

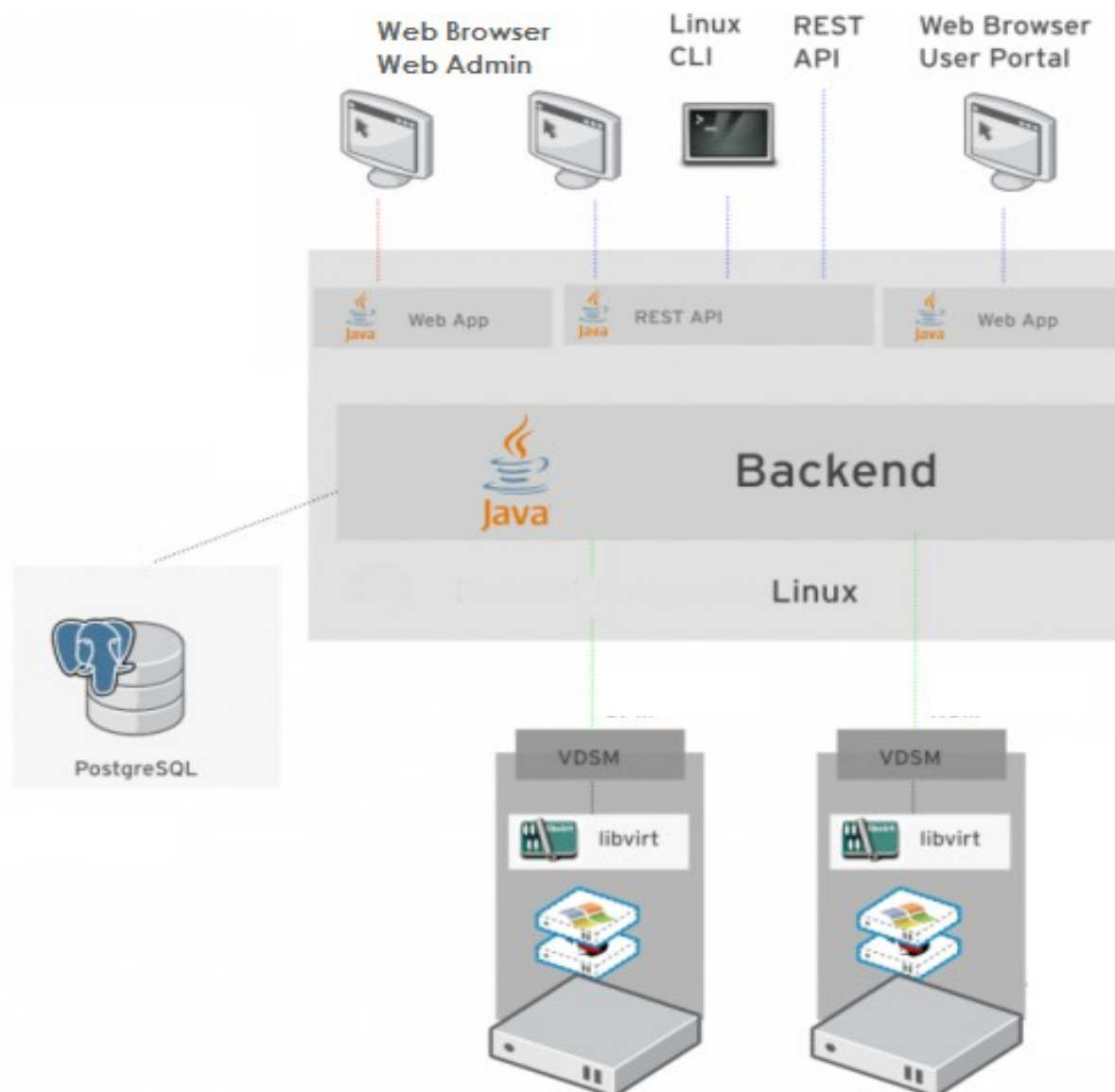
RAM Snapshots

21.10.2013

Arik Hadas
Red Hat

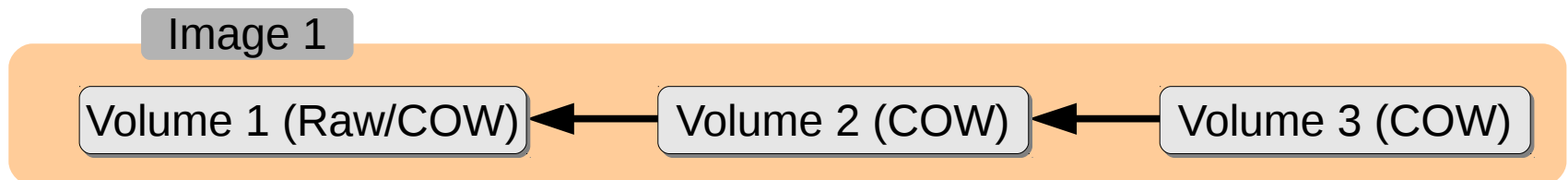
- Quick overview of oVirt architecture & volume types
- Overview of snapshots in oVirt
- Deep dive into RAM snapshot feature
 - The concept
 - Implementation details
 - How to use

oVirt architecture



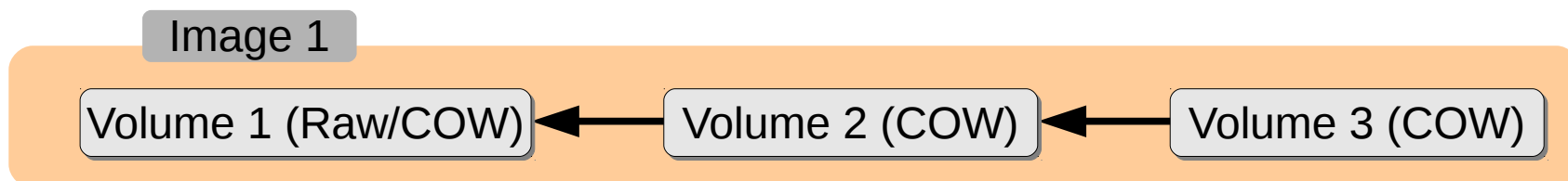
Virtual disk structure

- Virtual disk image is composed of volumes
- Volume Types
 - Raw - plain binary data
 - COW – only data that was changed
 - QCOW2 (QEMU Copy On Write 2)



Write data to disk with COW volume

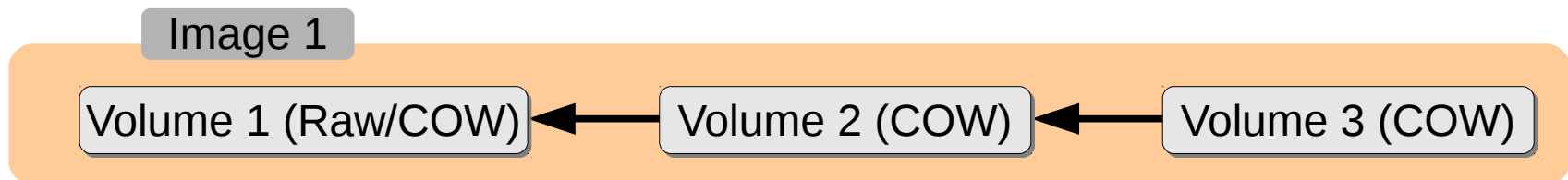
- The data will be stored in the last COW volume
- COW volumes contain the data that was changed after they were created
- All the volumes except the last one become read-only



Read data from disk with COW volume



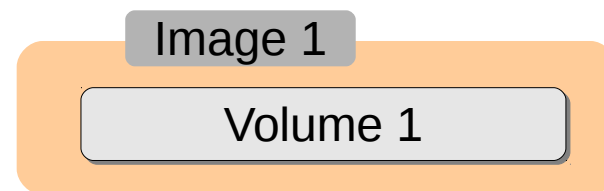
- We will try to read the data from the last volume
 - The volume contains meta-data that indicates which data exist in the volume
- If the data exist in the volume
 - We'll read it from the volume
- Otherwise
 - We'll try to read it from the 'parent' volume



Snapshot usages in oVirt (1)

- **Backup & Restore**
 - Create snapshot
 - Preview snapshot
 - Commit to snapshot

Snapshot Name	Volumes
Active VM	Volume 1



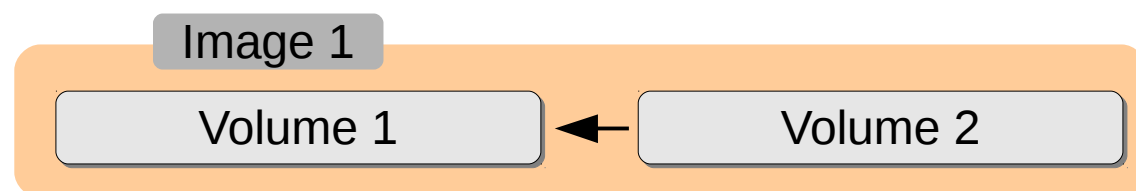
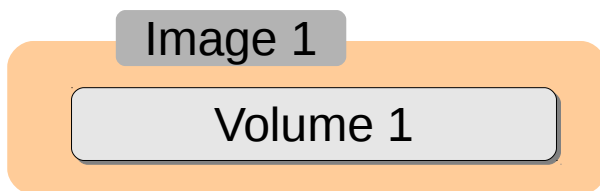
Snapshot usages in oVirt (1)

- **Backup & Restore**
 - **Create snapshot**
 - Preview snapshot
 - Commit to snapshot

Snapshot Name	Volumes
Active VM	Volume 1



Snapshot Name	Volumes
Active VM	Volume 2
Snapshot 1	Volume 1



Snapshot usages in oVirt (1)

- **Backup & Restore**
 - Create snapshot
 - **Preview snapshot**
 - Commit to snapshot

Snapshot Name	Volumes
Active VM	Volume 2
Snapshot 1	Volume 1

Snapshot Name	Volumes
Active VM	Volume 3
Previous Active VM	Volume 2
Snapshot 1	Volume 1



Image 1



Image 1



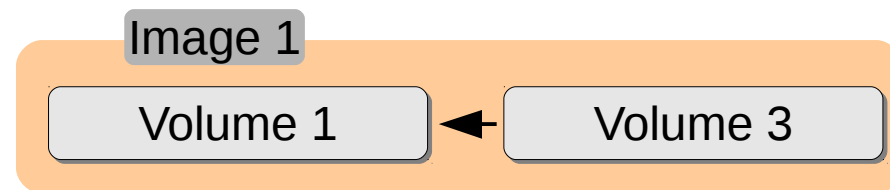
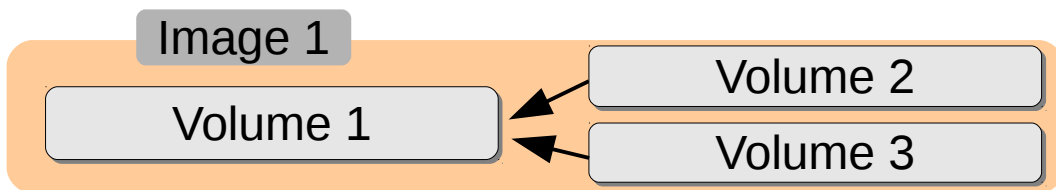
Snapshot usages in oVirt (1)

- **Backup & Restore**
 - Create snapshot
 - Preview snapshot
 - **Commit to snapshot**

Snapshot Name	Volumes
Active VM	Volume 3
Previous Active VM	Volume 2
Snapshot 1	Volume 1



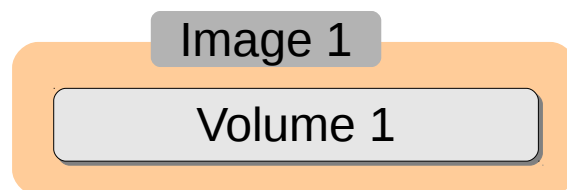
Snapshot Name	Volumes
Active VM	Volume 3
Snapshot 1	Volume 1



Snapshot usages in oVirt (2)

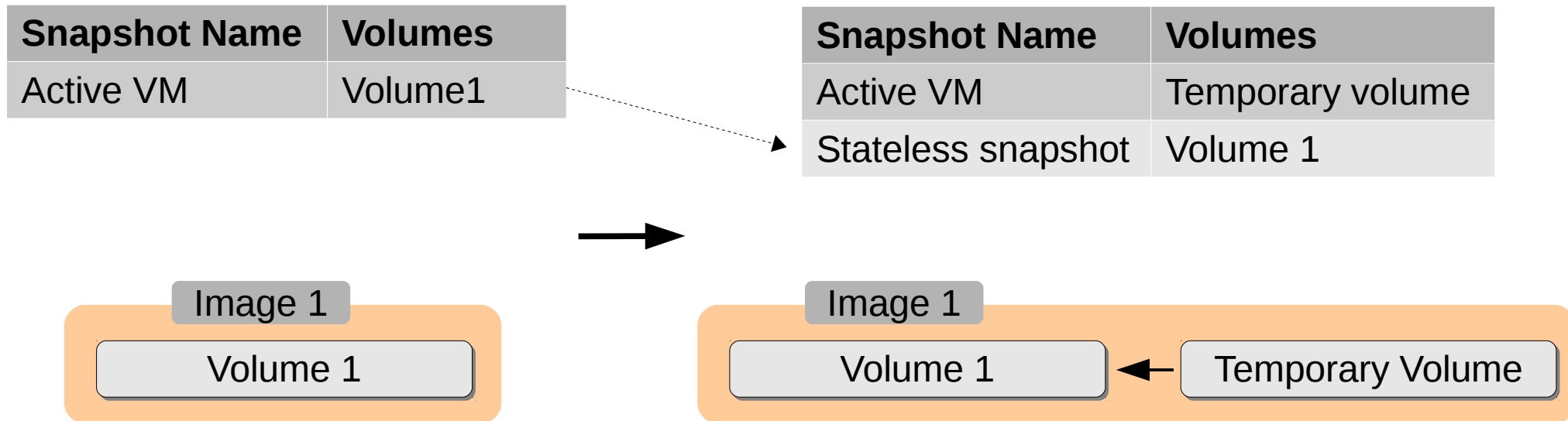
Stateless VM implementation

Snapshot Name	Volumes
Active VM	Volume1



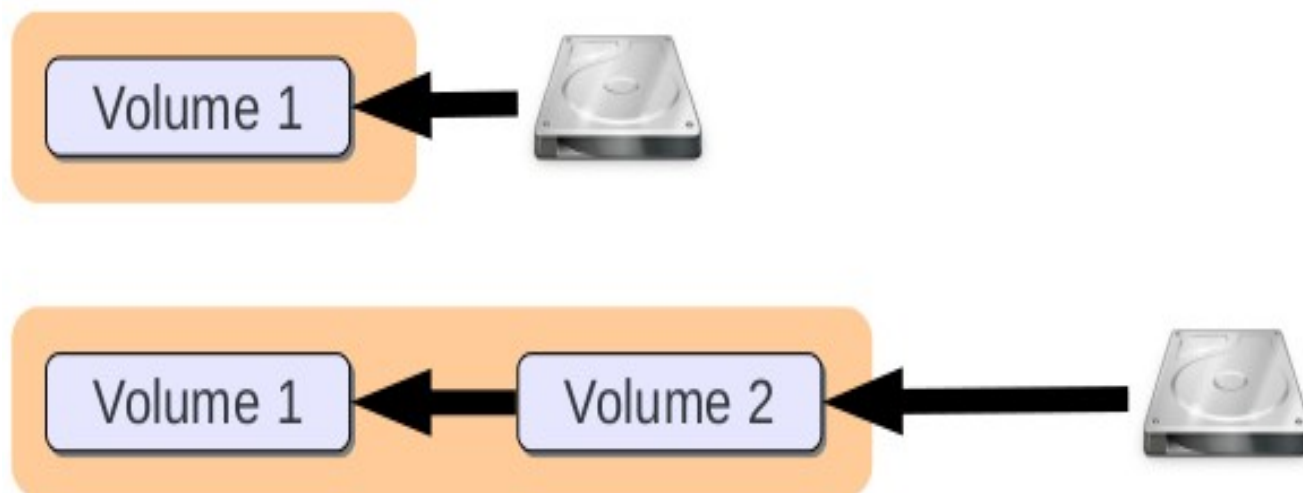
Snapshot usages in oVirt (2)

Stateless VM implementation



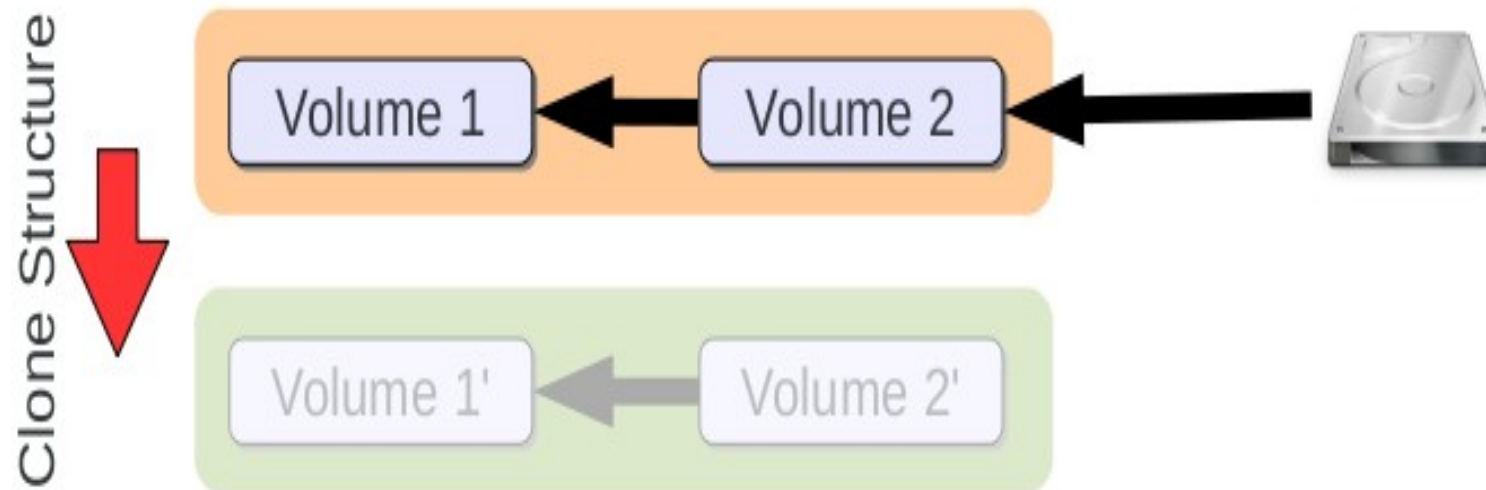
Snapshot usages in oVirt (3)

Preliminary step in Live Storage Migration process



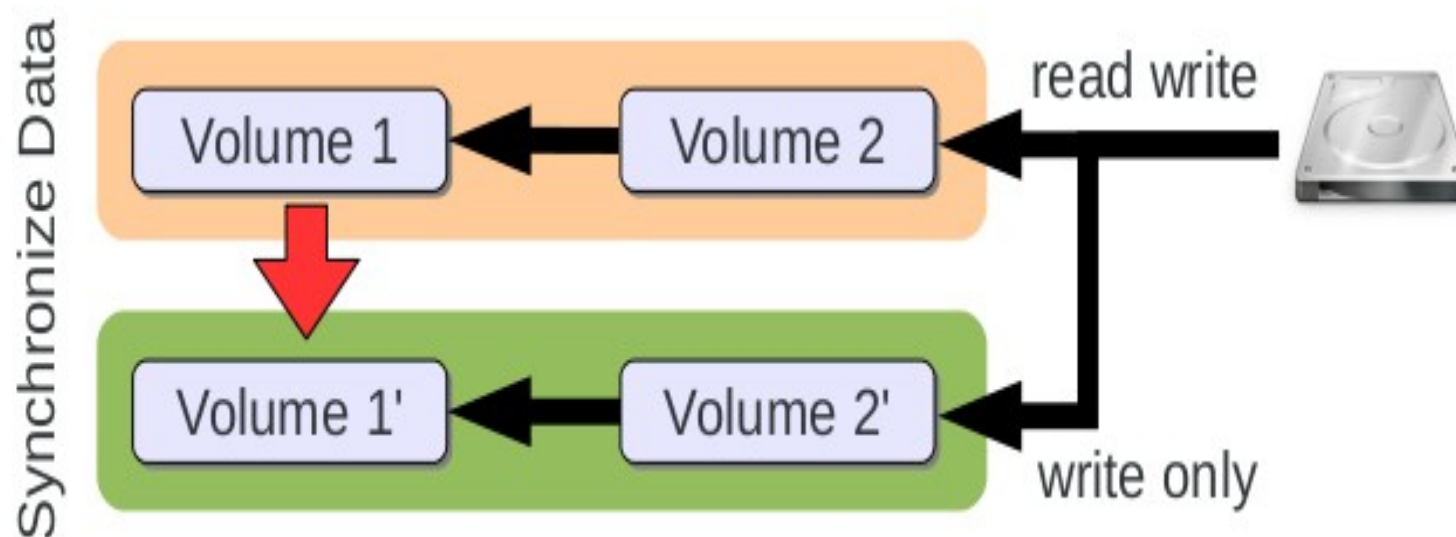
Snapshot usages in oVirt (3)

Preliminary step in Live Storage Migration process



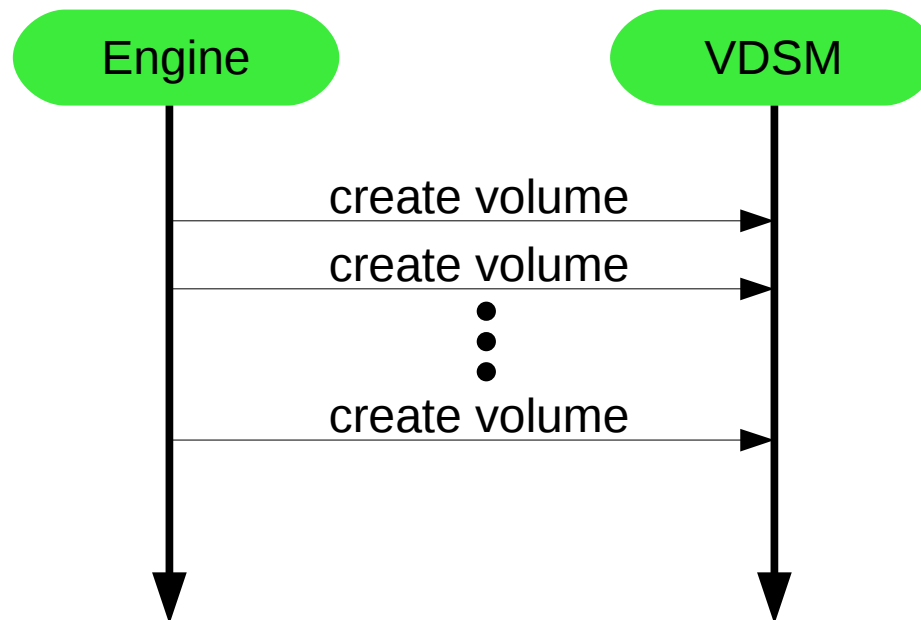
Snapshot usages in oVirt (3)

Preliminary step in Live Storage Migration process



Offline Snapshot

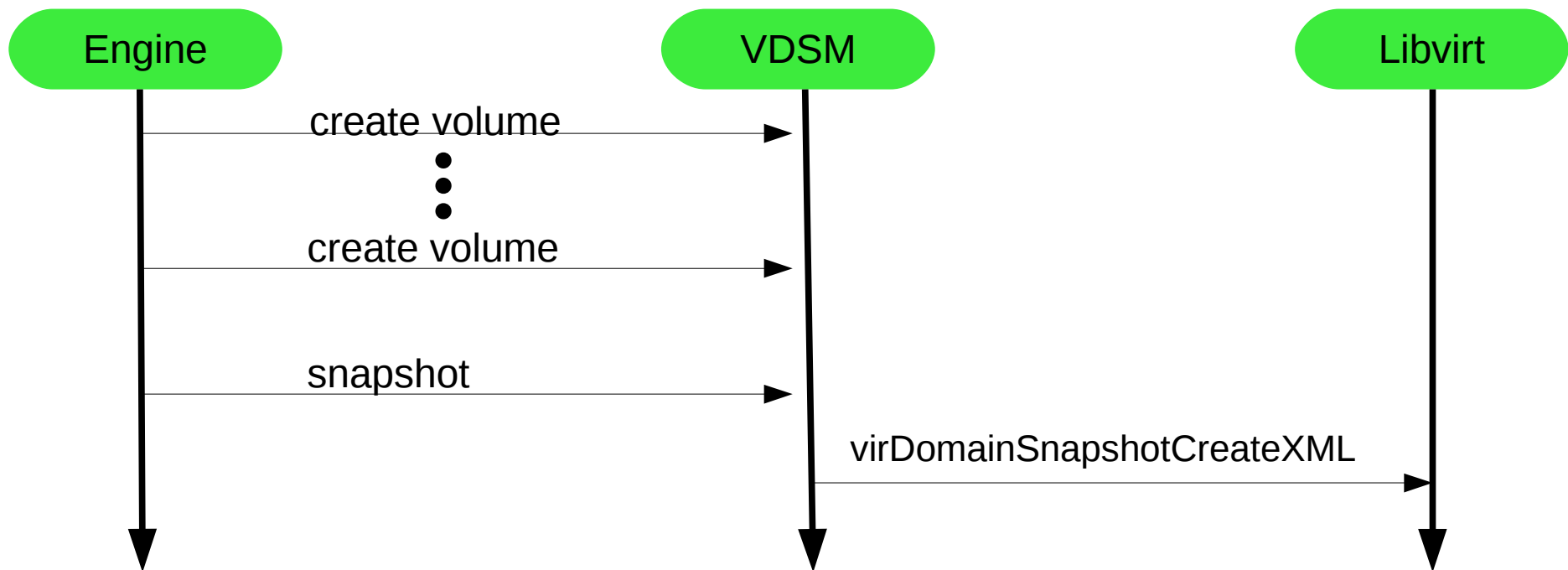
- Taking snapshot for VM which is not running
- Add volume for each of the VM disks
- The added volumes will be used on next run



Snapshot Types in oVirt

Live Snapshot

- Taking snapshot for running VM
- Add volume for each of the VM disks
- The VM switch to the added volumes



```
virDomainSnapshotCreateXML (VM, xml, flags)
```

- VM: VM ID
- xml: snapshot properties in xml format
- flags: snapshot properties as flags

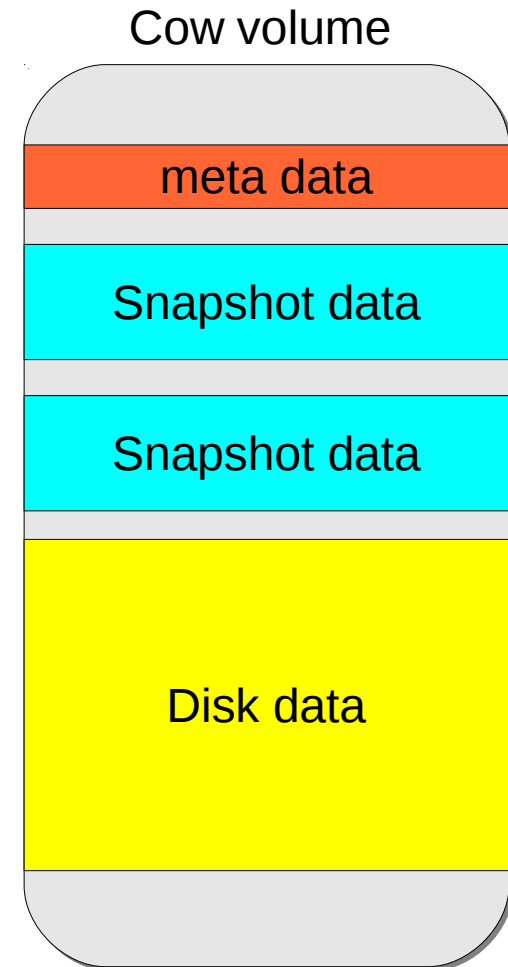
Snapshot types in libvirt



- Disks snapshot
 - Internal
 - External
- Memory state (VM state)
 - Piggy-backed
 - External
- System checkpoint
 - Disk snapshot + Memory state

Snapshot types in libvirt

- Disks snapshot
 - **Internal**
 - External
- Memory state (VM state)
 - Piggy-backed
 - External
- System checkpoint
 - Disk snapshot + Memory state



Snapshot types in libvirt

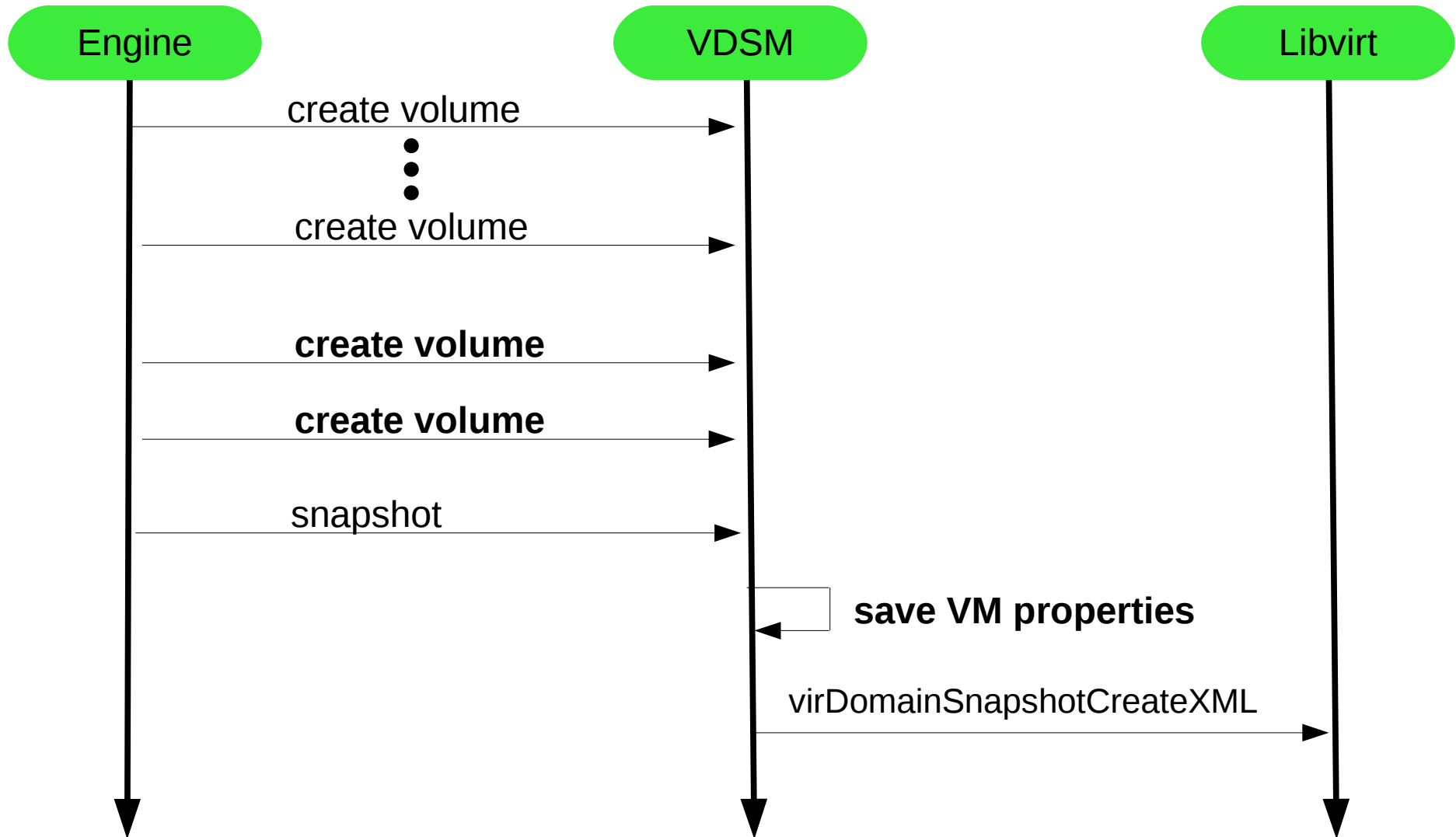


- Disks snapshot
 - Internal
 - External
- Memory state (VM state)
 - Piggy-backed
 - External
- System checkpoint
 - Disk snapshot + Memory state

- External disks snapshot
- xml
 - Volume to switch to for each disk
- flags
 - VIR_DOMAIN_SNAPSHOT_CREATE_DISK_ONLY
 - VIR_DOMAIN_SNAPSHOT_CREATE_REUSE_EXT
 - VIR_DOMAIN_SNAPSHOT_CREATE_NO_METADATA
 - VIR_DOMAIN_SNAPSHOT_CREATE_QUIESCE

- Disks snapshot with memory state
- When running VM that was reverted to RAM snapshot
 - The saved state (memory + disks) is restored
 - TCP connections might time out
- Unlike hibernation the VM remains active

Creating RAM Snapshots

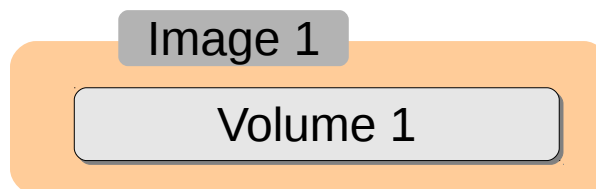


- System checkpoint
 - External disks snapshot
 - **External memory state**
- xml
 - Volume to switch to for each disk
 - **Volume to save the memory state in**
- flags
 - **VIR_DOMAIN_SNAPSHOT_CREATE_LIVE**
 - VIR_DOMAIN_SNAPSHOT_CREATE_REUSE_EXT
 - VIR_DOMAIN_SNAPSHOT_CREATE_NO_METADATA

RAM snapshot usages

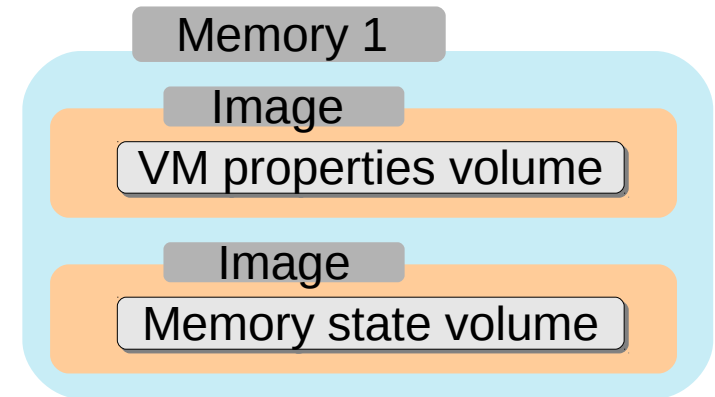
- Create snapshot with memory
- Preview snapshot with memory
- Commit to snapshot with memory
- Stateless VM with initial memory

Snapshot Name	Volumes	Memory
Active VM	Volume 1	



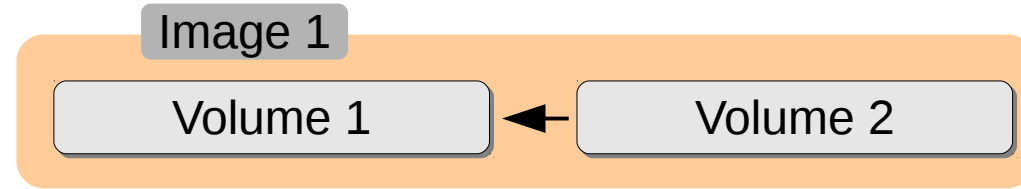
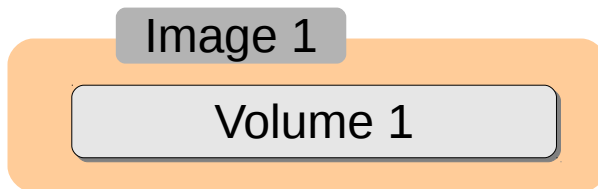
RAM snapshot usages

- **Create snapshot with memory**
- Preview snapshot with memory
- Commit to snapshot with memory
- Stateless VM with initial memory



Snapshot Name	Volumes	Memory
Active VM	Volume 1	

Snapshot Name	Volumes	Memory
Active VM	Volume 2	
Snapshot 1	Volume 1	Memory 1



RAM snapshot usages

- Create snapshot with memory
- **Preview snapshot with memory**
- Commit to snapshot with memory
- Stateless VM with initial memory

Snapshot Name	Volumes	Memory
Active VM	Volume 2	
Snapshot 1	Volume 1	Memory 1



Snapshot Name	Volumes	Memory
Active VM	Volume 3	Memory 1
Previous Active VM	Volume 2	
Snapshot 1	Volume 1	Memory 1

Image 1

Volume 1

Volume 2

Image 1

Volume 1

Volume 2

Volume 3

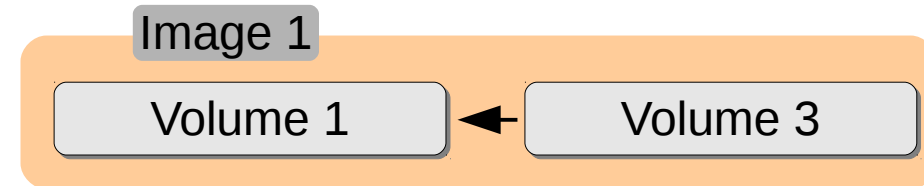
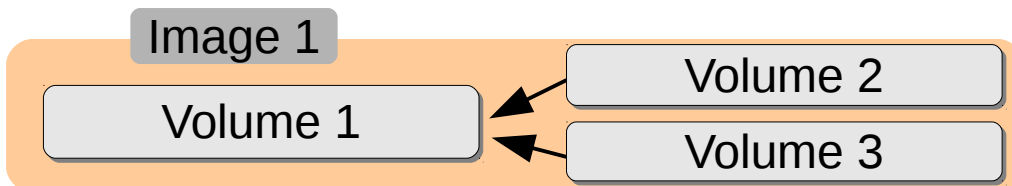
RAM snapshot usages

- Create snapshot with memory
- Preview snapshot with memory
- **Commit to snapshot with memory**
- Stateless VM with initial memory

Snapshot Name	Volumes	Memory
Active VM	Volume 3	Memory 1
Previous Active VM	Volume 2	
Snapshot 1	Volume 1	Memory 1



Snapshot Name	Volumes	Memory
Active VM	Volume 3	Memory 1
Snapshot 1	Volume 1	Memory 1

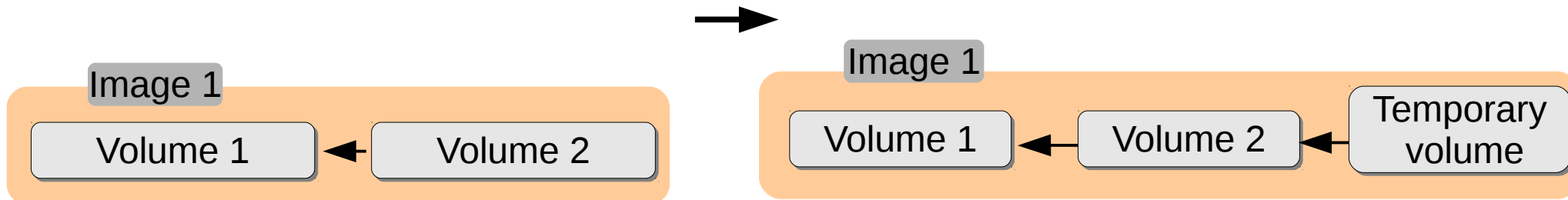


RAM snapshot usages

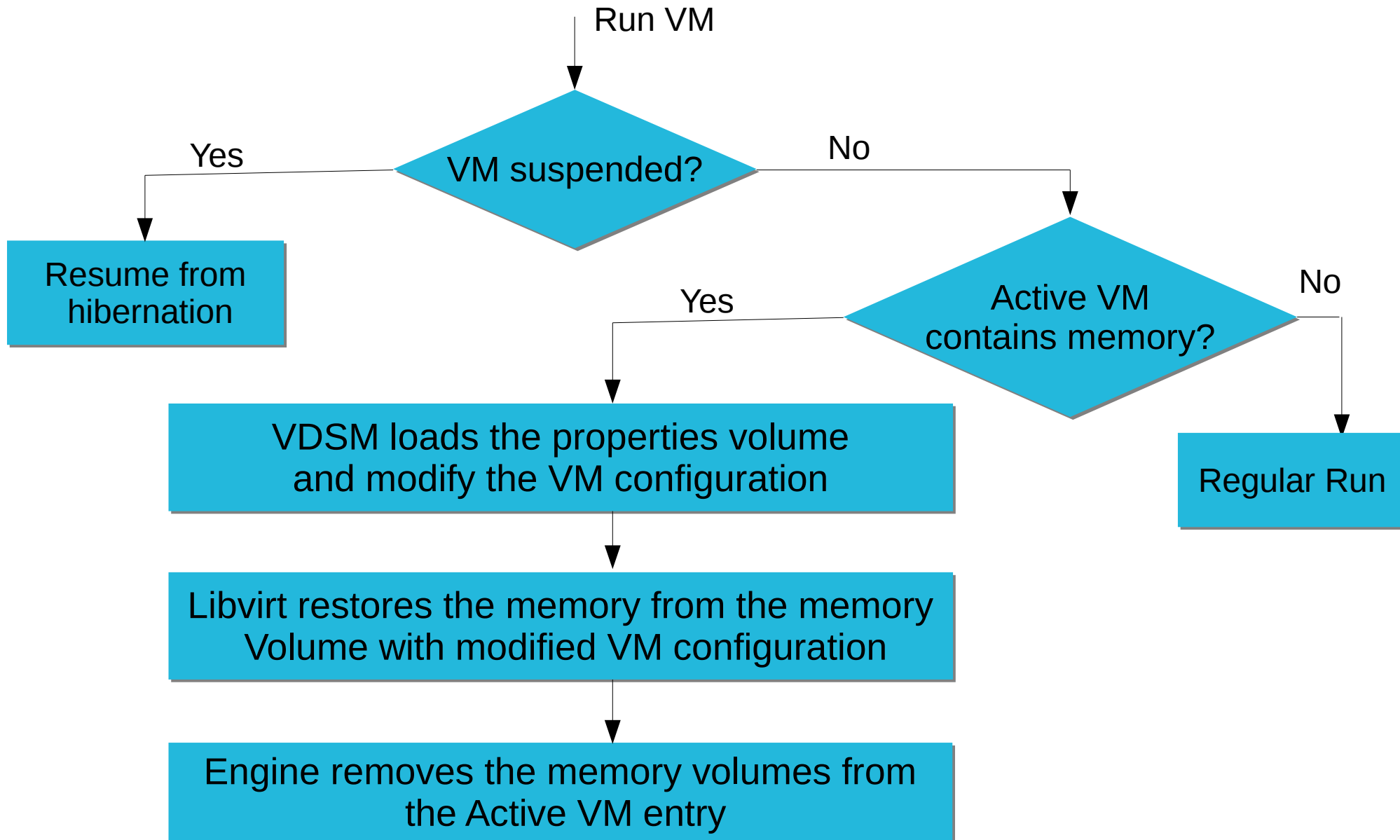
- Create snapshot with memory
- Preview snapshot with memory
- Commit to snapshot with memory
- **Stateless VM with initial memory**

Snapshot Name	Volumes	Memory
Active VM	Volume 2	Memory 1
Snapshot 1	Volume 1	Memory 1

Snapshot Name	Volumes	Memory
Active VM	Temporary volume	Memory 1
Stateless snapshot	Volume 2	Memory 1
Snapshot 1	Volume 1	Memory 1



Run VM – using RAM snapshot

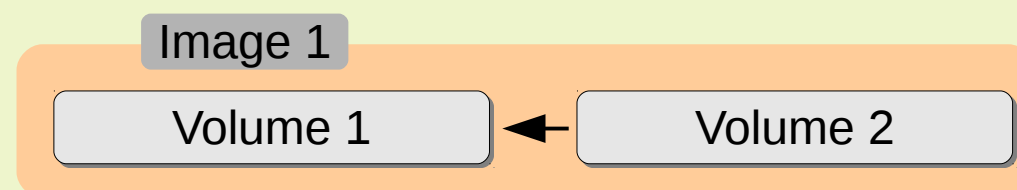
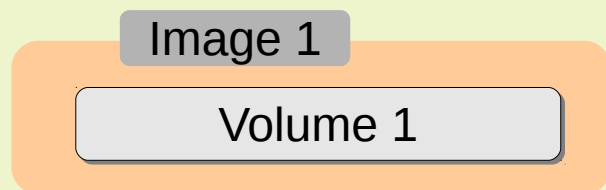
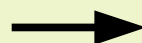


Why do we need to change volumes?

When creating the snapshot:

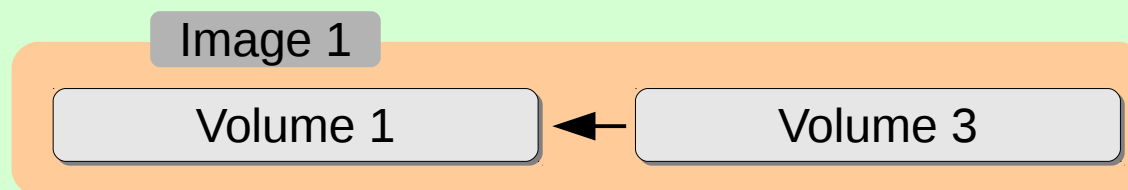
Snapshot Name	Volumes	Memory
Active VM	Volume 1	

Snapshot Name	Volumes	Memory
Active VM	Volume 2	
Snapshot 1	Volume 1	Memory 1

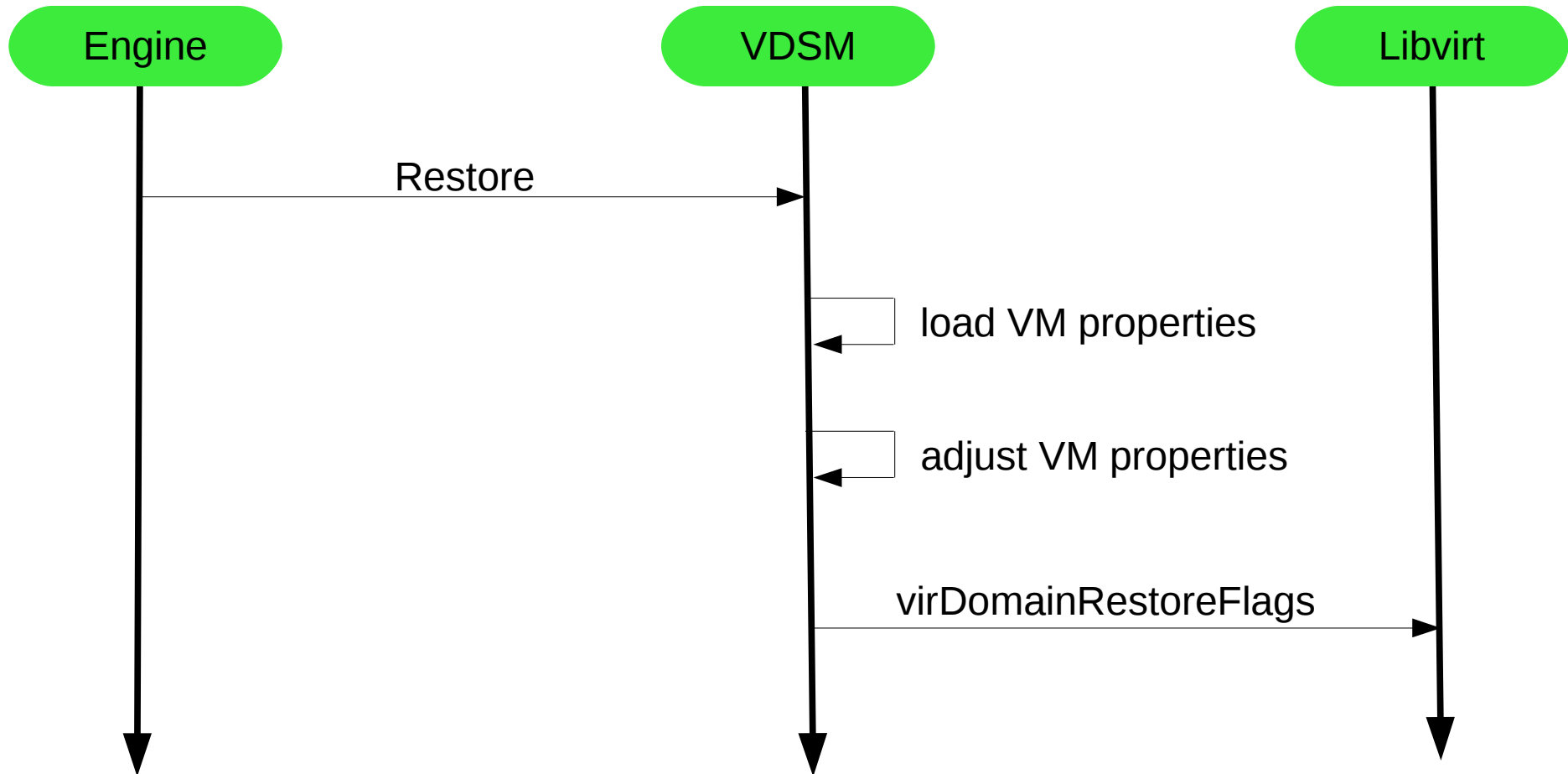


After committing to the snapshot:

Snapshot Name	Volumes	Memory
Active VM	Volume 3	Memory 1
Snapshot 1	Volume 1	Memory 1



Run VM – using RAM snapshot



Snapshot with memory state in libvirt (2) oVirt

virDomainRestoreFlags (VM, memory _state, xml, flags)

- Allows to alter specific portion of the VM configuration
 - Change active volumes
 - Change DC & cluster settings

OS Level: memory size, cpu type, disks, network cards..

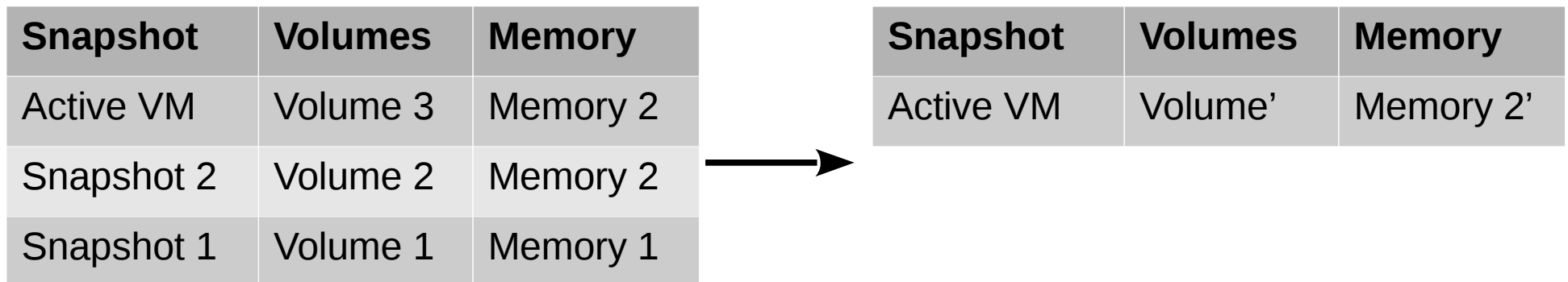
Virtualization

Host level: disk volumes, networks..

Export/Import VM with RAM snapshots



- RAM snapshots can be exported & imported
 - Except export/import with copy collapse set
- When copy collapse is set, snapshots are dropped
 - Including their memory volumes
 - Except the Active VM entry



VM with no snapshots



The screenshot shows the oVirt web interface for a virtual machine. The main navigation tabs are General, Network Interfaces, Disks, Snapshots, Applications, Permissions, Sessions, and Events. The Snapshots tab is active, showing a table with one entry: 'Current' with status 'Ok' and memory 'Active VM'. A right-hand sidebar is open to the 'General' tab, displaying 'Defined Memory:', 'Physical Memory Guaranteed:', and 'Number of CPU Cores:'.


Date	Status	Memory	Description
Current	Ok	<input type="checkbox"/>	Active VM

General Disks Network Interfaces

Defined Memory:
Physical Memory Guaranteed:
Number of CPU Cores:

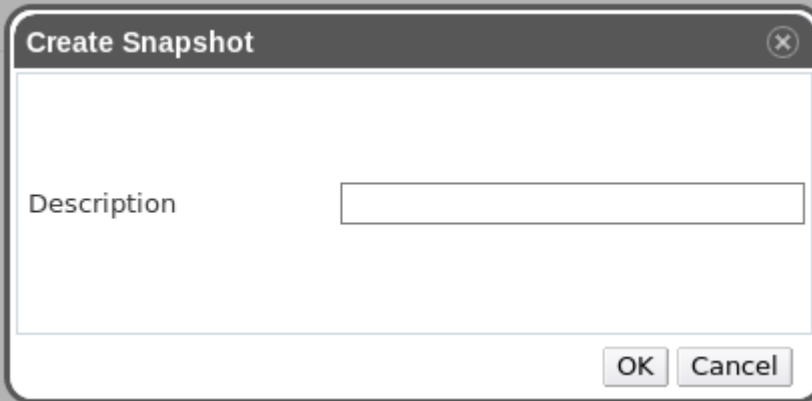
Create snapshot dialog

VM is running:



The dialog box titled "Create Snapshot" has a close button (X) in the top right corner. It contains a "Description" label followed by a text input field. Below this, there is a checked checkbox labeled "Save Memory". At the bottom right, there are two buttons: "OK" and "Cancel".

VM is not running:



The dialog box titled "Create Snapshot" has a close button (X) in the top right corner. It contains a "Description" label followed by a text input field. At the bottom right, there are two buttons: "OK" and "Cancel".

Snapshots creation



General Network Interfaces Disks **Snapshots** Applications Permissions Sessions Events

Create Preview Commit Undo Delete Clone

Date	Status	Memory	Description
Current	Ok	<input type="checkbox"/>	Active VM
2013-Oct-10, 11:34	Ok	<input type="checkbox"/>	snapshot2
2013-Oct-10, 11:33	Ok	<input checked="" type="checkbox"/>	snapshot1

General Disks Network Interfaces **Installed Applications**

Defined Memory: 8092MB

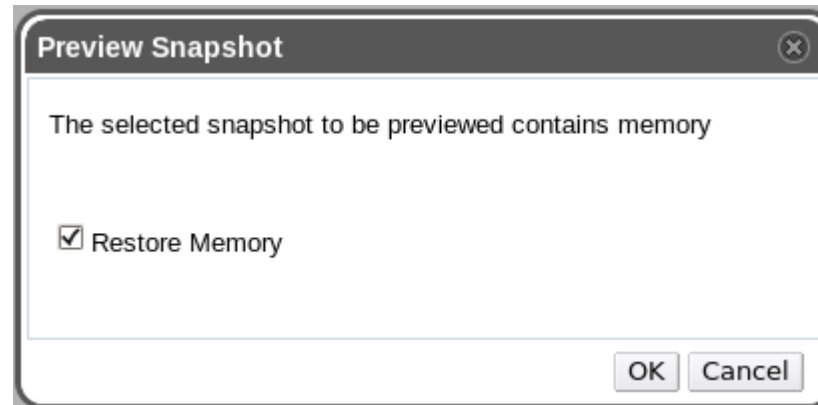
Physical Memory Guaranteed: 1024MB

Number of CPU Cores: 1 (1 Socket(s), 1 Core(s) per Socket)

Last Task: ✔ 2013-Oct-10, 11:34 Creating VM Snapshot snapshot2 for VM fedora_19 Alerts (4) Events Tasks (0)

✔ Creating VM Snapshot snapshot2 for VM fedora_19	2013-Oct-10, 11:34	Until 2013-Oct-10, 11:34	3bfcc23
✔ Validating	2013-Oct-10, 11:34	until 2013-Oct-10, 11:34	
✔ Executing	2013-Oct-10, 11:34	until 2013-Oct-10, 11:34	
✔ Creating Volume	2013-Oct-10, 11:34	until 2013-Oct-10, 11:34	
✔ Finalizing.	2013-Oct-10, 11:34	until 2013-Oct-10, 11:34	
✔ Creating VM Snapshot snapshot1 for VM fedora_19	2013-Oct-10, 11:33	Until 2013-Oct-10, 11:33	3b7b3381
✔ Validating	2013-Oct-10, 11:33	until 2013-Oct-10, 11:33	
✔ Executing	2013-Oct-10, 11:33	until 2013-Oct-10, 11:33	
✔ Creating Volume	2013-Oct-10, 11:33	until 2013-Oct-10, 11:33	
✔ Creating Volume	2013-Oct-10, 11:33	until 2013-Oct-10, 11:33	
✔ Creating Volume	2013-Oct-10, 11:33	until 2013-Oct-10, 11:33	
✔ Finalizing.	2013-Oct-10, 11:33	until 2013-Oct-10, 11:33	

Preview snapshot



The screenshot shows the oVirt web interface for a VM configuration. The "Snapshots" tab is selected in the top navigation bar. Below the navigation bar are buttons for "Create", "Preview", "Commit", "Undo", "Delete", and "Clone". A table lists the snapshots:

Date	Status	Memory	Description
2013-Oct-10, 11:48	Ok	<input type="checkbox"/>	Active VM before the preview
2013-Oct-10, 11:34	Ok	<input type="checkbox"/>	snapshot2
2013-Oct-10, 11:33	In Preview	<input checked="" type="checkbox"/>	snapshot1 (Preview Mode)

On the right side, the "General" tab of the hardware configuration is open, showing the following details:

- Defined Memory: 8092MB
- Physical Memory Guaranteed: 1024MB
- Number of CPU Cores: 1 (1 Socket(s), 1 Core(s) per Socket)

Commit to RAM snapshot



The screenshot shows the oVirt web interface. The 'Snapshots' tab is selected, displaying a table of snapshots. The table has columns for Date, Status, Memory, and Description. The 'Current' snapshot is 'Active VM' with a status of 'Ok' and a memory size of 8092MB. A snapshot named 'snapshot1' was created on 2013-Oct-10 at 11:33 with a status of 'Ok' and a memory size of 1024MB. To the right, the 'General' tab of the system details is visible, showing:

- Defined Memory: 8092MB
- Physical Memory Guaranteed: 1024MB
- Number of CPU Cores: 1 (1 Socket(s), 1 Core(s) per Socket)

Date	Status	Memory	Description
Current	Ok	<input checked="" type="checkbox"/>	Active VM
2013-Oct-10, 11:33	Ok	<input checked="" type="checkbox"/>	snapshot1

Run the committed VM



The screenshot displays the oVirt web interface. At the top, there are navigation tabs for Data Centers, Clusters, Hosts, Networks, Storage, Disks, Virtual Machines, Pools, Templates, Volumes, Users, and Events. The 'Virtual Machines' tab is active, showing a table of VMs. Below this, there are action buttons like 'New VM', 'Edit', 'Remove', 'Run Once', 'Migrate', etc. The VM 'fedora_19' is selected, and its details are shown in a panel below. This panel has tabs for General, Network Interfaces, Disks, Snapshots, Applications, Permissions, Sessions, and Events. The 'Snapshots' tab is active, showing a table of snapshots. To the right of the snapshots table, the 'General' tab of the snapshot details is active, showing memory and CPU information.

Name	Host	IP Address	Cluster	Data Center	Memory	CPU	Network	Display	Status
fedora_19	bamba		fedora_33	fedora	0%	0%	0%	SPICE	Up

Date	Status	Memory	Description
Current	Ok	<input type="checkbox"/>	Active VM
2013-Oct-10, 11:33	Ok	<input checked="" type="checkbox"/>	snapshot1

General	Disks	Network Interfaces	Installed Applications
Defined Memory:		8092MB	
Physical Memory Guaranteed:		1024MB	
Number of CPU Cores:		1 (1 Socket(s), 1 Core(s) per Socket)	

Stateful snapshot – REST API



```
<snapshot href="/api/vms/19f5f748-9c81-46c2-8f78-3379588981e7/snapshots/534f67ce-5a97-4acb-8e97-f31c0492738d" id="534f67ce-5a97-4acb-8e97-f31c0492738d">
+<actions></actions>
  <description>my_snapshot</description>
  <type>regular</type>
+<vm id="19f5f748-9c81-46c2-8f78-3379588981e7"></vm>
  <date>2013-10-10T13:43:04.681+03:00</date>
  <snapshot_status>ok</snapshot_status>
  <persist_memorystate>true</persist_memorystate>
</snapshot>
```

Stateful snapshot operations – REST API

Create:

```
<snapshot>  
  <description>my_snapshot</description>  
  <persist_memorystate>true</persist_memorystate>  
</snapshot>
```

Preview/Restore:

```
<action>  
  <restore_memory>true</restore_memory>  
</action>
```

THANK YOU !

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