

SJSU Unidata Revised Equipment Proposal, ~~March~~ May 2018

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B. Project Summary

This revised proposal targets an upgrade to a key component of our computing infrastructure in the Department of Meteorology and Climate Science at SJSU. Our Unidata grant in 2011 allowed us to purchase a high-end server (“*titan*”) to ingest, store, process and forward data from the Unidata stream. This server is our LDM server, so its well-being is critical. The data ingested are used: (a) in research applications by both faculty and students (undergraduate and graduate); (b) in classes, including some newly-developed data-intensive classes; and (c) to populate our program’s weather website. The current proposal seeks funds to upgrade our LDM server capabilities from 2011 technology to 2018 technology and capabilities.

C. Project Description

SJSU has been an active participant in the Unidata community for well over a decade, and we hosted a west coast Unidata Workshop in 2013¹. Our computing facilities are aging, and resources to replace them are very limited.

Upgraded data server

Our server *titan* ingests data from the Unidata stream, stores and then processes the data both to forward on to users beyond SJSU, and to display on the department weather page². The server is now seven years old, and was purchased in order to combine multiple data processing functions onto a single server, as well as manage expected growth over the following five years. The incoming data stream continues to expand beyond what *titan* can manage. For example, since *titan* was first installed, GFS model resolution has shrunk to c. 13km in the horizontal, resulting in substantially larger 3D data arrays. Starting in 2016, hourly data was distributed (for example, hourly total rainfall, updating the older 3-hourly total rainfall), and new output fields are being added. Data from new models is also streamed out (e.g., HRRR). Recently, GOES-16/east has become operational, with another large data stream of very high-resolution and high-frequency data. GOES-17 has now been launched, so we can soon expect a doubling of this new satellite data coming in.

As a result of this rapid growth in data flowing into the LDM, our server *titan* is now unable to fully process this large volume in a timely manner. This results in blank web pages because the processors have not had time to create a field by the time the field is being pulled for display to our web site. Further growth in data output over the next five

¹ https://www.unidata.ucar.edu/blogs/news/entry/unidata_regional_workshop_at_san

² http://www.sjsu.edu/meteorology/weather_climate/weather_center/index.html

years will exacerbate this problem. We desire therefore to upgrade *titan* with a new multi-core server in order to keep pace with the data stream, as well as software advances expected over the next five years. In fact, we plan to split operations into two parts over two servers: one will store and process only GOES-16,17 data; the other will handle everything else. We anticipate a significant expansion in our use and manipulation of this new satellite data – hence the desire to separate out this function in order to keep all operations running over the five-year period of expected server “life”.

Impacts

- 1) As mentioned above, an area in which the current server is *clearly* failing us is in getting products to our weather web page in a timely manner. We continue to have a significant number of professional users of our web products throughout California and the west, so “gaps” in our pages are a concern to us.
- 2) We have a long-standing tradition of being a strong forecasting program. In our undergraduate program, students take an Analysis and Forecasting class (METR 171A), a Mesoscale class (METR 172), and various elective classes in which Unidata products are used. Seniors conduct a senior thesis research project, and students typically choose thesis topics such as case studies or statistical comparisons which require data ingested via Unidata. Prior to their senior year, students also take two one-unit Analysis and Forecasting classes (170A,B), and all students (including graduates) are invited to participate in The Weather Challenge forecast contest, for which our data ingest/processing/display capabilities are key.
- 3) We recently added a new senior-level required class (METR 150) in which students learn to apply modern computing methods to process and display large datasets. Students learn to use different data display packages (IDV, GRADs, Python scripts etc.) as applied to large datasets including model output, both at fine scale and for climate studies.

Responses to Unidata proposal criteria

The upgrades requested in this proposal will allow us to improve our abilities in all fields mentioned in the call for proposals. Specifically:

- 1) “**Data-proximate analysis of large remote datasets**” will be enhanced via the proposed upgrades, along with the development of our new class(es) designed to teach students how to manage and analyze such large datasets. This will become more true as GOES-17 comes online, providing a wealth of new data for the west coast.
- 2) “**Machine learning techniques and data analytics**” A new server that has more compute capability, greater memory, and more storage provides the opportunity for the department to develop new algorithms, specifically in the area of machine learning. For example, with the launch and deployment of the GOES-17 satellite, the amount of data available for forecasting and analysis of weather systems along the west coast will be greater than ever before. The capability to ingest that data, develop algorithms using it, would allow the department to address forecasting issues that continue to trouble California and the entire the west coast.

- One example is forecasting fog for the three Bay Area airports – in particular SFO. Past attempts to do this involving SJSU faculty have included statistical methods based on available observations, such as dew point depression at surface stations, differences in dew point depressions between the surface and a higher level (e.g. 850 hPa) from the 12 UTC sounding at OAK, and conditional probability methods. Other attempts have included multiple WRF simulations with different boundary layer and microphysics schemes. However, lack of quality data to initialize WRF produces significant errors [O(1 hour)] in the predicted timing of fog dissipation at SFO. The data from GOES-17 together with WRF simulations would allow the department to take a new approach, i.e. developing machine-learning algorithms. The simplest and first approach would be multiple linear-regression, where the regression coefficients would adjust based on the surface observations of fog at SFO.
 - Succeeding algorithms might address rain shadows and other precipitation processes in the complex terrain of the west coast that affect the important hydrology of the region. We expect these could make use of our new radar data.
- 3) “**...provides student access to and use of GOES-R series satellite data**”. The two new servers will maintain our ability to download and store new large datasets from both GOES, and the enhanced student computing lab will allow students to work with that data (not just view it, but examine and analyze it).
- 4) “**...operational use of ensemble models**”. We have several ongoing projects in which models such as WRF are being run in ensemble mode. WRF output files are large, and thus an ensemble approach requires significant compute power, both for running code, but also for storage that allows fast access for comparing multiple runs. The new servers will give us these capabilities.

a) **Summary of benefits**

SJSU is a non-R1 institution (we offer the BS and MS), and yet we function as an R1 institution in our research work³. We have two NSF Career Fellows on the faculty (seven faculty total), and in the last five years, multiple faculty have won awards of over \$1m to support their work. Our students graduate and go on to a variety of futures, including the NWS, the private sector, and graduate school (here and nationwide). Funding this project will go a long way to maintaining our ability to offer students cutting-edge classes (e.g., GOES data analysis), and will also support our strong research program which impacts undergraduate and graduate students, as well as faculty as they conduct data-intensive research projects.

D. Revised Budget

Our revised equipment proposal targets our need for a new LDM server and a “GOES server” as follows:

³ An external reviewer emphasized this point earlier this year.

Replacing our existing LDM server *titan* with two new LDM servers, one dedicated to the GOES data stream, the other to replace the current 2011 server (e.g., all model data for online weather display etc.) The proposed new servers will be a high-end multi-core machines with large storage capacity and high RAM. The quote attached is for a suitably configured Dell PowerEdge R640 (apologies for the format on page 1 – something got lost in transmission).

The equipment breakdown and costs are tabulated below, and **PLEASE NOTE THE FOLLOWING:**

Overhead is charged on items under \$5K. Since each server is quoted at about \$5500, we do not include overhead as part of this revised budget.

Note also that the Department of Meteorology & Climate Science will cover all costs over the \$10K maximum indicated by Unidata.

ITEM/SPECS	ITEM COST	LINE ITEM COST	TOTAL COST
Data servers			
Dell PowerRack P640. Full specs are on the attached quote from Dell. Both will act as LDM servers: one dedicated to new GOES data ingest, storage and processing (16 and 17); the second to ingest, store and process all non-GOES data (example: processing GFS data to go on our web site).	\$5,501.79 copy of quote attached	\$11,003.58	\$11,003.58
Data server total cost			\$11,003.58
Total requested			\$11,003.58
Tax (currently 9.25%)			\$1,017.83
Shipping charges Free shipping from Dell to educational sites	\$0.	\$0.	\$0.
Grand total			\$12,021.41

Cost Sharing: The Department of Meteorology and Climate Science will provide any necessary funding for the installation of hardware and software (none anticipated). In addition, the Department will cover costs over \$10K, as stated above (expected cost share around \$2K).

E. Project Milestones

Assuming funding awarded on June 15, 2018:

- a) June 15 – July 1: request revised quotes to allow for cost changes and hardware improvements between the dates of proposal submission and award; order servers. Current quote is attached.
- b) July 1 – August 15: install new servers in parallel with current server; install and test data access, processing and display software (IDD, IDV, GEMPACK, THREDDS, RAMADDA) and configure the new server to replicate the current functions of the old server. The College IT team has recently reconfigured many of our servers, so we anticipate that this can be done in a straightforward manner. There will be a testing period with the new and old servers side-by-side to ensure everything is working OK. The precise timing will depend on the workload of the College server team.
- c) Ideally, everything is installed and up and running in time for the new semester in late August 2018!

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[B417-A2F31B42EAF4&portid=88B394DE-1D38-42BB-8901-89FE759FA0FC&nareferer=%27+escape%28document.location%29](http://channels.us.dell.com/netagent/cimlogin.aspx?questid=049FD634-AFAA-423A-B417-A2F31B42EAF4&portid=88B394DE-1D38-42BB-8901-89FE759FA0FC&nareferer=%27+escape%28document.location%29))

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PowerEdge R640 Rack Server Summary

Dell Price \$5,501.79

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Option	Selection	SKU / Product Code	Quantity
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Option	Selection	SKU / Product Code	Quantity			
PowerEdge R640 Server	[210-AKWU] / R640	1	Base	PowerEdge R640 Server	[210-AKWU] / R640	1
No Trusted Platform Module	[461-AADZ] / NTPM	1	Trusted Platform Module	No Trusted Platform Module	[461-AADZ] / NTPM	1
3.5" Chassis with up to 4 Hard Drives and 3PCIe slots	[321-BCQF] / 5101045	1	Chassis	3.5" Chassis with up to 4 Hard Drives and 3PCIe slots	[321-BCQF] / 5101045	1
Intel® Xeon® Silver 4112 2.6G, 4C/8T, 9.6GT/s, 8.25M Cache, Turbo, HT (85W) DDR4-2400	[338-BLUR] / 5103400	1	Processor	Intel® Xeon® Silver 4112 2.6G, 4C/8T, 9.6GT/s, 8.25M Cache, Turbo, HT (85W) DDR4-2400	[338-BLUR] / 5103400	1
Intel® Xeon® Silver 4112 2.6G, 4C/8T, 9.6GT/s, 8.25M Cache, Turbo, HT (85W) DDR4-2400	[374-BBPO] / 5103401	1	Additional Processor	Intel® Xeon® Silver 4112 2.6G, 4C/8T, 9.6GT/s, 8.25M Cache, Turbo, HT (85W) DDR4-2400	[374-BBPO] / 5103401	1
Standard Heatsink for 2 CPU	[370-ABWE] [412-AAIQ] / 5099793	1	Processor Thermal Configuration	Standard Heatsink for 2 CPU	[370-ABWE] [412-AAIQ] / 5099793	1
2666MT/s RDIMMs	[370-ADNU] / 5099278	1	Memory DIMM Type and Speed	2666MT/s RDIMMs	[370-ADNU] / 5099278	1
Performance Optimized	[370-AAIP] / PEOPT	1	Memory Configuration Type	Performance Optimized	[370-AAIP] / PEOPT	1

Option	Selection	SKU / Product Code	Quantity			
16GB RDIMM, 2666MT/s, Dual Rank	[370-ADND] / 5098888	2	Memory ⁱ	16GB RDIMM, 2666MT/s, Dual Rank	[370-ADND] / 5098888	2
C7, Unconfigured RAID for HDDs or SSDs (Mixed Drive Types Allowed)	[780-BCDS] / 5098876	1	RAID	C7, Unconfigured RAID for HDDs or SSDs (Mixed Drive Types Allowed)	[780-BCDS] / 5098876	1
PERC H740P RAID Controller, 8GB NV Cache, Minicard	[405-AAMS] / 5099405	1	RAID/Internal Storage Controllers	PERC H740P RAID Controller, 8GB NV Cache, Minicard	[405-AAMS] / 5099405	1
120GB SSD SATA Boot 6Gbps 512n 2.5in Hot-plug Drive,3.5in HYB CARR, 1 DWPD, 219 TBW	[400-ASEH] / 5103626	2	Hard Drive	120GB SSD SATA Boot 6Gbps 512n 2.5in Hot-plug Drive,3.5in HYB CARR, 1 DWPD, 219 TBW	[400-ASEH] / 5103626	2
4TB 7.2K RPM SATA 6Gbps 512n 3.5in Hot-plug Hard Drive	[400-ASIE] / 5104008	2	Hard Drive	4TB 7.2K RPM SATA 6Gbps 512n 3.5in Hot-plug Hard Drive	[400-ASIE] / 5104008	2
None		1	Boot Optimized Storage Cards	None		1
No Operating System	[619-ABVR] / NOOS	1	Operating System	No Operating System	[619-ABVR] / NOOS	1
No Media Required	[421-5736] / NOMED	1	OS Media Kits	No Media Required	[421-5736] / NOMED	1

Option	Selection	SKU / Product Code	Quantity			
iDRAC9, Express	[385-BBKS] / 5099557	1	Embedded Systems Management	iDRAC9, Express	[385-BBKS] / 5099557	1
iDRAC Group Manager, Disabled	[379-BCQY] / 5100926	1	Group Manager	iDRAC Group Manager, Disabled	[379-BCQY] / 5100926	1
iDRAC,Factory Generated Password	[379-BCSF] / 5101343	1	Password	iDRAC,Factory Generated Password	[379-BCSF] / 5101343	1
Riser Config 4, 2x16 LP	[330-BBGY] / 5101341	1	PCIe Riser	Riser Config 4, 2x16 LP	[330-BBGY] / 5101341	1
Broadcom 57416 2 Port 10Gb Base-T + 5720 2 Port 1Gb Base-T, rNDC	[540-BBUK] / 5100009	1	Network Daughter Card	Broadcom 57416 2 Port 10Gb Base-T + 5720 2 Port 1Gb Base-T, rNDC	[540-BBUK] / 5100009	1
None		1	IDSDM and VFlash Card Reader	None		1
None		1	Internal SD Module	None		1
No Internal Optical Drive	[429-ABBF] / 5101077	1	Internal Optical Drive	No Internal Optical Drive	[429-ABBF] / 5101077	1
8 Standard Fans for R640	[384-BBQJ] / 5101073	1	Fans	8 Standard Fans for R640	[384-BBQJ] / 5101073	1
Single, Hot-plug Power Supply (1+0), 495W	[450-ADWP] / 495NR	1	Power Supply	Single, Hot-plug Power Supply (1+0), 495W	[450-ADWP] / 495NR	1

Option	Selection	SKU / Product Code	Quantity				
NEMA 5-15P to C13 Wall Plug, 125 Volt, 15 AMP, 10 Feet (3m), Power Cord, North America	[450-AALV] / 125V10	1	Power Cords	NEMA 5-15P to C13 Wall Plug, 125 Volt, 15 AMP, 10 Feet (3m), Power Cord, North America	[450-AALV] / 125V10	1	
No Bezel for x4 and x8 chassis	[350-BBBW] / [350-BBJS] / 5101328	1	Bezel	No Bezel for x4 and x8 chassis	[350-BBBW] / [350-BBJS] / 5101328	1	
No Quick Sync	[350-BBKB] / 5101881	1	Quick Sync 2 (Wireless At-the-box mgmt)	No Quick Sync	[350-BBKB] / 5101881	1	
Performance BIOS Setting	[384-BBBL] / HPBIOS	1	BIOS and Advanced System Configuration Settings	Performance BIOS Setting	[384-BBBL] / HPBIOS	1	
UEFI BIOS Boot Mode with GPT Partition	[800-BBDM] / UEFIB	1	Advanced System Configurations	UEFI BIOS Boot Mode with GPT Partition	[800-BBDM] / UEFIB	1	
No Rack Rails or Cable Management Arm	[770-BBHJ] / NORAIL	1	Rack Rails	No Rack Rails or Cable Management Arm	[770-BBHJ] / NORAIL	1	
No Systems Documentation, No OpenManage DVD Kit	[631-AACK] / NODOCS	1	System Documentation	No Systems Documentation, No OpenManage DVD Kit	[631-AACK] / NODOCS	1	
None		1	Enabled Virtualization	None		1	

Option	Selection	SKU / Product Code	Quantity
None		1	Microsoft SQL Server
None		1	ProSupport for Microsoft Applications
None		1	Additional Software

Support & Services

Option	Selection	SKU / Product Code	Quantity
3 Years Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite	[813-9254][813-9255] / NBD3	1	Warranty ⁱ 3 Years Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite
No Installation	[900-9997] / NOINSTL	1	Deployment Services No Installation
None		1	Keep Your Hard Drive
Declined Remote Consulting Service	[973-2426] / NORCS	1	Remote Consulting Services Declined Remote Consulting Service

Option	Selection	SKU / Product Code	Quantity
None		1	iDRAC Service Module None 1

Software & Accessories

Option	Selection	SKU / Product Code	Quantity
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Also included in this system

The following options and default selections are included with your order.

Additional Summary Information

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Lower TCO: TCO calculated over 5 years and applies to specific workloads. Source: "Cloud Comparison: Microsoft Private Cloud on the Intel-

Powered Dell Solution vs. a Leading Public Cloud Provider," a Principled Technologies Report commissioned by Dell, August 2014. Actual results will vary.

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