

Computing Fundamentals

Planning

Session	Subject	Test – Hand-in
1	Network Models	
2	Internet Protocol Suite	
3	Network segmentation	
4	Network protocols	
5	Operating systems	
6	Command Line	
-- 30/10 – 5/11 --	Autumn break – HERFSTVAKANTIE	
7	Virtualization	
8	Mid-term test	Test
9	Scripting	
10	Virtualization - Cloud computing - Storage	

Virtualization

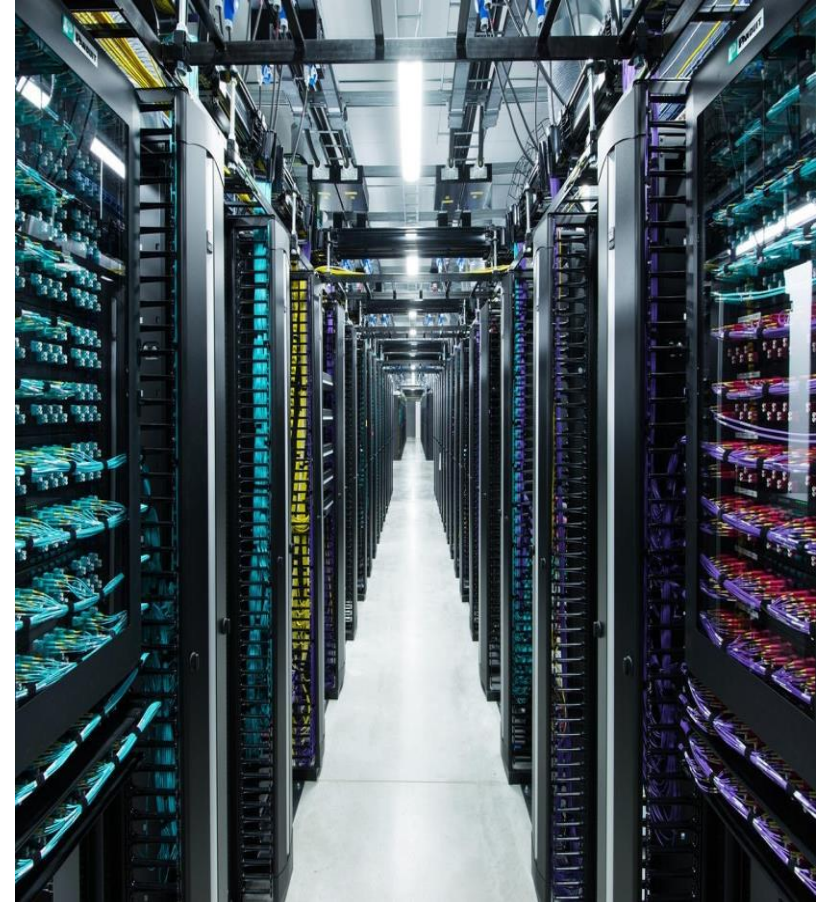
Virtualization

- **What is virtualization?**
- **The use cases**

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Servers

- Every machine or device on the network delivering a service or providing content to other machines or devices is a server
- Part of the client-server model
- In server-to-server communication, there still is a client-server relation

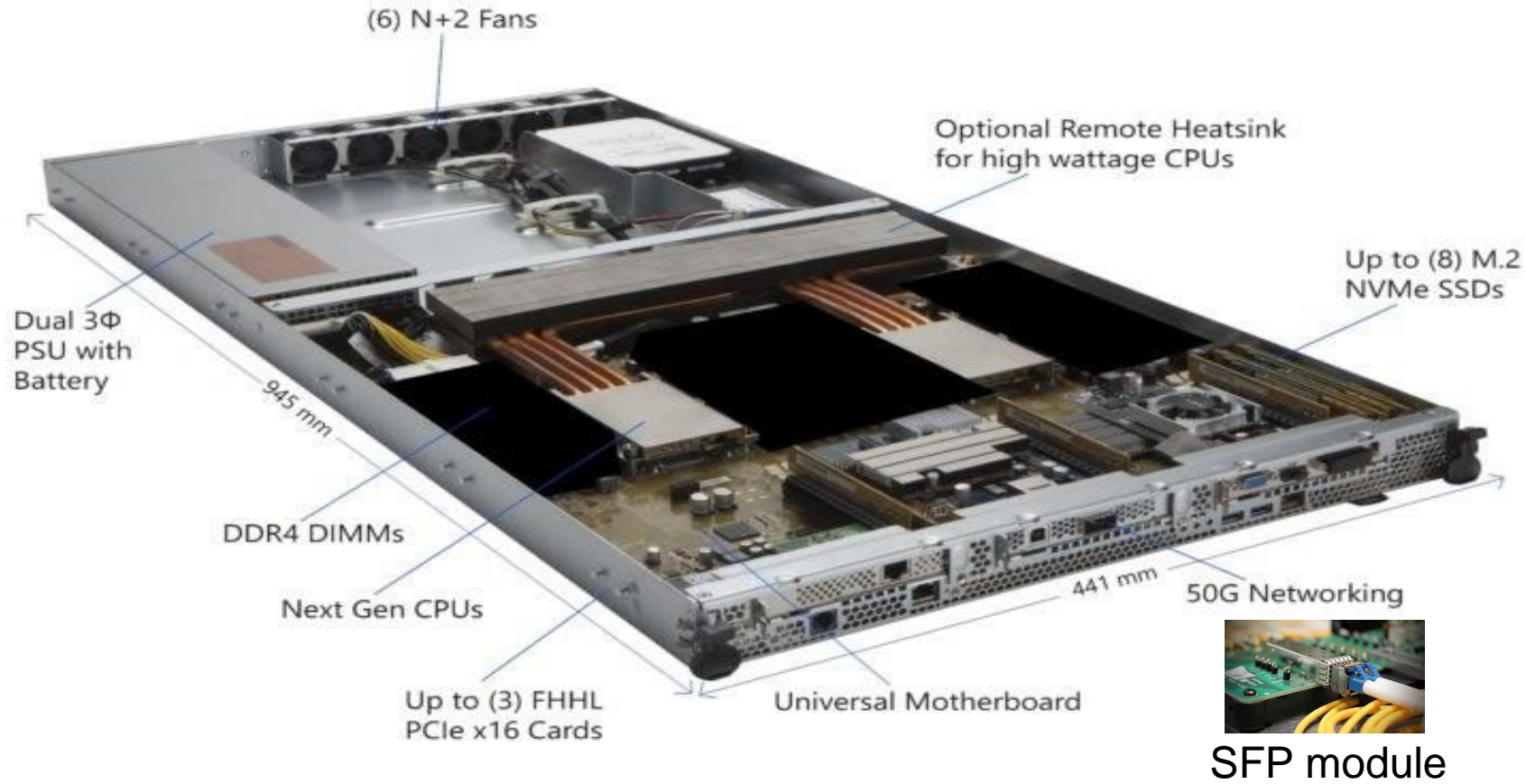


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Servers came in different forms

- Big and small, thick and thin, heavy and light weight
- Rack mounted (1-4U)
- Depends on what it is used for (compute, storage, rendering, networking...)
- It all starts with physical servers
- There is always hardware involved

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Virtual servers

- What we talk about here
- Obviously, a virtual server still runs on actual hardware



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Then there was cloud

*There is no cloud, it's
just someone else's
computer.*

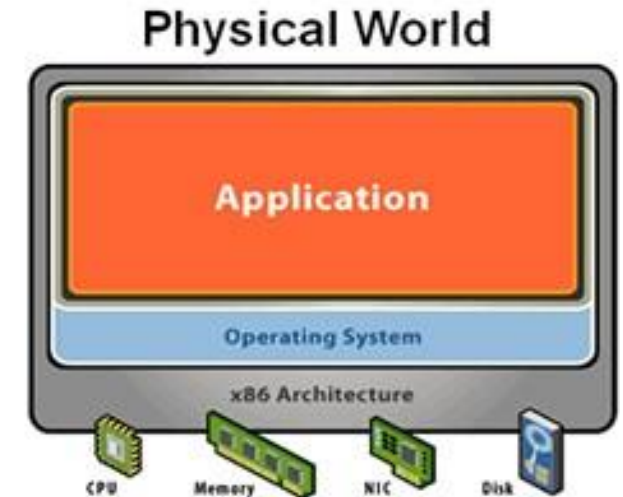
(is it? ☺)



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Physical servers

- Classic (well known) hardware on which an OS is installed
- Inside that OS certain functions are activated to deliver services
 - File, web, email, database, active directory, ...
- Usually one server per application
 - Especially when the application is resource hungry
- Inefficient use of resources and difficult to scale ↑ or ↓

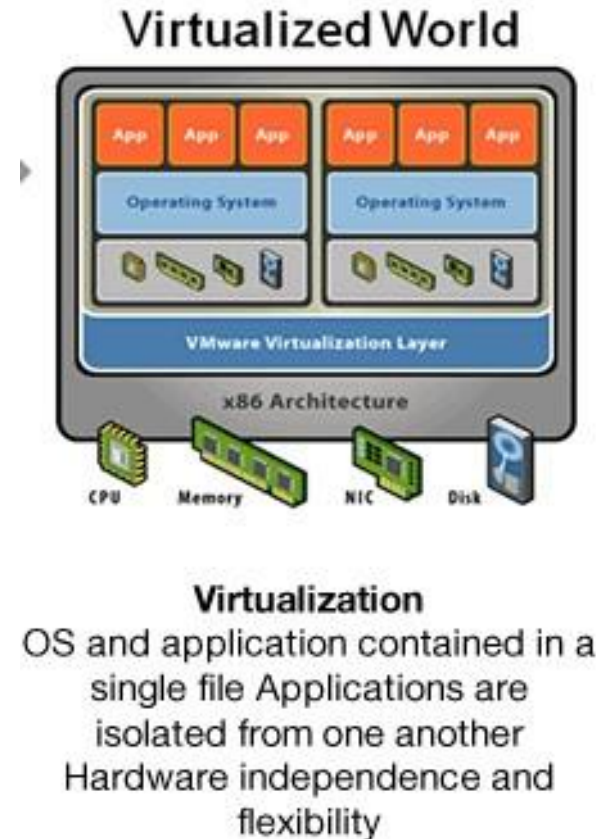


Traditional x86 Architecture
Single OS image per machine
Underutilized resources

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Virtual servers

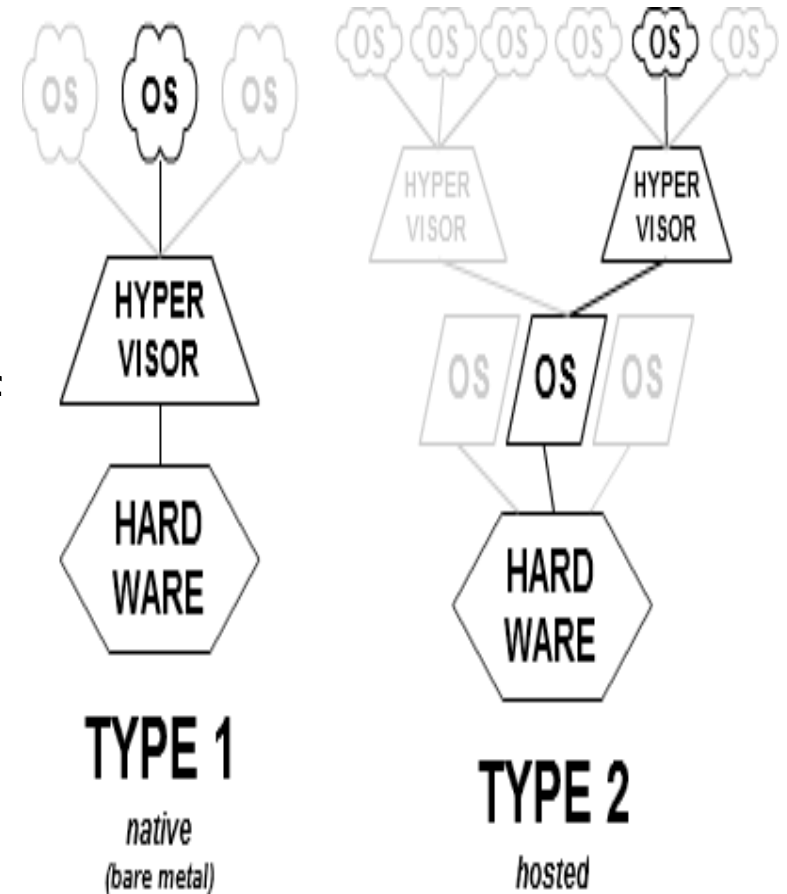
- Turns one physical server into many virtual servers
 - More efficient use of resources, easy to scale ↑or↓
- Different OSs can run side by side in logically separated environments, hardware is the same for all
- Each Virtual Machine (VM) runs applications on its own virtual storage, virtual memory, virtual OS
- Boots up as fast or slow as any ordinary physical server; it still needs to load the entire OS



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Virtual server types

- The virtualization layer (hypervisor) delivers abstraction
- Type 1 – runs its own OS directly on top of hardware, also called a ‘bare metal’
 - VMware ESX/ESXi, Hyper-V, Boot Camp
- Type 2 – runs on top of another OS as an application (inception, anyone?)
 - VMware workstation/Player, VirtualBox, Parallels



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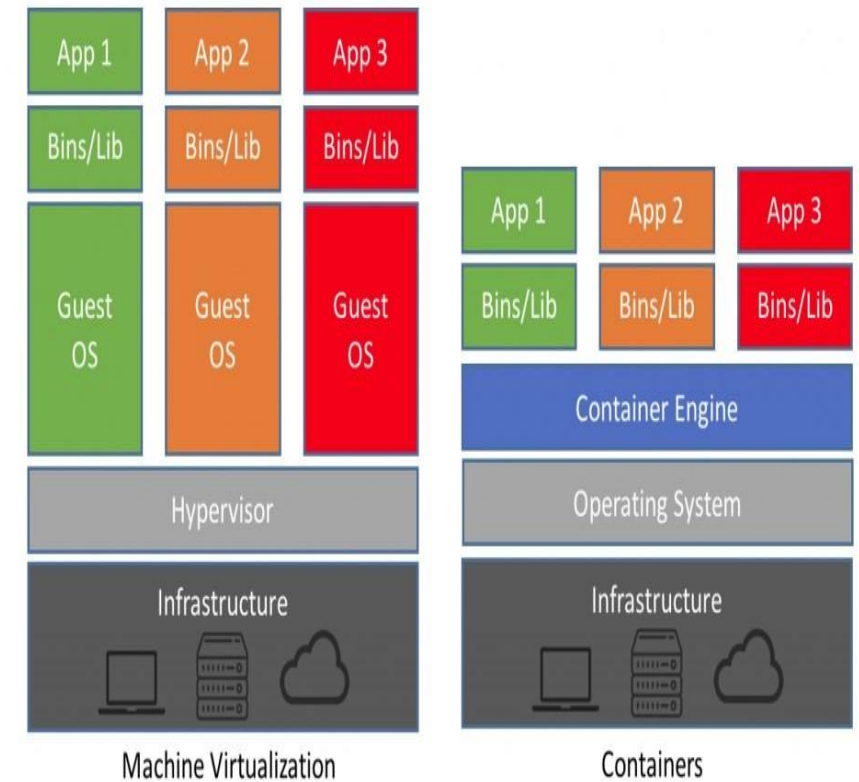
Cloud vs local

- Yes, you can also run a machine in the cloud
 - Use your tablet or smartphone as control device
- You don't have to have 32GB of RAM and 2TB of SSD in your computer
- Where's the fun in that and how much does it cost?

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Virtual server containers

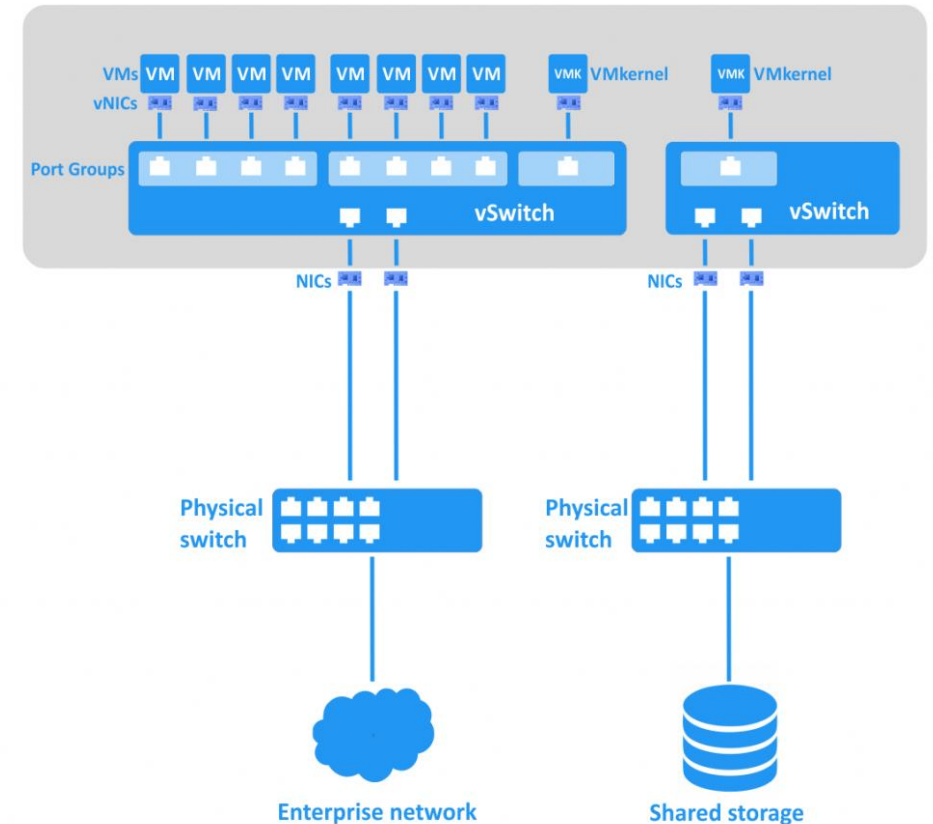
- It's virtualization, but different
- Abstraction at application level
- Targeted at super fast deployment
 - Boots up in seconds (not minutes)
 - Extremely efficient usage of resource
- To be used in combination with VM
- Needs orchestration
- Docker, Kubernetes, Swarm, Mesos, Vagrant, rkt, Podman, Buildah, Multipass, ...



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vSwitches and Virtual Networking

- Network traffic **cannot flow between vSwitches** within the same virtualized server.
- VMs connected to vSwitches can communicate with external networks through vNICs.



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The use cases for VirtualBox

- Run another OS on your day-to-day laptop
 - For testing almost anything
 - For supporting other OS
 - To have access to a local server for development
 - For penetration testing or hacking (Kali, Parrot, ...)
- Return to a previous state of software/OS
- No need for new hardware

Phoenix TrustedCore(tm) Setup Utility		
Advanced		
Advanced Processor Configuration		Item Specific Help
CPU Mismatch Detection:	[Enabled]	When enabled, a VM (Virtual Machine Monitor) can utilize the additional hardware capabilities provided by Vanderpool Technology.
Core Multi-Processing:	[Enabled]	
Processor Power Management:	[Disabled]	
Intel(R) Virtualization Technology	[Enabled]	
Execute Disable Bit:	[Enabled]	If this option is changed, a Power Off-On sequence will be applied on the next boot.
Adjacent Cache Line Prefetch:	[Disabled]	
Hardware Prefetch:	[Disabled]	
Direct Cache Access	[Disabled]	
Set Max Ext CPUID = 3	[Disabled]	
F1 Info ↑ Select Item ~/+ Change Values F9 Setup Defaults		
Esc Exit + Select Menu Enter Select ► Sub-Menu F10 Save and Exit		

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Hands-on

- Install a Linux guest OS.
- Configure the network connection as Bridge adapter.
- Find you VM's local and public IP addresses.
- Create a new storage device.
- Upload a downloaded image the newly created storage.
- Install apache webserver.
- Try to browse the local site.

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Hands-on

- Install docker and pull your first container on your linux machine:

```
apt install docker.io
```

```
docker pull citizenstig/owaspbricks
```

```
docker run -d -p 80:80 citizenstig/owaspbricks
```