Dos and Don'ts for Virtual Appliance Preparation

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Introduction

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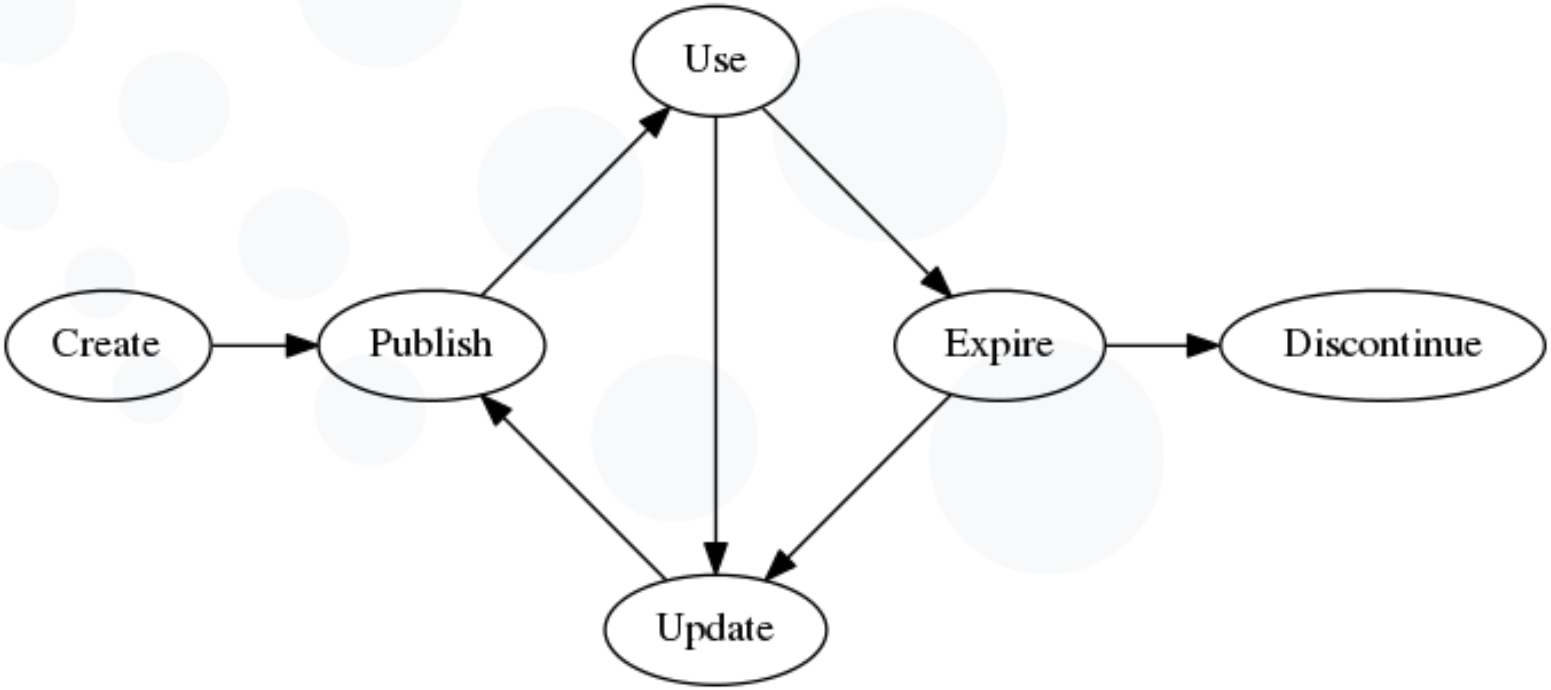
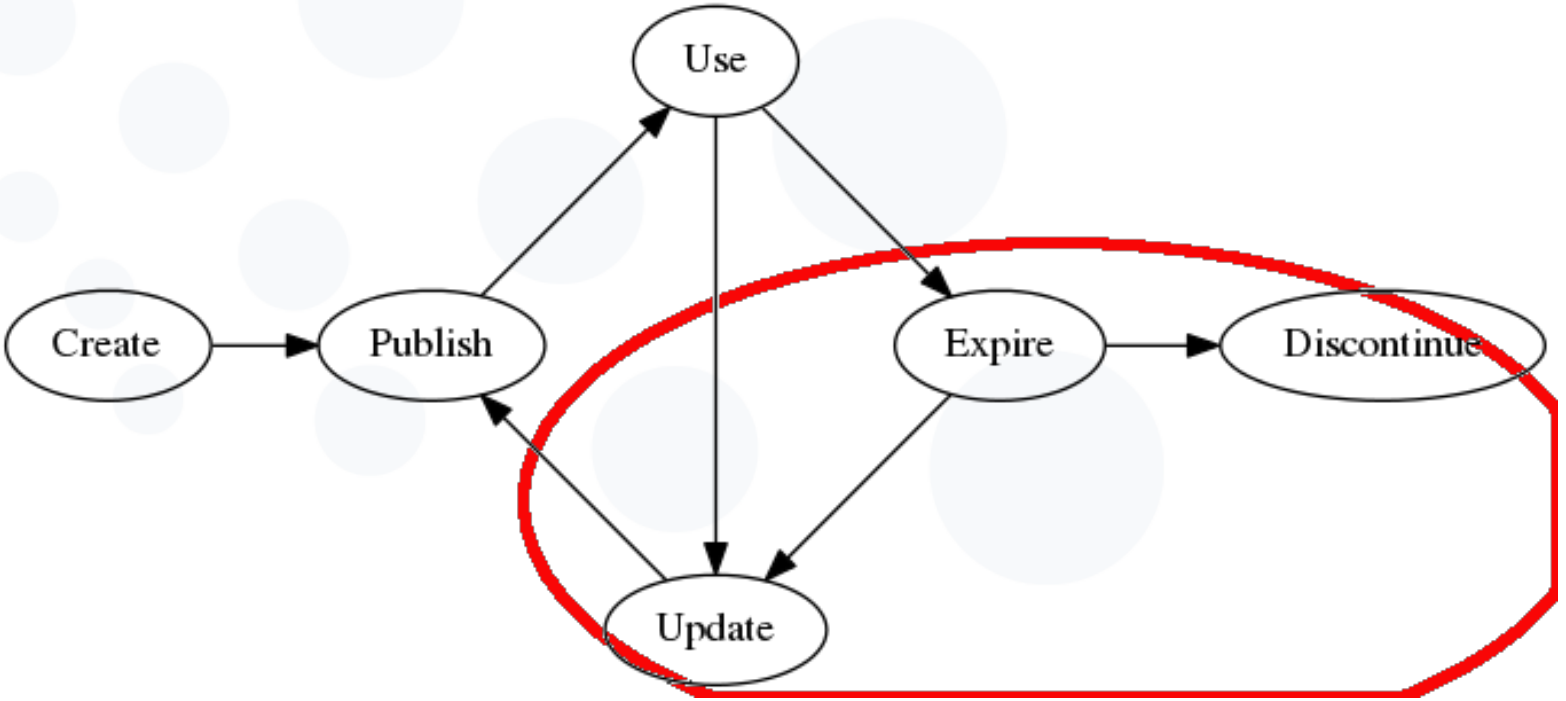
Virtual Appliance

- a set of one or more virtual resource descriptors
- in the cloud context, virtual resource == virtual machine
- metadata & binary data of included virtual machines
- pre-installed and *partially* pre-configured software
- simplifies and speeds up resource deployment for users
- for the purposes of this talk, one resource per appliance

Life-cycle



Maintenance



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Pros & Cons

+ easier for users, no installation guides
+ faster instance convergence, *provisioning* $\rightarrow$ *work*
+ fine-grained environment control (version, configuration)

– time-consuming preparation of appliances
– issues with interoperability across different platforms
– challenging security-related aspects

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EGI.eu VAs

- virtual appliances provided & endorsed by **EGI.eu**
- available in **The EGI Applications Database**
- mostly so-called **base** appliances containing a clean operating system
- providing useful jumping-off points for new users
- making sure users do not repeat the same mistakes
- isolating users from technical details of our infrastructure

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Community VAs

- virtual appliances provided by the community
- available in (& endorsed by) selected virtual organizations
- available in **The EGI Applications Database**
- contain end-user applications & computational frameworks
- responsibility of the community and endorsing VO managers

Should You Have One?

- depends on your workflow and applications
- use generic/base appliances as much as possible
- consider utilizing contextualization tools with base appliances
- create your own, if you really have to and know how
- a virtual appliance is your **pet**, for as long as it lives

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Hands-on Interlude

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Instructions

Prerequisites:

1. Install & test VirtualBox
2. Install & test Packer
3. Install & test OVFTool

Steps:

1. Get the tutorial package (flash drive or link)
2. Run the automated build
3. Package the resulting appliance as OVA

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Instructions

https://goo.gl/Md7zJp

```
$ cd fedcloud-userinterface-packer

$ packer build fedcloud-userinterface.json

$ ovftool output-virtualbox-iso/FedCloud-Client-Ubuntu.14.04.20150902.ovf \
          output-virtualbox-iso/FedCloud-Client-Ubuntu.14.04.20150902.ova
```

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VA Preparation Basics

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Think First

- Why am I doing this? Do I have to?
- How can I distribute my application in the best way possible?
- Which operating system should I choose?
- Do I know how to configure the chosen operating system?
- How should I (pre-)configure my application?
- Can I easily adjust my application's configuration for each instance?

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Installation

General:

- minimalistic OS installation
- basic configuration for remote access
- contextualization support (e.g., *cloud-init*)
- guest utilities or agents, not good for portability
- integration with 3rd party services

Linux-specific:

- no GUI, no desktop applications, no network managers
- up-to-date kernel & modules, ideally v3+
- avoid complex partition layouts
- make sure */etc/fstab* and *grub* use labels or UUIDs

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Contextualization

- every appliance must support contextualization
  $\rightarrow$ metadata-based configuration on boot
- **cloud-init** is the *de facto* standard
- *YAML*-based configuration file containing user data
- helps with credentials, user accounts, mounts, package installation, writing files, adding repositories, ...
- do **NOT** forget to remove */var/lib/cloud* before distributing the appliance
- see https://cloudinit.readthedocs.org/en/latest/

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Configuration

- always keep in mind “less is better”
- no unnecessary services or user accounts
- be careful with publicly visible listeners
- no password-based authentication, if possible
- no pre-installed credentials or “backdoor” utils
- let contextualization do the work

Security

- minimize the attack surface for running instances
- always use an up-to-date system, enable security updates if possible
- do **NOT** use plain authentication methods
- always check your newly created appliance
  - *nmap*, *netstat*, *lynis*, *ssh*
  - */etc/passwd*, */etc/shadow*, */etc/sudoers*
  - */etc/ssh/sshd_config*, *~/.ssh/authorized_keys*
- think about runtime patch status monitoring
  → Pakiti http://pakiti.sourceforge.net/

Security

```
$ apt-get update && apt-get dist-upgrade
# or
$ yum update

$ ssh -o PreferredAuthentications=none localhost

$ lynis audit system
# or
$ lynis --auditor system

$ nmap -sS localhost

$ netstat -tapn
$ netstat -uapn
```

Image & Appliance Formats

- every virtualization platform uses a different native disk image format
- commonly used: *qcow(2)*, *vdi*, *vmdk*, *raw*
- compression optional, reduces size $\rightarrow$ reduces performance
- on top of that, appliance "envelopes" $\rightarrow$ *OVF/OVA*
- Open Virtualization Format $\rightarrow$ Open Virtual Appliance
  - OVF appliance descriptor (metadata)
  - disk image(s), usually *vmdk*

Distribution w/ The EGI AppDB

→ Demo Later

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Advanced Topics

Format Conversion

Tools:

- QEMU utilities (for disk image conversion)
- VMWare OVFTool (for OVF/OVA transformation)

```
## convert formats
$ qemu-img convert -f vmdk -O qcow2 Appliance.vmdk Appliance.qcow2
$ qemu-img convert -f qcow2 -O vmdk Appliance.qcow2 Appliance.vmdk
$ qemu-img convert -f qcow2 -O raw Appliance.qcow2 Appliance.raw

## package
$ ovftool MyFirstAppliance.ovf MyFirstAppliance.ova

## unpack
$ tar xvf MyFirstAppliance.ova
```

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Portability

- changing hardware (CPU, memory, PCI devices)
  → most systems can cope with that
- dynamically adding/removing disks
  → most systems can cope with that
- dynamically adding/removing NICs
  → disable *udev* rules generator
- different network topologies
  → most systems can cope with that
- different methods of contextualization
  → *cloud-init v0.7.5+*
- different supported appliance/image formats
  → use one of the most popular formats and hope for the best

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Automation

- identify repetitive tasks, don't perform them manually
- good places to start looking
  - OS installation (building)
  - configuration (provisioning)
  - publishing appliances (distribution)
- automation saves your time and makes the process more reliable

Automating Builds

Tools:

- Packer → https://www.packer.io/
- VeeWee → https://github.com/jedi4ever/veewee

Sample Packer Templates:

- https://github.com/shiguredo/packer-templates
- https://github.com/joefitzgerald/packer-windows
- **Notice:** *builders*, *provisioners*, *post-processors*

```
$ packer build template.json
```

Automating Provisioning

- usual suspects
  - scripting (shell, powershell, . . .)
  - ansible, saltstack, chef
  - puppet
- select one based on the complexity of your application
- use in Packer *provisioners*

Automating Distribution

???

EGI Federated Cloud:

- The EGI AppDB (w/ custom built tools)

Out There:

- Project Raindrops http://projectraindrops.net/
- Atlas by HashiCorp https://atlas.hashicorp.com/

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The EGI AppDB

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Quick AppDB Summary

1. SSO Account Registration
2. First AppDB Login (w/ SSO account)
3. Quick AppDB Orientation
4. Registering a VA
5. Asking for VO Endorsement

Quick AppDB Summary

Example VA: https://goo.gl/WqEKsq

Register VA: https://goo.gl/2cCCjl

Populate VA: https://goo.gl/YikgZN

Notify VO(s): https://goo.gl/OxUTz7

Overall Summary

(Credit: Toronja Azul via Creative Commons)

. . . and automate . . . A lot!

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The End

– That's All Folks! –

...

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Contact Info

Do you have any questions?

- ask **NOW!**
- ask us directly at parak@cesnet.cz or enol.fernandez@egi.eu
- send your questions to ucst@egi.eu