Organisation of IT Infrastructure

Department of Accounting and Finance
School of Business Administration
University of Macedonia

- Virtualization
- Storage network
- Remote services

Prof. Nikolaos Protogeros

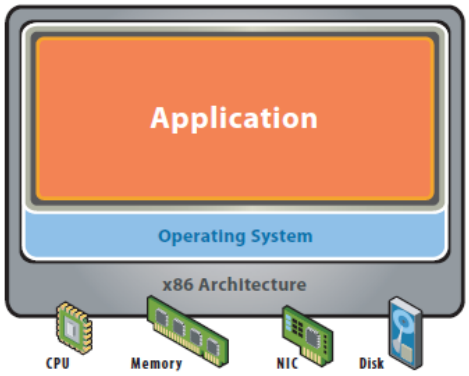
Thessaloniki 2020

Useful information

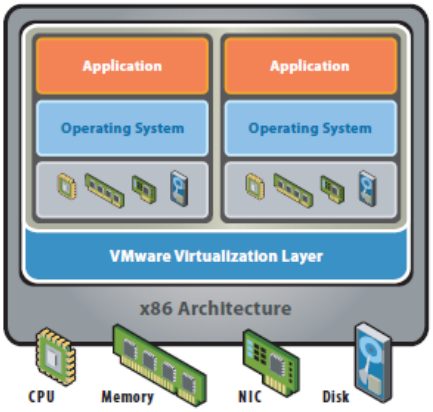
Virtualization

The term virtualization describes the separation of a resource or service request from the underlying physical provision of that service. For example, with the usage of virtual memory, computer software gains access to more memory than the available physical, by transferring in the background data to the disk. Similarly, virtualization techniques can be applied to other layers of IT infrastructure including networks, storage, laptops or servers, operating systems, and applications. This mix of virtualization technologies - also called virtual infrastructure - provides a decoupling between storage computers and network equipment on one hand and applications running on them on the other (see figure below).

The development of virtual infrastructure is transparent, as the user experience is largely unchanged. However, virtual infrastructure gives managers the advantage of managing resources across the organization and allows IT managers to better respond to the dynamic organizational needs by better leveraging infrastructure investment.



Before virtualization



After virtualization

- One Operating System (OS) image per machine
- Software and hardware are closely linked
- Run multiple applications on the same machine that often causes conflict
- Resources are underused
- Rigid and expensive infrastructure

- Independence between the hardware and the OS and the applications
- Virtual machines can be powered by any OS
- The OS and the application can be managed as a single unit by integrating them into virtual machines

Benefits of virtual infrastructure

Using virtual infrastructure solutions, managers can meet challenges that include:

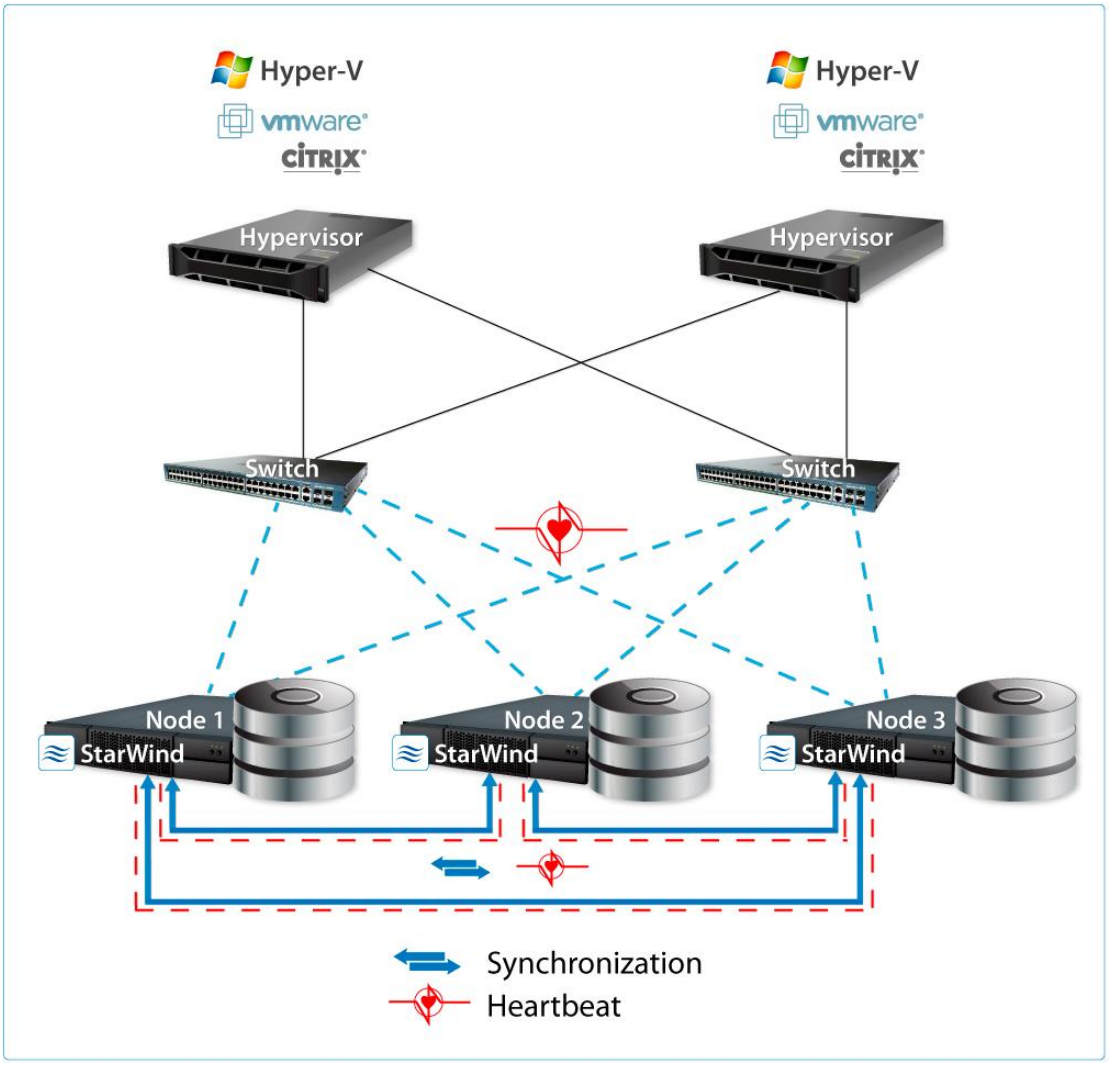
- ***Server Retention and Integration*** **-** Eliminate the need to commission new servers by developing systems as virtual machines (VMs) that can run safely and move transparently across the entire range of shared hardware. Increase of server usage rates from 5-15% to 60-80%.
- ***Expansion and Deployment Optimization*** **-** Easy and fast server development by reusing pre-configured systems, enhancing collaboration, and standardization in deployment environments.
- ***Business Continuity*** **-** Reduce the cost and complexity of business continuity (high availability and disaster recovery solutions) by enclosing entire systems in single files that can be copied and stored on any target server, minimizing the possibility of downtime.
- ***Business desktops*** **-** Secure managed computers, workstations, and laptops without compromising end-user autonomy by implementing a reliable software security policy**.**

Storage area networks

Storage Area Networks (SANs) are networks that rely on fiber optics or very fast network cards (10Gb Ethernet) and connect multiple storage devices to a separate high-speed network for exclusive storage use.

Advantages of storage networks

Sharing storage of storage networks simplifies storage management and adds flexibility as there is no need to move cables and storage devices to move storage media from one server to another. Also, the storage space can be easily shared on many PCs but also on virtual machine hosting servers so the virtual machines can be easily transferred from one server to another. Benefits also include the ability to remotely boot servers from the storage network. This allows defective servers to be replaced quickly and easily, as the storage network can be reconfigured so that the replacement server can use the same logical unit (LUN) server as the defective server. It also allows virtual machines to be transferred from heavily loaded servers to more inactive ones. This logic is the basis of the organization of modern data centers.

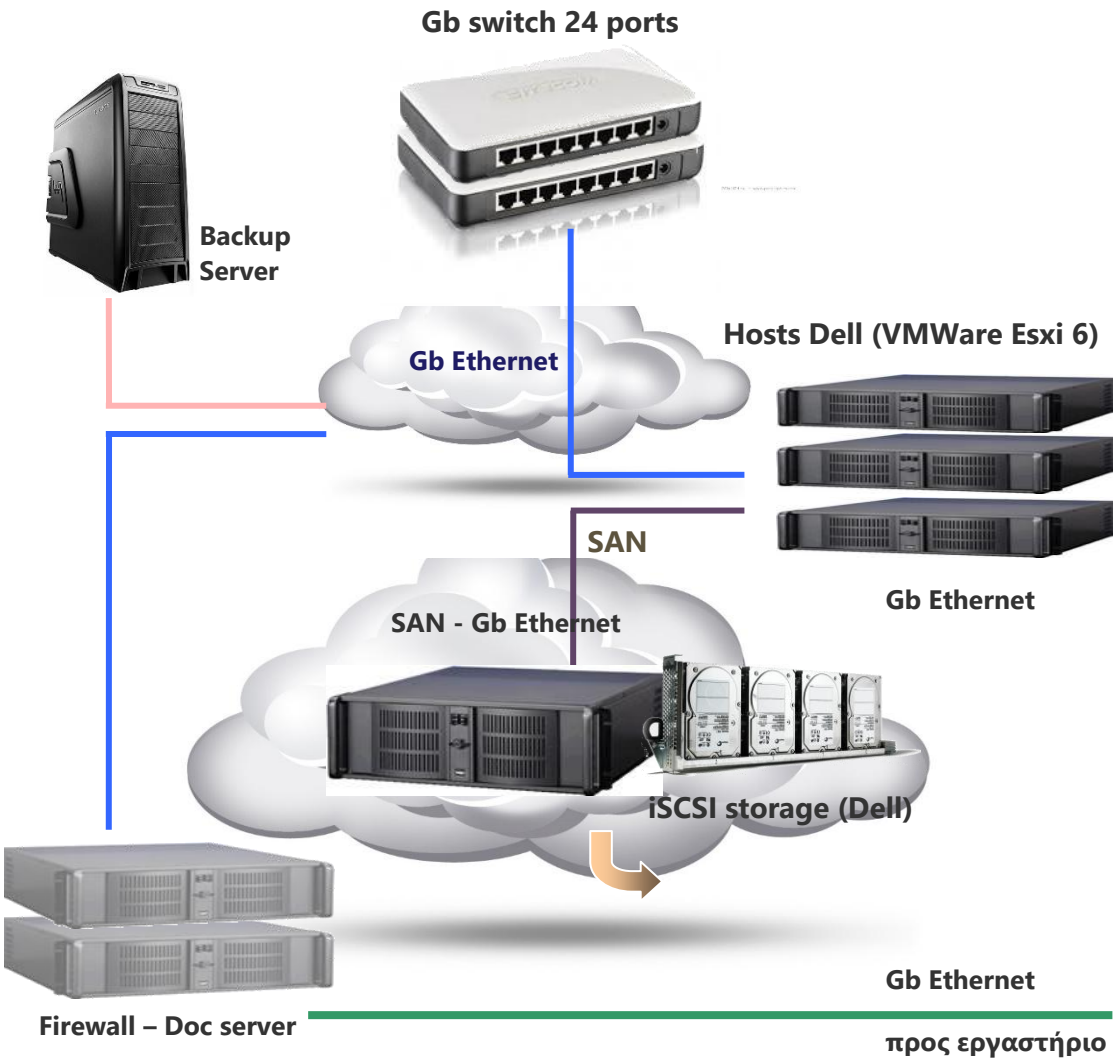


Finally, storage networks allow for more efficient data security and disaster recovery procedures. A storage network could cover a remote location that contains a secondary storage array. This would make it possible to secure the data either by implementing disk arrays, or by server software or by specialized devices that could be very far from the physical network space.

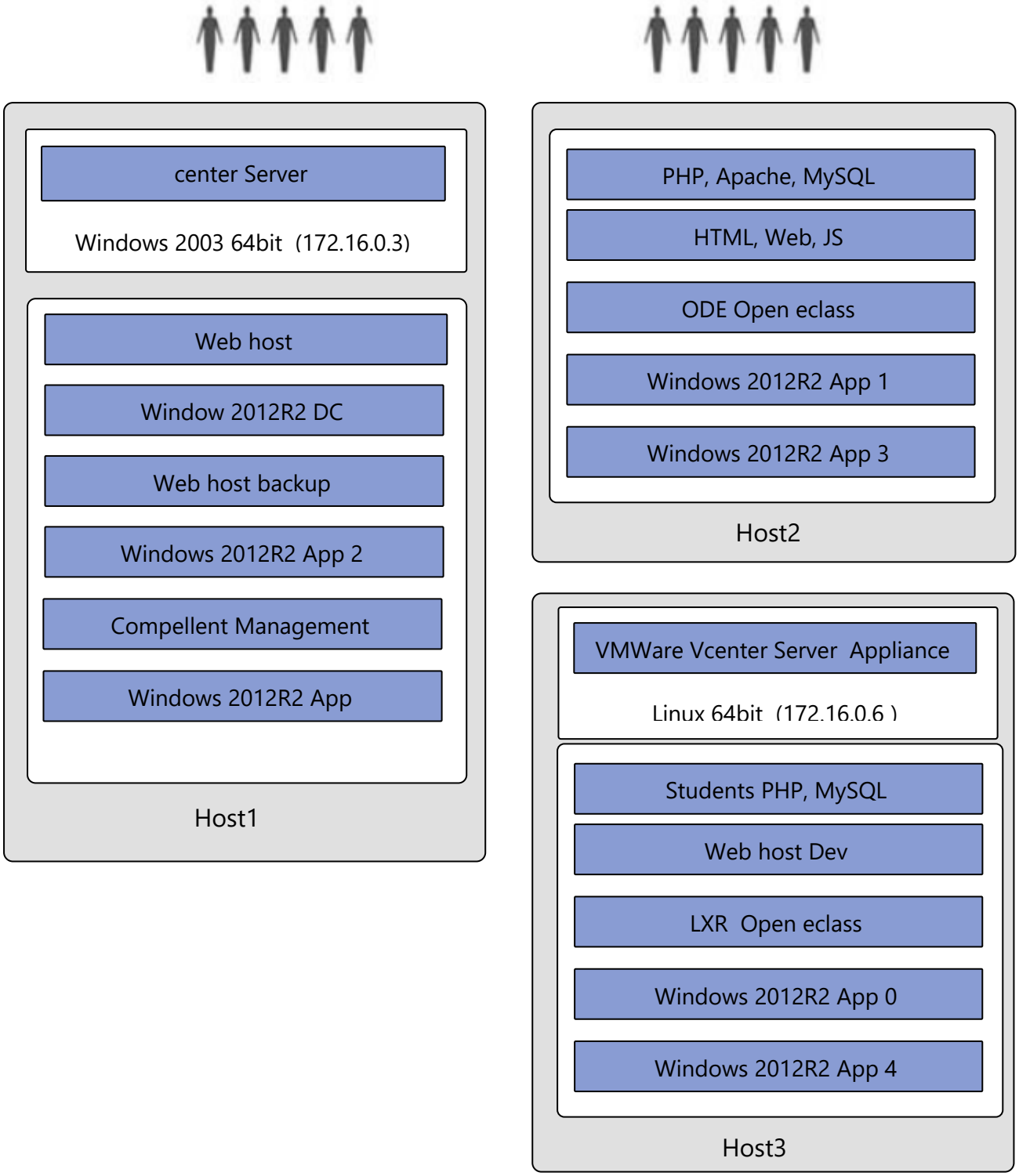
The organization of the IT infrastructure of the Department

The Department of Accounting and Finance has 5 servers, two of which are of old technology (10 years old) and three newer (5 years old). The three newer PCs (Dell P630) together with the central storage server (Dell SCV2020) constitute the central virtualization infrastructure of the Department. The storage server is connected via a Gb Ethernet-based SAN Storage Network to the three servers hosting the virtual machines (VMs). The SAN as well as the network that connects the hosts between them and to the rest of the infrastructure of the Department and of the university, is implemented with two Gb Switches (Cisco - 24 ports), which provide the necessary network infrastructure to connect the servers with each other and with the rest of the PCs.

Both older servers (IBM) are used in the architecture, the first one as a Firewall and the second as storage.



The figure shows the layout of the virtualization servers


center Server
Windows 2003 64bit (172.16.0.3)
Web host
Window 2012R2 DC
Web host backup
Windows 2012R2 App 2
Compellent Management
Windows 2012R2 App
Host1
PHP, Apache, MySQL
HTML, Web, JS
ODE Open eclass
Windows 2012R2 App 1
Windows 2012R2 App 3
Host2
VMWare Vcenter Server Appliance
Linux 64bit (172.16.0.6)
Students PHP, MySQL
Web host Dev
LXR Open eclass
Windows 2012R2 App 0
Windows 2012R2 App 4
Host3
VIRTUAL INFRASTRUCTURE
STORAGE
NETWORK
NETWORK
SERVERS
SERVERS
STORAGE

Finally, it should be mentioned that the infrastructure has been developed by several of the services provided by the modern cloud computing centers and relevant applications are already being developed to support educational and administrative activities that utilize them.

Finally, the infrastructure is complemented by a system for downloading backup files (Qnap server) in which changes to virtual machines (incremental backup) are constantly stored. The distribution of virtual machines to hosts is shown in the figure above.

In the above architecture all existing operating systems are virtual machines and are shared on the three hosting servers (host1 -3). They are stored on the storage server and are shared so that there is an inherent possibility of manually transferring a virtual machine from one host to another (the VMWare version available by the Department does not allow hot transfer). The system has all the advantages of virtualization such as load sharing, increased security against host failures and improved backup capability. The system can accommodate a large number of virtual machines with a small expansion of memory and network speed and therefore meet the future needs of the Department.

Finally, it should be mentioned that in the infrastructure has been developed several of the services provided by the modern cloud computing centers and relevant applications are already being developed to support educational and administrative activities that utilize them.