CSIRO Visualisation Service Assessment and Future Plans

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BACKGROUND

The CSIRO eResearch Program develops services that use advanced ICT to collect, model and analyse large and complex datasets. The Visualisation Service is one component of that Program, providing high-end visualisation capabilities.

The Visualisation Service capabilities include

- Remote Visualisation
- Tiled Display Systems
- Stereoscopic Display Systems
- Visualisation Application Support

In this presentation, we briefly describe these capabilities and provide an assessment of their uptake, perceived usefulness and future directions.

TILED DISPLAY SYSTEMS

CSIRO has had two large OptIPortal type displays[1] in place for many years but they have had fairly limited use. This is mainly because the underlying software stack limits application usage. Consequently, it was decided to deploy a smaller system – six monitors instead of twenty five – along with a much simpler architecture that is largely transparent to running applications.

These smaller units (known as CURVS – CSIRO Ultra high-Resolution Visualisation Systems) were allocated to researchers via an internal expression of interest (EOI) that was primarily intended to deliver pairs of tiled-displays to facilitate collaboration. Interested researchers were asked to complete a brief questionnaire outlining their requirements. The EOI eventually resulted in the deployment of ten CURVS at CSIRO sites across Australia.

CURVS are being used for a variety of research related tasks including

- Advanced collaboration and team discussion centred on high-resolution x-ray images
- High resolution displays dedicated to materials characterisation and microscopy
- Detailed analysis of national insect collection images and associated metadata
- Examining hi-res broad domain datasets for environmental modeling
- Comparative analysis of genes across multiple sequences

Unfortunately, there have been a number of barriers to further uptake across the organisation

- Lack of portability, system location
  - Higher resolution limits portability of design
  - If it's not scientist's desk… it's too far away
  - Limited access to meeting rooms
- Usability
  - Large bezels inhibit viewing experience
  - Easy to lose dialogue-boxes under bezels

In light of these issues, an even smaller, lighter-weight design will be trialled by several research groups over the next few months. These will mostly likely use three thinner-bezel monitors arranged in portrait layout. We believe this represents the best compromise across the various parameters: resolution, portability, bezel placement and width, required office space, and all at relatively low cost.

REMOTE VISUALISATION

Remote Visualisation has been the mostly widely adopted visualisation service in CSIRO to date. Its main advantage is that it makes high-end visualisation hardware and software directly available to users at their desktops. The same systems are efficiently shared and centrally managed in a datacentre. It also allows researchers to visualise their data without having to move large files between systems, a potential bottleneck in many situations. Lastly, remote visualisation enables geographically separated staff to work together in real-time. This is a very valuable feature in a distributed organisation like CSIRO.

CSIRO researchers primarily use either Windows or Linux desktop systems for their visualisation work. The Linux based Remote Visualisation service is based on the open source project VirtualGL[2] and allows most OpenGL applications to run with full 3D hardware acceleration.

Initially, Windows based remote visualisation was provided via a virtualised host on VirtualBox. VirtualBox is itself an OpenGL application and this combination enables users to run Windows 3D applications remotely. Unfortunately, this approach suffered from some technical issues, such as texture mapping problems, and has since been replaced with 3rd party solution based on Citrix XenDesktop[3].

Once configured for either platform, the remote visualisation layer is completely transparent to running applications. However, with the Linux based VirtualGL approach, GPUs can be shared amongst users whereas the Windows Citrix approach dedicates a single GPU to each user.

Remote visualisation is now being used by CSIRO researchers from a range of disciplines and a variety of tasks including computational fluid dynamics, tsunami modelling and mining research, volumetric displays of computerised tomography data and genome network analysis.

More recently, work has centred on integrating a remote visualisation capability alongside CSIRO's existing high-performance computing (HPC) systems. This includes CSIRO's GPU cluster and a more traditional hetereogenous compute cluster – both with high-performance file-systems. HPC systems are almost exclusively batch based, whereas visualisation is inherently interactive and integrating the workflows of these two systems in a useful way is a challenging exercise. However, good progress is being made.

There is also some interest from CSIRO scientists in accessing the remote visualisation service through mobile devices such as iPads. We have recently conducted a few brief trials in this area with mixed success. The main issues seem to be the high-bandwidth wifi based network requirements, combined with relatively immature client software. Some interim solutions - such as platform specific remote desktop tools – do provide very good performance, but there are concerns about their overall level of security.

STEREOSCOPIC DISPLAY SYSTEMS

Stereoscopic viewing can sometimes provide new insights that are not readily apparent in two dimensions. These include enhanced understanding of complex datasets as well as enabling design walk-throughs.

The eResearch Visualisation Team have put together a portable kit comprising a projector, specially configured laptop and shutter glasses. A number of these kits are available on a short-term loan basis for trial use and exploration by interested researchers. Recently, one kit was used to demonstrate a simulated 3D galaxy fly-through. However, PC-based stereoscopic systems are still not widely used in CSIRO at the moment, even though many scientific visualisation applications natively support stereo viewing with the appropriate hardware. It is anticipated this will change as the associated Visualisation Application Support capability becomes more widely adopted.

VISUALISATION APPLICATION SUPPORT

Discussions with managers of various visualisation facilities have reinforced the importance of a dedicated support capability. For that reason, a formal visualisation application support service has recently commenced with a range of capabilities including:

- Technical support to individual users and groups in relation to their visualisation needs. This includes development of workflows, converting and remapping data, and facilitating efficient use of a range of resources from desktop PCs to high-performance visualisation systems; and
- Expert guidance on third party visualisation applications including their recommendation, selection, training, demonstration and use across a range of scientific disciplines
- Facilitated access to partner resources

There appears to be significant demand for visualisation based support in CSIRO and it is anticipated that this service will grow over time. It also overlaps neatly with CSIRO's existing HPC support function, along with significant activity in the computational GPU area.

REFERENCES

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ABOUT THE AUTHOR(S)

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