



SECURE SYSTEMS & NETWORK ENGINEERING

LARGE INSTALLATION ADMINISTRATION

## Lab 3 High availability

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# Task 1 - Practical part

## 1.1 Cold Migration

Cold migration is the migration of a powered-off virtual machine. The downtime for cold migrations in our case — 12.5 minutes. It is possible to avoid application downtime in case of using live migration in the failover cluster. Application performance before and after migration has not changed since the migrating machine retained the same hardware configuration. With cold migration, you have the option of moving the associated disks from one datastore to another.

## 1.2 Live Migration

Live migration is a Hyper-V feature in Windows Server 2016. When paired with Windows Failover Clustering, live migration allows the creation of highly available and fault tolerant systems. It allows transparently moving a running Virtual Machines from one Hyper-V host to another without perceived downtime. There was no downtime for live migration. Application performance before and after migration has not changed since the migrating machine retained the same hardware configuration.

## 1.3 Cluster

Failover cluster (Figure 1) is a Windows Server feature that enables to group multiple servers together into a fault-tolerant cluster. The cluster's performance was verified by disabling one of the two machines. In this case, the resource was always available.

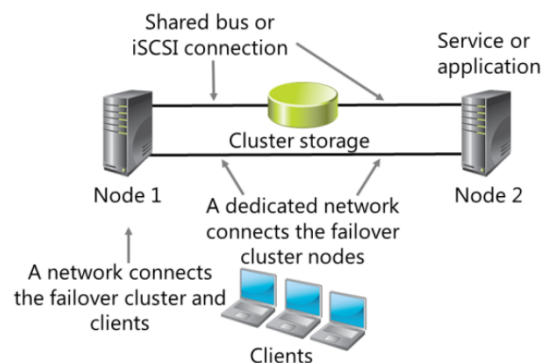


Figure 1: Failover cluster components

## 1.4 Continuous replication and snapshots (Optional)

For this task was used Hyper-V Replica (Figure 2). Hyper-V Replica is implemented as part of the Hyper-V role. We used Hyper-V server that are part of a failover cluster, in that case we configured Hyper-V Replica Broker. Unlike failover clustering, a Hyper-V role is not dependent on AD DS.

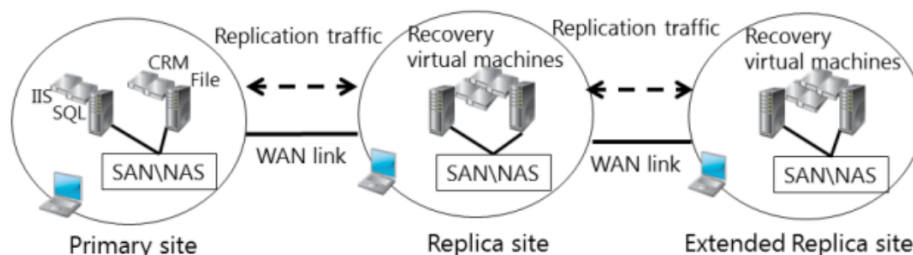


Figure 2: Hyper-V Replica schema

It is allowed us to replicate a virtual machine to another host, instead of moving the virtual machine, and to synchronize all virtual machine changes from the primary host to the host that holds the replica.

## Task 2 - Theoretical part

### Question 1

Describe the differences between cold (or off-line) migration and live migration.

#### Answer

Live migration allows to transparently move running virtual machines from one node of the fail-over cluster to another node in the same cluster without a dropped network connection or perceived downtime. Whereas cold migration does not provide such capabilities, you must first stop the virtual machines, export them from one node to the shared storage, and then import them to another node.

### Question 2

What mechanism makes live migration almost instantaneous under light load?

#### Answer

The mechanism of using shared cluster storage together with the shared memory address space during migration makes live migration almost instantaneous under light load.

### Question 3

What are the technical requirements to be able to live migrate VMs, and why?

#### Answer

A user account with permission to perform the various steps. Membership in the local Hyper-V Administrators group or the Administrators group on both the source and destination computers meets this requirement, unless you're configuring constrained delegation. Membership in the Domain Administrators group is required to configure constrained delegation.

The Hyper-V role in Windows Server 2016 installed on the source and destination servers. You can do a live migration between hosts running Windows Server 2016 if the virtual machine is at least version 5.

Source and destination computers that either belong to the same Active Directory domain, or belong to domains that trust each other.

The Hyper-V management tools installed on a computer running Windows Server 2016 or Windows 10.

### Question 4

Think of a definition of the downtime of a VM and your application, and what is the best way to measure that downtime. Write down both your definition and measurement method(s).

#### Answer

**Downtime** is a time during which a VM and an application on it, is out of action or unavailable for use. The best way to measure a downtime is to use logging system (such as the Debug and Analytic logs in the Event Viewer) and then analyze it. Highly available systems have minimal downtime, whether planned or unplanned, and they usually need to be available on a 24-hour-a-day basis. Also, it is possible to use a special software that would track downtime (e.g. Evocon, Thrive, MachineMetrics and so on).

## Question 5

Show in your report the summarized results from your measurements, what conclusion you can make from the results.

### Answer

The downtime for cold migrations in our case — 12.5 minutes. There was not downtime for live migrations. For high availability system, a requirement for 99.9 percent availability over a one-year period allows for 8.75 hours of downtime, whereas a requirement for 99.9 percent availability over a four-week allows for only 40 minutes of downtime per period. Our high availability cluster corresponds to these requirements when performing a live migration.

## Question 6

Which type of shared storage (technology) have been selected to configure and why? Describe the difference between technologies:

- which of them has better performance?
- which should be selected as most reliable and should be used for better resiliency?

### Answer

Most failover clustering scenarios require shared storage to provide consistent data to a highly available service or application after failover. The following are four shared-storage options for a failover cluster:

- Shared serial attached SCSI. Shared serial attached SCSI is the lowest-cost option, however, it is not very flexible for deployment because the two cluster nodes must be physically close together. In addition, the shared storage devices that support serial attached SCSI have a limited number of connections for cluster nodes.
- iSCSI. iSCSI is a type of storage area network (SAN) that transmits SCSI commands over IP networks. Performance is acceptable for most scenarios when 1 gigabit per second (Gbps) or 10 Gbps Ethernet is used as the physical medium for data transmission. This type of SAN is inexpensive to implement because no specialized networking hardware is required.
- Fibre channel. Fibre channel SANs typically have better performance than iSCSI SANs, but are much more expensive. Additional knowledge and hardware are also required to implement a Fibre Channel SAN.
- Shared .vhdx. In Windows Server 2016, you can use a shared virtual hard disk drive as storage for virtual machine guest clustering. A shared virtual hard drive should be located on a CSV or Scale-Out File Server cluster, and it can be added to two or more virtual machines that are participating in a guest cluster, by connecting to the SCSI interface.

The fibre channel has better performance and reliability. It should be used for better stability.

## Question 7

Share your web application performance results with other organizations. Which Hypervisor provides better performance? Guess why?

### Answer

Our organization has a very long cold migration time (12.5 minutes) compared to the organization that uses Xen (42 seconds). We believe that in our case it takes a lot of time to copy virtual hard disks to the network storage during export and during the import of machines.

### Question 8

Is it acceptable to use HA Hypervisor feature for all applications types to achieve high availability of the application?

**Answer**

If we have a badly designed application, the HA Hypervisor feature will not save it. Therefore, the use of the HA Hypervisor feature will indeed make sense for high-performance applications.