OpenBSD: VMM / packer / vagrant

puffy clouds?

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sysfive.com portfolio

- Continous system and application operation
- Collaborations with Providers, Developers, Services and QA
- Hybrid cloud provisioning
- cost efficient scaling on commodity HW
- scale out to AWS/GCE/Azure
- Incident, problem, disaster response
- Service availability independent of solution scenario
- migrate from or to private/public cloud or own HW
- robust, scalable technology portfolio
- continuous improvements in security and server architecture
- coherent provisioning across platforms (dev/stage/live)
- vendor/provider independence, OSS focus

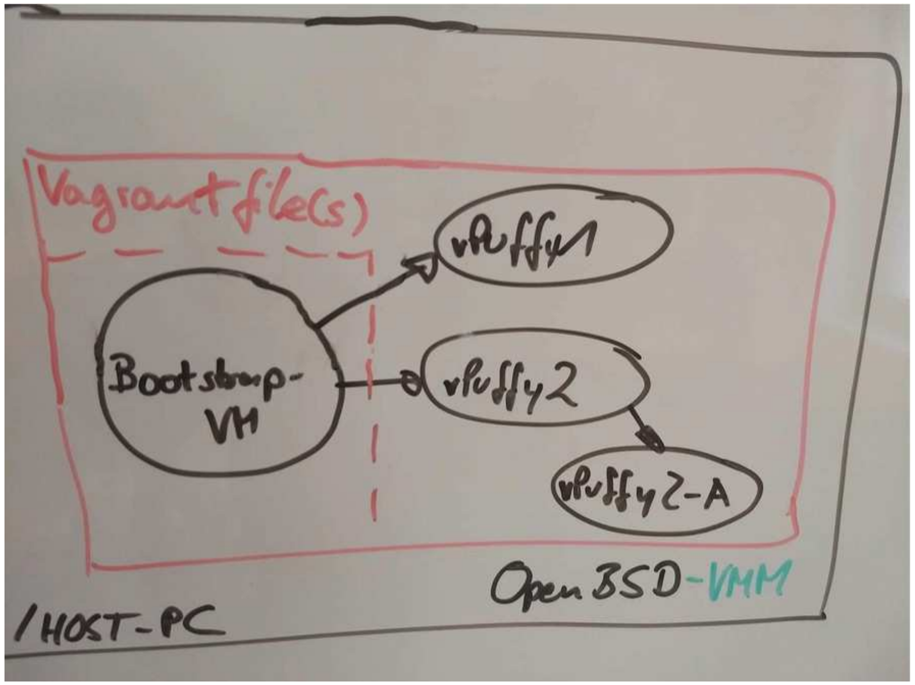
Ze problems I tackle with this setup

- Run multiple OpenBSD VMs on OpenBSD - w/o dealing with vm.conf(5)
- create reproducable installs - even "me so unique" ones
- develop and TEST autoinstall at 30,000ft (or -50) "infrastructure to go"
- make inter/intra-networking "just work" - no bridge(8) "hassle"
- and also retrospective (live --> test)
- use the same configuration (Vagrantfile) on OpenBSD/OSX/Linux to get the same resulting VM package/network/setup

Solutions / Approaches

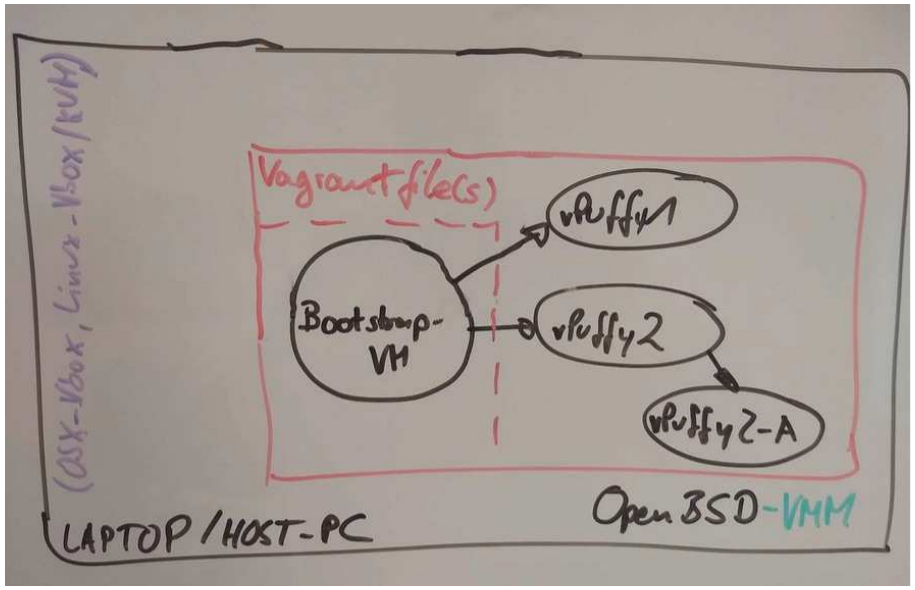
- my-imager.sh ; my-deploy.sh
- github | sh
- my-cold-hands ("VM guy is AWOL")
- wrong tool for the job (ansible-install-bsd.rd)
- vagrant / packer (o'rly)

Puffy boxed on OpenBSD (Dev#1)



- Bootstrap-VM: based on manual install or even better do it in ‘packer’
- vPuffy1+2: autoinstall from Bootstrap-VM directly
- vPuffy2a: autoinstall via dhcrelay on vPuffy2
- of course those cloud also be tailored images already ("vagrant box")

Puffy boxed on Linux/OSX/.. (Dev#2-n)

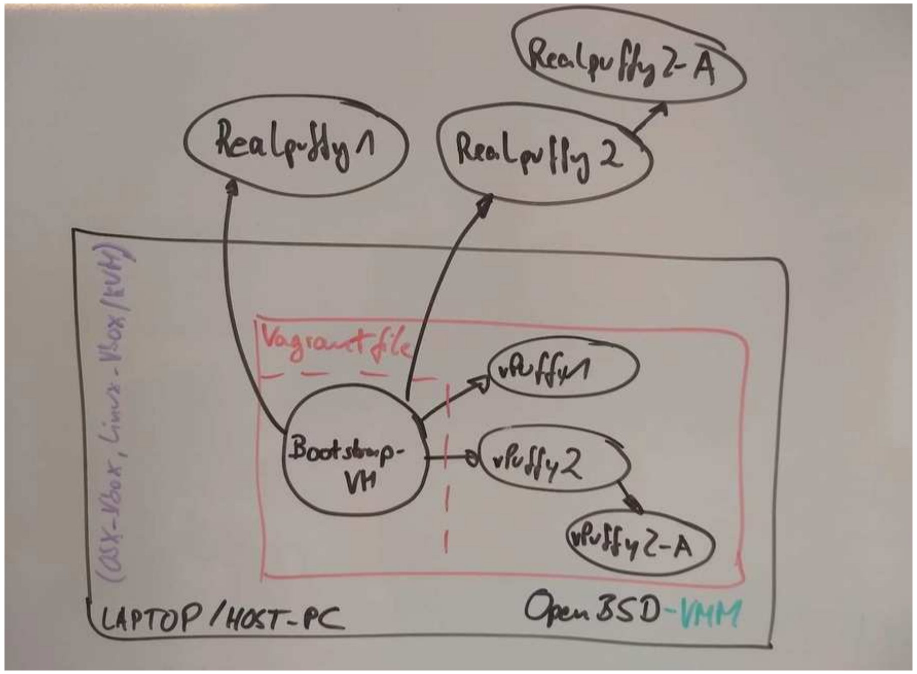


Just run the SAME "infrastructure" on

- OSX (Virtualbox/VMware)
- Linux (Virtualbox/libvirt)
- Cloud (AWS/GCE/..)
- basically everything that Vagrant supports (and that’s a lot)

‘Infrastructure’ going on a trainride or being airborne - not only as code (review) - but real testing

Puffy BREAKOUT to physical.



- Not impressed so far? Let's go 'physical'..
- Run the very SAME "infrastructure" on REAL puffymachines
- Develop + Test virtualized, use results for:
- Confidence in rollouts to baremetal
- debug problems on Laptop, roll-out solution to Realpuffy

OpenBSD VMM

vmm(4)
: virtual machine monitor (VMM) providing the required resources for the VMs (CPU, Disk, Net) and handles the necessary memory mapping (isolation).

vmd(8)
: userland daemon to interact with vmm(4) to create actual VMs and handle their lifecycle through:

vmctl(8)
: administrative tool to create, start/stop, etc VMs. In this scope also the main ’interface’ for the packer builder plugin.

vm.conf(5)
: configuration file for vmd(8), persist VM/network configurations.

doas(1)
: While most tasks the “builder” can (and should!) run as unprivileged user, some commands need to be run as root. The plugin does so automatically. Caveat: needs ’nopass’ for now (no tty), ’persist’ typically timeouts too early.

Vagrant - Architecture

Vagrant is a collection of ruby-gems wrapped by a go-binary CLI. Mainly it wraps e.g. VBox or VMWare commands into a abstract "ascii" configuration file. Also establishes a communication channel between host and guest and other networking gems as avaible.

Naming - what’s in the bento?

Core
: plugin loader "framework" + utils

Vagrantfile
: A single ruby-DSL configuration file (but there’s magic)

host
: capabilities (Linux, OSX, Free/OpenBSD, ..)

box
: Disk/BIOS image + metadata packed as tar.gz "under the hood"

guest
: capabilities (Linux, Free/OpenBSD, ..)

provider
: capabilities (vbox/VMM/bhyve/...) - where the main show goes

communicators
: ssh/winssh/winrm to let Vagrant configure the guest

provisioner
: shell/ansible/Chef/puppet/... run at the first ’up’ of the VM

Vagrant networking capabilities

- port-forward: open arbitrary ports (default 127.0.0.1) on the host and ssh-forward it into the VM
- bridged network: reach out from VM to The Internet (Host might need to NAT)
- "private" network: VM to VM communication on isolated network (bridge(8) rdomain(4)?)

Vagrant Provisioner - post-postinstall

Almost any automation stack can be included into a Vagrant based VM

- (inline) shell scripts
- ansible
- Chef
- Puppet
- Salt
- you-name-it, likely there's a plugin

Anatomy of an ‘vagrant up’ session

```
$ uname -a ; bundle exec vagrant status ; bundle exec vagrant up ; \
 bundle exec vagrant ssh -c "uname -a"
OpenBSD ssfnhv011.ham3.rootnexus.net 6.2 GENERIC.MP#134 amd64
Current machine states:
vagrobsd                 not_created (openbsd)
Bringing machine ’vagrobsd’ up with ’openbsd’ provider...
==> vagrobsd: Verifying VMM present and CPU capable...
==> vagrobsd: Importing an OpenBSD instance
    vagrobsd: Cloning virtual hard drive...
    vagrobsd: Successfully imported a VM image
    vagrobsd: Creating vmctl configuration
==> vagrobsd: Starting the machine...
==> vagrobsd: Waiting for the machine to report its IP address...
    vagrobsd: IP: 100.64.2.3
==> vagrobsd: Waiting for machine to boot. This may take a few minutes...
    vagrobsd: SSH address: 100.64.2.3:22
    vagrobsd: SSH username: root
    vagrobsd: SSH auth method: password
    vagrobsd: Inserting generated public key within guest...
    vagrobsd: Removing insecure key from the guest if it’s present...
    vagrobsd: Key inserted! Disconnecting and reconnecting using new SSH key...
==> vagrobsd: Machine booted and ready!
OpenBSD openbsd62.example.com 6.2 GENERIC#132 amd64
Connection to 100.64.2.3 closed.

$ cat Vagrantfile
Vagrant.configure("2") do |config|
  config.vm.box = "vagrobsd"
  config.ssh.shell = "ksh -l"
  config.ssh.sudo_command = "doas -n %c"
  config.vm.define "vagrobsd" do |v|
    v.vm.hostname = "openbsd-vagrant"
  end
end
```

Drawbacks?

- run a full auto-install from a kinda prepared local network infrastructure or internet every time a VM boots the first time
- new "box" imaging possible - but only on target platform
- multi-disk rather a pain to share (as a box)
- bottom-line: to flexible to be really reproducible and efficient

Now what? packer time!

What’s packer anyway?

```
Packer is an open source tool for creating *identical* machine images
for multiple platforms from a *single source* configuration.
Packer is lightweight, runs on every major operating system,
and is highly performant, creating machine images for multiple
platforms *in parallel*.

Packer does not replace configuration management like Chef or Puppet.
In fact, when building images, Packer is able to use tools like Chef
or Puppet to install software onto the image.
```

- written in golang
- small core providing communications (rpc)
- everything else is a plugin (but linked into one binary)
- configuration in JSON (+ optional variables)

packer: forms in the sandbox / Terminology

Artifacts
: Outcome of a "Build", e.g. AMI, .vmdk, .box

Builds
: The actual running task producing above artifacts

Builders
: Code to steer the VM host, handle disk images, etc (see below)

Provisioners (optional)
: Additional treatment, installation goes here and range from simple inline shell scripts to full-blown ansible, Chef, ..

Post-processors
: Treat the Artifacts after creation, e.g. compress, upload AWS, ..

Templates
: The JSON files defining all of the above (and some) - NOT a VM "template"

Packer: Builders + Post-Provisioning

By default the following “builder” engines are supported. Where needed the accompaning “post-processor” is typically available, too (e.g. EC2/AMI upload):

Alicloud ECS, Amazon EC2, Azure, CloudStack, DigitalOcean, Docker, File, Google Cloud, Hetzner Cloud, HyperOne, Hyper-V, Linode, LXC, LXD, NAVER Cloud, Null, 1&1, OpenStack, Oracle, Parallels, ProfitBricks, QEMU, Scaleway, Tencent Cloud, Triton, Vagrant, VirtualBox, VMware, Yandex.Cloud.

Further “builders” can be found in the wild and are just added as a single go binary in certain paths (e.g. ˜/.packer.d/plugins/)

By default additional provisioning support for the following tools:

Ansible, Breakpoint, Chef, Converge, File, InSpec, PowerShell, Puppet, Salt Masterless, Shell.

OpenBSD dependencies / configuration

- /etc/pf.conf:

```
# 100.64.0.0/10 default for vmd(8)'s DHCP server
pass in quick proto { udp tcp } from 100.64.0.0/10 to any port domain \
                 rdr-to $dns_server port domain
pass out quick on $ext_if from 100.64.0.0/10 to any nat-to $ext_if
```

- /etc/sysctl.conf

```
net.inet.ip.forwarding=1
```

- vmd(8)

```
rcctl enable vmd
rcctl start vmd
```

packer *DEMO TIME*

```
{
  "builders": [
    {
      "type": "openbsd-vmm",
      "name": "packer-obsd64-vmm-amd64",
      "vm_name": "myvm",
      "disk_size": "1500M",
      "disk_format": "raw",
      "output_directory": "images",
      "http_directory": "./docroot",
      "iso_image": "~/Downloads/install65.iso",
      "bios": "/bsd.rd",
      "boot_wait": "5s",
      "boot_command": [
        "A<enter>",
        "http://{{ .HTTPIP }}:{{ .HTTPPort }}/packer-auto_install.conf<ente
      ],
      "ssh_username": "root"
    }
  ]
}
```

https://asciinema.org/a/246654

asciinema play ~/devel/presenter/presentations/h4g/2019/tl-demo.cast

What's already around?

vagrant

- fake netboot (vmctl -B)
- bundle(1) Vagrant 2.1 (but likely works with 1.5+)
- Vagrant provider-plugin: 0.3.0
    - box support for disk install
    - host OS detection by vagrant
    - VM lifecycle "import/up/halt/destroy"
    - Host-to-Guest networking + SSH

packer

- plugin: all architectural integration (config/builder/driver)
- plugin_steps: create disk/VM/boot/provide auto_install infra

What’s still to be done?

vagrant

- Networking VM-to-VM
- vagrant-binary (Go)
- ports(7)

packer

- GetTapIpAddr
- ports(7)

Ohai + Links + Thanks

- Code/Slides - https://github.com/double-p
- Kickoff - Glarus, Switzerland / https://hack4glarus.ch
- Thanks to Claudio for the idea of vmctl -B
- Thanks to grubernaut for go.mod, review, ISO+QCOW2 support and other spurious fixes
- Any help/pull request very welcome (e.g. multi-disk)

Questions?

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