Unidata Community Equipment Awards Cover Sheet

Proposal Title:
Infrastructure Supporting Software Tools for Climate Impacts and Planning

Date: March 29, 2010

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Project Summary

The NOAA Southern Regional Climate Center (SRCC) is one of six Regional Climate Centers that collectively hold one of the largest climate data archives in the country. The SRCC provides real-time climate data and data-products to end-users. A steady flow of data streams in and out of SRCC networks on a 24/7 basis and is processed and merged into an historical, near real-time climate archive. The SRCC is an active participant with the Applied Climate Information Systems (ACIS) - a nationwide effort by the six Regional Climate Centers to provide an integrated climate data warehouse.

The SRCC is also an integral part of the Southern Climate Impacts Planning Program (SCIPP) - one of nine NOAA-funded Regional Integrated Sciences and Assessment (RISA) programs that seek to help communities plan for and adapt to climate variability and change. Additionally, SRCC and SCIPP are part of the Department of Geography and Anthropology (G&A) at Louisiana State University (LSU), which currently has over a dozen active graduate students pursuing Masters and PhD degrees on climatological topics with the support of SRCC and/or SCIPP resources. Consequently, the SRCC serves as an interface for research, education, and service in the development and delivery of stakeholder-driven climate resources.

The equipment requested in this proposal will be used in support of these research, education, and service activities, including: the development of new temporal-geospatial climate impacts and planning tools; data sets for ACIS and SCIPP related activities; sharing of such data sets using THREDDS; and the promotion of research, training, and education among students and staff who are part of the SRCC, SCIPP, and G&A organizations.

Project Description

Equipment Requested

Two Dell R510 rack servers are being requested to support the development and archival of geospatial climate data products and web-based software tools in support of SRCC, SCIPP, and G&A research, education, and service activities. Redhat Linux Enterprise 5 will be used as an operating system for the two Dell servers. Each of the servers will have the following specifications:

- Two processors, each an Intel Xeon E5530 2.4GHz quad-core processor
- 16GB memory
- RAID Controller with 8HD slots
- Five hot pluggable 15K RPM, 3.5in SCSI Hard Drives, each with a capacity of 146GB
- 750 Watt dual (main and redundant) power supplies

In addition to the servers, two iMac desktop computer systems ($1,149 each) and one Mac mini desktop computer system ($549) are also requested, all of which will be dedicated completely to research activities, climate product development, and education via graduate and undergraduate student training.

All of the desktop systems will be network linked to the data servers being requested. The use of Mac OS X operating systems will insure compatibility with existing Southern Regional Climate Center computing infrastructure for desktops.

<u>Description of how the equipment will be used</u>

Generation of geospatial climate data layers and gridded data sets

As part of ACIS and SCIPP activities, the SRCC seeks to build a tile cache of geospatial map layers/tiles that help support climate impacts and planning activities. These map layers/tiles will be used for developing web-based geospatial tools geared towards community outreach, graduate research work and hazard mitigation activities. The servers will be used in developing gridded data sets by incorporating gridding and interpolation techniques on site observations of climate data. The near real-time site observations are received over the LDM/IDD feeds, which are then parsed and assimilated into NetCDF data stores. This real-time data store is an integral part of the ACIS data warehouse. The conversion of point-based time-series observations into spatial, gridded climate data sets will help towards generation of effective climate impacts and planning tools. The gridded data sets will also help in providing a needed geospatial component to the ACIS data warehouse and facilitate development of web-based geospatial tools. The requested servers will help in meeting the demand for the daily generation of spatial-temporal data sets spanning multiple time periods and regions across 48 contiguous US states.

Dissemination and Sharing of data sets using THREDDS

An additional component to this project is sharing of such gridded data sets for graduate research work and software development of web-based map layers. One of the servers will be used for hosting a THREDDS server to facilitate sharing and usage of such data sets for climate research and outreach.

Tropical season activities and outreach

For the past 6 years, tropical storm bulletins issued by the National Hurricane Center have been downloaded from LDM/IDD feeds at the SRCC. This information is parsed and ingested into databases. During the hurricane season, this near real-time information is used to create relevant storm-specific products to deliver briefings at the Governor's Office of Homeland Security and Emergency Preparedness. The SRCC also uses this information to maintain a tropical storm web page that serves as both an archive and portal for real-time geospatial information for hurricane tracks, storm intensities and direction. These community-based services will be migrated to the new servers to computationally keep pace with the volume of demand for such products.

Severe Events Tracking

The SRCC uses LDM/IDD for obtaining daily and hourly National Weather Service updates on severe weather such as tornadoes, hail and winds. These updates are parsed into a database and archived for climate service needs of the community. The information collected is also overlaid as map layers on geospatial web services and provided as a data service product for end users such as news reporters, legal and insurance firms and energy companies. The capabilities of this database will be enhanced by moving the code base to a new server that has faster processors and larger memory modules, thus

enabling the provision of dynamic severe weather search tools (map-based and textual search) and faster dissemination of information for the community.

Expansion of data sets for ACIS data warehouse

The SRCC also maintains synchronized and concurrent NetCDF-based data stores with the other five RCCs and the NOAA National Climatic Data Center. A data distribution toolkit called Spread (www.spread.org) is used to keep data stores concurrent. As more climate data sets for different data networks are added to existing data stores, the volume of data ingested and delivered is steadily increasing. During the next year it is expected that data volume, data requests, and processing loads will increase dramatically as NOAA begins implementation of National Climate Service activities and as the SRCC subsequently transforms its service activities to incorporate more temporal-geospatial data-products.

Research and Outreach

The SCIPP program is tasked with a focus on integrated, place-based research to address climate challenges crossing physical, social, and decision sciences in the south-central United States. Among the SCIPP research and outreach activities designed to meet this challenge that are ongoing or in the developmental stage are:

- Developing an integrated extreme events database and information system
- Conducting climate variability and risk assessments
- Creating web-based GIS services for climate risk and scenario analysis
- Engaging in demonstration and development projects with selected pilot communities
- Providing general education and outreach regarding climate science

The equipment requested here will be used by investigators and graduate students affiliated with the G&A department to undertake original research, develop new stakeholder-specific climate tools, and promote outreach and engagement activities in fulfillment of SCIPP's mission. Additionally, the G&A department has a tradition of supporting women and minority students through mechanisms such as the Pruitt Fellowship, and the recruitment of traditionally underrepresented groups into G&A academic programs, to participate in SCIPP-sponsored research activities, will be enhanced by this improved infrastructure.

Benefits for research and education

One of the many roles as a RCC is to serve the University Consortium for Atmospheric Research (UCAR) as a node (sirocco.srcc.lsu.edu) for the Unidata Internet Data Distribution (IDD) system. As part of this system, SRCC also operates a NOAAPORT system (mistral.srcc.lsu.edu) that serves as a reliability backup to the IDD. The data received from these systems are relayed (through pavan.srcc.lsu.edu and sirocco.srcc.lsu.edu) to multiple universities and research sites within the 160 Unidata community members.

Internally, the raw data are processed to derive customized climate data products (graphical, text-based and temporal-geospatial). These data products are supplied to federal and state government agencies

(such as the Governor's Office of Homeland Security, National Weather Service, US Geological Survey, National Climatic Date Center), industries, and the general public using network-based services such as CORBA, RPC and relevant web services. The volume of data that flows through the IDD ingest, processing, and data delivery servers exceeds 1 Gbps during certain times of the day. Since the volume of data products being delivered through this pipeline is steadily increasing, there is a need for more infrastructure to meet the growing demands of users.

The equipment requested will help SRCC, SCIPP, and G&A in three ways. First, it will enable an expansion of the climate data products and services currently provided. In particular, it will enable the processing of vast amount of point observations into gridded, geospatial data sets and expand the current suite of temporal-geospatial SRCC products. The THREDDS server will enable the sharing of these data sets and information tools with the research community. Second, it will enhance the computing environment for graduate and undergraduate students who are engaged in climatological research, product development, and outreach activities. Third, it will provide an opportunity to migrate existing internal technology components – e.g., web services, tile cache generation libraries, geospatial toolkits and software libraries - to newer, more reliable servers.

Relationship to existing computing facilities and resources

The two 2U Dell rack servers will be housed in the SRCC server room. The SRCC server room is already equipped with 3 rack towers with vacant 2U racks to house the two new units. The server room is equipped with two industrial-grade uninterrupted power supplies (UPS) that supply conditioned power. Additionally, emergency and back-up power supplies are available to the room through a standalone generator that comes into effect in the event of a power outage. This is especially useful in the aftermath of a hurricane; recently, after hurricanes Katrina, Rita and Gustav, these servers continued to function despite power outages in surrounding areas. The server room has dedicated HVAC facilities with efficient climate monitoring tools that provide a stable environment for the servers. The server room is equipped with a 1Gbps network switch that provides high speed internet connectivity through internet backbones such as National Lambda Rail and Louisiana Optical Network Initiative (LONI).

The two iMac Desktop computers and the Mac-Mini Desktop will be housed in the adjacent student research center and laboratory and will be used for graduate and undergraduate research work. The laboratory is currently equipped with 8 desktops, each provided with stable power supplies and high-speed internet connectivity.

Over the past 16 years, the SRCC has hosted a stable Linux-based server environment and efficient LDM facilities to extract and maintain climate data. There are currently eight Linux-based Dell servers that host a variety of services - web services for client-based access to data stores (CORBA, XMLRPC, WSGI and WMS), web servers (Apache, Tomcat and Twisted), ldm services, NetCDF data stores, Postgres and MySQL databases, geospatial and charting libraries and software repositories. SRCC also operates a 24-node cluster for compute-intensive parallel processing jobs. For storage and backup solutions, a 24TB Sun Surefire X4500 disk array exists. SRCC servers are currently being used at their optimum performance levels (disk, memory and processor utilization has reached critical mass) and thus there is a marked need for additional servers to meet the growing demand for climate data products and climate analysis tools. The equipment requested will further boost SRCC computing capabilities and spur research activity among SCIPP and G&A graduate students.

Budget

Supplies

The total requested funding for supplies is $3,197. This will allow for the purchase of two iMac desktop computer systems ($1,149 each) and one Mac mini desktop computer system ($549), all to be dedicated completely to research activities, climate product development, and education via graduate and undergraduate student training. All of the desktop systems will be linked to the data servers being requested (see "Equipment"). The use of the Mac OS X operating system will insure compatibility with existing SRCC desktop computing infrastructure.

Equipment

The total requested funding for equipment is $15,166. This will allow for the purchase of two Dell PowerEdge R510 servers ($7,558 each) that will be dedicated to the development and archival of climate data and software tools in support of Southern Regional Climate Center and Southern Climate Impacts Planning Program activities. Each of the servers will have the following specifications:

Processor (2): Intel Xeon E5530, 2.4Ghz, 8M Cache, 5.86 GT/s QPI, Turbo, HT
Memory: 16GB (8x2GB), 1333MHz Dual Ranked RDIMMs for 2 Processors, Optimized
Controller: PERC6i Controller, PERC Battery with PERC, SAS 6/iR Hot Plug, 8HD
Hard Drive: 146GB 15K RPM Serial-Attach SCSI 3Gbps 3.5in Hotplug
Power Supply: 750 Watt Redundant Power Supply
Management: iDRAC6 Enterprise
Network: Broadcom 5709 Dual Port 1GbE NIC w/TOE
Optical Drive: DVD+/-RW, SATA, Internal
Power Cords: 2x NEMA 5-15P to C13 Wall Plug, 125 Volt, 15 AMP, 10 Feet (3m)
Support: 3 Year ProSupport for IT and Mission Critical 4HR 7x24 Onsite Pack

Total Direct Costs

The total direct cost for the project is $18,363.

Total Indirect Costs

The total indirect (facilities and administrative) cost for the project is $1,535, using the LSU-specified indirect rate of 48% applied to the "Supplies" category.

Total Project Costs

The total cost for the project is $19,898.

Project Milestones

July 2010

- Order the computing equipment (two servers, two iMac desktops and one Mac mini desktop)

August 2010

- Receive and configure the servers by installing Linux operating systems and setup firewall rules

September 2010 - February 2011

- Develop and test software code for daily generation of geospatial and gridded data sets
- Deploy software components on server and automate production of gridded data
- Deploy geospatial tiles for overlay of gridded data on web maps
- Setup and host THREDDS server for dissemination of gridded data sets
- Deploy web-based maps for display of climate impacts and planning tools
- Provide workstation interfaces for student research

March 2011

- Enhance Tropical season-based tools and databases and migrate to the new servers
- Improve functionality for severe weather records and deploy web-based tools for outreach