

# Building a Virtual Lab for Smart Grid Real-Time Simulator



SAYAWU DIABA



Vaasan yliopisto  
UNIVERSITY OF VAASA

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# Virtualization lab

A virtualization lab is a testing environment that allows users to create and manage virtual machines (VMs) to simulate different operating systems, network configurations, and software applications without the need for physical hardware.

They are designed to allow students, researchers, and engineers to practice and develop skills in a safe and controlled environment, without the need for expensive equipment, chemicals, or hazardous materials. Virtual labs are commonly used in education, research, and development to provide a cost-effective and flexible alternative to physical labs.



# Ways to build a virtualization lab

A virtualization lab can be implemented either as a **virtual lab** or as a **physical lab**.

## ❖ Virtual virtualization lab

A virtual virtualization lab refers to a lab that uses virtual machines to host and run other virtual machines. In a virtual virtualization lab, the virtual machines are hosted and run on virtual servers or desktops, and the users can access them remotely or directly from the virtual machines.

By the use of virtualization software such as

**Vmware:** provides advanced features such as high availability, live migration, and automated workload balancing. VMware is widely used in enterprise environments and offers a range of products, including VMware Workstation, VMware Fusion, and VMware vSphere.

**Virtualbox:** It provides basic virtualization features, such as running multiple virtual machines on a single host machine. VirtualBox is widely used in personal and small business environments.



# Ways to build a virtualization lab Cont'

## ❖ Physical virtualization lab

A physical virtualization lab refers to a lab that uses physical servers or desktops to host and run virtual machines. In a physical virtualization lab, the virtual machines are created and run on the physical hardware, and the users can access them remotely or directly from the physical machines.

By the use of virtualization software such as

**Vmware:** provides advanced features such as high availability, live migration, and automated workload balancing. VMware is widely used in enterprise environments and offers a range of products, including VMware Workstation, VMware Fusion, and VMware vSphere.

**Virtualbox:** It provides basic virtualization features, such as running multiple virtual machines on a single host machine. VirtualBox is widely used in personal and small business environments.

**Comparison:** VMware offers more advanced features and is more suitable for enterprise environments, while VirtualBox is more suitable for personal and small business use.



# Comparison of the virtualization labs

- The main difference between a physical virtualization lab and a virtual virtualization lab is that the former uses physical hardware to host and run virtual machines, while the latter uses virtual hardware to host and run virtual machines.
- A virtual virtualization lab provides greater flexibility in terms of scalability, as it can easily add or remove virtual servers or desktops as needed. However, a physical virtualization lab **may offer higher performance** and stability, as the virtual machines are running on dedicated physical hardware.



# General steps to create a physical virtualization lab

**Determine the hardware requirements:** Determine the hardware requirements for the physical virtualization lab. This depends on the number of virtual machines to run, the type of workloads to simulate, and the budget. At a minimum, it needs a server or desktop with a powerful processor, sufficient RAM, and storage capacity.

**Choose a virtualization platform:** A need to choose a virtualization platform that is compatible with the hardware and meets requirements. Popular options include VMware, Hyper-V, and VirtualBox.

**Install the virtualization software:** To install the virtualization software on the host machine. This will enable to create and manage virtual machines.

**Configure the network:** Need to configure the network settings for the virtualization lab. This includes setting up IP addresses, subnet masks, default gateways, and DNS servers.

**Create virtual machines:** With the virtualization software installed and the network configured, virtual machines can be created.

**Configure the virtual machines:** Once you have created the virtual machines, you need to configure them to meet your requirements. This includes allocating CPU, memory, and storage resources, configuring network settings, and installing any necessary software.

**Test the virtual lab:** To test the virtual lab to ensure that it is functioning as expected. Testing the virtual machines individually and testing the network connectivity between them.

# Remote access to the physical lab

- ❖ Choose the Right Remote Access Software: There are various remote access software options available, such as TeamViewer, AnyDesk, and LogMeIn.
- ❖ Install the Remote Access Software: Once you have selected the remote access software, install it on both the local and remote computers.
- ❖ Set up the Connection: Start the remote access software and connect to the remote computer where your lab equipment and devices are located. You may need to enter the remote computer's IP address, username, and password.
- ❖ Control the Lab Equipment and Devices: Once you have connected to the remote computer, you can control your lab equipment and devices as if you were physically present. You can also monitor your lab equipment and devices to ensure they are functioning correctly.
- ❖ Ensure Security: To ensure the security of your lab equipment and data, use strong passwords and enable encryption. Also, avoid accessing your lab equipment from public Wi-Fi or unsecured networks.





# Thank you