Feedback document on "Cloud Gaming and Containers"

by **Oscar Persson** and **Jonathan Arns** for the course DD2482.

I/We certify that generative AI, incl. ChatGPT, has not been used to write this feedback. Using generative AI without permission is considered academic misconduct.

This feedback document will bring up a general selection of strengths and improvements in a list format. It will then follow by providing them in a slightly more detailed way, through a general feedback format for the entire document. The feedback will then be provided per section of the essay, in order to relate the information for each section, and more detailed per part.

Strengths	**Areas to improve**
● Well researched with good sources ● Thought out choice of sections ● Interesting topic with relevant applications ● Clear stance on the topic	● Sometimes informal language ● Unsubstantiated claims (e.g. Stadia using Kubernetes) ● Slightly confusing structure (content-wise) ● Comparison of the alternatives could be more balanced

Strengths

The essay brings up an interesting and relevant topic to today's society, while connecting it to a relevant topic for the DevOps course. The topics in the essay are well-varied and bring in information from a wide variety of well chosen selection of relevant high quality sources. The author has chosen the sections of the essay to provide a good clarity on the subject, while providing a reasonable amount of information distributed along these sections in relation to their importance to the point the author is trying to make.

In order to both back up their claims, and also provide a good context around the points, the author interweaves numbers and statistics into the paragraphs, while keeping it from feeling redundant.

The choice of section titles and topics is also well made, in order to facilitate the information required to convey the point that the essay is trying to make. None of the sections feel redundant or superfluous, instead work well in order to provide the overlaying structure for the essay at hand.

In relation to the grading criteria, specifically the "self-contained" criteria, the essay is very self contained. While a lot of sources are brought up, in order to substantiate the claims in the essay (which have sources), no further reading is necessary as key-points have been lifted from these sources. The amount of sources is also well-satiated, using a substantially larger amount of sources than the required 10. Most of the sources also appear to be academic in nature, which helps further the legitimacy of the claims made from sources, which is good. The advanced concepts discussed in the

essay are also well explained, as no further reading is required outside of the essay in order to understand its content.

High-level Improvements

While the essay has its strengths, we also see some potential improvements. While we liked the overall topics brought up in the essay, we feel that some sections are missing important information that should be mentioned in order to guide the reader through the topic and to give a balanced representation of the matter. For example, because this is at the core of the topic, we think that a more detailed description of what containers and VMs are, with their technical differences pointed out, is necessary for this essay, even though a rough understanding is to be expected from the audience.

In relation to the grading criteria, the essay also lacks a clear problem statement. While it may be deduced after having read the essay itself, this problem statement becomes the most apparent at the end of the essay, in the conclusion. Instead, the introduction should state clearly what question the essay is intended to answer.

While, as previously stated, the choice of sources are good, there are a handful of claims and sections where sources are missing. Many of the claims made by the author become unsubstantiated, with numbers seemingly being pulled from nowhere. The use of language such as "it then is clear that", "it may be logical", or similar in order to infer that certain claims and information is not backed up by the appropriate amount of information beforehand. An improvement to this, if it is mentioned in the text, would be to internally refer back to the relevant parts in order to better provide the context.

A lot of the language, and structure, used throughout the essay appears informal. The use of first person, personal pronouns should not be in an academic essay and should instead be replaced by third person language. The order and nesting of the sections also appear rather informal, opting for a train of thought from the writer, instead of a planned structure that facilitates the information. The flow of information is inhibited. Examples of this is the choice of not having the information regarding containers and virtual machines in the background, instead opting to have them as their own sections, providing crucial information regarding them both inside of individual sections. For example having the comparison between them in the container section. One suggestion would be to put the background information regarding the two technologies in a background section, while breaking the comparisons out to their own section. In general, improvements would be made by using a common essay format such as IMRD, then adding relevant subsections within.

The addition of a reflective section would also help off-loading certain speculation regarding certain aspects from the reader. This would most likely be automatically added if the author opted to make use of an existing essay format.

Feedback per section

Background

Strengths

The section establishes the technology's place in today's society, while describing its necessity, popularity, and the problem it solves.

Improvements

The background part mostly provides a financial overview of the technology in order to establish its place in today's society. It fails, however, to provide an in-depth explanation as to what it actually is and the technologies behind it. There is also no problem statement stated.

Virtualisation

Strengths

The section does briefly but clearly explain the status quo in cloud gaming virtualization to lead into the author's argument that containers should play a bigger role there in the future.

Improvements

We would like a brief introduction to containers and VMs as well as their differences from a technical standpoint here, to establish a foundational understanding to build following arguments upon.
A more specific thing in this section is that the sentence "This makes it possible to isolate and separate user's access and utilisation of the underlying hardware through virtualization techniques." does not follow from anything that was stated beforehand in the section. The essay should either not claim that this is implied by previous information or even better, provide the required information, backed up with sources.

Containers

Strengths

This section contains multiple quantifiable advantages of containers over VMs, backed up with sources, which help support the overall claims of the essay.

Improvements

Specifically the claims about QoS and QoE around game performance are too vague and also not backed by sources. It should be clearly stated what metric the overhead of 27% is measured in.
We also think that the speculation about Google Stadia using Kubernetes under the hood is not an appropriate argument for this style of essay and if it cannot be validated by a source, it should not be used. After all, Google has developed many different technologies and the chance that any single one of them was used in Stadia seems far from certain.

Limitations

Strengths

The limitation within containerised environments is well explained with a reasonable use of sources to back up the claims. While the limitation itself is general, the author breaks it down and connects it back to the topic of the essay in a natural way.

Improvements

Since the author chose to separate the virtualisation section from the container section, while also not providing a problem statement, this section could make use of a better name as it is not currently clear what the section represents. The actual topic for this section is "Limitations within containers" compared to virtualisation, something that should be clearer for the reader. There is also mention of "a number of limitations", while only one is presented. This can be construed as misleading and the author should choose to either mention more limitations of the container technology, or mention the delimitations of what will be brought up.

Containers in game development

Strengths

While being mostly irrelevant to the topic at hand, the section does give a good background for how containers were used within game development outside of just cloud gaming. This gives the reader a perspective of its position in the industry, separated from the purely financial aspects. The section also makes good use of a varied selection of sources in order to back up its claims

Improvements

The relevancy of this section is questionable, as it regards game development as an industry, regarding the creation of the games themselves, rather than the use of a containerised environment for cloud gaming. The use of a section for this topic, instead of a subsection, gives it a false sense of importance within the document, which shouldn't be there. In order to increase its relevance the author could relate it back to how it affects cloud computing in addition to, or instead of, how it may scale game servers. Generally, however. This section appears to be wholly irrelevant to the essay topic and should probably be removed, or re-structured and re-integrated, in order to maintain the coherence of the essay.

Conclusions

Strengths

The section concisely states the author's most important insights into the topic and also makes a reasonable prediction of the future development of the field as a take away.

Improvements

The conclusion should mention the currently unresolved security concerns around containers that was explained in the essay, to represent the topic in a balanced way to a time-pressed reader who might only read the introduction and the conclusion.

Additional material

Material for this topic is indeed hard to find and we think that the most important sources on the topic were used in the essay, but we were able to find a few additional interesting resources that could enhance the essay nonetheless.

https://ieeexplore.ieee.org/abstract/document/9625050
Research into attack mitigation in resource-sharing cloud gaming scenarios. This provides an alternative approach to the mentioned, but disregarded, approach of containers running in VMs.

https://ieeexplore.ieee.org/document/8012937
An analysis of containers running on top of VMs. Useful for the essay, since there was no source for disregarding this as a solution to the security concerns with containers.

http://www.diva-portal.org/smash/get/diva2:1665577/FULLTEXT01.pdf
Comparison between VMs and containers (with a focus on HTTP requests). A useful additional comparison between the two technologies as more aspects are tested which can represent different types of stress.

Conclusion

In conclusion, it is recognised that many of the parts of the essay are well-written, and a lot of the choices made by the author helps back up the claims it is trying to make. However, the essay suffers from a disorganised structure, and a lack of sources in many places. While the foundation is good, it is recognised that it needs some work in order to become perfect.