FAULT TOLERANCE IN LIVE VM MIGRATION -A REVIEW

Avneet Kaur [1], Divyajot Gill [2]

[1] Student M.Tech, Computer science, Global Institute of Engg & technology, Punjab, India
[2] Assistant Professor, Computer Science, Global Institute of Engg & technology, Punjab, India

---***---

ABSTRACT - The technology is enhancing day by day. This technology allows users to utilize resources beyond the capacity of the machines they are using. Cloud is one such technology permitting the users to achieve the same. Cloud computing provide physical machines on which multiple virtual machines are supposed to execute. This helps in reducing the need of physical machine in computation environment. As the dependency on the virtual machines increases, the risk factor such as threat to integrity also increases. Fault tolerant capabilities hence are critical in virtual data centres or virtualization. The prime objective of proposed work is to analyse distinct fault tolerant capabilities utilized in virtualization and provide comprehensive comparison of techniques to determine optimal methods.

KEYWORDS

Resources, Cloud Computing, Physical Machine, Virtualization, Fault tolerance capabilities.

1. INTRODUCTION

Today dependency on virtual data centre for computation is increased beyond expected levels. The users can be of distinct categories. The threat to enterprise can adversely affect its performance and operation. The problem is independent of operating system on distinct physical machines. The fault tolerant capabilities hence have to be different to tackle various hazards. This section describes potential hazards and risks that can affect the performance of data centers providing virtual environment. The second section describes various techniques associated with Fault tolerance in VM migration. The third section presents comprehensive comparison between techniques by highlighting pros and cons. Last section presents conclusion indicating optimal strategy.

1.1 Software Crashes

This type of failure is omnipresent. It is common on physical as well as virtualized environment. The operating system present on virtual machine can crashes due to bugs in kernel causing temporary loss of server. This degrades performance of virtual as well as physical machine. Such events cause the server to be down indefinitely.

1.2 Updating Software

Every virtual machine has to be periodically upgraded which includes security fixes, bug fixes etc. During the up gradation both machines are down. This enhances the downtime of virtual as well as physical machines. This also appears within the hazards which degrade the performance of virtualization.

1.3 Start Up failure

This type of failure occurs when VM is migrated to older server. Migration not always assures flawless reliability. Insufficient and inappropriate resources cause the VM to fail immediately. Resources need to be shared and data is needed to be migrated to safe locations provided with the help of fault tolerant capabilities.

1.4 incompatible server hardware

At application level migration, compatibility is necessary. Compatibility is generally defined in terms of hardware. During migration process if hardware is not compatible then application fails to execute. So during migration hardware compatibility needs to be considered.

1.5 Conflicting VM task

Program when executes process formulates. Process run either in front or back end. The process sometimes continues to execute on the server even after finished execution. Such processes are known as daemon processes. These problems are tackled by handling processes through the techniques of concurrency control.

2. FAULT TOLERANT MECHANIMS AS PART OF VM MIGRATION

There exists fault and failures during hardware and software migration processes. Techniques for achieving it are discussed in this section.

2.1 FAULT TOLRANCE THROUGH RAPLICATION

This is a common approach for implementing fault tolerant capability using primary and secondary backup system. The secondary backup is always present if the primary server fails. The state of the secondary server should be same as the Primary server.

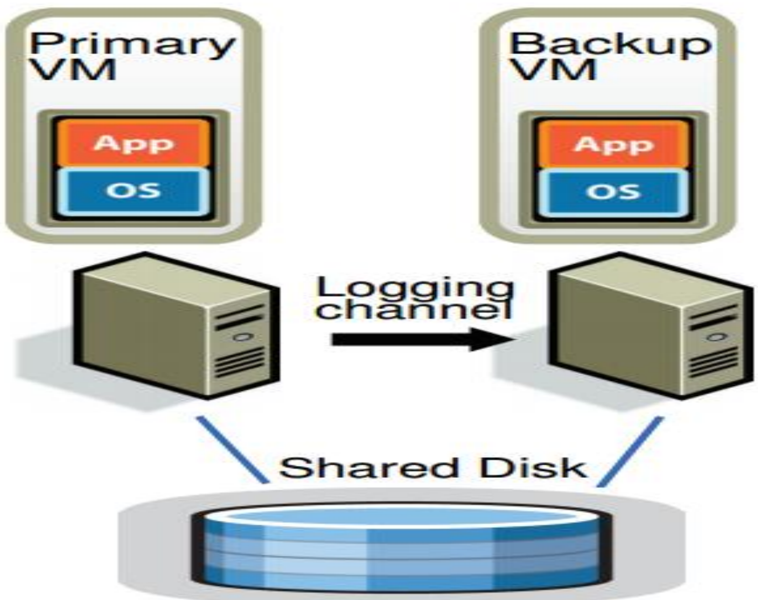

FIG 1: MODEL FOR BACKUP SERVER

The redundant array of independent disks along with parity check mechanism can also rectify faults also. The replication and parity check mechanism enhance the performance of server. The data in case of failure is recovered through RAID along with parity check mechanism. Parity can be even or odd. The even parity has even number of 1s in the data. The odd parity has odd number of 1s. (1)

2.2 FAULT TOLERANCE THROUGH TRANSPARENT VM LEVEL MIGRATION

Virtual cluster supra system is considered in this case. The virtual cluster consists of virtual machines along with multitude of software components which doomed to be failed eventually. The virtual cluster enhances availability, reliability and manageability VMs to reach the stable and consistent state. When fault occur virtual cluster automatically recovers the state of the VMs to consistent state. The save point and checkpoint is utilized in this case.

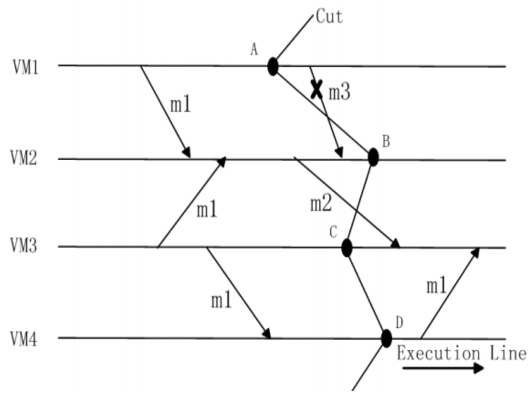

FIG 2: SHOWING TRANSPARENT VM LEVEL MIGRATION (2)

2.3 Survival Control Plane Strategy

This mechanism ensures backup to be taken in elastic optical network. Since network is utilized which is prone to failures hence entire process of elastic network is at stakes. In order to resolve the problem novel mutual backup model is proposed in the studied paper. Number of output lines required to transfer and back up is reduced by the use of WDM. The problem of slow migration appears in this case. in order to resolve the problem optical medium is suggested. The optical medium transfer the data at the speed of light hence overall transfer rate enhances. More data can be transferred hence throughput is also enhanced. (3)

2.4 Burstiness Aware Resource Allocation

The burstiness occurs aperiodically in migration. The spikes occur variantly and for short interval in cloud. VMs are consolidated by minimum number of physical machines utilized. Queue is maintained to store spare resources. These resources are exposed to VMs as and when required to reduce the work load and overhead associated with migration. (4)

2. COMPARISON OF TECHNIQUES UTILIZED FOR MIGRATION

The comparison is presented in terms of tabular structure illustrated as follow

TABLE 1: COMPARISON OF TECHNIQUES USED IN VM MIGRATION

Authors and Title	Year	Journal	Technique	Downtime	Migration Time	Cost	Energy Consumed=P *t/1000	Fault Tolerant	Bytes Transferred
(1) William Voorsluys and others, 'Cost of Virtual Machine Live Migration in Clouds : A Performance Evaluation', 254–65.	2009	Springer	Cost Evaluation in VM Migration	3 Sec	Home Page Loading 0.32 Sec Adding New Person 2.28 Sec	Cost Encountered is high for 600 Concurrent users	0.9*1.09/1000=0.0009J	Fault Tolerant Capabilities are absent and hence Service layer Applications are violated	Maximum 2GB
(2) Bangjie Jiang and others, 'Priority-Based Live Migration of Virtual Machine', 2013, 376–85.	2013	Springer	Priority Based	600 ms for high priority	600ms	Migration time is reduced by 5.5 % hence cost is also reduced	Power calculation mechanism is not specified	This capability is not utilized	Maximum 8GB
(3) Israfil Biswas and others, 'An Analysis of Live Migration in Openstack Using High Speed Optical Network', 2016, 1267–72.	2016	IEEE	OpenStack	Minimum 0.3s and maximum 0.7s	Minimum 11.2 s and Maximum 12 s	Zero Length Encoding is used to reduce Cost	Power calculation mechanism is not specified	Not utilized	Maximum 15.04 LTS
(4) 'Virtual Machine Migration Planning in Software-Defined Networks', 2015, 487–95.	2015	IEEE	Migration Technique which is software defined	20%Reduced	40%Reduced	Cost is reduced	No mechanism for power calculation	Not Defined	Minimum 203 GB Maximum 212 GB
(5) Umar Kalim and others, 'Seamless Migration of Virtual Machines Across Networks', 2013.	2013	IEEE	Protocol Based	Compatibility of protocols are checked	Compatibility of protocols are checked	Not defined	No mechanism for power calculation	Not Defined	Data transferred through use of TCP/IP protocol
(6) Ganesan Radhakrishnan, 'Adaptive Application Scaling for Improving Fault-Tolerance and Availability in the Cloud', 17.2 (2012), 5–14	2012	IEEE	Adaptive Scaling	Downtime is not considered	Migration Time is not considered	Not Defined	No mechanism for power calculation	Adaptive Scaling to enhance fault tolerance	Not Specified

5. CONCLUSION AND FUTURE SCOPE

The performance of existing algorithm is comprehensively described in this work. The comparison between techniques suggests need for state of the art algorithm for enhancing VM migration along with fault tolerance capabilities which is yet deprived. The adaptive scaling and memory exploration techniques are considered to be optimal in their class with reduced complexity but without cost parameter associated with them. The migration time and downtime in these strategies are also not optimal.

In future better features of both techniques can be utilized along with fault tolerant capabilities like checkpoint to create state of the art enhanced performance algorithm.

6. REFERENCES

1. Jbod M. Migrating JBOD to RAID.
2. Zhang M, Jin H, Shi X, Wu S. VirtCFT : A Transparent VM-Level Fault-Tolerant System for Virtual Clusters. 2010;147–54.
3. Zhao B, Chen X, Zhu J, Zhu Z. Survivable Control Plane Establishment With Live Control Service Backup and Migration in SD-EONs. 2016;8(6):371–81.
4. Zhang S, Qian Z, Luo Z, Wu J, Lu S. Burstiness-Aware Resource Reservation for Server Consolidation in Computing Clouds. 2015;9219(c):1–14.
5. Liu CYJ, Chou CHW. On improvement of cloud virtual machine availability with virtualization fault tolerance mechanism. 2013;
6. Li Z. Optimizing VM Live Migration Strategy Based On Migration Time Cost Modeling. 2016;99–109.
7. Wolke A, Bichler M, Setzer T. Planning vs . dynamic control : Resource allocation in corporate clouds. 2014;7161(c):1–14.
8. Zhang J, Ren F, Shu R, Huang T, Liu Y. Guaranteeing Delay of Live Virtual Machine Migration by Determining and Provisioning Appropriate Bandwidth. 2015;9340(c).
9. Voorsluys W, Broberg J, Venugopal S, Buyya R. Cost of Virtual Machine Live Migration in Clouds : A Performance Evaluation. :254–65.
10. Jung D, Chin S, Chung KS, Yu H. VM Migration for Fault Tolerance in Spot Instance Based Cloud Computing. 2013;142–51.
11. Jiang B, Wu J, Zhu X, Hu D. Priority-Based Live Migration of Virtual Machine. 2013;376–85.
12. Biswas I, Parr G, Mcclean S, Morrow P, Scotney B. An Analysis of Live Migration in Openstack Using High Speed Optical Network. 2016;1267–72.
13. Liu H, Jin H, Xiaofei CX. Performance and energy modeling for live migration of virtual machines. 2013;249–64.
14. Ma F, Liu F, Liu Z. Live Virtual Machine Migration based on Improved Pre-copy Approach. 2010;230–3.
15. Ma Y, Wang H, Dong J, Cheng S. ME2 : Efficient Live Migration of Virtual Machine With Memory Exploration and Encoding. 2012;2–5.

16. Virtual Machine Migration Planning in Software-Defined Networks. 2015;487–95.

17. Kalim U, Gardner MK, Brown EJ, Feng W. Seamless Migration of Virtual Machines Across Networks. 2013;

18. Radhakrishnan G. Adaptive Application Scaling for Improving Fault-Tolerance and Availability in the Cloud. 2012;17(2):5–14.

19. Pamboris A, Pietzuch P. C-RAM : Breaking Mobile Device Memory Barriers Using the Cloud. 2015;1233(c):1–14.

20. Perspective AS, Jhawar R, Member GS, Piuri V. Fault Tolerance Management in Cloud Computing : 2012;1–10.

21. Menzel M, Ranjan R, Wang L, Member S. CloudGenius : A Hybrid Decision Support Method for Automating the Migration of Web Application Clusters to Public Clouds. 2014;6(1).

22. Wu Q, Ishikawa F, Zhu Q, Xia Y, Member S. Energy and migration cost-aware dynamic virtual machine consolidation in heterogeneous cloud datacenters. 2016;1374(c).