

PANDORA'S BOX



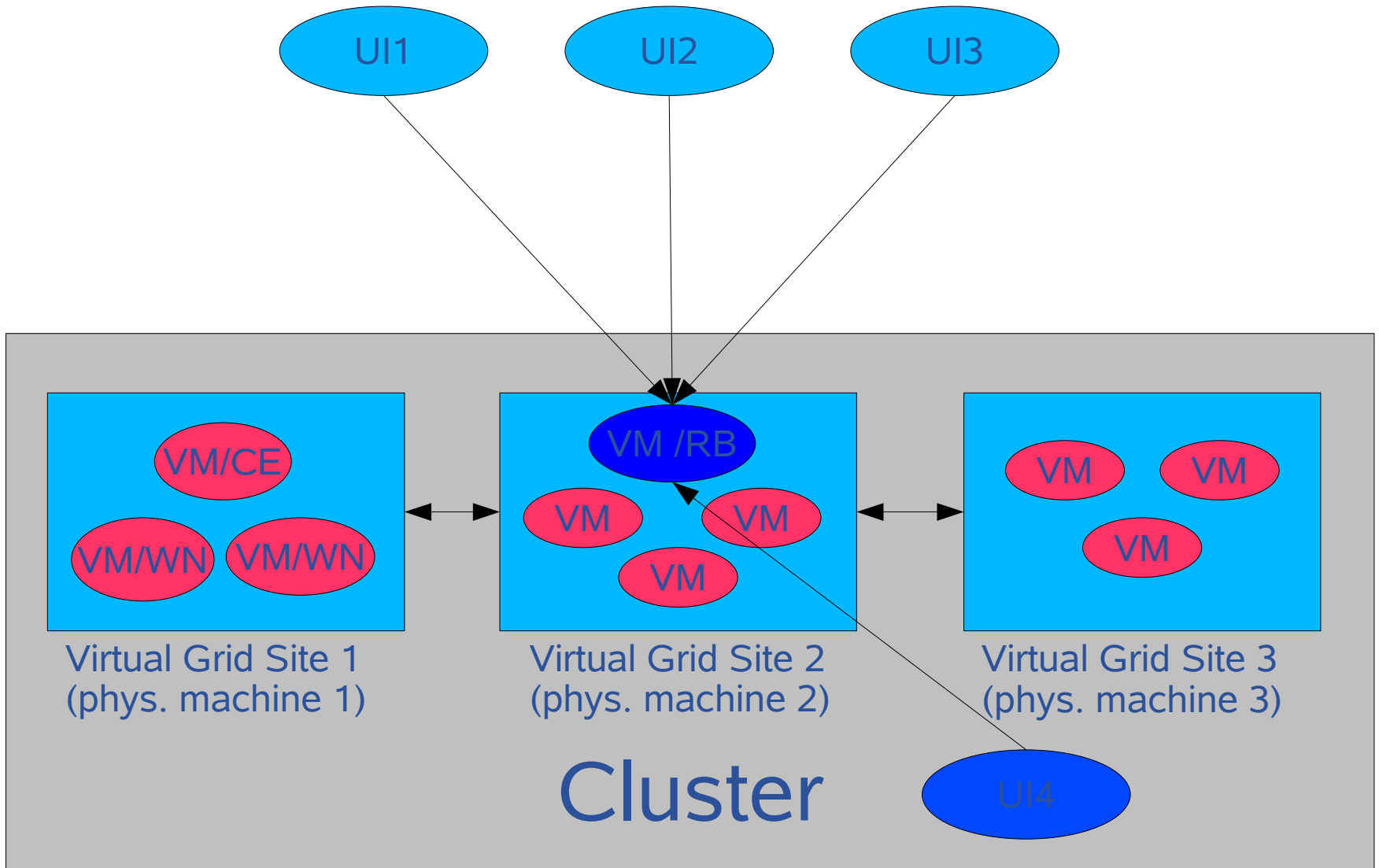
The Grid in a **Box**



*Dr. Rüdiger Berlich / Marcus Hardt
Forschungszentrum Karlsruhe
Athens / Greece; 3rd EGEE Conference*

- **Grid in a Box**
 - The Vision, Rationale
- **Components: User Interface – Plug and Play**
 - Getting and installing it
- **Components: Gilda Live CD**
 - Usage / The GLCD Video – bringing the CD to your customers
 - Knoppix and the Debian Linux distribution
 - Remastering Knoppix – making ROOT part of a Knoppix CD
- **Adding Components: Towards the “Grid in a Box”**
 - Adding Ressources with virtualisation techniques
 - Usermode Linux, VMWare, ...
 - Xen (technique, performance, reliability)
- **Use Cases – GiaB in NA3**

- First outlined in paper “A single-computer Grid gateway using **virtual machines**” by Univ. Dublin
- Basically: **Server-Konsolidation** using virtual machines (Install Server, CE, SE, UI)
- When thinking the thought further: Build an entire Grid in a cluster, running multiple virtual machines, provide easy access from private machines.
- **Biggest advantage:** In environments where performance is not the biggest concern, one can **multiply the available resources**



Advantages:

- Allows the creation of virtual Grids that are for the user indistinguishable (except for performance) from a “real” Grid (at least in theory ...)
 - Do this with a fraction of the typical resources
 - Take down or break single resources
 - Experimentation in a safe environment
- Ship a whole Grid as disk images to a customer

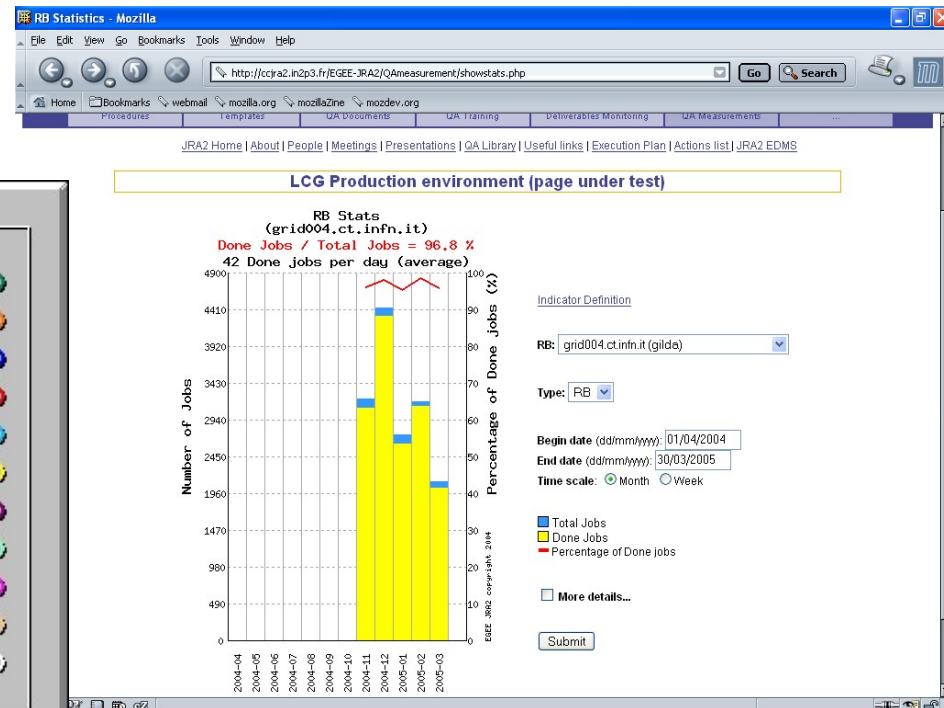
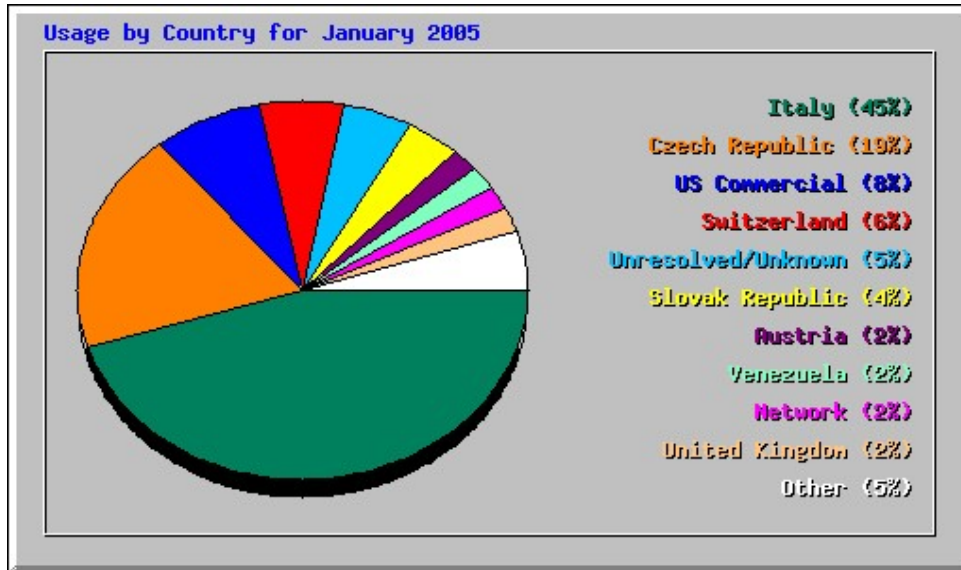
Disadvantages:

- Stability; Maintenance
- Single point of failure
- Not the “real thing”
- Easier said than done ...

- Available from <https://gilda.ct.infn.it>
- Developed by INFN Catania, independent of GiaB
- Idea: Unpack .tgz archive in home directory, call installation script and make certificates available (USB stick, copy from other machine, ...)
- Provides significant help with access of Gilda resources
- Takes away the pain from installing a UI

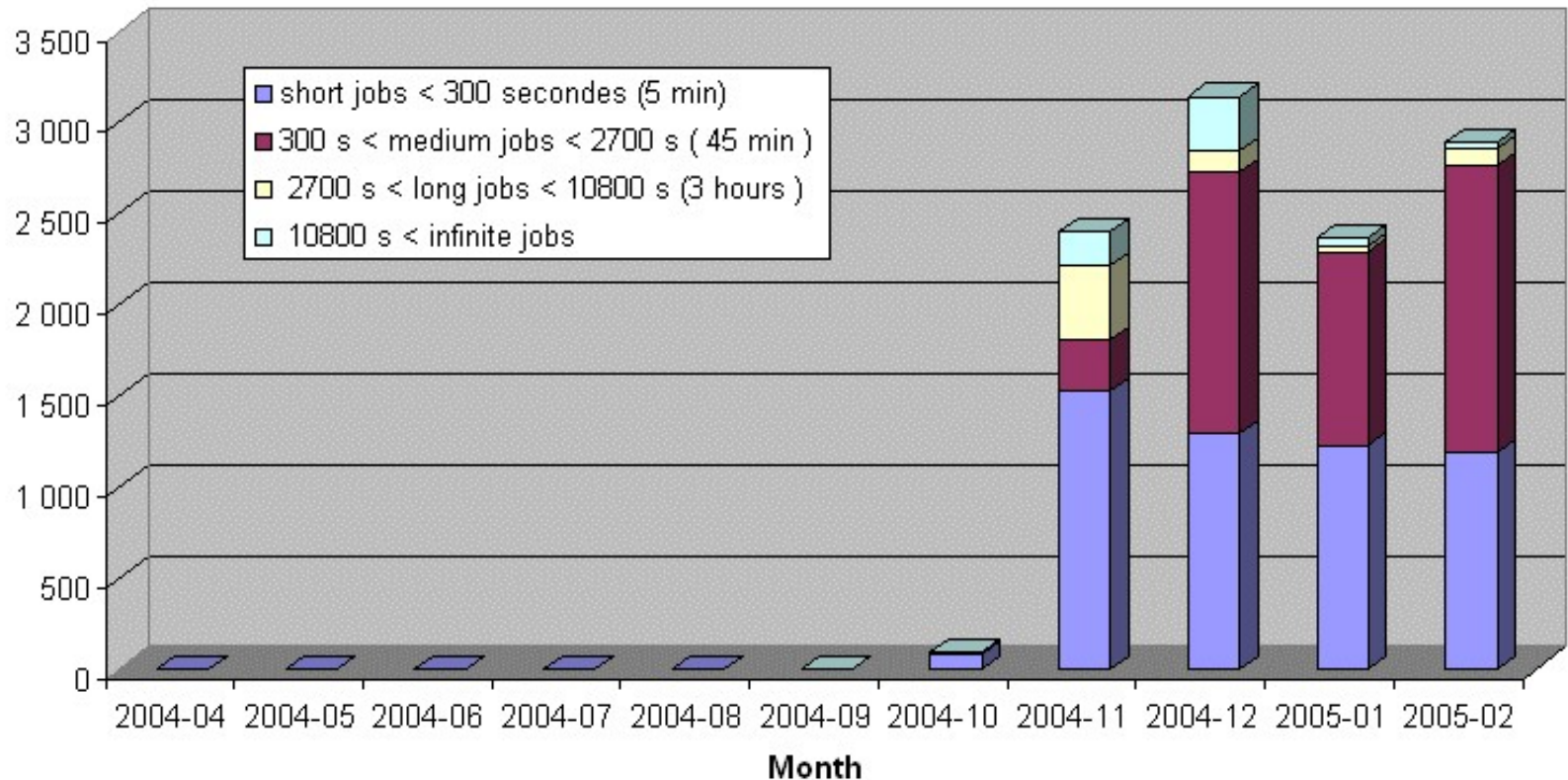


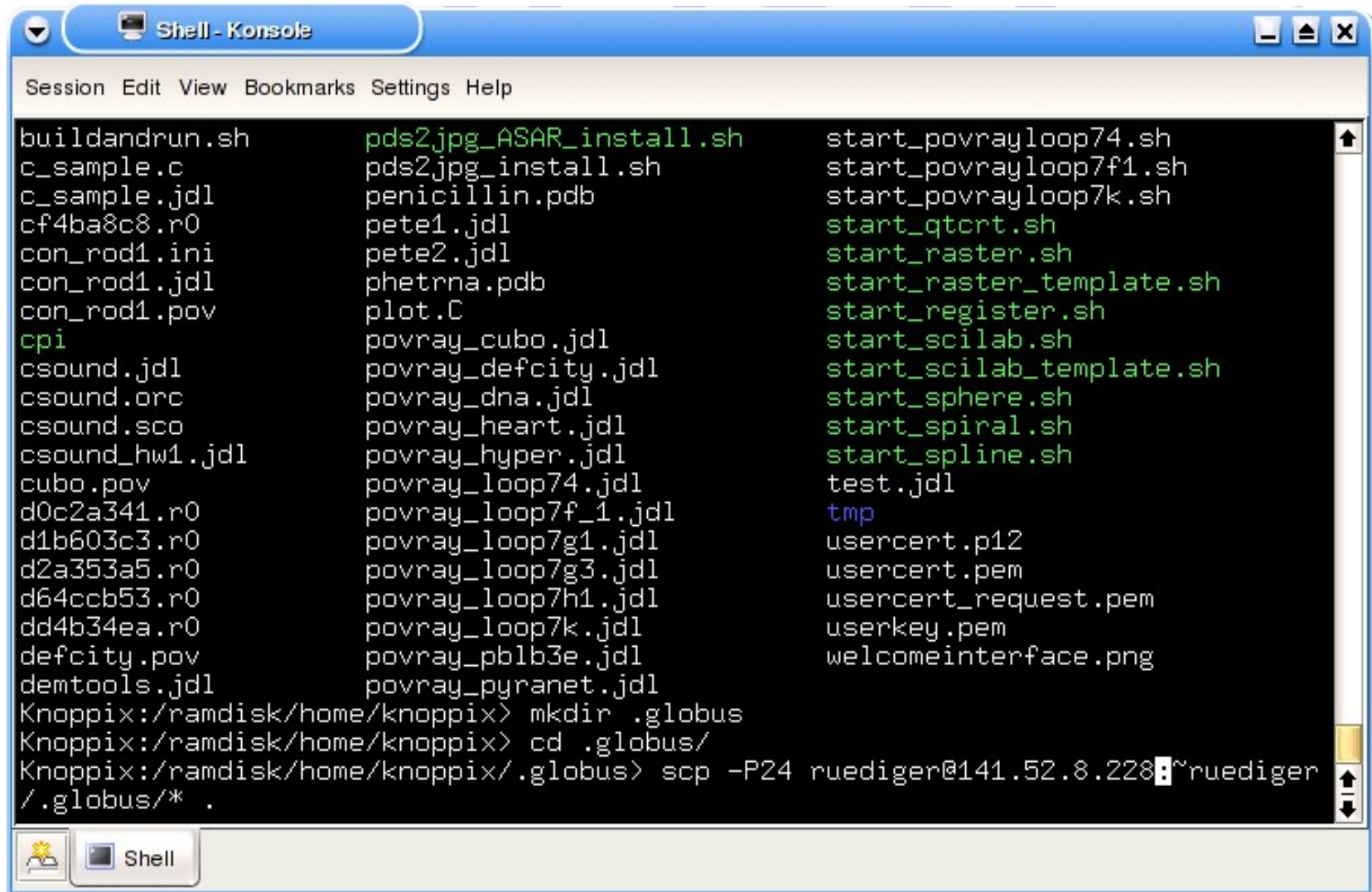
- 14 sites in 2 continents
- >1400 certificates issued, 10% renewed at least once
- >40 tutorials and demos performed in 12 months
- >40 jobs/day on the average
- Job success rate above 96%
- >400,000 hits on the web site from 10's of different countries
- >200 copies of the UI live CD distributed in the world
- >100 copies of the UI Plug&Play





Number of jobs





The screenshot shows a terminal window titled "Shell - Konsole" with a menu bar (Session, Edit, View, Bookmarks, Settings, Help). The terminal content is as follows:

```
buildandrun.sh      pds2jpg_ASAR_install.sh      start_povrayloop74.sh
c_sample.c          pds2jpg_install.sh          start_povrayloop7f1.sh
c_sample.jdl        penicillin.pdb              start_povrayloop7k.sh
cf4ba8c8.r0        pete1.jdl                   start_qtcrt.sh
con_rod1.ini        pete2.jdl                   start_raster.sh
con_rod1.jdl        phetrna.pdb                 start_raster_template.sh
con_rod1.pov        plot.C                       start_register.sh
cpi                povray_cubo.jdl             start_scilab.sh
csound.jdl          povray_defcity.jdl          start_scilab_template.sh
csound.orc          povray_dna.jdl              start_sphere.sh
csound.sco          povray_heart.jdl            start_spiral.sh
csound_hw1.jdl      povray_hyper.jdl            start_spline.sh
cubo.pov            povray_loop74.jdl           test.jdl
d0c2a341.r0         povray_loop7f_1.jdl         tmp
d1b603c3.r0         povray_loop7g1.jdl          usercert.p12
d2a353a5.r0         povray_loop7g3.jdl          usercert.pem
d64ccb53.r0         povray_loop7h1.jdl          usercert_request.pem
dd4b34ea.r0         povray_loop7k.jdl           userkey.pem
defcity.pov         povray_pblb3e.jdl           welcomeinterface.png
demtools.jdl        povray_pyranet.jdl
Knoppix:/ramdisk/home/knoppix> mkdir .globus
Knoppix:/ramdisk/home/knoppix> cd .globus/
Knoppix:/ramdisk/home/knoppix/.globus> scp -P24 ruediger@141.52.8.228:~ruediger
/.globus/* .
```

The terminal window has a taskbar at the bottom with a "Shell" icon and label.

```

ruediger@euridike:~/globus - Shell - Konsole
Session Edit View Bookmarks Settings Help
Knoppix:/ramdisk/home/knoppix> grid-proxy-init
Your identity: /O=GermanGrid/OU=FZK/CN=Ruediger Berlich
Enter GRID pass phrase for this identity:
Creating proxy ..... Done
Your proxy is valid until: Thu Apr 14 11:58:12 2005
Knoppix:/ramdisk/home/knoppix> edg-job-list-match hw.jdl

Selected Virtual Organisation name (from UI conf file): gilda
Connecting to host grid004.ct.infn.it, port 7772

*****
                        COMPUTING ELEMENT IDs LIST
The following CE(s) matching your job requirements have been found:

        *CEId*
dgt01.ui.savba.sk:2119/jobmanager-lcgpbs-infinite
dgt01.ui.savba.sk:2119/jobmanager-lcgpbs-long
dgt01.ui.savba.sk:2119/jobmanager-lcgpbs-short
gilda-ce-01.pd.infn.it:2119/jobmanager-lcgpbs-long
gildace.ct.astro.it:2119/jobmanager-lcgpbs-infinite
gildace.ct.astro.it:2119/jobmanager-lcgpbs-long
gildace.ct.astro.it:2119/jobmanager-lcgpbs-short
skurut1.cesnet.cz:2119/jobmanager-lcgpbs-gilda
grid011f.cnaf.infn.it:2119/jobmanager-lcgpbs-long
grid011f.cnaf.infn.it:2119/jobmanager-lcgpbs-short
gilda-ce-01.pd.infn.it:2119/jobmanager-lcgpbs-short
grid011f.cnaf.infn.it:2119/jobmanager-lcgpbs-infinite
gilda-ce-01.pd.infn.it:2119/jobmanager-lcgpbs-infinite
*****

Knoppix:/ramdisk/home/knoppix>
  
```

- Available from <https://gilda.ct.infn.it>
- Developed by INFN Catania
- Idea: Have a User Interface installed in a Knoppix Live CD
- A live CD contains an entire OS that runs of CD.
- Absolutely no modification of existing OS on harddrive required !
- No installation at all necessary – just boot from the CD
- Homogeneous environment !!!

- The Knoppix Linux distribution is installed in a compressed disk image, which can hold approx. 2 GB of data.
- Everything fits on a CD
- A Ramdisk allows to store data that needs to be modified in a Linux system (e.g. /home)
- V3.8.1 has an overlay filesystem (transparent writing of all files on disk)
- Knoppix can be easily customised. Literally hundreds of modifications exist for special purposes.

(See e.g. http://www.knoppix.net/wiki/Knoppix_Customisations)

- Knoppix is essentially a modified version of Debian
- This means that Knoppix does **not** use the common RPM package format, but uses instead the .deb format !
- A few useful commands:
 - Get list of packages:
`dpkg-query -l`
 - Remove packages:
`apt-get remove --purge <package-name>`
 - Install packages
`apt-get install <package-name>`
 - Getting rid of “orphans”:
`deborphan`

A few easy steps

(see http://www.knoppix.net/wiki/Knoppix_Remastering_Howto)

- Boot Knoppix, bring contents of compressed image to a writable disk partition
- “chroot” to Knoppix directory and modify content
- Create image and burn it to CD or DVD (possibly outside Knoppix)

Expect this to last **5-6 hours**, if you do it for the first time !

Boot Knoppix, bring contents of compressed image to a writable disk partition

- Start ROOT shell (Menu->Knoppix->Root Shell)
- `fdisk -l ->` Search for mountable partition
- `mount -rw /dev/hda2 /mnt/hda2`
- `cd /mnt/hda2`
- Make sure you have 1 GB of RAM (Swap + Physikal (`cat /proc/meminfo`))
- Make two directories: one for the new master CD, one for the source:
 - `mkdir -p /mnt/hda2/knx/master/KNOPPIX`
 - `mkdir -p /mnt/hda2/knx/source/KNOPPIX`
- Copy KNOPPIX files to the source directory:
 - `cp -Rp /KNOPPIX/* /mnt/hda2/knx/source/KNOPPIX` (takes 20 minutes)
 - `cp /cdrom/index.html /mnt/hda2/knx/master`
 - `cd /cdrom && find . -size -10000k -type f -exec cp \`
`-p --parents '{}' /mnt/hda2/knx/master/ \;`

“chroot” to Knoppix directory and modify content

- If programs are not available as Debian packages, make sure to copy them to the source directory: “cp mydata.tgz /mnt/hda2/knx/source/KNOPPIX”
- Make a backup of the knx directory, in case something goes wrong (avoid having to start all over again):

```
mkdir /mnt/hda2/knxback
cp -Rp /mnt/hda2/knx /mnt/hda2/knx
```
- chroot to the source directory:

```
chroot /mnt/hda2/knx/source/KNOPPIX /bin/bash
```
- Mount /proc directory (Important: Don't forget to unmount /proc before leaving the chroot environment !!!): “mount -t proc /proc proc” (ignore warning about missing fstab ...)
- Remove surplus packages with apt-get remove <package-name> OR decide to use DVD for the new image ...

“chroot” to Knoppix directory and modify content

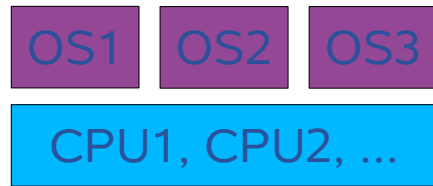
- Install packages you deem necessary (example ROOT)
 `mkdir /prog; tar -xvzf root.tgz; compile and install as normal`
 `./configure --prefix=/opt/root`
- don't forget to set various path variables, modify `/etc/ld.so.conf`
- If you want, try to install UI
- Remove `.bash_history` files (if any), temporary files, etc.
- “`umount /proc`” !!!
- Leave chroot environment (press `^D` or enter exit)
- Remove `.rr_moved`:
 `rm -rf /mnt/hda2/knx/source/KNOPPIX/.rr_moved`

Create image and burn it to CD or DVD

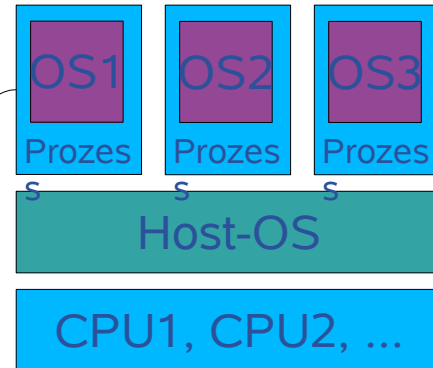
- Create KNOPPIX file:
`mkisofs -R -U -V "KNOPPIX.net filesystem" \
-publisher "KNOPPIX www.knoppix.net" -hide-rr-moved
-cache-inodes -no-bak -pad /mnt/hda2/knx/source/KNOPPIX | nice -5 \
/usr/bin/create_compressed_fs \
- 65536 > /mnt/hda2/knx/master/KNOPPIX/KNOPPIX`
- Ignore messages about non-ISO9660 conformant FS
- **Note the SPACE between "-" and "65536" !!!**
- Create final CD-ROM Image:
 - `cd /mnt/hda2/knx/master`
 - `rm -f KNOPPIX/md5sums; find -type f -not -name md5sums \
-not -name boot.cat -not -name isolinux.bin \
-exec md5sum '{} ' \; >> KNOPPIX/md5sums`
 - `mkisofs -pad -l -r -J -v -V "KNOPPIX" -no-emul-boot -boot-load-size 4 \
-boot-info-table -b boot/isolinux/isolinux.bin -c boot/isolinux/boot.cat \
-hide-rr-moved -o /mnt/hda2/knx/knoppix.iso /mnt/hda2/knx/master`

Virtualisation through hardware or specialised Master-OS (e.g.. Microkernel)

IBM zSeries
XEN
ESX Server



Guest-OS or emulated processor is process - higher overhead, but easier to implement



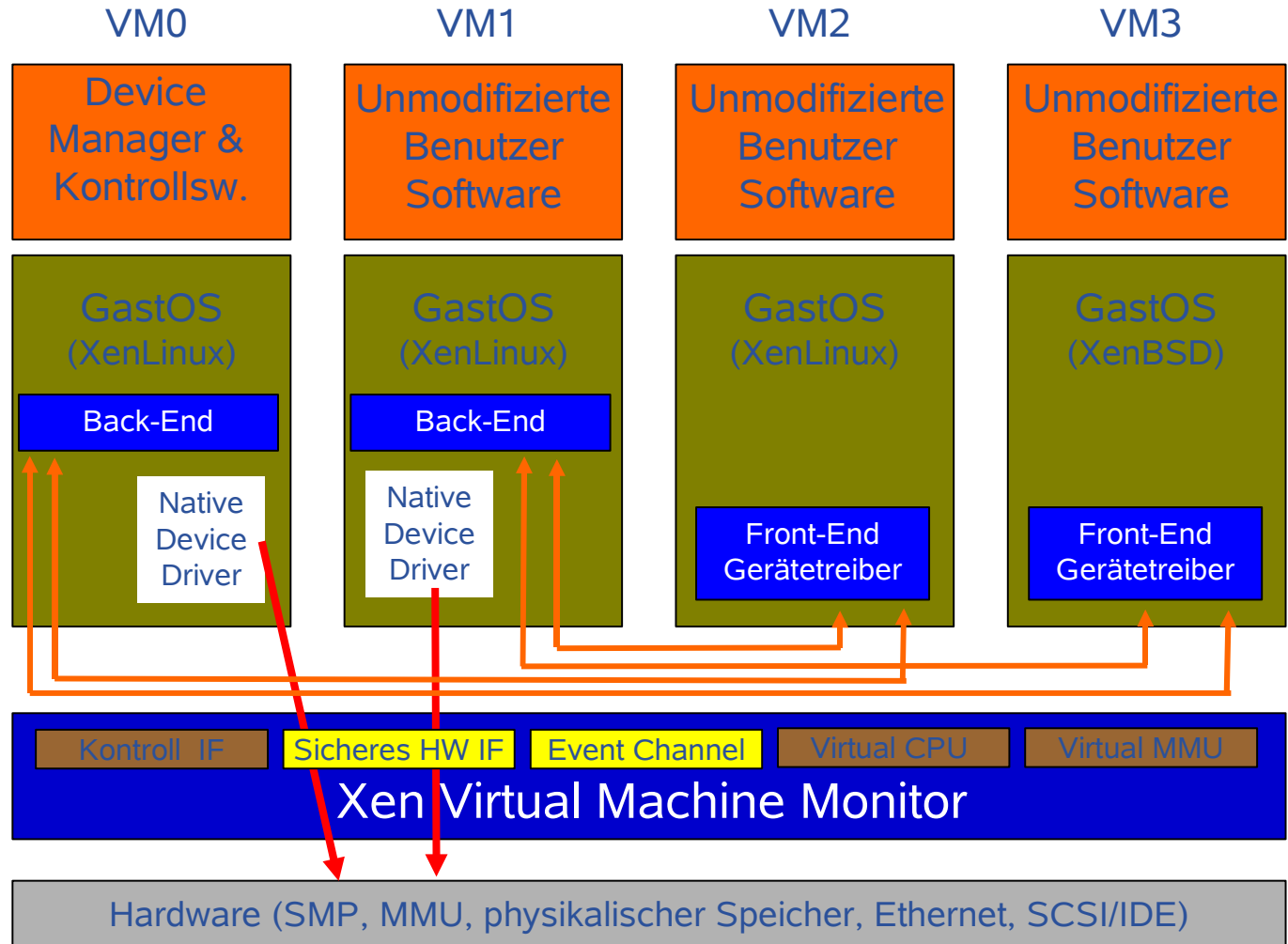
VMWare Workst.
GSX Server
Usermode Linux
Win4Lin
Bochs
Virtual PC
PearPC (PPC)
QEmu

Migration into Cluster or Grid ?



Expect about 90% of native performance !

Triple your training resources !






TightVNC: root's x11 desktop (xendemo-8:0)

Welcome to xendemo-8

Login:

Password:



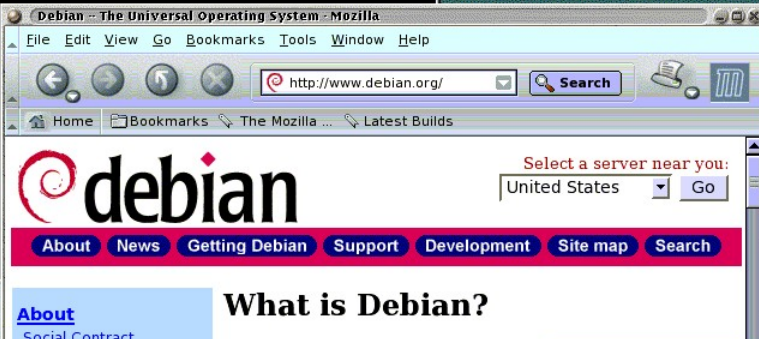
TightVNC: root's x11 desktop (xendemo-7:0)

```

Bash
xendemo-7:~# uname -a
Linux xendemo-7 2.6.10-xenU #2 Tue Mar 22 22:45:33 CET 2005 i686 GNU/Linux
xendemo-7:~#
  
```

Debian - The Universal Operating System - Mozilla

http://www.debian.org/



ruediger@orpheus:~ - Befehlsfenster

```

orpheus:~ # xm list
Name      Id Mem(MB) CPU State Time(s) Console
Debian-7  6   47      0 -b--- 16.1   9606
Domain-0  0  443      0 r----- 193.0
FreeBSD-6 5   47      0 -b--- 50.4   9605
NetBSD-8  7   47      0 -b---  1.7   9607

orpheus:~ # xm vif-list Debian-7
(vif (idx 0) (vif 0) (mac aa:00:00:10:b6:6f) (vif 0) (index 0))
orpheus:~ # xm vif-list Domain-0
orpheus:~ # xm vif-list FreeBSD-6
(vif (idx 0) (vif 0) (mac aa:00:00:15:c6:ee) (vif 0) (index 0))
orpheus:~ # xm vif-list NetBSD-8
(vif (idx 0) (vif 0) (mac aa:00:00:16:68:0e) (vif 0) (index 0))
orpheus:~ #
  
```

ruediger@orpheus:~ - Befehlsfenster - Konsole

```

xendemo-freebsd# uname -a
FreeBSD xendemo-freebsd 5.3-RELEASE FreeBSD 5.3-RELEASE #37: Mon Jan 24 16:11:53 PST 2005 kmacy@bldf1.eng.netapp.com:/t/niners/users/xen/bsd/sys-5.3/i386-xeno.tot/compile/XENCONF i386
xendemo-freebsd# ps
  PID TT  STAT      TIME COMMAND
   659 p0  Rs      0:00.08 -csh (csh)
   767 p0  R+      0:00.00 ps
   565 xc0 Is      0:00.01 login [pam] (login)
   608 xc0 I+      0:00.02 -csh (csh)
xendemo-freebsd#
  
```

Live Demo ??

The screenshot shows a web browser window displaying the Xen SV Web Interface. The address bar shows the URL: `http://localhost:8080/Main.rpy?mod=info&dom=29&tab=0`. The page title is "Domain Info" and it has three tabs: "General", "SXP", and "Devices".

On the left side, there is a sidebar with the Xen logo and the text "SV Web Interface (C) Tom Wilkie 2004". Below this are several links: "Node details", "Create Domain", "Migrate Domain", "Save Domain", and "Restore Domain".

The main content area displays the following information for domain VM1:

- Name: VM1
- ID: 29
- State: Paused, (--p--)
- Up Time: 0 weeks, 0 days, 00:02:58.6 (hh:mm:ss.s)
- Total CPU: 00:00:28.0 (hh:mm:ss.s)
- CPU: 0

Below the information, there are five circular icons: a bomb (destroy), a pause symbol, a starburst (reset), a power button, and a right arrow. Below these icons is the text "Unpause the Domain".

At the bottom of the page, there is a status bar that says "Page loaded.".

Domain	Name	State
0	Domain-0	r----
29	VM1	--p--
30	VM2	-b---
31	VM3	-b---
32	VM4	-b---
33	VM5	-b---

- Install & Admin Courses ?
- Take down single components and let trainee reinstall
- Unbreakable Grid – good for testing
- Testing new, insecure Grid techniques
- Self-Training: Download the disk-images for the virtual machines
- **Multiply ressources**

STABILITY ???

- Nice, **assumed-to-be stable** and high-performance technology available
- Building blocks for a “Grid in a box” are there
- Some people working on related projects
- Subcomponents available and applicable in many environments (Knoppix / UI)
- **Urge for more resources (“T-Infrastructure”) is an argument pro GiaB**
- **But probably much more work than visible on the surface; argument contra full-featured GiaB**

Thanks for listening ! Do you have questions ?

I'd like to thank the German Federal Ministry of
Education and Research, BMB+F,
as well as Forschungszentrum Karlsruhe / Germany for
their continuous interest and support !



bmb+f - Förderschwerpunkt
Hadronen -
und Kernphysik
Großgeräte der physikalischen
Grundlagenforschung