated local cpu load(%) . In this graph we can see that. In the 30-user login test, dr-go website transferred data the best, reader-quiz e-game site transferred data the worst performance.

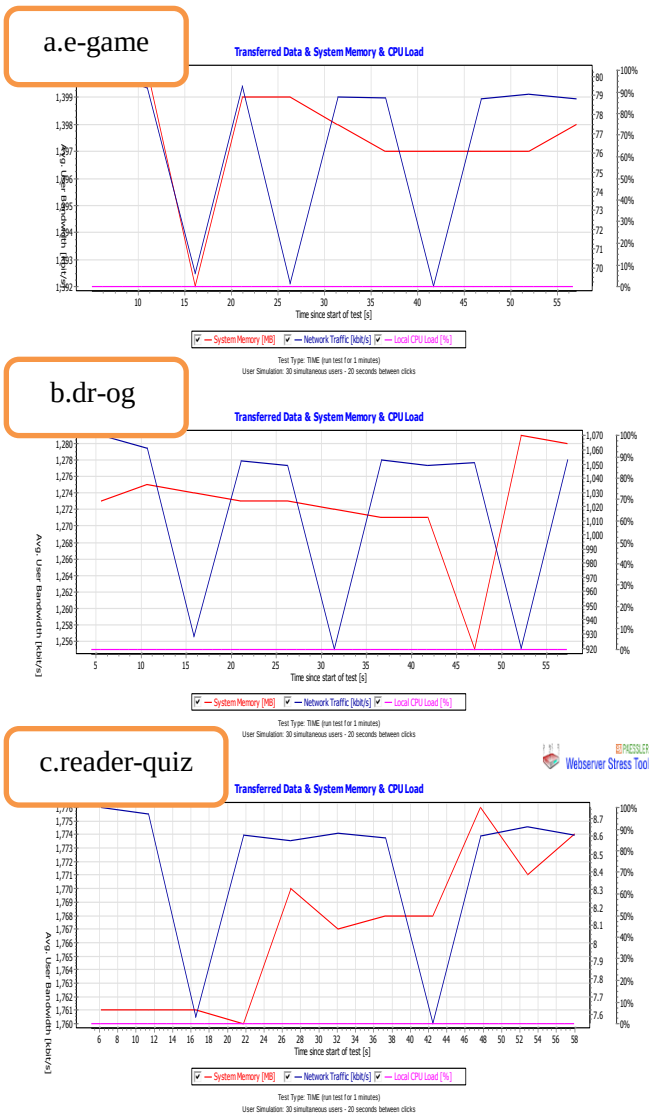

Fig. 8 transferred data, system memory and cpu load

B. Verification statistics

In this section, statistical test results would be report. The efficiency of OpenId would be evaluated based on Avg. click time in ms, Bytes, and Kbit/s according to different on-line service.

One-way ANOVA procedure was conducted for testing the mean difference. In Table 4, the significant level of Avg. Click is 0.045, <0.05; the significant level of Bytes is 0.989, >.05; the significant level of Kbit/s is 0.990, >.05. It was concluded that there exists significant efficiency of Avg. Click Time mean difference among servers. Also, there exist no significant efficiency of both Bytes and Kbits mean difference among servers.

Table 4 ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Avg. Click Time (ms)	Between Groups	.200	2	.100	3.222	.045
	Within Groups	2.700	87	.031		
	Total	2.900	89			
Bytes	Between Groups	34.956	2	17.478	.011	.989
	Within Groups	139223.100	87	1600.266		
	Total	139258.056	89			
Kbit/s	Between Groups	147044.903	2	73522.452	.010	.990
	Within Groups	663914830.868	87	7631204.953		
	Total	664061875.771	89			

For further exploring the difference, a LSD Post hoc multiple comparison procedure was conducted. In Table 4, Avg. Click Time were paired for comparisons. There was found that two pairs are with significant level less than 0.05. Those pairs are both Reader Quiz-E-game and Reader Quiz-Dr. Go.

Table 5 LSD post hoc multiple comparisons

Dependent Variable	(I) Service	(J) Service	Mean Difference (I-J)	Std. Error	Sig.
Avg. Click Time (ms)	E-game	Dr. Go	.00000	.04549	1.000
		Reader Quiz	.10000*	.04549	.031
	Dr. Go	E-game	.00000	.04549	1.000
		Reader Quiz	.10000*	.04549	.031
	Reader Quiz	E-game	-.10000*	.04549	.031
		Dr. Go	-.10000*	.04549	.031

IV. Conclusions and Suggestion

In the previous finding section, the efficiency of OpenID service exists significant difference among three selected on-line learning service. Based upon finding and research background, conclusions would be drawn from and reported in the following section. According to the efficiency difference, three major conclusion were reported.

A. Open-ID favor on-line resource

From the no difference evidence of transfer volume efficiency and transfer speed efficiency, OpenID service firmly provides physical quality for users. Based upon literature, on-line learning resource servers in Taiwan all provide OpenID interface for user. This is the evidence of OpenId must supporting on-line resource.

B. twisted on-line learning experience

Free choices behaviors have changed, some on-line learning resources need to apply new accounts with manage difficulty, however, only rely on OpenID Used on On-line Learning.

C. Un-free choice of resource

OpenID user manages only one identity when the user requests service from participating in OpenID identification website. However, some users maybe give up excellent websites just because of low efficiency of OpenID service.

By simulating design the HTTP requests generated by multiple simultaneous users, the OpenID service performance under normal loads to collect data for statistical procedure, one-way ANOVA. It was found that there exists significant OpenID efficiency difference among servers

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