



# Tooling Linux for the Future of Embedded Systems

Patrick Quairol  
Director of Alliance and Embedded Technology  
SUSE / [Patrick.Quairol@suse.com](mailto:Patrick.Quairol@suse.com)

**With SUSE You Can**



**Control  
Infrastructure**



**Optimize  
Operations**



**Innovate  
Faster**

# What is Embedded



SUSE Embedded solutions deliver an optimized operating system for single-purpose workloads



Reduced Operating System

SUSE Linux Enterprise Server as the Foundation

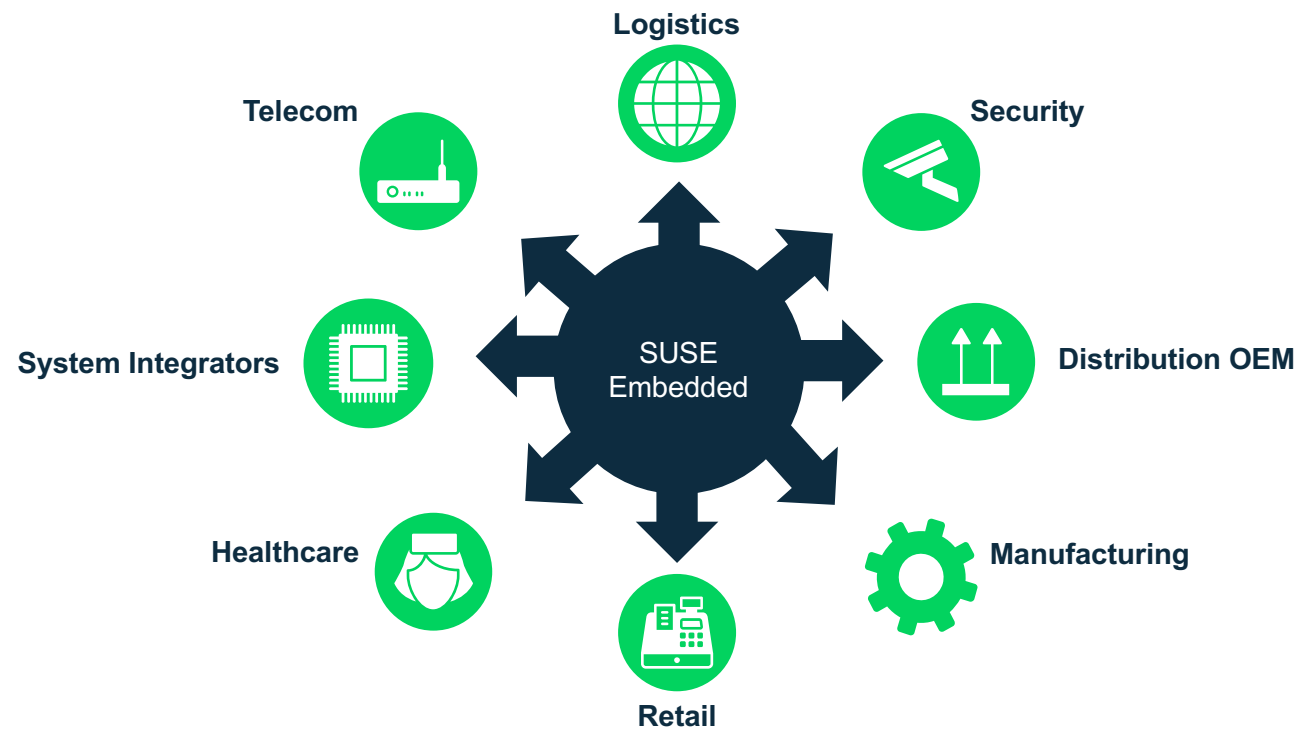
Embedded-based Subscription

JeOS provides a lean, yet powerful footprint for a task-specific, fixed-function hardware or software stack

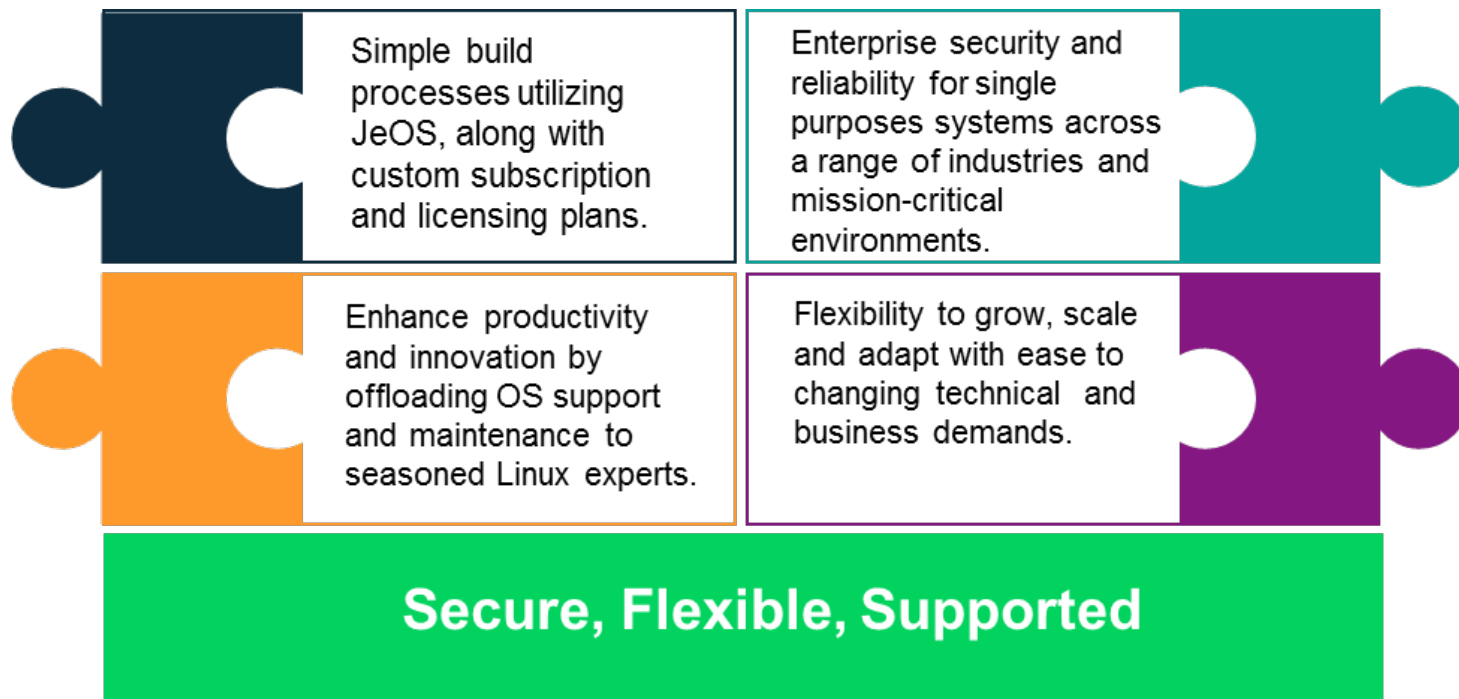
Enterprise-grade systems made simple for fixed-function product solution development

Flexible and customized licensing and subscription model allows access to a select set of SUSE components

## Current Market Penetration

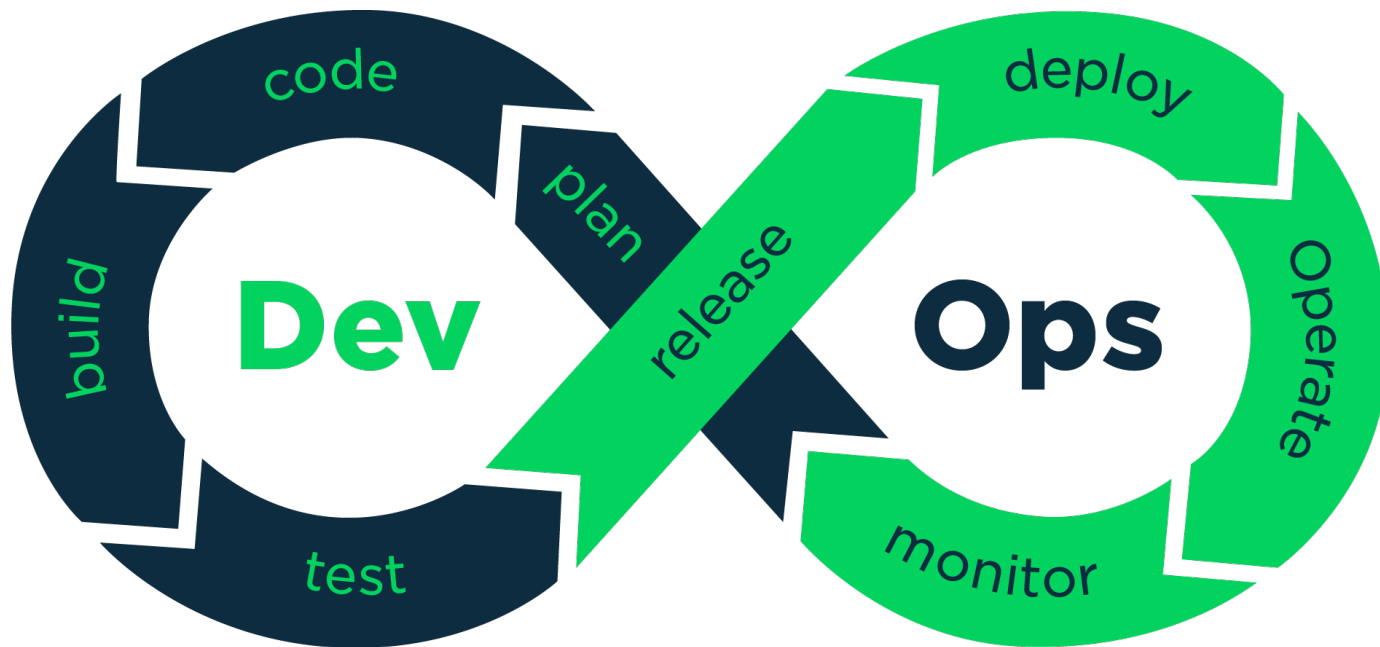


## Advantages of a SUSE Embedded Solution



# SUSE Embedded

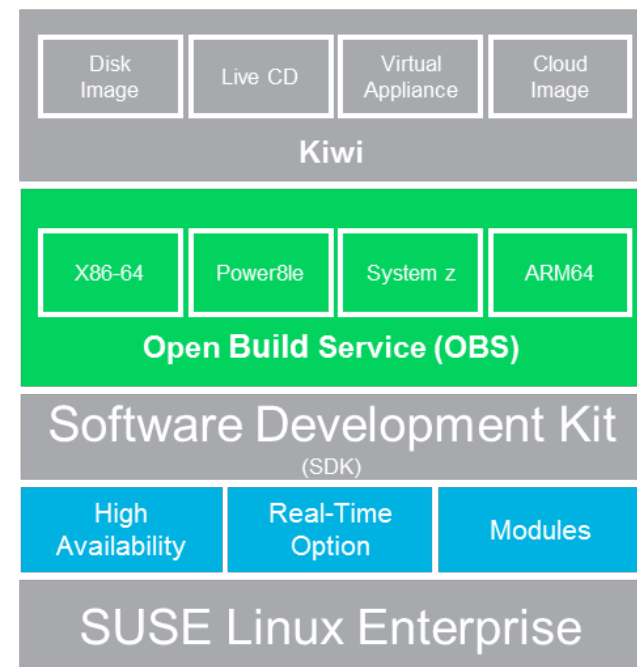
## Building an Embedded System is Challenging



## Embedded Systems Simplified

- Enterprise Quality OS
  - Maintenance Updates
  - Security patches
  - Just enough OS
- Package Builds
  - X86, ARM64, Power, System z, more...
- Package Repositories
  - Public
  - Private
- Repeatable Clean Builds
  - Multiple hypervisors or image formats
- Version control

**Build Your Applications  
on SUSE Linux Enterprise**  
for Any Architecture





# SUSE Linux Enterprise Server

Power your physical, virtual, and cloud-based, mission-critical workloads with a world-class, secure open source server operating system

- Create an agile IT infrastructure using the latest container applications
- Maximize service uptime with live patching and built-in virtualization
- Improve IT infrastructure with proven security and optimized performance

**99.999%**

Mission-critical  
availability

**80%**

Savings in server  
management

**80%**

Cost  
reduction



[www.suse.com/products/server](http://www.suse.com/products/server)

# SUSE Linux Enterprise Server 12

## Life Cycle Model

- **13-Year Life Cycle**
  - 10 years general support
  - 3 years extended support
  - Different life cycles for modules
- **Long Term Service Pack Support (LTSS)**
  - Available for all versions
  - Up to 3 years extended support



## Rapid Innovation

- Leverage latest Linux kernel
- Avoid backporting patches; benefits of peer review with upstream Kernel
- Improved hardware support

SUSE Release	Kernel Version	Competitive Kernel
SLES 11	2.6.27	2.6.32
SLES 11 SP1	2.6.32	2.6.32
SLES 11 SP2 - SP4	3.01.101	2.6.31
SLES 12	3.12	3.10
SLES 12 SP1	3.12	3.10
SLES 12 SP2	4.4	3.10

# Focus on the Solution, Not the Operating System

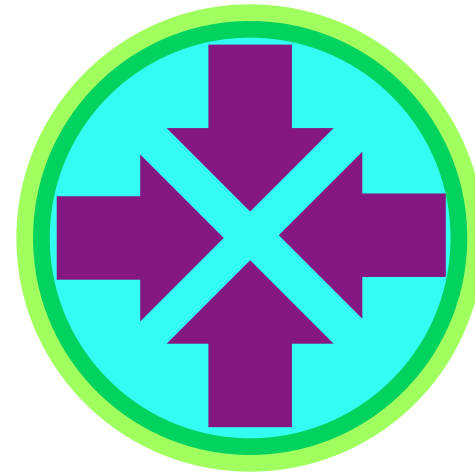
## Just Enough Operating System (JeOS)

What is JeOS?

- A lean, function-specific operating system built on SUSE Linux Enterprise Server
- Ideal platform for products and appliances in today's agile environments
- Perfect minimized host operating system

Take Advantage of JeOS

- KVM/Xen Fully Virtualized
- Xen Para-virtualized
- Microsoft Hyper-V
- VMware
- OpenStack Cloud



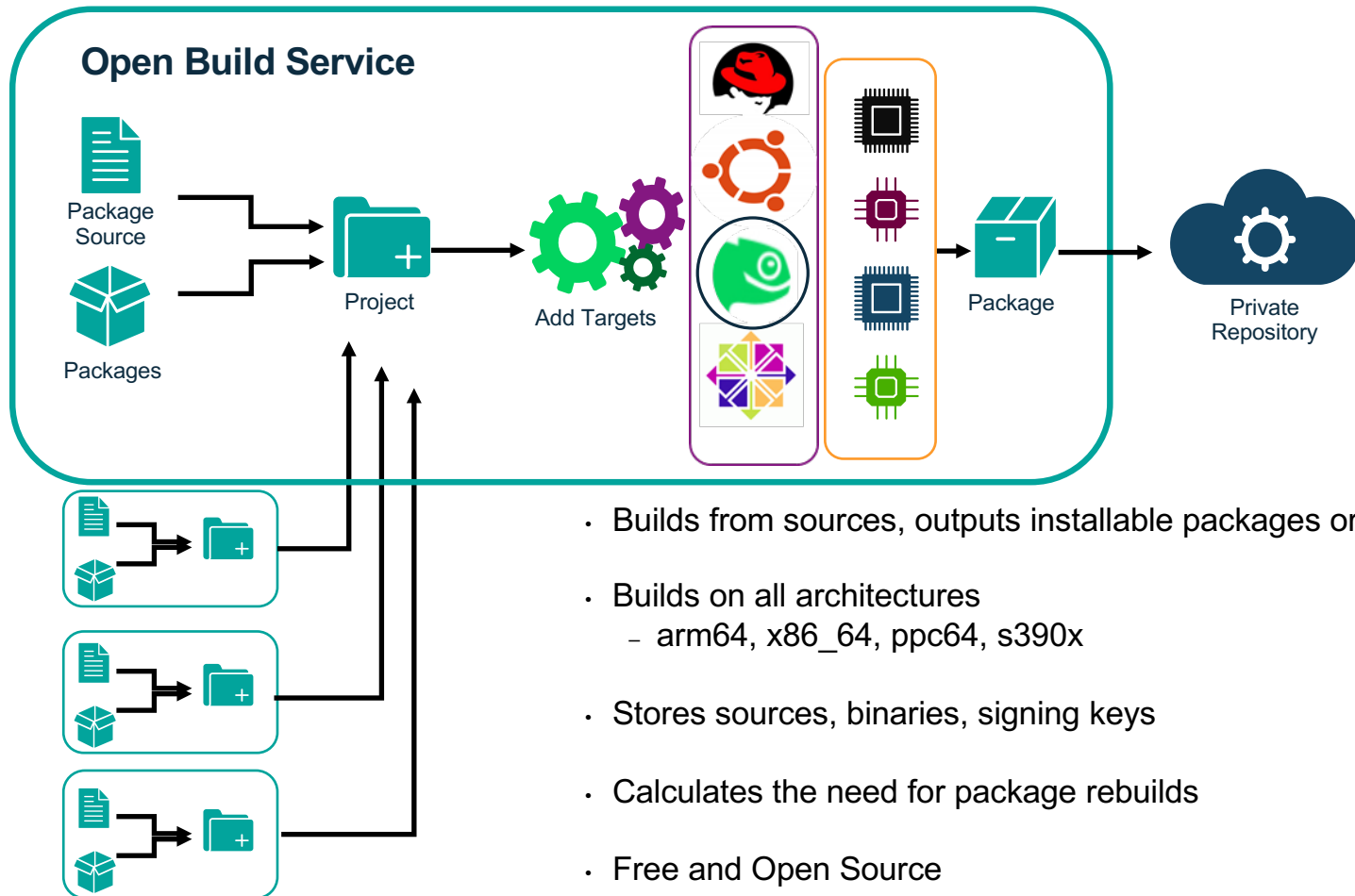
## Packages, Platforms, and Repositories

### SUSE Open Build Service (OBS)

OBS is a generic system to build and distribute binary packages from sources in an automatic, consistent and reproducible way.

- Build (Packaging) Formats
  - rpm (spec)
  - deb (dsc)
- Build Architectures: Qemu can be used to emulate not existing hardware
  - ia32, ia64, x86-64, ppc\*, hppa, mips, m68k, s390\*, various ARM architectures.
- Image System (KIWI)
  - ISO, Live CD/DVD, PXEBoot, HDD, etc.
  - Build in chroot, lxc, XEN or KVM, etc.
- Repositories: rpm-md, yast, apt, maintenance channels
- Build Process Features

## Open Build Service



## SUSE Package Hub

### Community Packages for SLES

- Built and maintained by the community of users
- Approved and supported by SUSE
- High-quality, up-to-date packages delivered by openSUSE Factory
- No additional charge to use packages
- Packages available for the life of the product, including multiple releases



Over 600 packages available for all architectures

## Virtual, Physical and Cloud

### SUSE KIWI

KIWI is a command line tool, written in Perl, for building Linux images & supporting a variety of image formats.

- Types & Formats:
  - Images: ISO, Live CD/DVD, PXEBoot, HDD, USB
  - Appliances: .ovf, .ova
  - Virtual Machines: .vmdk, .vhd, .vdi, .qcow2
  - Containers
- Hosted on github <https://github.com/openSUSE/kiwi>
- All SUSE® & openSUSE images are built with KIWI
  - Physical, Virtual and Cloud!
- KIWI can produce most formats known to humankind





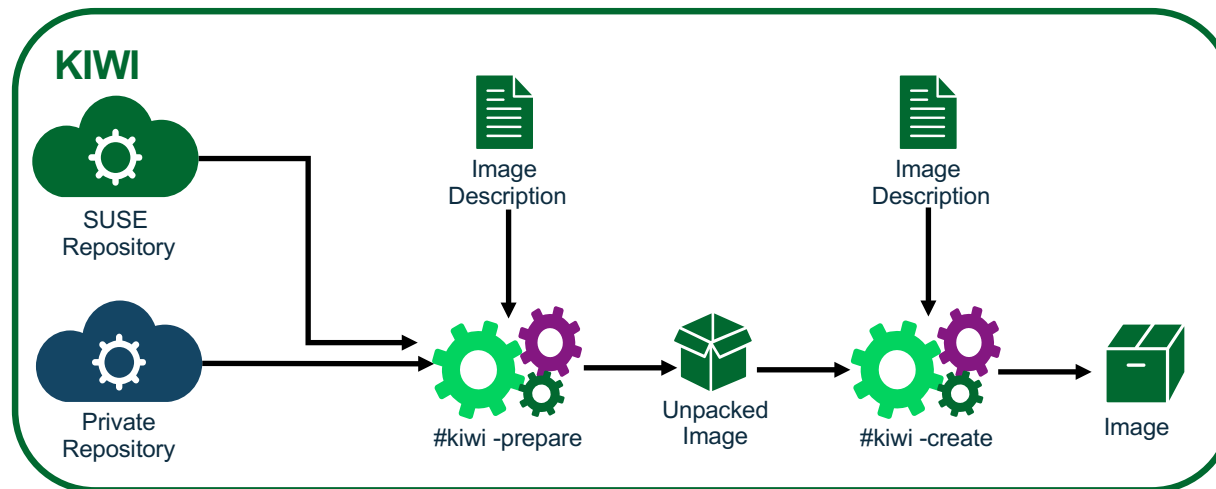
## Leveraging the Benefits of KIWI

### Prepare

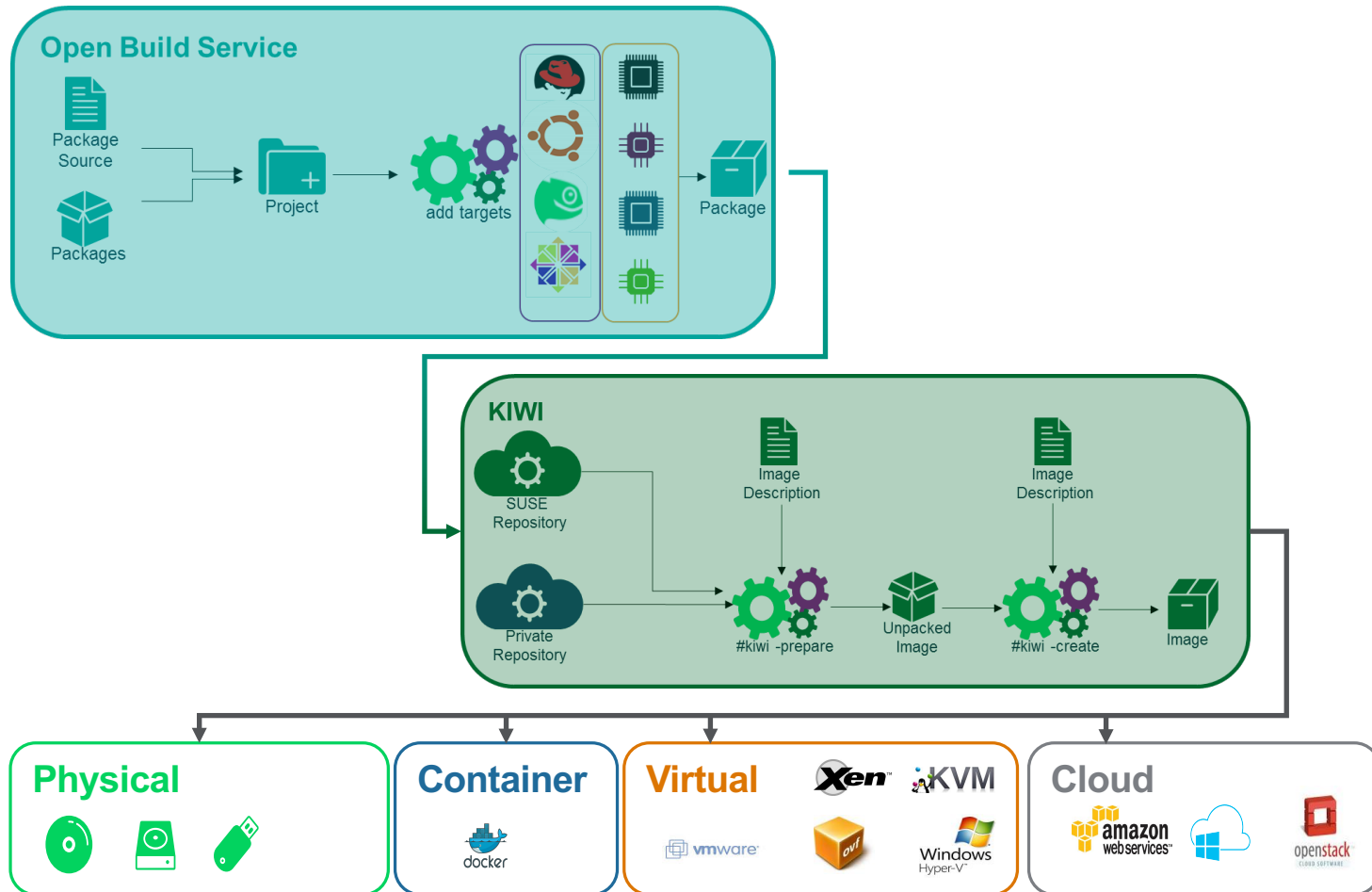
- Read config.xml
- Initialize the repositories
- Install Packages
- Apply overlay files
- Execute config.sh
- Output is an unpacked image tree (directory)

### Create

- Read information from unpacked image tree
- Read the config file
- Execute images.sh
- Read bootimage description
- Create bootimage
- Bundle boot image and target image to create final image



## Compile, Build, Run



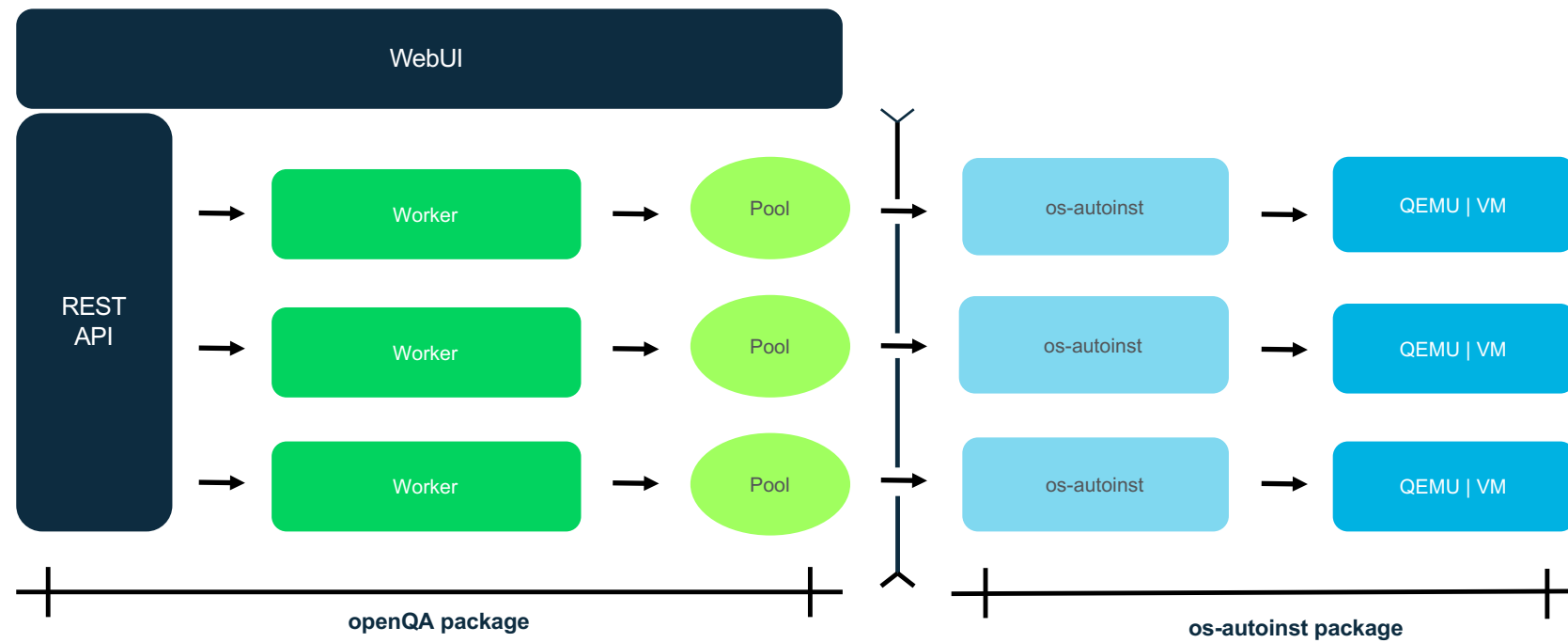
# Automated Testing

## openQA

- Used by openSUSE® Leap, Tumbleweed, SUSE® Linux Enterprise & Fedora®
- Tests Operating Systems and Applications
- GUI & Console Testing
  - Uses OpenCV to 'read' the actual screen output and compare to predefined needles
  - Controls keyboard & mouse and uses them like a user
  - Also reads plain text from serial
- Execute console test scripts (openQA DSL, (bash perl, python) Deployed via openQA test API
- Comparison
  - String comparison, Junit Parsing, custom results in openQA DSL
- Pluggable backend for os-autoinst support QEMU/VM, LibVirt/RemoteVM, IPMI/HW

# Automated Test Infrastructure

## SUSE openQA



## Patch and update

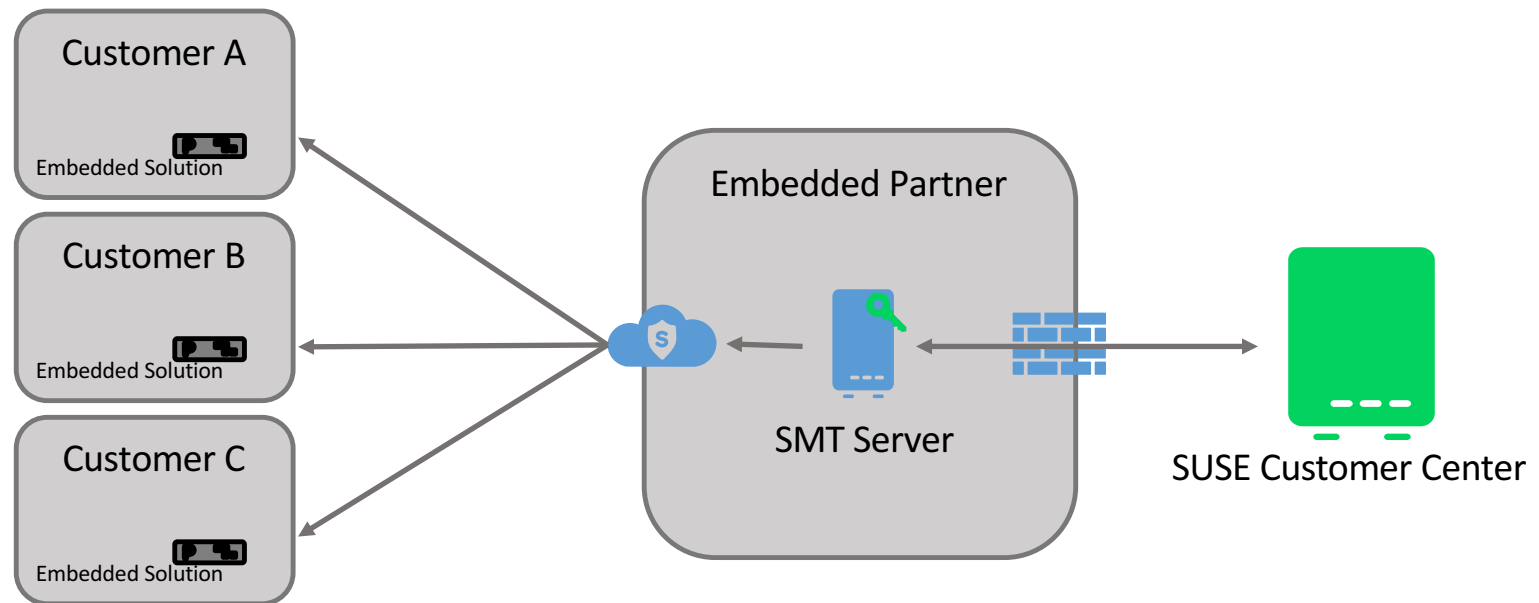
### Subscription Management Tool

The Subscription Management Tool establishes a proxy system for SUSE Customer Center which allows enterprise customers to optimize the management of SUSE Linux Enterprise software updates and subscription entitlements.

- The proxy provides repository and registration targets while optimizing bandwidth consumption
- The Subscription Management Tool informs the SUSE Linux Enterprise devices throughout the network of available software updates.
- Firewall policy and regulatory compliance during the software update process
- Automated server entitlement tracking across large server deployments and effective measurement of subscription use
- Staging
  - Mirror
  - Test
  - Validated

# Subscription Management Tool

## Mirror Patches and Updates for Active Subscriptions



Why SUSE?



# What Do We Mean by Always Open?



























It's not just **WHAT** we do.  
It's **HOW** we do it.

- True to open source vision
- Flexible and adaptive
- Enterprise support

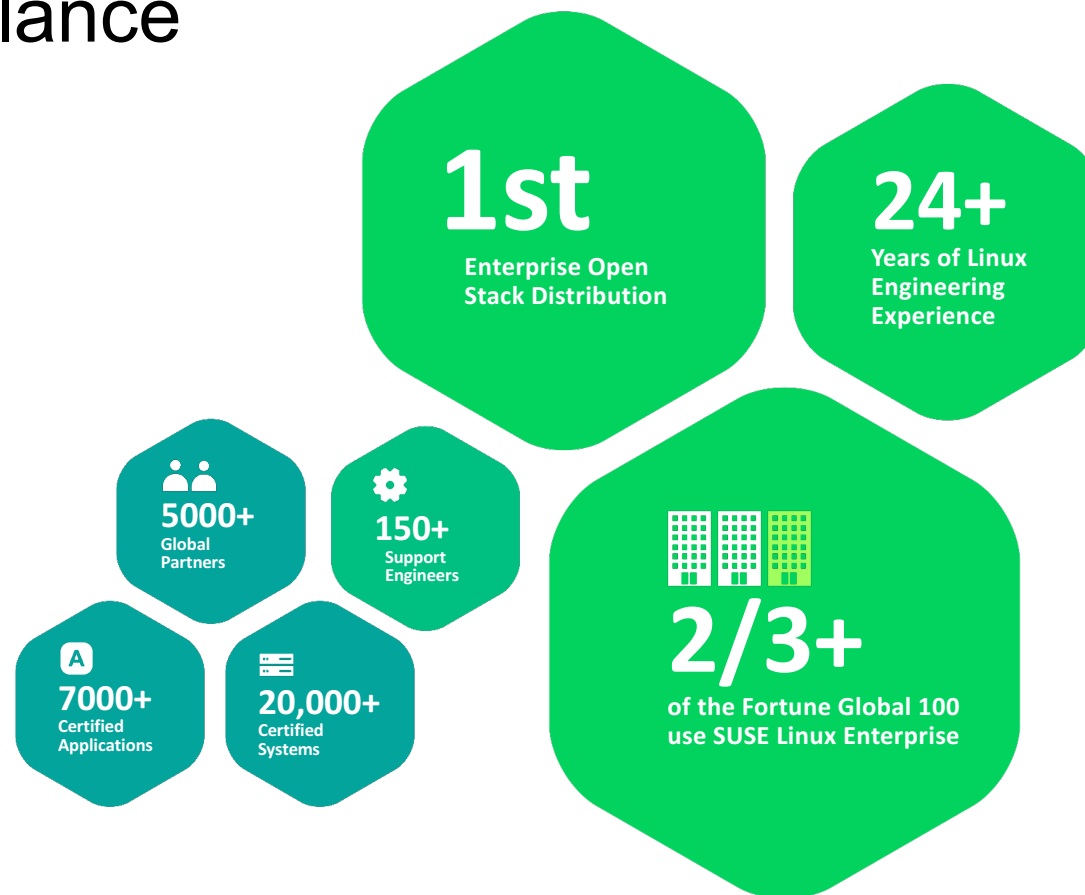




# Community Involvement


		 QEMU	 spec	 GNOME™	 OPEN DATA CENTER ALLIANCE
 OPEN CONTAINER INITIATIVE	 mozilla FOUNDATION	 openstack™	 KVM		 SPACEWALK
 iVISOR PROJECT	 YaST	 openSUSE™		 HA HighAvailability	 open build service
 OPEN MAINFRAME PROJECT	 X.Org	 Xen™	 THE LINUX FOUNDATION	 ceph	 SAMBA
 MariaDB	 OPEN VIRTUALIZATION ALLIANCE	 openinventionnetwork	 CLOUD FOUNDRY		And more...

# SUSE at a Glance



# Where SUSE Leads

**15+**   
**Mainframe Linux**  
Over 15 years of mainframe Linux  
market share leadership

**4/5**   
**Linux in Finance**  
4 out of 5 of the world's largest  
banks use SUSE Linux Enterprise

**70%**   
**SAP on Linux**  
70% of all SAP applications running  
on Linux run on SUSE

**80%**   
**Linux in Large Enterprise**  
Over 80% of the Fortune Global 50 are  
active SUSE Customers

**9/10**   
**Linux in Aerospace**  
9 out of 10 of the largest aerospace  
companies rely on SUSE

**x10**   
**Linux in Telecom**  
10 of the largest telecommunications  
carriers rely on SUSE

**7/10**   
**Linux in Pharma**  
7 out of 10 of the largest pharmaceutical  
companies use SUSE Linux Enterprise

**7/10**   
**Linux in Retail**  
7 out of 10 of the largest retailers in the  
U.S. are active SUSE customers

**x10**   
**Linux in Automotive**  
10 of the largest global automobile mfgs. are  
active SUSE customers

**50%**   
**Linux in HPC**  
Half of the world's 20 largest super  
computers run on SUSE

**7/10**   
**Linux in Manufacturing**  
7 out of 10 world's largest manufacturers  
use SUSE Linux Enterprise

Thank You



**Embedded**

[www.suse.com/embedded](http://www.suse.com/embedded)

[embedded@suse.com](mailto:embedded@suse.com)

## Appendix: Resources

### SUSE Embedded

- [www.suse.com/embedded](http://www.suse.com/embedded)  
Download the [White paper on Embedded Security](#)

### Open Build Service

- Main website <http://openbuildservice.org/>
- Documentation <http://openbuildservice.org/help/manuals/>
- SUSE instance <https://build.opensuse.org/>

### KIWI

- Main website <http://opensuse.github.io/kiwi/>
- Documentation <https://doc.opensuse.org/projects/kiwi/doc/>

### openQA

- Main Website <http://open.qa/>
- Documentation <http://open.qa/documentation/>