Performance Analysis Of Failover Cluster For System Recovery

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ABSTRACT

The need for up-to-date information systems encourages web server service providers to build systems with high availability. One who needs it is the Online Shop Business and large-scale companies. The technique that can be used is implementing server clustering. Cluster Server is a technology that combines several resources that work together so that it looks as though a single system. Cluster technique that can be used to provide a system with high availability that is failover cluster. In this study, the failover cluster system was built using the VMware provided Vmware's failover feature. Failover cluster built consists of three physical servers with Vmware ESXi operating system. One server is used as data traffic monitoring and Shared Storage while two servers are used as nodes of the Failover Cluster which will be used to run the Guest OS. Each node in the Failover Cluster will be tested using a System Failure Scenario created based on potential interruptions in the company. Parameters measured in this study are Availability and Network Utilization. The Availability trial results performed using Vmware features called Vmware Fault Tolerance can generate a 94.44% Availability Value for 7 System Failure Scenarios. The Network Utilization value of 13,041.54% was obtained when the failover occurred between nodes in failure scenarios performed in a row.

Keywords: Index Terms—Failover Cluster, Availability, MTBF, MTTR

1. Introduction

Server as a computer system provides various types of services in the networkcomputer, it has a high ability to serve requests from clients. Servers become an important part of the company, when companies have important applications running on the server. Server failure to provide services will hinder the work of employees or can interfere with the company's business processes, so it takes the backup server method to maintainintegrity and availability of services in the event of a hardware or server software interruption or the influence of a network connection resulting from a natural disaster ordisorders caused by humans.

One solution to solve the above problem is to usefailover clustering technology. To use this technology it takes at least two servers are combined in one cluster. In a failover cluster, there are two computers (or occasionallyseveral computers). One (Primary) provides the service innormal situations. A second (failover) computer is present inorder to run the service when the primary system fails. Theprimary system is monitored, with active checks every fewseconds to ensure that the primary system is operatingcorrectly. The system performing the monitoring may beeither the failover computer or an independent system (calledthe cluster controller). In the event of the active system failing,or failure of components associated with the active systemsuch as network hardware, the monitoring system will detectthe failure and the failover system will take over operation ofthe service. Every company or an organization has to use adatabase for storing information. But what if this databasefails? So it behooves the company to use another database forbackup purpose. This is called ad failover clustering. Formaking this clustering manageable and lucid the corporatepeople spend more money on buying a licensed copy for both,the core database and the redundant database[1].

In this study the author will implement a system Failover Cluster Server Virtual to overcome the server failure. The system was built by utilizing the Failover Cluster feature in Vmware under the name Vmware Fault Tolerance and the guest OS operating system

using Windows Server 2008 R2. This system will then be analyzed using several tests to determine the level of Availability.

Computer Cluster

A computer cluster consists of a set of connected computers that work together in so many ways that it can be viewed as a system. Components are usually connected to each other over a local area network (LAN), with each node (the computer used as a server) that performs its own function of an operating system. Clusters are typically used to improve the performance and power of a single computer, otherwise it is usually more cost-effective with comparable computers or networks. Computer clusters emerge as a result of the convergence of the number of trends including low-cost microprocessors, high-speed networks, and software for high-performance distributed computing. The concept of clusters is actually the management of some physical machines that are highly connected with these independent hosts into a single entity. The cluster provides the power of multiple hosts with the simplicity of managing a single unit with combined resources and higher power[2].

Failover Clustering

In computing, Failover switches to computer servers, systems, network or excessive hardware components in the event of abnormal failures or termination of previously active applications, servers, systems, hardware components or networks. Failover and transition are essentially the same operations, except the failover works automatically and usually operates without warning, while the transition requires human intervention. System designers typically provide failover capabilities on servers, systems or networks that require ongoing availability - the term used is High Availability and network utilization.

Failover cluster isset of servers that work together forprovide service despite being in a placedifferent, and have quality data or resourcesthe same between one server with another server.The failover system will work to contact server-the server that belongs to its cluster fortakes over the primary server task when a failure occursfunction within a certain time[3]. The main function of failover clustering aims to helpkeeping client access to applications and server resources, even whena software failure, or a server failure that resulted in the server stopping working[4].

Availability

In a mission critical application, “Availability” is the very first requirement to consider. Thusunderstanding what it is, what would affect it, and how to calculate it, is vital. Proper functioning of asystem can be evaluated based on different factors. availability” is considered as a function of time, defined as the probability that systemis operating correctly and is available to perform its function at the instant of time “t”[5]

High-availability clusters also known as HA clusters or failover clusters are groups ofcomputers that support server applications that can be reliably utilized with a minimum ofdown-time. They operate by harnessing redundant computers in groups or clustersthat provide continued service when system components fail. Without clustering, if aserver running a particular application crashes, the application will be unavailable untilthe crashed server is fixed. HA clustering remedies this situation by detectinghardware/software faults, and immediately restarting the application on another systemwithout requiring administrative intervention, a process known as failover. As part of thisprocess, clustering software may configure the node before starting the application on it[6].

MTBF(Mean Time between Failures) is the average (expected) time between the two successive failures of acomponent. It is a basic measure of a system’s reliability and availability and is usually represented asunits of hours[7]. “Recovery” is yet another main concern about any service. Having a correct recovery procedure andbeing prepared to recover from any failure in a defined amount of time via defined amount of energy andresources spent, one may decide not to lower the likelihood of the system to fail, but just simply recoverit in case of a failure as soon as possible. All in all, what matters is to have the service do what is itsupposed to do at the right time. MTTR (Mean Time to Repair) is the main term when determining howa system would behave in case of

recovery. It is another major factor of determining a system"Availability"[8].

$$\textbf{Availability} = \frac{MTBF}{MTBF + MTTR} \times 100\ \% \quad (1)$$

The following conclusions can be reached based on these formulas:

- The higher the MTBF value is, the higher the reliability and availability of the system.
- MTTR affects availability. This means if it takes a long time to recover a system from afailure, the system is going to have a low availability.
- High availability can be achieved if MTBF is very large compared to MTTR

2. Research Method

In figure 1, all devices connected via switch. Server Management will run vCenter Server and Virtual Storage. As for Server A and B will run Online Shop System simultaneously. The Notebook will be used for monitoring Failover Cluster through vCenter Server in Server Management.

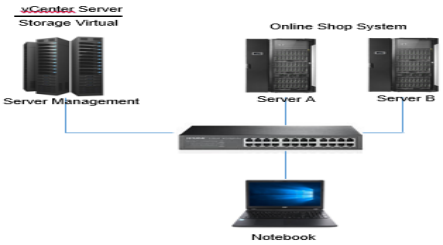

Figure 1. Failover Cluster Topology

Configuration of the Failover Cluster System on Vmware vSphere Hypervisor via Vmware vSphere Client. To enable the feature, first need to create a virtual machine (VM) that will run Vmware vCenter Server. Vmware vCenter Server will be run on top of Server Management so that all Server operational processes will be monitored through this Server.To create a Failover Cluster, the installation process must meet the Vmware Fault Tolerance criteria that each Physical Server must have the following Vmkernel. (Management Traffic, vMotion, Fault Tolerance Logging, and iSCSI Port Binding).

Testing of this research includes several tests, such as when power failure, reboot server, disconnected network cable, 2 times unstable power supply, dead server, switch off, 3 times unstable electrical voltage.

3. Discussion

A. Availability Analysis

No.	Time	Master	Slave	Failover Cluster Status
1	09.30	Server A	Server B	Normal
2	10.05	Server B	-	Server A Down
3	10.20	Server B	Server A	Normal
4	10.45	Server A	-	Server B Down
5	10.55	Server A	Server B	Normal
6	11.15	Server A	Server B	Normal
7	11.20	Server A	Server B	Normal
8	11.25	Server B	-	Server A Down
9	11.35	Server B	Server A	Normal
10	11.40	Server A	-	Server B Down
11	11.50	Server A	Server B	Normal
12	11.55	Server B	-	Server A Down
13	13.30	Server B	Server A	Normal
14	13.45	-	-	Both Server Down
15	14.00	Server A	Server B	Normal
16	14.55	Server B	-	Server A Down
17	15.05	Server B	Server A	Normal
18	15.20	Server A	-	Server A Down
19	15.30	Server A	Server B	Normal
20	15.30	Server B	-	Server B Down
21	15.35	Server B	Server A	Normal

1. Power Failure
   Server A that the downtime duration (MTTR) is 15 minutes when a failure due to Power Off with uptime duration (MTBF) is 35 minutes. Availability Results for Server A is 70%. For Server B and Guest OS Failover Cluster did not experience downtime at all so it was found that the duration of downtime (MTTR) was 0 minutes when failure due to Power Off with uptime duration (MTBF) was 50 minutes. The result is 100%.
2. Server Reboot
   Server B has a downtime duration (MTTR) is 10 minutes with uptime duration (MTBF) is 75 minutes. Availability Results for Server B is 88.24%.For Server A having a downtime duration (MTTR) is 0 minutes with uptime duration (MTBF) is 25 minutes. The result is 100%.For Guest OS Failover Cluster does not experience downtime at all with the duration of downtime (MTTR) is 0 minutes and uptime duration (MTBF) is 85 minutes. Availability result is 100%.
3. Network Cable Lost
   Server A, Server B, and Guest OS Failover Cluster have a downtime duration (MTTR) is 0 minutes with uptime duration (MTBF) is 20 minutes. The result of the Availability calculation for the three servers is 100%.
4. Voltage of Unstable Electricity 2 times
   Server A that the duration of downtime (MTTR) is 10 minutes with uptime duration (MTBF) is 55 minutes. The result of Availability for Server A is 84.62%.For Server B having a downtime duration (MTTR) is 10 minutes with uptime duration (MTBF) is 45 minutes. The result of Availability for Server B is 81.82%.For Guest OS Failover Cluster did not experience downtime at all so found that the duration of downtime (MTTR) is 0 minutes with uptime duration (MTBF) is 140 minutes. Availability result is 100%.
5. Server is off
   Server A that the duration of downtime (MTTR) is 95 minutes with uptime duration (MTBF) is 20 minutes. The result of the calculation of Availability for Server A is 17.39%. For Server B having a downtime duration (MTTR) is 0 minutes with uptime duration (MTBF) is 100 minutes. The result is 100%.For Guest OS Failover Cluster did not experience downtime at all so found that the duration of downtime (MTTR) is 0 minutes with uptime duration (MTBF) is 240 minutes. The Availability result is 100%
6. Switches Off
   Server A that the duration of downtime (MTTR) is 15 minutes with uptime duration (MTBF) is 15 minutes. Availability Results for Server A is 50%.For Server B it was found that the duration of downtime (MTTR) was 15 minutes with uptime duration (MTBF) was 115 minutes. The result of Availability for Server B is 88.46%.For Guest OS Failover Cluster found that the duration of downtime (MTTR) is 15 minutes with uptime duration (MTBF) is 255 minutes. The result of the Availability is 94.44%.
7. Unstable Electrical Voltage (3X)
   Server A that the duration of downtime (MTTR) is 15 minutes with uptime duration (MTBF) is 80 minutes. Availability Results for Server A is 84.21%.For Server B it was found that the duration of downtime (MTTR) was 10 minutes with uptime duration (MTBF) was 80 minutes. The result of Availability for Server B is 88.89%.For Guest OS Failover Cluster did not experience downtime at all so found that the duration of downtime (MTTR) is 0 minutes with uptime duration (MTBF) is 95 minutes. The result is 100%.

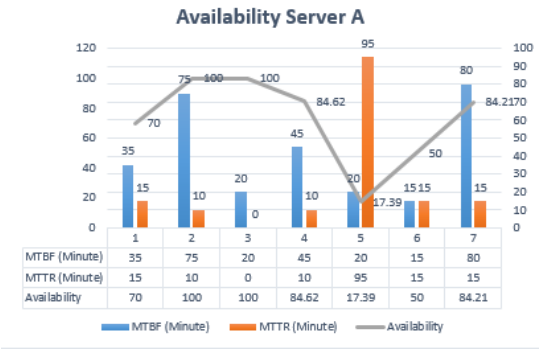

Figure 2. Availability Server A

From the test results data Scenario in Figure 2. shows that the duration of downtime (MTTR) the fastest occurs in scenario 3 breaks down while the longest downtime occurs in scenario 5 when the server is damaged Hardware requires replacement sparepart long enough and cause downtime during 95 minutes.

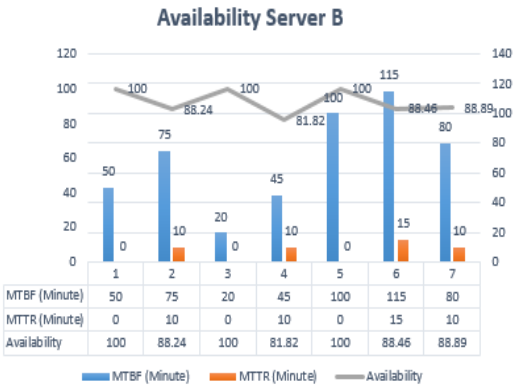

Figure 3. Availability Server B

From the test results data Scenario in Figure 3. shows that the duration of downtime (MTTR) occurs most quickly in Scenario 1, Scenario 3 and Scenario 5 while the longest downtime occurs in Scenario 6 when the server is experiencing local network disconnection because the switch dies causing downtime during 15 minutes.

8. Conclusion

The Cluster Failover System Recovery process is tested by running 7 Potential Failure Scenarios. Failover Clusters built using the Vmware Fault Tolerance feature work well according to the concept of work, so Guest OS can still provide services to the Client without any interruption except in Scenario 6 where the Switch as a data transmission center is damaged.

The results of Availability testing analysis is strongly influenced by the duration of On from the Cluster. The highest Availability value is 94.44% in Guest OS with downtime of 15 minutes.

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