

Virtualizzazione



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Inaf ICT Workshop
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Virtualizzazione

Parte I – ore 9.00

Parte II – ore 11.00

Virtualizzazione

Parte I

Donatella Vecchies



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Virtualization

From Wikipedia, the free encyclopedia

In computing, **virtualization** refers to the act of creating a virtual (rather than actual) version of something, including virtual computer hardware platforms, operating systems, storage devices, and computer network resources.

Virtualization began in the 1960s, as a method of logically dividing the system resources provided by mainframe computers between different applications. Since then, the meaning of the term has broadened.^[1]

Contents [show]

Look up *virtualization* in Wiktionary, the free dictionary.

Hardware virtualization [edit]

Main article: Hardware virtualization

See also: Mobile virtualization

Hardware virtualization or *platform virtualization* refers to the creation of a virtual machine that acts like a real computer with an operating system. Software executed on these virtual machines is separated from the underlying hardware resources. For example, a computer that is running Microsoft Windows may host a virtual machine that looks like a computer with the Ubuntu Linux operating system; Ubuntu-based software can be run on the virtual machine.^{[2][3]}

In hardware virtualization, the *host machine* is the actual machine on which the virtualization takes place, and the *guest machine* is the virtual machine. The words *host* and *guest* are used to distinguish the software that runs on the physical machine from the software that runs on the virtual machine. The software or firmware that creates a virtual machine on the host hardware is called a *hypervisor* or *Virtual Machine Manager*.

Different types of hardware virtualization include:

- Full virtualization – almost complete simulation of the actual hardware to allow software, which typically consists of a guest operating system, to run unmodified.
- Partial virtualization – some but not all of the target environment attributes are simulated. As a result, some guest programs may need modifications to run in such virtual environments.
- Paravirtualization – a hardware environment is not simulated; however, the guest programs are executed in their own isolated domains, as if they are running on a separate system. Guest programs need to be specifically modified to run in this environment.

Hardware-assisted virtualization is a way of improving overall efficiency of virtualization. It involves CPUs that provide support for virtualization in hardware, and other hardware components that help improve the performance of a guest environment.

Hardware virtualization can be viewed as part of an overall trend in enterprise IT that includes autonomic computing, a scenario in which the IT environment will be able to manage itself based on perceived activity, and utility computing, in which computer processing power is seen as a utility that clients can pay for only as needed. The usual goal of virtualization is to centralize administrative tasks while improving scalability and overall hardware-resource utilization. With virtualization, several operating systems can be run in parallel on a single central processing unit (CPU). This parallelism tends to reduce overhead costs and differs from multitasking, which involves running several programs on the same OS. Using virtualization, an enterprise can better manage updates and rapid changes to the operating system and applications without disrupting the user. "Ultimately, virtualization dramatically improves the efficiency and availability of resources and applications in an organization. Instead of relying on the old model of "one server, one application" that leads to underutilized resources, virtual resources are dynamically applied to meet business needs without any excess fat" (ConsonusTech).

Hardware virtualization is not the same as hardware emulation. In hardware emulation, a piece of hardware imitates another, while in hardware virtualization, a hypervisor (a piece of software) imitates a particular piece of computer hardware or the entire computer. Furthermore, a hypervisor is not the same as an emulator; both are computer programs that imitate hardware, but their domain of use in language differs.

Snapshots [edit]

Main article: Snapshot (computer storage)

A *snapshot* is the state of a virtual machine, and generally its storage devices, at an exact point in time. A snapshot enables the virtual machine's state at the time of the snapshot to be restored later, effectively undoing any changes that occurred afterwards. This capability is useful as a backup technique, for example, prior to performing a risky operation.

Virtual machines frequently use virtual disks for their storage; in a very simple example, a 10-gigabyte hard disk drive is simulated with a 10-gigabyte flat file. Any requests by the VM for a location on its physical disk are transparently translated into an operation on the corresponding file. Once such a translation layer is present, however, it is possible to intercept the operations and send them to different files, depending on various criteria. Every time a snapshot is taken, a new file is created, and used as an overlay for its predecessors. New data are written to the topmost overlay; reading existing data, however, needs the overlay hierarchy to be scanned, resulting in accessing the most recent version. Thus, the entire stack of snapshots is virtually a single coherent disk; in that sense, creating snapshots works similarly to the incremental backup technique.

Other components of a virtual machine can also be included in a snapshot, such as the contents of its random-access memory (RAM), BIOS settings, or its configuration settings. "Save state" feature in video game console emulators is an example of such snapshots.

Restoring a snapshot consists of discarding or disregarding all overlay layers that are added after that snapshot, and directing all new changes to a new overlay.

Migration [edit]

Main article: Migration (virtualization)

The snapshots described above can be moved to another host machine with its own hypervisor; when the VM is temporarily stopped, snapshotted, moved, and then resumed on the new host, this is known as migration. If the older snapshots are kept in sync regularly, this operation can be quite fast, and allow the VM to provide uninterrupted service while its prior physical host is, for example, taken down for physical maintenance.

Failover [edit]



Virtualizzazione a modo mio

- no definizioni
- no classificazioni
- no teoria

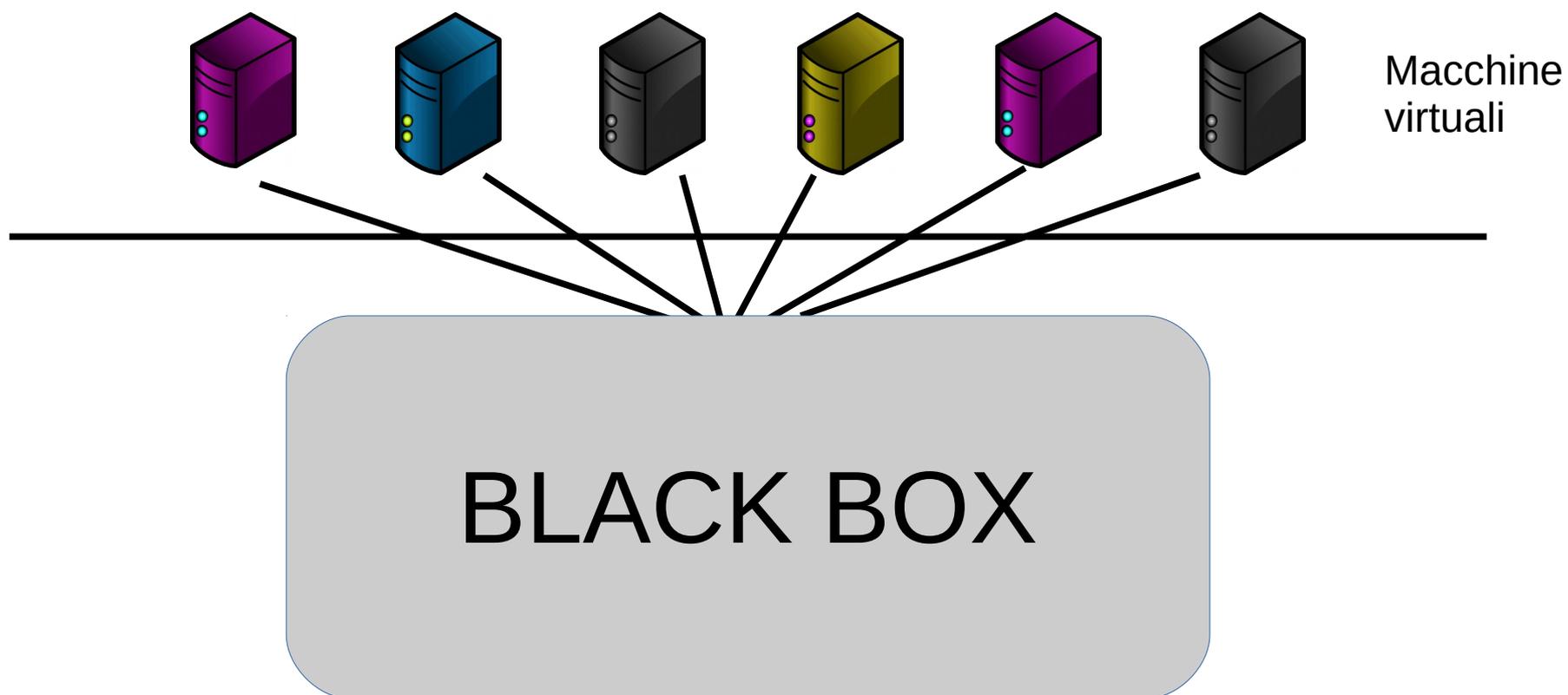
- punto di vista tecnico
- esempi pratici

Ho vissuto benissimo finora

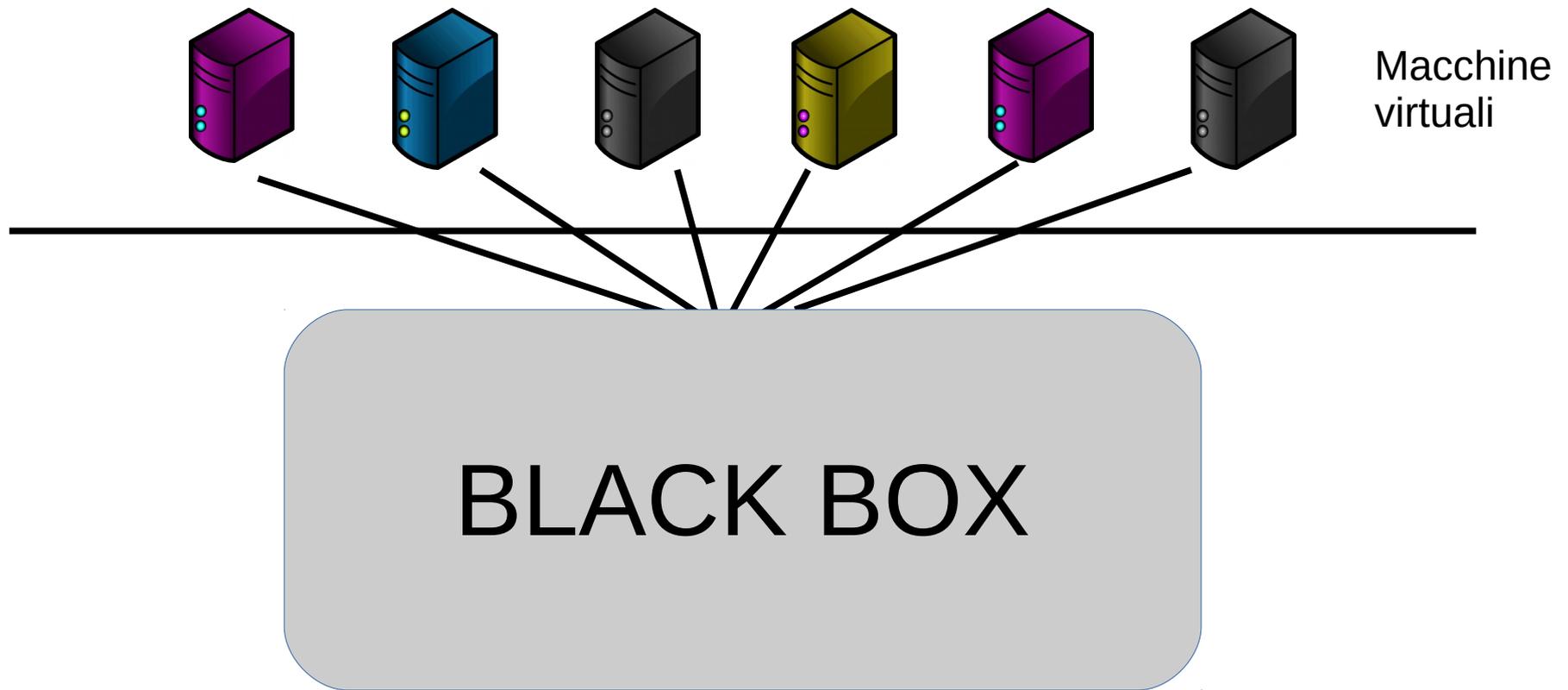
Perche' mai dovrei virtualizzare??

- perche' non ne posso piu' di quelli che mi chiedono un nuovo server per i loro progetti
- perche' voglio mostrare sul mio smartphone la simulazione 3D che ho appena creato, senza interrompere la mia passeggiata in piazza Unita' :-)
- la notte mi piace dormire (o fare altro...)

Molto schematicamente...



...ancora schematicamente



Si cominciano ad intuire i vantaggi?

Ho separato i **servizi** (sulle macchine virtuali) dall'**hardware** e dai guasti che puo' subire

Si rompe un disco? Lo cambio senza disturbare i servizi delle macchine virtuali

Devo potenziare una CPU? La sostituisco senza che i servizi se ne accorgano

Voglio migrare da uno storage vecchio ad una SAN moderna? Non devo spegnere nulla

Vantaggi

1. maggiore affidabilità

- migliore resistenza ai guasti
- recupero piu' rapido in caso di guasti disastrosi

Vantaggi

1. maggiore affidabilità

2. meno sprechi

- sfruttamento razionale di CPU/RAM/disco
- minore consumo elettrico

Vantaggi

1. maggiore affidabilità

2. meno sprechi

3. meno mal di pancia

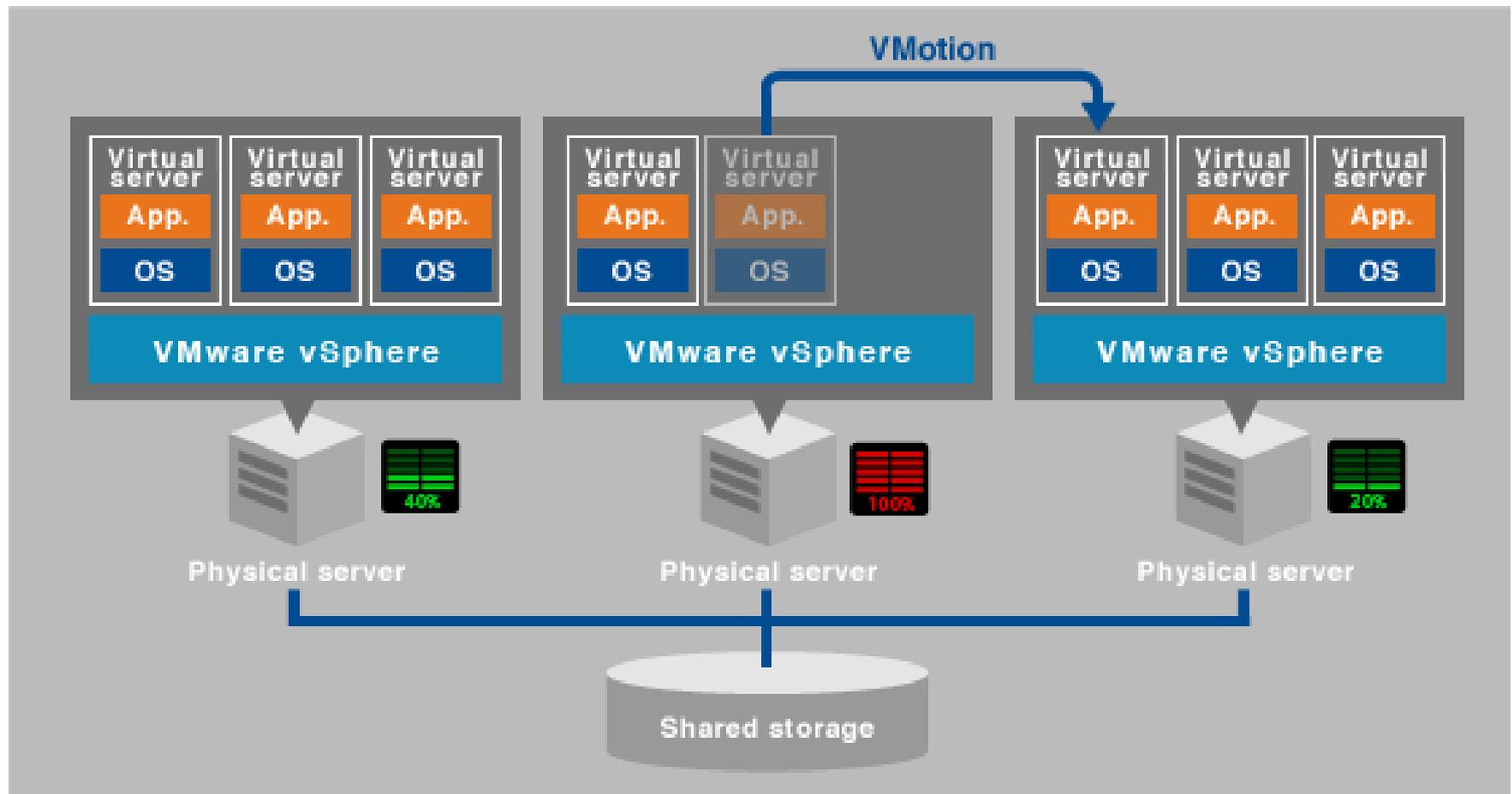
- amministrazione semplificata del parco macchine
- una VM per ogni applicativo/servizio
- cloni rapidi di VM, snapshot, migrazioni a caldo,...

Tutto bello, ma a che prezzo?

Niente di piu' che il costo di un cambio di prospettiva!

- il costo del software per virtualizzazione non e' un problema
- e' piu' pesante ripensare l'infrastruttura

Schema generale



Qualche considerazione

per chi fa i primi passi nella virtualizzazione

- nulla vieta di introdurla gradualmente
- basta non “navigare a vista”!
- server+storage+network: vanno pensati assieme!

Qualche considerazione

per chi fa i primi passi nella virtualizzazione

Server

di fascia medio alta, con componenti ridondati
(meglio se anche uniformi tra loro)

Storage

condiviso ed espandibile

Network

meglio se organizzato

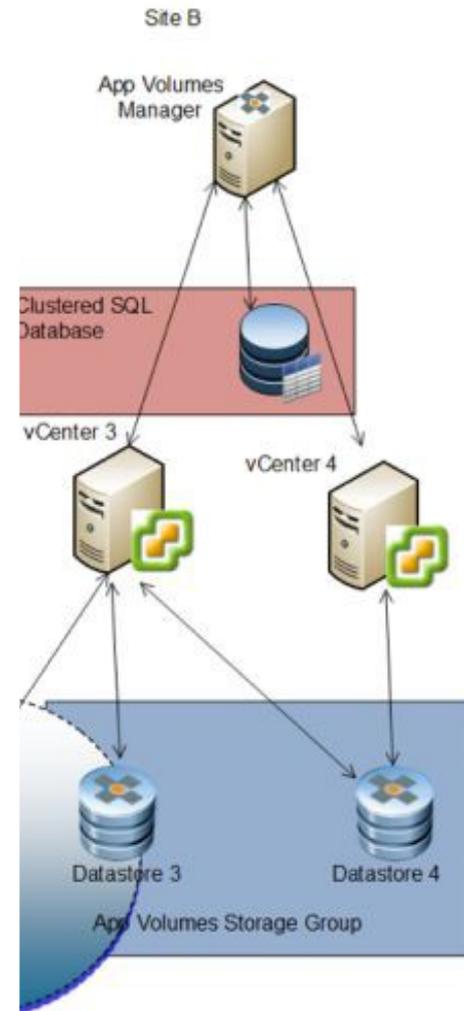
Quando virtualizzare?

Qualcuno dice **SEMPRE/TUTTO**

Ci sono dei casi in cui ci si complica meno la vita se **NON** si virtualizza:

- strumentazione particolare → dispositivi seriali
- firma digitale?
- vincoli di licenze → chiavi hw

E se pensassimo in grande?



La vostra sala server assomiglia a questa?



O a questa?



Ottimizzare l'investimento

Virtualizzazione = ottimizzazione risorse

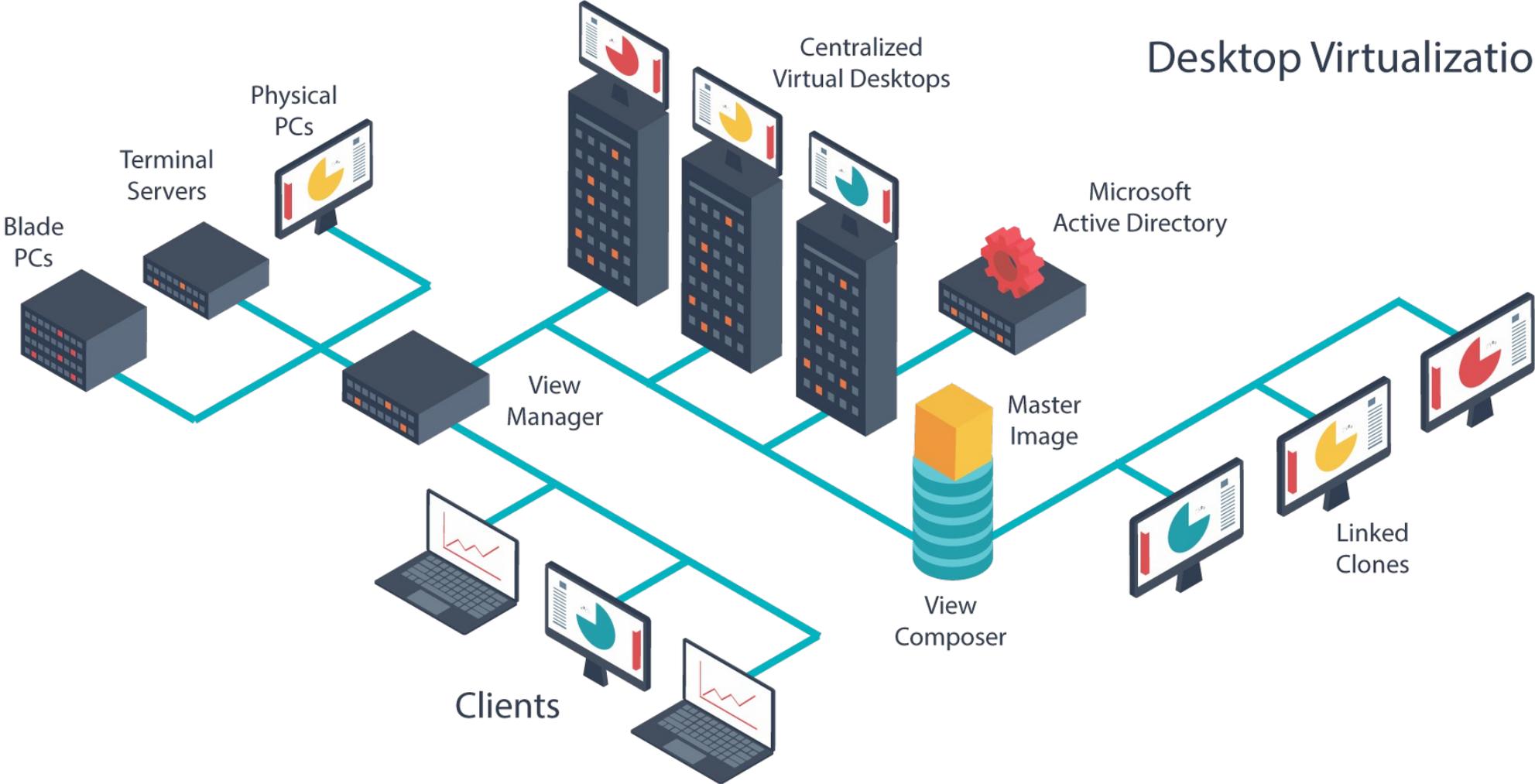
→ posso ottimizzare anche gli investimenti fatti nella virtualizzazione

E il desktop di tutti i giorni?

Anche il pc di tutti i giorni puo' essere una macchina virtuale:

- e' un clone
- pulito come installato di fresco ogni giorno
- uguale per tutti

Desktop Virtualization

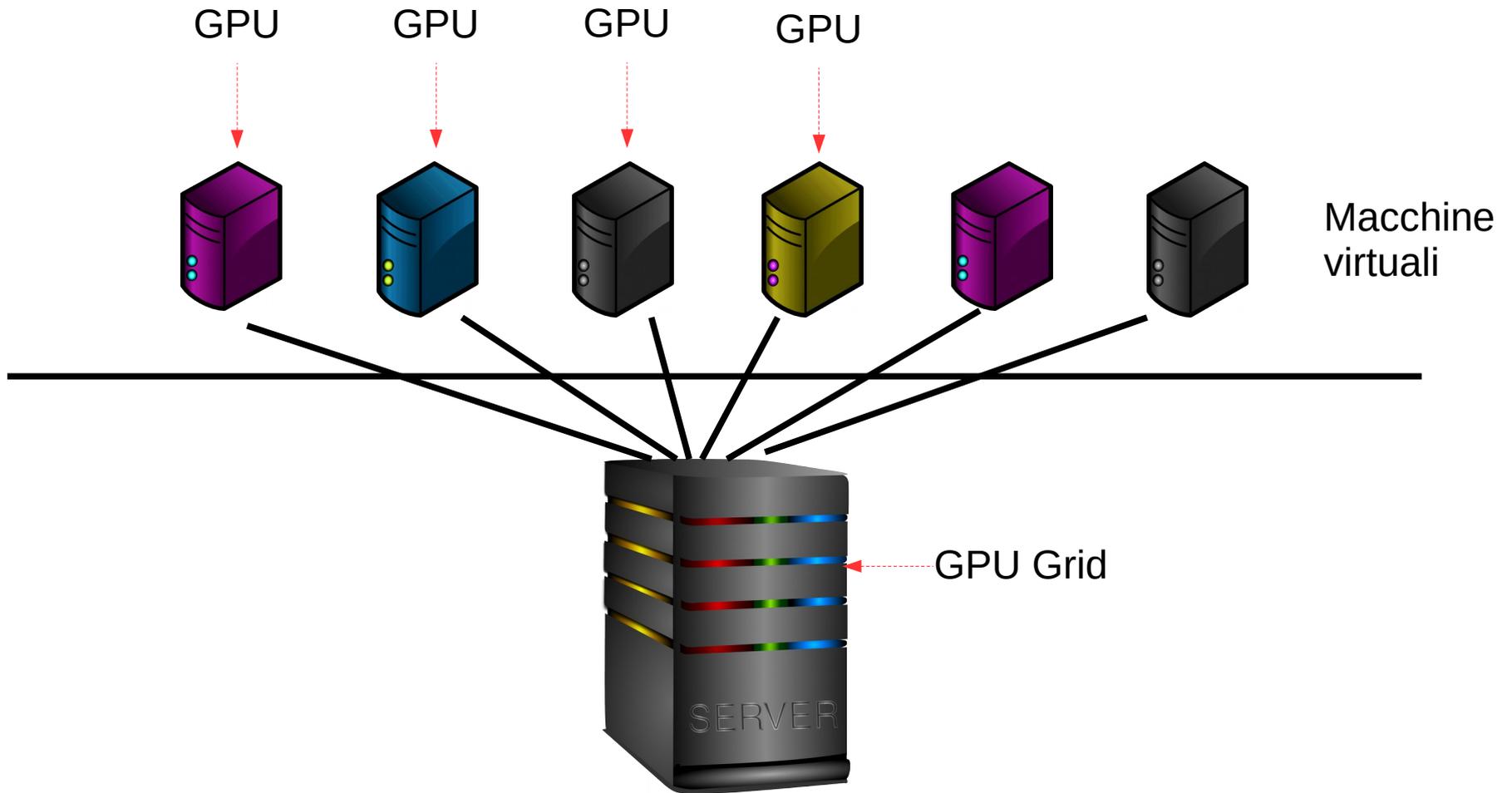


Virtualizzare la GPU

Applicazioni che richiedono processori grafici possono essere virtualizzate:

- condivido la stessa scheda grafica tra piu' VM
- trasporto la grafica evoluta su dispositivi che non sarebbero in grado di generarla (notebook, tablet, smartphone,...)

GPU Grid



VirtualBox



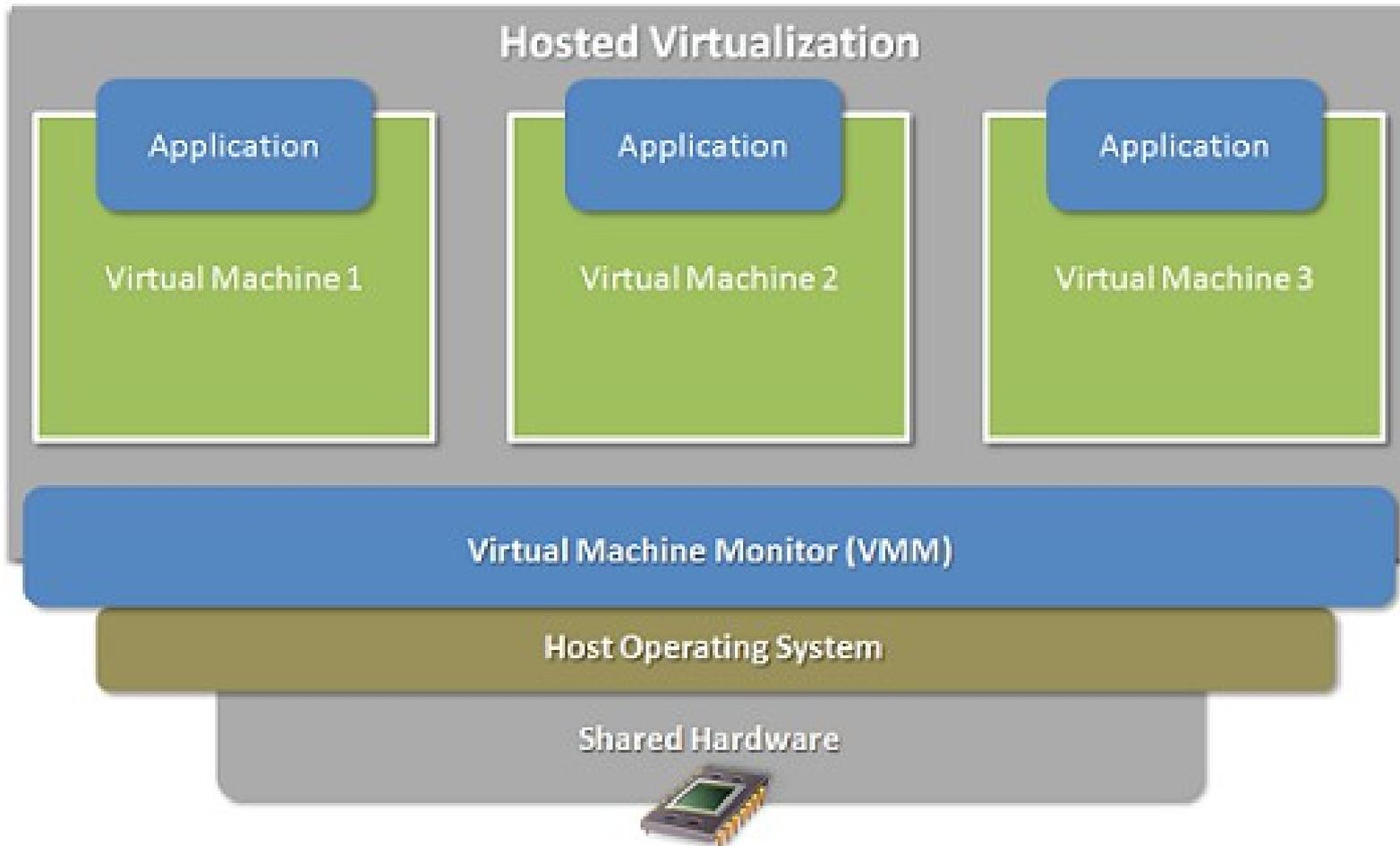
<https://www.virtualbox.org/>

Sistema di virtualizzazione “hosted”

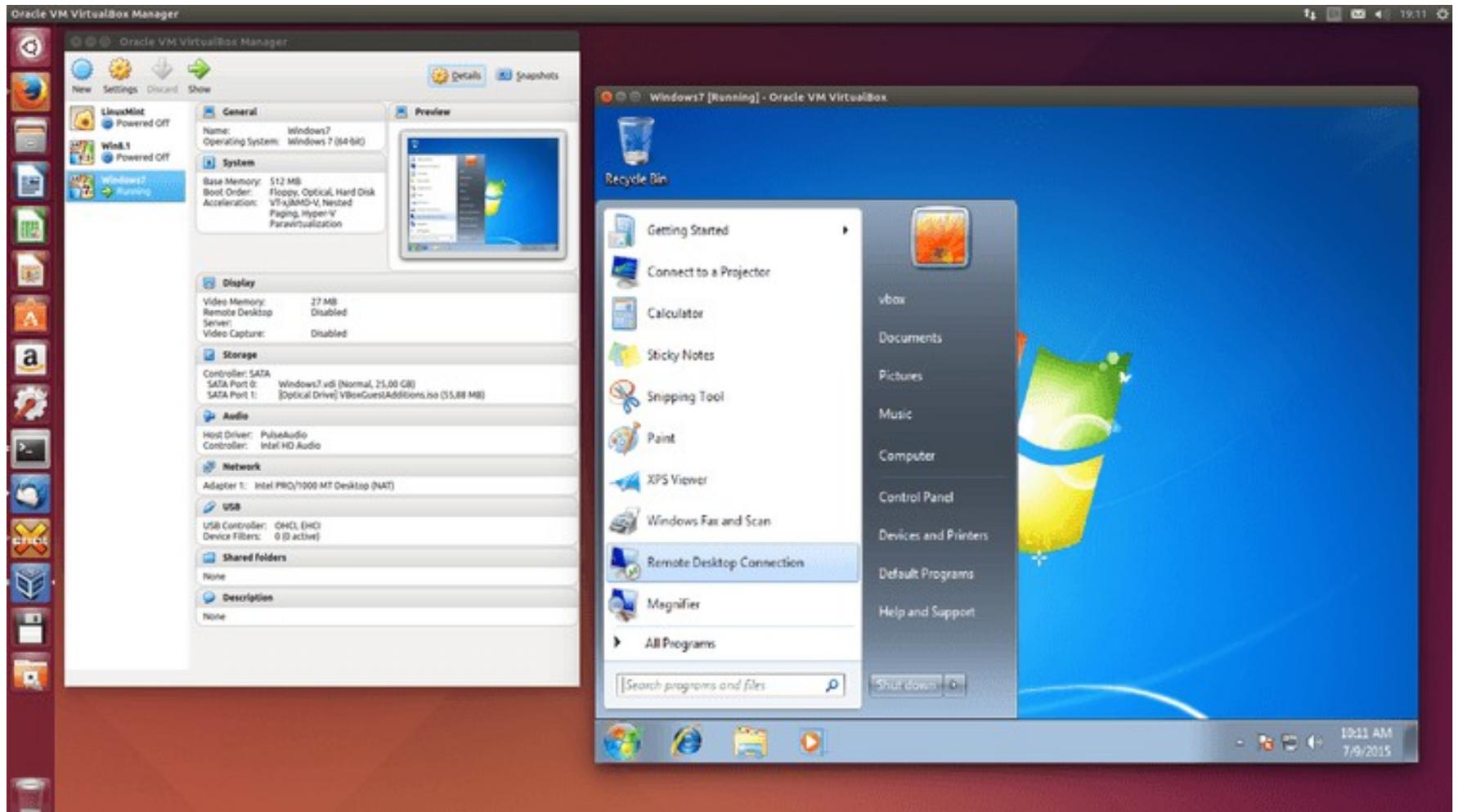
Open source

Nessun costo di licenza

VirtualBox



VirtualBox



Oracle VM



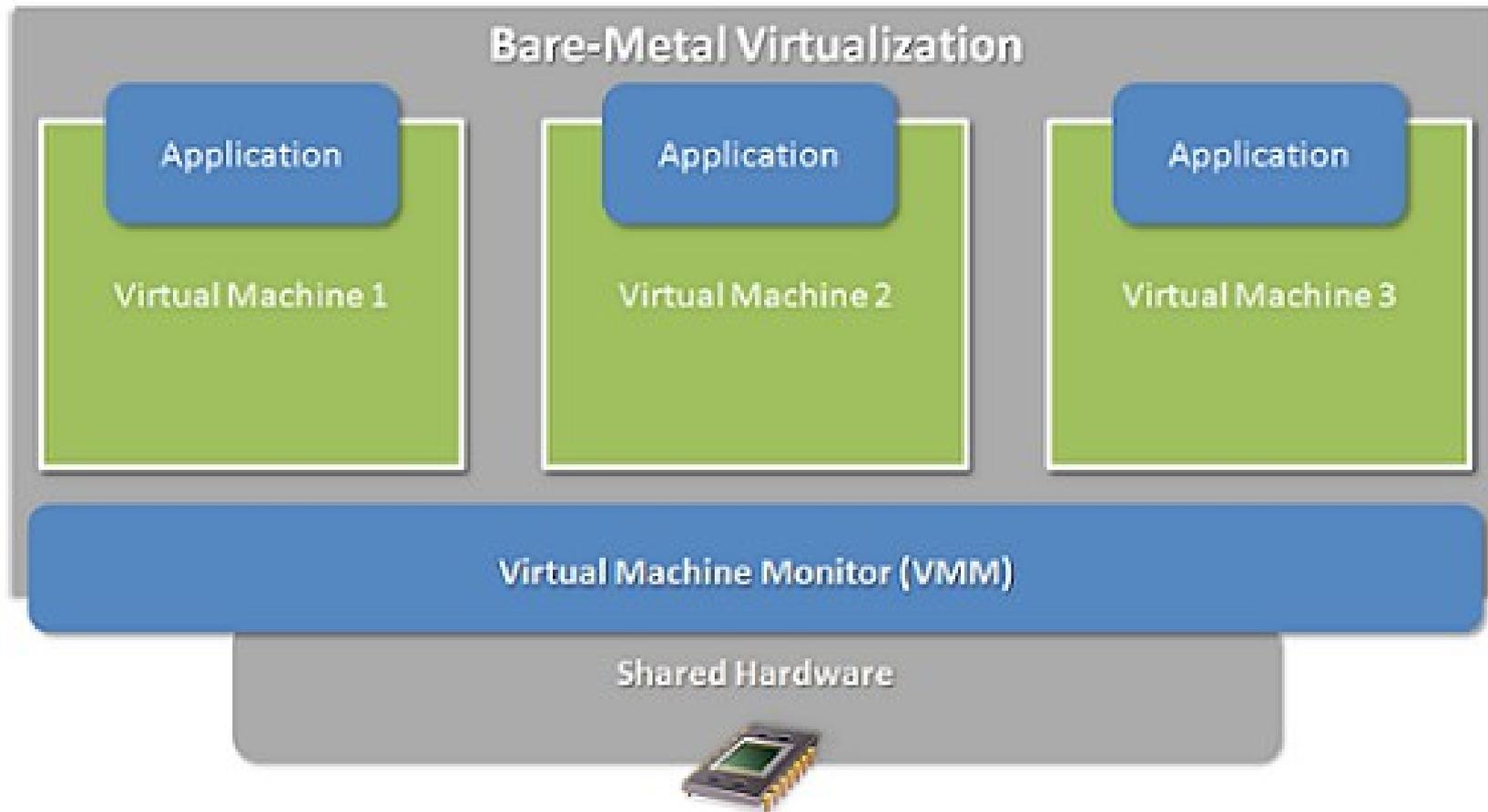
<https://www.oracle.com/virtualization/vm-server-for-x86/index.html>

Sistema di virtualizzazione bare-metal

Nessun costo di licenza

“la miglior piattaforma su cui far girare Oracle Database”

Oracle VM



Oracle VM

The screenshot shows the Oracle VM Manager web interface. The top navigation bar includes 'ORACLE VM Manager' and links for 'Home', 'Help', 'About', and 'Logout'. The user is logged in as 'admin'. Below the navigation bar is a menu with 'View', 'Tools', 'Actions', and 'Help'. A toolbar contains various icons for server management. On the left, a navigation tree shows a hierarchy: 'Home' > 'Server Pools' > 'MyServerPool' > 'MyServer1', 'MyServer3', 'MyServer2', and 'Unassigned Virtual Machines'. The main content area has tabs for 'Info', 'Servers', 'Virtual Machines', 'Policies', and 'Events'. The 'Servers' tab is active, displaying a table of server details. Below the table is a 'Jobs' pane showing a list of completed tasks.

Global links — ORACLE VM Manager Home Help About Logout
Logged in as admin

Menu — View Tools Actions Help

Toolbar — [Icons]

Navigation Tree — Home Server Pools MyServerPool MyServer1 MyServer3 MyServer2 Unassigned Virtual Machines

Management pane showing Virtual Machine tab — Servers

Name	Version	Update Required	Status	Utilization (%)	Speed (GHz)	Processors	Memory (GB)	IP Address
MyServer1	3.0-559	No	Running	3	2.0	4	32.0	10.31.1
MyServer3	3.0-559	No	Running	0	2.0	4	32.0	10.31.1
MyServer2	3.0-559	No	Running	0	2.0	4	32.0	10.31.1

Jobs pane — Jobs

Description	Status	Message
Add Server MyServer2 to Server Pool MyServerPool	Completed	
Add Server MyServer3 to Server Pool MyServerPool	Completed	
Add Server MyServer1 to Server Pool MyServerPool	Completed	

Navigation shortcuts (Views) — Home Hardware Jobs

Vmware vSphere



<http://www.vmware.com/>

Sistema di virtualizzazione bare-metal

Prodotto commerciale

Ampia diffusione, flessibile e versatile

Vmware vSphere

The screenshot displays the VMware vSphere Client interface. The title bar reads "CSO-VC-DEV-1 - vSphere Client". The menu bar includes "File", "Edit", "View", "Inventory", "Administration", "Plug-ins", and "Help". The breadcrumb navigation shows "Home > Inventory > Hosts and Clusters". A search bar labeled "Search Inventory" is present. The left sidebar shows a tree view of the inventory, including "AppC" (with sub-items "esxvm-1", "esxvm-2", and "sc-26050bfc-1976-4") and "Prom E" (with sub-items "cso-vmg-1", "cso-vmg-2", "qa-vmg-1", "esxqa-1", "esxqa-2", "ubuntu-qa-1", and "ubuntu-qa-2"). The main content area is titled "CSO-VC-DEV-1, cso-vc-dev-1 VMware vCenter Server, 4.1.0, 345043" and features a "Hosts & Clusters" view. This view includes a "Getting Started" section with the heading "What is the Hosts & Clusters view?" and a "Basic Tasks" section with a "Create a datacenter" button. A 3D-style illustration of the "Hosts & Clusters view" is shown on the right. At the bottom, a "Recent Tasks" table is visible, showing a task "Revert snapshot" initiated by "Administrator" on "3/15/2011 3:18:00 PM" with a status of "Completed".

CSO-VC-DEV-1, cso-vc-dev-1 VMware vCenter Server, 4.1.0, 345043

Getting Started | Datacenters | Virtual Machines | Hosts | Tasks & Events | Alarms | Permissions | Maps

What is the Hosts & Clusters view?

This view displays the set of computing resources that run on a particular host, cluster, or resource pool. Using the Hosts & Clusters view, you can manage and organize your inventory of computing resources.

Basic Tasks

Create a datacenter

Hosts & Clusters view

Recent Tasks

Name	Target	Status	Details	Initiated by	vCenter Server	Requested Start Ti...	Start Time
Revert snapshot	bsh	Completed		Administrator	CSO-VC-DEV-1	3/15/2011 3:18:00 PM	3/15/2011 3:18:00 PM

Grazie

Fine Parte I