Preventing Version Sprawl in Containers and Virtual Machines

TUT1364 – Build and manage your fleet with SUSE® Manager

Michele Bologna
Software Engineer
SUSE

How do you treat your servers?

Like pets or like cattle?

Preventing version sprawl in containers and virtual machines

TUT1364 – Build and manage your fleet with SUSE® Manager

What would happen if several of your servers went offline right now?

What would you do if one server gets “sick”?

How *should* you treat your servers?

Treat your servers like cattle, not pets

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Agenda

- Modern Approach: Pet vs. Cattle
- Modern Approach: Evolution
- Modern Approach: Notable Problems
- Lifecycle Management: SUSE Manager
- Building Images with SUSE Manager: Workflow
- SUSE Manager Benefits: Recap
- SUSE Manager Image Building: Notable Use Cases
- Q & A

Pet vs. Cattle

Modern Approach: Pet vs. Cattle

“Treat your servers like cattle, not pets”

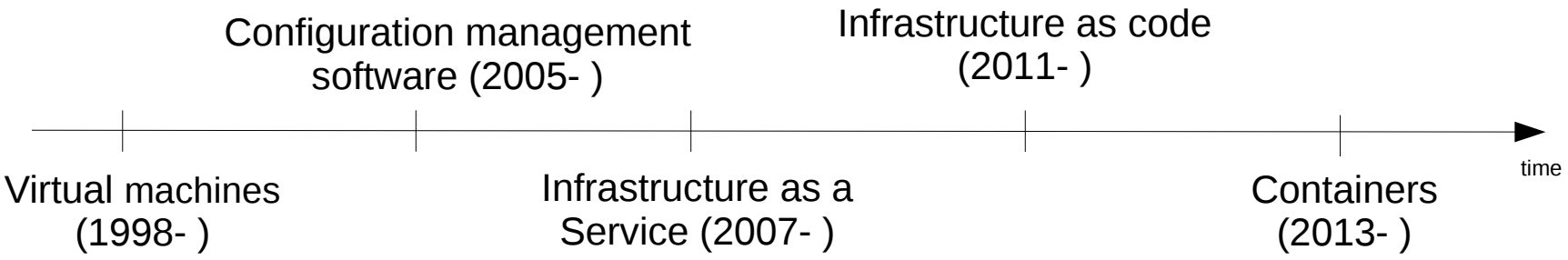
Pets (antipattern):

- Every server is named (“unique snowflake”, difficult to reproduce)
- Every server is mission-critical: all hands on deck if it goes down
- Manually built, managed and “hand fed”
- Cannot be easily replaced

Cattle:

- Every server is numbered because they are identical to each other
- When one server goes down, it is taken out back and replaced on the line
- Built using automated tools
- Designed to “route around failure”: replace failed servers and replicate data quickly and easily

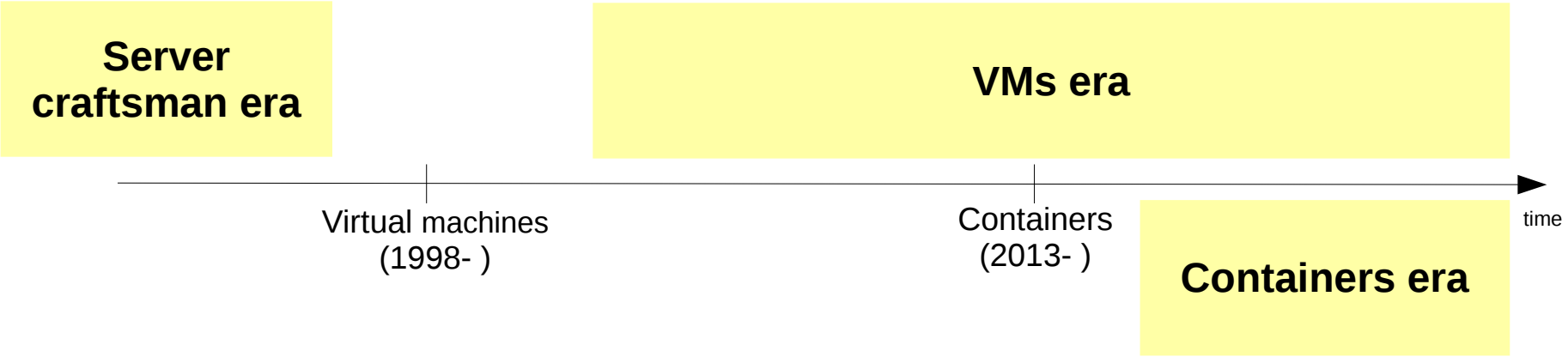
Modern Approach: the Evolution of Cattle



The tendency is to have an **immutable production**, where *disposable* virtual machines and containers are configured at deployment.

Notable Problems of Modern Approach

Modern Approach: the Evolution of Cattle



Notable problems

- **Configuration drift**: do you store the “recipe” to recreate the server somewhere? Has the server state changed against the recipe?
- **Version sprawl**: which version of the image is correct?
- **Workflow**: what process do we follow to build or rebuild an image?
- **Audit**: is the image using a vulnerable version of the software?

Modern Approach: Auditing Problems

- **An ACM study on 356,218 public container images found that (2017):**

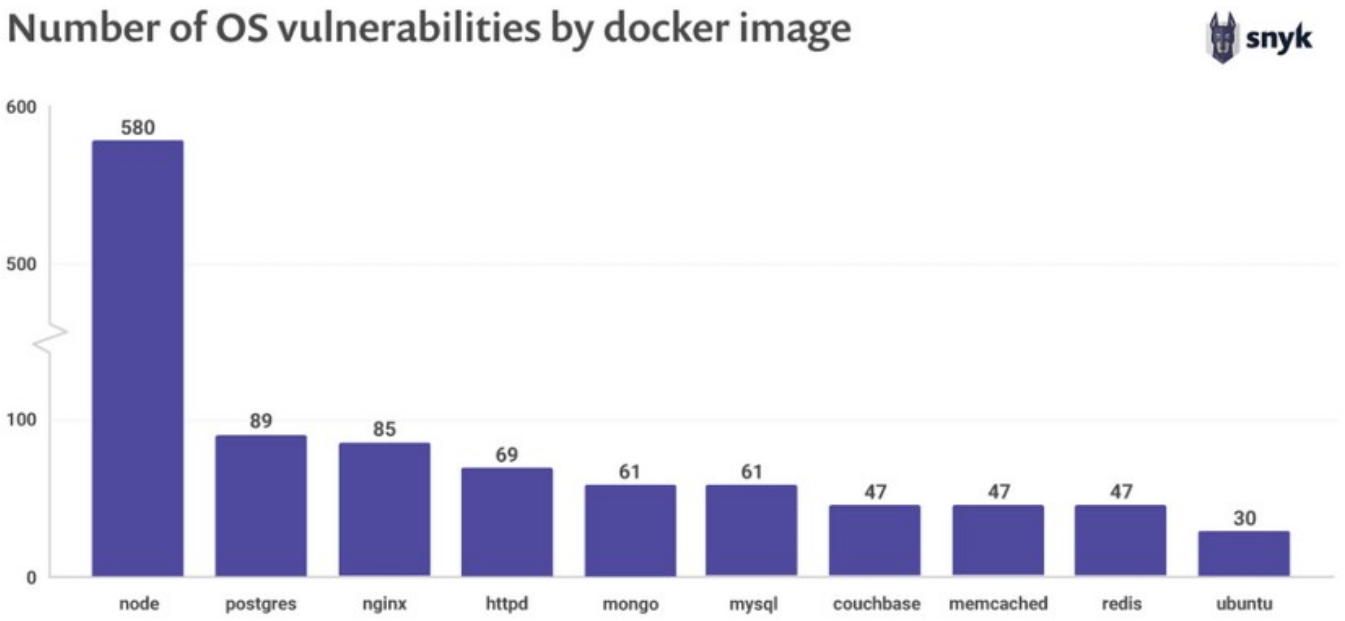
On average, official and community images contain more than 180 vulnerabilities

- **Many images have not been updated for hundreds of days**
- **Vulnerabilities propagate from parent to child images**

Source: http://dance.csc.ncsu.edu/papers/codaspy17.pdf

Modern Approach: Auditing Problems

Top ten most popular container images each contain at least 30 vulnerabilities (2019)



Source: https://snyk.io/blog/top-ten-most-popular-docker-images-each-contain-at-least-30-vulnerabilities/

Notable Problems: a Security Nightmare

(based on a true story)

Modern Approach: Auditing Problems

You are running an application in a container and you have been asked:

"Is our application vulnerable to Tomcat - Remote Code Execution via JSP Upload Bypass (2017-12617)?"

Modern Approach: Auditing Problems

Tilix: Default

1: root@golf: ~

```
root@golf:~# docker run -ti tomcat bash
root@7ecf406f78ed:/usr/local/tomcat# bin/catalina.sh version
Using CATALINA_BASE:   /usr/local/tomcat
Using CATALINA_HOME:   /usr/local/tomcat
Using CATALINA_TMPDIR: /usr/local/tomcat/temp
Using JRE_HOME:        /docker-java-home/jre
Using CLASSPATH:       /usr/local/tomcat/bin/bootstrap.jar:/usr/local/tomcat/bin/tomcat-juli.jar
Server version: Apache Tomcat/8.5.38
Server built:   Feb 5 2019 11:42:42 UTC
Server number:  8.5.38.0
OS Name:        Linux
OS Version:     4.18.0-15-generic
Architecture:   amd64
JVM Version:    1.8.0_181-8u181-b13-2~deb9u1-b13
JVM Vendor:     Oracle Corporation
root@7ecf406f78ed:/usr/local/tomcat#
```

Modern Approach: Auditing Problems

148	Application	Apache	Tomcat	8.5.18				Version Details Vulnerabilities
149	Application	Apache	Tomcat	8.5.19				Version Details Vulnerabilities
150	Application	Apache	Tomcat	8.5.20				Version Details Vulnerabilities
151	Application	Apache	Tomcat	8.5.21				Version Details Vulnerabilities
152	Application	Apache	Tomcat	8.5.22				Version Details Vulnerabilities
153	Application	Apache	Tomcat	9.0.0	M2			Version Details Vulnerabilities
154	Application	Apache	Tomcat	9.0.0	M15			Version Details Vulnerabilities
155	Application	Apache	Tomcat	9.0.0	M5			Version Details Vulnerabilities

To be repeated manually for all containers and all packages

Auditing scenarios

- How often do your audit your base images?
- How long does it take to check your compliance status?

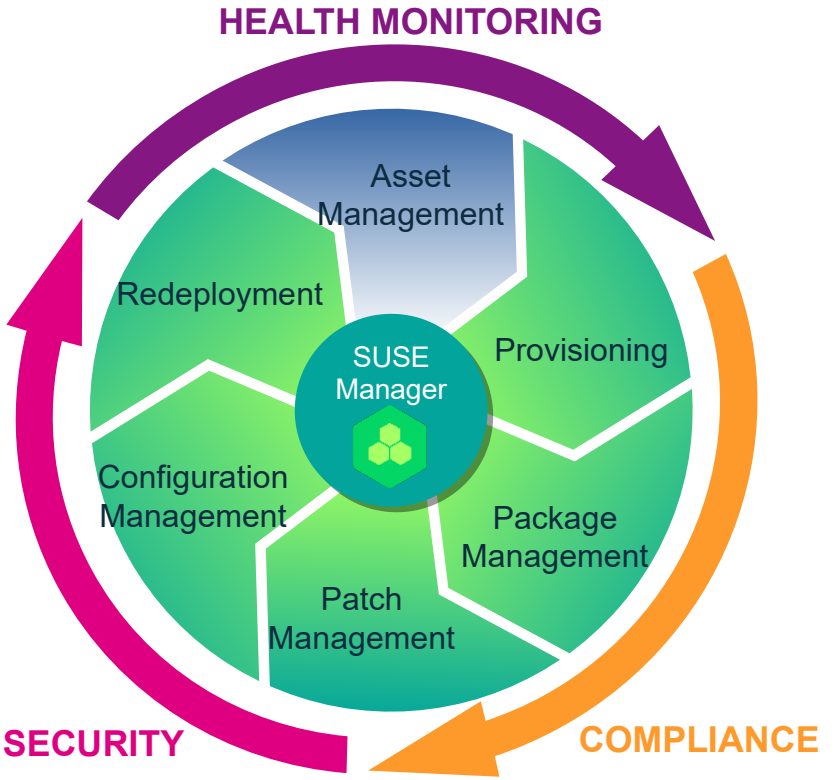
SUSE Manager

SUSE Manager

Available on the Public Cloud

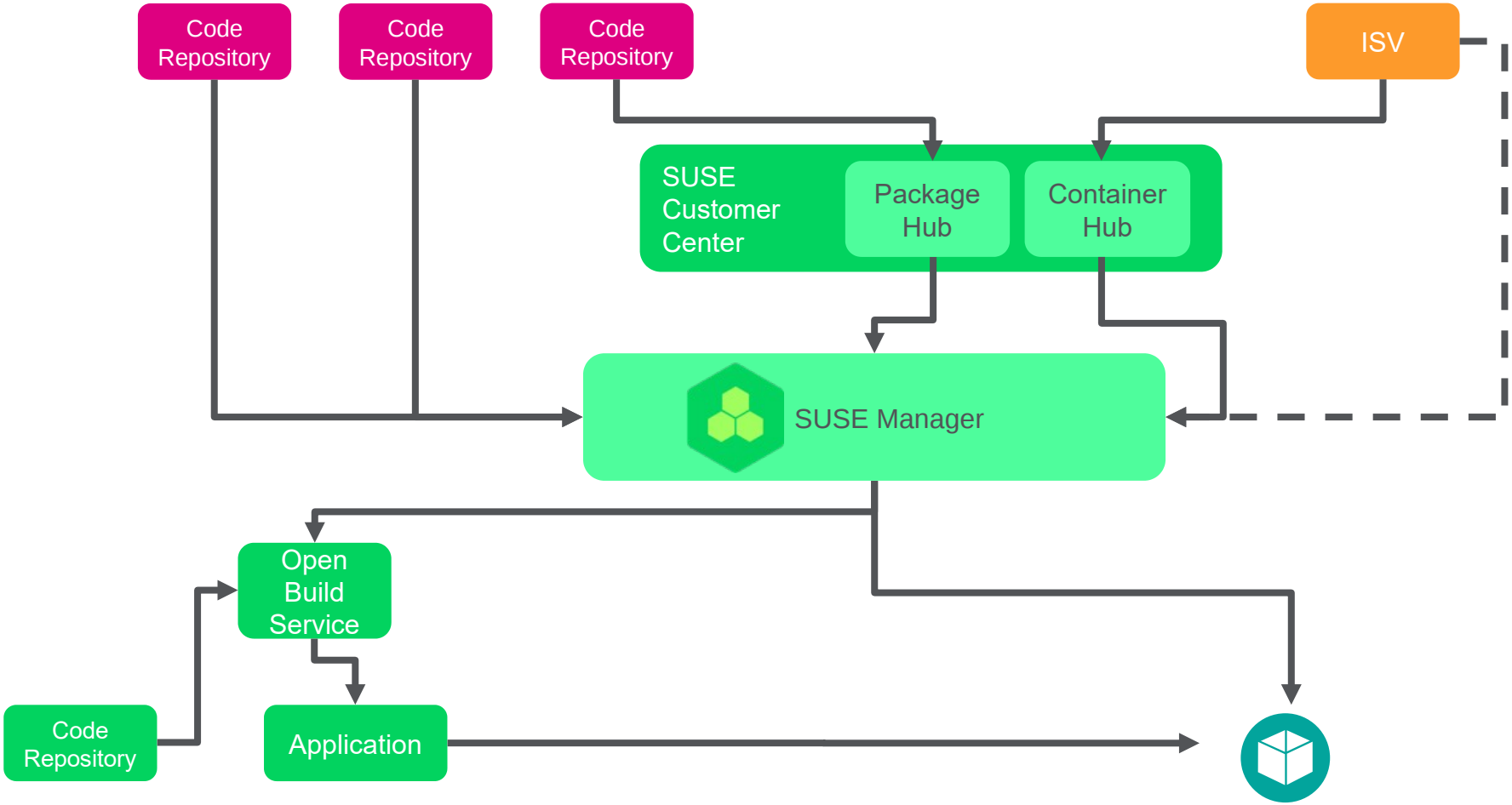
Best-in-class open source infrastructure management solution designed to help your enterprise DevOps and IT Operations teams to:

- Optimize operations while reducing **costs**
- Reduce **complexity** and regain control of IT assets
- Ensure **compliance** with internal security policies and external regulations



SUSE Manager Image Building

Image Building with SUSE Manager



Hands on SUSE Manager Image Building

Image Building with SUSE Manager: Workflow

1. Define a worker (build host)

Edit System Details

System Name:	minion.tf.local
Base System Type:	Salt
Add-On System Types:	☐ Container Build Host ☐ OS Image Build Host
Notifications:	☑ Receive Notifications of Updates/Patches. ☑ Include system in daily summary report calculations.

Image Building with SUSE Manager: Workflow

2. Create an image profile

Create Image Profile

Label *: my-awesome-image-profile

Image Type *: Dockerfile

Target Image Store *: container-registry

fake-url

Dockerfile URL *: https://github.com/SUSE/manager-build-profiles.git#master:Containers/apache

Git URL pointing to the directory containing the Dockerfile.
Example: *https://mygit.com#<branchname>:path/to/dockerfile*.
See also the SUSE Manager templates repository for some out-of-the-box working examples.

Activation Key: 1-DEFAULT

testchannel

Custom Info Values: Create additional custom info values

+ Create

Clear fields

Image Building with SUSE Manager: Workflow

Configuration option	Meaning	Container images	OS Images
Image store (output)	Where all built images will be pushed	Container registry	OS Image store (a directory served via HTTPS)
Config URL	A Git URL pointing to the instructions to build the image	Dockerfile	Kiwi config file
Activation Key	Specifies the software channels to use when building the image	Optional	Mandatory

Image Building with SUSE Manager: Workflow

21 lines (14 sloc) | 531 Bytes

```
# VERSION               1.0.0

FROM opensuse:42.3
MAINTAINER Michele Bologna <michele.bologna@suse.com>

ARG repo
ARG cert

RUN echo "$cert" > /etc/pki/trust/anchors/RHN-ORG-TRUSTED-SSL-CERT.pem
RUN update-ca-certificates
RUN echo "$repo" > /etc/zypp/repos.d/susemanager:dockerbuild.repo

ADD add_packages.sh /root/add_packages.sh
RUN /root/add_packages.sh

ADD pub.conf /etc/apache2/conf.d/pub.conf
RUN mkdir -p /srv/www/htdocs/pub/
ADD index.html /srv/www/htdocs/pub/index.html

CMD /usr/sbin/start_apache2 -DFOREGROUND -k start
```

Source config file are public: https://github.com/SUSE/manager-build-profiles

Image Building with SUSE Manager: Kiwi

- KIWI is a utility to build Linux system appliances
- It creates an image file starting from a configuration file
- Created images can be ISOs as well as virtual images for QEMU, Xen and other providers (even cloud)
- It can also build images that boot via PXE or Vagrant boxes

Image Building with SUSE Manager: Kiwi config

```
    <packages type="image">
        <package name="patterns-sles-Minimal"/>
        <package name="aaa_base-extras"/> <!-- wouldn't be SUSE without that ;-) -->
        <package name="acl"/>
        <package name="btrfsprogs"/>
        <package name="btrfsmaintenance"/>
        <package name="cron"/> <!-- needed by btrfsmaintenance -->
        <package name="curl"/> <!-- needed for openQA, maybe delete -->
        <package name="dracut"/>
        <package name="fipscheck"/>
        <package name="grub2-branding-SLE" bootinclude="true"/>
        <package name="iputils"/>
<!--        <package name="jeos-firstboot"/> -->
        <package name="zypper-lifecycle-plugin"/> <!-- bsc#1030278 fate#320597 -->
        <package name="vim"/>
        <package name="gettext-runtime"/>
        <package name="shim" arch="x86_64"/>
        <package name="grub2"/>
        <package name="grub2-x86_64-efi" arch="x86_64"/>
        <package name="fontconfig"/>
        <package name="fonts-config"/>
        <package name="haveged"/>
        <package name="less" />
```

Source config file are public: https://github.com/SUSE/manager-build-profiles

Image Building with SUSE Manager: Workflow

Configuration option	Meaning	Container images	OS Images
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Image Building with SUSE Manager: Workflow

Base Channel: SLES12-SP3-Pool for x86_64

Choose "SUSE Manager Default" to allow systems to register to the default SUSE Manager provided channel that corresponds to the installed SUSE Linux version. Instead of the default, you may choose a particular SUSE provided channel or a custom base channel, but if a system using this key is not compatible with the selected channel, it will fall back to its SUSE Manager Default channel.

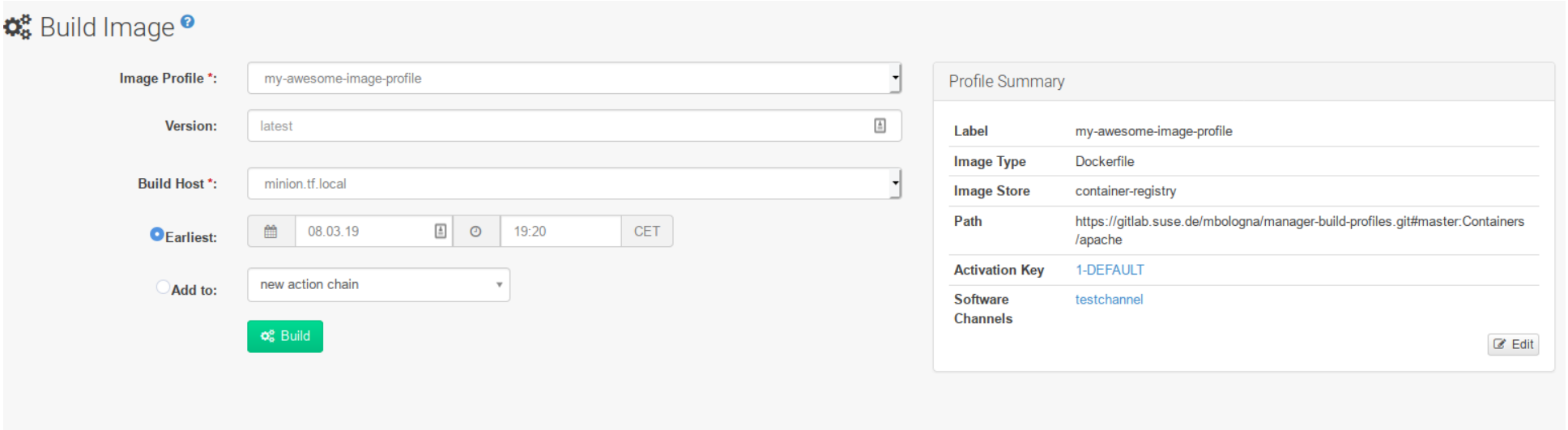
Child Channels: SLES12-SP3-Pool for x86_64

- [x] PROD - VETTED Clone of SLES12-SP3-Updates for x86_64
- [x] SLE-Manager-Tools12-Pool for x86_64 SP3 mandatory
- [x] SLE-Manager-Tools12-Updates for x86_64 SP3 mandatory
- [ ] SLE-Module-Containers12-Pool for x86_64 SP3
- [ ] SLE-Module-Containers12-Updates for x86_64 SP3
- [x] SLES12-SP3-Updates for x86_64 mandatory
- [ ] SUSE-Manager-Server-3.2-Pool for x86_64 SP3

Fine-grained selection of software channels to use when building the image across SUSE Manager

Image Building with SUSE Manager: Workflow

3. Build the image



SUSE Manager: Security Audits

Image Building with SUSE Manager: Workflow

3. Build the image

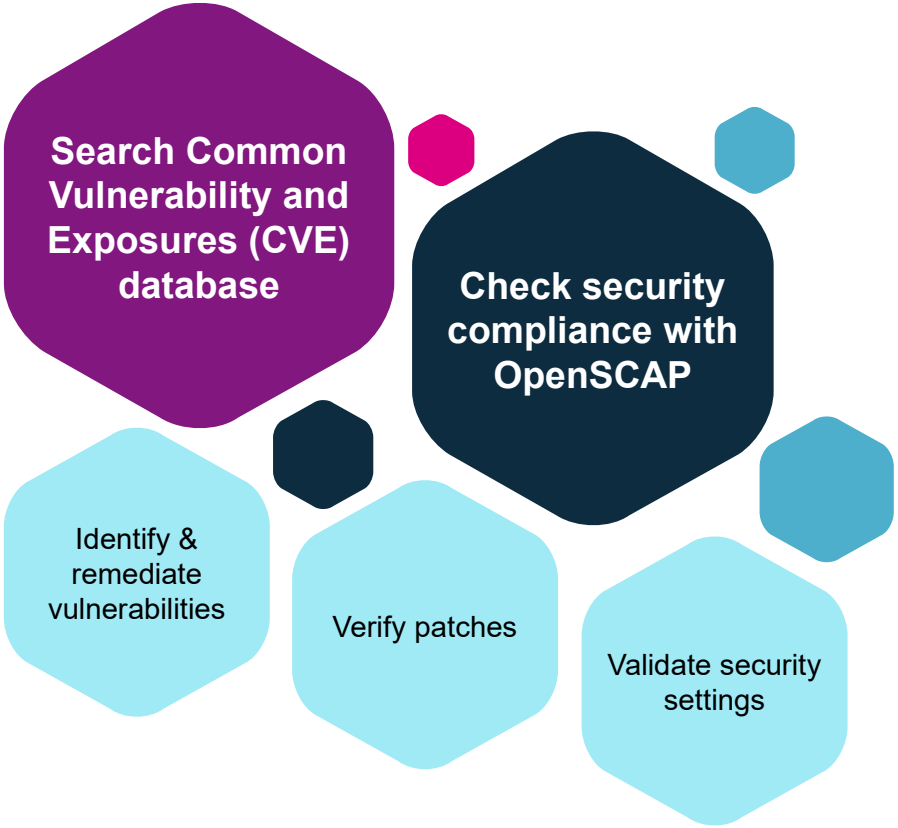
Overview Patches Packages

Items 1 - 25 of 285

Package Name	Architecture	Installed
aaa_base-13.2+git20140911.61c1681-38.8.1	x86_64	12 minutes ago
aaa_base-extras-13.2+git20140911.61c1681-38.8.1	x86_64	12 minutes ago
acl-2.2.52-6.1	x86_64	12 minutes ago
bash-4.3-83.10.1	x86_64	12 minutes ago
blog-2.18-2.7	x86_64	12 minutes ago

Image is inspected after build to collect installed package information (version, arch, installed timestamp)

Ensure Compliance



Secure images with SUSE Manager

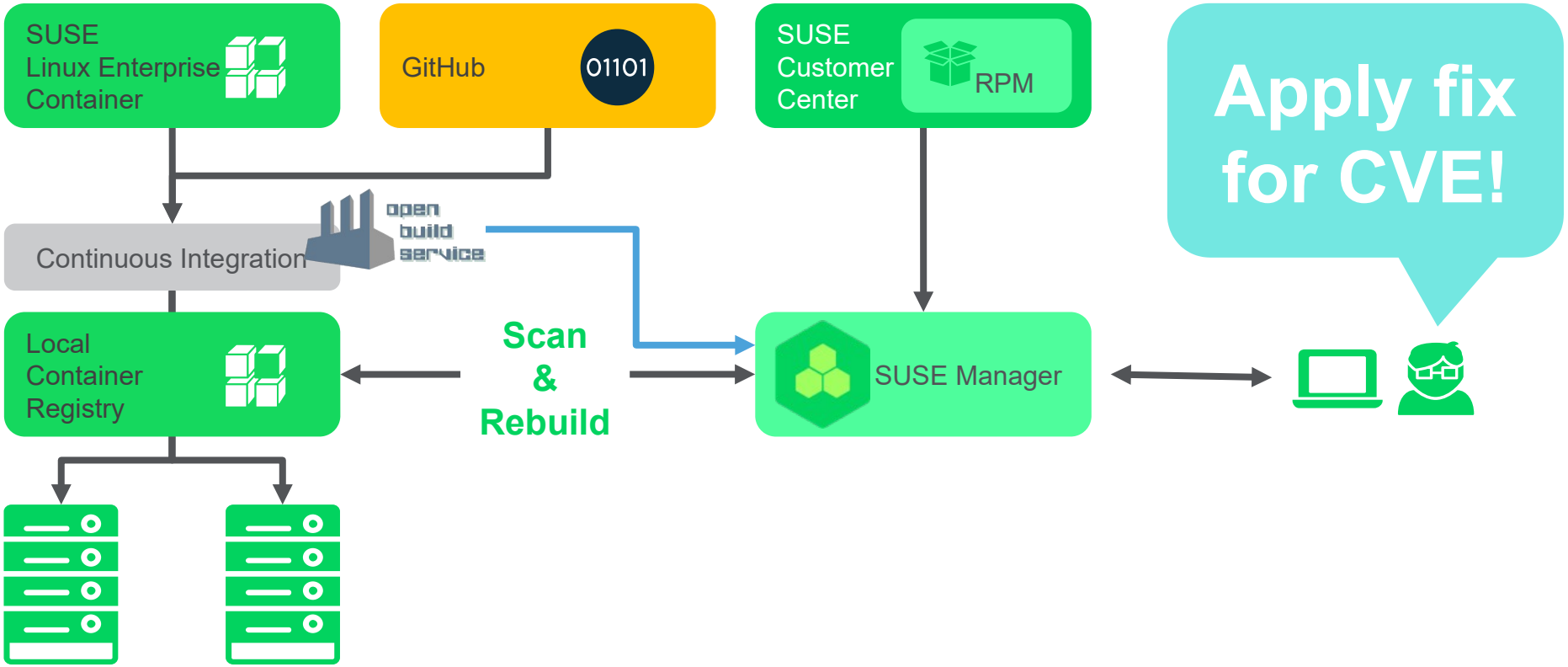
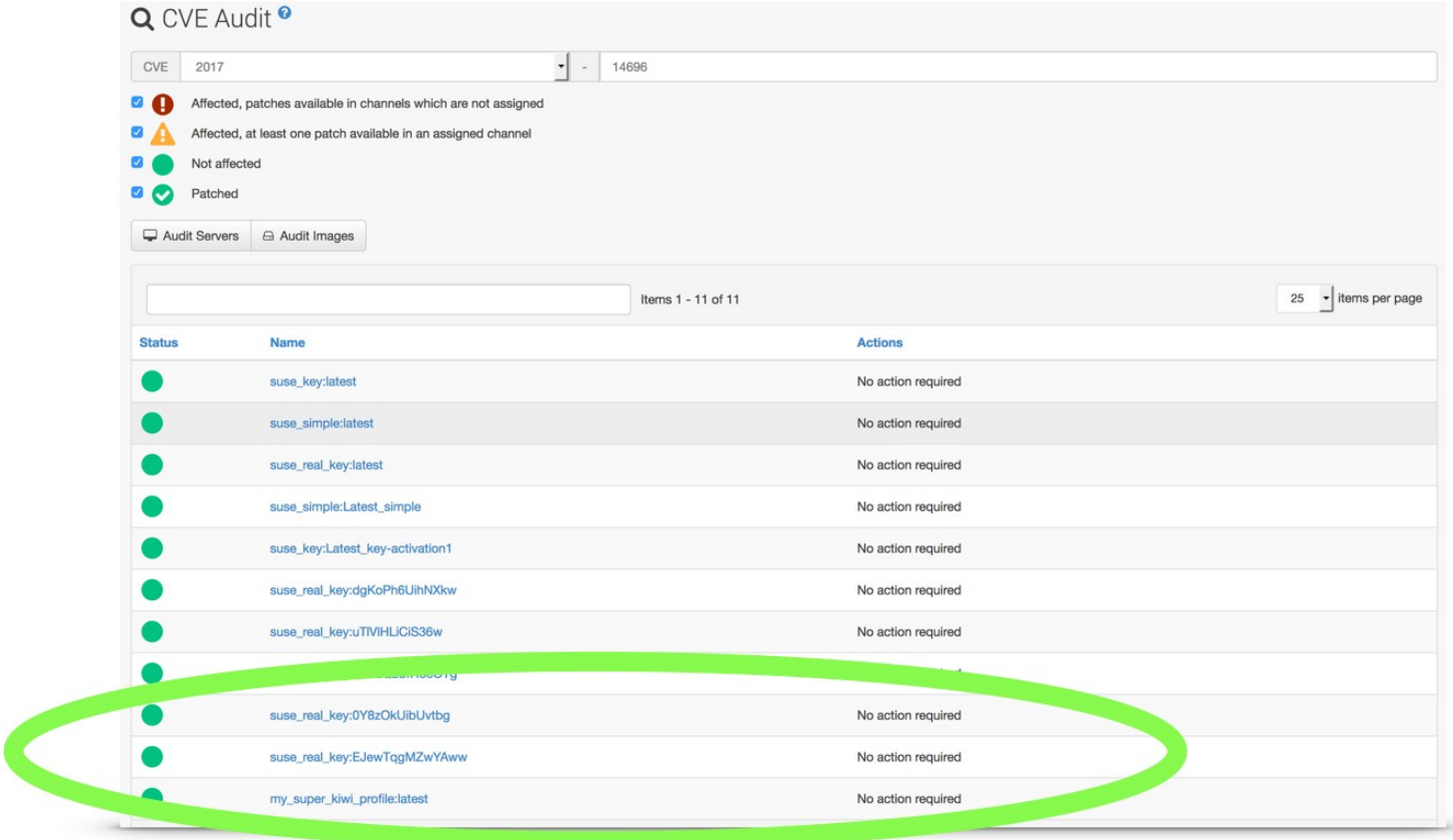


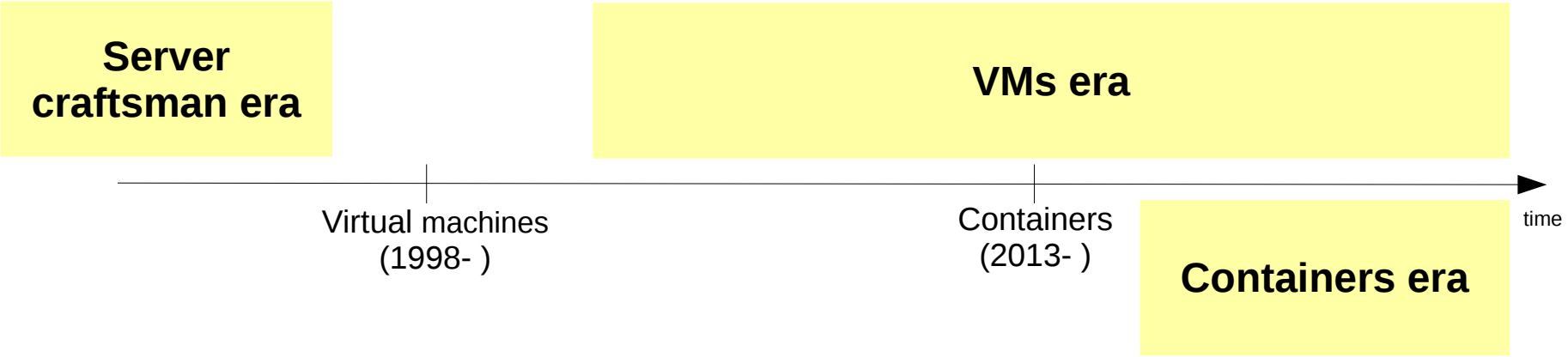
Image Building with SUSE Manager: Workflow

4. Audit your images and rebuild them when needed



SUSE Manager Benefits: Recap

Modern Approach: the Evolution of Cattle



Notable problems

- **Configuration drift**: do you store the “recipe” to recreate the server somewhere? Has the server state changed against the recipe?
- **Version sprawl**: which version of the image is correct?
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Image Building with SUSE Manager
Mitigating Problems

Notable problems

Configuration drift: do you store the “recipe” to recreate the server somewhere? Has the server state changed against the recipe?

With SUSE Manager

The instructions to (re-)create the image from scratch are versioned in a Git repository. Every change is versioned. Every change to the recipe will lead to a different resulting image built by SUSE Manager.

Image Building with SUSE Manager: Mitigating Problems

Notable problems

Version sprawl: which is version of the image is correct?

With SUSE Manager

SUSE Manager is managing the entire lifecycle of the built images, from the initial building with selected channels to the rebuild option, along with security and compliance check.

Image Building with SUSE Manager: Mitigating Problems

Notable problems

Workflow: What process do we follow to build or rebuild an image?

With SUSE Manager

SUSE Manager is a central tool with a defined a workflow:

- define a store and a configuration file
- build the image
- rebuild an image

Bringing up a new container or VM image is just as quickly as pressing the build button

Image Building with SUSE Manager: Mitigating Problems

Notable problems

Audit: is the image using a vulnerable version of the software?

With SUSE Manager

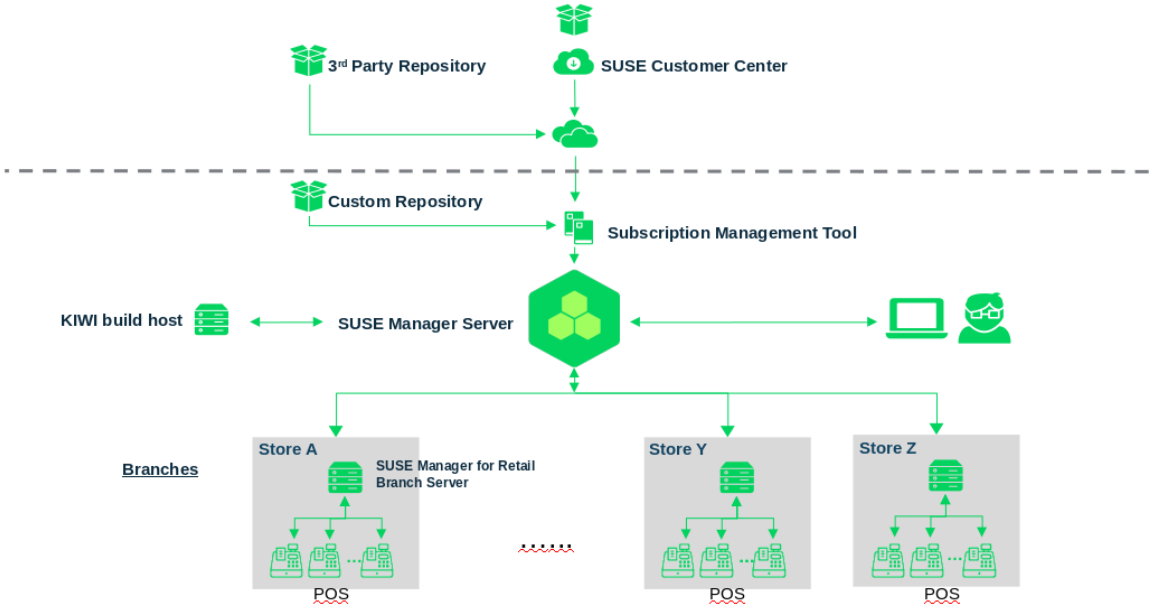
SUSE Manager can quickly check to see if the image is using a vulnerable version of the package. A build for an updated image is as simple as triggering a rebuild.

Notable Use Cases

SUSE Manager for Retail

SUSE Manager for Retail uses image-building feature to:

- Centrally create and maintain images for Point of Service devices
- Deploy images for POS terminals via PXE booting



Other Use Cases

- **Use SUSE Manager to build images and push them to the cloud**

- **Can you imagine another use case? Sky is the limit!**

Q & A

If you liked this session, please **rate it**

Preventing version sprawl in containers and virtual machines

TUT1364 – Build and manage your fleet with SUSE® Manager

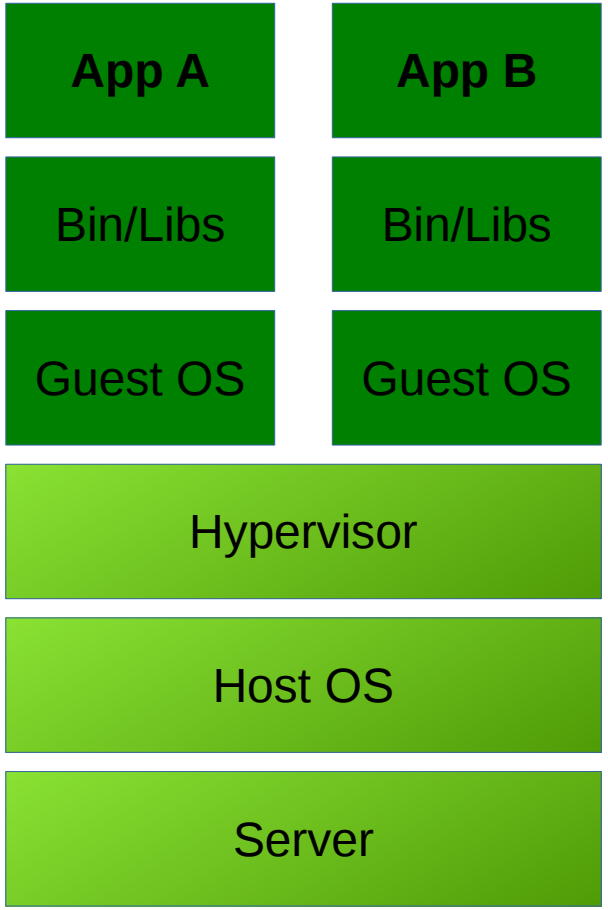
Thank you!

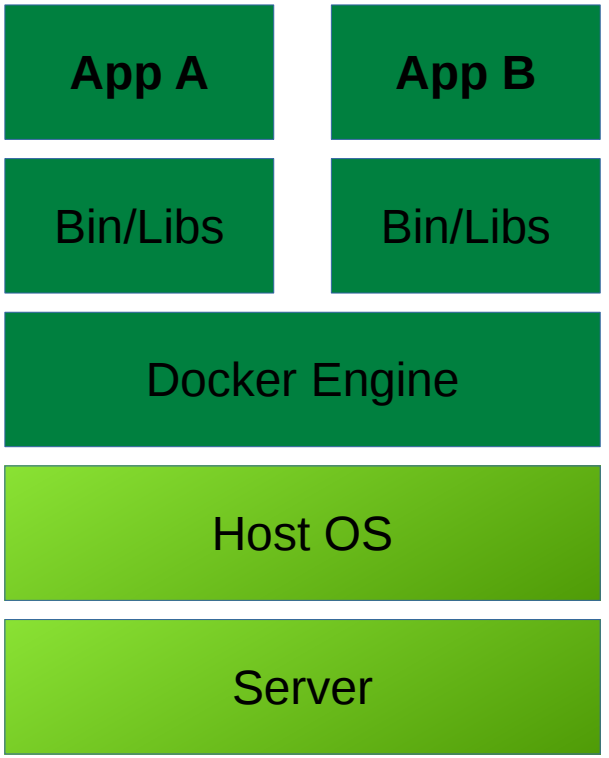
SUSE®

We adapt. You succeed.

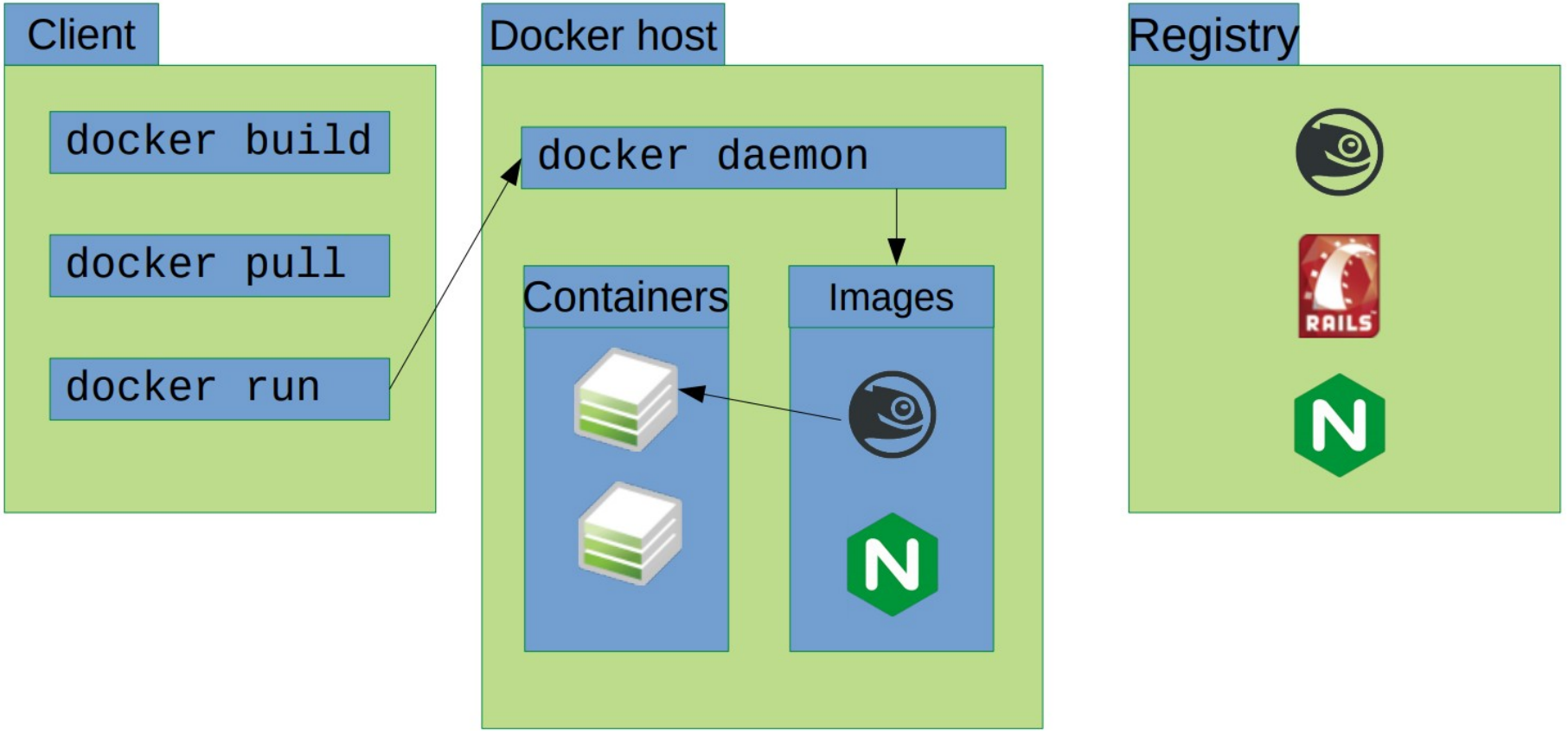
Backup

Virtual Machines vs. Docker Containers





Docker Basics



Dockerfile Example

```
FROM suse/sles12:latest

# Create a new demo_user.
RUN /usr/sbin/useradd demo_user
# Add our demo application inside of the /demo/ directory.
ADD webapp_demo /demo/webapp
ADD web /demo/web
WORKDIR /demo
# Run everything as the "demo_user" user.
USER demo_user
# The demo web application listens on port 8080 by default
EXPOSE 8080
```

Docker Registry

- **A registry is a storage and content delivery system, holding named Docker images, available in different tagged versions**
- **A Docker Registry can be public or private**
- **Looking for a Docker Registry?**
  - SUSE Portus is an authenticated Docker Registry
  - Available on SLE 12 Enterprise Container Module