AWIPS II Prototype Testing Equipment for a Standalone Experimental EDEX/LDM/CAVE System for Penn State and Unidata
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Abstract

The National Weather Service is implementing its third generation of information processing technology, called AWIPS II, across all offices. This implementation requires the latest hardware and software technologies to be implemented in an open-source computing environment. Once fully developed and deployed, AWIPS II will provide powerful tools and display capabilities for both research and operational use. As a University, Penn State Meteorology plans to leverage these powerful capabilities in education and research via its 2014 Unidata Community Equipment Award.

The Penn State AWIPSII EDEX/CAVE Prototype

A prototype AWIPS II EDEX/CAVE pair was installed with the award funds. The EDEX system was originally specified as a high-end server with RAID 10 10K rpm disk storage. However, after consultation with Unidata, it was revealed that conventional disk performance would be insufficient to keep up with the demands of the EDEX database environment, so high throughput SSD disks were selected instead. The final prototype EDEX server installed at Penn State consisted of a 2-U rack mounted single Intel Xeon 2.6 GHz 6-core processor, 64 GB RAM, and four 1 TB Samsung 840 EVO SATA SSD's connected to an LSI 9271-8i controller. Configured as a RAID 10 array, 2 TB of usable high-speed SSD storage was available. One additional conventional 10K rpm disk was installed for use as an LDM queue disk.

To verify that the SSD array was indeed performing well, I/O tests were performed using the Flexible I/O Tester, FIO. FIO was run in an emulation mode for the "Intel IOmeter File Server Access Pattern" with a variety of random read/write percentages, queue depths representative of a file server, and a test file size of 30 GB. Holding latencies to less than 1 ms, the worst case result for 50% reads and 50% writes provided a total throughput of 19,000 I/O's per second (iops) at 116 MB/sec. For all writes and no reads throughput was 38,000 iops at 251 MB/sec, and for all reads and no writes throughput was 76,000 iops at 495 MB/sec. Considering that a fast 10K rpm spinning disk can only do about 300 iops at just a few MB/sec of random disk activity, the SSD was truly up for the challenge of high-performance I/O that the EDEX server demands. However, SSD cost is higher, and endurance is a concern since most current SSD's are warranted for only 150 TB of lifetime writes. An LDM receiving data at a rate of 200 GB/day would write 150 TB of data in about 2 years, though spreading data across a RAID array would increase SSD longevity.

Testing Results and User Comments

After performance testing was completed, 64-bit Red Hat 6 Server OS and the Unidata AWIPS II EDEX software were installed on the server. The installation was straightforward and the system has been performing well. A few glitches (e.g. java heap shortage, configuration issues, data ingest issues) have been reported to Unidata and have either been resolved, or will be resolved in a future release.

A CAVE workstation was also purchased and installed with 64-bit Red Hat 6 Workstation OS and Unidata CAVE software on a Dell T1700 workstation with 16 GB of memory and a 2GB Nvidia Quadro K2000 graphics adapter. After working out a few glitches (mostly related to the java heap memory settings on the EDEX server), the workstation was placed in the Penn State Weather Station for students and faculty to evaluate along with an optional online survey to complete. Since the system was experimental, usage was not heavily promoted and only 2 faculty members and 1 student responded to the survey. The responses were still interesting however. Interface ease-of-use was average or below, while response time was average or above. Its strength as an analysis and display tool was mixed. When the users were asked what capabilities were missing or what could be improved, the following were listed:

- Reloading displayed variables should not affect the map projection
- Inclusion of a legend for distinguishing between variables
- Ability to change contour values
- Interface is too cryptic (ten minutes of guessing yielded one satellite picture)
- Self-explanatory interface or a training video is needed
- Ability to create new diagnostic fields is needed
- An elevation map for mesoscale phenomenon would be useful

When asked what capabilities were most-liked, the following were listed:

- Much faster than GARP
- Overall, pretty cool but requires a learning curve
- More extensive information is shown (variety of non-standard variables such as Q-vectors)
- Sounding and hodograph plotting routines

Finally, an attempt was made to produce GEMPAK analysis and display products using the AWIPS II database through the CAVE workstation. Recent versions of GEMPAK are able to read the AWIPS II database through the use of XML control files that tell GEMPAK how to access the AWIPS II database rather than the traditional GEMPAK data management files. This attempt was unsuccessful, however, due to problems with the XML control files. Further investigation into this capability is ongoing.

IDD Relay Upgrades

A second component of the Penn State award was an upgrade of our existing IDD relay hardware facilities. This upgrade was straightforward and involved the purchase and installation of additional processors and memory for three existing IDD servers. These servers were initially funded via the 2011 Unidata Equipment Awards program (IDD Ingest Relay Replacement in Support of the THREDDS/RAMADDA Server System at Penn State; UCAR Sub-Award No. Z11-90985). The new servers are now each configured with 72 GB of memory and dual Xeon E5606 processors and are performing well.