The Concept of LXD-based Web Hosting Panel

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Abstract. Web hosting is a cheapest alternative to running a website. Web hosting offers a simplicity of website management, but gives very limited access to users. Web hosting users can manage file or database easily because it has been available on this panel, but the features are static. Web hosting users cannot add other service in their environment. On the other side, Virtual Private Server (VPS) provides a flexible access to the operating system by giving root access to it. VPS users can add any services they need as long as the VPS resources are available, but they must do it manually. As result, website management in VPS is more complicated than web hosting. This paper proposed a model of web hosting panel that having capabilities like VPS. Each user will be created a linux container (LXD) that can be modified freely as needed. The proposed model divides the client environment using LXD that usually uses operating system user access. As a result, clients obtain not only a simplicity in web hosting, but also a root access to operating system when they need. For hosting provider, they can provide full operating system services while saving computer resources.

1. Introduction

Website is a powerful publication tool for many companies or organizations. Companies or organizations can freely build their own website; determines theme, content, and everything they want to publish. On the other side, visitors can access the website from any device that connect to the Internet.

A server is required to run the website. The server is a computer system that is provide to serve the client. As server must always be online, it is an expensive infrastructure. Therefore, not all parties have a budget to build their own server infrastructure. For this reason, however, a party can rent a server from the server provider. The provider usually offers some server infrastructures to be chosen: web hosting panel, VPS, or bare-metal machine.

Web hosting is a cheap server infrastructure. It creates a user account in the operating system for each client. A client who has user access can utilize the installed services in the operating system. For example, suppose apache2 web server is installed in the operating system. The system administrator could make a virtual host for each user with specific domain or subdomain. If the operating system received a request for a specific domain, the request would be directed into authorized user for the domain. Examples of the web hosting panel are cPanel [1] and iMSCP [2].

Virtual Private Server (VPS) is an advanced alternative of server infrastructure [3]. VPS would be creating a virtual machine for each client. Therefore, each client has dedicated computer resources. For example, if client rent a VPS with 2 core processor and 2 GB memory, the host operating system would be reserving the resources only for this client. The host operating system would not share the resources with another client. As consequence, client must install, utilize and configure anything
manually. Clients could buy a bundled VPS with hosting panel (for example cPanel) but it made a budget more expensive [4] [5].

This paper proposed a model that combine the concept of web hosting panel and VPS by utilizing LXD container [6] [7]. LXD approach is similar with VPS [8] [9] [10]. LXD could be made isolated operating system for each client, but it shared a host resource. Shortly, our model provides instant service like web hosting panel, but it is isolated inside dedicated operating system with LXD approach. The advantage, client could also install another service if they are needed.

The rest of the paper is outlined as follows. Section 2 describes a brief review on Web Hosting Panel, Virtual Private Server and LXD Container. Section 3 presents the proposed model, while the analysis of the model is provided in section 4. Finally, conclusion and future works are drawn in section 5.

2. Related Works
This section provides a brief review on some concepts that are related to our topic. They are web hosting panel, virtual private server (VPS), and LXD container. Web hosting panel and VPS are existing services on the server provider. While LXD container is a new approach in virtualization technology which we will adapt.

2.1. Web Hosting Panel
Web hosting panel is a cheap approach to hosting a website. Web hosting provider would share a user access of single machine to the clients. Clients could login to the web hosting interface, then upload a website file. They also could use existing services for their requirement with their gived accounts, such as MySQL database and mail server. Clients only could customize an available configuration in web hosting interface.

cPanel [1] and iMSCP [2] are examples of web hosting panel provider. cPanel has commercial license and iMSCP has hybrid license. Usually, web hosting providers buy a web hosting panel license and install it into their server machine. After installed, web hosting panel would be shared to the clients. Web hosting panel interface of both providers can be seen in Figure 1.

![Figure 1. Example of Website Hosting Panel.](image)
2.2. Virtual Private Server

Virtual Private Server (VPS) is an alternative approach for hosting a website. Usually, VPS provider has a bare-metal machine and install a virtual technology like VMware or OpenStack. VPS provider initially creates a virtual machine for each client, then gives root access to the client. VPS users would install the application they need and configures it in the VPS manually. VPS users could buy a bundled VPS with web hosting panel license, but it would be more expensive.

Biznet Neo [5] and Dewaweb VPS [4] are examples of VPS provider. To use their VPS, a client must rent a specific VPS resource. Rental costs would be distinct for each specification. Usually, VPS users also could buy other services like public IP address (to be accessed anywhere with internet), Network Attach Storage (to increased disk storage space), etc. VPS panel interface of both providers can be seen in Figure 2.

2.3. LXD Container

LXD [6] is a method to divide user environment in a virtual technology. Unlike virtual machine, LXD shares a computer resource to each user environment that called a container. Each container has an independent operating system, but shares a resource. LXD container would use the host operating system resources alternately. For example, if the host operating system has 4 core processor and 4 GB memory, then each container would also have 4 core processor and 4 GB memory.

LXD uses Linux Container (LXC) image to deploy a container. Operating system inside the container would definitely be a Linux and its derivatives. LXC only provides free linux distribution like Debian, Ubuntu, CentOS, etc. LXD container could only run and install application that not updated kernel system, like web server and database server. An application that changes kernel system, like desktop environment, would be fail when it is run inside the container.

3. Proposed Method

The proposed model combines the advantages of web hosting panel and Virtual Private Server (VPS). This model would be isolating a user environment inside the LXD container and injecting a service installation script into the LXD container. The beginner user can use script to install general services like web server or database server. While the advanced user can install and configure manually via ssh access.

Firstly, LXD container is created for each user. Since LXD container do not parsing computer resources like virtual machine, each user would have the same computer resources. They use the computer resources alternately. Illustration of first step can be seen in Figure 3.
Secondly, general service scripts are uploaded inside the LXD container. General service script is an installation script for general services like Apache2 web server and MySQL database server. User will be asked if they want to install the services. If the answer is yes, LXD container will execute the scripts. Figure 4 illustrates this second step.

![Figure 3. Create container for each user.](image1)

![Figure 4. Upload an installer script of general services.](image2)

Thirdly, secure shell (ssh) server would be installed inside the LXD container. This feature is provided for advanced users or users with special needs. For example, user want to using Nginx web server, not apache2 web server. They could skip second step and install Nginx web server via “apt-get install nginx” via ssh access.

Finally, reverse proxy and port forward are configured in the host operating system. Reverse proxy and port forward are required because LXD container divides user environment using a different computer. Proposed model must be bridging host operating system and LXD container because main IP address is located in the host operating system, not in the LXD container. Details illustration of this final step can be found in Figure 5.

4. Analysis
Ease of use is an advantage of the web hosting panel approach. Users could use existing services without installing and configuring manually. Users only manage their website from website user interface (Web UI) and their website would be online automatically. However, users could only take
the advantages from the existing services. They could not add a new service or customize existing services because their access is very limited. This approach is suitable for beginner users.

Flexibility is an advantage of VPS approach. VPS users gain full access to the machine. They could install and customize anything on their machine. VPS provider only install main operating system in the machine, then give away to the users. However, users must do anything manually. This approach is suitable for advanced users.

Our proposed model has both advantages. Users can use an installation script if the user requirements are available. Users can also install and customize anything if they need. In other side, provider can update the installation script anytime to satisfy user requirement which is always evolving. Comparison between our approach and existing approach could be seen in Table 1.

Web hosting panel and our proposed model has website user interface (Web UI) that make it easy to use for beginner user. User can operate this service from web browser instantly. In VPS, it is optional feature. User must install it manually or purchase an additional license for cpanel.

![Figure 5. Proposed model.](image)

|                      | Web Hosting | VPS | Proposed |
|----------------------|-------------|-----|----------|
| **Web UI**           | Yes.        | Optional. User must install it manually or buy bundled package. | Yes. |
| **OS Access**        | Guest.      | Root. | Root (with container limitation). |
| **OS Encapsulation** | No.         | Yes | Yes |
| **Console Access**   | Rarely.     | Yes | Yes |
| **Computer Resources** | Shared | Dedicated | Shared |
VPS and our proposed model have operating system independently for each user. The advantage, user can control everything in their encapsulated operating system via console access because they have full (root) access to their machine. For examples, user can edit installed script in restricted directory (/etc, /var/lib, /root) that could not be done by website hosting panel generally. It is very helpful for advanced user. User also can install custom service by using operating system package management or compiling custom service manually in their linux container.

In the other side, service provider can save more because proposed model shared a computer resource. If VPS separate computer resources strictly, our proposed model that using LXD shared a computer resources to all users inside machine. For example, service provider must allocate 8 core processor and 8 GB memory for 8 users if each user must have 1 core processor and 1 GB memory. In our model, computer resources with 8 core processor and 8 GB memory can used by more than 8 users because the computer resources are used interchangeability.

5. Conclusion and Future Works
LXD approach can be used to improve web hosting panel capabilities. We could create isolated environment for each user without dividing computer resources. Each user would be using full resources alternately. To get ease of use advantage from web hosting panel, we could add installation scripts to LXD container and execute them [4] automatically.

Our future work is implementing this model into the real product. We are developing web hosting panel that integrated with LXD approach. Progress of this project can be found in our website, https://ilkom.unej.ac.id/netsec/.

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