Unidata Community Equipment Awards
Cover Sheet
Proposal Title:

The Creation of a Community Resource for Weather Case Studies and Innovative Real-Time Weather Data for the IDD

Date: March 14, 2008

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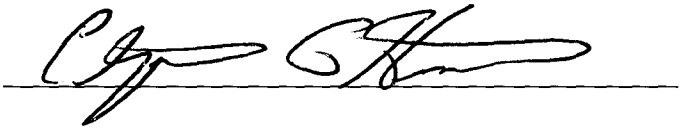

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Project Summary

This objective of this proposal is to provide new community resource to satisfy a number of needs for both real-time and archived data. This hardware will provide a number of basic services to both our campus and the greater community by virtue of our Internet and Internet2 connectivity.

The requested hardware will provide a number of new and replacement services that are provided in more detail below. These services include the following internal and Internet accessible activities:

- A new compliment to the “Motherlode” THREDDS catalog and ADDE services that Unidata supplies
    - This will provide both intranet and Internet access to these data for the Integrated Data Viewer (IDV), McIDAS, Grads, and other capable software packages.
- A new, and potentially unique, THREDDS and ADDE server to provide access to a large number of existing UNIDATA/COMET and NWS weather case study data sets – called the “Community Weather Case Server” within this proposal.
- A new external LDM server for community data sharing of the following data sets:
    - CONDUIT model data
    - Level2 NEXRAD data
    - Better positioning ERAU for a relay node in the IDD rather than as a leaf node
    - Introduction of a new ERAU composite satellite data set
    - Backup data insertion point as a failover for the USPLN data feed offered by WSI
- A consolidation, reorganization and enhancement to a number of Internet weather information web portals serving both our academic mission and the community at large.

While each of these new, or enhanced, services is elaborated on in the *Project Description* section below, it is worth noting here that each of these individual applications of the proposed hardware alone meets a number of the criteria being used to evaluate the proposals. Together these various services offer a significant set of resources to both our sizeable group of meteorology students here at ERAU, as well as the meteorological and broader geoscience communities at large by virtue of the many Internet data delivery protocols that will be exploited.

Project Description:

Embry-Riddle Aeronautical University (ERAU) was founded just 22 years after the Wright brothers' first flight; the University and its graduates have built an

enviable record of achievement in every aspect of aviation and aerospace. Residential campuses in Daytona Beach, Florida, and Prescott, Arizona, provide education in a traditional setting, while an extensive network of more than 130 centers throughout the United States and Europe and a Web-based distance learning program serve civilian and military working adults. Each of these campuses offers courses in meteorology, a natural marriage in the safety culture of aviation, as well as Bachelor of Science degree programs in Applied Meteorology at the two residential campuses. The Unidata supported software packages are celebrating their tenth anniversary of their arrival on the ERAU campus this year, coincident with the arrival of the PI of this proposal. The PI had already established a relationship with COMET using GEMPAK and GARP in his doctorial and post-doctorial work and is reluctant to admit his "age of association" with Unidata, but it is roughly coincident with the emergence of Unidata in the academic community.

Our facilities

The Daytona Beach campus, where this hardware will be housed and maintained, is located next to, and upon, the Daytona Beach International Airport. The 185-acre campus serves roughly 5,000 undergraduate and graduate students. The campus offers state-of-the-art facilities, including the 75,000-square-foot College of Aviation building, which has air traffic control virtual reality simulation and research labs, a spatial disorientation simulator, two computer-based classrooms dedicated to support the Applied Meteorology curriculum, as well as a number of other classroom space on partial use for our courses.

In addition to our classrooms, there is a state-of-the-art Weather Center where we provide continuous displays of real time weather data on two plasma monitors and an 8' projector screen. *The Unidata supported display programs (GARP, NMAP, and the IDV) are cornerstones to this facility.* There are 25-30 additional computers available to the students in this facility. All of our academic computers (~90 workstations) are dual-boot systems, allowing our students to access all of our real-time data streams utilizing the Linux OS and the aforementioned Unidata software. When the students boot into Windows XP their only current option is to use the Unidata IDV for data access. Our current servers do not have the resources to provide the additional services to support the IDV, so our students end up using the Internet to obtain data that could be provided internally. This presents an unnecessary burden on our campus bandwidth and causes unnecessary delays for the students and faculty using the software. Due to the way our campus ISP operates, we pay separately for inbound versus outbound bandwidth. Since we are well below our outbound subscription level providing these same data to external users would not represent any additional burden on our network infrastructure (which is all gigabit internal to campus).

Our Students

Our degree program in Daytona Beach currently has approximately 110 FTE undergraduates that are pursuing one of four areas of concentration, each of which provides a degree of specialization. These four areas are:

- Aviation Meteorology
  - Prepared and qualified to take the FAA Dispatch Certification exam
- Commercial Meteorology
  - Minor in Business
- Media Meteorology
  - Minor in Communications
- Research Meteorology
  - Graduate school preparation in math, physics and dynamic meteorology.

In recent years we have added a GIS laboratory and a television studio with the necessary equipment to generate both live and recorded weather broadcasts on the campus cable television network. Video segments of "Today's Weather" will be linked from this new web server hardware.

In addition to the 110 students that are in our Applied Meteorology degree program, courses offered in our program are required to support the degree programs in Air Traffic Management (300+ students), Aerospace Studies (100), and Aeronautical Science (>1300) Bachelor of Science degree programs. These programs comprise *more than 1800 meteorology students* that will be impacted by this hardware. Many of these students will complete our Minor in Aviation Weather, taking at least five meteorology courses in our program. In fact, meteorology is such an important area in both a student's curriculum, and in their general interest, that *more than 25% of the ERAU student body takes a meteorology course during any given academic year*.

Existing Applied Meteorology Resources

Roughly ten servers act in concert to ingest and process all available weather products. The main data feed is via two full four channel NOAAPORT systems. Data not available through NOAAPORT are brought in through Internet2 and the commodity Internet using the LDM and the Unidata IDD. Level II RADAR data from all available sites are ingested and relayed to downstream sites. A subset of the CONDUIT data feed is ingested and shared among a number of users internally and externally. Internally, the data are decoded into GEMPAK formats for access by faculty and students through the available workstations. Also, the data are used to create thousands of images each day for the weather center's ever growing web pages (http://wx.erau.edu/data/, http://fltwx.db.erau.edu/, http://wxkiosk.erau.edu/, and http://wx.erau.edu/erau_sat/). Additionally, selected text products are inserted into a continually growing database.

ERAU has robust campus Internet and Internet2 bandwidth, with 90-megabit and 45-megabit throughput, respectively. Both the Internet and Internet2 connectivity is balanced over redundant fiber cables that ensure high reliability of our networking with off campus destinations. The campus networking and the Applied Meteorology server closet have UPS devices to support transient power disruptions and generator backup to support longer-term disruptions to the commercial power supply. This was tested a number of times during the fall of 2004 as three direct hurricanes passed across our area. In all cases the commercial power was lost for multiple hours, but our data servers never lost products through either our NOAAPORT or IDD feeds.

Hardware Description

The Sun T5220 server with the Solaris operating system ($14,617, see provided quote) was chosen as a reliable and robust solution to running the many proposed services. The system will have enough RAM to provide numerous concurrent LDM connections, and sizeable data queue, for external subscribers as well as providing a unified system for all of the other data and web page applications. This will allow us to consolidate a number of processes currently spread across multiple systems while providing a fault tolerant solution without the creation of a farm of data and web servers.

For real-time data storage, an existing Dell PowerVault disk array provides about 1 TB of space for real-time data. These disks will provide the real-time data for the server, while a set of internal disks (included in the quote) will provide a repository for us to store the existing case study data that are currently stored offline on tape and DVD archives. The addition of the single Sun server is an ideal solution to providing both real time and archived case studies to both the university and Unidata communities.

The services to be provided include all typical data dissemination techniques currently utilized by the Unidata community including LDM, ADDE, and THREDDS. The ADDE and THREDDS protocols are supported, wholly or in part, by the Unidata IDV and McIDAS software packages.

This new server will allow us to re-task some existing equipment. The additional CPU cycles will allow us to begin the dissemination of some derived satellite-based products that are being developed internally here at ERAU using the McIDAS software package. The types of new products that will be generated and shared with the Unidata community include:

a) a brightness normalized visible product merged with a night time fog product (using channel differencing) to make a day/night low cloud monitoring product
b) a convective cloud product
c) a volcanic ash product, composites of IR, water vapor, and visible/fog images
d) a cloud-free IR sea surface temperature composite

e) Other products are still to be developed. These include a haze/smoke product, a snow cover product, and enhanced volcanic ash product.

It is proposed that these new products will also be made available to the Unidata Internet Data Distribution (IDD) program through the LDM software using this new server.

Intellectual or technical merit of the proposed work

Making all of the existing case studies available to users of the IDV software package, with a startup link to configure the IDV to only display data in the Community Weather Case Server for a particular case will greatly facilitate the use of these studies by a large community of educators and students in the geosciences around the world. The THREDDS server will also allow users to download the various files from the case studies for use on their own systems in the GEMPAK family of programs.

The sharing of new data sets such as the USPLN and the ERAU derived satellite images will allow for new scientific inquiries by all who have access.

Contribution to Unidata community capabilities

The use of Unidata sponsored software to support our efforts guarantees access to these resources by those who are members of our community. Given that many of the case studies require significant resources to generate the proper file formats, directory structures, configuration files and ultimately disk space to house the study, we will be providing a valuable resource to the entire community. All of this is now possible due to the continued development of the THREDDS and IDV software which can now use the existing GEMPAK files from the COMET/Unidata case studies, as well as the real-time data.

Broadens the Unidata community scope and capabilities

COMET and Unidata have chosen the case studies that are available due to the particular focus on a specific atmospheric phenomenon (like winter weather) or event (like the “Storm of the Century” in March 1993). The Community Weather Case Server will greatly enhance the ease of access and use to all interested users.

The LDM capabilities of this server will provide a valuable resource for data relay here in Florida and could be of interest to those Unidata IDD sites operating in the Caribbean and South America given the “gigapop” Internet link located in South Florida.

Enhanced participation in the Internet Data Distribution (IDD)

ERAU is a participant in the Unidata IDD, both as a receiver and provider of data. We currently compliment our NOAAPORT receiver with data from the IDD, such as the Unidata/Wisconsin satellite images, CONDUIT model data, and as a Second Tier Relay site for Level-II radar data. Many of our NOAAPORT products now have the same data header as those using the Wisconsin NOAAPORT software, thanks to development efforts at Planetary Data Inc.

Additionally, the new satellite products described above will be inserted into our LDM and made available to other IDD sites.

Commitment to participate actively in Unidata's community-based support efforts

ERAU faculty and staff have a long record of participating in the Unidata community efforts. An example of our participation is that our Applied Meteorology System Administrator, and programmer, has developed a new Java class to extend the IDV. This new class allows for the display of aircraft data positions as a small airplane shaped icon. The icon can be chosen such that it represents the type of aircraft in question and oriented on the map background in the direction it is heading. This class has been adopted, support has been provided, and users can now take advantage of this method.

The P.I. of this project has worked with Unidata software packages since his days as a graduate student in the end of the 1980's. The PI currently serves on one of the Unidata governance committees, and helped to organize the summer workshop hosted by Unidata in 2006.

Contributes to the advancement of technology

The distribution of archive and real-time data is an ongoing development for the meteorological community. The distribution of our new suite of satellite products represents a number of advancements for monitoring of weather, especially over the open ocean. Currently ERAU is working with United Airlines to integrate a number of these products into their operational workflow as they allow for real-time detection of potential aviation hazards.

Contribution to education

The impact to the ERAU community will be significant. As mentioned above, there are almost 2,000 students annually taking our meteorology courses. These are individuals who will be using weather information throughout their careers (as pilots, controllers, forecasters, aerospace engineers or computer scientists).

In addition to the global access to a broad range of weather cases provided by the NWS, COMET and Unidata, it is envisioned that the Community Weather Case Server will eventually have an area for educators to share lesson plans that have been developed for the individual cases. Providing a portal in which the data are packaged and ready to be used and the lesson plans to accompany those data will greatly increase the utility of these cases in all aspects of geoscience education.

Contribution to research

The Community Weather Case Server and more general distribution of weather data with this server will allow for the phenomenological inspection of various weather events. The software tools available to our community through Unidata have a proven track record in the literature as robust tool sets – when given the data resources they require.

In addition to the case study archive, the new and innovative products that we will develop and make available to the community will allow for a number of new scientific inquiries by students and scientists at all levels of education. The scope of application will be limited only by the vision of the end users.

Budget:

The budget of $14,617 allows for the purchase of a robust server to support the broad range of data services proposed. The new Sun T5220 server and our existing disk storage will allow for a suitable upgrade path in the future as additional computing resources become necessary. The proposed hardware represents a significant enhancement to our computing infrastructure, and is the beginning of a trend where we will be replacing old hardware with new equipment that consumes much less electricity and cooling than our older systems. This means that we will effectively reduce our carbon footprint for our computing needs as we continue to replace our old equipment.

All hardware and software will be configured and developed by ERAU faculty and staff, though it is anticipated that modest help from the Unidata staff will be solicited to design and implement this resource. It is anticipated that the creation of the ADDE and THREDDS services will require some input from the skilled Unidata staff so that the services are properly and efficiently configured.

There are no requirements for our time that extend beyond the responsibilities that we already perform within our jobs. While the case study archive will require some time to assemble, we have already been working on this effort internally and will simply need to expand our efforts to more cases when the disk space becomes available.

Since this purchase falls into a Capital Equipment category, there are no direct or indirect costs imposed.

Project Milestones:

If this proposal is funded, the equipment will be purchased as soon as possible so that the configuration of the hardware and case study data can be done during the summer months when the faculty and staff at ERAU, in general, have more flexible schedules and free time to work on a project like this.

A proposed timeline is provided for the development of this project:

- June 2008 – Purchase and delivery of the hardware to ERAU.
- July 2008 – Initial configuration of the server and case study disk array. Development of a design for the holdings of the Community Weather Case Server.
    - Initial implementation of the new real-time satellite products on a server class system. Current product generation is being done on a faculty member's office workstation.
    - Real-time data service configurations and implementation.
- August 2008 – December 2005– Population of the Community Case Study Server holdings using the COMET/Unidata weather cases.
- January 2009 – Initial announcement to community of the new Community Weather Case Server resource.
- February – April 2009 – Development of the Community Teacher's Resource Portal for the sharing of case study lesson plans to compliment the Community Weather Case Server's holdings.
    - The THREDDS Data Repository (TDR) is being considered as the logical solution to this, but consultation with Unidata staff will determine the final method chosen for this task.
- April – May 2009 – Development of a final report to Unidata on the status and usage of the Community Weather Case Server.

Budget Justification

The Creation of a Community Resource for Weather Case Studies and Innovative Real-Time Weather Data for the IDD

Embry-Riddle Aeronautical University

Dr. Christopher Herbster

		6/1/08-5/31/09
Direct Costs		
General Equipment	$	-
Sun T5220 Server with Solaris Operating System	$	14,617
Sub-total Direct Costs	**$**	**14,617**
Indirect Costs		
35.9% Modified Total Direct Cost - Not included on Capital Equip	**$**	**-**
TOTAL REQUESTED BUDGET	**$**	**14,617**