Using Storage with VMs

StratusLab Tutorial (Orsay, France)

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Storage Services

Volatile (Read-Write) Disks

- Useful for temporary (!) data storage
- Data will disappear when VM instance is destroyed

Static (Read-Only) Disks

- Useful for distribution of quasi-static databases
- Handled and shared like VM images via Marketplace

Persistent (Read-Write) Disks

- Allows the storage of service state or user data
- Mounted as a disk on VMs
- Disks are persistent and have a lifecycle independent of a single VM
- Can be mounted by single VM at any time
- Only available within a single cloud instance

Volatile Storage

Use: Storage of large temporary data files.

Declare Volatile Disk

- When starting machine use option: `--volatile-disk` **SIZE_GB**
- Raw disk can be found using the command `fdisk -l`

Use of Disk

- Disks are not formatted! Use: `mkfs.ext4` **/dev/xxx**
- Mount disk: `mount /dev/xxx /mnt/volatile`
- Use normally: `touch /mnt/volatile/mydata`

Data is Volatile!

- Disk and data will survive reboots of the machine instance
- Disk and data will be destroyed once the machine is halted or killed

Static Disk

Use: Distribution and caching of fixed/versioned data

Declare Static (Read-Only) Disk

- When starting machine use option: `--readonly-disk` ***MKTP_ID***
- Disk will be available when machine starts

Use of Disk

- Disks appear exactly as in reference image, formatting included
- Mount disk: `mount /dev/xxx /mnt/readonly`
- Use normally: `touch /mnt/readonly/mydata`

Data is fixed!

- Disk and data cannot be modified
- Disk must be registered in the Marketplace

Persistent Disks with VMs

You've seen the full persistent disk lifecycle, but it isn't very interesting unless you can use the disk with a VM!

Create a disk and start a machine with it:

```
$ stratus-create-volume --size=5 --tag=with-vm
DISK d862e974-d785-47bd-b814-d27269eb610a

$ export TTYLINUX_ID=BN1EEkPiBx87_uLj2-sdybSI-Xb
$ stratus-run-instance \
    --persistent-disk=d862e974-d785-47bd-b814-d27269eb610a \
    ${TTYLINUX_ID}

 ::::::::::::::::::::::::
 :: Starting machine(s) ::
 ::::::::::::::::::::::::
 :: Starting 1 machine
 :: Machine 1 (vm ID: 183)
     Public ip: 134.158.75.219
 :: Done!
```
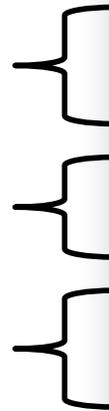
Mount Information (Web)

Disk UUID

Manual mount

Active mount

Disks mounted at deployment time will be marked as "static".

Dynamically mounted disks will have device ID (to be taken with a bit of skepticism!).

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Home | Disks

Mount Information

Disk: d862e974-d785-47bd-b814-d27269eb610a

	VM ID	Node	Register Only?
Mount			false

VM ID	Device
183	static

Logged in as cal (logout)

Prepare Persistent Disk for Use

Log into the VM and find disk:

- Use `fdisk` to find the unformatted volume with correct size.

```
$ ssh root@vm-219.lal.stratuslab.eu
#
# fdisk -l

...

Disk /dev/hdc: 5368 MB, 5368709120 bytes
255 heads, 63 sectors/track, 652 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Disk /dev/hdc doesn't contain a valid partition table
```

Format disk:

```
# mkfs.ext4 /dev/hdc
mke2fs 1.42.1 (17-Feb-2012)
...
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done
```

- Disk can also be partitioned, but this isn't necessary.

Mount Disk and Store Data

Mount the disk:

- Create directory for mount point and mount the disk there

```
# mkdir /mnt/pdisk

# mount /dev/hdc /mnt/pdisk

# ls /mnt/pdisk
lost+found
```

Store some data on the disk:

- We will check later that the data is preserved.
- Unmount disk afterwards

```
# echo "TESTING PERSISTENT DATA" > /mnt/pdisk/my-persistent-data

# cat /mnt/pdisk/my-persistent-data
TESTING PERSISTENT DATA

# umount /mnt/pdisk/
# ls /mnt/pdisk/
#
```

Second VM with Same Disk?

Start a new machine with same disk:

```
$ stratus-run-instance --quiet \
  --persistent-disk=d862e974-d785-47bd-b814-d27269eb610a \
  ${TTYLINUX_ID}
184, 134.158.75.220

$ stratus-describe-instance -v 184
...
id  state      vcpu memory    cpu% host/ip                  name
184 Failed    1    0         0    vm-220.lal.stratuslab.eu one-184
    Error deploying virtual machine: Could not create domain from /var/lib/one//184/
images/deployment.0
```

Why did this fail?

- Disk is unmounted in first machine, but…
- The machine is still active and the disk is still allocated to it!
- It cannot be allocated to more than one machine.
- Kill first machine, then retry.

Validate Data in New Instance

Start a new machine with same disk:

```
$ stratus-run-instance --quiet \
  --persistent-disk=d862e974-d785-47bd-b814-d27269eb610a \
  ${TTYLINUX_ID}
190, 134.158.75.226

$ stratus-describe-instance
id  state      vcpu memory   cpu% host/ip                     name
190 Running    1    131072   5    vm-226.lal.stratuslab.eu one-190
```

Check that the data is still on the disk:

```
# mkdir /mnt/pdisk
# mount /dev/hdc /mnt/pdisk
# ls /mnt/pdisk
lost+found          my-persistent-data
# cat /mnt/pdisk/my-persistent-data
TESTING PERSISTENT DATA
```

Hot-Plug Disks

Dynamic mounting of persistent disks:

- Volumes can be attached and detached from virtual machines while the machine is running.
- This can be accomplished with both the command line or web interfaces.
- Commands are: `stratus-{attach/detach}-volume`

Feature needs OS support:

- OS must have the acpiphp kernel module available and loaded.
- The ttylinux does not support this!
- All other StratusLab maintained images have this enabled by default.

Attach Disk to Ubuntu VM

Disk UUID

Manual mount
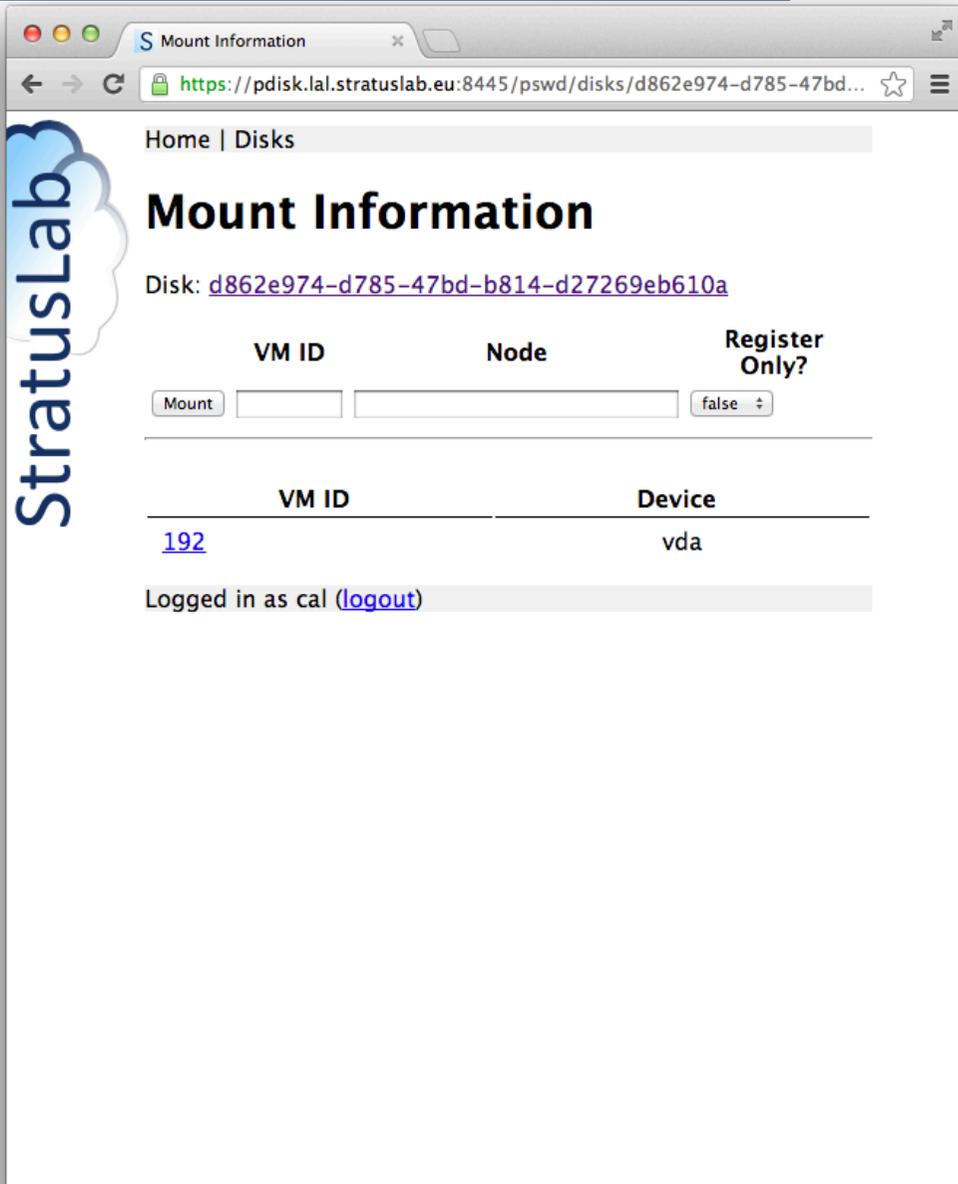
Active mount

Mounts are visible on the web interface.

Mounts can be made via the web interface as well.

Mount Information (Web)

Mount details

Mount Information (Web)

Unmount the disk inside machine:

- To avoid corruption, unmount file systems before detaching disk
- To detach:
  `stratus-detach-volume --instance` *VM_ID DISK_ID*

```
# umount /mnt/pdisk
# exit
logout
Connection to vm-228.lal.stratuslab.eu closed.

$ stratus-detach-volume --instance 192 d862e974-d785-47bd-b814-d27269eb610a
DETACHED d862e974-d785-47bd-b814-d27269eb610a from VM 192 on /dev/vda
```

Detach Disk from Ubuntu VM

Unmount the disk inside machine:

- To avoid corruption, unmount file systems before detaching disk
- To detach:

  `stratus-detach-volume --instance` *VM_ID DISK_ID*

```
# umount /mnt/pdisk
# exit
logout
Connection to vm-228.lal.stratuslab.eu closed.

$ stratus-detach-volume --instance 192 d862e974-d785-47bd-b814-d27269eb610a
DETACHED d862e974-d785-47bd-b814-d27269eb610a from VM 192 on /dev/vda
```

Questions and Discussion

Exercises: Storage

Volatile Disks

- Create VM with volatile disk.
- Verify that disk space is present and usable.

Use persistent disk with a virtual machine

- Verify that disk can be remounted on another machine
- Verify that data on disk is preserved
- Verify that disk can be mounted/unmounted from running VM (warning: use Ubuntu or CentOS, ensure acpiphp module is loaded!)

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