A GPU enabled remote desktop for astronomers

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Abstract

Astronomers are used to working with data that is too big to be processed on their local desktop computers. While remote high performance computing for processing astronomical data is common practice, reliance remains on desktop based applications for some aspects of the research workflow, especially data visualization. These applications typically run on a local computer, which requires the transfer of processed data from the remote facility, and suitably powerful computing hardware at the astronomer's desk. However, we show that a virtual hosted desktop provisioned from a cloud service such as Amazon Web Services or the NeCTAR Research Cloud, operating over a suitable network, can provide a desktop experience that exceeds that of a local computer. Operating on sharable hardware that can be deployed ad hoc and far more cost-effectively than a high-end graphics workstation, this approach to desktop computing also eliminates the need to transfer large amounts of data for processing from a remote facility to the local desktop, and the dependence on particular capabilities of a local computer. The approach described in this presentation is directly applicable to many other research disciplines.

Big Data Challenges

1. Volume
2. Velocity
3. Variety
4. Veracity

1. Volume
2. Velocity
3. Variety
4. Veracity
5. Validity
6. Value
7. Variability
8. Venue
9. Vocabulary
10. Vagueness

Images sourced from Google Images

My 3 Vs

Vhy does is matter?

Vhen does is matter?

Vhat can we do about it?

Big Data Challenges

My definition:

"When accumulated data exceeds the capacity or capture rate of local resources, local storage and manipulation is impractical at best, impossible at worst."

Images sourced from Google Images

Background

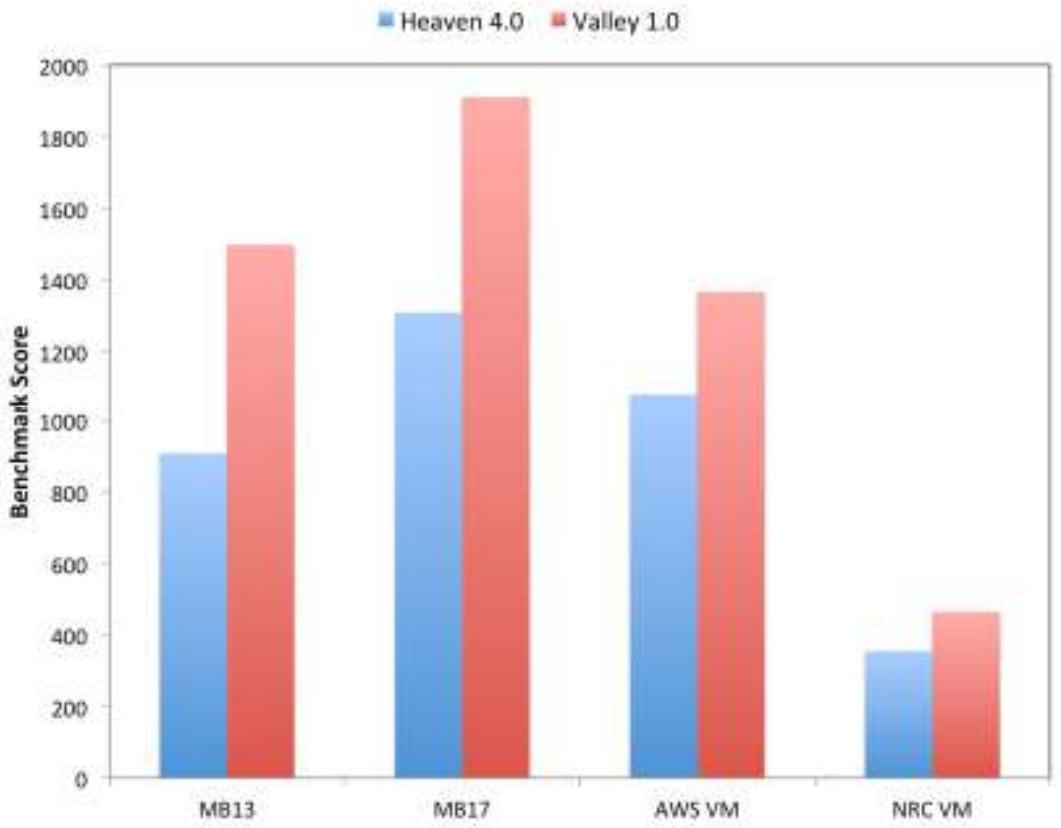
- Data is stored in data centres, along with compute
- Visualisation is usually done on a local desktop
- “Astrocompute in the Cloud”, 2015 – AWS and SKA
- The need for a virtual desktop
  - X11 Forwarding
  - VNC
  - RDP
  - Etc…

Cloud computing and virtual hosted desktops

- Cloud computing in astronomy
- Virtual Hosted Desktops (VHDs) in astronomy
- Comparing cloud desktops and physical desktops
  1. It must be simple to use
  2. It must provide a smooth experience
  3. It must be cost-effective
  4. It must be powerful enough to perform the required tasks
  5. It must be available when required

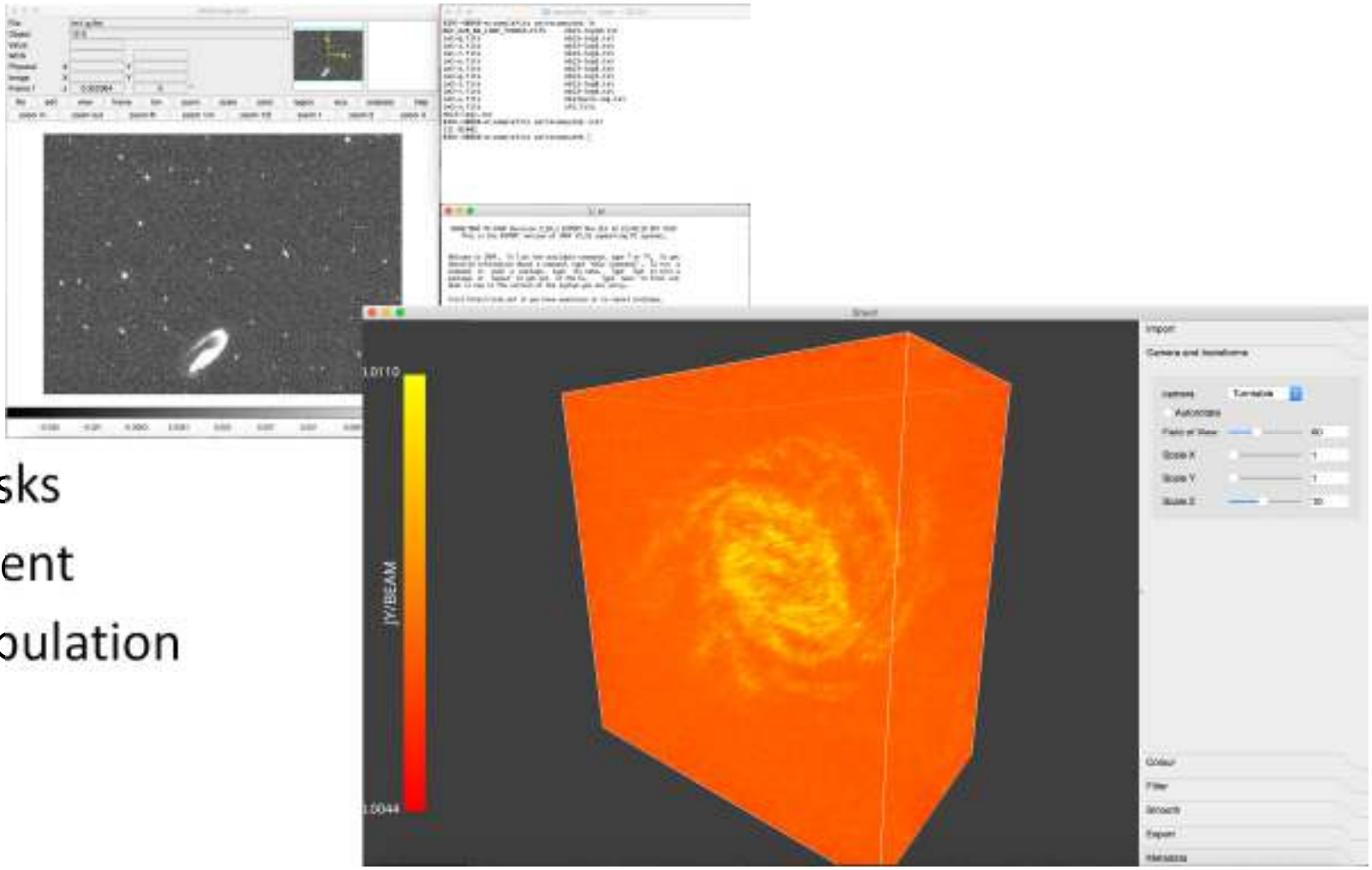
User experiences with virtual hosted desktops

- Evaluation methods (Lam et al, 2012)
- Purchasing scenarios
- Properties of local and virtual desktops
  - Laptops
  - AWS
  - Nectar Research Cloud
- Benchmarking the envirovments



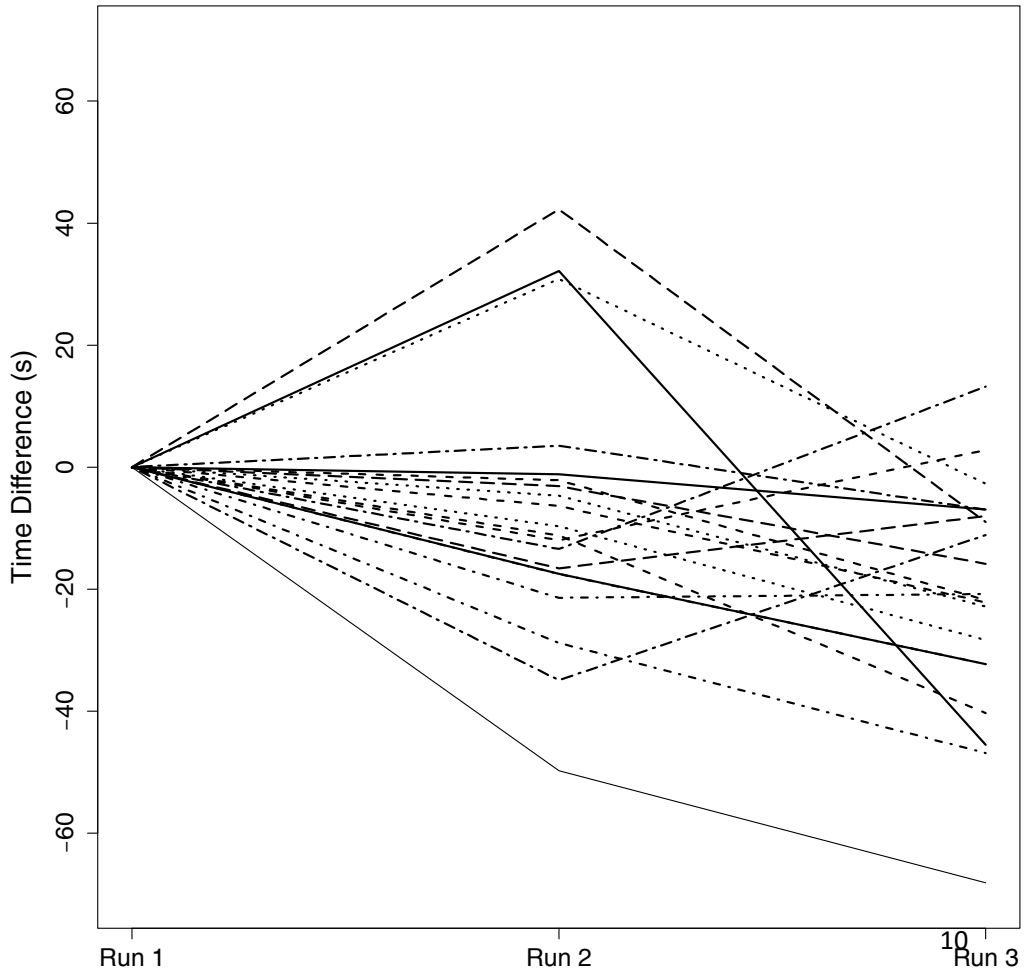
User experiences with virtual hosted desktops

- 20 Participants
- Setup
  - Short survey
  - Tasks
  - Reflection
- User experience tasks
  - 2D image alignment
  - 3D volume manipulation



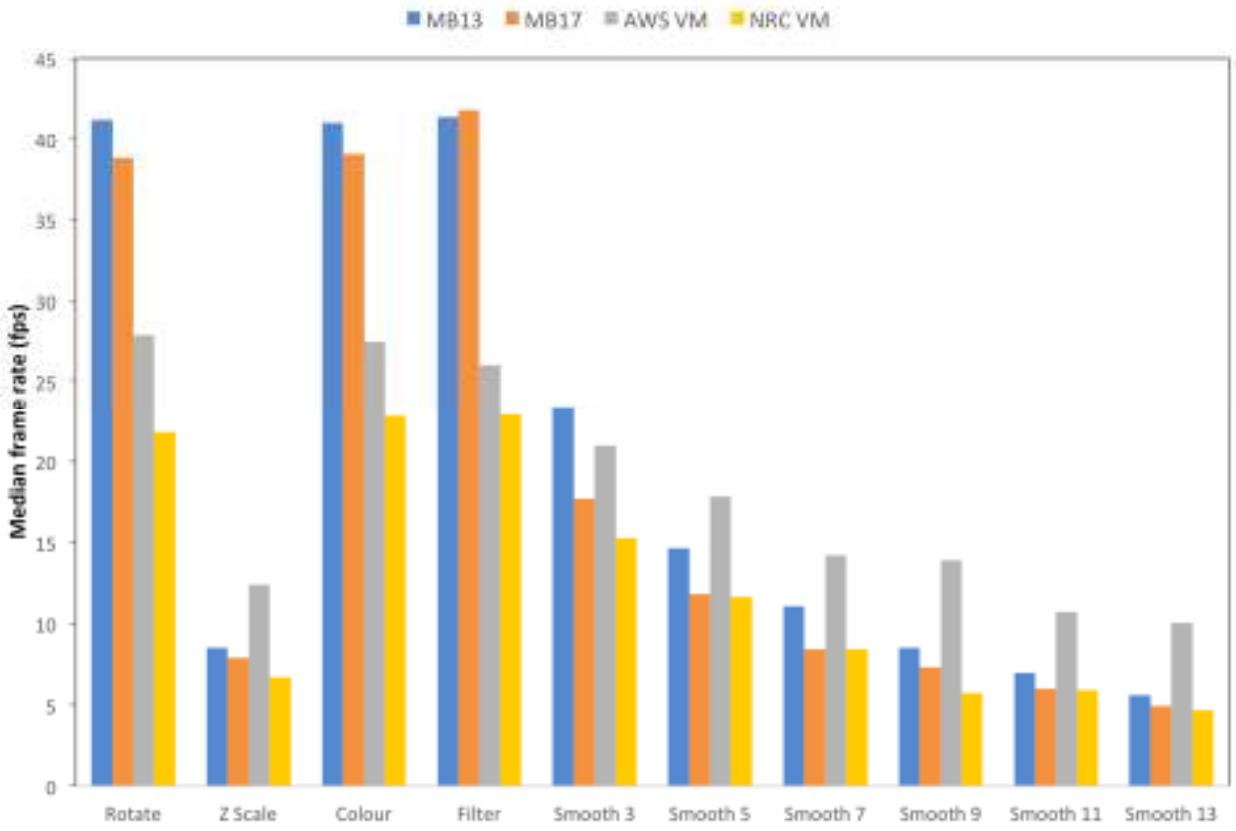
2D image alignment task

- Images displayed in DS9
- IRAF commands and offsets were provided
- Participants were guided through the task once
- Subsequent attempts were timed
- A learning effect was observed



3D volume manipulation task

- Volume loaded in Shwirl
- Participants manipulated the volume and reported experience
- Tasks were completed in 3 environments
- An automatic manipulation process was used to provide a benchmark

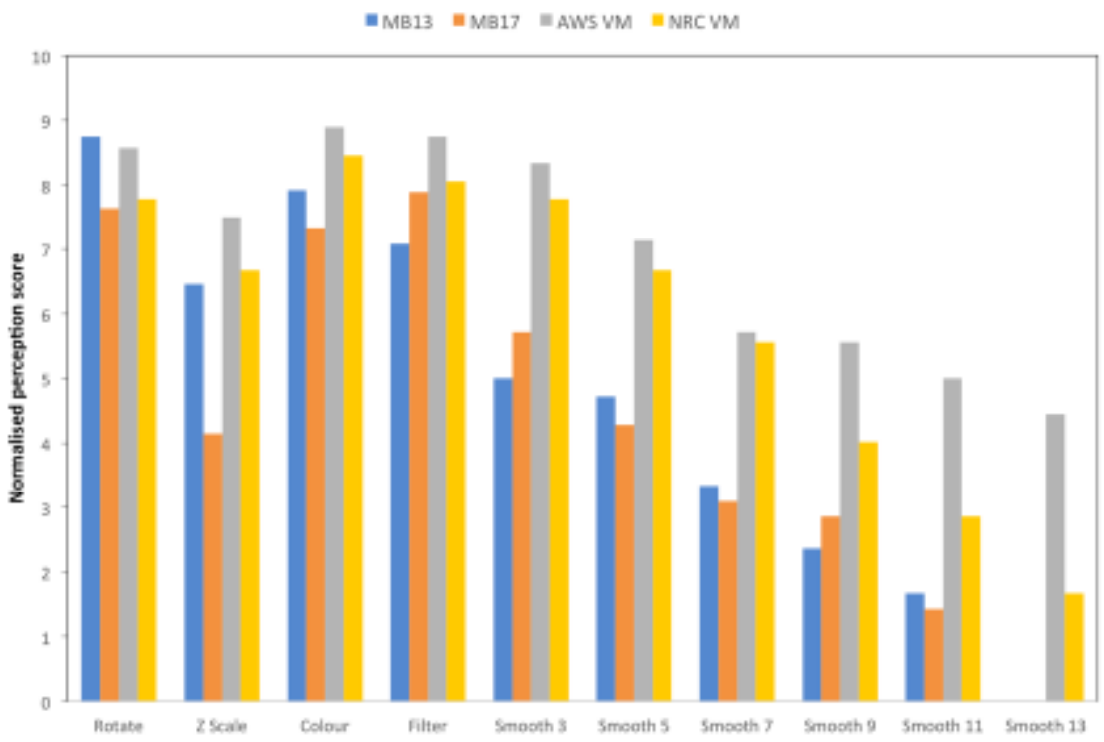


Participants' scoring

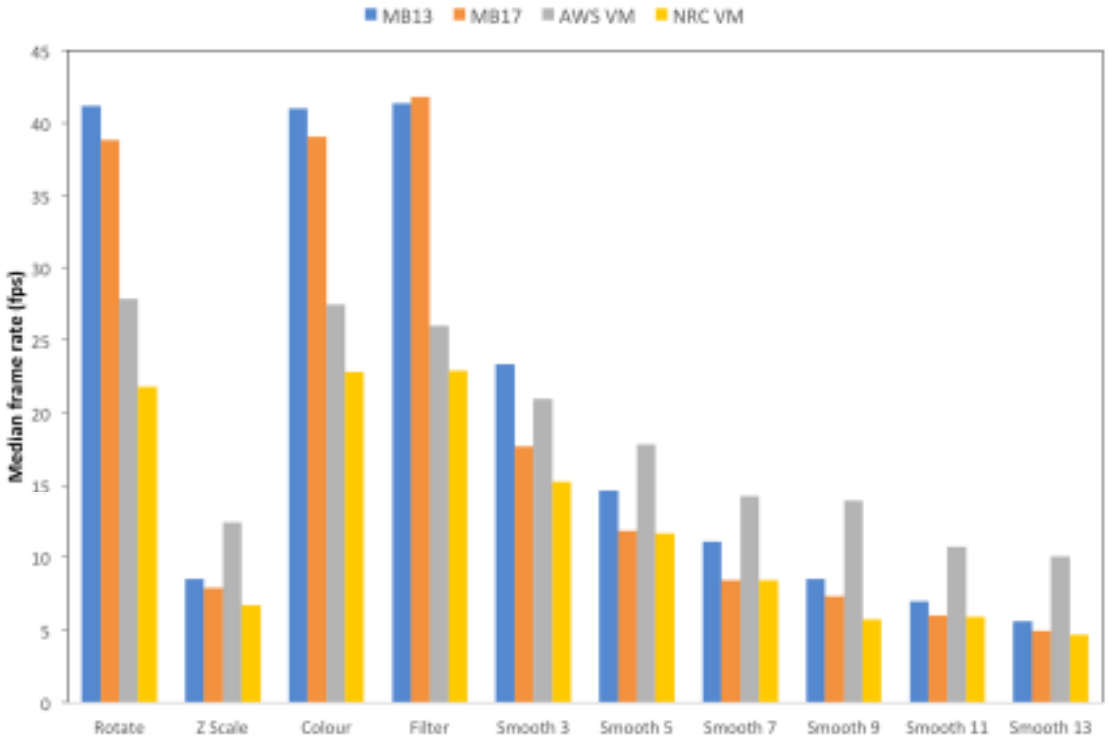
10 9 8 7 6 5 4 3 2 1 0

Images from Elf (New Line Cinema, 2003) and Anchorman: The Legend of Ron Burgandy (Dreamworks, 2004), sourced from Google Images

Perception vs Reality



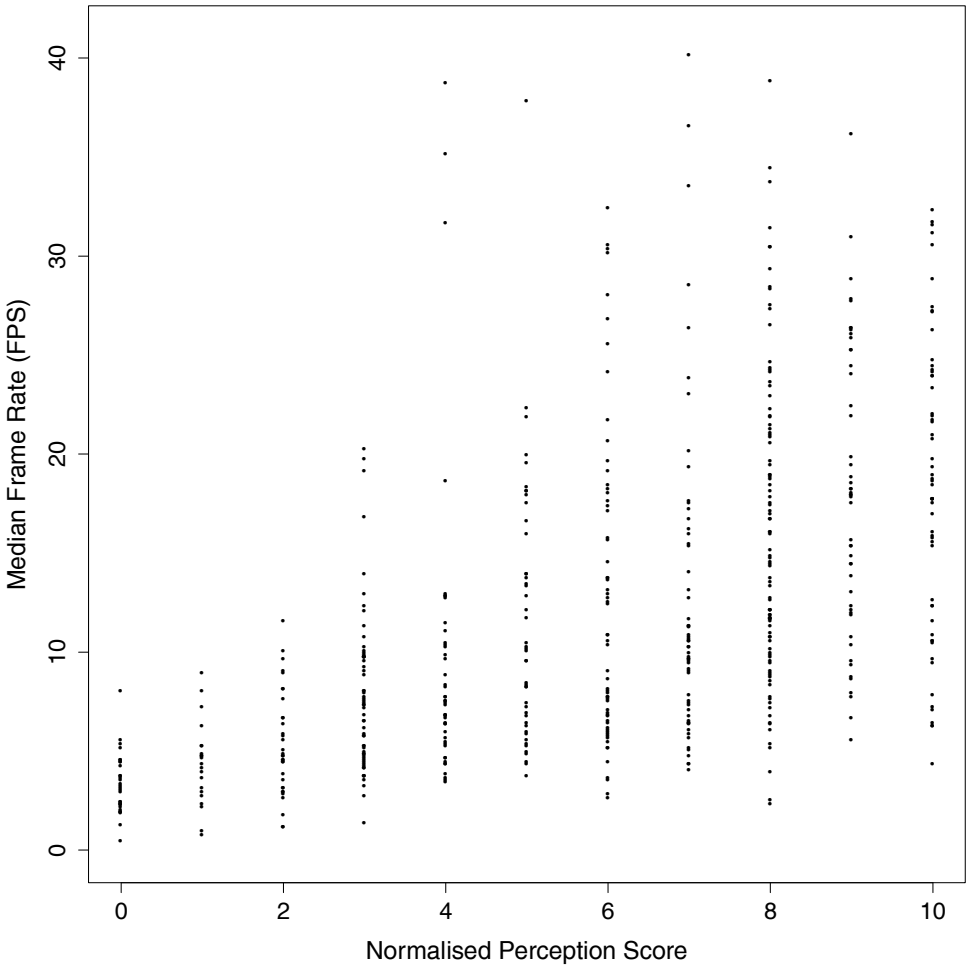
Normalised perception scores



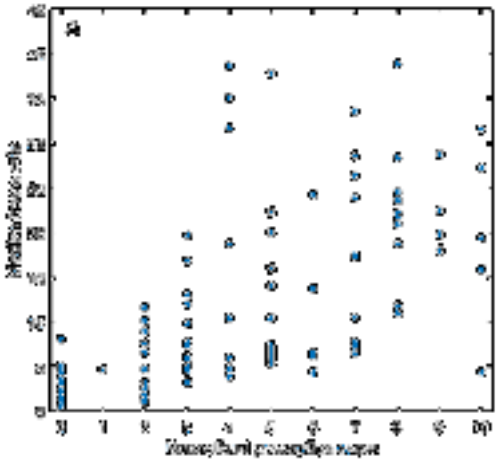
Median frame rate (fps)

Perception vs Reality

Combined



MB13



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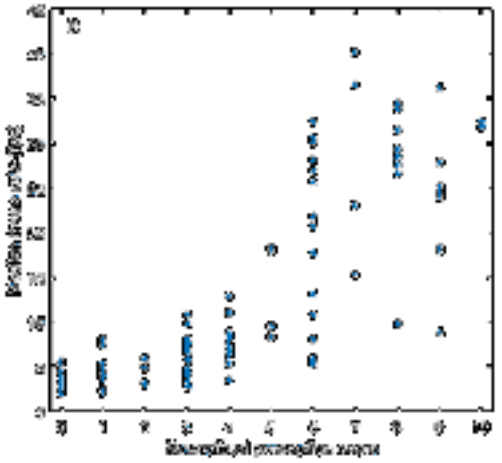
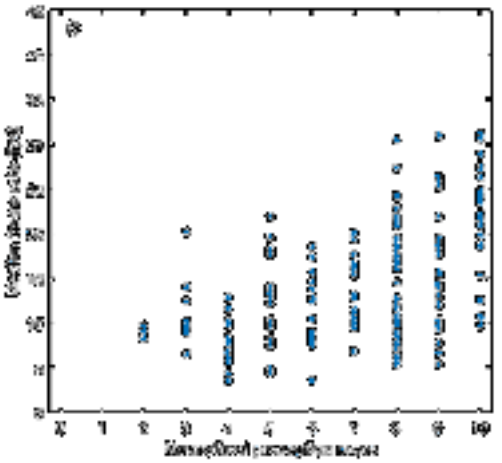
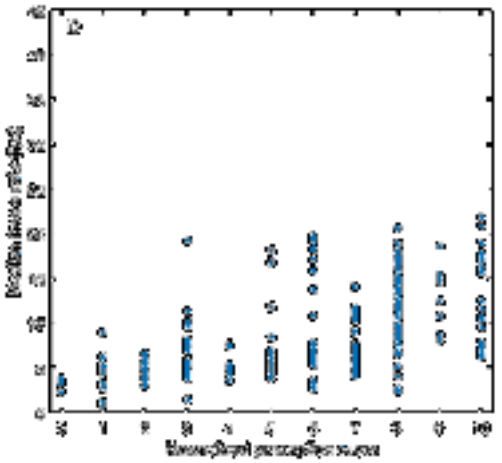


AWS VM

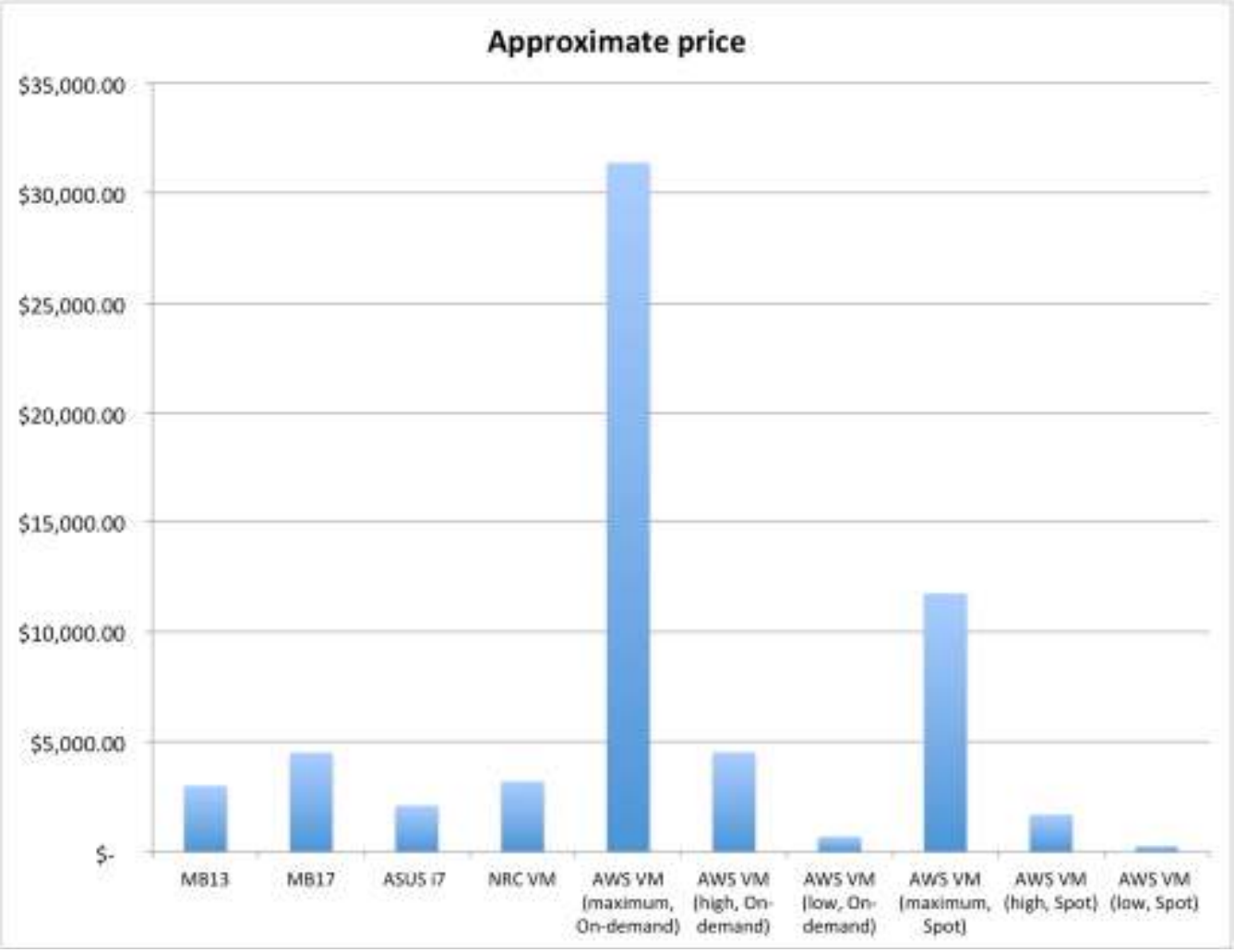


NRC VM



Pricing scenarios

- Maximum use
  - 24h x 7d x 52w x 4y
- High use
  - 6h x 5d x 42w x 4y
- Low use
  - 2h x 3d x 32w x 4y



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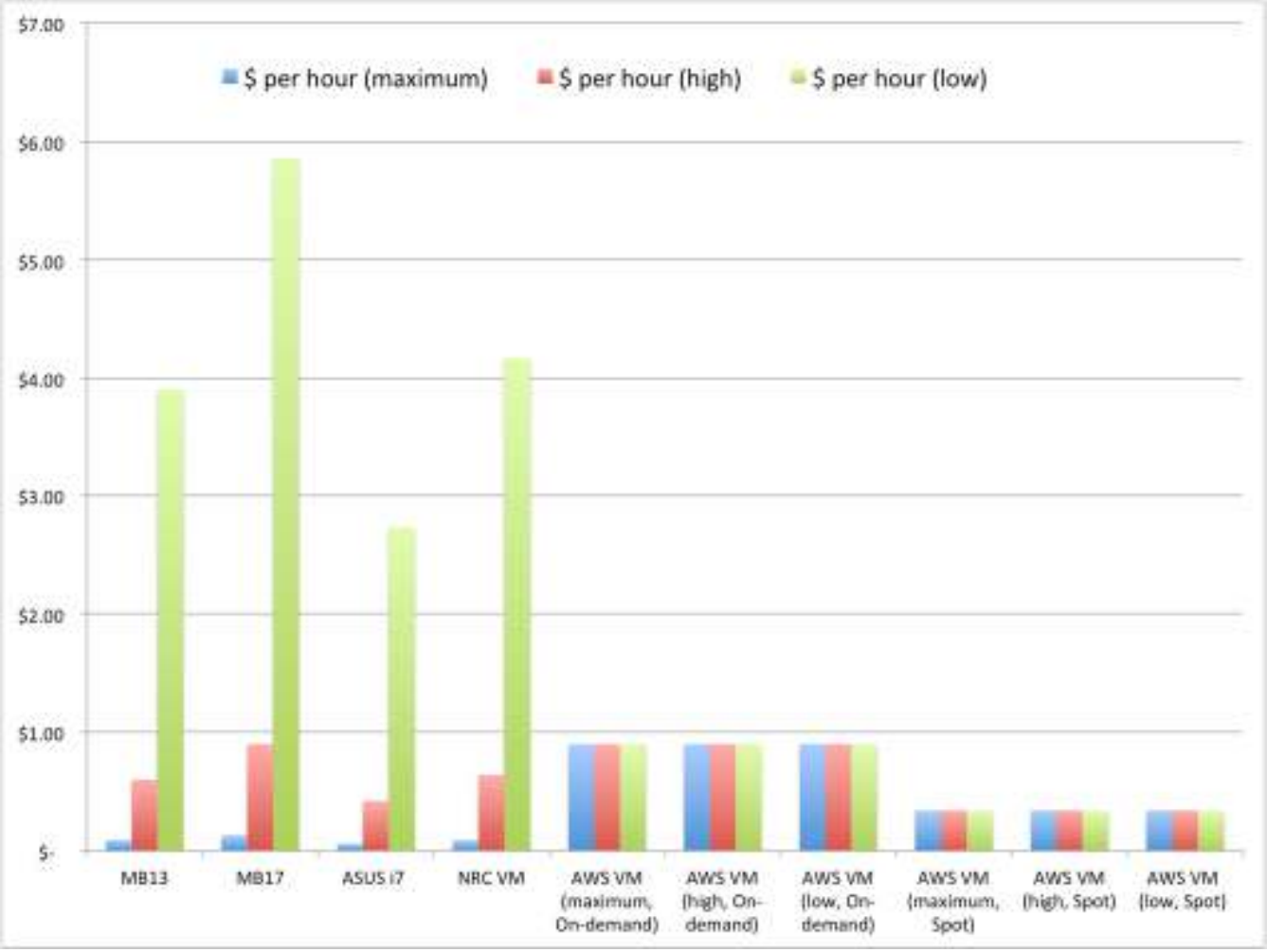
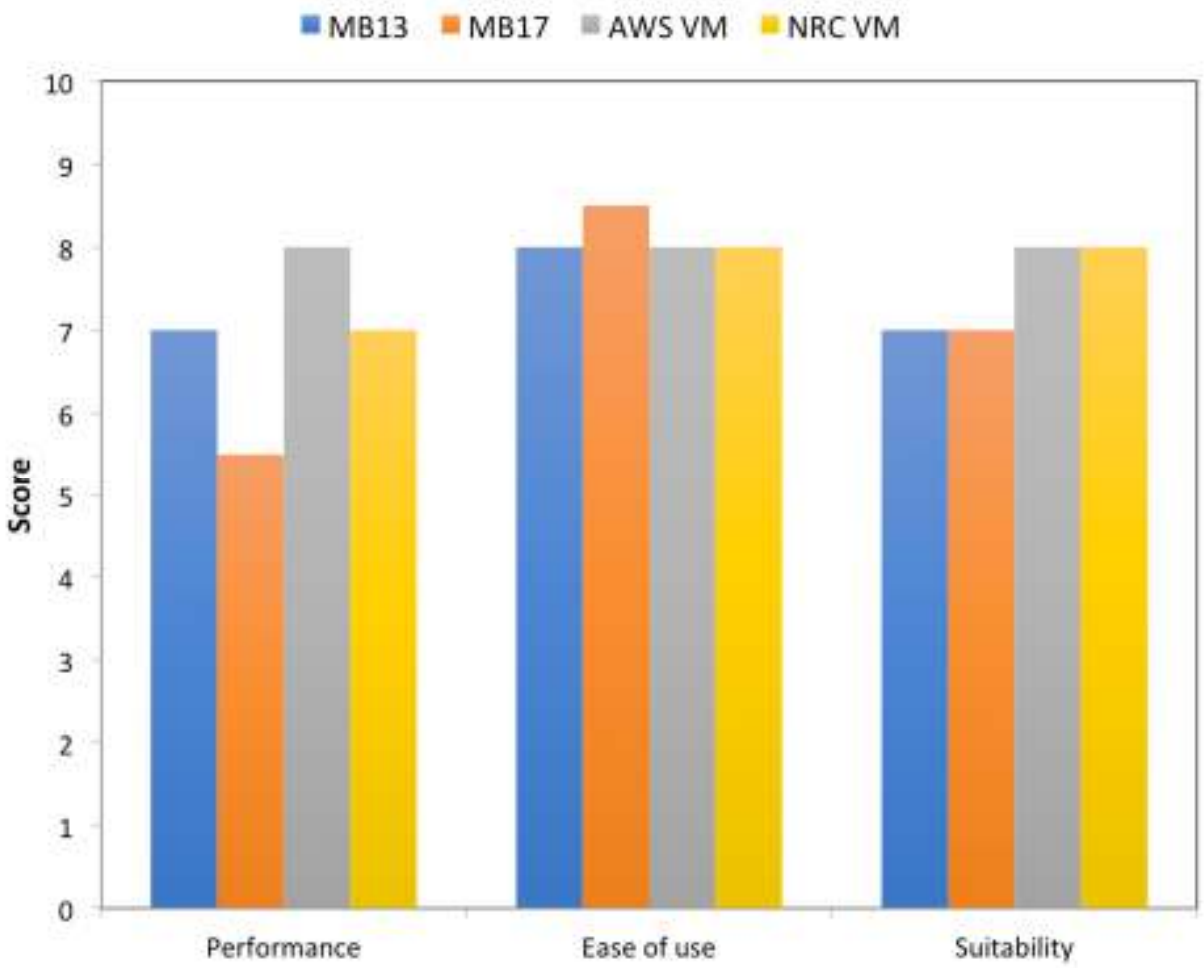
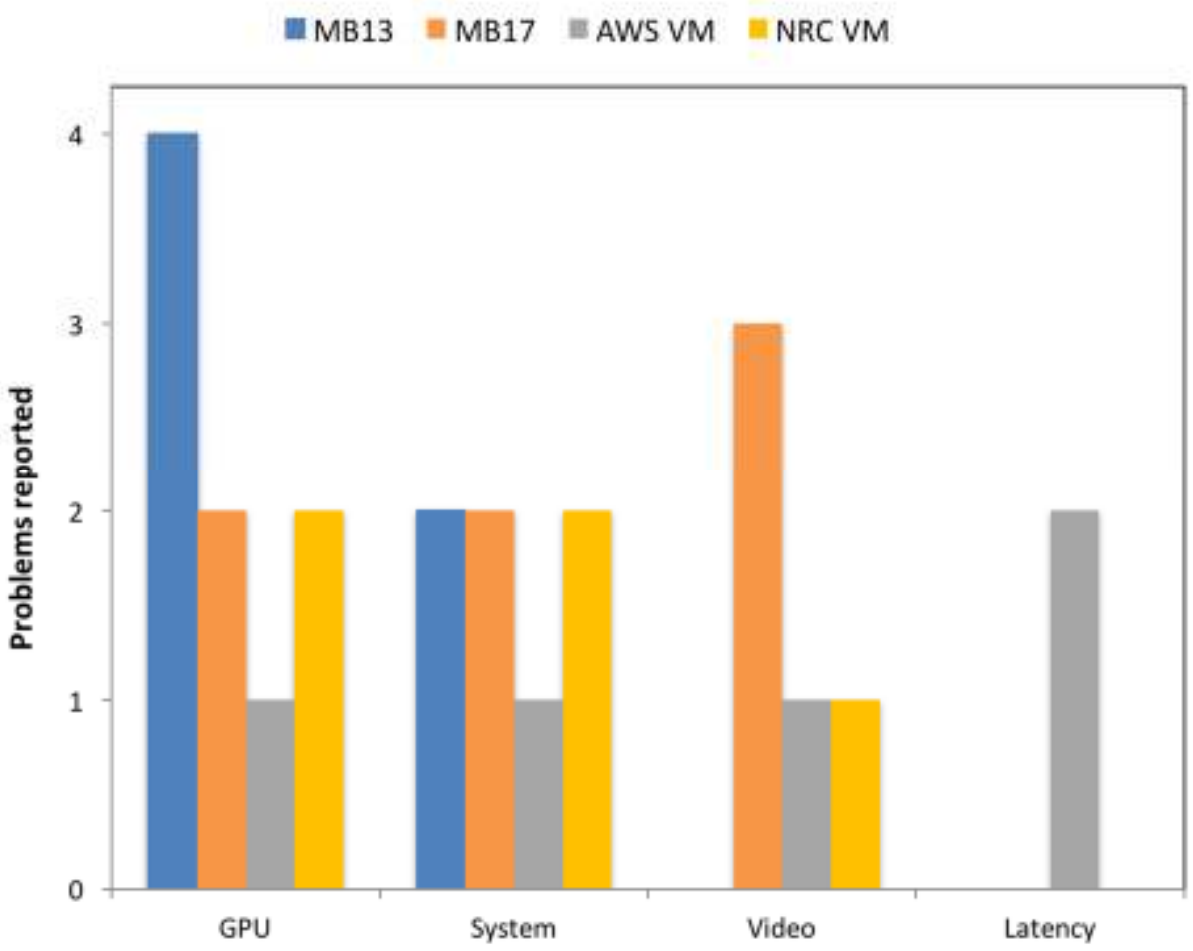


Qualitative responses



Qualitative responses



Conclusion

1. It must be simple to use
2. It must provide a smooth experience
3. It must be cost-effective
4. It must be powerful enough to perform the required tasks
5. It must be available when required

- **VHDs are as easy to use as a standard desktop**
- **A correctly resourced and configured VHD provides a suitable environment to run typical astronomy software**
- **A correctly resourced and configured VHD can provide a better user experience than a local laptop computer**
- **VHDs can provide a viable desktop alternative for astronomers**

Additional considerations

- Network availability
- Hidden costs
- Security
- Convenience

References

- Meade, B., & Fluke, C. 2018, Evaluating virtual hosted desktops for graphics-intensive astronomy, Astronomy and Computing, 23, 124

- Lam, H., Bertini, E., Isenberg, P., Plaisant, C., & Carpendale, S. 2012, Empirical studies in information visualization: Seven scenarios, IEEE transactions on visualization and computer graphics, 18, 1520

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Thank you