

Unidata Community Equipment Awards Proposal Cover Sheet

Proposal Title: Maintaining access to LDM and EDEX data streams to support CAVE and legacy NAWIPS software at the University of Missouri

Date: 10 March 2023

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Signature of University Official: _____

MU Project: 00083245

Maintaining access to LDM and EDEX data streams to support CAVE and legacy NAWIPS software at the University of Missouri

Project Summary

The dedicated computing facilities in the Atmospheric Science Program at the University of Missouri are housed in the newly updated Weather Analysis and Visualization Laboratory (the WAV Lab). The WAV Lab consists of 12 Linux machines:

- 11 client machines - Dell Precision 5820, with 32GB RAM, Intel W-2245 8 core CPU, NVIDIA RTX A4000 video cards, and 256 GB NVMe storage, and
- 1 quasi-server machine (“Obukhov”) - Dell Precision 5820, with 64GB RAM, Intel W-2275 14 core CPU, NVIDIA RTX A5000 video card, 2TB NVMe storage, and 12TB additional spinning storage

These and numerous upgrades were made possible through a \$100,000 internal grant from our Provost in late 2021. The updated WAV Lab relies heavily on CAVE and IDV for daily forecasting and instruction, respectively. Additionally, proprietary software such as MATLAB also resides on the quasi-server, Obukhov. However, the machines dedicated to running the LDM (“Monin”) and EDEX (“Prandtl”) were not included in this funding request.

This proposal requests funding to purchase two high-end machines capable of being LDM and EDEX servers. The current situation has our LDM and EDEX servers residing outside of the WAV Lab in a more secure “server farm” facility. However, both of these machines are nearing the end of their life cycle, with no clear internal mechanism for replacement.

The machines that we intend to acquire would allow continuity in our Linux environment and software offerings. They would also enable rapid access to the CAVE/AWIPS-II environment on our newer computing platforms that we have acquired. The overarching theme of this proposal is to broaden local and community access to UCAR data streams as well as to support continued MU student use of our WAV lab workstations in both teaching and research modes.

Project Description

Goals of the Project

If funds are awarded, we will replace aging servers that receive and process data via the LDM and EDEX.

Each machine comes with a quote (with educational discounts) of \$11,497. MU can provide \$3,000 as cost share.

The equipment specified in this proposal would modernize a significant portion of our Linux environment and provide an EDEX server that would facilitate faster CAVE/AWIPS-II access both on the MU campus and to the larger UNIDATA community.

Project Activities

Education

We envision a significant impact of the proposed hardware/software in our teaching. The WAV Lab is an interactive classroom, where students can view diagnostic and prognostic meteorological fields. Our courses typically have between 10 and 20, which means one to two students per computer in class. Over the course of the academic year, students will have ample time to use the workstations in an unstructured environment in order to explore the particulars of the software. The following courses are significant subscribers to the WAV Lab, and the hardware that underly it:

Synoptic Meteorology I/II (Junior level)

For real-time map discussions, skew-T analysis, isentropic analysis, Q-G theory interpretation, calculation of convective parameters, comparing numerical models, satellite imagery analysis, and the like, CAVE, and to a lesser extent the IDV, are used extensively.

Dynamic Meteorology and Thermodynamics (Senior level)

Students will have freedom to calculate vertical motion, vorticity tendencies, and other diagnostic quantities. Finite differencing techniques are studied in detail. Multiple tools are employed for these activities, but UNIDATA software are used for occasional visualization in real-time scenarios.

Mesoscale Meteorology and Dynamics (Senior / Graduate level)

In addition to in-class examples and homework sets, students are required to perform a detailed case study of a given mesoscale event as a part of their grades, beginning at the synoptic scale with conventional data and progressing downscale to the analyses of individual storm cells using radar (reflectivity and velocities) and satellite imagery. MATLAB and the IDV are tools used for the analysis of these observed data.

Weather Briefing (Freshman / Sophomore level)

An introduction to surface and upper air analysis, satellite imagery, and RADAR will be made to this class using CAVE and the IDV, which are particularly well-suited to incoming freshmen. The proposed hardware for the WAV Lab would be invaluable to this course, as it reinforces the idea that students are in a laboratory setting analyzing data, and not merely surfing the Web looking at pictures. Although Web access of rasterized images is convenient and expedient, students do not manipulate data in the process, which sets low expectations on them as students and scientists at the outset of their academic careers.

Radar Meteorology (Junior/Senior level)

MATLAB and the IDV allow students to view radar data in its natural orientation giving them a better understanding of where the atmosphere is sampled by the radar relative to the surface. It will also allow them to explore the how the radar observations are related to other meteorological fields produced by model. For example, Doppler velocity fields can be compared to model winds to illustrate differences in sampling and structure scale.

We believe it is critical that students learn how to use modern “tools of the trade” in meteorology, both the hardware and software that they may end up using in many aspects of the profession. This is where the requested EDEX server becomes especially valuable, as **students will have sustained access to CAVE and IDV.**

Contributions to Research

The WAV Lab has a long history of supporting faculty and student research. Both archived datasets and the real-time data provided by UNIDATA have been critical to research efforts in our program for at least the last 25 years.

All of our faculty (N=5) use the WAV Lab to some degree to support their research. We will also have two new professors starting in Fall 2023, bringing our total cohort to seven (7). These new faculty have Linux experience, and an interest in using the WAV Lab once they arrive.

One recent highlight is a local build of the WRF Model that originated from the graduate course, Atmospheric Simulations. This WRF model instance was done at the request of the Missouri Water Center to support real-time surface hydrology /flood forecasting research.

Resources Requested

We intend to acquire two (2) machines meeting the following specifications:

- DELL PowerEdge R650A with
- 64GB RAM,
- Intel Xeon Gold 6336Y 2.4G, 24C/48T, 11.2GT/s, 36M Cache, Turbo,HT (185W) DDR4-3200, and
- 3 x 3.84TB SSD SAS ISE Read Intensive 12Gbps 512 2.5in Hot-plug AG Drive, 1 DWP

These machines are similar to, but much faster and more modern than our existing equipment.

Information Technology Support Available

Computing in the School of Natural Resources (SNR) is mostly Windows-based, and the WAV Lab is the largest single Linux footprint in SNR. We have strong IT support, who recognizes the utility of Linux, even though he cannot support it. However, after 20+ years of struggling to identify reliable Unix/Linux support at MU, in the last 3-4 years the University has *finally* recognized the value of such support. Matt Stanley is our IT Pro dedicated to Linux support, and he has been phenomenal.

Although Linux is a small percentage of computing in SNR, it is making a resurgence across our campus due in part to Matt Stanley’s influence. It was through discussions with him that we identified the looming need for replacements to our EDEX and LDM servers.

Benefits for Education or Research

The requested resources will benefit students, educators, and researchers in your organization by allowing continued access to the high quality software and data streams provided by UNIDATA. Our students graduate, prepared well for both the workforce as well as for graduate education. Our faculty can continue to do meaningful scientific work at a minimal cost, even though they may be on sabbatical or between grants.

Potential Community Benefit

The University of Missouri has been involved with UNIDATA since the early 1990s, and is also a UCAR member. The LDM and EDEX servers will also allow us to participate in data exchange with other UNIDATA member institutions. Through this process, we can also relate our experiences using UNIDATA products in the classroom with our fellow institutions and UNIDATA. Our program will continue to support UNIDATA's efforts in whatever capacity is available to us.

With respect to the language in the RFP, our School has made improvements in the enrollment of under-represented minority students. Owing to the COVID pandemic, our population of under-represented minority students at the undergraduate level has been static at ~13%. However, our graduate percentage is up steadily from 8.7% in 2019 to 10.8% in 2020, and 12.2% in 2021, the latest year for which data are available.

Budget

A breakdown of the actual computer equipment and peripherals follows and includes a discount available to our educational institution:

| | | |
|----------|---|---------------------|
| 2 | DELL PowerEdge R650A with 64GB RAM, Intel Xeon Gold 6336Y 2.4G, 24C/48T, 11.2GT/s, 36M Cache, Turbo,HT (185W) DDR4-3200, and 3 x 3.84TB SSD SAS ISE Read Intensive 12Gbps 512 2.5in Hot-plug AG Drive, 1 DWP | \$11,496.54 |
| | Total Direct Costs | \$22,993.08 |
| | Cost shared by MU | -\$ 2,993.08 |
| | Indirect Costs (56.5% of modified total) | \$ 0.00 |
| | Total Requested | \$20,000.00 |

Indirect cost for on-campus research is 56.5% of the modified total direct costs. However, any unit item over \$5,000.00 may be considered equipment, and not subject to indirect cost charge. Consequently, no indirect may be charged. Prof. Aldrich and Dr. Market will provide oversight of the upgraded facilities.

We believe that the requested computer hardware are justified for a program of our size, and that the proposed additions would represent a major upgrade to our present networked system. The machine upgrades will allow our aging machines to retire; we may thus keep pace with other institutions in making curricula and research opportunities available to our students.

Project Milestones

Mid-2023 - Equipment from these funds will be purchased and deployed immediately.

Fall 2023 - We anticipate these upgrades to be complete within 3-4 months of funds receipt.

Equipment Quotes

PDF of Dell quote is provided.



A quote for your consideration

Based on your business needs, we put the following quote together to help with your purchase decision. Below is a detailed summary of the quote we've created to help you with your purchase decision.

To proceed with this quote, you may respond to this email, order online through your [Premier page](#), or, if you do not have Premier, use this [Quote to Order](#).

| | | | |
|----------------------|------------------------------|-------------------|--------------------------------|
| Quote No. | 3000143292896.1 | Sales Rep | Amy Thole |
| Total | \$11,496.54 | Phone | (800) 456-3355, 80000 |
| Customer # | 145585306 | Email | Amy.Thole@Dell.com |
| Quoted On | Feb. 03, 2023 | Billing To | ACCOUNTING SERVICES |
| Expires by | Feb. 25, 2023 | | UNIV OF MISSOURI @ COLUMBIA |
| Contract Name | Enterprise Servers - Q043003 | | 801 CONLEY AVE, JESSE-RM 00325 |
| Contract Code | C000000008765 | | COLUMBIA, MO 65211 |
| Customer Agreement # | Q043003 | | |
| Solution ID | 17284347.1 | | |
| Deal ID | 24370575 | | |

Message from your Sales Rep

Please contact your Dell sales representative if you have any questions or when you are ready to place an order. Thank you for shopping with Dell!

Regards,
Amy Thole

Shipping Group

| | |
|---|-----------------------------|
| Shipping To | Shipping Method |
| ROBB LAMMERS UNIV OF MISSOURI @ COLUMBIA 1400 ROCK QUARRY RD ROCK QUARRY CTR-RM Q012/DIV OF COLUMBIA, MO 65211 (573) 882-9293 | Standard Delivery Free Cost |

| Product | Unit Price | Quantity | Subtotal |
|---------------------------------------|-------------|----------|-------------|
| PowerEdge R650 - Equote 3000143143070 | \$11,496.54 | 1 | \$11,496.54 |

| | |
|----------------------------|--------------------|
| Subtotal: | \$11,496.54 |
| Shipping: | \$0.00 |
| Environmental Fee: | \$0.00 |
| Non-Taxable Amount: | \$11,496.54 |
| Taxable Amount: | \$0.00 |
| Estimated Tax: | \$0.00 |
| <hr/> | |
| Total: | \$11,496.54 |

Shipping Group Details

Shipping To

ROBB LAMMERS
UNIV OF MISSOURI @ COLUMBIA
1400 ROCK QUARRY RD
ROCK QUARRY CTR-RM Q012/DIV
OF
COLUMBIA, MO 65211
(573) 882-9293

Shipping Method

Standard Delivery Free Cost

| | Quantity | Subtotal |
|--|----------|--------------------|
| PowerEdge R650 - Equote 3000143143070 | 1 | \$11,496.54 |

Estimated delivery if purchased today:

Feb. 22, 2023

Contract # C000000008765

Customer Agreement # Q043003

| Description | SKU | Unit Price | Quantity | Subtotal |
|--|----------|------------|----------|----------|
| PowerEdge R650 Server | 210-AYJZ | - | 1 | - |
| 8x2.5 Front Storage | 379-BEIC | - | 1 | - |
| SAS/SATA Backplane | 379-BDSS | - | 1 | - |
| No Rear Storage | 379-BDTE | - | 1 | - |
| Trusted Platform Module 2.0 V3 | 461-AAIG | - | 1 | - |
| 2.5" Chassis with up to 8 Hard Drives (SAS/SATA), 3 PCIe Slots, 2 CPU | 321-BGHH | - | 1 | - |
| Intel Xeon Gold 6336Y 2.4G, 24C/48T, 11.2GT/s, 36M Cache, Turbo, HT (185W) DDR4-3200 | 338-CBXH | - | 1 | - |
| Intel Xeon Gold 6336Y 2.4G, 24C/48T, 11.2GT/s, 36M Cache, Turbo, HT (185W) DDR4-3200 | 338-CBXH | - | 1 | - |
| Additional Processor Selected | 379-BDCO | - | 1 | - |
| Heatsink for 2 CPU configuration (CPU more than 165W) | 412-AAVM | - | 1 | - |
| Performance Optimized | 370-AAIP | - | 1 | - |
| 3200MT/s RDIMMs | 370-AEVR | - | 1 | - |
| RAID 5 | 780-BCDP | - | 1 | - |
| PERC H745 Controller, Front | 405-AAUZ | - | 1 | - |
| Front PERC Mechanical Parts, front load | 750-ACFR | - | 1 | - |
| Performance BIOS Settings | 384-BBBL | - | 1 | - |
| UEFI BIOS Boot Mode with GPT Partition | 800-BBDM | - | 1 | - |
| 4 High Performance Fans for 2 CPU | 750-ADIH | - | 1 | - |
| Dual, Hot-Plug, Power Supply Redundant (1+1), 1100W MM Titanium | 450-AKLF | - | 1 | - |
| Riser Config 0, 2CPU, Half Length, Low Profile, 3 x16 Slots, SW GPU Capable | 330-BBRP | - | 1 | - |
| PowerEdge R650 Motherboard with Broadcom 5720 Dual Port 1Gb On-Board LOM | 329-BFGW | - | 1 | - |
| iDRAC9, Enterprise 15G | 385-BBQV | - | 1 | - |
| Broadcom 57414 Dual Port 10/25GbE SFP28, OCP NIC 3.0 | 540-BCOC | - | 1 | - |
| Standard Bezel | 325-BCHH | - | 1 | - |
| Luggage Tray x8 and x10 Chassis, R650 | 350-BCEI | - | 1 | - |
| BOSS Blank | 403-BCID | - | 1 | - |

| | | | | |
|---|----------|---|---|---|
| No Quick Sync | 350-BBXM | - | 1 | - |
| iDRAC,Factory Generated Password | 379-BCSF | - | 1 | - |
| iDRAC Group Manager, Disabled | 379-BCQY | - | 1 | - |
| No Operating System | 611-BBBF | - | 1 | - |
| No Media Required | 605-BBFN | - | 1 | - |
| ReadyRails Sliding Rails Without Cable Management Arm or Strain Relief Bar | 770-BECD | - | 1 | - |
| No Systems Documentation, No OpenManage DVD Kit | 631-AACK | - | 1 | - |
| PowerEdge R650 Shipping | 340-CUQR | - | 1 | - |
| R650 Ship 8x2.5 | 340-CUQO | - | 1 | - |
| R650 Dell/EMC label (BIS) for 2.5" Chassis | 343-BBQY | - | 1 | - |
| PowerEdge R650 CCC Marking, No CE Marking | 389-DYHX | - | 1 | - |
| Custom Configuration | 817-BBBB | - | 1 | - |
| Basic Hardware Services Business Hours 5x10 Next Business Day Onsite Hardware Warranty Repair 5 Years | 853-2130 | - | 1 | - |
| Dell Hardware Limited Warranty Plus Onsite Service | 853-2137 | - | 1 | - |
| On-Site Installation Declined | 900-9997 | - | 1 | - |
| 8GB RDIMM, 3200MT/s, Single Rank | 370-AEVO | - | 8 | - |
| 3.84TB SSD SAS ISE Read Intensive 12Gbps 512 2.5in Hot-plug AG Drive, 1 DWPD | 400-AXPE | - | 3 | - |
| C13 to C14, PDU Style, 12 AMP, 6.5 Feet (2m) Power Cord, North America | 492-BBDI | - | 2 | - |

| | |
|---------------------------|--------------------|
| Subtotal: | \$11,496.54 |
| Shipping: | \$0.00 |
| Environmental Fee: | \$0.00 |
| Estimated Tax: | \$0.00 |
| Total: | \$11,496.54 |