Cray XT in SecondLife

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ABSTRACT: *Virtual social networking allows multiple users to virtually interact with each other in the virtual world. Second Life provides that platform for CRAY XT series MPP educational opportunities to be injected into potential and current users at The University of Western Australia. Users can virtually lift-off and fly over the CRAY, learn how to launch jobs, monitor jobs thus provides an intuitive environment for user training and visualization.*

KEYWORDS: XT3, SecondLife

1. Introduction

1.1 WASP

The Western Australian Supercomputer Program (WASP) is situated in the main Crawley campus of The University of Western Australia (UWA). Founded by Associate Professor Karen Haines, the WASP focuses on providing next-generation computing and immersive visualization technologies to Western Australian researchers and scientists. In the area of High Performance Computing, the WASP has a Cray XT3 which is massively parallel processor system. The Access Grid technology allows researches and students on campus to effectively communicate and collaborate with other university partners across Australia.

1.2 High Performance Computing

The key high performance computational resource house at WASP is the Cray XT3, which is a massively parallel processor (MPP) system from Cray. It is named Marron, after a Western Australian crayfish. Marron is a 164 node Cray XT3 supercomputer with 2.6GHz, 64bit AMD Opetron 100 series processors. It has a resident 2GB memory per processor that adds to a total of 330GB ECC SDRAM. The compute FLOPS reaches up to 0.853 Tflops. Configured with a 3D torus topology of 6 x 4 x 8 to provide high speed network link through the Cray SeaStar chip interconnects. Marron is also connected to a

32TB Lustre file system to provide a high speed data storage device for users work scratch and storage area.

Compute Partition
Number of Compute Blades: 41
Number of Compute PEs: 164
Compute Processor Type: AMD Opteron, 2.6 GHz
Compute Teraflops: 0.853 TFlops
Memory Configuration/Blade: 8 GB
Compute Partition memory capcity: 0.33 TB

High Speed Storage
I/O Cabinets: 2
Parallel FS Sustained Bandwidth: 1 GB
Parallel FS Total Capacity: 32 TB
Total Peak Flops: 0.962 TFlops

In collaboration with Cray Australia, the spare XT3 cabinet has been configured as a stand alone test XT3 platform, Black Swan. It has one compute blade and one service partition. This will act as a test bed for upgrades and experimental developments for the XT3.

The Cray XT3 system was chosen because of its ability to deliver superior performance for parallel application, including:

- scalable processing elements each with their own high performance AMD Opteron processors and memory
- high bandwidth, low latency interconnect

- MPP optimized operating system standards-based programming environment
- sophisticated Cray Reliability, Availability and Serviceability (RAS) and system management features
- high speed, highly reliable I/O system

One of the main key feature of the XT3 is the interconnect. The XT3 system incorporates a high bandwidth, low latency interconnect, comprised of Cray SeaStar chips and high speed links based on HyperTransport and proprietary protocols. The interconnect directly connects all processing elements in a XT3 system in a 3D torus topology, eliminating the cost and complexity of external switches. This improves reliability and allows systems to economically scale to tens of thousands of nodes well beyond the capacity of fat-tree switches. The backbone of the XT3 system, the interconnect carries all message passing traffic as well as all I/O traffic to the global file system.

The Cray SeaStar chip combines communications processing and high speed routing on a single device. Each communications chip is composed of a HyperTransport link, a Direct Memory Access (DMA) engine, a communications and management processor, a high-speed interconnect router, and a service port.

1.3 Other resources

Rear projection, linear polaroid passive stereoscopic projection wall. Specifications:

Resolution: SXGA; 1400x1050 pixels.
Attributes: 2.5m wide by 1.9m tall.

Workstation style stereoscopic display based upon active shutter glasses and CRT monitor. Software includes mostly locally developed tools designed to handle various data types. Applications cover essentially all aspects of stereoscopic capture and presentation, including stereoscopic photography, filming, stereoscopic (immersive) panoramic imagery, CG movies, real-time visualization of data, and more artistic endeavors.

The dome is a 3m diameter rigid hemisphere, truncated on the bottom to fit within the 2.7m high floor to ceiling space. Projection is based upon a HD projector = 1920x1080 pixels and the spherical mirror projection hardware invented/developed by Paul Bourke [1]. Software tools are currently being developed for real-time applications targeting immersive data visualization. Used also for full dome movie content development and preview for planetarium style content.

The dedicated Access Grid installation allows different partners in the community and groups of diverse discipline to collaborate thus improving communication in research development.

2. Research

This research has been broken down into two phases. The first phase is user education and the second phase is user interaction. User education deals with equipping potential and current marron users in Australia with the necessary knowledge of the Cray XT at the WASP. This would include collaborative objects in SecondLife assisting users in discussion and teaching. Some commonly use function such as "qsub, qstat and xtshowcabs" will be presented in SecondLife so that users can learn what are the commands functionalities & usage. The second phase of the research will cover live interactive functions allowing users to actually launch and monitor real time jobs in SecondLife. Phase two is currently in experimental stage and will be discussed in the next publication.

Figure 1

2.1 SecondLife

SecondLife provide a 3D environment that allows users to interact with each other. Users enter the virtual environment as an Avatar. The avatar can be dress in a pre-defined fashion or modified to suit the taste and preference of the user. Avatar modification includes clothes and physical skin/facial/body appearance. User can altar the appearance to match an actual person in real life or could take on an entirely different imaginative look.

Currently, Linden Labs provides SecondLife servers for users to login if network support is available. This option presents SecondLife users with many grids to teleport. An analogy for this option would be surfing the Internet thus connecting to a "big world". Nevertheless,

the other option is to install an Opensource version of the world, called OpenSIM. This server software provides user with either a grid option to connect to other existing OpenSIM grids or a standalone installation. With the standalone option, SecondLife virtual world can still exists without network connectivity.

Upon logging in, Avatars are able to walk, run and fly within the virtual 3D world. Objects can be built using a tool found in the viewer. Users can communication with other avatars by typing text messages into the chat bar or connect a headset to chat in audible mode.

2.2 Objects

The first object that was modeled in SecondLife for this research was the CRAY XT3 located in the WASP machine room. Like most High Performance Computing Center, the machine room is usually a highly secure room. However, the WASP has a glass panel on the outside that allows users to view the XT3 from the room. Nevertheless, visitors are not able to see what it looks on the inside and the rear. The model in SecondLife allows visitors, staff & students at The Unviersity of Western Australia to view the full machine from any angel they choose. The back pane is a texture mapping of a picture of marron from the rear view. The front colors are exactly the same colors found on the cabinets housed at the WASP. The signboard on the left of the cabinets is a introduction of marron. Users are presented with a quick summary of the machine specification positioned just next to the machine.

Figure 2

The second model is the Cray SeaStar architecture object. This model is drawn using the build tool inside the viewer. Closely resembling the model found on the Cray product document. It is drawn with a combination of two cylinders and a cube. This model allows users to discuss the Cray interconnect architecture providing a 3D model

to reference. Users can hold the object move it wherever it is suitable for learning and collaborative discussion. The model is programmed to go on a 360 degrees rotation thus highlighting the different aspect of the architecture from multiple perspectives.

Figure 3

2.3 Functions

The rest of the objects found on the right side are interactive poles. The poles allow users to choose the different function that they would like to learn more extensively. The 4 interactive functions chosen for the purpose of user education are

1. PBS scripting
2. XT Blade
3. Command line - xtshowcabs
4. Command line – qstat, qsub

The above functions are the most commonly used therefore they are chosen for the purpose of this research. The only user interaction that is common on all interactive poles is touch. User must touch the pole for it to provide the information required for presentation.

2.3.1 PBS scripting

The first pole from the left is pbs scripting. When the user touches the pole. An example pbs scripting will be given to the user as a form of a notecard. The user can then choose to either copy the content of the notecard or save it in the inventory list for later use. Users are able to send notecard to each other in the virtual environment. This will allow user-learning collaboration to take place within SecondLife with exchanges of example pbs script.

2.3.2 XT Blade

The second pole which is just next to the pbs script pole is XT Blade. The same interaction rules applies to this pole. When the user touches the pole a 3D object of an XT blade is presented to the user. The functionality of this object is rather similar to the Cray SeaStar object where is create opportunities for user to discuss the architecture of the machine by having a rotational view. Users are able to view the blade from different perspectives thus allowing discussion and gain better understanding regarding the internals of the Cray XT.

2.3.3 Command line - xtshowcabs

The next pole is the command line usage interactive pole. xtshowcabs is a common command used by XT users to display the status of the cabinet. By touching the pole, an example of an xtshowcabs output printed in a terminal window is displayed just above the pole. This allows users to discuss the different attributes that are printed in the xtshowcabs output. Users can point and highlight the different sections in the output and discuss the content in greater detail. User can choose to delete the floating objects or save the object in their inventory for future discussions.

2.3.4 Command line – qstat, qsub

The last pole is another command line interactive pole. Upon touching the pole a signboard will appear above the pole. It contents information regarding two most commonly use commands in pbs which is qstat and qsub. The information shows an example out of qstat and how qsub should be used on marron. Similarly to the rest of the interactive objects, user can choose either to delete the object from the SecondLife virtual world or execute a "take" command to save in the object folder found in the inventory listing.

Figure 4

Currently, these objects created are not permanently set in the Linden Lab SecondLife virtual world. Development was done using a Sandbox provided free to any user. Sandbox is a term used in SecondLife, which can be defined as a location for users to freely create any object on the condition rules governed by the owner of the Sandbox. Objects created in Sandbox

3. Future Consideration

Phase two of the research will allow users experiment job submission and real time monitoring. It will focus on user interaction where different animations of processor, queues and architecture. The four basic function found in this current phase will be reviewed to provide higher level of user interaction. User will be able to gain real time information about the machine, watch their jobs launch on the processor and view possible visualization of the communications between different processor.

Acknowledgments

About the Author

Jason Tan is the Senior Computer Support Officer at the WASP, where he maintains the WASP network and provides HPC systerms administration and support. He brings with him seven years of experience in Linux and Windows system administration. Jason is also the Access Grid pilot at the WASP and was recently appointed the Western Australian Access Grid Quality Assurance Tester responsible for certifying Access Grid nodes in Western Australia to ensure high level of quality. Jason has a Masters Degree in Electronic Marketing and Information Management and a Bachelor's in Computer Science from The University of Western Australia. Jason has a broad interest in computing and networking technologies, and aims to continue his efforts and develop his expertise in these areas. He can be reached at The University of Western Australia, Western Australian Supercomputer Program, M024, 35 Stirling Highway, Crawley, Western Australia 6009. His office is located in the physics building of main university Crawley campus in room G13; Tel:+61 8 6488 8742; Email: jason.tan@uwa.edu.au

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