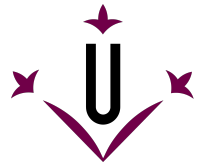

Universitat de Lleida

Virtualization

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Virtualitzation

Virtualitzation

Definition:

Has some characteristic that is apparent
(in oppositon to a real or absolute one)

Webster:

Existing in essence or effect though not in actual fact.

Virtualization

Our definition:

Virtual Systems: use logic objects to **abstract** physical components while keeping **behaviour intact**.

Examples:

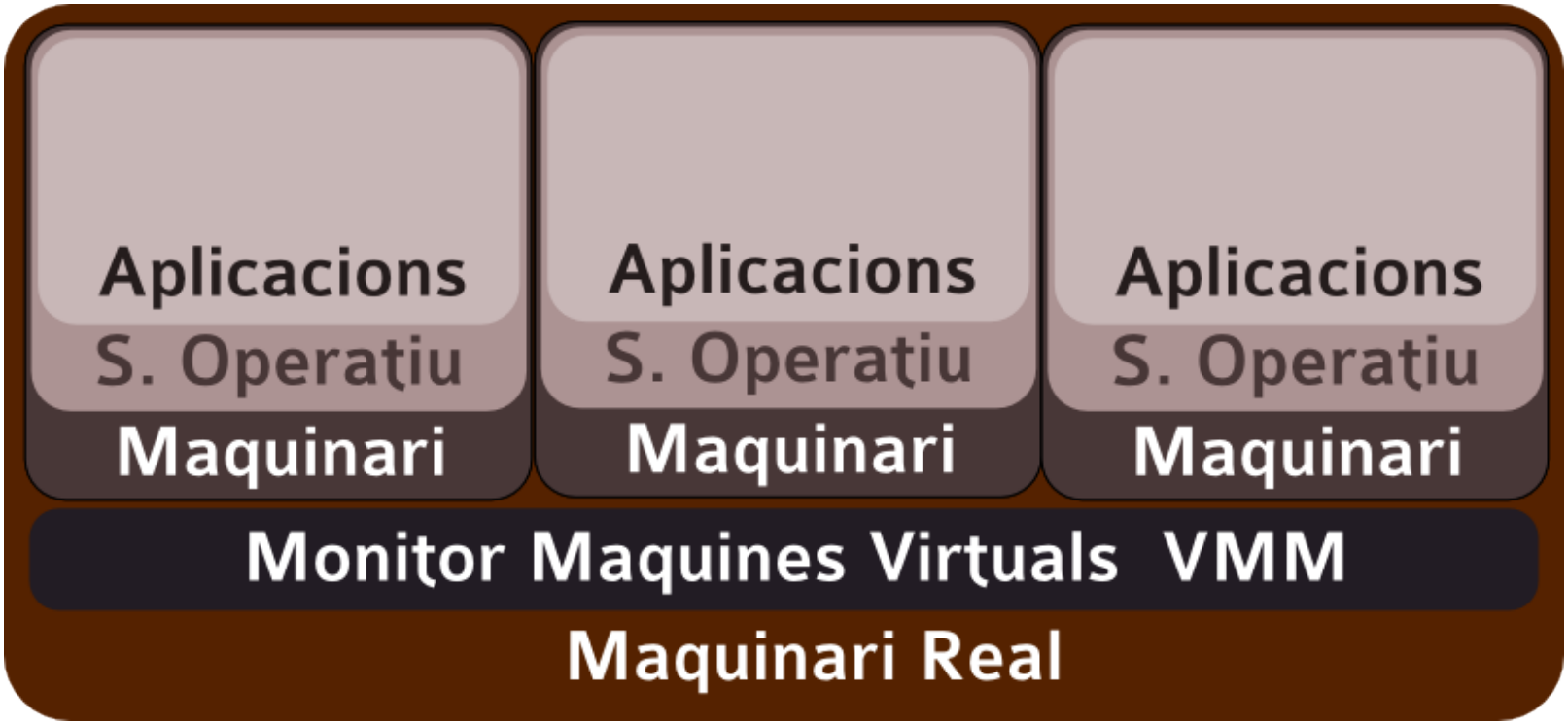
- Netwok: Virtual LAN (VLAN), Virtual Private Network (VPN)
- Storage: Storage Area Network (SAN), LUN
- Computers: Virtual Machine (VM), simulators or emulators
- Servers: VHOST, ParaVirtualitzation

Machine virtualization

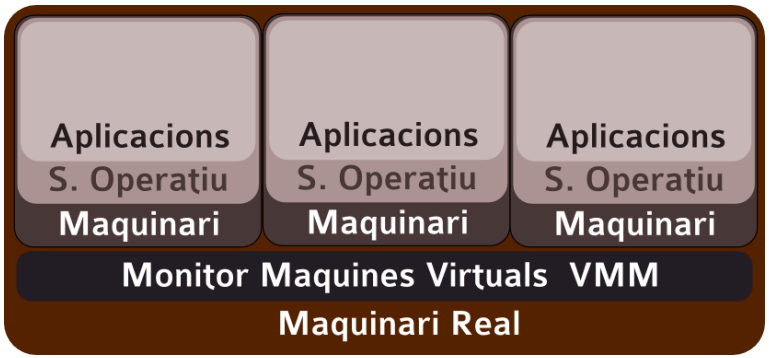
Machine definition:

- Hardware:
  - Processor, Memory, Disk, ...
  - Usually under used
- Software:
  - An OS image
  - Tighly coupled to HW
  - OS controls HW

Machine virtualization



Machine virtualization



Machine abstraction:

- Virtual hardware: processors, memory, I/O devices, etc.
- Encapsulates OS status and applications

Virtualitzation software:

- Additional indirection level: isolates OS and HW.
- Multiplexes hardware for VMs
- VMs highly isolated
- Better resource management

VM isolation

Safe Multiplexing:

- Multiples VM in only one host
- Isolating HW from VM

Intermachine safety:

- Virii, problems, etc. are confined to a single VM

Capability insulation:

- VMM (Hipervisor) assigns and controls resources: better usage, no monopolization.

VM Encapsulation

Each VM in a single file/directory:

- Storage (OS,Apps, Data)
- Device State, Memory

Clones & Snapshots:

- Freeze VM state and point-in-time recovery

Ease of distribution:

- Pre-config machines, demos, etc.
- Virtual servers (appliances) .

VM Compatibility

Hardware isolation

- Real HW hidden to VM
- VM accesses “standard” virtual HW

Migration

- Host change != VM reconfig

VM legacy

- Execute legacy apps/OS on new platforms (HW, OS) “creating” standard/legacy HW

Uses

Test

- Test new OS releases
- New configurations
- Test over pristine OS installation

Development

- Have “clean” systems (DLL Hell)
- Systems similar to client
- Multiples target systems

Uses

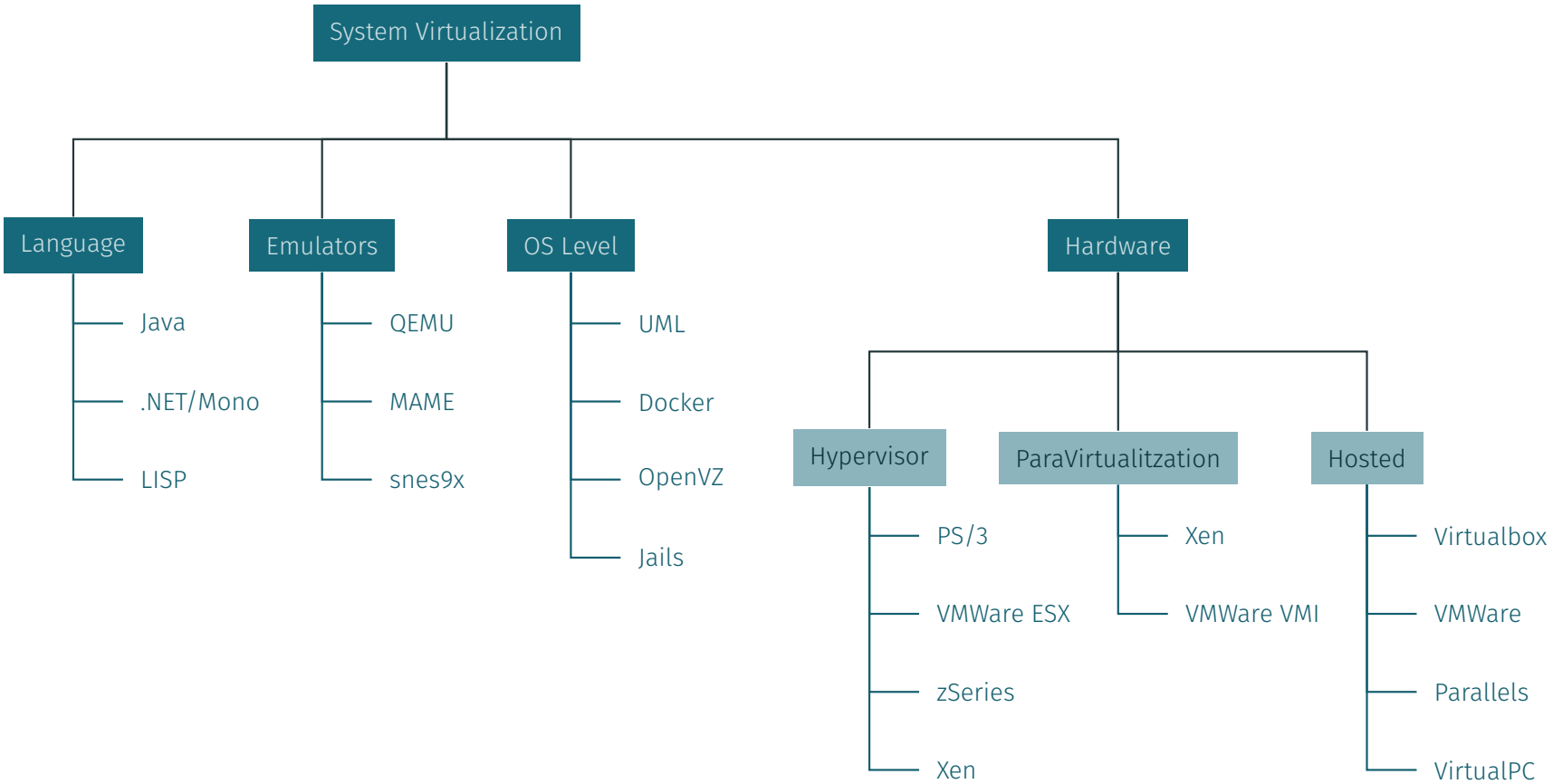
Security

- Easily replicable servers
- SNAPSHOTS
- From: n services x 1 server to 1 service x server

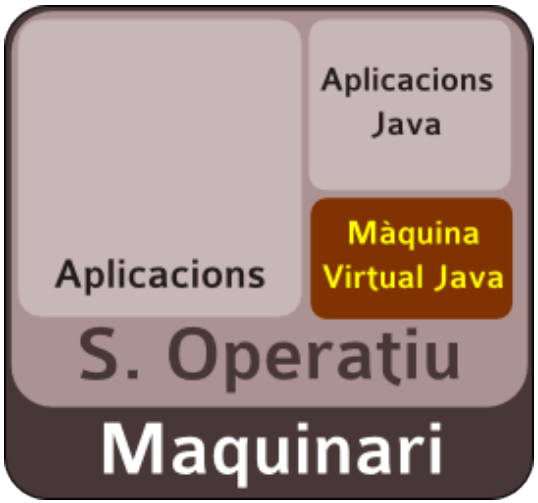
Cost/Consumption

- Hardware sharing (BLADES)
- Reduce power usage
- Hardware reuse

Models


System Virtualization
Language
Java
.NET/Mono
LISP
Emulators
QEMU
MAME
snes9x
OS Level
UML
Docker
OpenVZ
Jails
Hardware
Hypervisor
PS/3
VMWare ESX
zSeries
Xen
ParaVirtualitzation
Xen
VMWare VMI
Hosted
Virtualbox
VMWare
Parallels
VirtualPC

Models



Language Level

OS Level

Hardware Level

Language

- Reduced HW requirements
- Easy deployment
- Less security (only Sandbox)
- Usable alongside other models
- Applications:
  - Sandbox wrt sistema
  - Sandbox wrt other apps

Emulators

- Less HW required
- Easy to deploy
- Enough security
- Can run alongside other apps
- Bad performance:
  - Emulates CPU instruction by instruction
- Allows to use binaries from other archs

OS level

- Middle security:
  - Isolates big share of actions
  - Everything is running in the same address space
- Good performace
- Sometimes require special OS versions
- Cannot mix architectures/systems

Hardware hypervisor

- Good security:
  - Perfectly isolated machines
  - Good control of adressing and resource access
- Good performance
- Usually does not require special OS versions
- Allows mixes of architectures (sometimes)/systems (sometimes)
- Requires special hardware and systems

Paravirtualitzation HW

- Good Security:
  - Perfectly isolated machines
  - Virtualizator controls addressing/resource access
- Good performance on good HW, underperforming otherwise
- Usually doesn't require special OS versions
- Allows arch/system mixing (sometimes)
- Doesn't require special HW (affects performance)

Hosted Machine

- Good security:
  - Perfectly isolated HW
  - Virtualizator controls addressing/resource access
- Good performance (Special HW required)
- Doesn't require special OS versions
- Can allow arch/systems mixing (with limitations)
- Requires special HW (virtualization abled processors)