

Block Level Backups with EMC NetWorker

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Abstract

We discuss here image backup of Windows, Linux and other operating systems, without using a EMC NetWorker agent in the operating system. There is a new feature in Oracle VirtualBox since version 3.2, which allows the backup of live snapshots. We show in this paper some experiences with making image backups of live snapshots, and restoring them, using EMC NetWorker software. For backup, we use `savepnp` and the `VBoxManage snapshot take` and `VBoxManage snapshot delete` commands. Instead of installing a EMC NetWorker agent inside the guest operating system, this is a true online block-level backup of the virtualized operating system. It does not require taking the guest OS offline.

1 Theory of operation

EMC NetWorker has a command called `savepnp` which allows the execution of a precommand and a postcommand before and after actually saving any files.

For a specific virtual machine called `virtclient`, we use as precommand:

```
VBoxManage snapshot virtclient take nsr
```

And after the image backup of the snapshot, we use as postcommand:

```
VBoxManage snapshot virtclient delete nsr
```

This theory is fairly simple, and works fine with Oracle VirtualBox 3.2, as we will show in this paper.

During backup, a live snapshot called `nsr` temporarily exists, and the virtualised operating system continues to work (without going offline).

At the end of the backup, the live snapshot is deleted, and the differences are automatically merged into the running image.

For a restore, we restore the following files using EMC NetWorker :

```
/root/.VirtualBox  
/vbox/Machines  
/vbox/HardDisks
```

And subsequently we restore the live snapshot using :

```
VBoxManage snapshot win2003 restore nsr
```

2 Test setup

We use the following version of Oracle VirtualBox for our test :

```
# pkginfo -l SUNWvbox
  PKGINST: SUNWvbox
    NAME: Oracle VM VirtualBox
  CATEGORY: application
    ARCH: i386
  VERSION: 3.2.6,REV=2010.06.25.16.01.63112
  BASEDIR: /
  VENDOR: Oracle Corporation
```

The important point is that the version is more recent than 3.2, because it is only since version 3.2 that deleting live snapshots works.

The EMC NetWorker version is :

```
# pkginfo -l LGTOclnt
  PKGINST: LGTOclnt
    NAME: NetWorker Client
  CATEGORY: application
    ARCH: i386
  VERSION: 7.5.2.Build.452
  BASEDIR: /usr
  VENDOR: EMC Corporation.
```

Because we only use basic savepnc functionality, probably any EMC NetWorker version would work fine.

3 Configuring a Windows 2003 test client

All commands will be performed as user *root*.

This is important since EMC NetWorker runs as root, so if we will use scripts (savepnc commands) to make backups, these scripts will also run as *root*.

First we create a virtual machine. As user *root*, we execute the following command :

```
# VBoxManage list ostypes | grep 2003
ID: Windows2003
Description: Windows 2003
ID: Windows2003_64
Description: Windows 2003 (64 bit)
```

Next, we create a virtual machine that we will locate on a special filesystem /vbox :

```
# VBoxManage createvm --name win2003 --basefolder /vbox/Machines --ostype Windows2003
Oracle VM VirtualBox Command Line Management Interface Version 3.2.6
(C) 2005-2010 Oracle Corporation
All rights reserved.

Virtual machine 'win2003' is created.
UUID: 177dfaae-0edd-4a1a-b426-8859c2a993b4
Settings file: '/vbox/Machines/win2003/win2003.xml'
```

Next, we register the virtual machine, and check the VirtualBox directory in the /root home directory :

```
# VBoxManage registervm /vbox/Machines/win2003/win2003.xml
Oracle VM VirtualBox Command Line Management Interface Version 3.2.6
(C) 2005-2010 Oracle Corporation
All rights reserved.

# ls /root/.VirtualBox
compreg.dat      VirtualBox.xml  xpti.dat
```

Note that the /root directory now contains some info on the setup, which we will also have to make sure is being backed up by EMC NetWorker.

Finally, we launch the X11 front-end to a remote machine, to configure the Oracle VirtualBox as user *root*. We do this remotely because we do not logon locally as user *root* on the machines :

```
# DISPLAY=10.0.0.1:0.0
# export DISPLAY
# VirtualBox &
```

In the GUI, we add some storage (IDE hard drive and CD-rom) and we install the Windows 2003 R2 operating system from an ISO image of Microsoft Windows 2003 R2.

```
# VBoxManage showvminfo win2003

Storage Controller Name (0):          IDE Controller
Storage Controller Type (0):         PIIX4
Storage Controller Instance Number (0): 0
Storage Controller Max Port Count (0): 2
Storage Controller Port Count (0):    2
IDE Controller (0, 0): /vbox/Harddisks/win2003.vdi (UUID: 83eaa4ba-cc69-474d-9bbc-2e2a87
```

The virtual machine thinks it uses an IDE 20GB harddisk (which is mapped to the /vbox/Harddisks/win2003.vdi file).

Next we start the machine and grant VRDP access to the virtual machine, so to control the console via RDP (remote desktop). We do this via the VBoxHeadless command.

```
# VBoxHeadless -s win2003 &
VirtualBox Headless Interface 3.1.2
(C) 2008-2009 Sun Microsystems, Inc.
All rights reserved.
```

```
Listening on port 3389.
```

On a different machine we use *rdesktop* to connect to the console.

Note that this virtual machine believes that it runs on some generic PC hardware (as configurable in Oracle VirtualBox).

Inside the virtual machine, we install the Oracle VirtualBox guest additions (via the CD-ROM).

This ISO image provides some guest additions that make the mouse pointer and keyboard behave friendly.

We did not test a virtual machine *without* guest additions, because possibly these guest additions are essential for the good operation of the snapshot mechanism; in any case, installing the guest additions is not much work and provides helpful improvements to the use of the guest operating system under Oracle VirtualBox.

We do not need to install EMC NetWorker client in the guest OS.

4 Base snapshot

The deletion of live snapshot only works if there remains at least one other snapshot, so first we need to make a snapshot which we will give the name *base*. It is not possible to delete this snapshot while the guest OS is running.

```
# VBoxManage snapshot win2003 take base
Oracle VM VirtualBox Command Line Management Interface Version 3.2.6
(C) 2005-2010 Oracle Corporation
All rights reserved.
```

```
0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
```

Once this *base* snapshot exists, subsequent live snapshots can be deleted without stopping the guest operating system.

5 Configuring savenpc backup

We create a EMC NetWorker group called VBox.

The client is added to this group, and we configure a EMC NetWorker client resource as follows :

```
# nsradmin -i /tmp/c | egrep 'group|save|command'
      group: VBox;
      save set: /root/.VirtualBox,/vbox;
      backup command: savenpc;
```

This will make a backup of the files under /root/.VirtualBox and /vbox.

The savenpc resource is as follows:

```
# cat /nsr/res/VBox.res
type: savenpc;
precmd: "/usr/bin/VBoxPrcmd >> /nsr/logs/savestate 2>&1";
pstcmd: "/usr/bin/VBoxPstcmd >> /nsr/logs/savestate 2>&1";
timeout: "12:00:00";
abort precmd with group: No;
```

The script VBoxPrcmd makes the live snapshot of the win2003 virtual client :

```
# cat /usr/bin/VBoxPrcmd
#!/bin/sh

/usr/ucb/echo -n "BEGIN take snapshot:"
date
VBoxManage snapshot win2003 take nsr
/usr/ucb/echo -n "ENDED take snapshot:"
date
```

At the end of the EMC NetWorker backup, we delete the snapshot :

```
# cat /usr/bin/VBoxPstcmd
#!/bin/sh

/usr/ucb/echo -n "BEGIN delete snapshot:"
date
VBoxManage snapshot win2003 delete nsr
/usr/ucb/echo -n "ENDED delete snapshot:"
date
```

Then we run the group to make a full backup:

```
# savegrp -l full VBox
```

The logfile /nsr/logs/savestate will contain information such as:

```
BEGIN take snapshot:Wed Jun 30 19:51:33 CEST 2010
Oracle VM VirtualBox Command Line Management Interface Version 3.2.6
(C) 2005-2010 Oracle Corporation
All rights reserved.
```

```
0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
ENDED take snapshot:Wed Jun 30 19:51:36 CEST 2010
BEGIN delete snapshot:Wed Jun 30 19:57:44 CEST 2010
Oracle VM VirtualBox Command Line Management Interface Version 3.2.6
(C) 2005-2010 Oracle Corporation
All rights reserved.
```

```
0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
ENDED delete snapshot:Wed Jun 30 19:57:57 CEST 2010
```

Before running the backup, there is only snapshot :

```
# VBoxManage showvminfo win2003 | tail
Shared folders: <none>

Guest:

Configured memory balloon size:          0 MB

Snapshots:

    Name: base (UUID: 46b0451e-ce2f-4151-8fc4-674d71933740) *
```

During the backup we can see two snapshots (one temporary) using the showvminfo command.

6 Image Restore

We recover the files using the EMC NetWorker command :

```
# recover -a /root/.VirtualBox
Recovering 5 files into their original locations
Total estimated disk space needed for recover is 24 KB.
Requesting 5 file(s), this may take a while...
Requesting 1 recover session(s) from server
./VirtualBox/xpti.dat
./VirtualBox/VirtualBox.xml
./VirtualBox/compreg.dat
./VirtualBox/VirtualBox.xml-prev
./VirtualBox/
```

and

```

# recover -a /vbox
Recovering 28 files into their original locations
Total estimated disk space needed for recover is 6139 MB.
Requesting 28 file(s), this may take a while...
Requesting 1 recover session(s) from server
./vbox/HardDisks/win2003.vdi
./vbox/HardDisks/
./vbox/Machines/win2003/win2003.xml
./vbox/Machines/win2003/Snapshots/{767f4738-3b32-4f8f-a9a9-f4e503cc246c}.vdi
./vbox/Machines/win2003/Snapshots/{75e242e2-11b5-4410-ad68-6e82e33592fa}.sav
./vbox/Machines/win2003/Snapshots/{07549aaf-b151-4fb6-9ef6-8b417b660ecb}.sav
./vbox/Machines/win2003/Snapshots/{34a4e681-5ed4-4e93-b56b-e4d6bfd06b50}.vdi
./vbox/Machines/win2003/Snapshots/{716aa58b-8cfb-43bd-a156-dfac08f9c04c}.vdi
./vbox/Machines/win2003/Snapshots/{5ae5297f-bf2b-459e-a87a-ec7303dbd189}.vdi
./vbox/Machines/win2003/Snapshots/
./vbox/Machines/win2003/win2003.xml-prev
./vbox/Machines/win2003/Logs/VBox.log.2
./vbox/Machines/win2003/Logs/VBox.log.1
./vbox/Machines/win2003/Logs/VBox.log
./vbox/Machines/win2003/Logs/VBox.log.3
./vbox/Machines/win2003/Logs/
./vbox/Machines/win2003/
./vbox/Machines/
./vbox/

```

Next, we can observe that after the restore there are two snapshots available.

```

# VBoxManage showvminfo win2003 | tail

Snapshots:

    Name: base (UUID: 46b0451e-ce2f-4151-8fc4-674d71933740)
    Name: nsr (UUID: 07549aaf-b151-4fb6-9ef6-8b417b660ecb) *

```

We restore the live snapshot :

```

# VBoxManage snapshot win2003 restore nsr
Oracle VM VirtualBox Command Line Management Interface Version 3.2.6
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Restoring snapshot 07549aaf-b151-4fb6-9ef6-8b417b660ecb
0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%

```

Also note that the state of the machine changes to *saved*.

```

# VBoxManage showvminfo win2003 | grep State
State:          running (since 2010-06-30T19:25:41.164000000)

```

We can start the virtual machine, and delete the nsr snapshot.

7 Conclusion

Thanks to virtualization, it is easier to perform BMR (bare metal recovery) as the virtualization layer can present on different hardwares the same virtual hardware to a virtual machine. With EMC NetWorker we can achieve high performance backups of both image backup (make a EMC NetWorker backup of the underlying disk images for the virtual machines) or work at filesystem level in the virtual machine (run the EMC NetWorker agent in the virtual machine). Oracle VirtualBox version 3.2 supports hot backup of live snapshots, so making block level image backups does not require any downtime.