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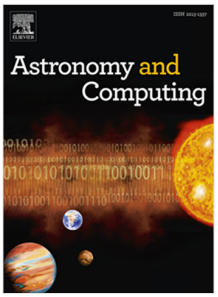

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Evaluating virtual hosted desktops for graphics-intensive astronomy

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Abstract

Visualisation of data is critical to understanding astronomical phenomena. Today, many instruments produce datasets that are too big to be downloaded to a local computer, yet many of the visualisation tools used by astronomers are deployed only on desktop computers. Cloud computing is increasingly used to provide a computation and simulation platform in astronomy, but it also offers great potential as a visualisation platform. Virtual hosted desktops, with graphics processing unit (GPU) acceleration, allow interactive, graphics-intensive desktop applications to operate co-located with astronomy datasets stored in remote data centres. By combining benchmarking and user experience testing, with a cohort of 20 astronomers, we investigate the viability of replacing physical desktop computers with virtual hosted desktops. In our work, we compare two Apple MacBook computers (one old and one new, representing hardware and opposite ends of the useful lifetime) with two virtual hosted desktops: one commercial (Amazon Web Services) and one in a private research cloud (the Australian NeCTAR Research Cloud). For two-dimensional image-based tasks and graphics-intensive three-dimensional operations – typical of astronomy visualisation workflows – we found that benchmarks do not necessarily provide the best indication of performance. When compared to typical laptop computers, virtual hosted desktops can provide a better user experience, even with lower performing graphics cards. We also found that virtual hosted desktops are equally simple to use, provide greater flexibility in choice of configuration, and may actually be a more cost-effective option for typical usage profiles.

Keywords:
methods: miscellaneous, cloud computing, graphical user interfaces

1. Introduction

Astronomy, as with many other scientific disciplines, is now in the petabyte-data era (Brunner et al., 2001; Borne, 2009; Juric & Tyson, 2012). This growth in the total volume of data is due, in part, to the improvements in resolution that modern instruments and detectors are able to access and record. Alongside this is the increased computational power available for numerical simulations.

Visualisation is a crucial component of knowledge discovery. As both the size and complexity of astronomical data sets continue to grow, the existing paradigm of the astronomer visualising and analysing data at the desktop is being pushed to the limit. The high computational and graphics-intensive requirements for many research workflows now exceed the processing, storage, and memory capabilities available with standard desktop-based solutions (Berriman & Groom, 2011; Hassan & Fluke, 2011).

A compelling option is to move all of the processing requirements away from the desktop to a dedicated remote data centre or into the cloud. Here, on-demand computational resources can be co-located with the data such that computation and analysis can be performed at an appropriate scale.

Choosing the right mix of dedicated compute resources that suit the needs of all users is complex. The availability of cloud services allows for flexibility and experimentation with config-

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