Configuring thin client solution for Orang Asli community in Malaysia

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Abstract: - Orang Asli community is continuously given attention by the government for their development so as not to widen digital gap with other advanced races in Malaysia. IT education and access to computers and internets seem to be one of the noble viable options for the young generations to nurture the knowledge society values. This is due to many adverse reports related to Orang Asli attitudes and behaviours in the media as well as research publications. Thus, our IT social inclusion project is timely and hoped to contribute to their development for better lives. This paper describes the proposed thin client configuration for Orang Asli community in Gombak area. It begins with literature reviews on previous studies, concepts and products available and description of Orang Asli schoolchildren in the area. Based on risk management assessment, thin client system is chosen for the community and the proposed architecture configuration is described and illustrated.

Key-Words: - **thin client, schools, Malaysia, Orang Asli, configuration, education, information technology**

1 Introduction

Thin clients are seen as promising innovative alternatives to fat clients for users. One of the main benefits for thin client is the improved maintenance and security due to central administration of the servers in the datacenter. Thin client is where a client machine relies on the server to perform the data processing. It can be either a dedicated terminal or a regular PC with thin client software. In recent years, more thin client products are developed by manufacturers and providers including the virtualization or even Linux platform.

Thin client technology and server virtualization are technologies that have been in use for several years or longer, both in the corporate world and in some institutional data centers. Client-server architecture is predominant in this circumstance connecting multi-workstations through internet. As issues such as management costs and security concerns rise, IT departments have looked for solutions that specifically address device and network manageability. Organizations are turning to two technologies – thin clients and virtualization – to bring device management under control.

In education, the possibility to easily reach an extremely large number of users with significantly low costs has motivated the development of an increasing number of Web applications for educational purposes [3]. The application of thin client technology in education significantly achieves many benefits as promised such as cost savings and mass reach. Hence, in the case of Orang Asli community in Malaysia, providing internet access through thin client is made possible given the low implementations costs.

The remainder of the paper is organized as follows. Firstly, the literature review section discusses on thin clients technologies and several previous studies found in the literature. Then, we bring into the scene the Orang Asli schoolchildren and their community in Gombak, Selangor. The main aim of this paper is to describe the proposed thin client systems design and network configuration for the Orang Asli community library. Finally, discussion and conclusion for future works wrap up the paper.

2 Literature

With thin client technology, desktop computers are replaced with “thin clients” which are devices that have no hard drive but instead rely on a network connection

to a remote server in datacenter, for example, where application processing and storage of information takes place.

2.1 Thin client concepts

Generally, three methods of thin client configurations are available for adoption. Firstly, shared services thin client enables users to share the operating system and applications in the server with all other users at thin client stations. Although presented with their own desktop, users do not have the same flexibility as they do with their own PC and are limited to running prescribed applications and simple tasks such as creating folders and shortcuts. Secondly, a more innovative approach using virtualization concept also seems practical. In this desktop virtualization, each user's desktop (OS and applications) resides in a separate partition in the server called a "virtual machine." Users are essentially presented with their own PC, except that it physically resides in a remote server in the datacenter. Users can modify the desktop and add applications like they could with their own PC (a "fat client"). Thirdly, the user's machine does the processing; however, the applications and data come from the server. The thin client contains a Web browser, and the programs come in the form of scripts on Web pages (HTML pages) from a Web server on the Internet or from the company's intranet. This is known as Browser-Based Applications - HTML Pages. One of its drawbacks is that the software scripts are always downloaded into the user's browser for each session.

As Fig. 1 illustrates, under a thin client setup, applications run on a remote server. They can also run on a virtual PC – essentially a space on the server that has been set aside for that user – or a blade PC. Brokers are used to allocate an available virtual PC or blade PC to a thin client, but are not needed in a server-based setup. On the server end (or the virtual PC or blade PC), the graphic is captured, compressed, encrypted and sent back to the thin client. At the client, keyboard and mouse events are captured and transmitted to the server [2, 4].

A recent innovative thin client product is the virtualization. Thin client virtualization goes beyond the power of thin clients and server virtualization, building on their potential to address some of the biggest challenges IT faces today.

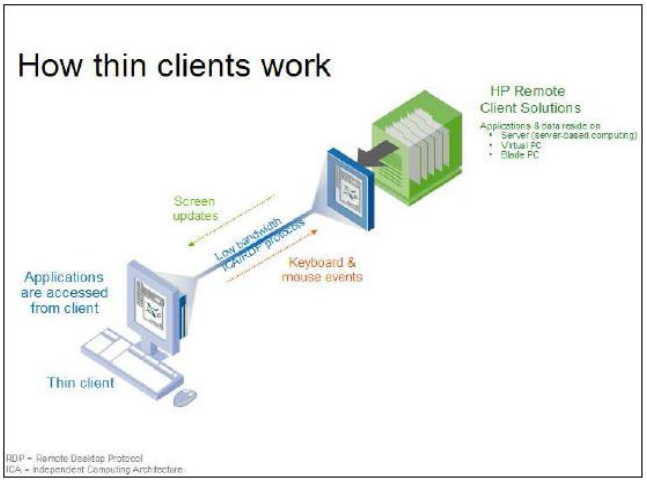

Fig 1: A thin client typically appears to the user as simply a display unit, keyboard and mouse. It is connected to a remote server for its processing power. Keyboard and mouse events are sent upstream to the server and screen updates are sent back to the client. Users can be unaware that they are actually using a thin client rather than a desktop system [2, 4].

With virtualization technology, a single server can act like multiple computers, sharing its resources via the network with many clients and applications. The ability to virtualize servers is an extremely powerful concept because each virtual "instance" created on the server can run different applications and even different operating systems, all transparent to the user. That frees administrators from the typical physical and geographic limitations imposed by server locations and capacities. Virtualization allows servers to be located anywhere and set up for any purpose. The servers can run virtualization software on the backend server to create multiple "virtual desktops" on a single server. Each virtual client, while resident on the server, is in essence a user's desktop. It can consist of an operating system, applications and data as well as information specific to a particular user such as personal system settings. Each virtual client session is then "mapped" back to a thin client. The end result is that each user has a computing experience identical to running his own desktop personal computer [2].

There are many thin client products available in the market such as Hewlett Packard and Wyse. On the other hand, Linux thin client is also a viable option to be considered but requires knowledge on Linux open source technical setting up, installation, configuration, maintenance and also troubleshooting.

2.2 Thin-client architecture

As described in Section 2.1 above, thin client can operate in three environments namely shred services, virtualization and browser-based applications. Users can develop their own thin client system architecture depending on system requirements. For instance, Casella et al. [3] proposed architecture of e-learning systems characterized by the use of Web services and a suitable middleware component. These technical infrastructures allow extending the system with new services as well as to integrate and reuse heterogeneous software e-learning components. Moreover, they let users better support the "anytime and anywhere" learning paradigm. Their proposed architecture is an example of an implementation for the run-time environment in a sharable content object reference model (SCORM) to trace learning processes which is also suitable for mobile learning.

A book chapter by Grundy and Zou [6] describe a new approach to providing adaptable thin client interfaces for web-based information systems. Developers specify web-based interfaces using a high-level mark-up language based on the logical structure of the user interface. At run-time this single interface description is used to automatically provide an interface for multiple web devices such as desk-top HTML and mobile WML-based systems as well as highlight, hide or disable interface elements depending on the current user and user task. Their approach allows developers to more easily construct and maintain adaptable web-based user interfaces than other current approaches.

An architecture can be designed over low-quality LAN links and they do not provide satisfactory end-user performance in enterprise environment for more and more popular graphical and multimedia applications. To overcome this, Lubonski et al. [7] designed architecture of server-side quality of service (QoS) management component responsible for mapping application QoS requirements into network QoS. In their architecture, flexible adaptation mechanisms can dynamically map user-perceived QoS defined for each application and terminal device to the current network state in order to maximize user experience. Additionally, by combining perception information with traffic management techniques they are able to prioritize the multimedia flows (such as video streaming) in a single thin-client connection as well as provide fair resource allocation among multiple user connections to the same server. The component architecture provides a set of QoS management mechanisms for remote desktop protocols and is a solid basis for further enhancements.

2.3 Orang Asli community

Orang Asli, also known as the original people or the indigenous people, make up 0.5% of the total population of Malaysia [9]. They are divided into three main tribal groups, namely Semang (negrito), Senoi and Proto-Malay (Aboriginal Malay). Orang Asli has 18 ethnic subgroups and are not a homogeneous race, which indicates their diversity in terms of cultures, traditions and their lifestyles. The Orang Asli people have different beliefs and languages which all depend on the ethnicity and their location. Thus, their relationship, life dependency and identity make them very much related to their land and nature.

Orang Asli is commonly perceived and reported in some researches and publication, as community with different problems such as population, education, attitudes and is regarded as barbaric and too lazy to work hard to develop themselves and their race [9]. From the study, Tijah et al. [9] found that developing and creating awareness among Orang Asli had not yielded a tangible result but rather complicated matters further. Thus, suitable methods or programmes that give them sense of belonging or ownership and excitement from the programmes are warranted. For instance, the implementation of different programmes at their childhood stage are very noble way of developing and creating awareness among Orang Asli children. Common public perception is that Orang Asli are said to be introverts [8], but these set of people are said to be intelligent and spend most of their time thinking and using their brain for activities that will benefit them rather than talking [1].

2.2.1 Internet usage among Orang Asli schoolchildren

The research team survey to Orang Asli schoolchildren in three schools, two secondary and one primary, in Gombak area shows that these students are familiar with computers and internets because they can access their schools resources centre. Nevertheless, the computer facilities are insufficient to cater for all students in the schools and hence, their usage is limited. This hinders their computer and internet proficiency level predominantly due to limited accessibility to computers and internets either at schools or homes. Demographic shows that most respondents cannot afford to own a personal computer at homes let alone subscription to internet. Most respondents have to go to cybercafés in order to access computers and internets.

In short, this study proposes installation of thin client system for the Orang Asli community in Gombak to use internet facilities for all kinds of purposes. Thus, the team must assess the environment such as infrastructure,

economic, social and technology that is most suitable in order to maximize the project benefits.

The team started the groundwork in April to November 2009 to obtain computer and internet education and usage among Orang Asli schoolchildren in three schools near the Gombak Orang Asli community area. In addition, several discussions were also held between research team and authorities such as Jabatan Hal Ehwal Orang Asli (JHEOA) and staff in the library. The following section will discuss and illustrate the proposed thin client architecture configuration selected by the research team as the most suitable approach for the project.

3 Thin client solution

Since the system architecture affects all aspects of software design and implementation, the choice of appropriate system architecture is critical. Basically, two main aspects are considered thoroughly for the proposed architecture as described in the following subsections.

3.1 Risk management

The benefits of thin clients become the main criteria for its adoption in the project. Thin clients also prove that risk management is better performed in thin client environment compared to fat clients.

Firstly, a thin client architecture normally allows instant distribution of updates and revisions if the risk system software is changed as it places the risk applications on the server side. Secondly, the thin client can run directly without browser versioning, installation and environment issues. The users will find it easier to operate the system. Next is that thin client promotes software reuse and facilitates system integration as it can leverage the interface, applications, and database between the client side and the server side.

Fourthly, thin client has better security as it just includes graphical user interface (GUI) while business logic is put onto the server side. And finally, thin client can run on any system that supports a browser. It enables users to access information from any browser without carrying configuration and other files between locations.

The proposed thin client set up involves two separate locations initially which is Orang Asli community library and university administrative datacenter. Besides that, remote server is placed behind a university firewall and thus, extra careful care must be heavily emphasized. Hence, the above risk managements clearly favour virtualized thin client environment.

3.2 Users' knowledge

The Orang Asli community library is managed by librarians and no IT personnel is stationed or servicing the library. Thus, placing the server in the university administrative datacenter allows all the updates and maintenance tasks taken care by existing trained IT staff. The research team is able to monitor the thin client PCs in the library from time to time.

In addition, from earlier findings and observations, the users are expected to have limited knowledge on technical aspects of IT. Therefore, installing fat clients pose higher risks to virus, information and computer security, hard disks overflowed and corrupted and others. Hence, thin client is preferable since the main purpose of the project is to provide internet access to the community.

3.3 Proposed solution

Considering the points in Sections 3.1 and 3.2 and the advantages of virtualization technologies above, thin client virtualization provides significant benefits to the project. However, the team must decide on whether to use open source Linux or proprietary products such as Hewlett Packard or Wyse's technologies. Academic literature does not provide enough evidence on this and therefore, based on reviews of information available on internet the team approaches the products resellers and inquire more about their products and services. In addition, the team also approaches ITD, IIUM to learn from their experiences on the use of thin client system. From these, the team decides to opt for Wyse's Desktop Manager 2 for the pilot project for its distinct advantages and suitability for the project environment.

With virtualization technology, a single server can act like multiple computers sharing its resources via the network with many clients and applications. The ability to virtualize servers is an extremely powerful concept because each virtual "instance" created on the server can run different applications and even different operating systems, all transparent to the user. That frees

administrators from the typical physical and geographic limitations imposed by server locations and capacities. Virtualization allows servers to be located anywhere, and set up for any purpose. In addition, it is also far more efficient because it makes the best use of existing resources and thus ensuring high availability and lower equipment expenses. It can also save on energy costs, since fewer servers are needed to do that same job.

Wyse's Desktop Manager 2 is based on VMware's Virtual Desktop Infrastructure (VDI). Like other virtualization technologies, VDI divides the host's physical resources - memory, storage, processor cycles, etc - into multiple virtual machines (VMs). With VMWare's VDI technology, the VMs on a server host are remotely accessible via the network (see Fig. 2), with thin clients providing the user interface.

This approach results in thin clients that work more like full desktop personal computers while still offering some of the administrative advantages of thin clients, such as centralized application installation, upgrades, and patches, better support for unattended backups, greater resource utilization, and lower electricity usage. There are many other thin clients, virtualization as well as cloud computing products [5].

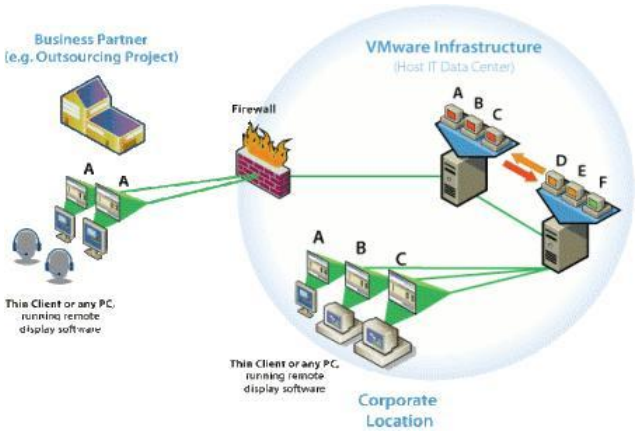

Fig. 2. Wyse's VMWare VDI typical use [5]

The above method seems practical for our study whereby the community especially the Orang Asli schoolchildren will be able to access the internet located in the library and the server is remotely located in IT division, IIUM datacenter.

In addition to that, another option that adds usability to the proposed thin client is via web services. Web Services technology provides a common infrastructure to integrate heterogeneous software components, thus enhancing interoperability between different components and component reuse, whereas the extendibility feature of e-learning systems is ensured by the use of a specific Middleware component [3]. Web services are modular, self-describing applications universally accessible in a standardized and platform independent way. These applications communicate by standardized XML messages. Web Services are based upon three technologies: Web Services Description Language (WSDL), Universal Description Discovery and Integration (UDDI), and the Simple Object Access Protocol (SOAP).

4 Conclusion

Thin client technology is definitely an alternative viable option for users who look for facilities and characteristics offered by them. One cautious note is that the products must honour the cost savings feature compared to fat clients. Nevertheless, both fat and thin client have their own strengths and weaknesses. Users must therefore think carefully on their requirements and choose the most suitable option wisely.

This proposed solution is based on current environment which may be less favourable when conditions change. We aim, in the future, to expand the thin client system to the whole state of Selangor and this definitely requires a reassessment and reconfiguration of the new architecture which involves a more complex different environment and needs in each user organizations and IT administrative datacenter.

Orang Asli remains one of the development agenda for government. From a survey by team to three schools in Gombak area, Orang Asli schoolchildren are quite familiar with computers and internet. But affordability remains an issue for them to own a personal computer at home. Perhaps the parents can find means to own a personal computer at home since they are relatively affordable ranges of products available in the market. These children, however, live in off-reserve areas and thus their living styles resemble other races. The parents must change their attitudes and give priority to education as one of the main efforts to bring their off-reserve and reserve community a better standard of living. Orang Asli in reserve areas must come out and stress the importance of education and change their attitudes in order for them to stay put with other major races.

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