

ABB Technology Days Fall 2013

# Server and Client Virtualization

# Virtualization

Customers specify it

Customers harmonize with IT

Training environments

Lower cost of ownership

Backup validation

Lower power and cooling costs

Server footprint reduction

## Virtualization

Spare parts reduction

Flexibility

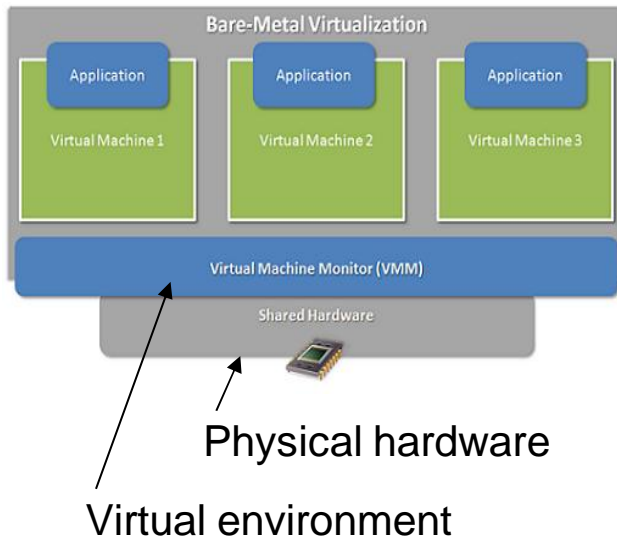
Lifecycle benefits

Performance benefits

Project upgrade benefits

Improved availability

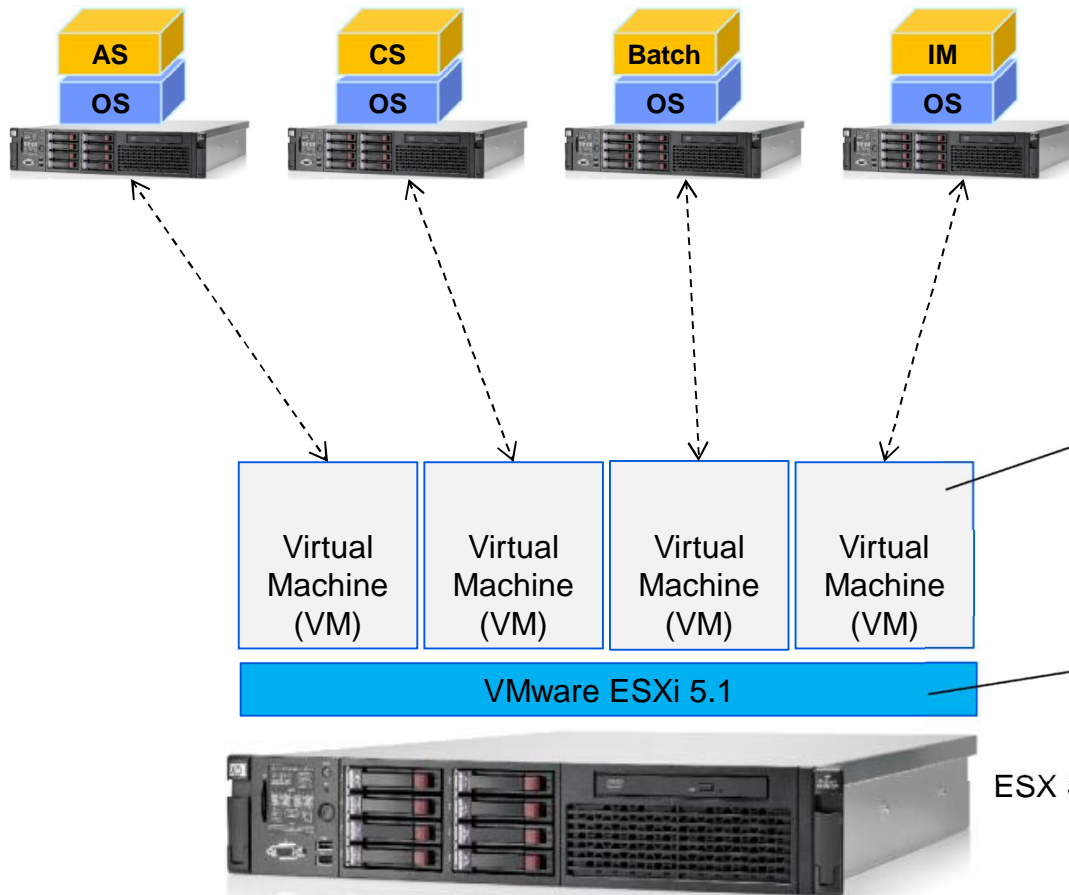
# What is a Virtual Machine?



- A virtual machine (VM) emulates a physical computer
- One or several VMs run on a regular computer
- Virtual hardware of each VM can differ, e.g. 2 NICs, amount of RAM, etc.
- Run different operating systems on the same physical computer - old as well as newer ones
- Reduced server footprint
- Simplified system maintenance
- Energy saving

# Virtualization

## Virtualization – What is this???



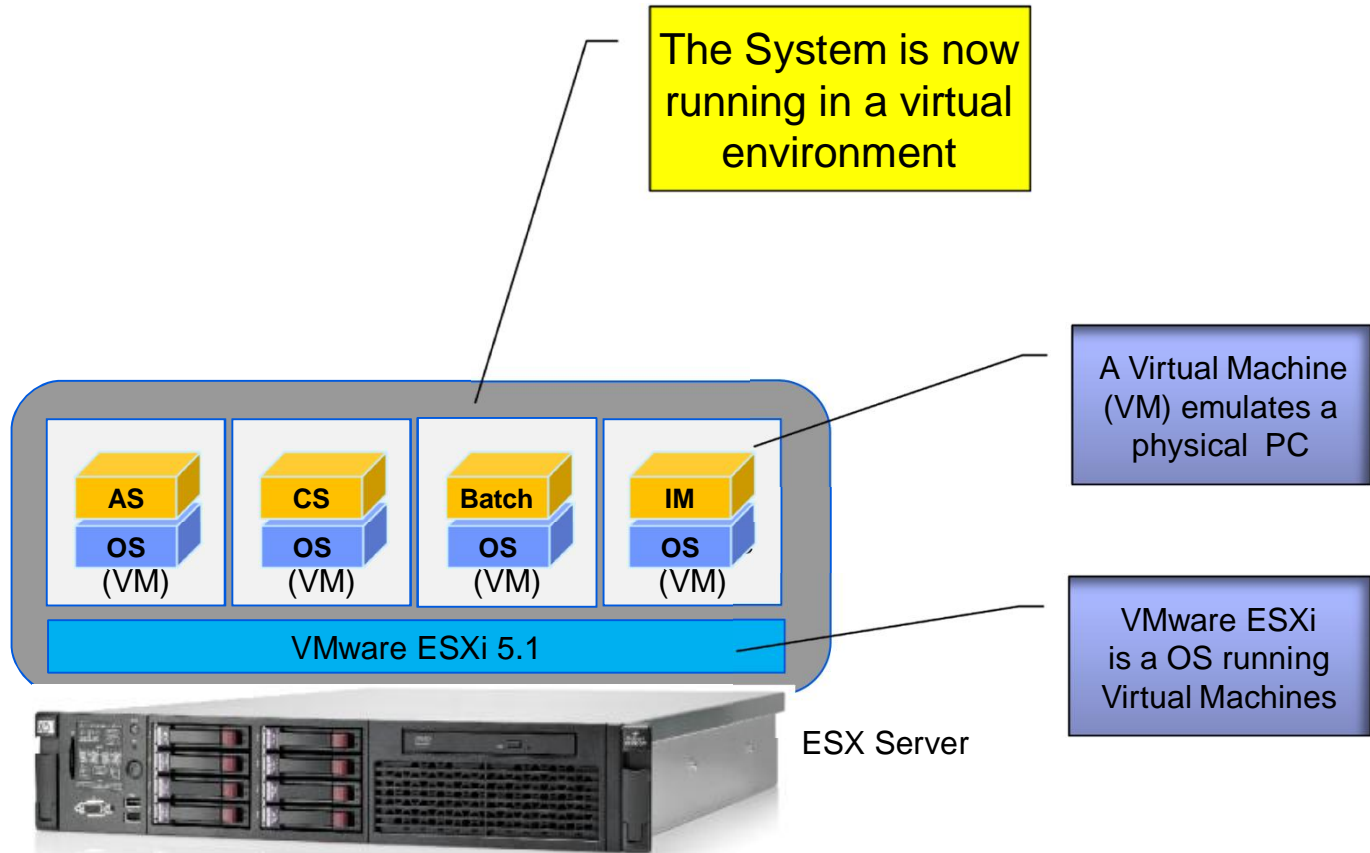
**Application:** AS, CS, Batch, IM.....  
**OS:** Windows 7 / Windows Server 2008  
**HW:** Workstation / Server

A Virtual Machine (VM) emulates a physical PC

VMware ESXi is a OS running Virtual Machines

# Virtualization

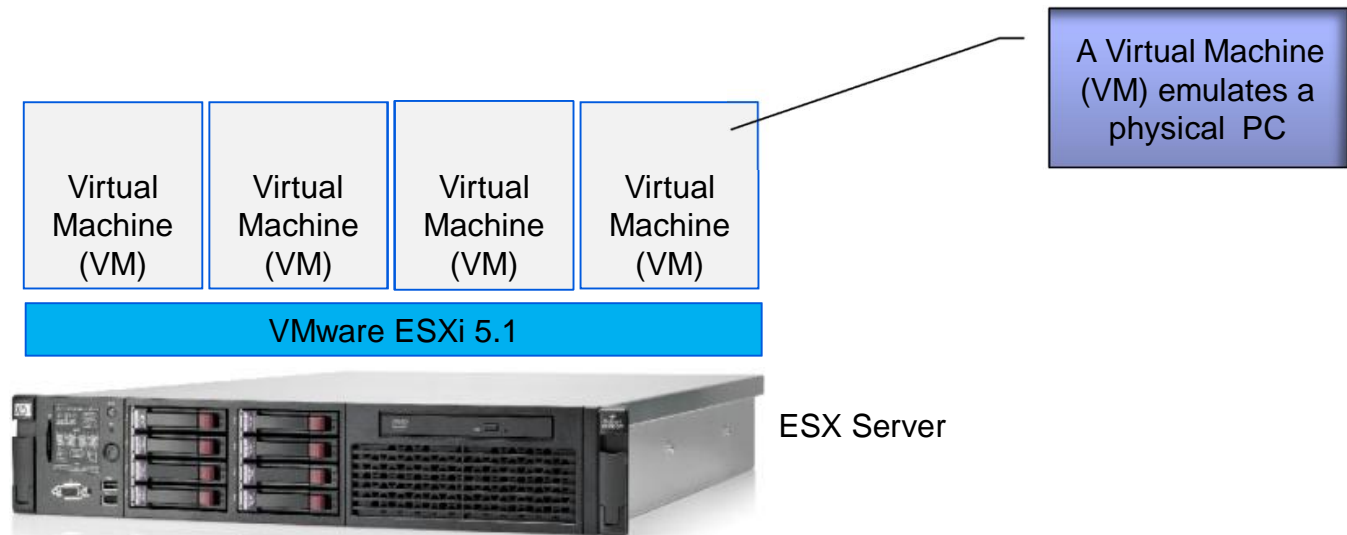
## Virtualization – What is this???



# Virtualization

## What is a Virtual Machine?

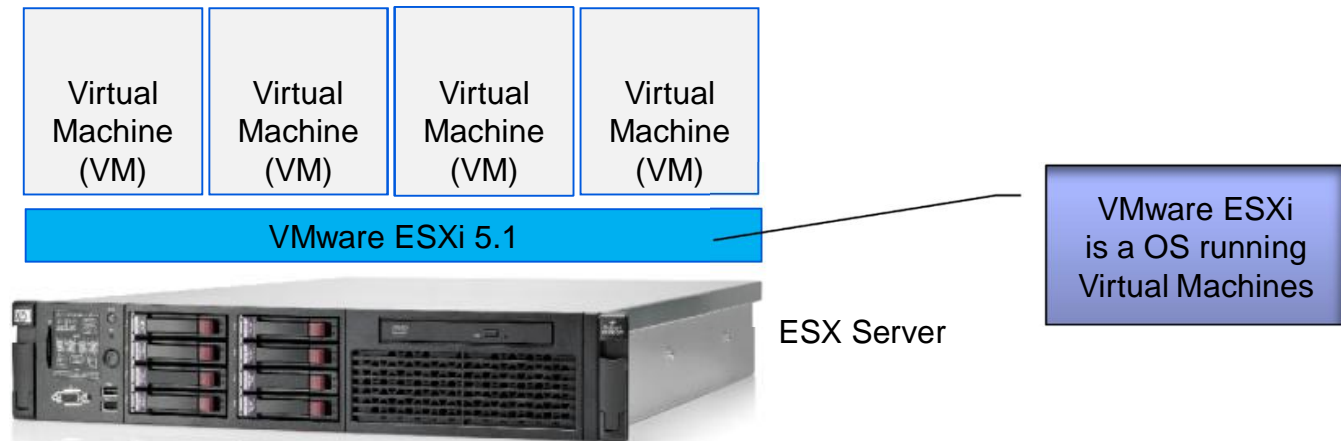
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# Virtualization

## What is VMware vSphere ?

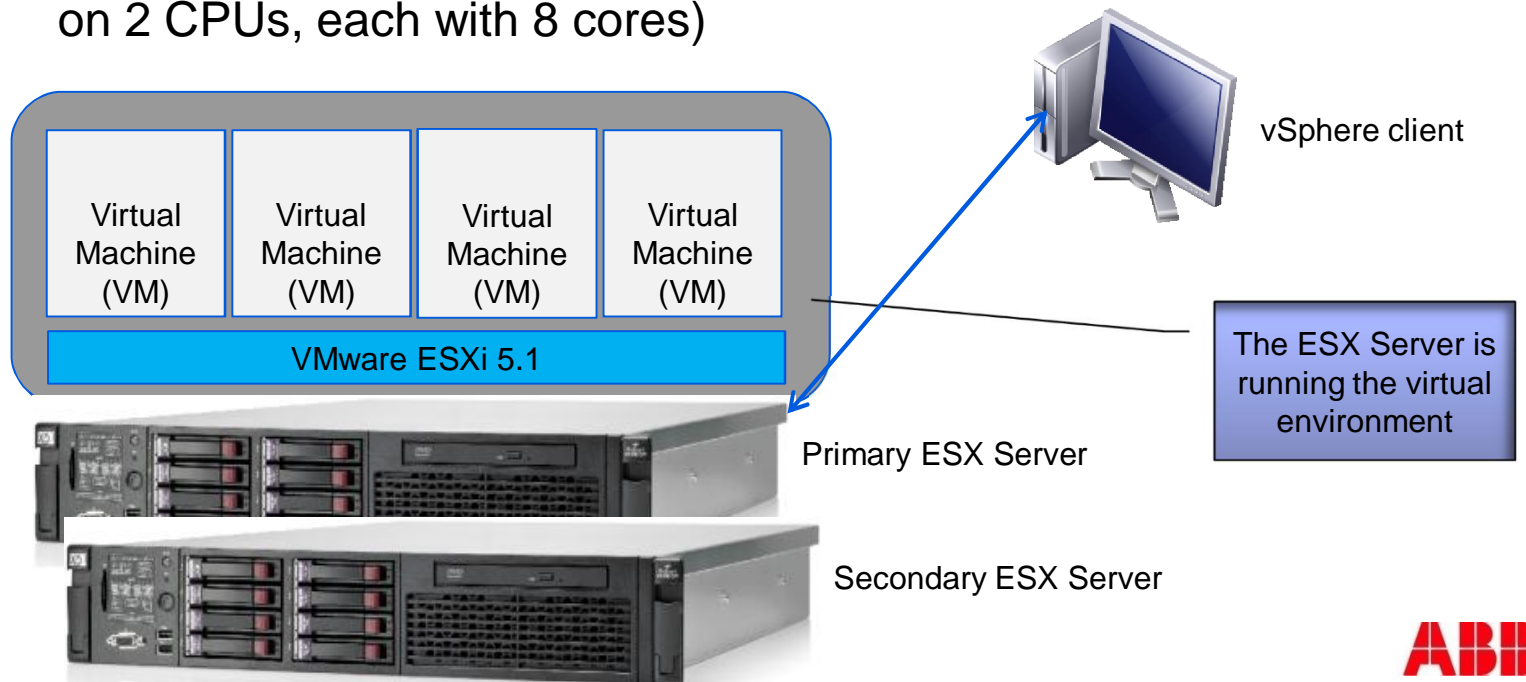
- VMware vSphere is a virtualization technology and market leader in virtualization
- VMware vSphere is used in 70%-90% of the worlds virtualized computer systems
- VMware vSphere has a proprietary VMware kernel for running Virtual Machines
- vConverter converts physical computers to virtual machines



# Virtualization

## What is an ESX Server ?

- The ESX Server is running the virtual environment and can be redundant (1oo2)
- ESX Server does not have a graphical interface
- vSphere client software running on Windows is used for interaction with the ESX Server
- The ESX server is based on multi CPUs and multi cores server hardware (e.g. Dell PowerEdge R720, which is based on 2 CPUs, each with 8 cores)

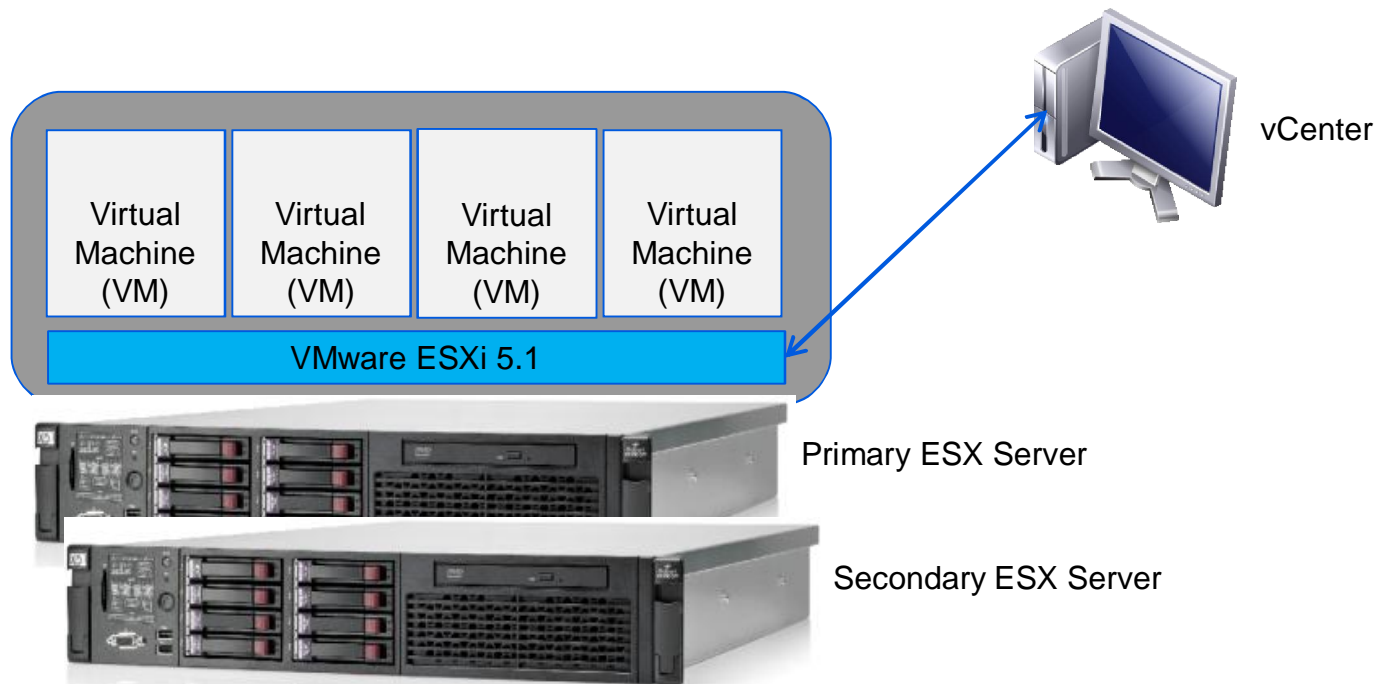




# Virtualization

## What is vCenter ?

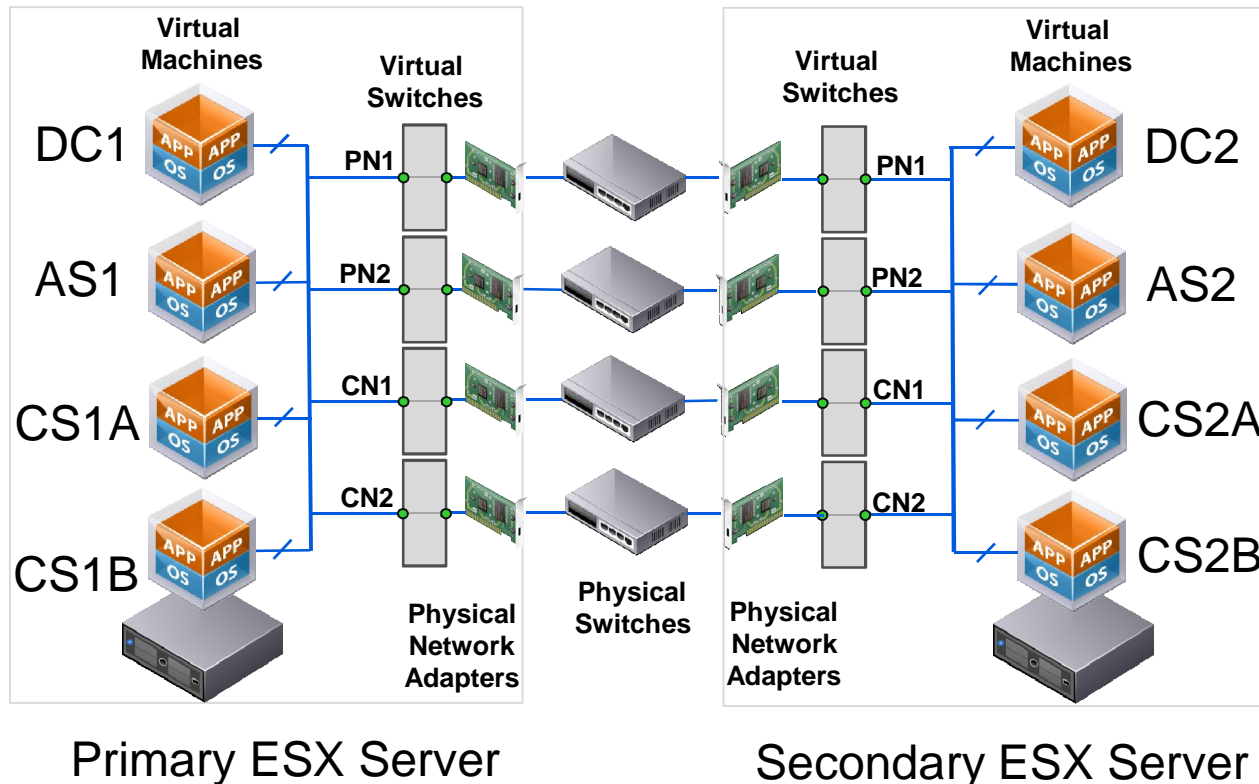
- vCenter is used for the maintenance of the ESXi environment and runs on a Windows computer:
  - Backup and update
  - Performance diagnostics
  - Moving of virtual machines between servers



# Virtualization

## System services running as virtual machines

- Primary and Secondary System services are running on respective ESX Servers
- Virtual switches connect the System nodes to the physical network via ESX Ethernet adapters



# System Virtualization

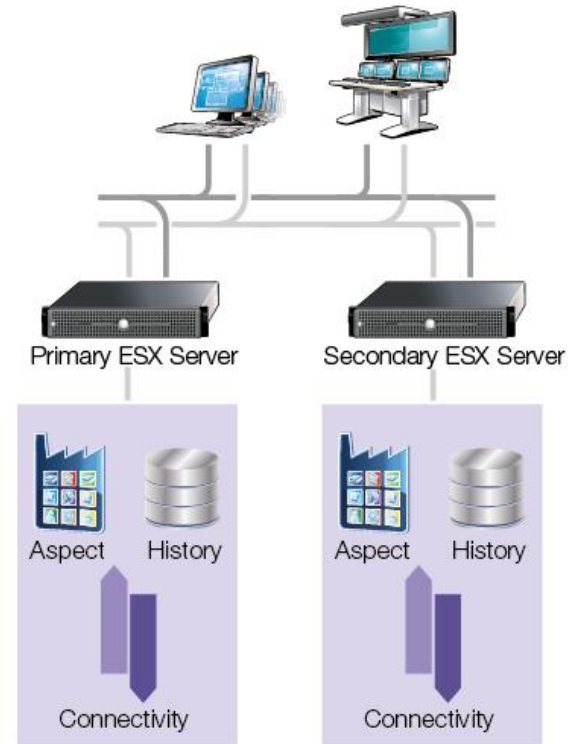
## Virtualized Clients



- Support for ESXi 5.1
- Virtualized Client capability in addition to System Servers
- No System SW on physical client machines
- Easier to install and maintain

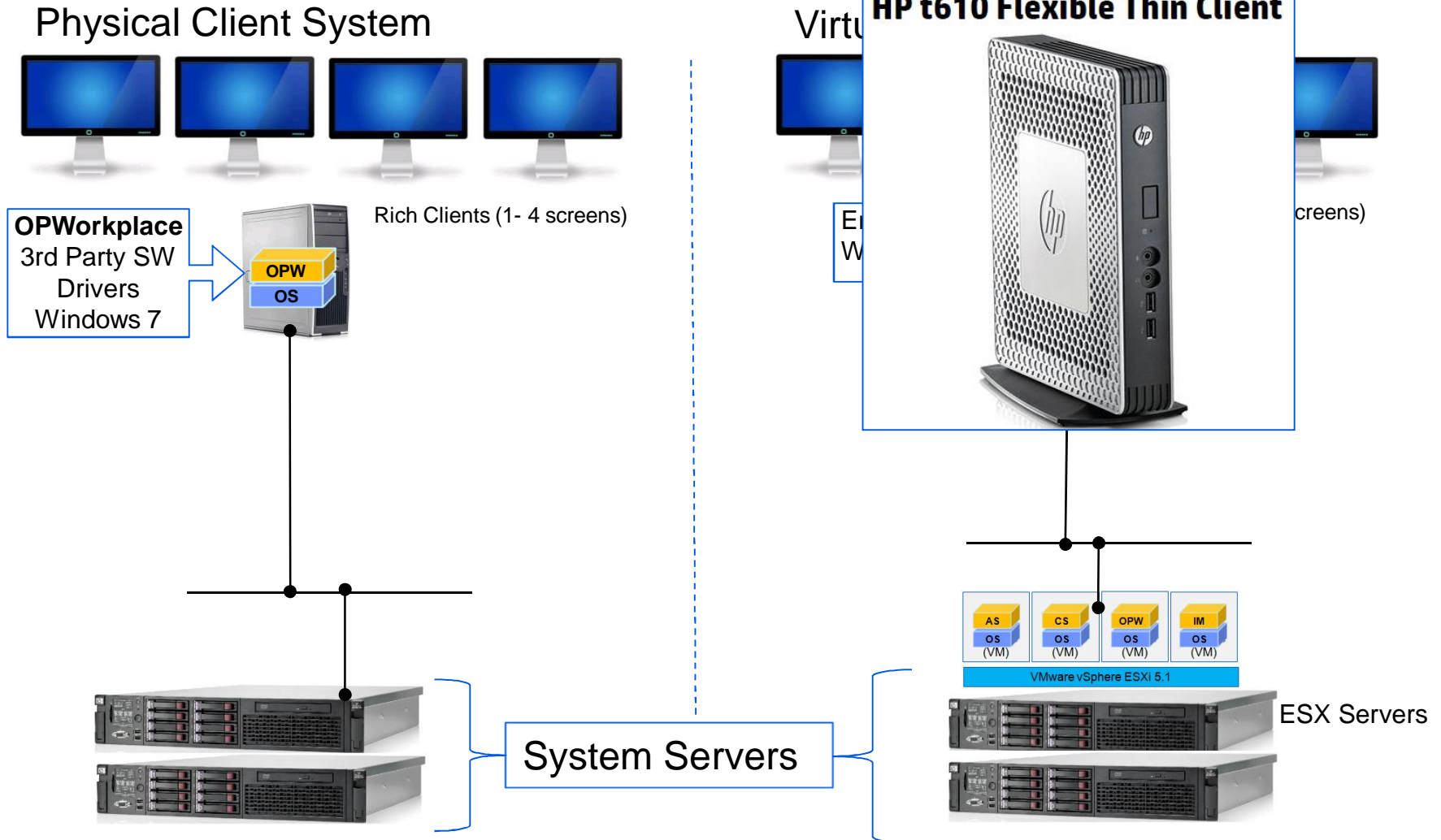
**The entire control system can literally be virtualized!**

Virtualization with 2 servers



# System Virtualization

## Client Virtualization based on Remote Desktop

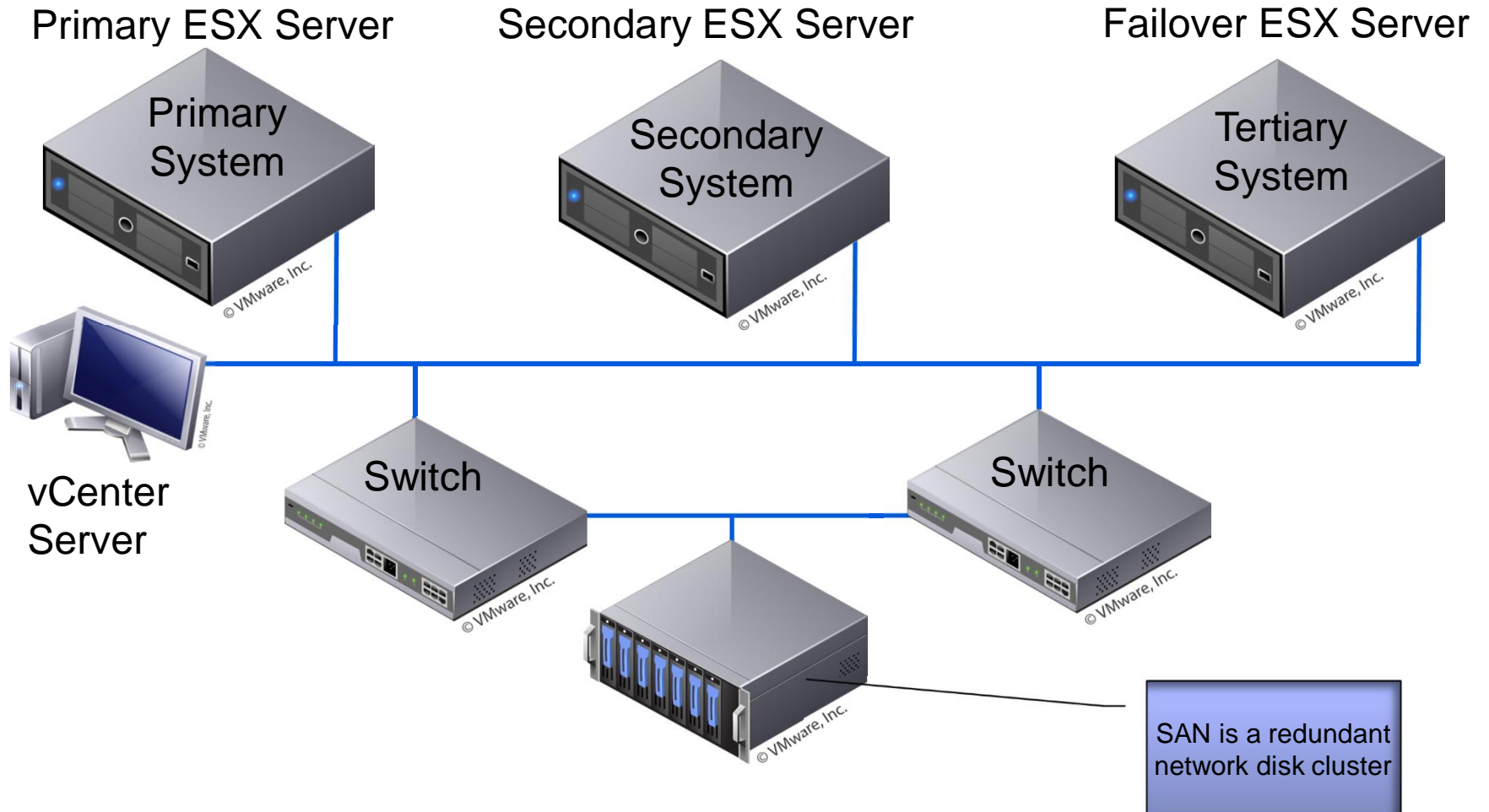


# System Virtualization

## Virtual Client Benefits

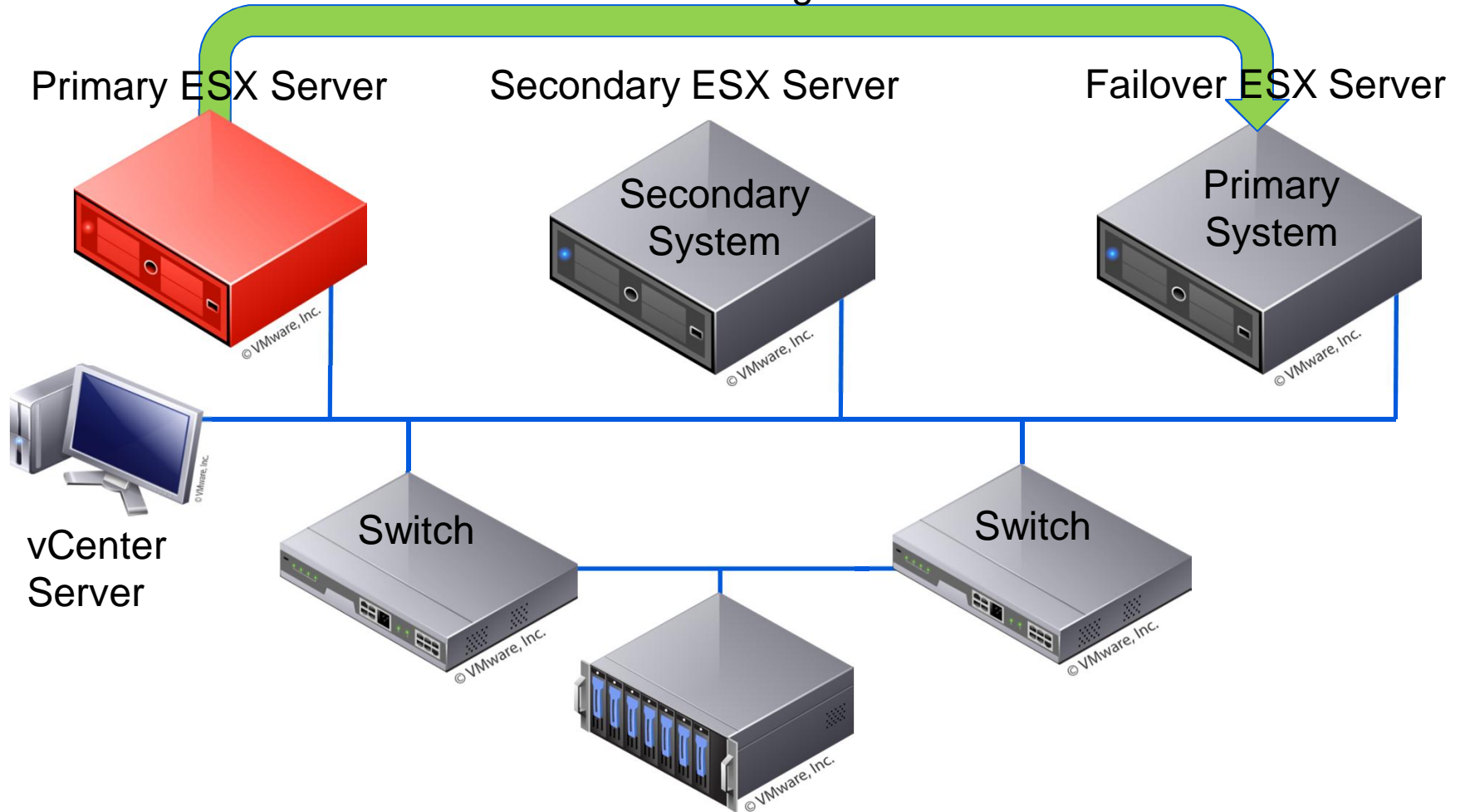
- + Reduced operator room space requirements
  - + Reduced operator room power and heating requirements
    - + Reduced operator room cooling requirements
    - + Reduced operator room noise
  - + Fast replacement of thin client
  - + Ability to move virtual client to new hardware without reinstall
  - + Standard installation. No messing with drivers.
  - + Added security by setting up virtual client with no USB ability
  - + Clients now in server room without costly remote solutions
- ...but...don't install all client in the same server!

# System Virtualization SAN Cluster



# System Virtualization SAN Cluster

Automatic Restarting Of Nodes



# System Virtualization

## Improved MTTR (Mean Time To Recovery)

- At server failure the Virtual Machines are restarted on another server automatically
- Single mode operation only for a few minutes – MTTR improved
- Makes use of the VMware High Availability feature
  - Restarting virtual machines on another ESX server in case of hardware failure
  - Will not replace 800xA redundancy schemes – not real time from a DCS perspective



# System Virtualization Security

- The same rules apply for a virtual system, e.g.
  - Apply security updates
  - Configure virus scanner
  - Secure the system with firewall/application gateway
  - Secure access to the hardware
- Security benefits of virtualization
  - CDROM, USB and Floppy Disk support can be removed from the virtual machines, eliminating one entry point of viruses

# System Virtualization

## Virtualization benefits

### 1. **Increased performance**

- Utilize latest processor technology
- Faster network through virtual machines on virtual switches

### 2. **Increased Availability**

- Well proven installation and configuration of all software

### 3. **Reduced Maintenance Cost**

- Less variants of software, hardware and related configurations
- Migration to new hardware without reinstallation
- More possibilities to add additional servers

# System Virtualization

## Virtualization benefits

### 4. **Reduced Upgrade Costs and risks**

- The complete upgraded system can be set-up, tested, and started in parallel with the previous version

### 5. **Reduced physical equipment**

- Reduced server count
- Reduced installation and wiring

### 6. **Second order effects in**

- Power saving, less cooling
- Saving cabinets and space
- Reduced spare parts requirements
- etc.

# System Virtualization

## Energy saving potential

▪ Before



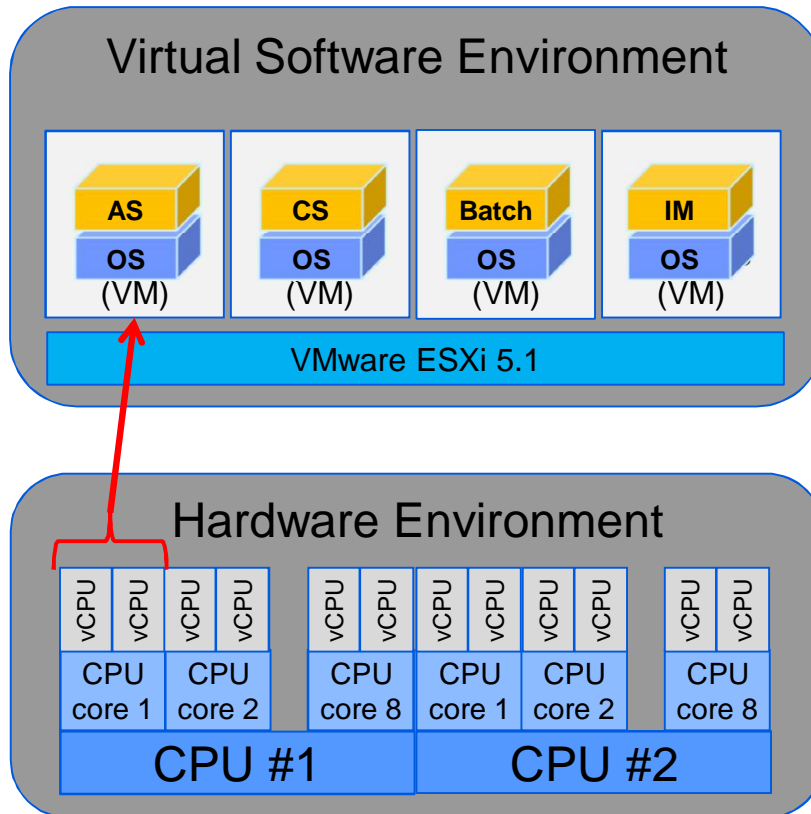
▪ After



- System servers used for various product support tasks
- Before virtualization:
  - 9 st Dell PE1850 - 200W  
=> 15.768 kWh/year
- After virtualization:
  - 1 Dell R610 - 200W =>  
1.765 kWh/year
- Annual saving – 14.000 kWh

# System Virtualization

## Virtual CPU – What is that???



- E.g. Dell PowerEdge R720, based on 2 CPUs, each with 8 cores  
=> 16 cores
- Each core can handle 2 Virtual CPUs => 32 vCPUs
- One Virtual Machine (VM) requires two vCPUs  
=> Max 16 Virtual Machines



ESX Server

# Best practices for creating robust virtualized solutions

Node	vCPU	RAM GB	Disk GB	Node	vCPU	RAM GB	Disk GB
DC1	2	2	60	DC2	2	2	60
AS1	2	4			2	4	60
CS1	2	4			2	4	60
IM	2	4			6	8	60
BS1	2	4	60	SC	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
VCL	2	4	60	VCL	2	4	60
ECS	2	4	60		2	4	60
Total	26	50	970		30	54	780
Node	Log CPU	RAM GB	Disk GB	Node	Log CPU	RAM GB	Disk GB
Server	32	64	1500	Server	32	64	1500
Note	Log CPU = Logical CPU. i.e. Hyperthreaded cores. e.g. 2 x 8 core CPU gives 2 x 8 x 2 Logical Processors						
For each server, the total number of vCPU should be less than the number of Logical Processors							

2 vCPUs per System service nodes are required

26 vCPUs totally are required

30 vCPUs totally are required

32 vCPUs are available => OK!

32 vCPUs are available => OK!



# Summary

- Virtualization offers excellent cost-of-ownership advantages
- ESX(i) 4.x and ESXi 5.x supported
- From a security standpoint a system running on virtual machines does not differ from a conventional one
- No performance drawbacks identified

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