

# VDI (VIRTUAL DESKTOP INFRASTRUCTURE) IMPLEMENTATION FOR CONTROL SYSTEM - OVERVIEW AND ANALYSIS

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## WHAT IS VIRTUALIZATION?

Virtualization is a process that involves increasing the physical resources of a hardware through its virtualization.

There are different kinds of virtualization. We can divide virtualization into three groups:

- Hardware virtualization.
- Systemic virtualization.
- Network virtualization.

Because of virtualization implementation we are able to run multiple processes simultaneously on one physical machine. This process allows multiple operating systems(OS) to work at the same time on the same machine. We can also freely change the system configuration. On virtual machines we can increase or decrease:

- Processors and their cores.
- Hard drives:
  - RAM, Configure the network adapters.
  - USB devices.
  - USB controllers and many other devices.

Server virtualization is a great example of **hardware virtualization**.

If using the right software we can run 30 virtual servers based and operating on different operating systems (OS) on various subnets and performing different tasks at the same time.

Another type of virtualization widely used nowadays is **network virtualization**.

Creating VLAN (Virtual LAN) on switches allows to extend the capabilities of the device and increases its productivity. One port may have multiple VLANs or virtual subnets.

We can also use virtualized network adapters. There are only one physical network adapter and the right software needed to configure many virtual environments.

## WHAT IS VDI?

I would like to discuss also an **VDI – Virtual Desktop Infrastructure**. It is the virtualization of desktops which are used in every office.

This method is called a *thin client* and it allows to implement an end-user application and its configured environ-

ment on the server. This involves creating a virtual machine resource (VM) for each user who is authorized and has access when logging into VMware Horizon 7 with the installed agent on the terminal. The created virtual machines (MV) are on the server and work under control of hypervisor using the same process as in server virtualization.

Each VM desktop has appropriately configured RAM memory, disk space, and other resources. The entire installation takes place on a virtual disk created on the physical server. The user interacts with the VM using the remote graphical terminal protocol, for example: RDP (Remote Desktop Protocol). The VDI client is a simple terminal whose operation is solely connecting to the VDI infrastructure on the server. The protocols used for connection between terminal and VDI are:

- PCoIP
- VMWare Blast

This solution works very well in places where computers or laptops are used for multi-tasking and multi-shifts, or for different users who have access to a particular desktop where each of them have their own applications, directories and data. Also all data lives in the data center, not on the endpoint, so there are significant security benefits of VDI. There is no data on the machine itself. This is a big advantage and massive benefit of using VDI in the control system and therefore it was decided to test it in NCPS "Solaris".

## VDI TEST IN NCPS "SOLARIS"

Tests were performed in the control room. Eleven desktop computers with Centos 64 v7.3 operating system and Tango system were virtualized. All computers had a special configuration, and were very sensitive to any change. Many packages and repositories have been installed for a long period of time to balance the quality of work and requirements imposed by operators (see Fig.1).

After moving these computers and creating the same number on virtual machines(VM), it occurred that there were no losses on the hardware performance. "Everything worked as well if not better" - this is a quote from the system users'. Also the assumption was made that the server must have efficient graphics card because each station has to be able to operate 4 monitors. The NVIDIA Tesla M60 GPU graphics card was used for testing. It was expected to be very efficient and meet our expectations. After many tests a problem with the drivers was detected. The card could not handle 4 monitors at the same time. The

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problem occurred while defining the main monitor. After the configuration of the graphical environment and the desktop by the Operator it turned out that the image starts to flicker and constantly refresh itself. An attempt to set up a Ticket in Nvidia was made. Unfortunately, there was no improvement. After many tedious tests the solution was found and it was simpler than anticipated. A standard graphics card located on the server was used as a solution. Everything worked smoothly. The fault was only in the compatibility of CentOS drivers.

### BENEFITS OF VDI

The advantages of VDI implementation in the Control System are:

- Access any computer to the VM.
- Possibility to dedicate appropriate groups to the VM with specific rights to access resources.
- Easy Backup.
- Can be used as Ansible - easy to deploy VM with the corresponding system configuration.
- Lack of physical computers (cheaper operation, no support, no failure).
- Efficiency.

The main disadvantage of this system unfortunately is the price.

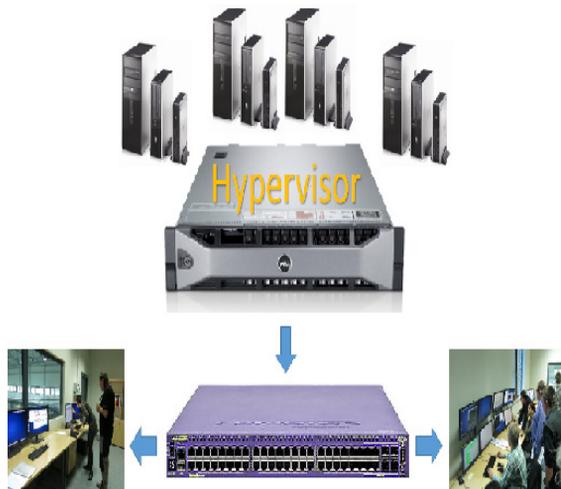


Figure 1: VDI in Solaris.

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