

# Hand Writing Code-PHP Or Wire shark Ready Application Over Tier Architecture with Windows Servers Operating Systems or Linux Server Operating Systems

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**Abstract**— Before the Information Communication Technology (ICT) era; most of the systems in Kurdistan Region Independent (KRI) were in a traditional way. But nowadays systems is not fully electronic because all systems are working with human activity, thus hundred percentages of systems in KRI is neither traditional nor fully electronic, but it's Semi Electronic (SE) due to impossibility of services without human activity. The human activity and the ICT facilities (i.e. SMS, email, mobile and landline phone, Answering machine, Viber and Fax) are both working to reach to target. The fully Electronic Systems (FES) is much better than SES because of the real time availability and controlled by administrator of the Internet facility and as fewer as of human interfering. The proposed electronic hospital system (EHS) in this paper has the facility of integrating all prototypes are in one home page and connected by the hyperlink-unintelligent recommendation method. The proposed EHS is designed and implemented using both (Two and Three) Tier Architectures named (2TA and 3TA) respectively. To determine server(s) efficiency (i.e. response-time) for both of 2TA and 3TA, two different techniques are depended. First one is traditional hand-writing program by Hypertext Preprocessor (PHP) script code, and second one is ready application namely Wireshark (Network Protocol Analyzer). Two different platforms (i.e. Operating System (OSs)) are depended for performance analysis which are; Linux-Ubuntu version 14.04 and Microsoft Windows-7.

**Keywords**—Client/Server architecture; Tiers Architecture Web Applications; Database Systems

## I. INTRODUCTION

Since the hospital staffs or patients are eager to use ICT particularly the Internet to engage in some or all of these activities. Hence, hospital becomes electronic-hospital system. Therefore, e-hospital could be classified as using of technologies services, such as Internet to assist in the hospital behaviors, other terms that refer to doing business over the Internet include (Electronic-business, Electronic-learning, and Electronic-Mail) [1]. The use of both hand writing PHP-code and Wireshark ready application are for testing the response time of different operating systems with different tier architectures (2TA and 3TA). The semi-electronic-matchmaking and electronic-matchmaking for making appointment, registry, and medical test results are a factor of reducing the health & safety hazards (air pollution), due to patients not need of using transportations to reach healthcare center, and can achieve everything through a connected computer to Internet at home. There is a direct proportion between both Internet growth and web-services; hence HSs have been appeared to keep pace with the process of evolution [2]. EHS is a global tool with a

high level of availability, and it uses 3-TA [3]. Accessing to the processed data via tools of communication such as Internet has a close dealing with the Information systems and technologies, and cell phones. The attractive of this method is that much better than the other methods due to present of real time activity.

Faraj, (2009) [4], explored the complexities and security requirements of a company increase. The IT specialists will move to three (or more) tier architecture. The front-end will still be the user's desktop PCs. But, the server function is divided into two (or more) parts. Three tier application designs can be used as a proper solution for different types of distributed applications. The more tiers provide better load balancing and decrease traffic-network and increase the E-commerce-traffic.

Sallau (2011) [5], proposed a web-based Telemedicine system between the Medical practitioners in urban cities and the healthcare workers in the rural area to communicate over a patient illness, an expert system would also be designed and developed.

Oguntunde and Odim (2013) [6], offered a brief overview about the system was designed by using a 3-tier Internet service architecture consisting of a client tier (web browser), an application tier built on Apache and PHP, and a database tier running on MySQL. In a mentioned design, each tier can be run either on a separate machine or on the single machine. Also rapid advancements in technology and telecommunications, especially the Internet, have led to an explosive growth of Web-based Internet Applications. This work presents a framework for the development of a web based information system for doctor's directory. the researcher of the previous work were focusing on implementing proposed system using three-tier Internet Service architecture, due to they said that the performance of 3TA is better than the other architectures.

Liu and Park (2013) [7], presents their solution framework for e-Healthcare interconnection infrastructure, operational management services with security control, QoS guarantee, and new networking services creation. In the interconnection arena taking into consideration to incorporate service management, on-demand access, QoS accounting, and system interconnection requirements. In the security realm, their results include an e-Healthcare network security solution that enables multi-party participation, allows variable visibility into selective parts of data, and guarantees end-to-end security control. Altogether, their research provides a much needed innovative infrastructure framework to address the challenges and requirements as presented in that paper.

According to the World Health Organization (WHO) and the Ministry of Health (MoH) of Iraq, the lack of computerized Healthcare Information System (HIS) in most Iraqi hospitals leads to poor data analysis and information flow within the hospital environment. Also, the HS in Iraq is still centralized and hospital-based [8]. Based on that, this work aims to propose a web-based system for healthcare and finds the performance of implementing such system on 2TA and 3TA.

Based on that, this paper aims to propose a web-based system for healthcare and finds the performance of implementing such system on 2TA and 3TA. Also, to compare architectural tiers for design of web healthcare application and evaluate of performance on the both architectures with load balancing aspect on different OSs; Windows and Linux. The main aspire of this system is to modify the semi electronic system to fully electronic system. Kurdistan Regional depended the classical approach in the absent of the Internet ICT era. Additionally, the process is health & safety, time and uneconomic for the patient and health centers with lots of untidiness, paper work, that effect unfairness of information delivery between them. The paper will solve the real life problem by using technology.

## II. ELECTRONIC HOSPITAL SYSTEMS

An e-government solution is a solution to conduct government using technology, through an intra, extra or Internet solution [9]. As shown in "Fig. 1", the e-government makes the interaction of Government-to-Citizens (G2C), Government-to-Government (G2G) and Government-to-Employee, Government-to-Business (G2B) friendlier, convenient, transparent, and inexpensive [10,11]. Every modification from past until now has created new generation. Each modification of ICT and computer science creates a new healthcare generation because there are direct relations between computer and ICT modifications with healthcare; for example; the Internet facility changed traditional healthcare to WBH. The improvements of technology develop the healthcare gradually and facilitate fast and continuous improvement in price-performance of both computing and communications [12]. E-hospital refers to the use of modern information and communication technologies to meet the necessary requirements specified for the services produced by the centers of health and which persons will be benefit from these services. E-hospital tools or solutions include products, systems and services that go beyond simply Internet-based applications [11]. E-hospital is an online hospital application and processing system that allows hospital center to advertise their information on WBH applications via the Internet. Using the powerful medium of Internet, patient is no longer hassled for pre-visit & post-visit to healthcare center in this enhanced era [13]. There are five important components that must come together in order to produce an E-healthcare or Computer-Based Information System (CBIS) for healthcare [14]: Hardware Components, Software Part, Related data, Functions and People. "Fig. 2" shows the main parts of adopted architecture of the established of any WBH.

The mean of web services is exactly web technology such as; Windows Apache MySQL and PHP (WAMP) and Linux Apache MySQL and PHP (LAMP). The WAMP Platform is a multi-tier enterprise application, the web server tier, PHP programming tier, database server tier and business logic tier. WAMP, group software often used to build dynamic Web site or server, itself are separate programs, but because often used together with the increasing of compatibility, constitute a powerful web application platform [15]. LAMP is a popular setup for Ubuntu servers. There is a plethora of open source applications written using the LAMP application stack. The advantages of PHP and MySQL are strong motives behind their utilization in developing various web-applications [16]: fast and easy, cross-platform, accesses everything, constantly being improved, free to download, cost effective, quick and powerful.

The Architecture and Component-Level Design contains some of the modern design models of the software application, which are [4]:

**Two-Tier Architecture (2TA):** contains a middle effective

item (protocol) that provides the communication between both of (server and clients). Design of 2TA is very effective for network programming as well as for Graphic User Interface (GUI) programs. The 2TA is an architecture where a client presents a GUI to the user and uses the selections of the patient to do require activities of database server which is running on a different machine. 2TA consists of two layers: client and server as shown in “Fig. 3”.

**Three-Tier Architecture (3TA):** The main reason for developing 3TA systems is due to the incapability's of the 2TA. Designers should avoid using 2TA because if the user would like to scale up to larger projects in the future, the 2TA approach is not enough and usually results in an ineffective system, as a server becomes weighted down with users. To properly scale to huge amounts of users, it is usually too necessary to move to 3TA, as shown in “Fig. 4”. As the complexities and security requirements of a company increase, the IT specialists will move to 3TA or more. The server function is divided into two (or more) parts. Considers the issue of web site development, basically its three tiers E-healthcare architecture includes: database (Data tier, MySQL database), web server (Application tier, PHP) and web browsers (Client tier, Users of the site). Using 3TA leads to a system having the advantages of: Load balancing, better security and Maintenance [4].

**Wireshark (Network Protocol Analyzer):** Wireshark tool is a network packet analyzer and it is used to capture the packets during live migration. The captured packets are stored in the Wireshark tool and can be used for the analysis [17].

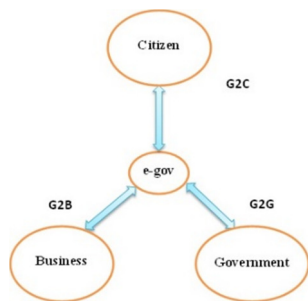


Fig.1 The Participants in E-government

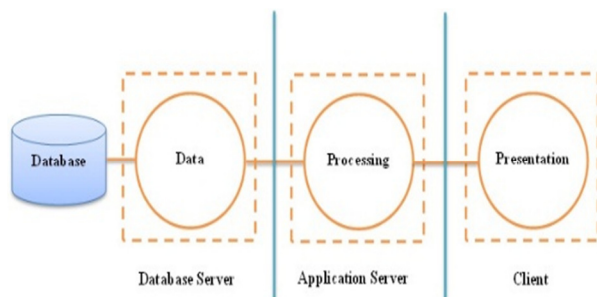


Fig.4 Three-Tier Architecture

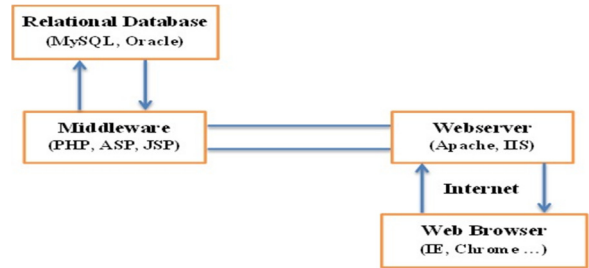


Fig. 2 Architecture of the developed web based application [4]

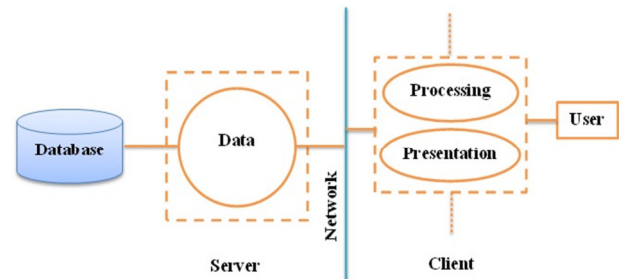


Fig. 3 Two-Tier Architecture

### III. DESIGN OF EHS

In general, the proposed system was designed to run either on 2TA or 3TA. Both tiered architecture client/server computers are 32-bits and 64-bits computer architecture or on client/server base networked computers with any network scales. MySQL is an outstanding tool to implement the database system. The technology used in the proposed system to link the database to front-end interface is PHP with Window-7 OS as a server using of WAMP application and Linux- Ubuntu 14.04 OS as a server using of LAMP application. “Fig. 5” shows the general tier architectures, while “Fig. 6” shows the basic phases of established the EHSs. In order to design such e-healthcare care system, it is necessary to prepare the requirements of both of software and hardware requirements.

1) **Software Requirements:** In order to implement the WBH proposed system, it is necessary to have two different types of computers hardware and software, the server side computer must be more powerful than the client side (due to the rule of networking and data communication). The capacity of the server side computer must be very high in order to solve the problem of traffic network (Bottleneck). Table.I describes all software and applications used for designing proposed system.

2) **Hardware Requirements:** The hardware features of depended equipment includes (hosts, switches and cables) in this system are shown in Tables. II and III. In order to provide more practical applications and to be close to the

real situation, the system has been implemented using hosts with different features and abilities. These Tables show all hardware equipment that features for the proposed system machinery and the features of switch and cables depended in the proposed system.

Table.I Specification of the software and applications that used for proposed WBH

Software Requirements-1-	Software Requirements-2-
Development server: WAMP W Windows platform, A for Apache HTTP server, M for MySQL, P for PHP	Development server: LAMP L Linux platform, A for Apache HTTP server, M for MySQL, P for PHP
Operating System: Windows-7	Operating System: Ubuntu 14.04
Backend: (Database) MySQL	Backend: (Database) MySQL
Frontend: HTML, Ajax, JQuery, CSS and JavaScript	Frontend: HTML, Ajax, JQuery, CSS and JavaScript
Server Side Scripting Language: PHP	Server Side Scripting Language : PHP
Applications: Text Editor sublime, Almost any web browser, Wireshark	Applications: Text Editor sublime, Almost any web browser, Wireshark

Table. II Features of depended hosts in implementing the proposed system

Host	CPU	Architecture	RAM	HD
Server-one (Application Server)	Corei3 3.3GHZ	32 bits	4 GB	512 GB
Server-two(DB Server)				
Client hosts	Corei3 3.3GHZ	32 bits and 64 bits	4 GB	512 GB

Table. III Features of communication equipment depended in implementing the proposed system

Properties	HUB Switch
Name	TP-Link
Number of Ports	24 port
Speed	10/100 Mbps
Properties	Cable
Type	UTP-CATE5E
Maximum Length	10 meter
Connector	RJ-45

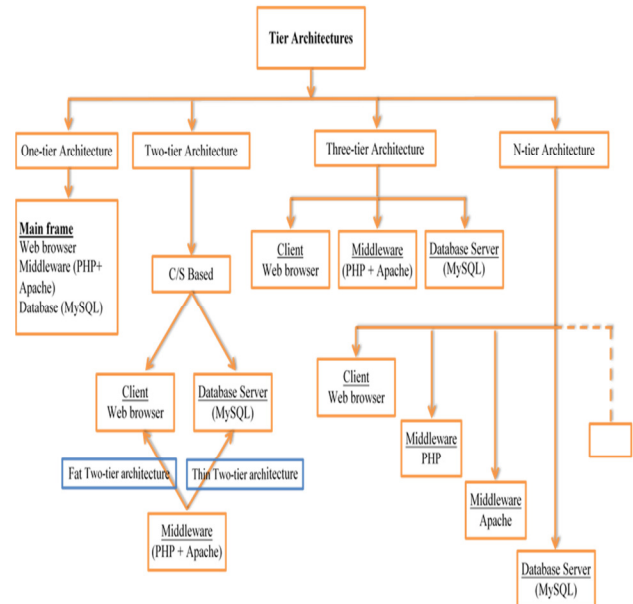


Fig.5 General Tier Architectures

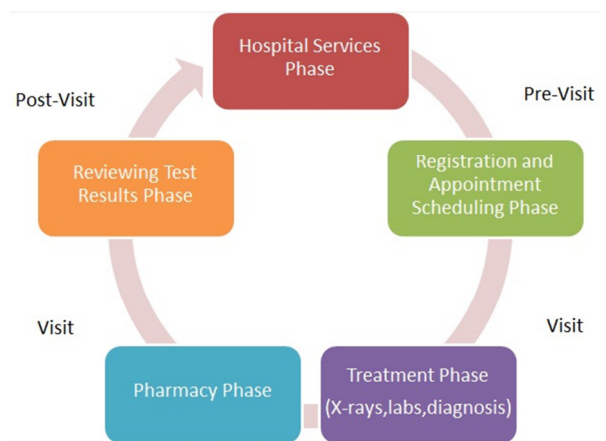


Fig. 6 Basic phases establishes of WBH proposed system

The hardware part consists of two sub-parts; servers-side and clients-side. Servers-side can be organized into two structures; consists of (one-host as 2TA or two-hosts as 3TA) as shown in “Fig. 7”. and “Fig. 8” respectively. For 3TA first host is specified for application tier and the other specified for database tier. These servers are connected directly via a cable; it is preferred to locate them within same room provided by special conditions. Servers-side must be connected with clients-side via Internet. The clients-side hardware consists of two parts internal and external clients. Internal-clients consist of number of hosts (let equals C1). These hosts must be inside the hospital/clinic and specified for; administrator, physicians, pharmacies, radiography, laboratory, and receptionist. These hosts are connected to the servers-side via Internet. Also, external-clients consist of number of hosts (let equals C2). That are basically outside of

the hospital/clinic and are specified for external users (almost are patients). Again these hosts are connected to the servers-side via Internet.

In general, the proposed EHS site consists of several services provided by related modules illustrated in “Fig. 9”

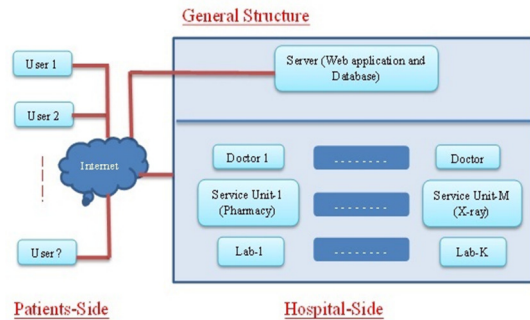


Fig. 7 Hardware part of WBH proposed system 2TA

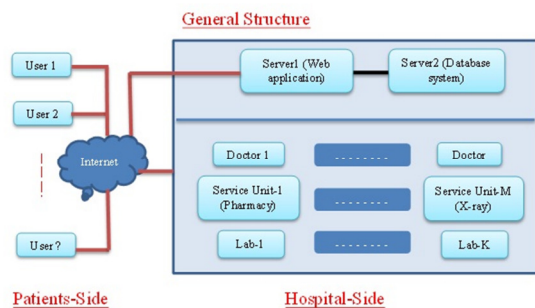


Fig. 8 Hardware part of WBH proposed system 3TA

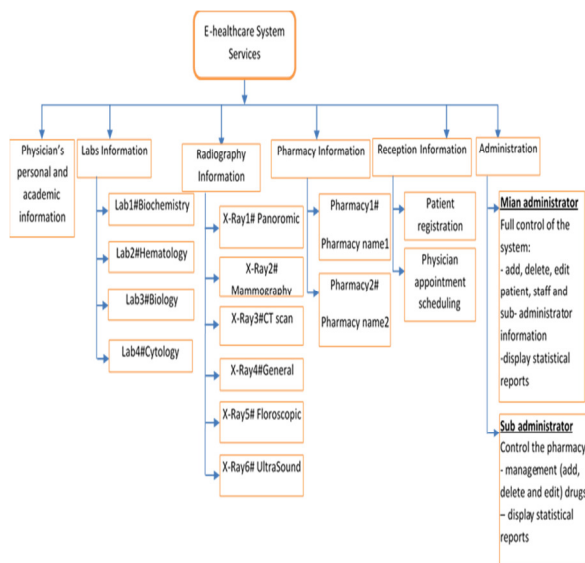


Fig. 9 The proposed system services

#### IV. IMPLEMENTATION OF EHS

In order to browse and navigate among these modules-pages "any browser" can be used with both Windows and Linux OSs. All web-hospital pages were built using HTML, CSS, AJAX, JavaScript and JQuery in a client-side, while the PHP acts as an interpreter for the server side. There are lots of hyperlinks used to facilitate for users' navigation for matchmaking purposes.

The Established Prototype of the Proposed EHS, supported by some testing techniques, was designed and implemented. Adding to these modules, there are two options existing at the main web-hospital window such as Contact us and Physician Information. “Fig. 10” shows the main web-hospital page of the established E-hospital prototype.

In the main web-page of modules, there are many hyperlinks; each one is a connection to other webpage. These hyperlinks help users to easily navigate between the pages.

The database or web database (backend) holds all sets of data.



Fig. 10 The main window of EHS

## V. PERFORMANCE ANALYSIS OF EHS

The performance analysis of the proposed EHSs will be described by web technologies WAMP and LAMP. The response time testing is used for WBH over both types of 2TA and 3TA. Four connection-LAN networks are addressed for testing the proposed EHS depending on both of 2TA and 3TA, using Windows OS and Linux OS. The two techniques of testing are manually test (hand-writing code PHP) by a programmer for testing response time (in seconds), and Wireshark ready software application for testing response time (in seconds). "Fig. 11" represents established network for the proposed EHS.

Figs. (12 to 15) show the average consumed-time and the data follow of (2TAand3TA) with Windows-7. While, Figs. (16 to 19) show the average consumed-time and the data follow of (2TAand3TA) with Ubuntu-14.04. for the both OSs one, five and ten clients have been used. The PHP code is shown in dark line color while the light line color is for Wireshark ready software. Figs. (20 and 21) represent the average consumed time for 2TA and 3TA using Windows 7 and Ubuntu-14.04

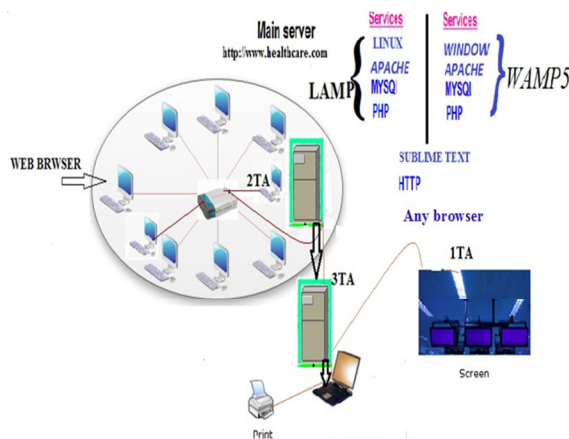


Fig. 11 The established network for EHS

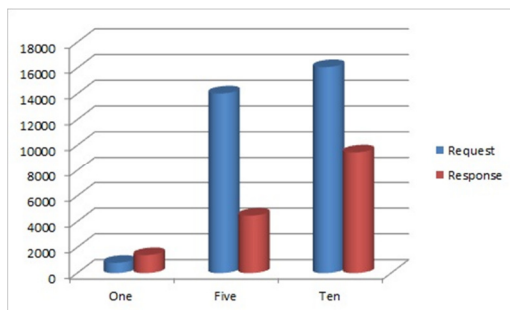


Fig.12 Average Consumed-time for 2TA with window-7

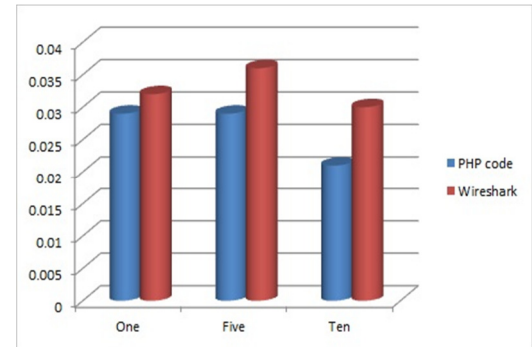


Fig. 13 Total Dataflow for 2TA with Windows-7

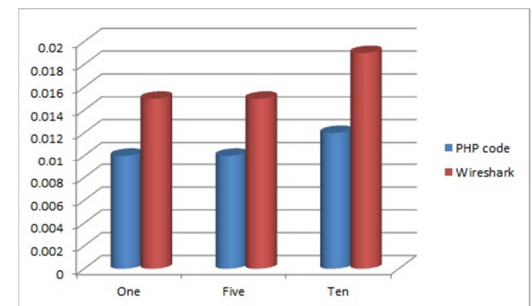


Fig. 14 Average Consumed-time for 3TA with Windows-7

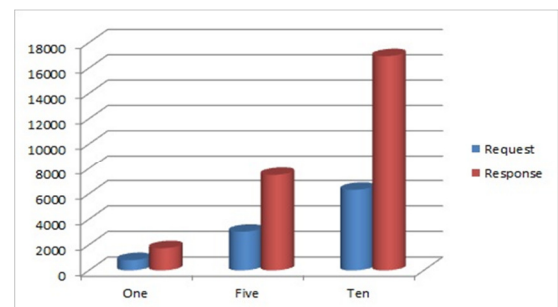


Fig. 15 Total Dataflow for 3TA with Windows-7

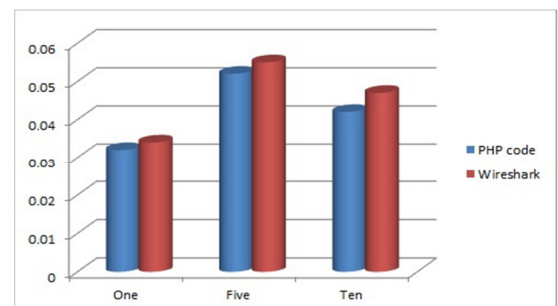


Fig. 16 Average Consumed-time for 2TA with Ubuntu-14.04

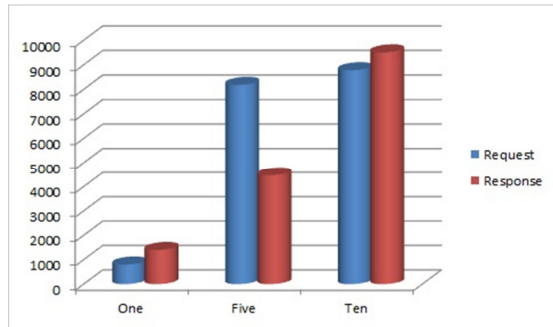


Fig. 17 Total Dataflow for 2TA with Ubuntu-14.04

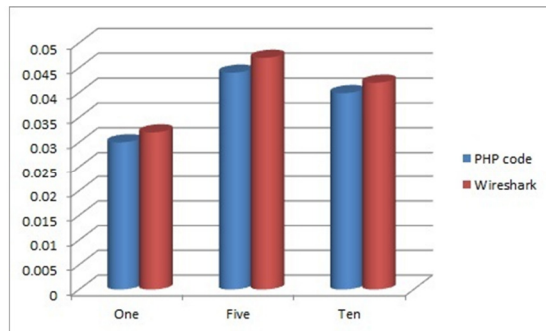


Fig.18 Average Consumed-time for 3TA with Ubuntu14.04

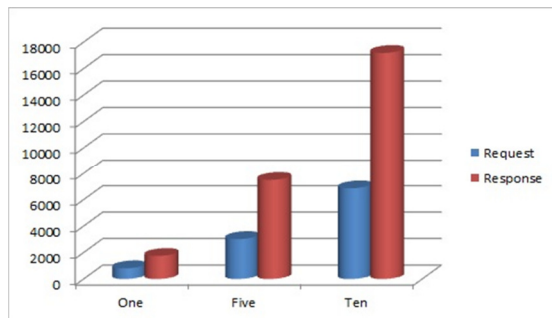


Fig. 19 Total Dataflow for 3TA with Ubuntu-14.04

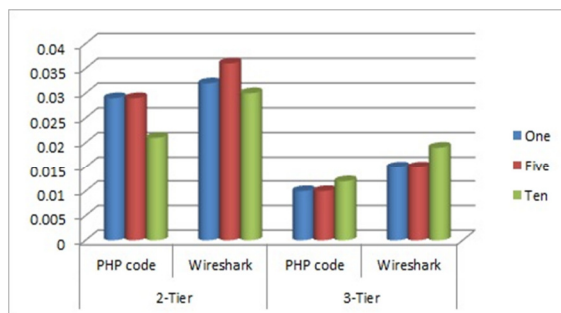


Fig. 20 Average Consumed-time for 2TA and 3TA using Windows-7 OS

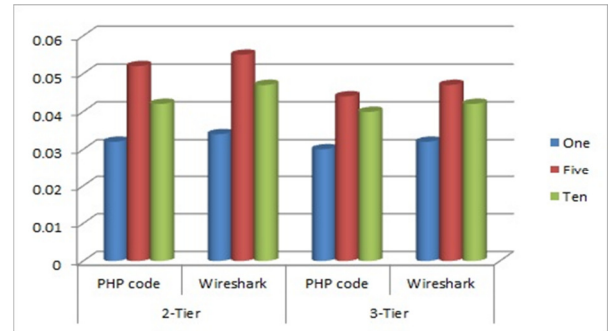


Fig. 21 Average Consumed-time for 2TA and 3TA using Ubuntu-14.04

## VI. CONCLUSION

1) An efficient EHS is implemented and designed depending on client/server base principles.

2) The implementation of this system proved that the reduction of important factors such as: consume-time, effort, cost (more economic), related conjunction traffic, and even decreasing the side effects of environment causes (reduce health & safety hazards).

3) The performance of the system using 3TA was more accurate than that of 2TA. This is determined from the obtained results and proved by evaluator software called Wireshark (Network Protocol Analyzer).

4) Profession statistics can be provided very simply and within little time for (daily, monthly and yearly) periods. These statistics are very important which considered as great steps toward E-government systems.

5) As a result of two servers when using 3TA, high security is provided by splitting both of application-server and DB-server. The QI, QoI, QoS are much better than the 2TA.

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