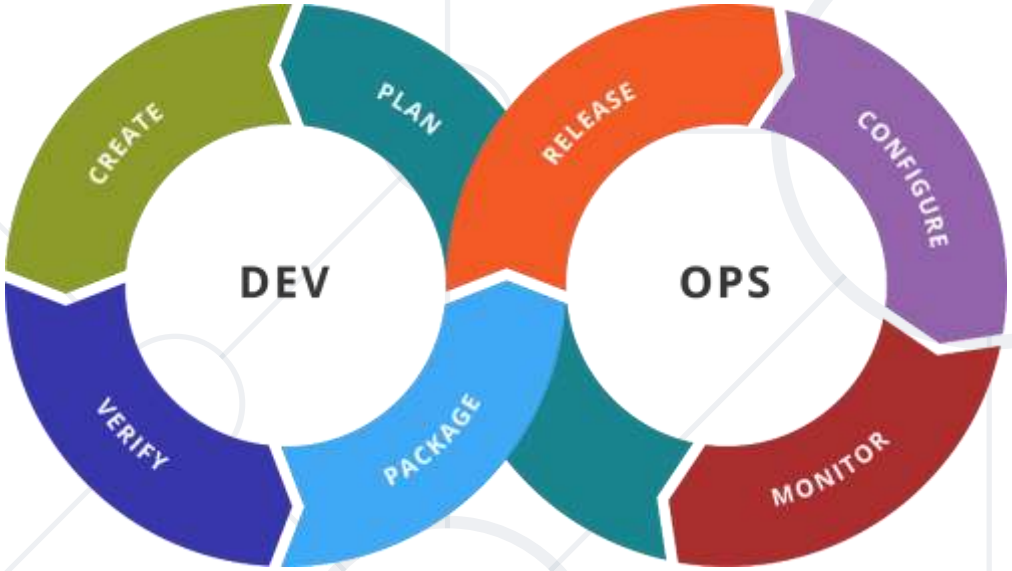
Introduction to DevOps

The Big Picture. Basic Toolkit. Basic Automation



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You Have Questions?

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#DevOps-23

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/groups/DevOpsContainerizationCICDMonitoringJanuary2023

This Module (M1)

Topics and Infrastructure

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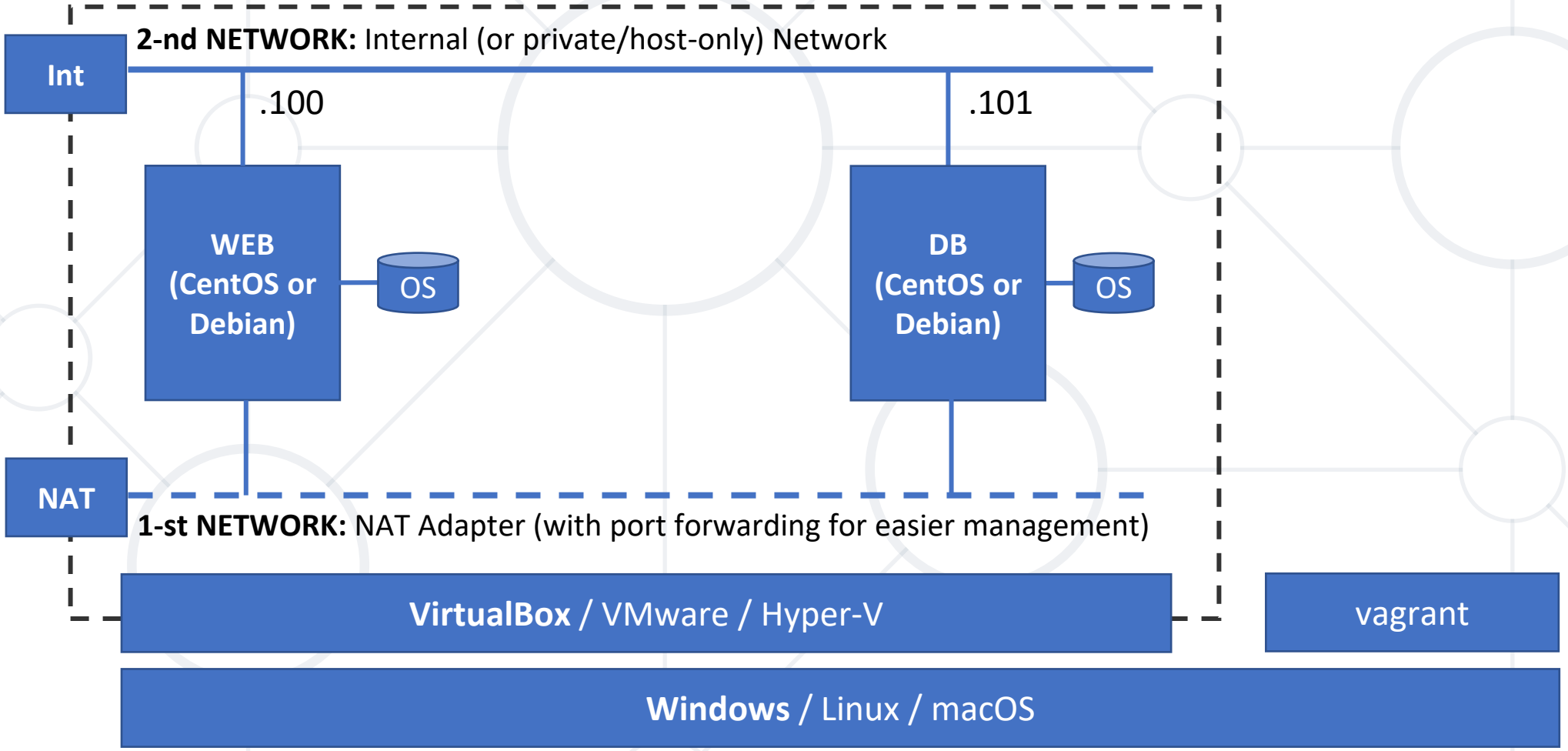
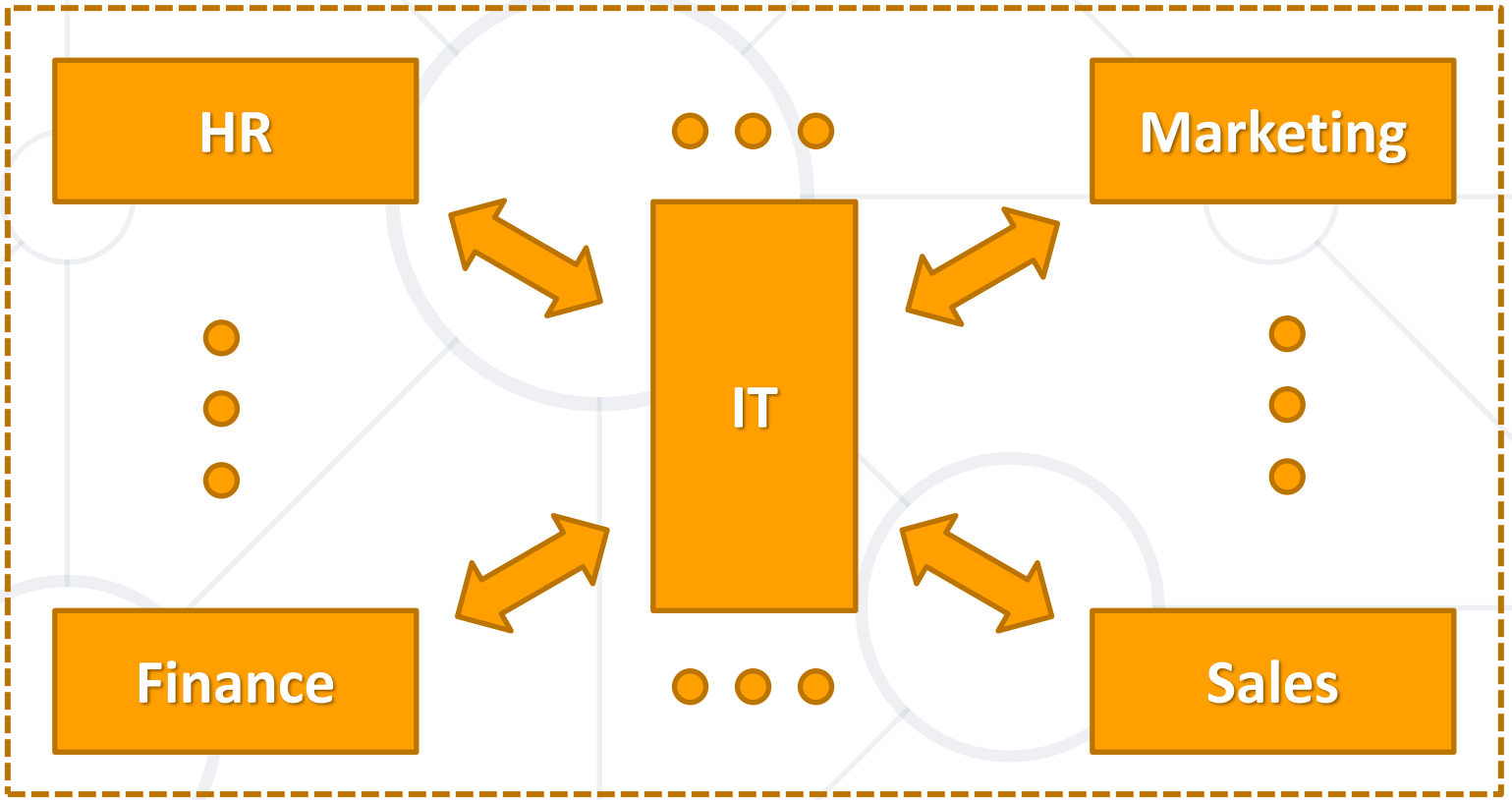
Lab Infrastructure



The Big Picture

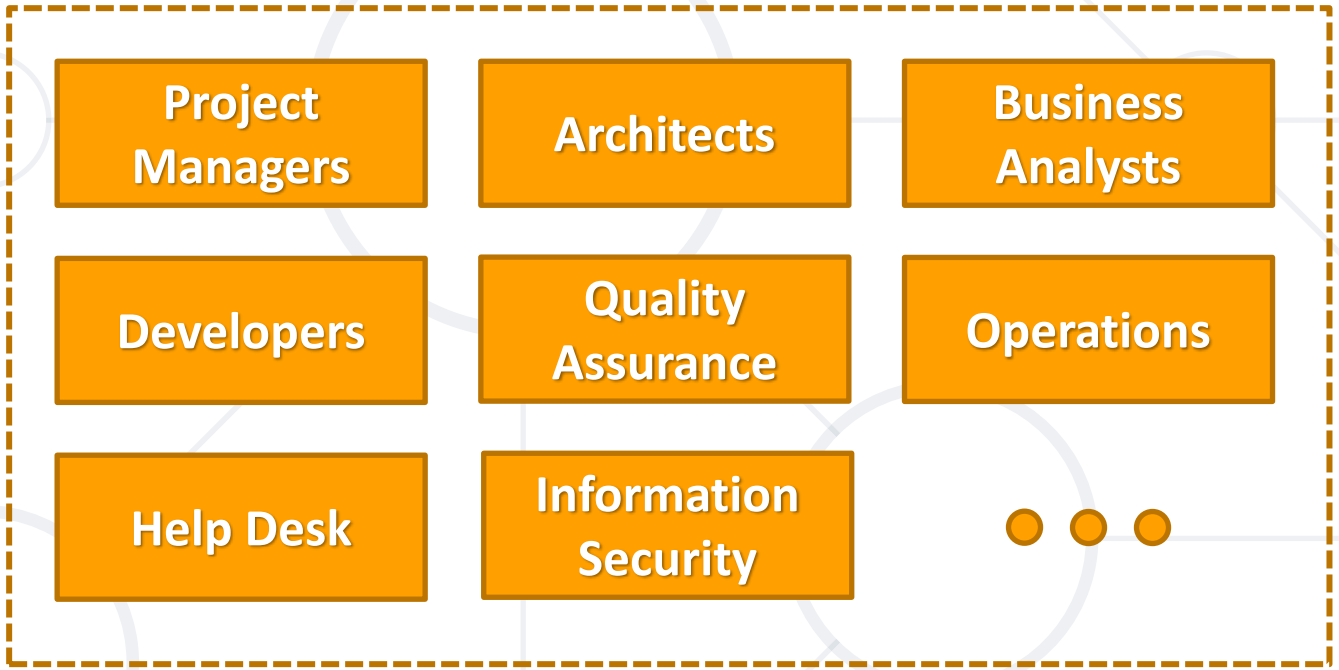
(Why) Do we need a change?

Typical Company Organization*



* Many departments and all depend on IT in one way or another

Typical IT Organization*



* IT has its own units

Typical Challenges

- Complex pipeline
- Mixed environment
  - Externally customized software
  - Custom internal software
- Staff is leaving or being moved elsewhere
  - Absent know-how, outdated or missing documentation
- Operations have to maintain black-boxes

Main Pain Points

At leas some of them

Outages

- Happen at the most inappropriate time
  - Typically, in high priority systems
  - Usually with long recovery time
- Lead to
  - Panic mode
  - Lost trust
- May be caused by
  - Repeated errors/issues
  - Lack of expertise

Low value

- Slow delivery
  - Long time to wait before the actual consumption
- Long implementation periods
  - Often the delivery is outdated and doesn’t match the current requirements

Slow IT

- In fact, is more a perception than a reality
- It leads to
  - Software-as-a-Service solutions
  - Departmental solutions
- It is caused by
  - Long waiting
  - Too many restrictions
  - Poor performance

Fighting

- Involved parties
  - IT vs. Business
  - Internally in IT
- Typically caused by
  - Lost trust
  - Absence of transparency
  - Different motivators or bonus schemes

Causes

Lack of Knowledge

- **Poor communication**
  - Between the departments
  - Internally in IT, between roles
- **Missing documentation**
- Hard to **distinguish** between **important** and **unimportant**
  - Too many meetings
  - Too many and too complex reports

Slow Processes

- **Sources**
  - Slow provisioning of environments
  - Approval takes time
  - (Too many) too specialized people
  - Next role is waiting for the previous one to finish
- **Affected parties**
  - Internal
  - External

Over-*something*

- **Over-provision**
  - Request more resources than actually needed
- **Over-production**
  - Ask for features just to keep everyone busy
- **Over-processing**
  - For example, apply unnecessary transformations over and over
- **Over-delivery**
  - Deliver more than requested

Logistics

- **Slow delivery of features**
  - Long (time expensive) updates
  - Repetitive manual testing procedures
- **Unnecessary iterations**
  - From environment to environment
- **Delivery in a rush**
  - Do it on time no matter the quality
- **Postpone a delivery**
  - A ready feature is waiting something else to be shipped first

Goals and Benefits

Main Goal

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Increase the Value

Respect the People

How can DevOps help?

- Can add value and flow improvement
- Mind the prerequisites
  - Identify a **shared pain**
  - **Address** the **causes**
- Embrace the result
  - **Added value => financial impact**

DevOps is Lean for IT

- We should not cut costs, but free up resources
- This can be achieved by
  - Focus on customer value
  - Optimize the process
  - Reduce delivery time
  - Shared knowledge
  - Avoid batching
  - Address bottlenecks

Core Values* of DevOps Movement

- **Culture**
  - Break down barriers between teams, safe environment
- **Automation**
  - Save time, prevent defects, create consistency, self-service
- **Measurement**
  - If you can not measure it, you can not improve it
- **Sharing**
  - Sharing the tools, discoveries, and lessons

* Damon Edwards and John Willis

Adoption

Making the Transition

Three Main Tasks

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Change the Culture

Change the Organization

Handle the Objections

Change Culture

- **Question** to identify the **Shared Objective**
- **Data-driven** decisions
- **Authorization** for action
- **Responsibility** for actions
- (Cross-) **Teamwork** and **Respect**
- **Learning** and **Sharing** even from ***Mistakes***
- **Trust** (between parties)
- **Values** and **Rewards** (who, why, how)
- **Continuous improvement** mindset

Change Organization (understand & assess)

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- **Understand** the processes
  - All components - systems, people, value, etc.
  - Achieve **clear vision**
- **Assess** and **acknowledge bottlenecks**
  - Inconsistent environments
  - Manual and custom builds
  - Poor quality
  - No communication

Change Organization (change & improve)

- **Change (or adjust) team structure** (if needed)
  - Concentrated knowledge or many tasks assigned to one person
  - Generalists vs Specialists
  - Complete (or consistent) team
  - Prepare handoff (think about the next step)
- **Assessment** of people and processes
  - Including the rewards and punishment system
  - Including the budgeting
- **Clean-up** (remove extra steps, components, …)

Typical Objections to Handle

- **Security** (developers on production, security issues)
  - Communication, Upfront quality, Proper testing, Ship quickly
- **Compliance** (restricted access, all-or-nothing)
  - Better control - who, what, where
- **Remote teams** (internal teams or external parties)
  - Shared objectives, Technology solutions, Renegotiation
- **Impact** on employees
- Presence of **legacy systems**
- Lack of appropriate **skills** (technical and soft skills)

Mentality and Tools

Mentality

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~~If it isn't broke, don't fix it~~

Continuous Improvement

Tools

- Planning (transparency)
- Issue tracking (feedback)
- Source control (control code & configuration)
- Building and testing
- Security assessment (vulnerabilities, secrets, privileges, etc.)
- Continuous integration and deployment
- Configuration and infrastructure management (consistency)
- Monitoring and logging (measurement)
- Collaboration and knowledge sharing (connect & share)

Cloud Platforms could provide the whole environment or serve one or more of the listed categories

It’s Time For a Break

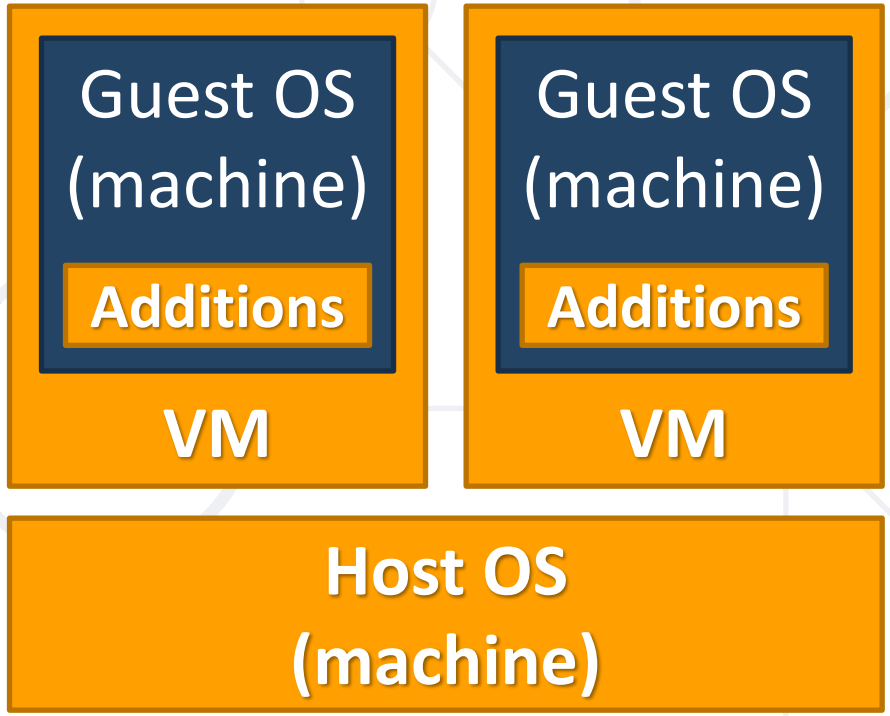
Back in a few minutes ☺

Virtualization

Fundamental Principles and Use Cases

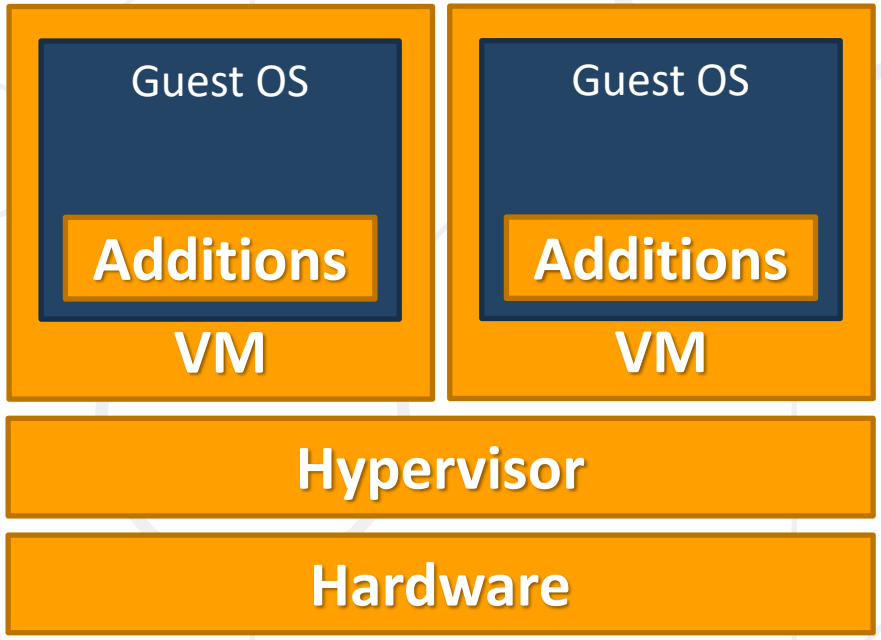
What is Virtualization?

- Virtualization is the **act** of creating a **software-based** or virtual (rather than physical) version of something
- Main definitions
  - Host OS (machine)
  - Virtual machine
  - Guest OS (machine)
  - Guest additions

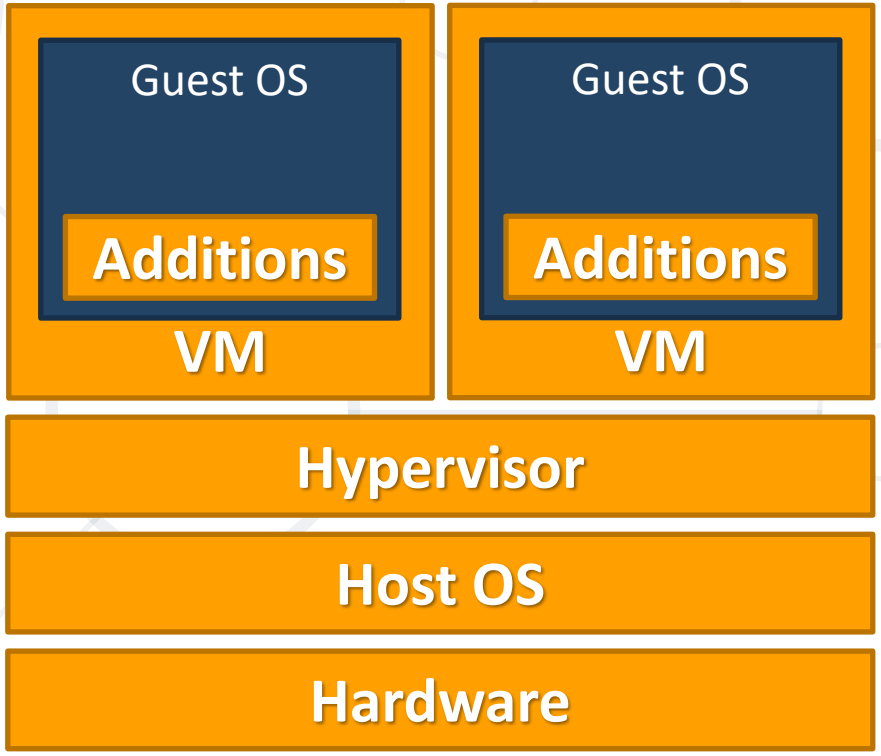


Hypervisors

- A **hypervisor** or **virtual machine monitor (VMM)** is computer software, firmware, or hardware, that creates and runs virtual machines



Type 1 (bare metal)



Type 2 (hosted)

Use Cases

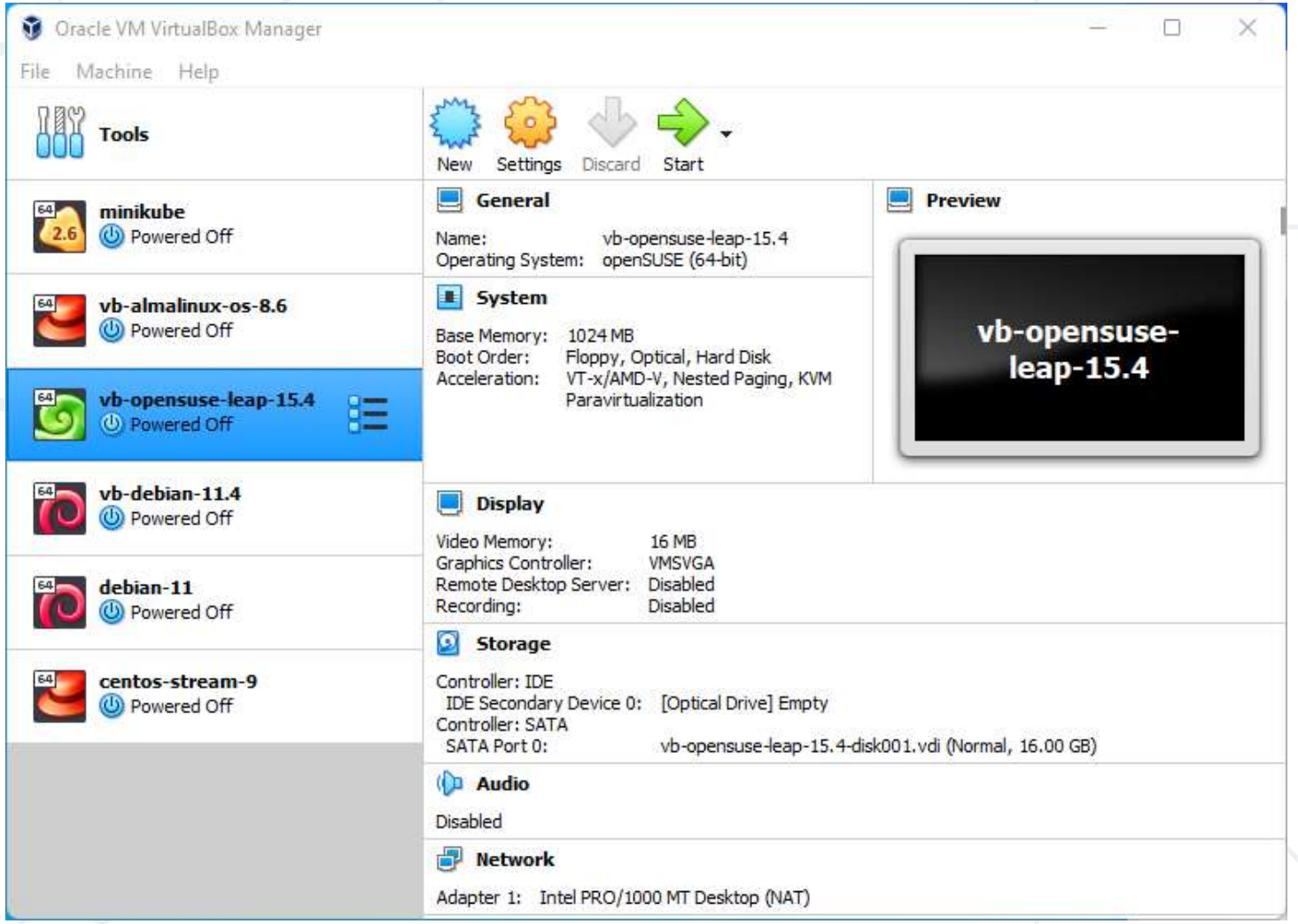
- Infrastructure **consolidation**
  - Better usage and utilization of the available hardware
- Maintain **separate environments**
  - For example – development, test, production
- **Testing** and **evaluation**
  - Test a newer software version or evaluate a product
- **High availability** and **disaster recovery**

Our Case

- We would like to
  - Install **multiple** machines on **limited** hardware resources
  - Manage their **isolation**
  - Manage their **state** – our own time-machine
  - **Move**, **export**, and **import** them
  - **Clone** them – create **multiple copies** out of one master
- The answer is **Virtualization**

VirtualBox

- Cross-platform
- Broad guest OS support
- Easy to install
- Simple GUI
- Automation options
- Free



Linux

Why Linux?

- It is a **phenomenon**
  - Went all the way from a **student's hobby** to **world domination**
- Internet **runs** on Linux
  - Operating system for **over 95%** of the top one million domains *
- It runs on **100%** of the **top 500** supercomputers **
- There is **huge demand** for Linux skills
- It is both **challenging** and **fun**

* https://www.linuxfoundation.org/about
** https://www.top500.org/statistics/details/osfam/1

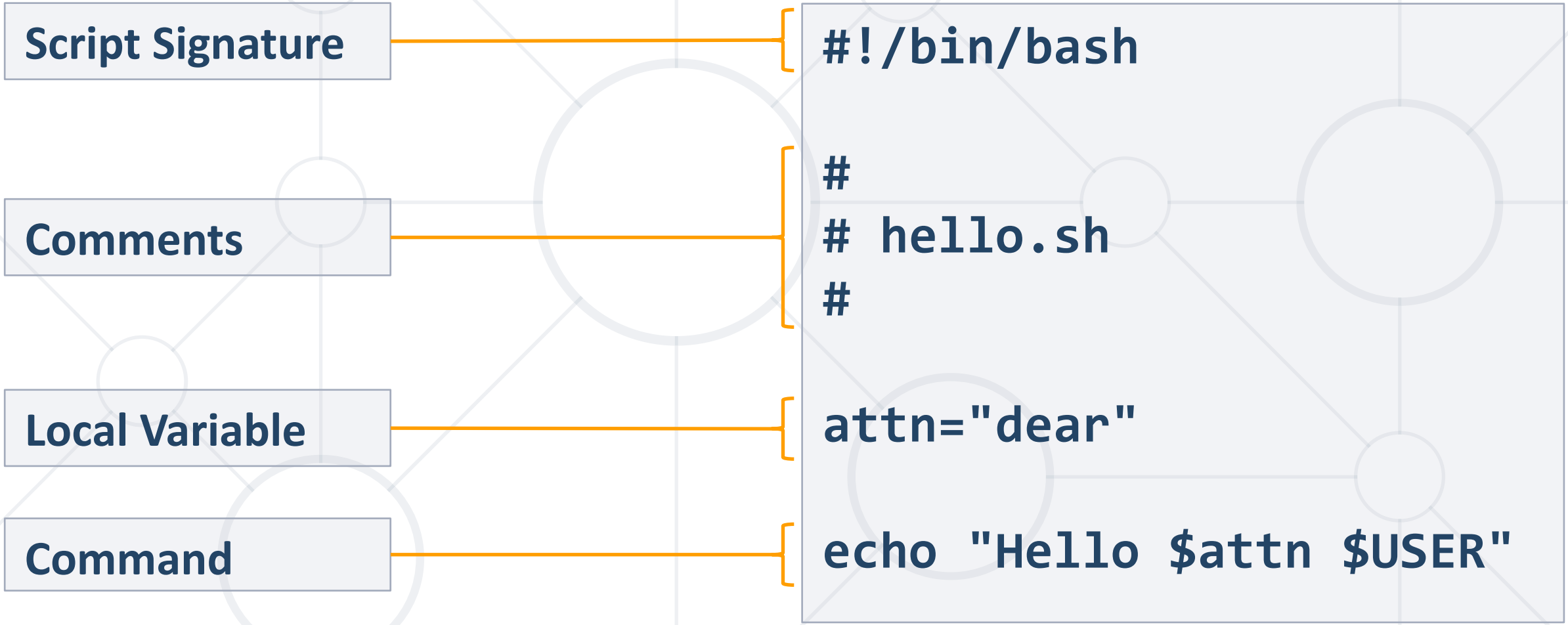
What we need to know?

- General knowledge about Linux
- Working with users, groups, and permissions
- Working with files and folders
- Handling some basic network related tasks
- Software and services management
- Basic bash scripting skills

Bash Scripting

Structure. Flow Control. Sourcing. Execution

Structure



Execution: **`bash hello.sh`** or **`./hello.sh`** or just **`hello.sh`**

echo

- Description
  - Display line of text
- Example

```
[user@host ~]$ echo 'Hello world!'
'Hello world!'

[user@host ~]$ echo -e 'Line 1\nLine2’
Line1
Line2
```

read

- Description
  - Read a line from the standard input and split it into fields
- Example

```
[user@host ~]$ read -p "Enter name:" NM_ENT
Enter name: James

[user@host ~]$ echo $NM_ENT
James
```

if

- Description
  - Execute commands based on conditional
- Example

```
count=1
if [ $count -eq 0 ]; then
   echo 'Equal to 0'
else
   echo 'Not equal to 0'
fi
```

test

- Description
  - Evaluate conditional expression
- Example

```
# Compare numbers: OP1 -eq|-ne|-lt|-le|-gt|-ge OP2

# Compare strings: ST1 =|!=|<|> ST2

# Compare files: FL1 -nt|-ot FL2

# File tests: -d|-e|-f|-x FILE
```

for

- Description
  - Execute command for each member in a list
- Example

```
# List all files with prefix "item:"

for i in $( ls ); do
    echo item: $i
done
```

while

- Description
  - Execute commands as long as a test succeeds
- Example

```
# Print numbers from 1 to 5
count=1
while [ $count -le 5 ]; do
    echo $count
    count=$((count+1))
done
```

until

- Description
  - Execute commands as long as a test does not succeed
- Example

```
# Print numbers from 1 to 5
count=1
until [ $count -gt 5 ]; do
    echo $count
    count=$((count+1))
done
```

Sourcing vs. Execution

- Sourcing
  - No subshell is created
  - Any variables set become part of the environment
  - Methods: `. script.sh` or `source script.sh`
- Execution
  - Subshell is always created
  - No subshell if using `exec ./script.sh`

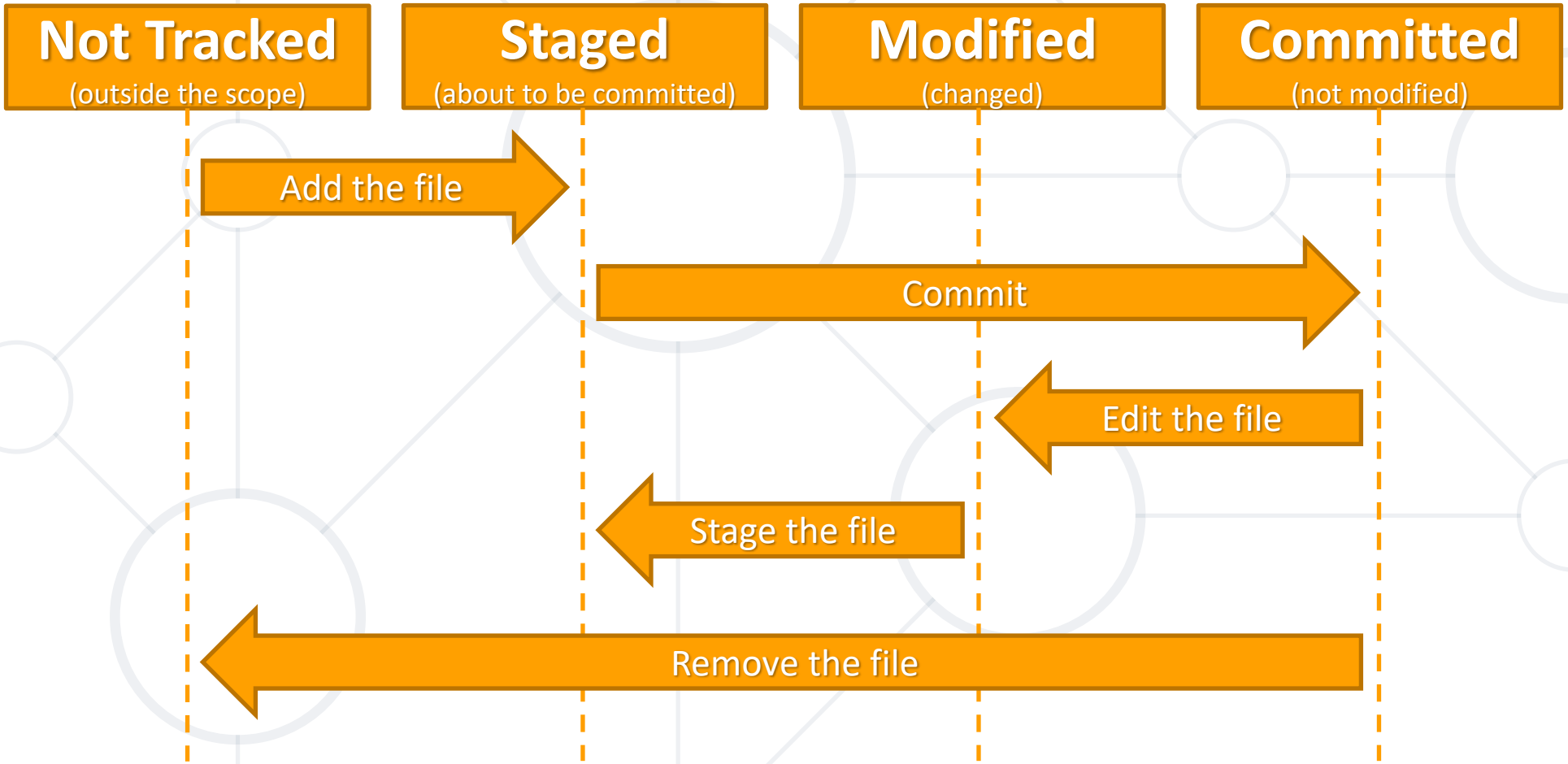
Source Control

Git. Files Lifecycle. Basic Commands

General Information

- Distributed Version Control
- Created by the Linux development community in 2005
- Can be used on-premise and in the cloud
- Snapshot based
- Three states - Committed, Modified, and Staged

Files Lifecycle



Basic Git Commands

- Create an empty Git repository

```
git init
```

- Clone an existing repository

```
git clone https://github.com/user/repo
```

- Show repository objects

```
git show
```

- Show different states of files in working directory and staging

```
git status
```

Basic Git Commands

- Add files from working directory to staging

```
git add file.txt
```

- Remove a file from staging and working directory

```
git rm old_file.txt
```

- Move or rename file

```
git mv old_file.txt new_file.txt
```

- Commit the staged changes

```
git commit
```

Basic Git Commands

- Get all not existing objects from remote repository

```
git fetch https://github.com/user/repo
```

- Get and merge changed objects from remote repository

```
git pull
```

- Push the changes to a remote repository

```
git push
```

Practice: Non-automated Way

Live Demonstration in Class

Vagrant

Introduction. Basic Commands

Introduction

- Building and managing virtual machine environments
- Supports providers like VirtualBox, VMware, AWS, etc.
- Provisioning tools such as shell scripts, Chef, or Puppet
- Multiplatform
- Integration with source control systems
- Public boxes catalog: https://app.vagrantup.com/boxes/search
- Local storage for boxes: ~/.vagrant.d/boxes

Boxes

- Boxes are the package format for the Vagrant environment
- They can be used by anyone on any supported platform
- Used to bring up an identical working environment
- Box files have three different components
  - **Box File** - Compressed (tar, tar.gz, zip) file that is specific to a single provider and can contain anything
  - **Box Catalog Metadata** - JSON document that specifies the name of the box, a description, available versions, etc.
  - **Box Information** - JSON document that can provide additional information

Box Creation

- Create a tiny VM
- Install the OS with minimalistic profile (SSH included)
- Install any additional required tools and services
- Install hypervisor addons (for example, VirtualBox Add-ons)
- Make the **vagrant** user a sudoers member
- Install the insecure vagrant key
- Cleanup packages cache and align the hard drive
- Package and publish the box

https://www.vagrantup.com/docs/boxes/base.html

Vagrantfile

- Ruby syntax
- One file per environment
- General file structure

```
# -*- mode: ruby -*-
# vi: set ft=ruby :
...
Vagrant.configure("2") do |config|
 config.vm.box = "shekeriev/debian-11"
...
end
```

Vagrantfile

```
Vagrant.configure("2") do |config|
  config.vm.box = "shekeriev/centos-8-minimal"
  # Provider settings
  config.vm.provider "virtualbox" do |vb|
    # Display the VirtualBox GUI when booting the machine
    vb.gui = true
    # Customize the amount of memory on the VM:
    vb.memory = "1024"
  end
  # Provisioning section
  config.vm.provision "shell", inline: <<SHELL
    dnf -y upgrade
    dnf install -y httpd
SHELL
end
```

Basic Vagrant Commands

- Initialize the environment

```
vagrant init [options] [box]
```

- Login to HashiCorp's Vagrant Cloud

```
vagrant login
```

- Connect to machine via SSH

```
vagrant ssh [options] [name|id]
```

- Check status of a vagrant machine

```
vagrant status [name|id]
```

Basic Vagrant Commands

- Start and provision grant environment

```
vagrant up [options] [name|id]
```

- Stop a vagrant machine

```
vagrant halt [options] [name|id]
```

- Stop and delete vagrant machine

```
vagrant destroy [options] [name|id]
```

- Manage boxes

```
vagrant box <subcommand> [<arguments>]
```

Practice: Vagrant in Action

Live Demonstration in Class

Summary

- DevOps
  - Is for companies of any size
  - Adds value and flow improvement
- DevOps is a combination of
  - Cultural changes
  - Organizational changes
  - Tools
- We are not alone – there is a toolkit to help us
- Vagrant allows us to automate infrastructure life-cycle

Resources

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- Vagrant download
  - https://developer.hashicorp.com/vagrant/downloads
- Vagrant documentation
  - https://developer.hashicorp.com/vagrant/docs
- Vagrant boxes repository (Vagrant Cloud)
  - https://app.vagrantup.com/boxes/search
- VirtualBox download
  - https://www.virtualbox.org/wiki/Downloads
- VirtualBox documentation
  - https://www.virtualbox.org/manual/UserManual.html
- CentOS download
  - https://www.centos.org/download/
- CentOS (Red Hat) documentation
  - https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/9
- Debian download
  - https://www.debian.org/download
- Debian documentation
  - https://www.debian.org/doc/

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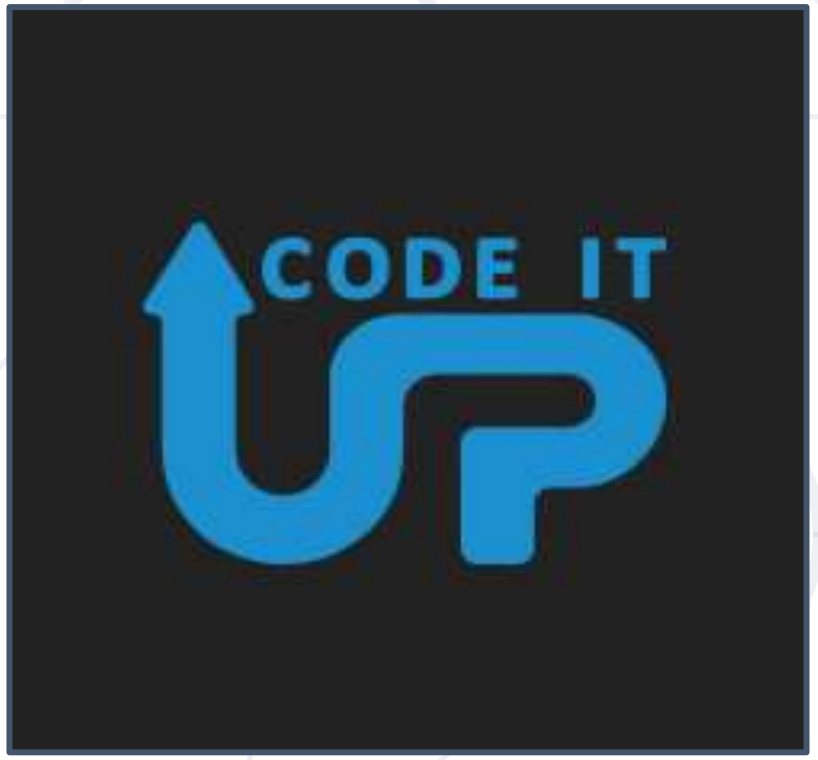
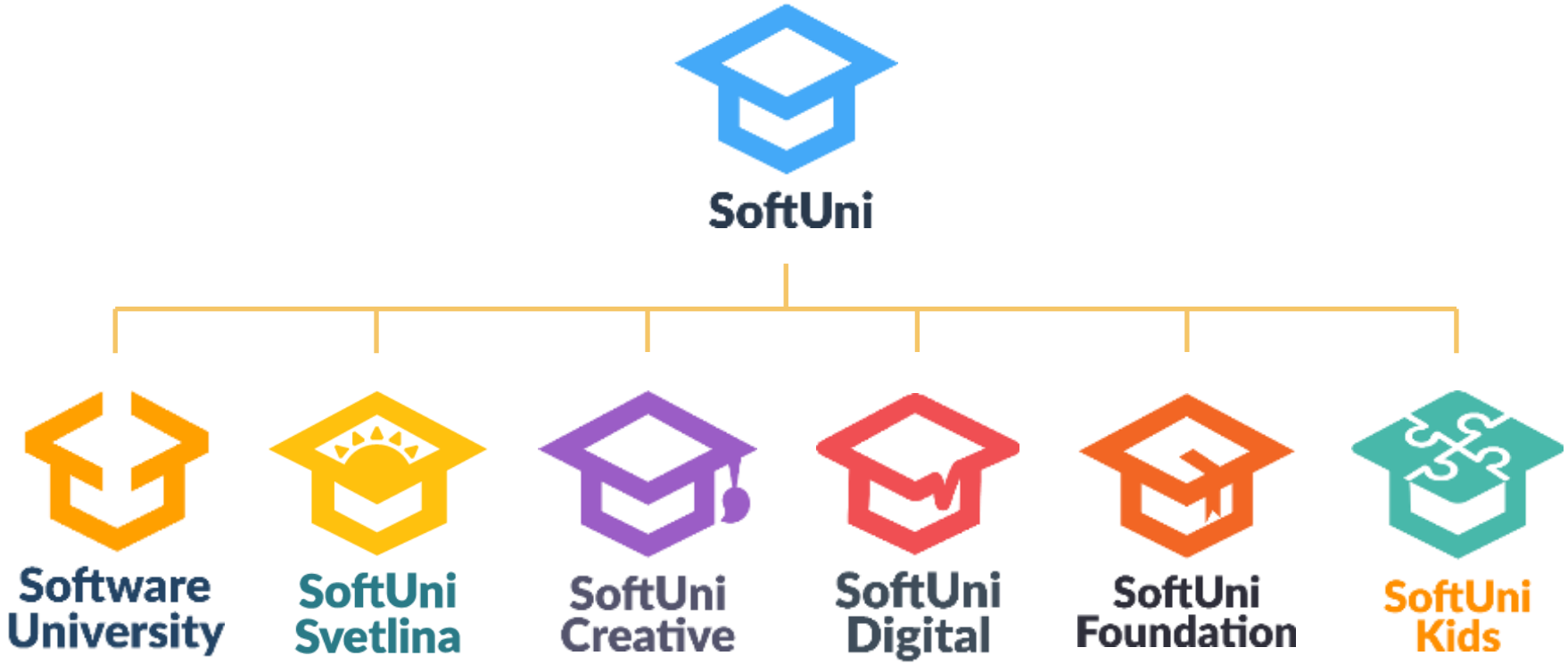


Questions?



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