Snapshot, Backup or Replication

BEGINNERS GUIDE TO VIRTUAL ENVIRONMENT BACKUP

Snapshot, Backup or Replication

Corporate IT without virtualization is hard to imagine. Virtual environments have great potential in private or semi-professional circles and have also become a point of interest for small businesses since Microsoft's release of its free proprietary hypervisor, Hyper-V. Hyper-V is making tremendous gains in the industry. Alternatively, VMware is the market leader with its ESX / vSphere solutions.

But what is the best way to back up a virtual Hyper-V or ESX server? What are different approaches, benefits and drawbacks? Some of our customers express uncertainty: «Why do I need an extra backup solution?» «Our virtualization solution already offers native snapshot creation».

Creating snapshots is not enough for a reliable data and system backup. Whereas backups significantly contribute to sustainable business operations. This whitepaper describes backing up VMware-based systems, but the approaches described are largely universal.

Snapshots are not backups

It's a widespread misconception that a snapshot of machine can be used as a backup. While snapshots and backups do have a few things in common, their intended purpose differs drastically.

A few facts about snapshots:
A snapshot is a recording of the state of a virtual machine at a particular point in time.

- A snapshot is not a full copy of a virtual hard drive, but a delta file or change log.

- The current state of the virtual machine is a combination of the original virtual disk and snapshots.

- ESX / vSphere snapshots are saved in the immediate vicinity of the original virtual data media.

- VMware snapshots are always thin-provisioned and thus have a detrimental effect on the performance of production environments.

- While it is theoretically possible to create a chain of up to 32 snapshots, VMware recommends a maximum of 2-3 elements in a snapshot chain. The consistency of the data and the performance of the environment may no longer be stable at higher numbers.

- A single snapshot should generally cover no more than 72 hours. Otherwise, the snapshot will be so large that it would take too long to play it back on the original hard drive.

- ESX / vSphere snapshots grow in increments of 16 MB and can thus reach or even exceed the size of the original virtual disk. If the virtual machine is an email or database server, i.e. a system with drastically high change rates, the size of snapshot will quickly reach the size of the original virtual disk.

Snapshots of virtual machines are primarily made for testing purposes. For instance, they are excellent for undoing recently changed configurations or rectifying problems from improperly run software.

However, using snapshots instead of backups will impair the performance of the virtual machine. You will also run the risk of losing data. Reduction in performance might be tolerable, but the loss of data or vital applications could ruin a company's business operations altogether. Furthermore: Who wants to sacrifice storage capacity and performance if it's not absolutely necessary?

In most virtual systems, the snapshots and original virtual disk are stored at the same location. If the original data medium is lost, then the snapshots – and thus the data – will be irretrievably destroyed. Snapshots have a slew of useful properties and are perfect for temporarily backing up a system while the virtual machine is being updated. If a problem appears, a snapshot can be used to restore the system to its original state. Deleting the snapshot is all it takes to make faulty modifications history. But if everything works properly, the changes are simply used on the original virtual disk. Snapshots are practical and extremely helpful in many situations, but they are no substitute for a proper backup.

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Backups are not snapshots

Backup creation is a multi-level process: an exact and complete copy of the virtual machine is created, then moved to a new storage location, and normally compressed in the process as well. Depending on the backup solution used and its configuration, the copy is either compressed before or after it is transferred to the target storage. Both variants have benefits and drawbacks, so they should be chosen based on specific requirements. The compression on the original system reduces the system's processing power, but enables significantly more efficient transmission over a network.

However, by far the most important aspect of creating a backup is the creation of a consistent copy of the virtual machine. And even though a snapshot should not be considered an actual backup solution, it is an part in the backup process. Most existing backup solutions for ESX / VSphere environments are based on VMware-native snapshot technologies.

A snapshot can also be described as a «frozen» version of the virtual machine, and a consistent point-in-time copy of the VM can only be created under this condition. If the file system were not «frozen» during the copy process, the .vmdk (virtual VMware hard drive) and .vmx (configuration settings file of a VMware guest machine) files would most likely change during the copy process. The resulting copy would thus not be consistent at any point in time.

So a snapshot on its own does not make a backup, but it is necessary to create reliable VM backups. In addition to the manufacturer's native solutions, there are many different backup products for VMware infrastructures on the market. Even though some of these products differ greatly in design, virtually all solutions rely on snapshot technology. Snapshot technology is part of the backup process in Paragon Protect & Restore as well.

The agony of choice

A Snapshot is an integral part in the backup process!

If backup software has access to the virtual machine's files provided via a snapshot, then the creation of the actual backups varies from manufacturer to manufacturer. Various storage locations, redundant backup options, different methods of compression and data duplication, incremental approaches and countless restoration options are only a few of the conceivable selection criteria. Many of these technologies and scenarios are supported by Paragon Protect & Restore. This solution is also an excellent choice for hybrid infra-structures, where the combined backup of physical and virtual systems is configured via a central management interface.

The restore scenarios required are a no less important factor in selecting the correct backup solution. For instance, some solutions are better suited if the machine is to be restored at its original location, while others can start up a virtual server directly from a backup. Paragon Protect & Restore includes many different options for these and other scenarios, making it a truly robust solution.

Removing snapshots is another critical part of the backup process. If the backup process was successful, the snapshot will no longer be needed, and may even have a detrimental effect on the VM's performance and take up unnecessary storage space if left unmanaged. In normal cases, the backup solution will send a delete command to the ESX or vSphere environment to have the snapshot removed.

If communication problems occur in the process, it can lead to «abandoned» snapshots and the aforementioned disadvantages. A good backup solution will check for this scenario and remove the remnant during the next run.

Depending on the backup concept and the solution used, the software also archives backups, shifting the older backup images to second-tier storage and de-duplicates the data to be archived in the process.

Backup, snapshot and then there is the …

In emergencies, replicas can immediately be put into operation without extra configuration work.

… replication of virtual machines. Replication is another alternative to backing up virtual machines (specifically for virtual servers) which provide first tier applications and thus must have high availability. Replication offers by far the best RTO (recovery time objective), since VM replicas do not have to be com-pressed and are kept in their original format in near proximity to the original machine. In emergencies, replicas can immediately be put into operation without extra configuration work. Paragon Protect & Restore provides VM replication methods and can even create incremental backup chains. No additional solution is required to do this, which reduces work and saves money.

As you might think, VM replication is a better implementation of the VM snapshot. With replications, there is no need to fear data corruption, complete loss of the original data, or reduced performance of the original VM, since unlike snapshots, they are kept in a different storage location and are only used in emergencies. However, since the design of replications (or replicas) requires them to reside in first tier data storage, there are significant cost factors to consider, depending on the size of the virtual infrastructure.

This means VM replication may not necessarily be the right concept for systems which do not require high availability.

In conclusion, if you want to back up data and virtual machines effectively, a backup solution is the method of choice. Snapshot technology scores points for maintenance work on short notice, and VM replication is the right method for optimal RTOs.

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