Overview of SAGE (Scalable Adaptive Graphics Environment) for Artists, and Critique of its Associated Technical and Other Documentation

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ABSTRACT:

SAGE (Scalable Adaptive Graphics Environment) is software that bridges high-speed networks with high-resolution displays. The software allows the user to view files remotely or collaboratively on large multipanel high resolution display surfaces, through a multiplicity of interfaces. The main types of files tested were images and movie files. While useful for other types of projects, this paper focuses on applying the knowledge of this software, network and hardware environment for the use of artists and examines the viability of that wpork vis a vis the availability and quality of technical and other documentation needed for successful collaborations using SAGE.

keywords: art, SAGE, Scalable Adaptive Graphics Environment , devices, applications, networking, visualization

Introduction

Several unique events gave me the preconditions for exploring this paper. Before the semester began, I spet a considerable amount of time browsing the EVL website. Much of the work at EVL has to do with collaboration using large datasets. On the first day of class in Electronic Visualization Graduate Seminar, the class given a tour of the EVL main lab. For me the 55-panel LambdaVision display stood out. I made an inquiry as to whether these devices were available and this was confirmed. Thus I chose to research LambdaVision, and thus came across its main software component, SAGE. This in turn also led me to research the Global Lambda Integrated Facility which referenced also by many other names. I wrote a proposal to use the equipment, and began working immediately on content that would take advantage of this high-resolution collaborative

environment and display. The technical challenge of actually using SAGE within the context of a performance art event was considered. Several of the drawbacks seen early on were: the LambdaVision is mostly immobile, therefore the main lab would have to be used as the performance space (not ideal). My lack of hands-on familiarity with the system made it difficult to envision how the actual performance interaction would work. Once my project was approved, however, I was given the go ahead to actually get some hands on experience with the system. I was given an account on the cluster and a 4-panel display workstation (papyrus) was at my disposal to experiment with SAGE. I was also briefly given access to the LambdaVision demo station (yorda) to experiment with the 55-panel display. The luxury of working with yorda was such that this account on the cluster and its SAGE installation is handled by the technical staff at EVL, and all of the latest applications are installed and working properly. On my own account on papyrus, I had the pleasure of installing and configuring SAGE 3.0d for my own use. This exercise was instructive in several ways: I got a first hand look at how the display functions, and immediately had hands-on experience of wading through the documentation for my own use.

This paper attempts to shed light on the disparate elements of the SAGE software developed by the Cavern Group at EVL. Noting several built in presumptions and assumptions as part of a complete working methodology, this paper will address the ability to assess SAGE software as an outsider to EVL's common practices, and High Performance Computing and Communications in

general. This paper uses technical, anecdotal, and other research methods. The main assumptions of this paper are there is basic clarity within the SAGE documentation and like most software and associated documentation SAGE goes through sporadic revisions as part of its development cycle. The goals of this document are 1) to assess the current state of SAGE and draw conclusions from it, 2) to provide an outsider's view of the documentation of SAGE, specifically its correctness and usefulness, 3) to add to the knowledgebase of SAGE.

SAGE at Electronic Visualization Laboratory at University of Illinois at Chicago

SAGE development began in the 2003-2005 timeframe, but is still being developed (version 3.0e) in November 2008. SAGE builds upon work on on Teravision, and the applications Vol-A-Tile and Juxtaview. The main network component of the software relies upon QUANTA, which uses reliable blast UDP. SAGE mainly acts like a virtual frame buffer. The UI is built around Freespace Manager, a window manager that allows collaborators to manipulate data on the screen. This is now known as the SAGE UI.

SAGE is the is a project of the University of Illinois at Chicago and is Electronic Visualization Laboratory's answer for the need for a software environment for a cluster-based high-resolution tiled display system. This type of environment can handle high resolution graphics, HD video and audio streams, and volumetric datasets, accessed by multiple users on separate continents using Lambda networks. The computing environment for SAGE consists of

several components, hardware, network environment, and software. Tiled displays can come in many shapes and sizes. For example, Papyrus is a 2x2 display by multiplying the pixels, we can geta count of the total number of pixels. Yorda is a 5x11 display with a total of 105 megapixels. SAGE utilizes a cluster-based rendering capability. What makes the system viable under this load is the core of the SAGE application. SAGE couples specific sets of tiles to nodes on the cluster, thus enabling distributing the workload. Photonically-based Lambda networks are used to move data from one location (display) to another. These are a. ~ 10 gigabit for data onto tiled displays. The SAGE UI can be utilized from a laptop and wireless connection. The SAGE UI is installable separately on a laptop without he undeslying SAGE engine. This enables a user to connect locally to an existing tiled display and manipulate it, while leaving the network intensive work to the other elements of the network. The SAGE Web UI is used for screen sharing. Screensharing utilizes the vnc:// protocol. Separate VNC client and server software is required. The Web UI must be installed separately on a laptop actually running SAGE.

Multiple software components must be understood and configured to use the software and maintain it in its environment. SAGE come in several flavors according to the underlying operating system (Mac, Windows, UNIX). Regardless of the operating system used, the correct most up to date version of SAGE must be installed. SAGE requires the use of preinstalled libraries. Some are available directly from EVL. Some of the libraries are modified libraries optimized for SAGE

use. Some of the library dependencies come third parties. Most are open-source. Some of the required libraries are built in to OSs. Other libraries required for SAGE may be rolled into a pre-existing operating system installation and may be different based on the operating system version. Most of the SAGE components (libraries, SAGE UI, etc) ship with basic package, Demo applications and some add-ons ship with the basic package. However, some components must be configured separately. SAGE needs to know your tile display resolution and network IP addresses. Many of the original applications written for SAGE have been deprecated in favor of newer more robust applications. However, some of the old applications still work. Newer applications may or may not be available from EVL. Instead some are available from third parties.

In November 2008 I was informally involved in Supercomputing '08 in Austin Texas, where EVL along with UCSD are sharing a booth demoing SAGE. EVL was also participating in the SC08 Bandwidth Challenge showcasing Global Visualcasting - Collaboration in Ultra-Resolution Work Environments. The yorda machine used for EVL demos was being staffed by EVL staff. I saw demonstrated a HD camera hooked up to stream EVL/Chicago live to the show floor. Similarly, the yorda machine was being utilized locally and remotely to help visualize the Supercomputing '08 demos and the Bandwidth Challenge. Multiple live feeds were being visualcast to various locations globally.

SAGE Documentation & Support

A brief overview of the SAGE website shows that is serves as the main

point of entry for current and potential SAGE users. The site is divided into PR, documentation and download sections, many of which have old but not critical information. Features include a general description, available applications, developer list, links to papers, download, documentation, community of lambda-based users, related projects, photo and video gallery, funding and contact information. While the whole website serves as a basic overview, the documentation section breaks down more specifically. The main lessons learned from the SAGE documentation is that while the installation instructions are a version (or two) old, much of what is written there is still relevant. Installing the 2.5 way may introduce some redundancy, but is otherwise fairly solid in scope. However, given the nature of complexity, it would make sense to update these instructions. On the cavern forum, SAGE support is the only set of active threads, and questions are answered by Ratko Jagodic and Luc Renambot within a day or two (or sooner) of their posting. The ReadMe files that ship with the most current versions of the software (3.0e) have not been updated. An add-on to the Quickstart page, the SAGE Web UI sheds light on some very useful features os SAGE for desktop sharing, but are unevenly documented and could be foregrounded.

The SAGE website resources include a technical documentation section for the software itself, the Cavern forum for support, SAGE papers, and related papers.The SAGE documentation includes a Quickstart page based on SAGE v. 2.5. This section is out of date. Notably however, this is where the Web UI

information appears. Information for fsManager.conf and stdtile-1.conf files remain unchanged. The FAQ section probably should be updated with information from the Cavern forum. In the fulldocumentation section (also available as a .pdf) a discussion of some of the technical issues, while instructive, are deprecated because they are auto-configured in the newer versions of SAGE.

The Cavern forum has the most up-to-date information. The organization of the forum is difficult to follow. Some of the questions and answers refer to versions 2.5 and earlier, specific applications and libraries, and specific hardware and network environments. It would be nice to be able to search or sort this information as it grows.

Many SAGE papers are very useful and delineate the usefulness and technical issues and environment of SAGE, and specifically complement the technical documentation of SAGE. Of particular importance are Jeong, B., Collaborative Visualization Architecture in Scalable Adaptive Graphics Environment, and Renambot, L., Jeong, B., Hur, H., Johnson, A., Leigh, J., Enabling High Resolution Collaborative Visualization in Display Rich Virtual Organizations. Global Lambda Visualization Facility (GLVF), The OptIPuter Project, LambdaVision sections of the EVL Cavern website and their associated documentation are useful related sections.

The various Readme files from available downloads contain information pertinent to the individual releases of the code. In come cases the information

reflects the same information as that presented on the website, but in some cases is not up to date. For example, in the Readme.txt file for SAGE v2.5 attributed to Byungil (Brent) Jeong and Ratko Jagodic the file has a note that says "Needs to be changed for SAGE 3.0 (Ratko, 07/12/04)." Some other files eluded my examination due to the fact I did not test the software on multiple systems. However, there are readme files for the specific components (SAGE UI, apps) multiplied also by the various platforms they engage (Windows, Mac, and UNIX).

I had the pleasure of engaging various EVL staff in discussions concerning SAGE. Some of the discussions were of a technical nature, others administrative. WIth Lance Long I discussed some of the environment issues (network, hardware). With Dr. Jason Leigh I recieved feedback on the viability of my proposal to research SAGE (and present this paper). Robert Kooima and Maxine Brown separately provided some insight into SAGE usage. I spoke with Ratko Jagodic and Luc Renambot with some specific installation and configuration issues.

Conclusions

The conclusions I drew from my experience with SAGE thus far is that SAGE is indeed a robust tool for just the sort of work it is designed for, but it does take institutional support, some technical consideration, and a background understanding of its goals.

SAGE may at first seems to have a high barrier of entry but if those roadblocks

can be overcome, the overall effect is rewarding. I would further explore especially SAGE's OpenGL capabilities, specifically as they relate to lower-level computer vision techniques and potential for use with with Open Sound Control (OSC) and Processing libraries.

I would recommend that the readme files be updated to the specific releases for which they are intended. The website could use some of the newer information in order for it to retain its robust usefulness. The information from the forum cannot be specificaly replicated, but the more useful items could be summarized into the FAQ. A new overview document focussed on non-developer users could be created. I also believe that there are features advertised in the 2.5 documentation that have been deprecated and should be removed. A select up to date overview of applications useable by SAGE is of primary importance.

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