Hybrid Backup

The snapshot is dead, long live the snapshot!

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RHV Demo, March 2022
Why?
**Live backup**

Diagram showing a hypervisor with qemu-kvm and imageio server connected to backup host with backup app and backups.
Live backup problems

✗ Can start only when VM is running
✗ Cannot power down the VM during backup
✗ Cannot migrate a VM during backup
✗ If VM is stopped via API (force), backup is aborted
✗ If VM is powered down within the guest, backup is aborted
✗ If the scratch disk becomes full, VM pauses
✗ Backup I/O degrades guest I/O
✗ Guest I/O degrades backup I/O
✗ Complex flow on engine
Cold backup
Cold backup problems

✗ Can start only when the VM is down
✗ Cannot power up the VM during the backup
What if we could...

- Start and stop a VM during backup
- Start a backup in any VM state
- Migrate a VM during backup
- Take a snapshot during a backup
- Backup on one host, run the VM on another
- Have only one kind of backup
Can we decouple backup from VM life cycle?
Backup a snapshot!
Hybrid backup (same host)
Hybrid backup (multiple hosts)

- Hypervisor 7
  - qemu-kvm
  - active (rw)
  - snapshot (ro)

- Hypervisor 42
  - qemu-nbd
  - imageio
  - server
  - snapshot (ro)

- Backup host
  - Backup app
  - Backups
Hybrid backup pros and cons

✓ Can start, stop, migrate, snapshot a VM during backup
✓ Can start backup in any VM state
✓ Have only one kind of backup
✓ Backup I/O does not affect guest I/O
✓ Guest I/O does not affect backup I/O
✓ No scratch disks, no pauses
✓ Simpler flow on engine side
✓ Does not interfere with user snapshots like the old snapshot based backup
✗ Need to create and delete a snapshot
Disabling hybrid backup globally

Hybrid backup is enabled by default in oVirt 4.5. To disable it globally:

```
# engine-config -s UseHybridBackup=false
# systemctl restart ovirt-engine
```
Disabling hybrid backup for a single backup

To disable hybrid backup for single backup use the new use_active option:

```python
backup = backups_service.add(
    types.Backup(
        disks=disks,
        from_checkpoint_id="d377519f-c0e8-48ea-8731-92db4ab83fba",
    ),
    use_active=True,
)
```
Hybrid Demo
1. Create a new VM

Status: Down
2. Start full backup

$ ./backup_vm.py -c engine start e0bf8ae0-3360-4e0b-9fd8-12cf5fe9839c

[ 0.0 ] Starting full backup for VM 'e0bf8ae0-3360-4e0b-9fd8-12cf5fe9839c'

[ 0.5 ] Waiting until backup '46d3be69-1ef3-4da2-974d-90bc5d58c42b' is ready

[ 11.6 ] Created checkpoint 'a8deec5a-f08c-4cc3-af21-78d2917278c6'

[ 11.7 ] Backup '46d3be69-1ef3-4da2-974d-90bc5d58c42b' is ready
3. Auto-generated snapshot created

<table>
<thead>
<tr>
<th>Date</th>
<th>Mar 2, 2022, 11:02:14 AM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>LOCKED</td>
</tr>
<tr>
<td>Memory</td>
<td>false</td>
</tr>
<tr>
<td>Description</td>
<td>Auto-generated for Backup VM</td>
</tr>
<tr>
<td>Defined Memory</td>
<td>1024 MB</td>
</tr>
<tr>
<td>Physical Memory Guarantee</td>
<td>1024 MB</td>
</tr>
<tr>
<td>Number of CPU Cores</td>
<td>1 (1:1:1)</td>
</tr>
</tbody>
</table>
4. Start the VM

Status: Powering Up
5. Start downloading full backup...

$ ./backup_vm.py -c engine download e0bf8ae0-3360-4e0b-9fd8-12cf5fe9839c \
    --backup-dir /data/scratch/backups \
    --backup-uuid 46d3be69-1ef3-4da2-974d-90bc5d58c42b

[  0.0 ] Downloading VM 'e0bf8ae0-3360-4e0b-9fd8-12cf5fe9839c' disks

[  0.1 ] Downloading full backup for disk '56a62431-624d-4309-af8b-b9b2407dbce5'

[  2.0 ] Image transfer '0eae849f-7451-451a-9727-d8b2d0ac7834' is ready

...
6. Migrate VM during backup

Status: Migrating From

Migrate VM(s)

Select a host to migrate 1 virtual machine(s) to:

- Destiantion host: host4
- Migrate all VMs in positive enforcing affinity with selected VMs.
- Virtual machines: demo

[ Migrate ] [ Cancel ]
7. Download backup finished

...  
[100.00%] 6.00 GiB, 3.38 seconds, 1.77 GiB/s
[  5.3 ] Finalizing image transfer
[  8.4 ] Download completed successfully
[  8.4 ] Finished downloading disks
8. Stop the backup

$ ./backup_vm.py -c engine stop e0bf8ae0-3360-4e0b-9fd8-12cf5fe9839c \ 46d3be69-1ef3-4da2-974d-90bc5d58c42b

[ 0.0 ] Finalizing backup '46d3be69-1ef3-4da2-974d-90bc5d58c42b'

[ 7.3 ] Backup '46d3be69-1ef3-4da2-974d-90bc5d58c42b' completed successfully
9. Auto-generated snapshot deletion started...
10. Auto-generated snapshot deleted
11. Start incremental backup

$ ./backup_vm.py -c engine start e0bf8ae0-3360-4e0b-9fd8-12cf5fe9839c \
  --from-checkpoint-uuid a8deec5a-f08c-4cc3-af21-78d2917278c6

[   0.0 ] Starting incremental backup since checkpoint 'a8deec5a-f08c-4cc3-af21-78d2917278c6' for VM 'e0bf8ae0-3360-4e0b-9fd8-12cf5fe9839c'

[   0.4 ] Waiting until backup '2f27c101-d118-46f9-a82a-735f5a587441' is ready

[   9.5 ] Created checkpoint 'c73f3985-19ff-45bb-a288-4e9bf265c815'

[   9.6 ] Backup '2f27c101-d118-46f9-a82a-735f5a587441' is ready
12. Auto-generated snapshot created
13. Stop the VM

Status: Powering Down
14. Download incremental backup

$ ./backup_vm.py -c engine download e0bf8ae0-3360-4e0b-9fd8-12cf5fe9839c \   --backup-dir /data/scratch/backups \   --backup-uuid 2f27c101-d118-46f9-a82a-735f5a587441 \   --incremental

[  0.0 ] Downloading VM 'e0bf8ae0-3360-4e0b-9fd8-12cf5fe9839c' disks
[  0.1 ] Downloading incremental backup for disk '56a62431-624d-4309-af8b-b9b2407dbce5'
[  1.9 ] Image transfer 'b10b448b-0bc2-43be-b683-9c2b91318b31' is ready
[ 100.00% ] 6.00 GiB, 0.62 seconds, 9.69 GiB/s
[  2.5 ] Finalizing image transfer
[  4.5 ] Download completed successfully
[  4.6 ] Finished downloading disks
15. Start the VM

Status: Powering Up
16. Stop the backup

```
$ ./backup_vm.py -c engine stop e0bf8ae0-3360-4e0b-9fd8-12cf5fe9839c \
   2f27c101-d118-46f9-a82a-735f5a587441

[   0.0 ] Finalizing backup '2f27c101-d118-46f9-a82a-735f5a587441'

[   5.2 ] Backup '2f27c101-d118-46f9-a82a-735f5a587441' completed successfully
```
No virtual machines were harmed
More info

- [RFE] Allow changing vm powerstate during backup operation without interrupting the backup
  https://bugzilla.redhat.com/2053669

- [CBT] [RFE] Extend backup scratch disk as needed
  https://bugzilla.redhat.com/1913387

- [CBT] Provide a way to control backup mode per request
  https://bugzilla.redhat.com/2071744