Opposition for "Performance Comparison of Virtual Disk Formats"

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General Overview

This opposition is reviewing the project "Performance Comparison of Virtual Disk Formats", written by Khalid Elbashir <elbashir@kth.se> and Khalid Omer Mahgoub Saied <koms@kth.se>. The project compares two popular Virtual Disk format performances between them and with RAW hard drive access performance. The project is generally well structured, with a clearly defined problem statement, hypothesis, and goal. However, we have found some issues at various points in the document, and the aim of this opposition is to address them.

Introduction section

This section introduces the problem to be addressed, provides the hypothesis the project will work on proving, and explains the goals. This section is divided in smaller subsections, but could be better presented if interleaved in the general introduction.

The goals the project plans to achieve are clear, as is the general approach this project takes in dealing with the stated problem.

The problem statement subsection contains a reiteration of the general approach stated in the background assessment. The following problem stated in the problem subsection is not a problem but a solution. It could be better stated as "Virtualization of storage optimizes usage at the cost of performance, and minimizing these losses is the main aim of virtual storage formats".

 The hypothesis is not really clear either, as it essentially states that they can rank the two formats based on their performance in different operations. This hypothesis would be rather hard to disprove, as it is almost self-evident. A better hypothesis would be that one format would outperform the other at certain operations, or that they would perform almost equally. If no confidence exists on the expected results, having no hypothesis could be the correct choice.

Theoretical Framework section

This section introduces us to the formats that the project plans to compare, as well as the tools used for emulation and benchmarking. It is well written, with proper citation for the claimed facts. The two compared formats are explained, and previous research done comparing them is referenced.

Summary of Comments on MiguelGordo_NikolaosTatsis_Opposition_Report_20151016-commented.pdf

Page: 1

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I think that this reflects a misreading of their hypothesis, as they have the statement about ranking, but the hypothesis follows the comma in their statement: "and thus identify the best format for an application with this ratio of operations". It is this later part that is their hypothesis. The first part "Given a set of disk formats we can rank order them in terms of their performance for
a weighted set of operations," is a set of conditions that must be met before one can test their hypothesis.

I should note that I had this same problem in understanding there text when I read it the first time.

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Methods section

This section is thorough and well presented. A few details are missing, for example what was the format of the hard disk drive on the host computer, and what were the QEMU and VirtualBox versions.

We've seen in the appendix that Virtio, which was introduced in the theoretical framework, is used in the execution of the tests, but it is not mentioned in this section. Finally fio creates files for the tests, but there is no mention of whether the files are compressible or not, which could make a difference in the testing. This can be achieved with the flag `buffer_compress_percentage.`

Results section

The plots presented here are complete, well formatted, and informative. However, all of the figures are box plots, and an explanation could be given for the values that the "whiskers" represent, as there are a number of different approaches widely used.

In this section the entirety of the plots produced for this project are presented. Not all are required, since most of them convey no new information about the measured results. Specifically, the IO per second and Bandwidth plots have a distinct linear correlation for every operation tested. Just one IO per second plot could be provided instead, to show this correlation. This correlation probably ensues from stable IO throughput.

There is also another argument on plot redundancy: as long as a stable throughput is obtained, the latency plots will just be a "mirrored" version of IO/s and BW plots, and this can be seen happening, even for outliers (take for example 2.4 IO/s and latency plots). Exploring additional metrics could help shed more light in the data, like trying different block sizes.

In this section there should also be a brief description along with the results, not so much for analysis as for presentation. More importantly, none of the figures have captions, which makes them impossible to reference afterwards. There are different types of latency to be measured in IO operations, and we understand here it is understood as total latency, but a clear statement would help the reader.

In section 4.1.1, the latency plot shows no RAW information for file sizes larger than 8MB, and there is no explanation on why they are not present there. it an artifice of the plot creation, with the RAW data plotted "behind" that of the other two formats, or was the data in question removed from the plots?

Discussion section

This section feels a bit brief. There is a mention of inconsistency in random read results when file size exceeds 8Mb, but there is no mention to possible causes, why i

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Does it? Do you or they have evidence to support this?

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I would suggest putting the full set of graphs in the an appendix.

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No the problem is that they are there, but as they have very small variance you cannot see the color that is filled into them - hence they look just like short black line segments. However, they can easily be see if you note that they are on the vertical line for the file size.

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it out of the scope of this project, its importance or it is relevant for future research.

The report also mentions unfair comparison, and while it is true, it could be played out to the advantage of the authors as a benchmark reference.

As for the results themselves, some of them are quite curious but not explained. For example, in the comparison of FVD vs QCOM2 Random Write BW vs File Size, there is a huge drop in bandwidth for 512Mb files, and the following plots show almost twice the latency. Also in Random Read IO/s vs File Size for both protocols show a huge difference for the 128MB mark. Perhaps it would be interesting to see why there is that huge difference and why the IQR big in this case compared to the neighboring file sizes.

Moreover, the fact that the Bandwidth plots are linearly correlated to the IO plots, as well as the latency plots, is open to interpretation. Does this signify a stable IO average throughput per operation for all different formats, and, if so, a plot of that average throughput could be provided to clarify.

The report mentions that one format outperforms the other in certain cases, but it would be interesting to show how good is the improvement, is it 5% faster, 30% less IO operations, etc. justifying the argument visually seems incomplete, since some file sizes still behave better for the other format. We would also like to see the implications that this has in the type of applications that are best suited for each format. There is a final mention of other comparison metrics, such as block size. Why they were left out of this project and why is it important to research them is not explained.

Finally, there is no mention to either sustainability or ethical concerns in the report, and we would like to see the impact this project could have in those areas.

Overall, this section presents some results, but not what they imply,why did they happen, or how is it important for future research.

References and Appendix

The included references are all relevant, well selected, recent and accessible. All are proper references in the relevant places except one exception mentioned above. A small recommendation would be to remove the periods after the urls so they are all accessible easily.

An appendix should only be added to support claims or provide additional data relevant to the project, and that can be applied to sections 8.2 and 8.3 but not to the others. Make sure that if appendixes 8.2 and 8.3 are included in the final document they are appropriately referenced (8.2 is referenced but not 8.3)

The milestone chart is in present tense, which is not correct, but it would be better if removed altogether. Section 8.4 does not provide additional information for the purpose of this project, and should be removed as well.

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Final remarks

This project has broadened our knowledge in virtual disk formats and showed us an interesting area of research that we were not aware of before. In its current state this is a promising report and we hope that our feedback will help eliminate this project's weak points.

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Excellent!