

Strategic Scheduling of a Live Migration Virtual Machine using Machine Learning: A Review

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Abstract: This paper discusses virtual machines (VM) and their use in server technology. This study focuses on the use of machine learning (ML) to schedule live migrations of VMs. The authors conducted a systematic literature review (SLR) to gather evidence of ML research in server migration. The study found that there is a lack of research in this area, and quantitative research can be conducted to explore the potential of ML in terms of server migration. The paper also presents a selection of paper criteria defined for the study, including the exclusion and inclusion criteria, quality assessment, and quantity assessment. The authors retrieved reliable and related papers using the definition of the paper selection criteria and keywords. The SLR method is not discussed in all papers, and the authors want to develop the title into SLR format to produce high-quality papers on live migration VM machine learning. The paper also includes a journal review that discusses the theory of graph team infra and the scheduling algorithm. The authors also present their research questions, which include the definition of virtual machine, live migration, and its application. The paper includes a list of references that discuss various aspects of VMs, including migration strategies, scheduling methods, and self-management of virtual network resources. The authors conclude that there is a need for further research in the area of ML in server migration, and quantitative research can be conducted to explore the potential of ML in this field.

Keywords: Live Migration, Virtual Machine, Machine Learning, A Review

Introduction

The use of Virtual Machine (VMs) technology in the industrial world in the 4.0 era is increasing, in line with the growth of startup businesses and other industries ([Shao et al., 2020](#)). The presence of virtual machines provides benefits for the industry in which users will no longer use physical servers. However, along with the development of VM technology, there are new problems that must be addressed, such as downtime and cyberattacks. Thus, we must ensure that the availability of VMs is always good and that the performance of its application services is stable ([Forsman et al., 2015](#); [Li et al., 2013](#)). Problems like this will continue to occur if not handled properly. There are many ways to maintain VMs; in research, it was stated that for VMs to remain in good condition, a strategy is needed to handle them, namely by placing VMs on hosts that do not have too busy workloads, by monitoring network traffic that does not have a high load. The literature ([Li et al., 2019](#)) explains that live migration of VMs can be performed by considering the high memory load of VMs. Another study reported the same conclusion that live migration can be performed on the network traffic in each VM ([Paulraj et al., 2018](#); [Zhang et al., 2021](#)).

Furthermore, the authors conducted a literature review and analysis of existing research to identify gaps and research positions not previously reported. The author also attempts to find and analyze several papers related to "live migration VMs" in search databases, such as IEEE, ScienceDirect, and Tandfonline, which will produce resumes related to research opportunities that have not been carried out by previous research. The systematic literature review approach is expected to provide new knowledge for further research ([Altahat et al., 2018](#)).

Research Method

At this stage the author tries to find papers from the Wiley, IEEE Explore, Sciencedirect, and Tandfonline databases for the period 2018 to 2023, which are tailored to the field in which the author wishes to study. Then, the author selects papers based on several criteria for further analysis to find research opportunities. Figure 2 shows the stages of determining the theme, defining keywords, analyzing the paper, and preparing a resume paper ([Hidayat & Mahardiko, 2021b](#)).



Figure 1 Systematic Literature Study

As the authors are aware of SLR, this is a formal review and only translates on the basis of the research question. SLR consists of five steps: research question creation, library selection, data extraction, data synthesis, and results discussion. The table below summarizes the authors' questions and responses to this paper ([Hidayat & Mahardiko, 2021a](#)).

Table 1 Research questions

No	Question	Target Achievement
1	What are Virtual Machines?	Is a server resource that uses virtualization techniques?
2	What is live migration and how is it implemented?	Can a virtual machine be transferred from one host to another using an Internet service? The live migration technique has many applications, including pre-copy and overload-underload Detection, etc.
3	What is the research contribution?	Identify problematic VMs using machine learning and determine the storage space.

From 2018 to 2022, related papers were searched in trusted libraries on March 9, 2023. The research question in table 2 is then translated into keywords. " Migration Virtual Machine," " Live Migration Virtual Machine," "Machine Learning Live Migration Virtual Machine," and "Machine Learning Neural Network Live Migration Virtual Machine" are search terms. All keywords are in lowercase letters with a space between them and no quotation marks. As a result, the keywords are checked against three reliable digital libraries. This study also describes the criteria used to find related papers and answer the research questions. The following table presents the paper criteria selected for this study.

Table 2 Selection Criteria Paper

ID	Exclusion
E1	Every article not in peer reviewed paper
E2	Paper not in English
E3	Paper which not discusses Live Migration VMs
E4	This paper presents a case study of live migration. VMs and Machine Learning
ID	Inclusion
I1	Peer reviewed papers and full-length journal articles and discusses live migration VMs and Machine Learning
I2	Papers published from 2018 to 2022
I3	Papers which propose a solution to Live Migration VMs
I4	English paper
I5	Paper which is not opened access
ID	Quality Assessment
QUA1	The methods were implemented in accordance with the research?
QUA2	Is there enough description in research context?
QUA3	What are the strengths of research objective?
QUA4	Has the paper been reviewed from previous research?
ID	Quantity Assessment
QAS1	Are measurement standards defined?
QAS2	Is there any process to measure?
QAS3	Is anything measured by numbers?

Results and Discussion

Result Paper

The table below shows some reliable and related papers retrieved using the definition of paper selection criteria and keywords.

Table 3 Results Paper

Year	Keyword	IEEE	Sciencedirect	Tandfonline
2018 - 2022	Virtual Machine Migration	173	4773	1719
	Live Migration Virtual Machine	77	1484	1244
	Live Migration Virtual Machine and Machine Learning	1	32	139
	Virtual Machine and Machine Learning Neural Network	1	19	21

From the obtained keyword search results, the author selected papers that matched the theme and created a resume for further analysis of research opportunities.

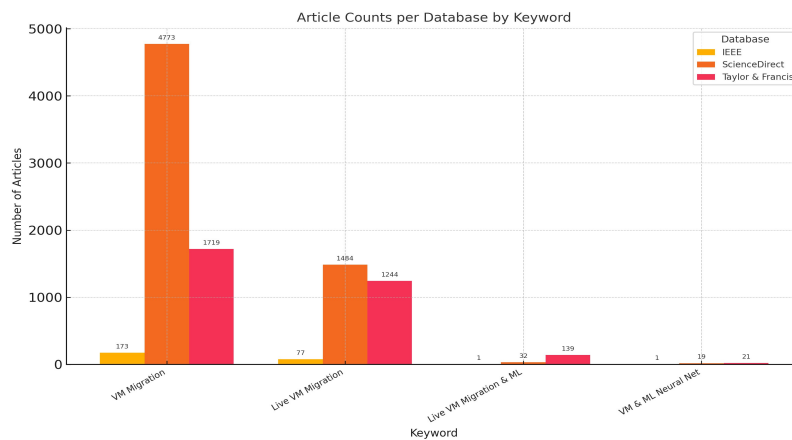


Figure 2 Statistic Result Paper

Figure 2 shows that there are one related paper in IEEE, 19 papers in ScienceDirect, and 21 papers in Tandfonline. The SLR method has not been previously discussed. The research developed the title into SLR format because of this result, allowing the paper to be developed using other methods. In addition, it can produce high-quality papers using live migration VM machine learning.

Journal Review

After these many papers received from 3 trusted digital libraries, authors took some potential papers to be discussed in order to overcome research questions 13 papers were taken as examples and extracted to obtain their results. Table 4 explains each definition, such as Live Migration VMs and Machine Learning and quantity measurement.

Table 4 Summary of resumes

Author	Focus and Objectives	Conclusion
(Li et al., 2019)	Hash method during pre-copy migration; some of these workloads are mostly fake. Intelligent hybrid migration design automatically switches from pre-copy to post-copy	The proposed scheme significantly improves the VM migration performance at nearly optimal times. Workloads that failed to migrate with a pre-copy now complete migration quickly, with TMT from 27 s to 98 seconds
(Mijumbi et al., 2015)	Achieving better efficiency in resource utilization in virtual networks	Better utilization of substrate network resources with a yield of about 23%.
(Seddiki et al., 2022)	Timed fuzzy virtual machine migration approach	Using knowledge acquisition techniques can optimize the rule base to improve the scheduler behavior in VMs with efficient energy use
(Imran et al.,	To achieve efficient VM migration, a large number of VM	The live migration scheme of VMs is carried

(2022)	migration schemes have been proposed in the literature, and these schemes aim to serve the needs of users driven by quality of service.	out by AI and conventionally.
(Haris et al., 2022)	Live Migration VMs avoid or minimize the interruption of application services running on VMs during migration from source to destination host servers, focusing on memory content	A category study on the memory data migration approach
(Liang et al., 2022)	The migration rules are defined for one-dimensional and multidimensional trusted VMs	This increases the success rate of VM migration and reduces the CDC energy consumption and improves load balancing while ensuring VM performance
(Singh & Singh, 2022)	Allocation transfer rates across multiple VMs that are migrating	VM workload migration can improve SLA services
(Le, 2020)	The VMs can be rearranged across physical machines to reduce the load on congested hosts	Tailored VM placement to improve goal achievement, performance and reduce errors
(Gillani & Lee, 2020)	Migrating services using KVM or Docker can reduce the average RTT (round trip time) compared to the old approach	Service migration with Docker shows better performance
(Noshy et al., 2018)	A review of advanced optimization techniques for developing live VM migrations according to memory migrations	Advanced optimization via memory migration, which generally attempts to minimize the total migration time, total data transfer, and downtime.
(Chen et al., 2018)	Perform VM vMotion sequentially by considering one by one the Virtual Motion process	Perform VM migration by scheduling multiple virtual machines to reduce operations and minimize total migration
(Zhu et al., 2015)	Assess the device state migration, which is also important for successful live VM migration	Mimics the live migration of virtual machines in a program-controlled manner and proposes a solution that extracts the device's key state
(Yazidi et al., 2019)	Infra team graphic theory Scheduling Algorithm	In some cases, discrete traffic volumes can be reduced by factors greater than 60%
Author	Review Paper on Virtual Live Migration Machine by Machine Learning	Migration of VMs based on network traffic time that is not busy by means of time scheduling

From the above table, we obtain the results for the 12 extracted papers. 8 papers discuss Live migration VMs (6 papers in specific Live Migration, VMs Machine Learning. Otherwise, only 2 papers tell Live migration machine learning.

Conclusions

Based on a paper search with many strings, we discovered that machine learning-live migration VMs can be realized. There are not many papers on this topic in the three trusted libraries. According to previous research, Live Migration Machine Learning can be successfully implemented in the industry. The impact of implementation may impact decision-making to improve productivity. Allocation live migration VMs may provide information from attached notifications. Based on this conclusion and result, research can be directed toward large industries to produce more productive data centers.

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