Oracle VM 3.0 Was nicht im Handbuch steht...

DOAG Konferenz 2012

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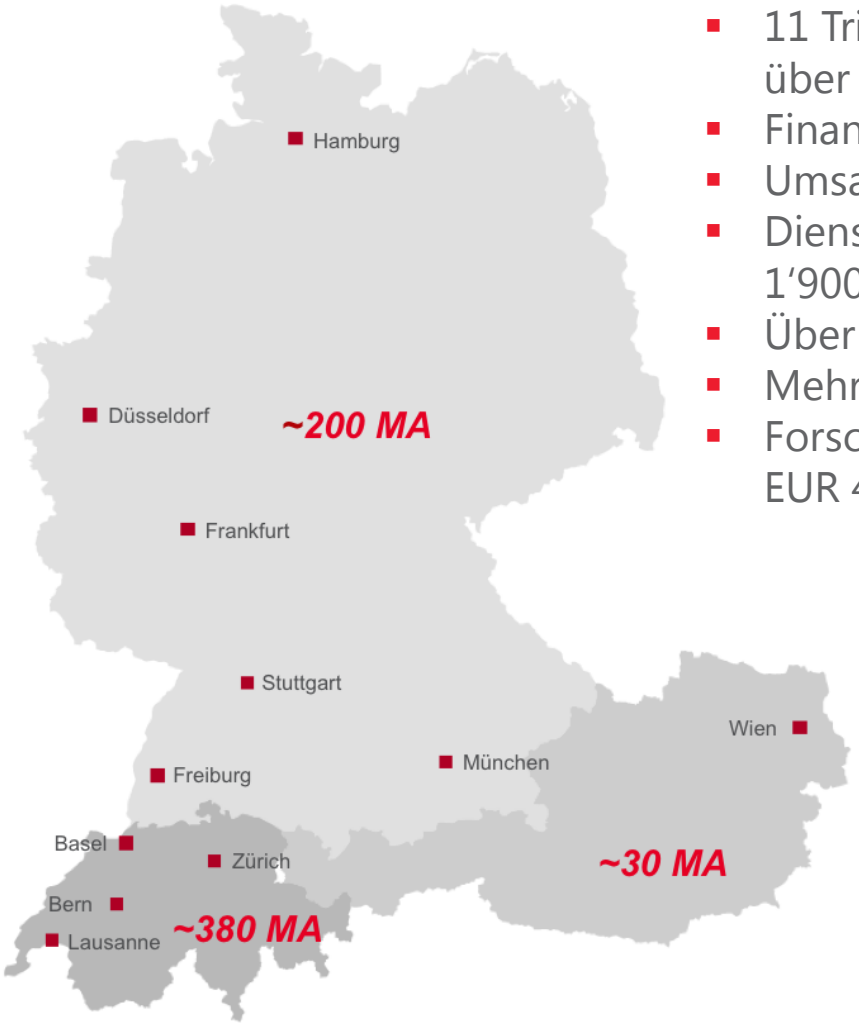

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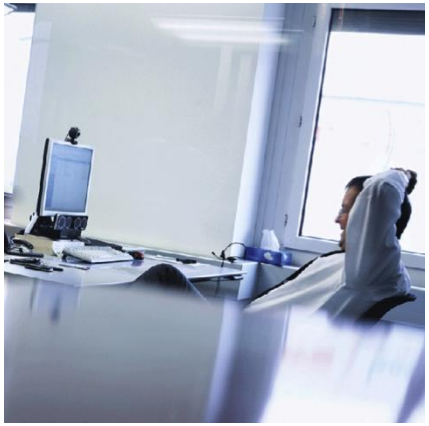

Compliance

- übersetzt
- optimiert
- umfassend

biGenius

- schnell
- einfach
- umfassend

Toolbox

- standardisiert
- generiert
- automatisiert

Infrastructure Care

- optimiert
- nachhaltig
- modular

Application Care

- planbar
- effizient
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Comprehensive Application Development

- unabhängig
- kompetent
- vollständig

AGENDA

1. Working on Commandline
2. Snapshots
3. High available database connect
4. Hard-partitioning

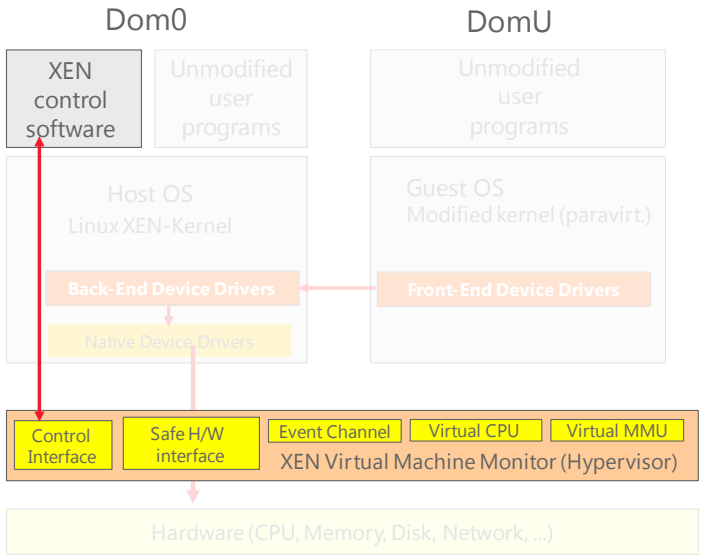
XEN commands

- OracleVM is based on XEN
  - "xm" is the tool to access control interface
    - Start a DomU

      `xm create /path-to/vm.cfg`
    - show DomU's

      `xm list; xm list -l`
    - Power-off a DomU

      `xm destroy <name_of_vm | number>`



XEN commands

- Show the running VM's
  - Unfortunately, Oracle uses an UUID name instead of name displayed in GUI

```
#   xm list
Name                                        ID   Mem VCPUs      State   Time(s)
0004fb0000060000059ec32f98918b07            20  2048     2     -b----  51543.1
0004fb00000600004c953ac4246637eb            19   512     1     -b----    756.0
0004fb0000060000008219e1e797e01b0d          29  2048     2     -b----    998.7
0004fb000006000088cde8cce067a63b            24  2048     2     -b----  60768.4
Domain-0                                     0  1134    16     r----- 474653.3
```

  - Fortunately, with a wrapper-script we can adapt the output

```
#  xm2 list
Shortname   Name                                ID  Mem VCPUs State   Time(s)
slot031     0004fb0000060000059ec32f98918b07  20 2048     2 -b----  51600.7
ovminfra    0004fb00000600004c953ac4246637eb  19  512     1 -b----    756.4
master249   0004fb0000060000008219e1e797e01b0d  29 2048     2 -b----   1003.8
slot001     0004fb000006000088cde8cce067a63b  24 2048     2 r-----  60829.3
Domain-0                                       0 1134    16 r----- 474750.4
```

XEN commands

- How to get the mapping from UUID to well-known name?
  - It is stored in the file /OVS/Repositories/*/VirtualMachines/*/vm.cfg

```
OVM_simple_name = 'slot031'
disk = …
...
uuid = '0004fb00-0006-0000-059e-c32f98918b07'
...
name = '0004fb0000060000059ec32f98918b07'
```

  - First, get the name of the configuration file for the given uuid (in $1):

```
vm_cfgfile=$( grep -l "name = '$1'" /OVS/Repositories/*/*/*/vm.cfg )
```

  - Afterwards, read the human-readable name from this file

```
vm_name=$( sed -n -e "s/^OVM_simple_name = '\(.*\)'/\1/p"  ${vm_cfgfile} )
```

  - Then, print the original "xm list" output, prefixed by the $vm_name

XEN commands

- "xentop": shows usage of hardware by VM's (xm top will do the same)
  - "top" only shows usage of curent domain

```
xentop - 10:20:36   Xen 4.0.2-OVM
3 domains: 1 running, 2 blocked, 0 paused, 0 crashed, 0 dying, 0 shutdown
Mem: 12581880k total, 5088772k used, 7493108k free    CPUs: 8 @ 2327MHz
      NAME  STATE   CPU(sec) CPU(%)     MEM(k) MEM(%)  MAXMEM(k) MAXMEM(%) VCPUS NETS NETTX(k) NETRX(k) VBDS   VBD_OO   VBD_RD   VBD_WR VBD_RSECT VBD_WSECT SSID
0004fb0000 --b---        223    0.2    2097152   16.7    2097152      16.7     2    1     3954       23    3        0    28983     6658    577707     94634    0
0004fb0000 --b---          0    0.1    2097152   16.7    2097152      16.7     2    1      132        0    1        0        0       28         0       224    0
  Domain-0 -----r       1183    4.8     752128    6.0  no limit       n/a     8    0        0        0    0        0        0        0         0         0    0

  Delay  Networks  vBds  Tmem  VCPUs  Repeat header  Sort order  Quit
```

  - Good to have a wide-screen ☺
  - Very bad! Output uses UUID-name of VM and cuts the name
    - you only see the first 10 chars, usually identical for all VM's

XEN commands

- Starting and stopping a VM on the server
  - Get the location of the vm.cfg file, then start it with xm commands

```
xm create /OVS/Repositories/.../vm.cfg
xm2 create slot002
```

  - OVM Manager detects change of state

  - VM can be handled by OVM Manager afterwards

XEN commands

- What is different to start via OVMM?
  - If the VM is configured "Enable High Availability" and the vm crashes

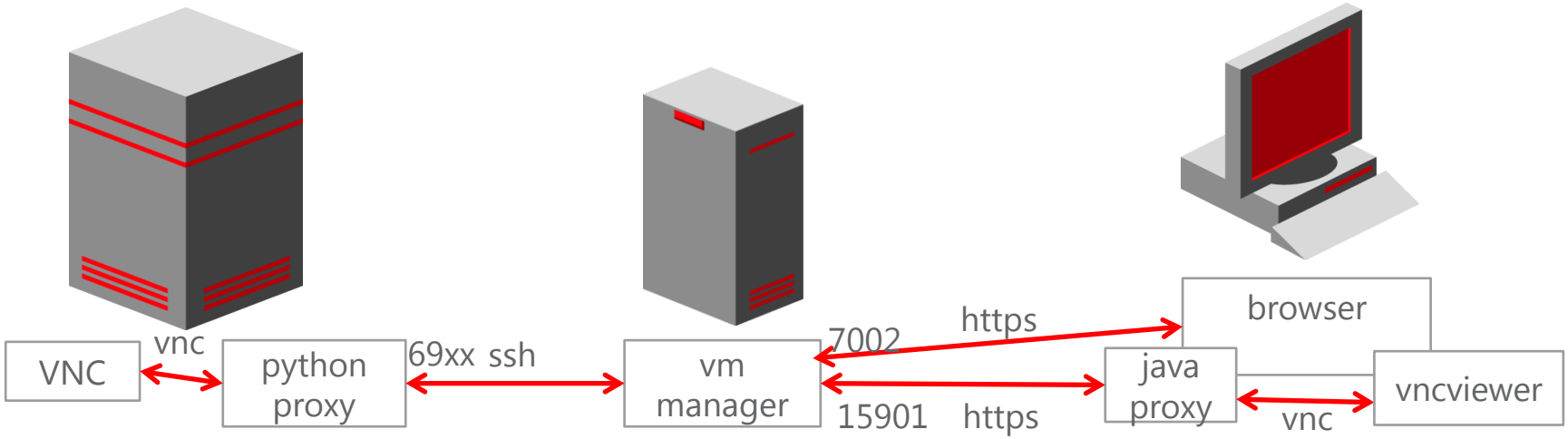
    - If started on server: the VM will not be automatically restarted
    - If started via OVMM: It will be monitored and restarted by a server agent
      - HA also works if the manager is down
      - "xm shutdown" on server works without automatic restart
  - → no problem to start on server as long as we do not use HA

  - Alternative 1: **ovm_vmcontrol** (from Oracle VM utilities)
    - but does not run on OVM Server (requires java), OK on OVM Manager
  - Alternative 2: OVM cli with the latest patch of OVM Manager 3.1.1
    - `ssh -p 10000 admin@ovmmanager "start vm name=slot002"`

Virtual Console

Access to the console of the VM

- VNC protocol ist tunneled via http(s) to the Manager
  - On OVM Server the console is started
    - /usr/bin/python /opt/ovm-console/vncViewer/vnc.py 127.0.0.1 34171
  - On client, via browser, a Java proxy is downloaded



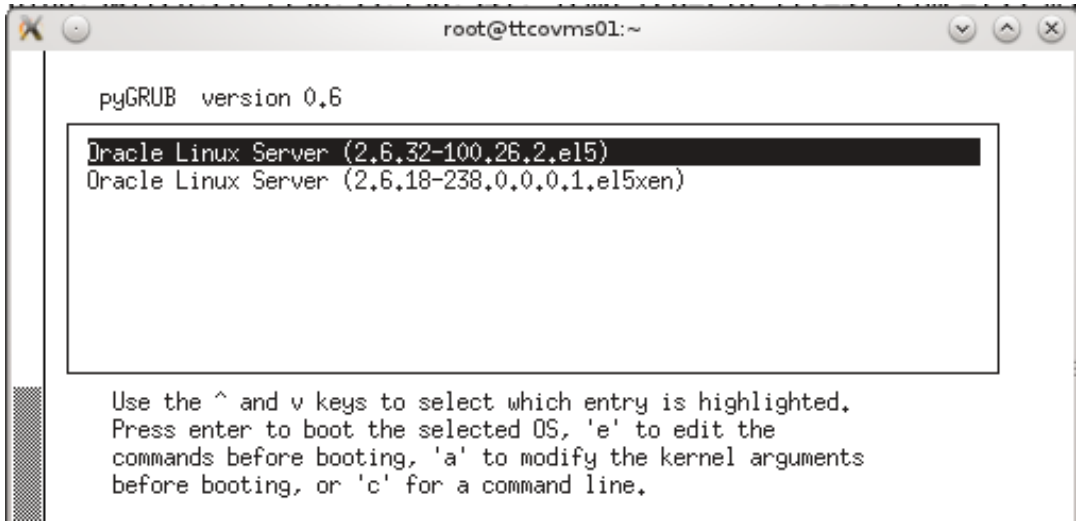
Virtual Console in text-mode

- Why do so?
  - VNC console does not work (wrong Java-Version on client)
  - Troubleshooting boot-procedure
    - If it does not boot (no output on vnc-console), use the textmode console
      - See note ID 579413.1
      - Maybe the wrong kernel is set as default
      - Leave the console with Ctrl-] or Ctrl-5
      - To see the whole boot-process in textmode console:
        > remove temporarily "vfb=" entry in vm.cfg

Virtual Console in text-mode

- Start the console
  - Login to OVM server and start it manually
    - in this textmode-console, the emulated GRUB bootloader is accessible
      - Not displayed in VNC console (emulation running outside of VM)

```
xm create -c /<path_to>/vm.cfg extra="console=xvc0"
```



    - Leave the console with Ctrl-] or Ctrl-5
    -

Virtual Console in text-mode (permanent setting)

- Modify the VM for textmode-console
  - Inside the VM:
    - /etc/inittab

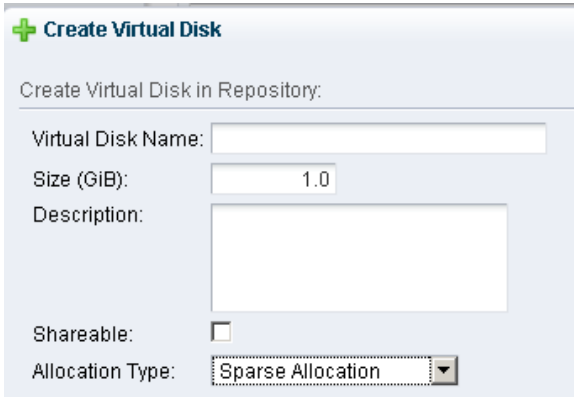
```
# Run a getty on the virtual console
co:2345:respawn:/sbin/agetty xvc0 9600 vt100-nav
```

    - /boot/grub/menu.lst

```
kernel /vmlinuz ... console=xvc0
```

    - Without modifying menu.lst
      - Boot-messages are displayed in VNC console
      - But afterwards, login is possible in text-mode **and** VNC console

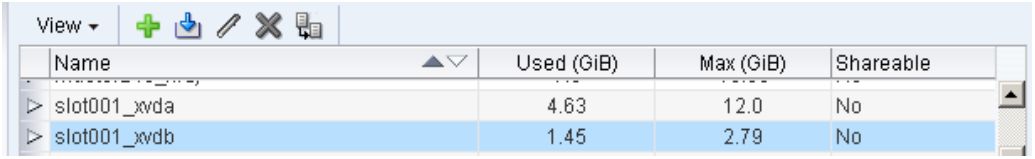
Creating virtual disks on commandline

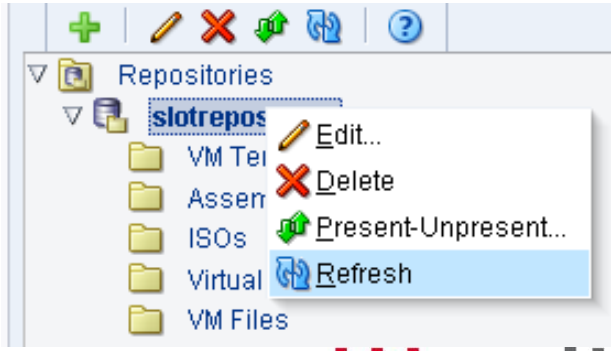


- Can be done via GUI
  - But not very efficient to create 100 similar disks...
- Solution: Can be done on commandline and OVM Manger recognizes it
  - Example: creating sparse-disks on the server

```
cd /OVS/Repositories/0004fb0000030000078778888fdcdb96e/VirtualDisks
for i in {01..30}; do
  nr=$(printf "%02d" $i)
  dd if=/dev/zero of=slot0${nr}_xvda bs=1k count=0 seek=12582912
  dd if=/dev/zero of=slot0${nr}_xvdb bs=1k count=0 seek=2929688
done
```

  - Afterwards, re-scan the repository
    - Found disks will be registered in OVMM
    - With the name of the file (no UUID)





Add missing commands - BusyBox

- OVM server only contains minimal packages
  - It is possible to install additional RPM packages, but not supported
  - Essential tools for troubleshooting are missing
    - traceroute, nslookup, telnet, ...
  - Solution without installing additional RPM's:
    - **BusyBox** - The Swiss Army Knife of Embedded Linux
    - Static binary, containing many of these small tools
    - Get busybox binary from a Linux installation and copy it to /usr/local/bin

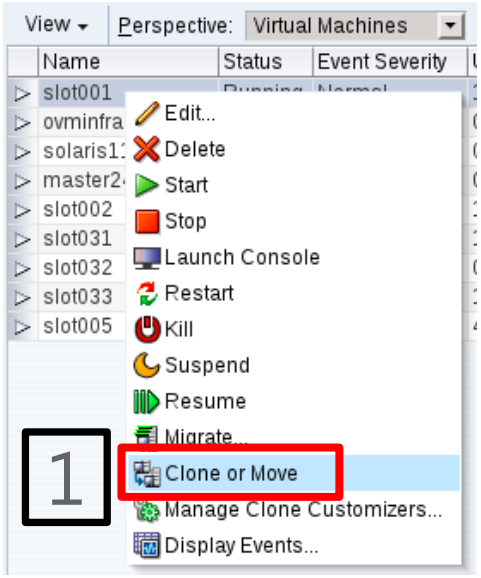
```
# busybox <command>  <arguments>
busybox nslookup ttcovms02.ttc.trivadis.com
busybox traceroute ttcovms02.ttc.trivadis.com
busybox telnet ttcovms02.ttc.trivadis.com 22
# if symlinked to <command>, it can be called directly
ln -s /usr/local/bin/busybox /usr/local/bin/telnet
telnet ttcovms02.ttc.trivadis.com 22
```

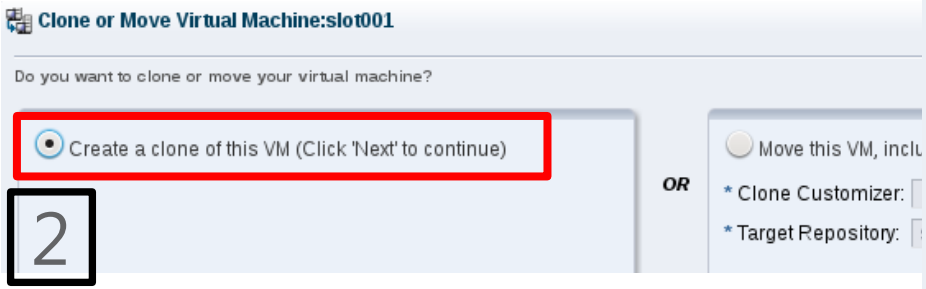
AGENDA

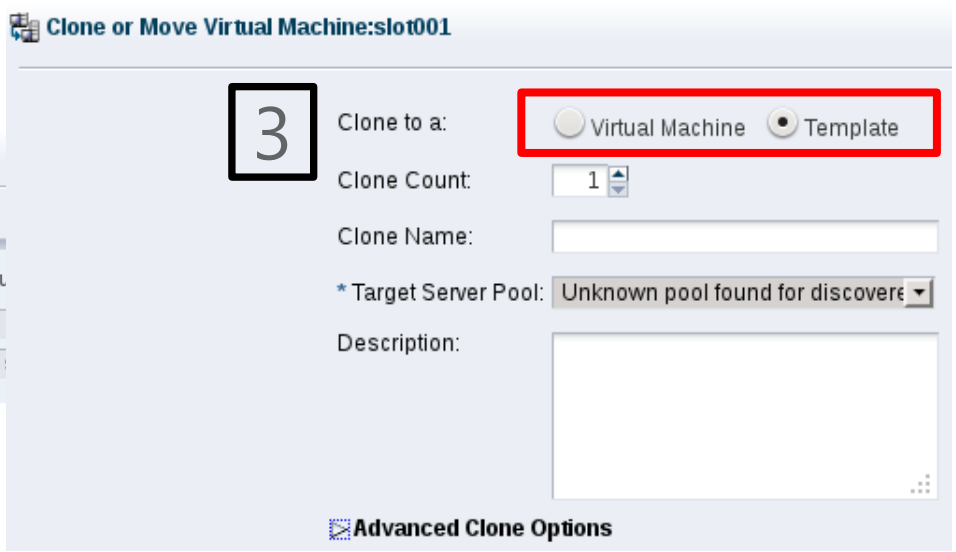
1. Working on Commandline
2. Snapshots
3. High available database connect
4. Hard-partitioning

Clone, Snapshot

- What is aSnapshot?
  - Saved state of a VM
- There are no snapshots like in VMware or VirtualBox
  - Take a snapshot and revert to it at a later time
- But: you can clone a VM
  - Create a template (recommended)
  - Create a new VM







Clone

- What cloning will do:
  - Copy files (if possible, a snapshot copy is created (on ocfs2))
  - Create new vm.cfg file
  - Register it as a template or new VM
- How to "revert to snapshot", the function that does not exist?
  - Create a clone (template) instead of a "snapshot"
  - "revert to snapshot" means, exchange the disks from the template with the disks of the VM
  - That is supported. We **do not change the definition of the VM**, we **exchange the contents of the disks**

Snapshots of a VM: Restore from a clone

- Restore of a clone
  - Get the disks of original and clone VM (vm.cfg)

    'file:/OVS/Repositories/…/VirtualDisks/<uuid>.img,xvda,w'
    - Filename
    - Devicename (inside VM)

```
origcfg=$(grep -l "OVM_simple_name = '$orig'" /OVS/Repositories/*/VirtualMachines/*/vm.cfg)
clonecfg=$(grep -l "OVM_simple_name = '$clone'" /OVS/Repositories/*/*/*/vm.cfg )

origdisks=$( grep "^disk *= *\[" $origcfg | \
             sed -e "s/^disk.*\[\(.*\)\].*/\1/g" | sed -e "s/', *'/' '/g")
clonedisks=$(grep "^disk *= *\[" $clonecfg | \
             sed -e "s/^disk.*\[\(.*\)\].*/\1/g" | sed -e "s/', *'/' '/g")
```

  - Stop the VM before restoring the clone
    - Caution! Check if it is not running on another node

```
xm destroy $(basename `dirname $origcfg` )
```

    - Better: with OVM cli

```
ssh -p 10000 admin@ovmmanager "kill vm name=$orig"
```

Snapshots of a VM: Restore from a clone

- Map the cloned disks to the original disks (same device-name)

```
for i in $origdisks; do
   #extract the filename
   origfile=${i#*:}
   origfile=${origfile%%,*}
   #extract the VM devicename
   origvmdevice=${i%,*}
   origvmdevice=${origvmdevice#*,}

   for j in $clonedisks; do

     if [ -z ${j/*,$origvmdevice,*} ]; then #if ",$origvmdevice," found, then …
       #extract the filename
       clonefile=${j#*:}
       clonefile=${clonefile%%,*}
       <WhatToDo>
     fi

   done
 done
```

Snapshots of a VM: Restore from a clone

- <WhatToDo>
  - Replace the original files with the files of the clone

```
rm –f $origfile
reflink $clonefile $origfile
#or "mv $clonefile $origfile"  if snapshot is no longer needed
```

  - Exchange the files of original and clone (current state is the new clone)

```
mv $origfile $origfile.tmp
reflink $clonefile $origfile
mv $origfile.tmp $clonefile
```

- Afterwards, restart the VM
  - Can be done on server, OVM Manager detects it

```
xm create $origfile
```

  - Better (supported): with OVM cli

```
ssh –p 10000 admin@ovmmanager "start vm name=$orig"
```

Snapshots of a VM: Without OVM Manager

- Implementation of Snapshots without Clones via OVM Manager
  - With scripts on server
    - Create a directory "snapshots" on the same level as "VirtualDisks"
    - Get filename of VM and create reflink to snapshot

```
reflink   VirtualDisks/disk1.img   snapshots/disk1.img.$(date +%Y%m%d-%H%M%S)
```

    - Restore is similar to "clone" description above
      - Identification of required snapshot files via naming-convention, not via config-file
  - Possibility to store the memory-content of the VM in the snapshot
    - Suspend the VM and make a snapshot of the "state" file (and diskfiles)

```
reflink $(dirname $origfile)/state  snapshots/state.$(date +%Y%m%d-%H%M%S)
```

AGENDA

1. Working on Commandline
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3. High available database connect
4. Hard-partitioning

Repository Database with RAC, DataGuard or Failover Cluster

- OVM Manager connects to repository-DB via jdbc thin-driver
  - SQL*Net configuration (tnsnames.ora, ldap) is NOT used
- Initial setup for database connect
  - jdbc:oracle:thin:@Host:Port:SID
  - Failover Cluster
    - OK if "Host" is a VIP address
  - RAC
    - If "Host" is the SCAN-address, good idea
    - but it does not work with SID → SERVICE_NAME is required
  - DataGuard
    - Does not work with "Host", databases on different hosts (no VIP addresses)
    - Use SERVICE, not SID; otherwise the standby could be connected
- What we need is a failover connect

Repository Database with RAC, DataGuard or Failover Cluster

- Failover connect
  - Jdbc-thin driver allows connect-time failover, but not transparent appl. failover

  - RAC

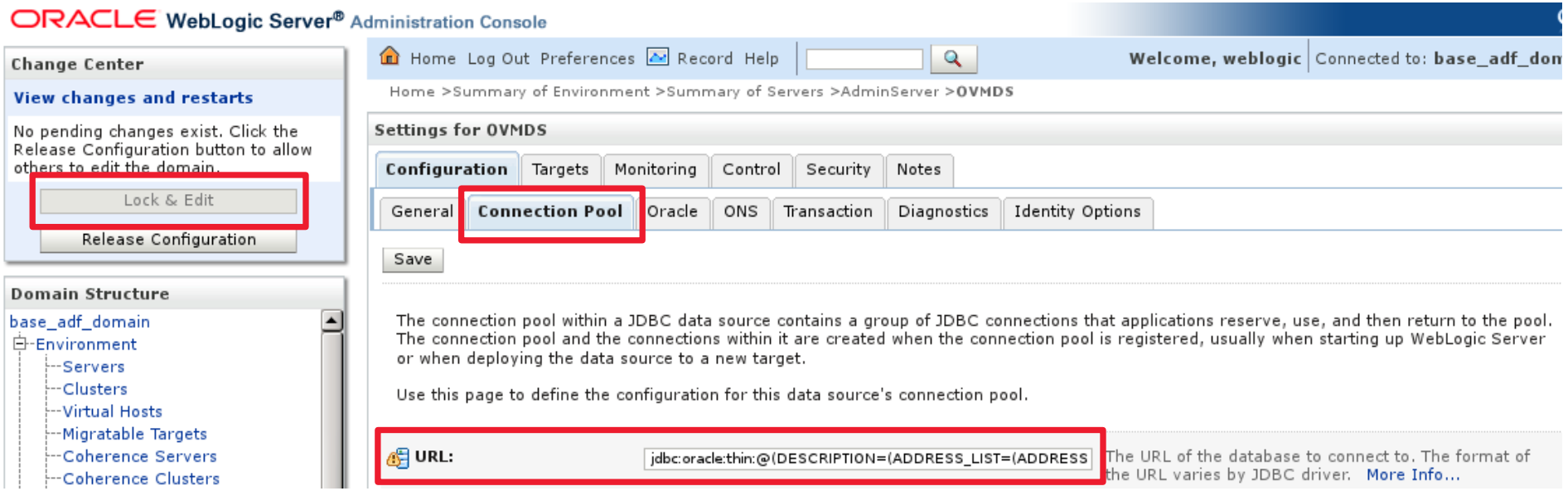
```
jdbc:oracle:thin@(DESCRIPTION=(ADDRESS=(PROTOCOL=TCP)(HOST=SCAN_IP)(PORT
=1521))(CONNECT_DATA=(SERVICE_NAME=OVMSERVICE.domain))
```

  - DataGuard

```
jdbc:oracle:thin@(DESCRIPTION=
(FAILOVER=ON)(LOAD_BALANCE=OFF)(ADDRESS_LIST=
(ADDRESS=(PROTOCOL=TCP)(HOST=site1)(PORT=1521))
(ADDRESS=(PROTOCOL=TCP)(HOST=site2)(PORT=1521)))
(CONNECT_DATA=(SERVICE_NAME=OVMSERVICE.domain)))
```

Repository Database with RAC, DataGuard or Failover Cluster

- Configure Failover connect
  - Login to Weblogic (url like OVMM, but /console instead of /ovm/console)
  - Domain Structure: base_adf_domain → Services→ Data Sources:
  - click "OVMDS", then "Connection Pool" tab



Repository Database with RAC, DataGuard or Failover Cluster

- Automatic re-connect
  - From the page before, scroll down to "Advanced" and expand it
  - Check "Test Connections On Reserve"
  - Test Frequency: e.g. 5
  - Seconds to Trust an Idle Pool Connection: e.g. 10
  - Connection Creation Retry Frequency: e.g. 5

  - Usually it takes some minutes until the connection is re-established

AGENDA

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Hard partitioning

Why Oracle VM for virtualization

- Oracle accepts hard-partitioning for licensing (ID 466538.1)
  - Hard-partitioning
    - explicitly assign physical CPU-cores to a VM
    - The VM can only use these cores (the default is all cores)
    - On top of the physical cores: virtual CPU's can be configured
  - You only have to pay licenses for the assigned cores
  - On VMWare there is no hard-partitioning accepted
    - All available cores have to be licensed (in a cluster all cores on all nodes!)

Hard-partitioning – What is a CPU in OracleVM?

- A physical core is a CPU in OVM

Socket 0		Socket 1	
Core 0	Core 1	Core 0	Core 1
CPU0	CPU1	CPU2	CPU3

physical hardware on server

In ovm presented CPUs

  - If using hyperthreading (HT), a core is visible as multiple CPU's
    - Carefully test, if it is better for your system
    - often it is better to deactivate HT

Socket 0				Socket 1			
Core 0		Core 1		Core 0		Core 1	
HT 0	HT 1	HT 0	HT 1	HT 0	HT 1	HT 0	HT 1
CPU0	CPU1	CPU2	CPU3	CPU4	CPU5	CPU6	CPU7

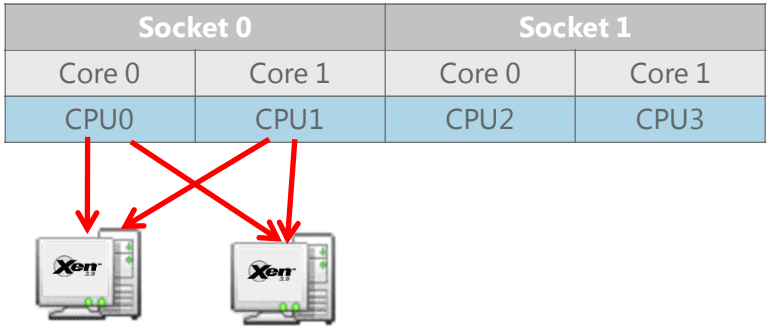
physical hardware on server

Threads presented as CPUs

In ovm presented CPUs

Hard-partitioning

- The same physical core can be assigned to more than one VM



- You only have to pay Oracle licenses for assigned cores (ID 466538.1)
  - But: live-migration is not permitted
    - no Dynamic Power Management / Dynamic Resource Scheduler
    - no server-maintenance without VM downtime
- Setup is not possible via GUI, edit vm.cfg
  - or use ovm_vmcontrol from the OracleVM3 utilities (patch 13602094)
  - www.oracle.com/technetwork/server-storage/vm/ovm-hardpart-168217.pdf

Hard-partitioning

- Per default, only virtual CPUs are allocated
  - Can run on any physical core (Benefit: using the least used core)

```
vcpus = 2
```

```
[root@elektra ~]# xm vcpu-list 3
Name                                ID  VCPU   CPU State   Time(s) CPU Affinity
0004fb00000600000a44c1da6a887b00     3     0     6   -b-     560.9 any cpu
0004fb00000600000a44c1da6a887b00     3     1     7   -b-     161.9 any cpu
```

- Edit the vm.cfg file and add "cpus" to limit the VM to certain cores

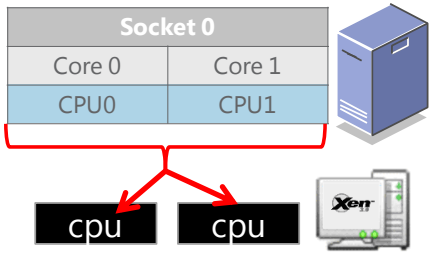
```
vcpus = 4
cpus = "1,3"
```

```
Name                                ID  VCPU   CPU State   Time(s) CPU Affinity
0004fb0000060000a980f351496991cc     4     0     1   -b-       1.0 1,3
0004fb0000060000a980f351496991cc     4     1     1   -b-       0.7 1,3
0004fb0000060000a980f351496991cc     4     2     3   r--      20.5 1,3
0004fb0000060000a980f351496991cc     4     3     1   ---       0.9 1,3
```

Hard-partitioning

- But can we assign virtual CPUs explicitely to a CPU Core?
  - Yes, we can. This feature is not well documented...
  - Instead of

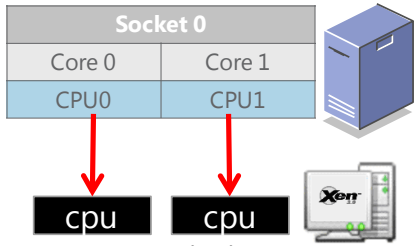
```
vcpus = 2
cpus = "0,1"
```




```
Name                                ID  VCPU   CPU State   Time(s) CPU Affinity
0004fb0000060000a980f351496991cc     4     0     1   -b-       1.0 0,1
0004fb0000060000a980f351496991cc     4     1     1   -b-       0.7 0,1
```

  - Use a slightly different syntax

```
vcpus = 2
cpus = ["0","1"]
```




```
Name                                ID  VCPU   CPU State   Time(s) CPU Affinity
0004fb0000060000a980f351496991cc     4     0     0   -b-       1.0 0
0004fb0000060000a980f351496991cc     4     1     1   -b-       0.7 1
```

Hard-partitioning

- Is explicit mapping Core-CPU better? It depends...
  - No overhead to switch tasks between physical cores
  - In OVM 2, substantial performance gain
    - In OVM 3, only slight difference

  - If Cores are assigned to only 1 VM, it is better to do this mapping
  - If Cores are assigned to more than 1 VM, it is better to use dynamic mapping
    - If 1 Core is used 100% by a process in a VM, it would probably be better if another VM can map 2 CPUs to the less used Core
    - The CPU scheduler inside the VM does not know that 1 CPU is slower because it is running on a overloaded core
  - → That's only theory! Test carefully what is better ☺

THANK YOU.

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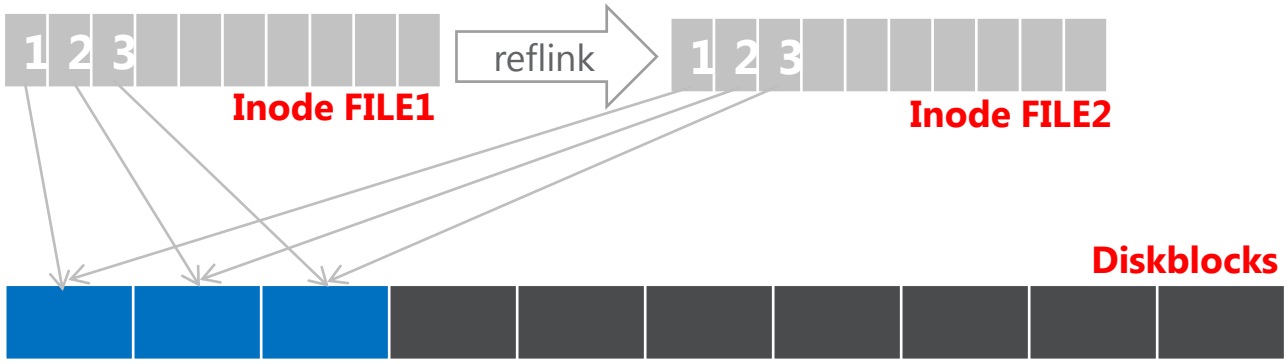
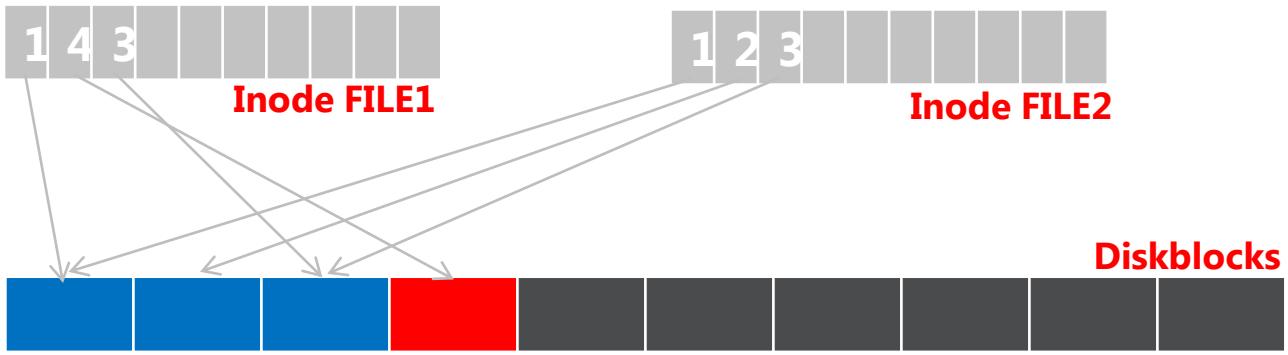
ANNEX

Snapshot of diskfiles with OCFS2: Reflink

reflink FILE1 FILE2

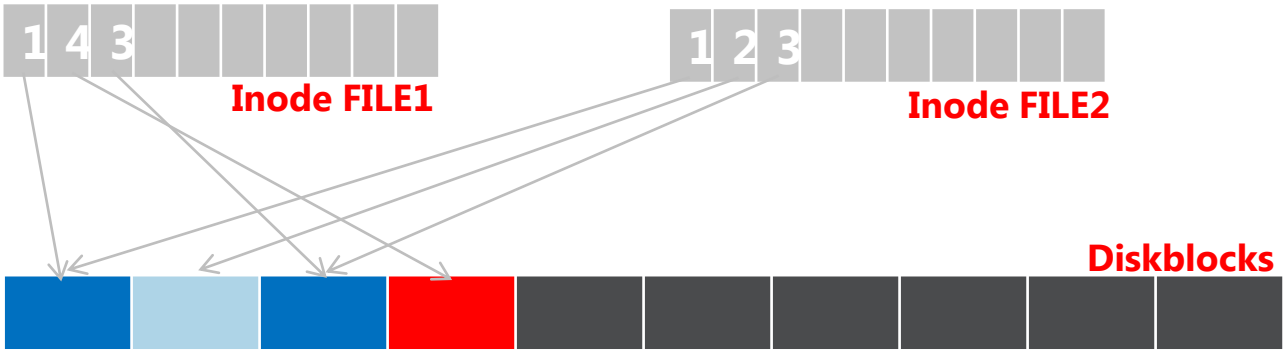


Change block 2 in FILE1

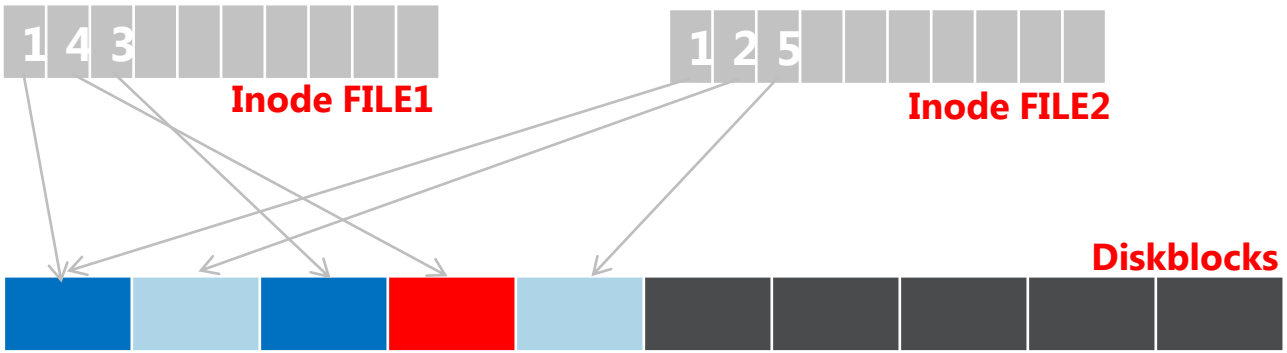


Snapshot of diskfiles with OCFS2: Reflink

Change block 2 in FILE2



Change block 3 in FILE2



Snapshot of diskfiles with OCFS2: Reflink

```
# df -k .
Filesystem           1K-blocks      Used Available Use% Mounted on …
                     976563200  63370240 913192960   7% …
# reflink file1 file2
# df -k .
Filesystem           1K-blocks      Used Available Use% Mounted on …
                     976563200  63370240 913192960   7% …
# ls -l file?
-rw-r--r-- 1 root root 2000000000 Mar 27 17:09 file1
-rw-r--r-- 1 root root 2000000000 Mar 27 17:11 file2
# dd if=/dev/zero of=file1 bs=1M count=1000 seek=500 conv=notrunc
1000+0 records in
1000+0 records out
1048576000 bytes (1.0 GB) copied, 17.5098 seconds, 59.9 MB/s
# df -k .
Filesystem           1K-blocks      Used Available Use% Mounted on …
                     976563200  64418816 912144384   7% …
# dd if=/dev/zero of=file2 bs=1M count=1000 seek=500 conv=notrunc
1000+0 records in
1000+0 records out
1048576000 bytes (1.0 GB) copied, 13.5592 seconds, 77.3 MB/s
# df -k .
Filesystem           1K-blocks      Used Available Use% Mounted on …
                     976563200  64418816 912144384   7% …
```