

# Virtualisierung im Cloud-Zeitalter

Spielt der *Hypervisor* noch eine Rolle?

**GUUG Frühjahrsfachgespräch 2015**

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science + computing ag

IT-Dienstleistungen und Software für anspruchsvolle Rechnernetze

Tübingen | München | Berlin | Düsseldorf



## Holger Gantikow

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**System Engineer**  
science + computing ag STANDARD

72070 Tübingen  
Deutschland

## Persönliches

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**Ich suche**

neue Kontakte

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**Ich biete**

Abgeschlossene Diplomarbeit ("Virtualisierung im Kontext von Hoherfügbarkeit"), IT-Know-How, Erfahrung mit Linux, speziell Debian&Red Hat, Windows, Mac OS X, Solaris, \*BSD, HP-UX, AIX, Netzwerkadministration, Netzwerktechnik, Hardware, Asterisk, VoIP-Systeme, Server Administration, Cluster Computing, Hochverfügbarkeit, Virtualisierung, HA, HPC, Autor von Fachartikeln zum Thema Cloud Computing, RHCT, RHSA, Python Programmierung, Neugierde, Flexibilität

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**Interessen**

IT-spezifisch momentan: Virtualisierung (Xen, ESX, ESXi, KVM), Cluster Computing (HPC, HA), Cloud Computing (speziell: IaaS, HPCaaS), OpenNebula, OpenSolaris, ZFS, XMPP, SunRay ThinClients - ansonsten: Freie Software, Musik, Gitarre, Fotografie



[https://www.xing.com/profile/Holger\\_Gantikow](https://www.xing.com/profile/Holger_Gantikow)

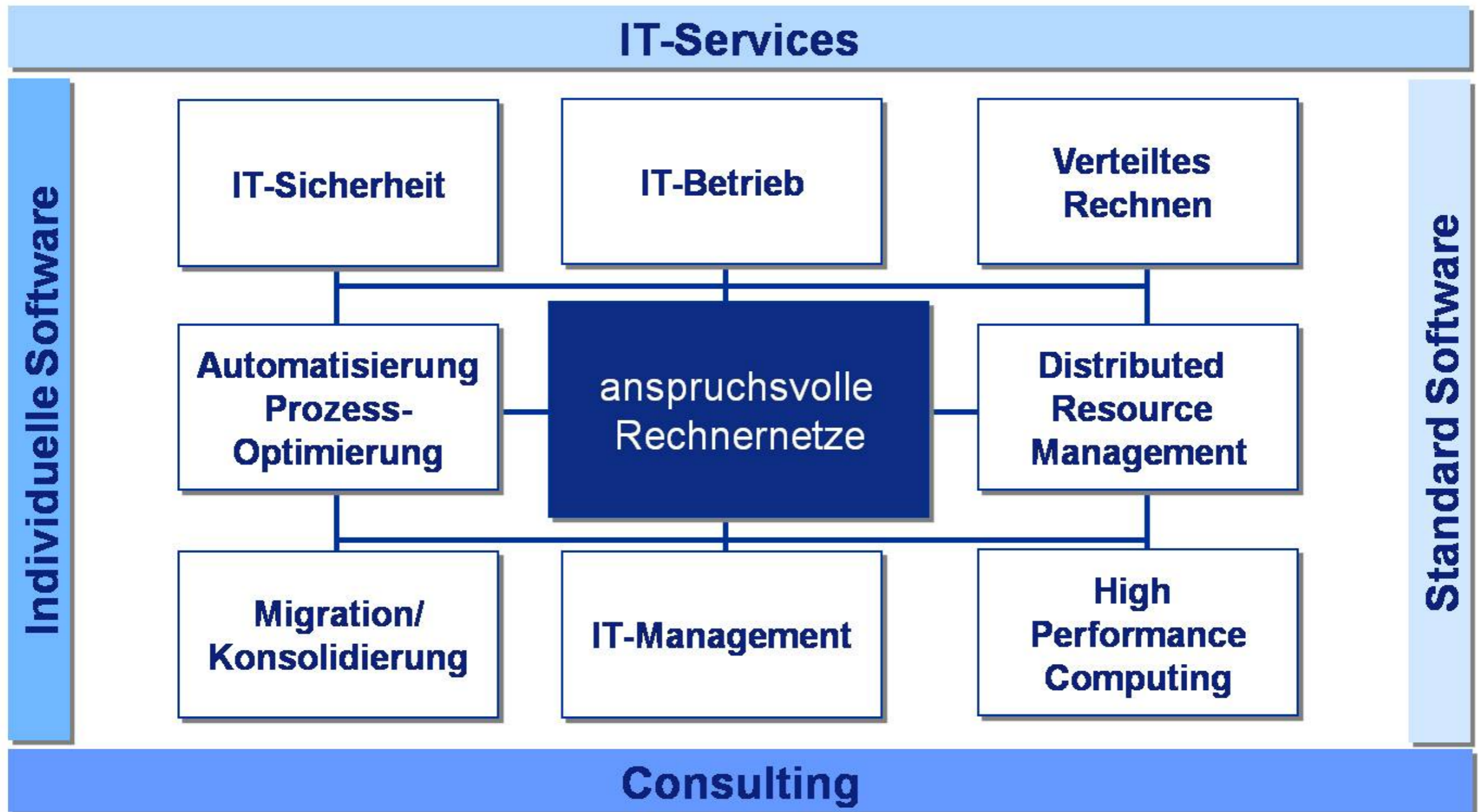
# science+computing ag

**Unser Fokus:**  
IT-Dienstleistungen und Software für  
technische Berechnungsumgebungen

<b>Gegründet</b>	<b>1989</b>
<b>Büros</b>	<b>Tübingen</b> <b>München</b> <b>Berlin</b> <b>Düsseldorf</b> <b>Ingolstadt</b>
<b>Mitarbeiter</b>	<b>320</b>
<b>Besitzer</b>	<b>Atos SE (100%)</b> <b>davor Bull</b>
<b>Jahresumsatz</b> <b>(2013)</b>	<b>30,7 Mio. Euro</b>



# Kernkompetenzen





# Schleichwerbung

TÜBIX

[Call for Papers](#) [Anfahrt](#) [Links](#) [Termine](#) [Log](#) [Impressum](#)

TÜBIX ist ein [Linuxtag](#) und findet am Samstag, den 13. Juni 2015 in [Tübingen](#) statt.



Der Linuxtag dient dem fachlichen

Dieser Tag könnte etwas für dich sein

- ... Lust auf Austausch mit anderen hast
- ... Experte / Profi / Veteran / Meister bist
- ... Neuling / Einsteiger / Umsteiger / Interessent bist
- ... nebenbei ein [Computermuseum](#) besuchen möchtest
- ... von anderen etwas dazulernen möchtest
- ... anderen etwas zeigen oder beibringen möchtest (siehe "[Call for Papers](#)")

Bildquelle: Wikipedia

Quelle: TÜBIX  
<http://tuebix.org>

Tübingen  
13.06.2015  
tuebix.org

**Teil I: Virtualisierung mit Linux**

**Teil II: *Relevanz-Diskussion***

**Teil III: „*Benchmark*“**

# Teil 0: Einleitung

Wie war das noch *gestern*...?



# Gartner's Top 10

## Strategic Technologies for 2009

1. **Virtualization**
2. **Business Intelligence**
3. **Cloud Computing**
4. **Green IT**
5. **Unified Communications**
6. **Social Software and Social Networking**
7. **Web Oriented Architecture**
8. **Enterprise Mashups**
9. **Specialized Systems**
10. **Servers – Beyond Blades**

Quelle:

[http://blogs.gartner.com/david\\_cearley/2008/10/14/gartner's-top-10-strategic-technologies-for-2009/](http://blogs.gartner.com/david_cearley/2008/10/14/gartner's-top-10-strategic-technologies-for-2009/)

# Gartner's Top 10

## Strategic Technologies for 2010

1. **Cloud Computing**
2. **Advanced Analytics**
3. **Client Computing**
4. **IT for Green**
5. **Reshaping the Datacenter**
6. **Social Computing**
7. **Security - Activity Monitoring**
8. **Flash Memory**
9. **Virtualization for Availability**
10. **Mobile Applications**

Quelle:

<http://gartner.com/it/page.jsp?id=1210613>

14.10.2008

Und *heute*...?

# All about the cloud...


There is an interesting long-term trend forming as well. Inspecting Gartner's picks for the past three years and its choices for 2015 (links to each year's report are at the bottom of this article), one notices that every year cloud services play an increased role in which trends are selected.

2012	2013	2014	2015
Big data	Strategic big data	Smart machines	Smart machines
Extreme low-energy servers	Integrated ecosystems	Web-scale IT	Web-scale IT
Next generation analytics	Actionable analytics	3D printing	3D printing
App stores and marketplaces	Enterprise app stores	Software-defined anything	Software-defined applications/infrastructure
IoT	IoT	IoT	IoT
In-memory computing	In-memory computing	Cloud/client architecture	Cloud/client computing
Mobile-centric applications/interfaces	Mobile applications/HTML5	Mobile apps and applications	Risk-based security/self-protection
Cloud computing	Hybrid IT/cloud computing	Hybrid cloud & IT as a service broker	Advanced pervasive/invisible analytics
Media tablets and beyond	Mobile device battles	Mobile device diversity/management	Computing everywhere
Contextual/social user experience	Personal cloud	Era of the personal cloud	Content-rich systems

In fact, a fair assumption is that all 10 of the 2015 trends rely on some type

Quelle: Gartner's top 10 technology trends for 2015: All about the cloud  
<http://www.techrepublic.com/blog/10-things/gartners-top-10-technology-trends-for-2015-all-about-the-cloud/>

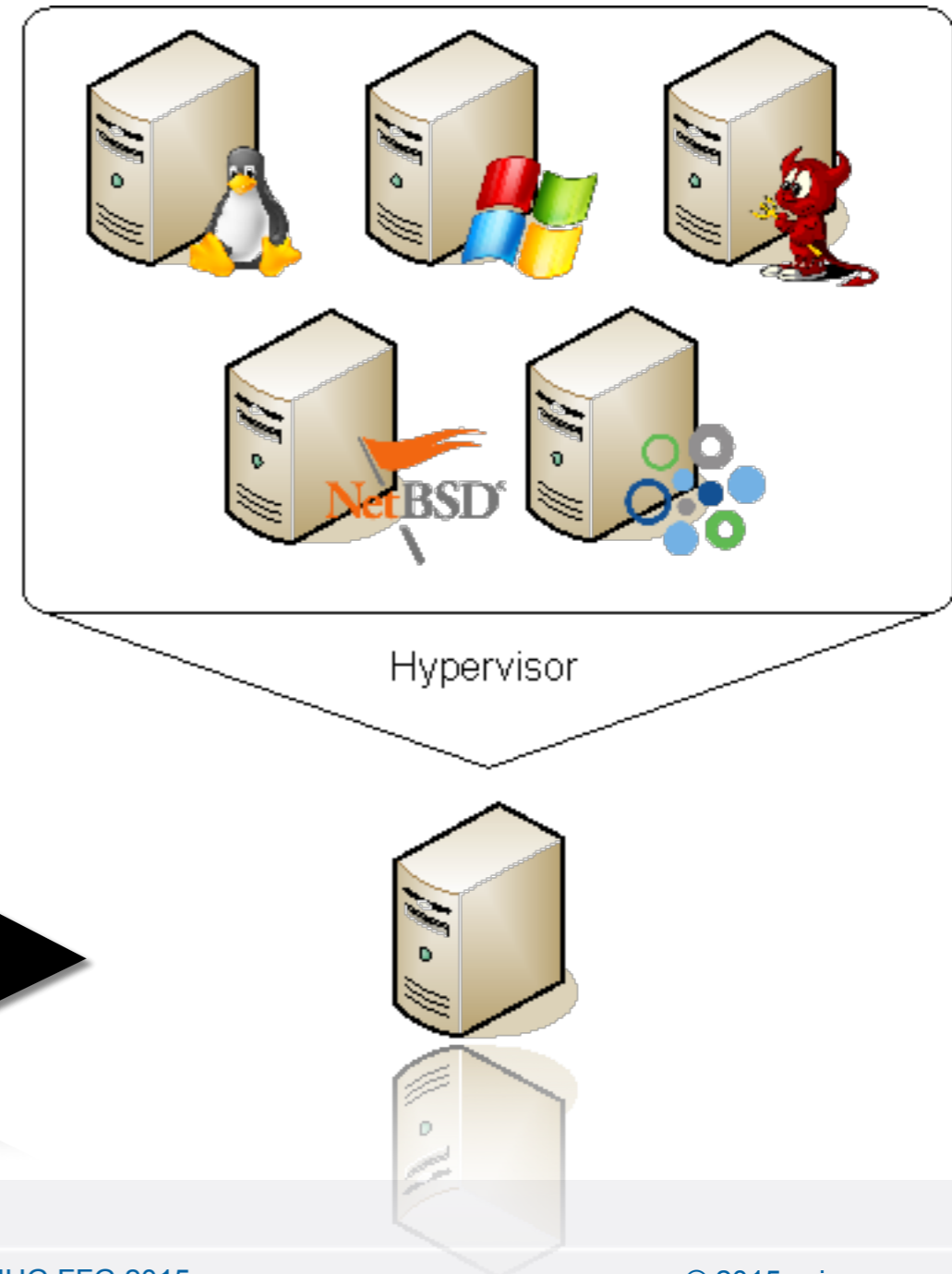
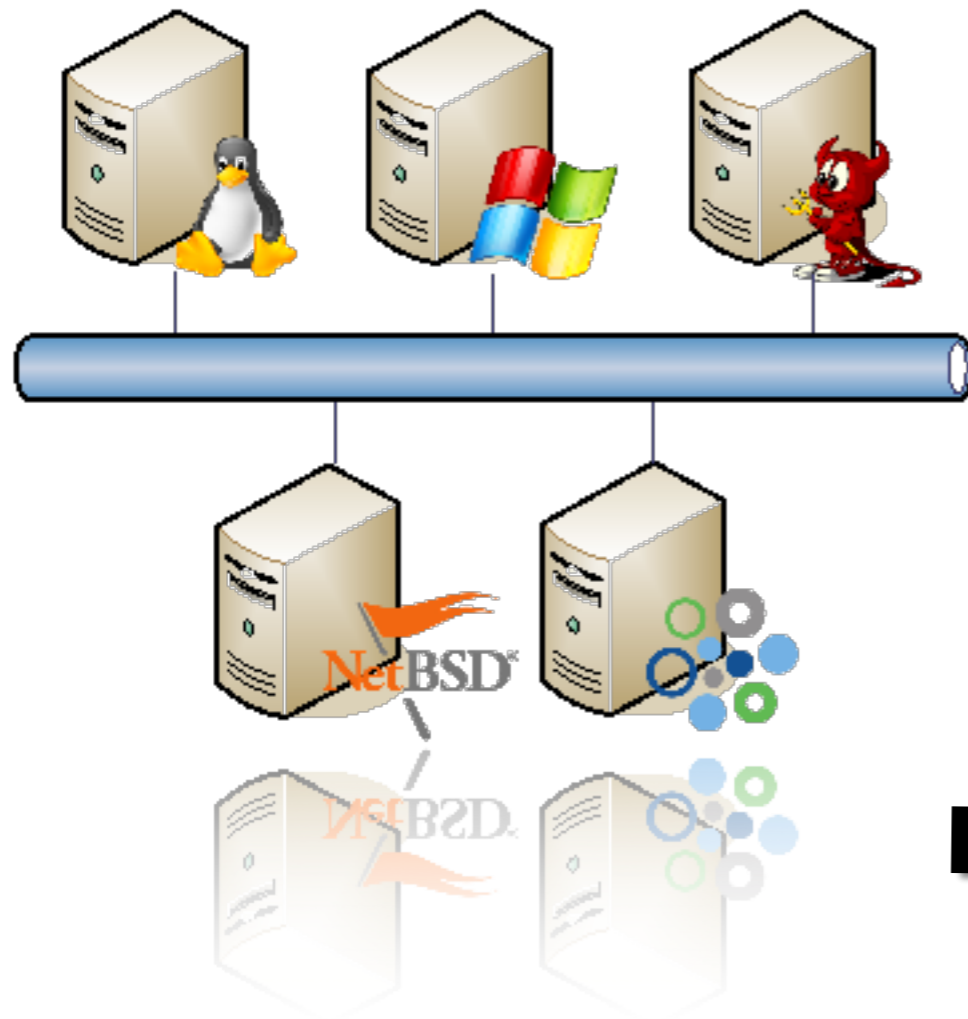




If you can touch it and you can see it, it's **REAL**.  
If you can touch it but you can't see it, it's **TRANSPARENT**.  
If you can't touch it but you can see it, it's **VIRTUAL**.  
If you can't touch it and you can't see it, it's **GONE**.  
(Unbekannte Quelle)

# Warum brauchen wir *Virtualisierung* nochmal?

# Übergang zur Virtualisierung



# Geschichtliche Entwicklung

## 60er und 70er

- IBM CP-40, System/370 (Mainframe)

## 80er

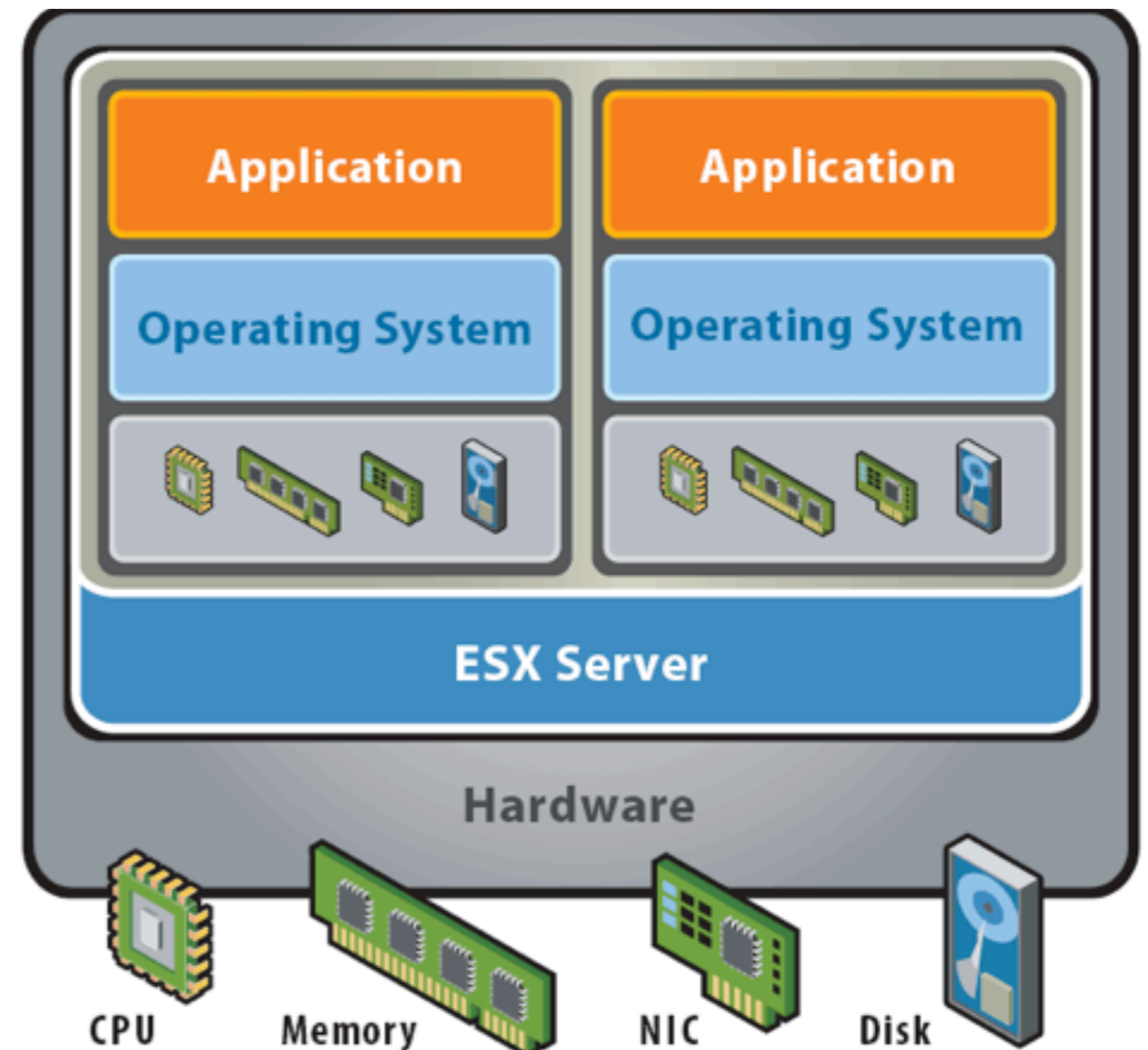
- Mach Microkernel
- Logical Partitioning (LPAR)

## 90er

- VMware: erstes Produkt für x86 ('99)

## 2000 - Gegenwart

- 2003: Xen
- 2007: Kernel-based Virtual Machine



Quelle: VMware Dokumentation

Teil I:  
*Virtualisierung* mit Linux





**Eine Welt voller  
Alternativen....**



# Xen - Totgesagte...



YOUTH  
I WANT TO SEE YOU GAME BOYS  
AND I ALSO WANT TO SEE YOU BRAVE AND MANLY  
AND TENDER  
BE PRACTICAL AS WELL AS GENTLE  
YOUR IDEALS KEEP YOU  
THE STARS AND KEEP YOU  
THE GROUND  
BRACE HARD WORK





## LINUX FOUNDATION COLLABORATIVE PROJECTS

Xen is now a Collaborative Project of The Linux Foundation

Laying the foundation and providing the infrastructure for the next evolutions in Xen's growth, adoption, and innovation.

- Home
- Products
- Support
- Community
- Blog

Check out our new community site at [xenproject.org](http://xenproject.org)!

### What is the Xen Project?

The Xen Project™ – hosted by Xen.org – is the home for several virtualization related open source projects and XEN PROJECT is the new name for the XEN open source community. The Xen Project™ develops virtualization technologies powering the world's largest clouds in production and is the foundation of many commercial products. Technology developed by the Xen Project™ powers public clouds such as *Amazon Web Services, Rackspace Public Cloud* and many others. Examples of Xen based server products include *Huawei UVP, Oracle VM and XenServer*. Examples of client products and appliances include *QubesOS, XenClient and Netscaler*. The Xen Project™ is 10 years old, and the technology it has created is mature and its stability and versatility is second to none.

### Xen Projects

The Xen Project™ has created a number of open source technologies for specific purposes:

- The **Xen® Hypervisor** is the open source standard for hardware virtualization and the foundation for all solutions hosted on Xen.org. — [Learn More](#)
- The **Xen Cloud Platform** is an enterprise-ready virtualization platform based on the Xen® Hypervisor, adding further functionality and many integrations for cloud, storage and networking solutions. — [Learn More](#)
- **Xen ARM** is a Xen based Hypervisor that targets embedded and mobile devices on the ARM architecture. — [Learn More](#)

If you are unsure, which Xen project is best for you, you may want to read the [Xen Overview](#) document which introduces the main components and some of the key choices you will have to make.

### Open Source

Quelle:  
<http://www.xen.org/>

```
[root@centos64-host ~]# cat /boot/grub/grub.conf
[...]
```

```
title Xen with CentOS (3.9.2-1.el6xen.x86_64)
    root (hd0,0)
    kernel /xen.gz dom0_mem=1024M
    module /vmlinuz-3.9.2-1.el6xen.x86_64 [...]
    module /initramfs-3.9.2-1.el6xen.x86_64.img
```

```
title CentOS (2.6.32-358.6.1.el6.x86_64)
    root (hd0,0)
    kernel /vmlinuz-2.6.32-358.6.1.el6.x86_64 [...]
    initrd /initramfs-2.6.32-358.6.1.el6.x86_64.img
```



Status - KVM

Status - KVM



Go Search

**MAIN PAGE**

**STATUS**

**GUEST SUPPORT STATUS**

**KVM-AUTOTEST**

**HOWTO**

**MIGRATION**

**LISTS, IRC**

**DOCUMENTS**

**DOWNLOADS**

**BUGS**

**CODE**

**TODO**

**FAQ**



## Status

KVM is included in the mainline linux kernel since 2.6.20 and is stable and fast for most workloads.

The userspace tools are part of mainline QEMU since 1.3.

It is also available as a patch for recent Linux kernel versions and as an external module that can be used with your favorite distro- provided kernel going back up to 2.6.16, therefore including all latest versions for Enterprise Linux Distributions.

**Working:**

- Intel-based hosts (requires VT capable processors)
- AMD-based hosts (requires SVM capable processors)
- Windows/Linux/Unix guests (32-bit and 64-bit)
- SMP hosts
- SMP guests (as of kvm-61, max 16 cpu supported)
- Live [Migration](#) of guests from one host to another (32-bit and 64-bit)
- See the [Guest Support Status](#) page for a list of guest operating systems known to work
- See the [Host Support Status](#) page for information on host hardware.
- Guest swapping
- [Paravirtualized networking](#)
- [Paravirtualized block device](#)
- [PCI-Express passthrough](#)

**In progress:**

- [PowerPC port](#)
- IA64 port
- xenner (<http://kraxel.fedorapeople.org/xenner>), a project to run x86 xen guest (domU) kernels
- [ARM port](#)
- [VGA device assignment](#)

**Related**

- [FLOSS weekly KVM interview by Avi Kivity & D...](#)

**Contents [hide]**

- 1 Status
  - 1.1 Working:
  - 1.2 In progress:
  - 1.3 Related

Quelle:  
<http://www.linux-kvm.org/page/Status>



# VirtualBox

[Login](#) [Preferences](#)

## Welcome to VirtualBox.org!

VirtualBox is a powerful x86 and AMD64/Intel64 [virtualization](#) product for enterprise as well as home use. Not only is VirtualBox an extremely feature rich, high performance product for enterprise customers, it is also the only professional solution that is freely available as Open Source Software under the terms of the GNU General Public License (GPL) version 2. See "[About VirtualBox](#)" for an introduction.

Presently, VirtualBox runs on Windows, Linux, Macintosh, and Solaris hosts and supports a large number of [guest operating systems](#) including but not limited to Windows (NT 4.0, 2000, XP, Server 2003, Vista, Windows 7), DOS/Windows 3.x, Linux (2.4 and 2.6), Solaris and OpenSolaris, OS/2, and OpenBSD.

VirtualBox is being actively developed with frequent releases and has an ever growing list of features, supported guest operating systems and platforms it runs on. VirtualBox is a community effort backed by a dedicated company: everyone is encouraged to contribute while Oracle ensures the product always meets professional quality criteria.

### Hot picks:

- Pre-built virtual machines for developers over at [Oracle Tech Network](#)
- **phpVirtualBox** AJAX web interface [project site](#)
- **IQEmu** automated Windows VM creation, application integration [project site](#)

### News Flash

- **New** **April 12th, 2013**  
**VirtualBox 4.2.12 released!**  
Oracle today released VirtualBox 4.2.12, a maintenance release of VirtualBox 4.2 which improves stability and fixes regressions. See the [ChangeLog](#) for details. VirtualBox 4.1.26, a maintenance release of VirtualBox 4.1 is available as well. See the [Changelog](#) for details.
- **New** **September 13th, 2012**  
**VirtualBox 4.2 released!**  
Read the official [press release](#) for more details.
- **Attention** **January 20th, 2012**  
**This site has switched to Oracle single-sign-on authentication.**  
Get your account at [myprofile.oracle.com](#) and on first login on this site associate it with a new or existing nick name.

[More information...](#)
[Contact](#) - [Privacy policy](#) - [Terms of Use](#)

Quelle:  
<https://www.virtualbox.org/>



VMware ESXi 5.1.0 (VMKernel Release Build 1065491)

innotek GmbH VirtualBox

Intel(R) Core(TM) i5-3427U CPU @ 1.80GHz  
2 GiB Memory

# VMware vSphere Hypervisor (ESXi)

Loading module tcpip3 ...

Quelle:  
VMware ESXi Installer

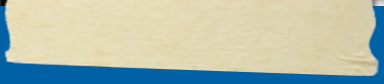
One more thing...



**DOGGY**

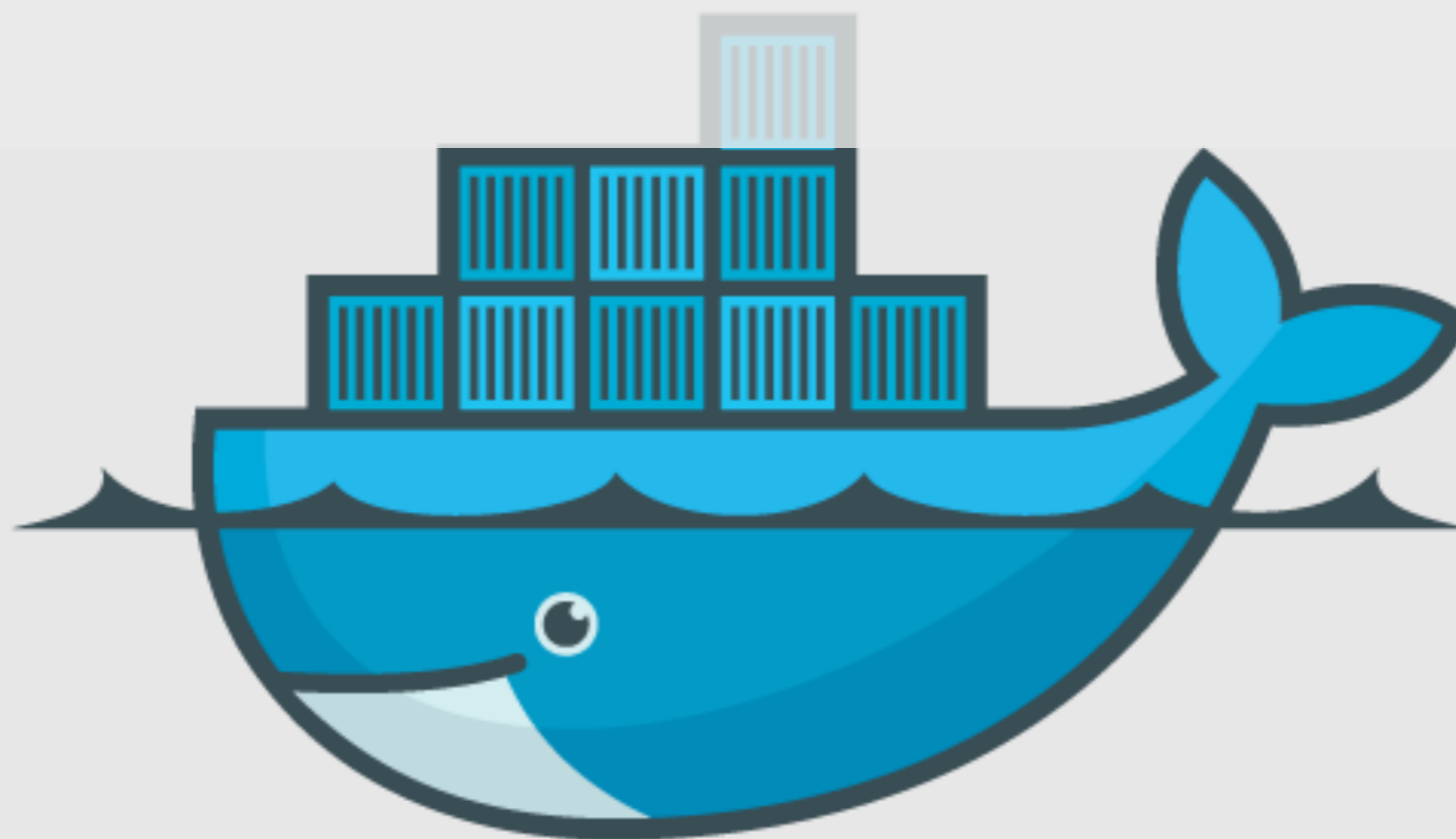


**ALL THE THINGS**

Quelle:   
<http://cdn.meme.am/instances/500x/59600465.jpg>

# Docker

## 101



# docker

Quelle:

<http://blog.docker.com/wp-content/uploads/2013/06/Docker-logo-011.png>



# Virtualisierung 2.0???

Und alle so NÖ!

Teil II:  
*Relevanz-Diskussion?*

Spielt der *Hypervisor* noch eine Rolle?

# Äussere Faktoren

# Tools!



[Home](#)[News](#)[Applications](#)[Downloads](#)[Documentation](#)[Wiki](#)[FAQ](#)[Bug reports](#)[Contact](#)[Test suites](#)[Related Links](#)[Sitemap](#)

## The virtualization API

### libvirt is:

- A toolkit to interact with the virtualization capabilities of recent versions of Linux (and other OSes), see our [project goals](#) for details.
- Free software available under the [GNU Lesser General Public License](#).
- A long term stable C API
- A set of bindings for common languages
- A [CIM provider](#) for the DMTF virtualization schema
- A [QMF agent](#) for the AMQP/QPid messaging system

### libvirt supports:

- The [KVM/QEMU](#) Linux hypervisor
- The [Xen](#) hypervisor on Linux and Solaris hosts.
- The [LXC](#) Linux container system
- The [OpenVZ](#) Linux container system
- The [User Mode Linux](#) paravirtualized kernel
- The [VirtualBox](#) hypervisor
- The [VMware ESX and GSX](#) hypervisors
- The [VMware Workstation and Player](#) hypervisors
- The [Microsoft Hyper-V](#) hypervisor
- The [IBM PowerVM](#) hypervisor
- The [Parallels](#) hypervisor
- Virtual networks using bridging, NAT, VEPA and VN-LINK.
- Storage on IDE/SCSI/USB disks, FibreChannel, LVM, iSCSI, NFS and filesystems

### libvirt provides:

- Remote management using TLS encryption and x509 certificates
- Remote management authenticating with Kerberos and SASL
- Local access control using PolicyKit
- Zero-conf discovery using Avahi multicast-DNS
- Management of virtual machines, virtual networks and storage

Quelle:  
<http://libvirt.org/>

```
holgrrr — root@lt-centos:~ — ssh — 80x24
root@lt-centos:~
VIRSH(1)          Virtualization Support          VIRSH(1)

NAME
  virsh - management user interface

SYNOPSIS
  virsh [OPTION]... [COMMAND STRING]

  virsh [OPTION]... COMMAND [ARG]...

DESCRIPTION
  The virsh program is the main interface for managing virsh guest
  domains. The program can be used to create, pause, and shutdown
  domains. It can also be used to list current domains. Libvirt is a C
  toolkit to interact with the virtualization capabilities of recent
  versions of Linux (and other OSes). It is free software available under
  the GNU Lesser General Public License. Virtualization of the Linux
  Operating System means the ability to run multiple instances of
  Operating Systems concurrently on a single hardware system where the
  basic resources are driven by a Linux instance. The library aims at
  providing a long term stable C API. It currently supports Xen, QEmu,
  KVM, LXC, OpenVZ, VirtualBox and VMware ESX.
```

Quelle:  
man virsh ;)

```
ssh
root 6042 1.9 0.3 924728 12476 ? Ssl 00:40 0:15 /usr
rtld --listen
qemu 6146 6.3 9.1 3392144 365476 ? Sl 00:40 0:48 /usr
vm -name opensuse12-kvm-64bit-SA -S -M pc-1.3 -enable-kvm -m 2048 -sm
=1,cores=1,threads=1 -uuid 41a5aef0-e337-a060-b980-a77001ccca84 -no-u
-nodefaults -chardev socket,id=charmonitor,path=/var/lib/libvirt/qemu
-kvm-64bit-SA.monitor,server,novait -mon chardev=charmonitor,id=monit
trol -rtc base=utc -no-shutdown -device piix3-usb-uhci,id=usb,bus=pci
.0x2 -drive file=/var/lib/kvm/images/opensuse12-kvm-64bit-SA/disk0.ra
d=drive-virtio-disk0,format=raw -device virtio-blk-pci,scsi=off,bus=p
x5,drive=drive-virtio-disk0,id=virtio-disk0,bootindex=1 -drive file=/
E-12.3-NET-x86_64.iso,if=none,id=drive-ide0-0-0,readonly=on,format=ra
de-cd,bus=ide.0,unit=0,drive=drive-ide0-0-0,id=ide0-0-0 -netdev user,
-device virtio-net-pci,netdev=hostnet0,id=net0,mac=52:54:00:34:89:4e
addr=0x3 -vnc 127.0.0.1:0 -vga cirrus -device AC97,id=sound0,bus=pci.
-device virtio-balloon-pci,id=balloon0,bus=pci.0,addr=0x6
root 7143 4.2 1.3 637372 54776 ? Ss 00:52 0:03 pyth
re/virt-manager/virt-manager.py
root 7226 0.0 0.0 10372 952 pts/2 S+ 00:53 0:00 grep
to virt
opensuse123-host:~ # lsmod | grep kvm
kvm_intel 136915 3
kvm 475491 1 kvm_intel
opensuse123-host:~ #
```

```
Handle 0x2000, DMI type 32, 11 bytes
System Boot Information
Status: No errors detected
Handle 0x7F00, DMI type 127, 4 bytes
End Of Table
opensuse123-kvm:~ # cat /proc/cpuinfo
processor       : 0
vendor_id     : GenuineIntel
cpu family    : 6
model        : 2
model name    : QEMU Virtual CPU version 1.3.0
stepping     : 3
microcode    : 0x1
cpu MHz      : 1861.999
cache size   : 4096 KB
cpu          : yes
fpu_excepti : yes
cpuid level  : 4
up          : yes
flags        : fpu de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pse36 clflush mmx f
_lm
bogomips     : 3723.99
clflush size : 64
cache_alignm : 64
address sizes: 40 bits physical, 48 bits virtual
power managem:
opensuse123-kvm:~ #
```

Virtual Machine Manager

Datei Bearbeiten Anzeigen Hilfe

Neu Öffnen Ausführen Pause Herunterfahren

Name	CPU-Verbr
localhost (QEMU)	
opensuse12 Ausgeschaltet	
opensuse12-1 Ausgeschaltet	
opensuse12-kvm-64bit-SA Wird ausgeführt	
opensuse12-kvm-x86_64 Ausgeschaltet	

localhost (xen) - Nicht verbunden

```
opensuse123-kvm:~ #
```

# virt-manager





ONE 4.0 is out!!

## Enterprise Cloud and Datacenter Virtualization

An enterprise-ready open-source platform to manage cloud data centers

### Open

Fully open-source (not open-core) software released under the Apache license

### Adaptable

Highly customizable to fit into your data center and leverage existing IT investments

### Proven

Rigorously tested, mature, widely used, and many massive scale deployments

### Powerful

Innovative functionality for enterprise clouds and data center virtualization

### Interoperable

Choice of interfaces, from open cloud, like OCCI, to de-facto standards, like AWS

### No Lock-in

Broad infrastructure support and platform independent on VMware, KVM and Xen

### Very Light

Highly efficient, easy to install and update, with packages for the main Linux distributions

### Enterprise-ready

Single installing and updating process, and community and commercial support

Why OpenNebula? ▶



## Our Users are the Industry & Research L

Some of our featured users building the most innovative and largest clouds in the

Quelle:  
<http://opennebula.org/>



**FOREMAN**



oVirt

Open**Nebula**.org

**PROXMOX**

Undundundundundundund?



**EUCALYPTUS**



Tipp:  
[http://www.linux-kvm.org/page/Management\\_Tools](http://www.linux-kvm.org/page/Management_Tools)

Deshalb...

Spielt der *Hypervisor* noch eine  
Rolle?



# Teil III: Benchmark

# *Motivation*

# openSoftware-Pakete

```
a2ps acroread ant apache2 argouml autoconf automake bash bison bonnie++  
cpan-5.10.1 cpan-5.8.4 cpio curl cvs ddd dia diffutils ding eclipse emacs  
findutils firefox flex fping freemind gawk gcc-3.4.6 gcc-4.1.1 gcc-4.3.2  
gcc-4.3.3 gcc-4.4.0 gcc-4.4.1 gdb ggrep ghostscript ghostview gm4 gmake  
gnupg gnuplot gqview grace gsed gtar gv gzip hpijs hping imagemagick java  
jedit jxplorer keepass kerberos less lsof lynx lyx mc mpeg_play mtools  
mutt ncd u nedit netbeans netcat netpbm ntp nttcp octave openSoftwareLib  
openoffice openssh patch perl-5.10.1 perl-5.8.4 pidgin pine postgresql  
procmail pstree psutils pvm python-2.6 python qt rcs rdesktop recode  
recordmydesktop rsync samba screen sox subversion sudo tcltk tcsh teTeX  
texinfo tgif thunderbird tkcvs tkdiff tomcat valgrind vim vnc wget x11vnc  
x3270 xemacs xev xfce4 xfig xftp xpdf xv Xaw3d Xvfb apache berkeleydb  
coreutils ctags cvs-local cyrus-sasl dejagnu dmalloc doxygen dvd+rw-tools  
expat f2c fftw freetype gcc-4.2.1 gdbm gettext ghostpcl gimp2 gmp gnuplot  
gpa gridengine groff html2ps iperf irfanview jpilot kerberos lapack libIDL  
libart libbz2 libgd libiconv libjpeg libpng libungif libxml2 lpd monitor  
mpfr mysql ncftp ncurses netscape nmon nvi nx openldap openscenegraph  
openssl pcre pdflib perl-ldap perl-spezial pgp php pilot-link plan pts pv  
python qt rcs readline rootsh samba-2.2 samba sgzip smartmontools squid  
tcpdump test tiff tkX-7.3.1 top xaff xemacs-large xforms xmon xscope  
xspread zip zlib
```

Drum prüfe wer sich bindet...

# openSoftware-Pakete

```
a2ps acroread ant apache2 argouml autoconf automake bash bison bonnie++  
cpan-5.10.1 cpan-5.8.4 cpio curl cvs ddd dia diffutils ding eclipse emacs  
findutils firefox flex fping freemind gawk gcc-3.4.6 gcc-4.1.1 gcc-4.3.2  
gcc-4.3.3 gcc-4.4.0 gcc-4.4.1 gdb ggrep ghostscript ghostview gm4 gmake  
gnupg gnuplot gqview grace gsed gtar gv gzip hpijs hping imagemagick java  
jedit jxplorer keepass kerberos less lsof lynx lyx mc mpeg_play mtools  
mutt ncd u nedit netbeans netcat netpbm ntp nttcp octave openSoftwareLib  
openoffice openssh patch perl-5.10.1 perl-5.8.4 pidgin pine postgresql  
procmail pstree psutils pvm python-2.6 python qt rcs rdesktop recode  
recordmydesktop rsync samba screen sox subversion sudo tcltk tcsh teTeX  
texinfo tgif thunderbird tkcvs tkdiff tomcat valgrind vim vnc wget x11vnc  
x3270 xemacs xev xfce4 xfig xftp xpdf xv Xaw3d Xvfb apache berkeleydb  
coreutils ctags cvs-local cyrus-sasl dejagnu dmalloc doxygen dvd+rw-tools  
expat f2c fftw freetype gcc-4.2.1 gdbm gettext ghostpcl gimp2 gmp gnuplot  
gpa gridengine groff html2ps iperf irfanview jpilot kerberos lapack libIDL  
libart libbzip2 libgd libiconv libjpeg libpng libungif libxml2 lpd monitor  
mpfr mysql ncftp ncurses netscape nmon nvi nx openldap openscenegraph  
openssl pcre pdflib perl-ldap perl-spezial pgp php pilot-link plan pts pv  
python qt rcs readline rootsh samba-2.2 samba sgzip smartmontools squid  
tcpdump test tiff tkX-7.3.1 top xaff xemacs-large xforms xmon xscope  
xspread zip zlib
```



# *Testumgebung*

# Hardware

```
holgrrr — ssh — 82x24
ssh
opensuse123-host:~ # dmidecode | egrep '(Manufacturer|Product Name)' | head -n 2
    Manufacturer: Dell Inc.
    Product Name: OptiPlex 745
opensuse123-host:~ #
opensuse123-host:~ #
opensuse123-host:~ # egrep '(model name)' /proc/cpuinfo
model name      : Intel(R) Core(TM)2 CPU           6300  @ 1.86GHz
model name      : Intel(R) Core(TM)2 CPU           6300  @ 1.86GHz
opensuse123-host:~ #
opensuse123-host:~ #
opensuse123-host:~ # egrep '^flags.*(vmx|svm)' /proc/cpuinfo | head -n 1
flags           : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pa
t pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx lm constant_tsc
arch_perfmon pebs bts nopl aperfmperf pni dtes64 monitor ds_cpl vmx est tm2 ssse3
cx16 xtpr pdcm lahf_lm dtherm tpr_shadow
opensuse123-host:~ #
opensuse123-host:~ #
opensuse123-host:~ # free -m
              total          used          free          shared          buffers          cached
Mem:           3895          2604          1291             0             70            2007
-/+ buffers/cache:           526          3369
Swap:           2053             0          2053
opensuse123-host:~ #
```

Informationen für Paket kvm:

Repository: openSUSE-12.3-1.7

Name: kvm

Version: 1.3.0-3.3.2

Arch: x86\_64

Anbieter: openSUSE

Installiert: Ja

Status: aktuell

Installierte Größe: 10,9 MiB

Zusammenfassung: Kernel-based Virtual Machine

Beschreibung:

KVM (Kernel-based Virtual Machine) is virtualization software for Linux. It is based on the hardware virtualization extensions provided by Intel VT and AMD-V technologies. KVM kernel modules provide a control interface at /dev/kvm which the qemu-kvm user-space program uses to provide a hybrid emulated and actual hardware environment sufficient to run various PC operating systems (guests) in unmodified form, including Linux, Windows, and Mac OS X.

Since qemu-kvm is derived from the qemu processor emulator sources it also is able to run guests using processor emulation mode, but with the expected performance impact. Conversely, hardware virtualization features outside the processor such as iommu and sr-iovt are used by KVM allowing for improved performance.

The seabios, vgabios and ipxe open source projects are also pulled from to provide the firmware components included.

To increase performance over emulated hardware devices virtio drivers are supported, and in the case of Windows, included.

KVM is compatible with various VM management solutions, including libvirt, virt-manager and vm-install.

Informationen für Paket gcc:

Repository: openSUSE-12.3-1.7

Name: gcc

Version: 4.7-7.1.1

Arch: x86\_64

Anbieter: openSUSE

Installiert: Ja

Status: aktuell

Installierte Größe: 0 B

Zusammenfassung: The system GNU C Compiler

Beschreibung:

The system GNU C Compiler.

opensuse123-host:~ # uname -a

Linux opensuse123-host 3.7.10-1.1-desktop #1 SMP PREEMPT Thu Feb 28 15:06:29 UTC 2013 (82d3f21) x86\_64 x86\_64 x86\_64 GNU/Linux

opensuse123-host:~ #

# Software

# Hosts & Hypervisors & Guests



# OpenSUSE 12.3



Welcome

Bienvenue

Vítejte

Benvenuto

Willkommen

Bienvenido

Добро  
пожаловать

Quelle:  
OpenSUSE 12.3 Installer



Welcome to CentOS 6.4!

**I**nstall or upgrade an existing system  
Install system with basic video driver  
Rescue installed system  
Boot from local drive  
Memory test

# CentOS 6.4

Press [Tab] to edit options

Automatic boot in 58 seconds...

**CentOS 6**  
Community ENTERprise Operating System



Quelle:  
CentOS 6.4 Installer



VMware ESXi 5.1.0 (VMKernel Release Build 1065491)

innotek GmbH VirtualBox

Intel(R) Core(TM) i5-3427U CPU @ 1.80GHz  
2 GiB Memory



# Hypervisorputtelchen



## Virtual

### Welcome to VirtualBox

VirtualBox is a powerful x86 and AMD64/Intel64 virtualization product for enterprise as well as home use. Not only is it a high performance product for enterprise customer solutions, it is also a solution that is freely available as Open Source software under the GNU General Public License (GPL) version 2.0. For more information, see the introduction.

- [About](#)
- [Screenshots](#)
- [Downloads](#)
- [Documentation](#)



- [MAIN PAGE](#)
- [STATUS](#)
- [GUEST SUPPORT STATUS](#)
- [KVM-AUTOTEST](#)
- [HOWTO](#)
- [MIGRATION](#)

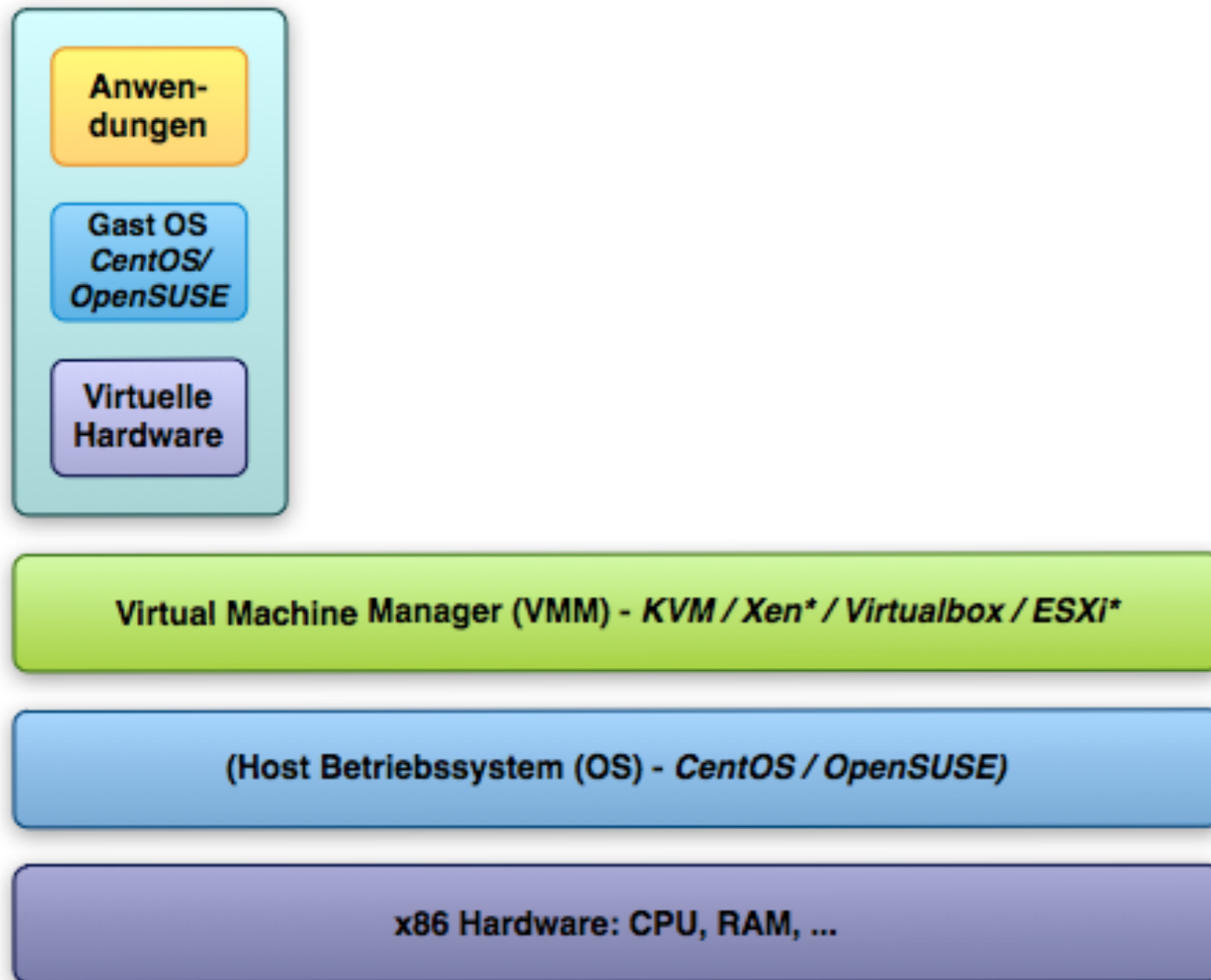
### Status

KVM is included in the mainline of most workloads.

The userspace tools are part of the mainline of most workloads.

It is also available as a patch for most of your favorite distros - provided you are using Enterprise Linux Distributions.

# Aufbau



**Hinweise:**  
Diagramm bei Lösungen mit \* nicht korrekt

## Hinweise zur Ausstattung VM

- \* 1 vCPU x86\_64
- \* 2 GB RAM
- \* 8GB vDisk

Entspricht was wir Infrastruktur-VMs vergeben.

## CentOS / OpenSUSE - Gast

- auf CentOS / OpenSUSE-Host
  - mit Xen, KVM, VirtualBox als Hypervisor
- oder auf VMware ESXi

**Immer nur 1VM aktiv!**



# Versions-Stände

	<b>OpenSUSE 12.3 64bit</b>	<b>CentOS (6.4) 64bit</b>
<b>Kernel</b>	3.7.10-1.1-desktop	2.6.32-358.6.1.el6.x86_64 2.6.32-358.6.2.el6.x86_64 3.9.2-1.el6xen.x86_64
<b>KVM</b>	1.3.0-3.3.2	1.0.3
<b>XEN</b>	4.2.1_12-1.8.1	4.2.2
<b>VirtualBox</b>	4.2.6-3.1.8	4.2.12_84980_el6
<b>GCC</b>	4.7-7.1.1	4.4.7

Und  
**VMware ESXi 5.1.u1**

# *Prozedur*

# Benchmark-Skript

```
[root@centos64-host 3.6.15]# cat bench.sh  
#!/bin/bash  
[...]
```

```
for run in 1 2 3 4 5  
do
```

```
    echo run $run
```

```
        (time bash -c 'tar xf samba-3.6.15.tar.gz ;  
cd samba-3.6.15/source3 ; time ./configure ;  
time make' ) >& logfile-$OS-$VIRTTYPE-$CPU-  
$run
```

```
    rm -rf samba-3.6.15
```

```
done
```

Samba:  
[http://ftp.samba.org/pub/samba/  
stable/samba-3.6.15.tar.gz](http://ftp.samba.org/pub/samba/stable/samba-3.6.15.tar.gz)

# Benchmark-Skript

## Hinweise

- \* Werte der Einzeldisziplinen nur wenig abweichend
- \* Deshalb für Auswertung nur Endergebnis betrachtet

```
[root@centos64-host run1]# grep ^real logfile-CENTOS-XEN-
PARA-x86_64-*
logfile-CENTOS-XEN-PARA-x86_64-1:real 1m41.054s
logfile-CENTOS-XEN-PARA-x86_64-1:real 6m12.247s
logfile-CENTOS-XEN-PARA-x86_64-1:real 7m55.886s
logfile-CENTOS-XEN-PARA-x86_64-2:real 1m39.449s
logfile-CENTOS-XEN-PARA-x86_64-2:real 6m11.782s
logfile-CENTOS-XEN-PARA-x86_64-2:real 7m53.842s
logfile-CENTOS-XEN-PARA-x86_64-3:real 1m40.055s
logfile-CENTOS-XEN-PARA-x86_64-3:real 6m11.735s
logfile-CENTOS-XEN-PARA-x86_64-3:real 7m54.394s
logfile-CENTOS-XEN-PARA-x86_64-4:real 1m39.619s
logfile-CENTOS-XEN-PARA-x86_64-4:real 6m10.562s
logfile-CENTOS-XEN-PARA-x86_64-4:real 7m52.780s
logfile-CENTOS-XEN-PARA-x86_64-5:real 1m39.542s
logfile-CENTOS-XEN-PARA-x86_64-5:real 6m10.701s
logfile-CENTOS-XEN-PARA-x86_64-5:real 7m52.857s
```

```
(time bash -c 'tar xf samba-3.6.15.tar.gz ; cd samba-3.6.15/source3 ;
time ./configure ; time make' ) >& logfile-$OS-$VIRTTYPE-$CPU-$run
```



# physikalisch vs virtuell



Ergebnisse



# Ergebnisse

	OpenSUSE 12.3				CentOS 6.4			
	Mittel	Min	Max	%	Mittel	Min	Max	%
<b>ohne Virtualisierung</b>	<b>7:24</b>	7:24	7:25	100	<b>6:09</b>	6:09	6:09	100
Xen Paravirtualisierung	<b>8:33</b>	8:28	8:40	87 115	<b>7:54</b>	7:53	7:56	78 128
Xen Vollvirtualisierung	<b>12:02</b>	12:01	12:04	61 163	<b>10:31</b>	10:30	10:32	59 171
KVM (X86)	<b>11:31</b> <b>(17:05)</b>	11:29 (17:04)	11:34 (17:08)	64 156 (43 231)	<b>9:40</b>	9:37	9:42	64 157
VirtualBox	<b>25:31</b>	22:49	27:56	29 345	<b>18:39</b>	18:35	18:44	33 303
ESXi (mit VMware Tools)	<b>10:06</b>	10:04	10:11	73 137	<b>8:28</b> <b>(8:29)</b>	8:26 (8:28)	8:32 (8:29)	73 138 (73 138)



# Ergebnisse - abgespeckt

	OpenSUSE 12.3		CentOS 6.4	
	Mittel	%	Mittel	%
ohne Virtualisierung	7:24	100	6:09	100
Xen Paravirtualisierung	8:33	87	7:54	78
Xen Vollvirtualisierung	12:02	61	10:31	59
KVM	11:31	64	9:40	64
VirtualBox	25:31	29	18:39	33
ESXi	10:06	73	8:28	73

**Genau** drauf geschaut...





# Wahl des Betriebssystem

- \* Bereits ohne Virtualisierung Unterschiede!
- \* Ursache wohl hier der Compiler
- \* anderer Benchmark = andere Ergebnisse

	OpenSUSE 12.3		CentOS 6.4	
	Mittel	%	Mittel	%
ohne Virtualisierung	7:24	100	6:09	100
Xen Paravirtualisierung	8:33	87	7:54	78
Xen Vollvirtualisierung	12:02	61	10:31	59
KVM	11:31	64	9:40	64
VirtualBox	25:31	29	18:39	33
ESXi	10:06	73	8:28	73

# Wahl des Betriebssystem

\* Wahl des Betriebssystems (relativ) egal  
 \* Prozentual gesehen ist Virt.-Verlust ähnlich

Paradeo Company

	OpenSUSE 12.3		CentOS 6.4	
	Mittel	%	Mittel	%
ohne Virtualisierung	7:24	100	6:09	100
Xen Paravirtualisierung	8:33	87	7:54	78
Xen Vollvirtualisierung	12:02	61	10:31	59
KVM	11:31	64	9:40	64
VirtualBox	25:31	29	18:39	33
ESXi	10:06	73	8:28	73



# Xen Para- vs. Vollvirtualisierung

- \* Paravirtualisierung nach wie vor *schnell*
- \* KVM nur paravirtualisierte IO
- \* kam hier nicht zum Tragen

	OpenSUSE 12.3		CentOS 6.4	
	Mittel	%	Mittel	%
ohne Virtualisierung	7:24	100	6:09	100
Xen Paravirtualisierung	8:33	87	7:54	78
Xen Vollvirtualisierung	12:02	61	10:31	59
KVM	11:31	64	9:40	64
VirtualBox	25:31	29	18:39	33
ESXi	10:06	73	8:28	73

# Vollvirtualisierung - Xen vs

\* bei vollständiger Virtualisierung KVM besser  
 \* kommt hier paravirt. IO zu tragen?

	OpenSUSE 12.3		CentOS 6.4	
	Mittel	%	Mittel	%
ohne Virtualisierung	7:24	100	6:09	100
Xen Paravirtualisierung	8:33	87	7:54	78
Xen Vollvirtualisierung	12:02	61	10:31	59
KVM	11:31	64	9:40	64
VirtualBox	25:31	29	18:39	33
ESXi	10:06	73	8:28	73

# VMware vs. Xen vs. KVM

\* gute Performance bei VMware  
 \* schlechter als Xen Para., besser als KVM

	OpenSUSE 12.3		CentOS 6.4	
	Mittel	%	Mittel	%
ohne Virtualisierung	7:24	100	6:09	100
Xen Paravirtualisierung	8:33	87	7:54	78
Xen Vollvirtualisierung	12:02	61	10:31	59
KVM	11:31	64	9:40	64
VirtualBox	25:31	29	18:39	33
ESXi	10:06	73	8:28	73

# Sonstiges

\* VirtualBox für Szenario ungeeignet

	OpenSUSE 12.3		CentOS 6.4	
	Mittel	%	Mittel	%
ohne Virtualisierung	7:24	100	6:09	100
Xen Paravirtualisierung	8:33	87	7:54	78
Xen Vollvirtualisierung	12:02	61	10:31	59
KVM	11:31	64	9:40	64
VirtualBox	25:31	29	18:39	33
ESXi	10:06	73	8:28	73



# Siegererhrung



- 1. Xen Paravirtualisierung**
- 2. VMware VSphere Hypervisor**
- 3. KVM**
- 4. Xen Vollvirtualisierung**
- 5. VirtualBox**

Tja...



# neue Hardware

```
HW-DETAILS — bash — 81x24
bash
u-082-c078:HW-DETAILS holgrrr$ cat dmidecore
    Manufacturer: Dell Inc.
    Product Name: PowerEdge T20
u-082-c078:HW-DETAILS holgrrr$
u-082-c078:HW-DETAILS holgrrr$
u-082-c078:HW-DETAILS holgrrr$ cat cpuinfo*
model name      : Intel(R) Xeon(R) CPU E3-1225 v3 @ 3.20GHz
model name      : Intel(R) Xeon(R) CPU E3-1225 v3 @ 3.20GHz
model name      : Intel(R) Xeon(R) CPU E3-1225 v3 @ 3.20GHz
model name      : Intel(R) Xeon(R) CPU E3-1225 v3 @ 3.20GHz
flags           : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov p
at pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtsc
p lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc aperf
mperf eagerfpu pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 fma cx16
xtpr pdc_m pcid sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave av
x f16c rdrand lahf_lm abm ida arat epb xsaveopt pln pts dtherm tpr_shadow vnmi fl
expriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm
u-082-c078:HW-DETAILS holgrrr$
u-082-c078:HW-DETAILS holgrrr$
u-082-c078:HW-DETAILS holgrrr$ cat free-m

```

	total	used	free	shared	buffers	cached
Mem:	15988	507	15480	10	0	350
-/+ buffers/cache:		156	15831			
Swap:	2053	0	2053			



# Featuresprung

ark.intel.com/de/compare/75461,27248

intel Menü Inhalte suchen Search Germany

Produktname	Intel® Xeon® Processor E3-1225 v3 (8M Cache, 3.20 GHz)	Intel® Core™2 Duo Processor E6300 (2M Cache, 1.86 GHz, 1066 MHz FSB)
Codename	Haswell	Conroe
<b>Innovative Technik</b>		
Intel® Turbo-Boost-Technik †	2.0	No
Intel® vPro-Technik †	Yes	
Intel® Hyper-Threading-Technik †	No	No
Intel® Virtualisierungstechnik (VT-x) †	Yes	Yes
Intel® Directed-I/O-Virtualisierungstechnik (VT-d) †	Yes	
Intel® VT-x mit Extended Page Tables (EPT) †	Yes	
Intel® TSX-NI	Yes	
Intel® 64 †	Yes	Yes
Inaktivitätsstatus	Yes	Yes
Erweiterte Intel SpeedStep® Technologie	Yes	Yes
Thermal-Monitoring-Technik	Yes	Yes
Intel® Fast-Memory-Access	Yes	
Intel® Flex-Memory-Access	Yes	
Intel® Identity-Protection-Technik †	Yes	

Quelle: CPU-Vergleich

<http://ark.intel.com/de/compare/75461,27248>

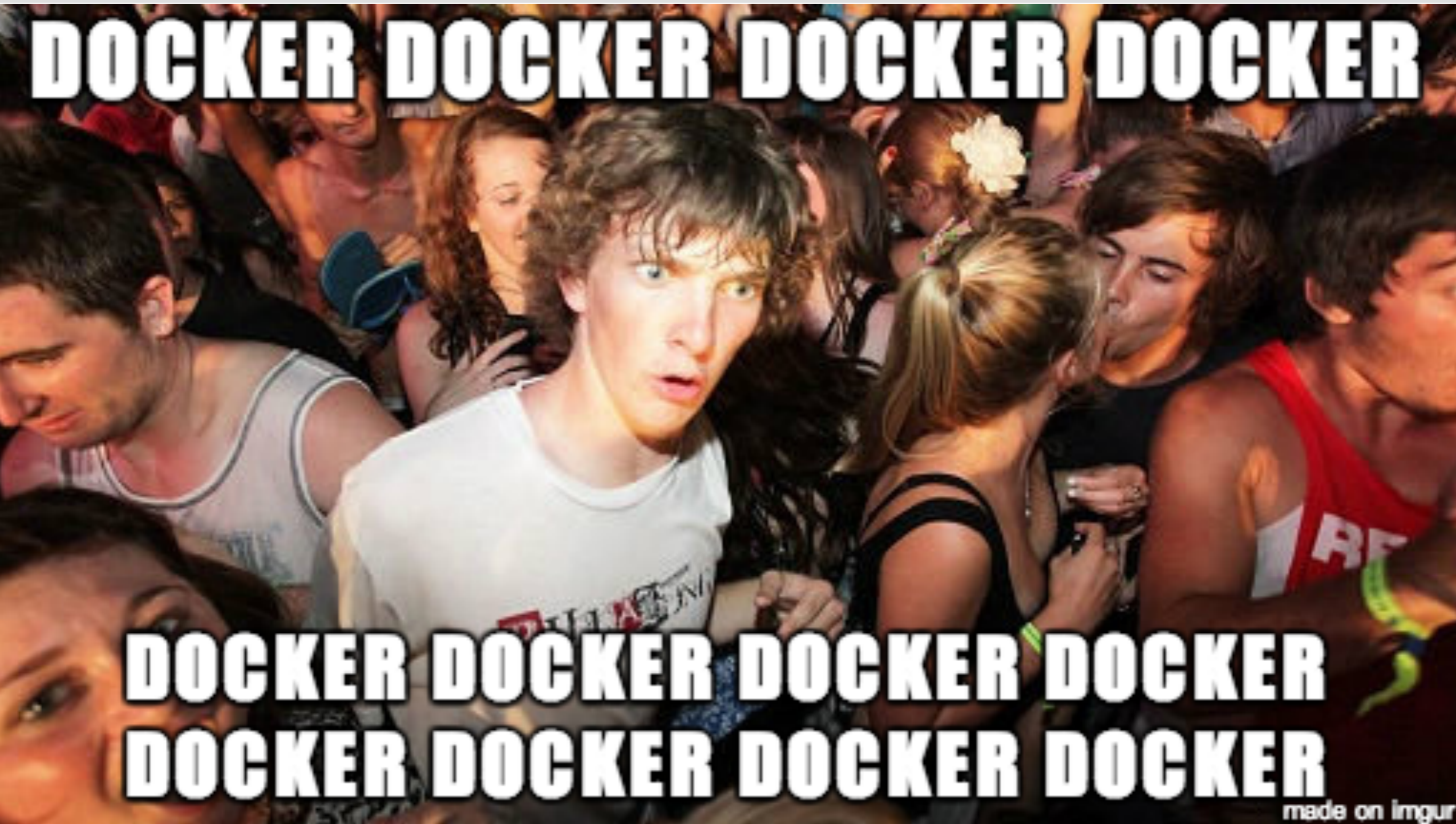
One more **time**...

# Neue Versionen



und natürlich...

**DOCKER DOCKER DOCKER DOCKER**



**DOCKER DOCKER DOCKER DOCKER**  
**DOCKER DOCKER DOCKER DOCKER**

made on Imgur

Quelle:

<http://jamespacileo.github.io/Slides-Dockerize-That-Django-App/img/docker-meme.png>



# openSUSE 13.2 (Harlequin) (x86\_64)

```
host:/root # rpm -qa | egrep -e kvm -e xen -e  
docker -e kernel | vonHandAusmisten
```

```
xen-4.4.1_08-9.1.x86_64
```

```
docker-1.5.0-21.1.x86_64
```

```
qemu-kvm-2.1.0-2.9.x86_64
```

```
kernel-default-3.16.7-7.1.x86_64
```

```
kernel-xen-3.16.7-7.1.x86_64
```

```
host:/root # rpm -qa | egrep -e gcc -e make
```

```
gcc-4.8-7.1.2.x86_64
```

```
make-4.0-2.2.3.x86_64
```



nochmal Ergebnisse

# Ergebnisse

Hinweis:

Gesamt = Gesamtzeit aus 10 Läufen in MM:SS

| an atos company

<i>alles unter OpenSUSE 13.2</i>	Mittel	Gesamt	%
<b>bare metall [4 CPUs, 16GB RAM]</b>			
Docker (unlimitiert) [4 CPUs, 16GB RAM]			
KVM [1vCPUs, 2GB vRAM]			
KVM [1vCPUs, 4GB vRAM]			
KVM [2vCPUs, 8GB vRAM]			
Xen HVM [1vCPUs, 2GB vRAM]			
Xen HVM [1vCPUs, 4GB vRAM]			
Xen HVM [2vCPUs, 8GB vRAM]			
Xen PV [1vCPUs, 2GB vRAM]			
Xen PV [1vCPUs, 4GB vRAM]			
Xen PV [2vCPUs, 8GB vRAM]			



# Ergebnisse

**Hinweis:**

Gesamt = Gesamtzeit aus 10 Läufen in MM:SS

| an atos company

<i>alles unter OpenSUSE 13.2</i>	Mittel	<b>alte Laufzeiten bare metal:</b> * 7:24 bei openSUSE 12.3 * 6:09 bei CentOS 6.4	
<b>bare metall [4 CPUs, 16GB RAM]</b>	<b>2:24,5</b>		
Docker (unlimitiert) [4 CPUs, 16GB RAM]	2:25,2	24:12	99,53
KVM [1vCPUs, 2GB vRAM]	2:21,4	23:34	102,19
KVM [1vCPUs, 4GB vRAM]	2:22,0	23:40	101,78
KVM [2vCPUs, 8GB vRAM]	2:25,3	24:13	99,49
Xen HVM [1vCPUs, 2GB vRAM]	2:20,6	23:26	102,72
Xen HVM [1vCPUs, 4GB vRAM]	2:23,3	23:53	100,88
Xen HVM [2vCPUs, 8GB vRAM]	2:28,0	24:40	97,64
Xen PV [1vCPUs, 2GB vRAM]	2:44,2	27:22	86,44
Xen PV [1vCPUs, 4GB vRAM]	2:45,2	27:32	85,76
Xen PV [2vCPUs, 8GB vRAM]	2:48,0	28:00	83,86



Nochmal genau...





# Ergebnisse

**Fazit:**  
*Xen Paravirtualisierung am langsamsten*

| an atos company

<i>alles unter OpenSUSE 13.2</i>	Mittel	Gesamt	%
<b>bare metall [4 CPUs, 16GB RAM]</b>	<b>2:24,5</b>	<b>24:05</b>	<b>100</b>
Docker (unlimitiert) [4 CPUs, 16GB RAM]	2:25,2	24:12	99,53
KVM [1vCPUs, 2GB vRAM]	2:21,4	23:34	102,19
KVM [1vCPUs, 4GB vRAM]	2:22,0	23:40	101,78
KVM [2vCPUs, 8GB vRAM]	2:25,3	24:13	99,49
Xen HVM [1vCPUs, 2GB vRAM]	2:20,6	23:26	102,72
Xen HVM [1vCPUs, 4GB vRAM]	2:23,3	23:53	100,88
Xen HVM [2vCPUs, 8GB vRAM]	2:28,0	24:40	97,64
Xen PV [1vCPUs, 2GB vRAM]	2:44,2	27:22	86,44
Xen PV [1vCPUs, 4GB vRAM]	2:45,2	27:32	85,76
Xen PV [2vCPUs, 8GB vRAM]	2:48,0	28:00	83,86

# Ergebnisse

**Fazit:**  
*Leistung ziemlich zusammengedrückt*

| an atos company

<i>alles unter OpenSUSE 13.2</i>	Mittel	Gesamt	%
<b>bare metall [4 CPUs, 16GB RAM]</b>	<b>2:24,5</b>	<b>24:05</b>	<b>100</b>
Docker (unlimitiert) [4 CPUs, 16GB RAM]	2:25,2	24:12	99,53
KVM [1vCPUs, 2GB vRAM]	2:21,4	23:34	102,19
KVM [1vCPUs, 4GB vRAM]	2:22,0	23:40	101,78
KVM [2vCPUs, 8GB vRAM]	2:25,3	24:13	99,49
Xen HVM [1vCPUs, 2GB vRAM]	2:20,6	23:26	102,72
Xen HVM [1vCPUs, 4GB vRAM]	2:23,3	23:53	100,88
Xen HVM [2vCPUs, 8GB vRAM]	2:28,0	24:40	97,64
Xen PV [1vCPUs, 2GB vRAM]	2:44,2	27:22	86,44
Xen PV [1vCPUs, 4GB vRAM]	2:45,2	27:32	85,76
Xen PV [2vCPUs, 8GB vRAM]	2:48,0	28:00	83,86

# Ergebnisse

Fazit:

kleinere VMs kürzere Laufzeit als bare metal

| an atos company

<i>alles unter OpenSUSE 13.2</i>	Mittel	Gesamt	%
<b>bare metal [4 CPUs, 16GB RAM]</b>	<b>2:24,5</b>	<b>24:05</b>	<b>100</b>
Docker (unlimitiert) [4 CPUs, 16GB RAM]	2:25,2	24:12	99,53
KVM [1vCPUs, 2GB vRAM]	2:21,4	23:34	102,19
KVM [1vCPUs, 4GB vRAM]	2:22,0	23:40	101,78
KVM [2vCPUs, 8GB vRAM]	2:25,3	24:13	99,49
Xen HVM [1vCPUs, 2GB vRAM]	2:20,6	23:26	102,72
Xen HVM [1vCPUs, 4GB vRAM]	2:23,3	23:53	100,88
Xen HVM [2vCPUs, 8GB vRAM]	2:28,0	24:40	97,64
Xen PV [1vCPUs, 2GB vRAM]	2:44,2	27:22	86,44
Xen PV [1vCPUs, 4GB vRAM]	2:45,2	27:32	85,76
Xen PV [2vCPUs, 8GB vRAM]	2:48,0	28:00	83,86



# Ergebnisse

**Fazit:**  
je *kleiner* VM umso kürzere Laufzeit

| an atos company

<i>alles unter OpenSUSE 13.2</i>	Mittel	Gesamt	%
<b>bare metall [4 CPUs, 16GB RAM]</b>	<b>2:24,5</b>	<b>24:05</b>	<b>100</b>
Docker (unlimitiert) [4 CPUs, 16GB RAM]	2:25,2	24:12	99,53
KVM [1vCPUs, 2GB vRAM]	2:21,4	23:34	102,19
KVM [1vCPUs, 4GB vRAM]	2:22,0	23:40	101,78
KVM [2vCPUs, 8GB vRAM]	2:25,3	24:13	99,49
Xen HVM [1vCPUs, 2GB vRAM]	2:20,6	23:26	102,72
Xen HVM [1vCPUs, 4GB vRAM]	2:23,3	23:53	100,88
Xen HVM [2vCPUs, 8GB vRAM]	2:28,0	24:40	97,64
Xen PV [1vCPUs, 2GB vRAM]	2:44,2	27:22	86,44
Xen PV [1vCPUs, 4GB vRAM]	2:45,2	27:32	85,76
Xen PV [2vCPUs, 8GB vRAM]	2:48,0	28:00	83,86

# Ergebnisse

**Fazit:**  
KVM hat deutlich aufgeholt

| an atos company

<i>alles unter OpenSUSE 13.2</i>	Mittel	Gesamt	%
<b>bare metall [4 CPUs, 16GB RAM]</b>	<b>2:24,5</b>	<b>24:05</b>	<b>100</b>
Docker (unlimitiert) [4 CPUs, 16GB RAM]	2:25,2	24:12	99,53
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Xen PV [1vCPUs, 4GB vRAM]	2:45,2	27:32	85,76
Xen PV [2vCPUs, 8GB vRAM]	2:48,0	28:00	83,86

*Fazit?*

Viele!



**aktuelle Hardware rockt!**

Spielt der *Hypervisor* noch eine Rolle?

It depends...

Traue keinen Benchmark...



sondern teste **Dein Setup!**

neue Anforderungen?

# Surviving

# the Zombie Apocalypse

## Surviving the Zombie Apocalypse

Security in the Cloud – Containers, KVM and Xen

Ian Jackson <ian.jackson@eu.citrix.com>

FOSDEM 2015

originally based on a talk and research by George Dunlap

Quelle: Surviving the Zombie Apocalypse - Ian Jackson  
<http://xenbits.xen.org/people/iwj/2015/fosdem-security/>

# Zombies? - Findings!

## Some Free Software VM hosting technologies Vulnerabilities published in 2014

	Xen PV	KVM+ QEMU	Linux as general container	Linux app container (non-root)
Privilege escalation (guest-to-host)	0	3-5	7-9	4
Denial of service (by guest of host)	3	5-7	12	3
Information leak (from host to guest)	1	0	1	1

Hosts only  
application,  
not guest OS

Quelle: Surviving the Zombie Apocalypse - Ian Jackson  
<http://xenbits.xen.org/people/iwj/2015/fosdem-security/>



**"Some people make the mistake of thinking of containers as a better and faster way of running virtual machines.**

**From a security point of view, containers are much weaker."**

Dan Walsh,  
SELinux architect(?)





**Frustbringer...**



# Docker - Missverständnisse

Jessie Frazelle's Blog

## Docker Containers on the Desktop

February 21, 2015

Hello!

If you are not familiar with [Docker](#), it is the popular open source container engine.

Most people use Docker for containing applications to deploy into production or for building their applications in a contained environment. This is all fine & dandy, and saves developers & ops engineers huge headaches, but I like to use Docker in a not-so-typical way.

I use Docker to run all the desktop apps on my computers.

But why would I even want to run all these apps in containers? Well let me

But why would I even want to run all these apps in containers? Well let me

Quelle: Docker Containers on the Desktop

<https://blog.jessfraz.com/posts/docker-containers-on-the-desktop.html>

# Docker - *Leichtsinn*

Jessie Frazelle's Blog

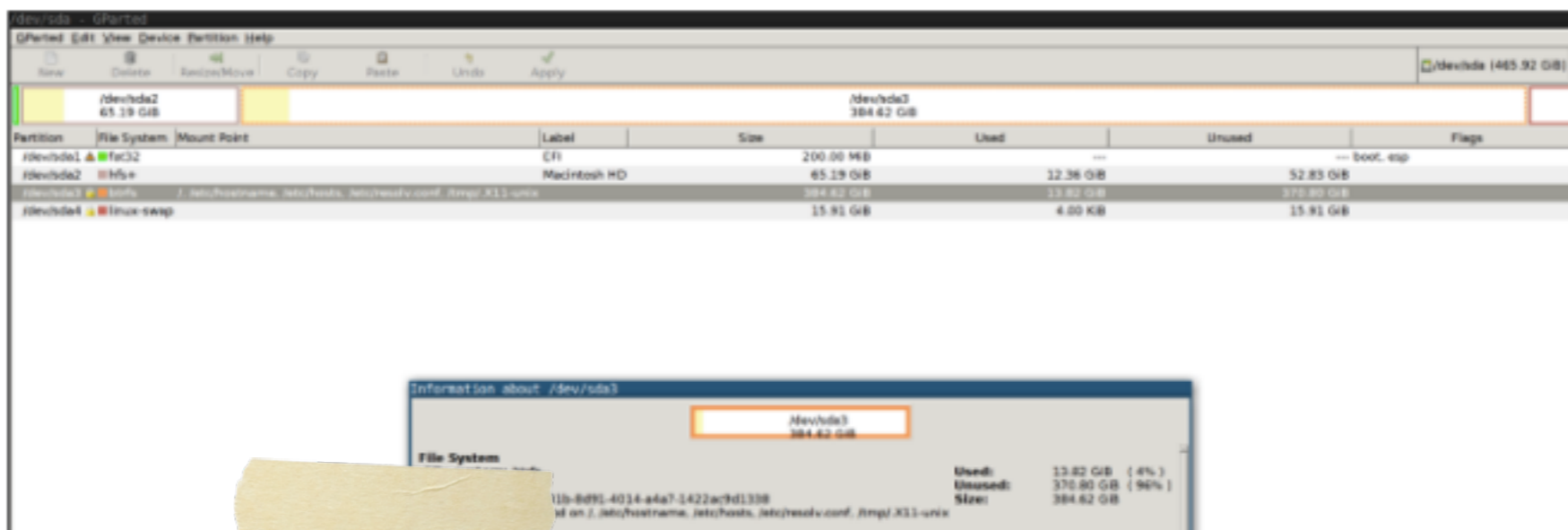
## 7. Gparted

### Dockerfile

Partition your device in a container.

MIND BLOWN.

```
$ docker run -it \  
-v /tmp/.X11-unix:/tmp/.X11-unix \ # mount the X11 socket  
-e DISPLAY=unix$DISPLAY \ # pass the display  
--device /dev/sda:/dev/sda \ # mount the device to partition  
--name gparted \  
jess/gparted
```



Quelle: Docker Containers on the Desktop

<https://blog.jessfraz.com/posts/docker-containers-on-the-desktop.html>



# Docker - Diskussion

X11 is completely unsecure, the "sandboxed" app has full access to every other X11 client.

if you have docker access you have root access [...]  
`docker run -v /:/tmp ubuntu rm -rf /tmp/*`  
Which will remove all the files on your system.

▲ alexlarsson 10 days ago

This is not sandboxing. Quite the opposite, this gives the apps root access:

First of all, X11 is completely unsecure, the "sandboxed" app has full access to every other X11 client. Thus, its very easy to write a simple X app that looks for say a terminal window and injects key events (say using Xtest extension) in it to type whatever it wants. Here is another example that sniffs the key events, including when you unlock the lock screen: <https://github.com/magcius/keylog>

Secondly, if you have docker access you have root access. You can easily run something like:

```
docker run -v /:/tmp ubuntu rm -rf /tmp/*
```

Which will remove all the files on your system.

[reply](#)

▲ jdub 9 days ago

Just so everyone knows, this is Alex "I have a weird interest in application bundling systems" Larsson, who is doing some badass bleeding edge work on full on sandboxed desktop applications on Linux. :-)

<http://blogs.gnome.org/alex/2015/02/17/first-fully-sandboxe...>

[http://www.youtube.com/watch?v=t-2a\\_XYJPEY](http://www.youtube.com/watch?v=t-2a_XYJPEY)

Like Ron Burgundy, he's... "kind of a big deal".

(Suffer the compliments, Alex.)

[reply](#)

Quelle: Docker containers on the desktop - Discussion  
<https://news.ycombinator.com/item?id=9086751>

not part of their  
ery to run,



**WHAT IF I TOLD  
YOU**

**DOCKER CONTAINERS ARE NOT MAGICAL VIRTUAL  
MACHINES**

memegenerator.net

Quelle:

<http://cdn.meme.am/instances/53646903.jpg>

# Teil IV: Zusammenfassung

## **Virtualisierung Grundlage für viele aktuelle Themen der IT**

**Linux bietet eine *Vielzahl* von  
*performanten Virtualisierungs-Lösungen*  
und Tools**

**Wahl des *Hypervisors* weiterhin  
(un?)wichtig!**



# Wa(h)lwerbung?



Quelle:

<http://cdn2.spiegel.de/images/image-806145-galleryV9-ygfz.jpg>





Quelle:

<https://www.flickr.com/photos/protohiro/3847864550>





Vielen Dank für Ihre Aufmerksamkeit.

**Holger Gantikow**

science + computing ag  
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Telefon: 07071 9457 - 503  
E-Mail: [h.gantikow@science-computing.de](mailto:h.gantikow@science-computing.de)

Frage?

Antwort!





# Schleichwerbung

TÜBIX

[Call for Papers](#) [Anfahrt](#) [Links](#) [Termine](#) [Log](#) [Impressum](#)

TÜBIX ist ein [Linuxtag](#) und findet am Samstag, den 13. Juni 2015 in [Tübingen](#) statt.



Der Linuxtag dient dem fachlichen

Dieser Tag könnte etwas für dich sein

- ... Lust auf Austausch mit anderen hast
- ... Experte / Profi / Veteran / Meister bist
- ... Neuling / Einsteiger / Umsteiger / Interessent bist
- ... nebenbei ein [Computermuseum](#) besuchen möchtest
- ... von anderen etwas dazulernen möchtest
- ... anderen etwas zeigen oder beibringen möchtest (siehe "[Call for Papers](#)")

Bildquelle: Wikipedia

Quelle: TÜBIX  
<http://tuebix.org>

Tübingen  
13.06.2015  
tuebix.org



**science + computing**

| an atos company



<http://www.science-computing.de>  
<https://www.science-computing.de/jobs>

## Logos

- <http://libvirt.org/libvirtLogo.png>
- <http://www.eucalyptus.com/sites/all/img/logos/eucalyptus-logo-349x83.png>
- [http://pve.proxmox.com/mediawiki/skins//common/images/proxmox\\_logo.png](http://pve.proxmox.com/mediawiki/skins//common/images/proxmox_logo.png)
- <http://www.convirture.com/images/logo.png>
- <http://www.ovirt.org/skins/common/images/oVirt-logo.png>
- [http://opennebula.org/\\_media/about:opennebula\\_logo\\_clean.png](http://opennebula.org/_media/about:opennebula_logo_clean.png)
- [http://theforeman.org/static/images/foreman\\_large.png](http://theforeman.org/static/images/foreman_large.png)
- [http://www.openqrm-enterprise.com/uploads/pics/logoOpenQrm\\_07.png](http://www.openqrm-enterprise.com/uploads/pics/logoOpenQrm_07.png)
- <http://www.openstack.org/blog/wp-content/uploads/2011/07/openstack-cloud-software-logo.png>

## Webseiten / Projekte

- [tuebix.org](http://tuebix.org)
- [http://blogs.gartner.com/david\\_cearley/2008/10/14/gartner's-top-10-strategic-technologies-for-2009/](http://blogs.gartner.com/david_cearley/2008/10/14/gartner's-top-10-strategic-technologies-for-2009/)
- <http://gartner.com/it/page.jsp?id=1210613>
- <http://www.techrepublic.com/blog/10-things/gartners-top-10-technology-trends-for-2015-all-about-the-cloud/>
- <http://www.xenproject.org>
- <http://www.linux-kvm.org/page/Status>
- <https://www.virtualbox.org>
- <http://libvirt.org>
- <http://opennebula.org>
- <http://ark.intel.com/de/compare/75461,27248>
- <http://xenbits.xen.org/people/iwj/2015/fosdem-security/>
- <https://blog.jessfraz.com/posts/docker-containers-on-the-desktop.html>
- <https://news.ycombinator.com/item?id=9086751>



## Abbildungen

- Docker all the things
  - <http://cdn.meme.am/instances/500x/59600465.jpg>
- Docker Logo:
  - <http://blog.docker.com/wp-content/uploads/2013/06/Docker-logo-011.png>
- Docker^n
  - <http://jamespacileo.github.io/Slides-Dockerize-That-Django-App/img/docker-meme.png>
- Neo Magical VMs
  - <http://cdn.meme.am/instances/53646903.jpg>
- Wa(h)lwerbung
  - <http://cdn2.spiegel.de/images/image-806145-galleryV9-ygfz.jpg>
- Container Cat
  - <https://www.flickr.com/photos/protohiro/3847864550?rb=1>