Proposal Title: Building a Real-Time Running Archive EDEX Server for Meteorology Instruction

Date: Updated on 4/20/2020 (originally submitted on 3/20/2020)
Total Unidata Equipment Request: $13,645.77

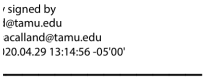
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Signature of PI

Co-Investigators: Don Conlee and Gyorgyi Gyarmati

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Signature of University Official



Project Summary

University education in meteorology requires real-time model and observational data access which is currently available through the Unidata EDEX cloud server and widespread internet availability. However, the time scale of education is often over the course of a week or more as students are assigned forecasts and case studies and complete the assignments before the next week's lab meeting, requiring a short-term archive of several days worth of data. While TAMU has experience with this sort of 10-day rolling archive in our existing LDM and implementations of older Unidata tools, the current Unidata EDEX cloud server is insufficient for our full educational needs to allow for widespread educational use of Unidata AWIPS-2. **Thus, we propose to build an EDEX server at TAMU that mirrors the Unidata EDEX cloud server, but provides a 10-day rolling real-time archive of model and observational data similar to our existing LDM, but providing this educational capacity to our department computer labs' implementation of Unidata AWIPS-2.** Additional goals include adding new model and observational data types, development of AWIPS-2 "bundles," adding capability for long-term (> 10 day) access to specific case studies, and sharing access to our EDEX server with other universities as described below. These goals will require purchase of three data servers. One large server is requested from Unidata via this proposal ($13,645.77) and the other two smaller servers will be cost-shared via a department purchase ($8217.10). Additionally, our department is committed to long-term personnel, maintenance, and technical support for the requested equipment and existing/new laboratory computers.

Project Description

Motivation

The Department of Atmospheric Sciences at Texas A&M was a Unidata founding member, and is one of the oldest and largest public Meteorology programs in the country. We have a rich tradition of supporting both advanced meteorological research and operational meteorology education and training. Although web-available, pre-built meteorological content has advanced due to the efforts of many parties in academia, government, and private industry, our educational philosophy is that the use of real, user-customizable tools provides the best preparation for operational careers and further study. Our two large teaching laboratories, each with 25 workstations, are maintained to support virtually all Unidata visualization tools. The adoption of Unidata AWIPS-2 is the natural progression as our primary laboratory tool, and the fact that it will continue to be the mainstay of the National Weather Service is a strong advantage for students who master it.

AWIPS has now become the leading tool for real-time operational labs in our capstone senior Practical Weather Forecasting class, thanks to the provision of the EDEX cloud server by Unidata. However, for other usage in this class such as for COMET module applications and verifications, and for our Severe Weather and Mesoscale Forecasting laboratory sessions, we continue to rely on older Unidata tools (GARP, NMAP2, NSHARP) which are served by our 10 day rolling LDM. This allows recent cases (within 10 days) to be researched and/or verified for

with student access to our computer labs and this data over the typical weekly period of lab assignments.

Project Goals

Our primary project goals are as follows:

1) Set up an EDEX environment which provides for approximately 10 days of model runs, observational data, radar, and satellite to support our teaching activities.
2) Add new model data (such as a second Global model, wave model, and additional Convection Allowing Models (CAMs)) which are not currently supported by the Unidata EDEX Cloud.
3) Add capability for long-term archiving of particularly instructive cases for future educational and research use.

These goals will be achieved through purchase and configuration of equipment described below, which was determined based on close consultation and advice from Unidata staff. While our initial goal is to implement this for use in our own laboratories, we will seek to expand use for offsite (student use at home, and access to other universities as is feasible).

Equipment Requested

The equipment we plan to purchase and configure is based on Unidata's recommendation. To be able to serve the amount of data to about 50 CAVE clients simultaneously and have a 10-day long running archive of data to be available, Unidata experts suggested to setup three servers: One main EDEX server with 44 effective cores (1 22-core, dual-threaded CPU), 128GB of RAM, 2TB of solid state drive, and 20TB of spinning hard disk. Another ancillary machine to serve radar data only with 12 cores and 32GB of RAM, 1TB of solid state drive and 1TB of spinning disk. A third ancillary machine for model and other miscellaneous data that has 24 cores, 32GB RAM, 1TB of solid state drive, and 1TB of spinning hard disk. We have obtained quotes for all three machines from Dell (see attached). Based on their quotes, we request funding for the large main server from this grant, and our department has agreed to purchase the two smaller servers (see budget section).

Relationship to Existing Facilities and Resources

Our department is equipped with two computer laboratories set up with 25 Apple iMacs each. We have tested the CAVE client on them and it works well in one lab on the newer iMacs, and works with some limitations in the older lab. The CAVE clients currently connect to a Unidata-operated Cloud EDEX server (edex-cloud.unidata.ucar.edu).

The Department of Atmospheric Sciences is already working on replacing the older lab with 25 new Linux PCs in the summer. In the planned Linux lab, students will have access to newer, faster machines, and access to features of CAVE that are not available in the Mac version. The College of Geosciences IT department is in the process of setting up a PC with the same specifications and software as the future lab machines will have in order to test the configuration.

The department will provide salary support to a staff member, Gyorgyi Gyarmati, to maintain the new EDEX server. She is already in charge of the department's LDM servers, and certain software in the teaching labs including CAVE. Thus, Gyorgyi has developed extensive experience working with the required software and datasets to meet our project goals. As such, she will be the main IT personnel in charge of implementing this system, and the department has committed to supporting her time in this effort. The department also committed to cover the cost of hosting the purchased servers at the University's West Campus Data Center. This data center houses the majority of our department servers. It is a relatively new, secure facility with redundant power and networking with high-speed connections to our building and department teaching labs. (https://it.tamu.edu/services/data-center-and-hardware/data-centers/campus-data-centers/).

Benefits to Research, Education, and the Unidata Community

The Texas A&M Department of Atmospheric Sciences has one of the largest undergraduate programs in Meteorology in the nation. Our students go on to an array of careers in public and private-sector weather forecasting, broadcast meteorology, air-quality, weather risk management, and research. Our typical undergraduate enrollment is ~150 students, with at least half enrolled in courses that make use of real-time weather data during any particular semester. Our two primary courses that will benefit from this project are Practical Weather Forecasting as well as Severe Weather and Mesoscale Forecasting. In particular, PI-Nowotarski has relied on GARP rather than transitioning to AWIPS-2, largely because of the lack of a long-term archive. To give students enough time to complete laboratory assignments, they need access to model data this is often several days old which is only currently feasible with our 10-day LDM configuration in GARP. This project will allow for transition of that and other classes' curricula to include AWIPS-2. We anticipate that other classes relying on real-time data (including Weather Observation and Analysis, Radar Meteorology, Satellite Meteorology and Remote Sensing) will also benefit greatly from the implementation of the proposed EDEX server. The longer-term data availability provided by this project will also enable greater in-house development of AWIPS-2 bundles, which will allow for 1) greater student learning and training on the full range of AWIPS-2 features, 2) development of new curriculum, and 3) easier use in lower-level classes.

While the main goal of this project is for improvements to our undergraduate education, there are likely to be secondary research benefits. As an example of the potential benefit to research, an active collaborative NOAA CSTAR project between PI Nowotarski, the Storm Prediction Center, and local NWS offices seeks to improve forecasting of tropical cyclone tornadoes. Understanding the real-time products available in forecast offices via AWIPS-2 is crucial to that project's goals, and our proposed EDEX server will allow for researchers here to experience a similar data stream for future tropical cyclones.

Apart from our own teaching and research benefits, this project will develop a capability that currently does not exist for any university with similar goals. While we necessarily develop and test our implementation for in-house use first, we plan to expand access to our EDEX server to

other universities (on a limited basis as capability allows). Moreover, our project will also serve as an example for other universities within the Unidata Community, which (based on personal communication) are sorely underutilizing unidata software in the classroom. Finally, AWIPS-2 bundles that we develop as part of our own teaching will be shared with interested parties across the Unidata Community.

Budget

Our total budget request for equipment from Unidata is **$13,645.77** for the large server described above based on a quote from Dell. As this is a capital equipment expense there are no indirect costs associated with this purchase.

Requested Item	*Cost*
Dell PowerEdge R740xd, 44-core Xeon Gold 6152 2.1 GHz	$13,645.77

Cost Sharing

The Texas A&M University Department of Atmospheric Sciences will provide support for data center rack space (~$425 per year), IT personnel, and PI time (0.25 month effort for each C. Nowotarski and D. Conlee with 1 month for G. Gyarmati; total value of cost shared personnel time is $14,682). Dedicated technical support for the installation, configuration, deployment, and continued maintenance and development of the EDEX server will also be provided by TAMU. TAMU also commits to purchasing two smaller servers suggested by Unidata staff and described above based on quotes from Dell, representing an equipment cost-share of $8217.10.

TAMU-purchased Items	*Cost*
Dell PowerEdge R640, 12-core Xeon Silver 4214 2.2 GHz	$3761.28
Dell PowerEdge R640, 24-core Xeon Silver 4214 2.2 GHz	$4455.82

Including overhead, this represents a cost share totaling $34,986 by Texas A&M. This cost sharing will join our previous recapitalization of one of our labs to be ready for AWIPS approximately 4 years ago, and the replacement of all older iMacs in our other major lab this FY with AWIPS-capable LINUX machines. Together, these expenditures represent a significant TAMU investment to running Unidata AWIPS-2 as our primary lab meteorological tool.

Project Milestones

May/June 2020: Bidding process and order equipment
July 2020: Expected delivery and hardware set up
Early August 2020: Target date of implementation of archive and servers
Late August 2020: Targeted first educational use

The target date of first educational use would be the beginning of the 2020-2021 fall semester, August 24th, but not later than the start of following spring semester.

Spring 2021: Continued use and refinement of EDEX server at Texas A&M in Practical Weather Forecasting class and Severe Weather and Mesoscale Forecasting, including bundle development. Limited experimentation with providing access to outside universities.
May 2021: Completion of required project report/article
Late 2021 and Beyond: Widespread adoption in all TAMU courses requiring access to real-time weather data. Sharing of bundles and educational modules with other universities, and more widespread EDEX server access to other universities (as hardware allows).

April 20, 2020

Re: Building a Real-Time Running Archive EDEX Server for Meteorology Instruction

The Texas A&M University College of Geosciences has a dedicated staff of 9 full time IT staff that will be committed to supporting the Real-Time Running Archive EDEX server. We will provide any support that the primary IT contact, Gyorgyi Gyarmati, requires. Our number one priority is the support of quality education both in terms of what our students have available to them to access and what our faculty has available to them to use in teaching. This project's immediate impact on learning and teaching will make it an extremely high priority for our team. We already have the infrastructure in place to support the new servers, and we will have a security, maintenance, and DR plans specific to this projects needs put in place as well, ensuring compliance with all mandated state and University requirements. We look forward to working with Dr. Nowotarski, Dr. Conlee, and Gyorgyi Gyarmati on this high impact project.

Sincerely,

Jennifer Hutchinson
IT Manager
Texas A&M University, College of Geosciences
Telephone Number: 979-862-3160
Address: 3148 TAMU, College Station, TX 77843
Email: j-hutchinson@tamu.edu

eQuote

Savings	$8,909.23
Subtotal (1)	**$13,645.77**

Details

EDEX-main-1lesscpu-idraca
Quote number # 1000496340117

Created April 17, 2020
Expires May 17, 2020
Created by
mark@ocean.tamu.edu

Billing

Order contact
Mark Mccann,
Dell Contract Code:
C000000383106
Customer agreement number:
DIR-TSO-3763
Phone number: (979) 985-0485
Additional::
mark@ocean.tamu.edu

Tax exemption
I am not tax exempt

Shipping

Delivery method
no charge delivery

Trade compliance
No, I will not be exporting

Payment method

Description

EDEX server - 1 22core cpu, Idrac Ent

Items	Quantity	Unit Price	Item total
PowerEdge R740XD Fully Configurable	1	$22,555.00	$22,555.00



Discounted unit price: $13,645.77
Dell Contract Code: C000000383106
Estimated Ship Date
Ships in 6 - 8 business days

Premier discount -$8,909.23
Catalog Number: 84 / pe_r740xd_12238

Category	Description	Code	SKU	ID
PowerEdge R740XD	PowerEdge R740XD Server	R740XD	[210-AKZR]	1
Motherboard	PowerEdge R740/R740XD Motherboard	MB	[329-BDKH]	1536
Trusted Platform Module	No Trusted Platform Module	NTPM	[461-AADZ]	1574
Chassis Configuration	Chassis with up to 12x3.5" HDDs on BP, No Mid-Bay and 4x2.5" HDDs Flexbay, 1 or 2CPU Config	GHPJ9DX	[321-BDSI]	1530
Shipping	PowerEdge R740XD Shipping	DSHIP	[340-BLBE]	1500
Shipping Material	PowerEdge R740 Shipping Material	GXP31JS	[340-CORZ]	1690
Processor	Intel® Xeon® Gold 6152 2.1G,22C/44T, 10.4GT/s, 30M Cache,Turbo,HT (140W) DDR4-2666	5101104	[338-BLMP]	1550
Additional Processor	No Additional Processor	1P	[374-BBBX]	1551
Processor Thermal Configuration	1 Standard Heatsink for greater than 125W CPU (no MB or GPU)	5099778	[370-ADPF] [412-AAIR]	1697
Memory DIMM Type and Speed	2666MT/s RDIMMs	5099278	[370-ADNU]	1561
Memory Configuration Type	Performance Optimized	PEOPT	[370-AAIP]	1562

Item total: $13,645.77

Category	Description	Code	SKU	ID
Memory Capacity	(4) 32GB RDIMM, 2666MT/s, Dual Rank	5098890	[370-ADNF]	1560
RAID Configuration	C7, Unconfigured RAID for HDDs or SSDs (Mixed Drive Types Allowed)	5098876	[780-BCDS]	1540
RAID/Internal Storage Controllers	PERC H740P RAID Controller, 8GB NV Cache, Minicard	5102516	[405-AANQ]	1541
Hard Drives	(6) 4TB 7.2K RPM SATA 6Gbps 512n 3.5in Hot-plug Hard Drive	5104008	[400-ASIE]	1570
Hard Drives	(2) 240GB SSD SATA Read Intensive 6 Gbps 512 2.5in Hot-plug Boot Drive,3.5in HYB CARR, 1 DWPD,438 TBW	G9Q05GY	[400-AWHF]	1570
Hard Drives (PCIe SSD/Flex Bay)	(4) 480GB SSD SATA Mix Use 6Gbps 512 2.5in Flex Bay AG Drive, 3 DWPD, 2628 TBW	GC6WUQ8	[400-AZSY]	1573
Operating System	No Operating System	NOOS	[619-ABVR]	1650
OS Media Kits	No Media Required	NOMED	[421-5736]	1652
Embedded Systems Management	iDRAC9,Enterprise	5099556	[385-BBKT]	1520
Group Manager	iDRAC Group Manager, Disabled	5100926	[379-BCQY]	1692
Password	iDRAC,Factory Generated Password	5101343	[379-BCSF]	1693
PCIe Riser	Riser Config 1, 4 x8 slots	5101683	[330-BBHF]	1510
Network Daughter Card	Broadcom 57416 Dual Port 10GbE BASE-T & 5720 Dual Port 1GbE BASE-T, rNDC	5100009	[540-BBUK]	1518
Fans	6 Performance Fans forR740/740XD	5100148	[384-BBPZ]	1531
Power Supply	Dual, Hot-plug, Redundant Power Supply (1+1), 750W	750R	[450-ADWS]	1620
Power Cords	(2) C13 to C14, PDU Style, 12 AMP, 2 Feet (.6m) Power Cord, North America	2FTUS	[492-BBDH]	1621
Bezel	PowerEdge 2U LCD Bezel	5099783	[325-BCHV] [389-BTTO]	1532
Quick Sync 2 (At-the-box mgmt)	No Quick Sync	5101166	[350-BBJV]	1695
BIOS and Advanced System Configuration Settings	Performance BIOS Setting	HPBIOS	[384-BBBL]	1533
Advanced System Configurations	UEFI BIOS Boot Mode with GPT Partition	UEFIB	[800-BBDM]	1534
Rack Rails	ReadyRails™ Sliding Rails Without Cable Management Arm	RNOCMA	[770-BBBQ]	1610
System Documentation	No Systems Documentation, No Open Manage DVD Kit	NODOCS	[631-AACK]	1590
Shipping Information	US No Canada Ship Charge	USNONE	[332-1286]	111
Remote Consulting Services	Declined Remote Consulting Service	NORCS	[973-2426]	735
Regulatory	PowerEdge R740 CE, CCC, BIS Marking	G5GYPBC	[389-DSWP]	1507

Category	Description	Code	SKU	ID
Dell Services: Hardware Support	5 Years Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite	NBD5	[813-6068] [813-6070]	29
Deployment Services	No Installation	NOINSTL	[900-9997]	714

Savings: $8,909.23

Subtotal (1): $13,645.77

Savings	$8,909.23
Subtotal (1)	**$13,645.77**

Ultrabook, Celeron, Celeron Inside, Core Inside, Intel, Intel Logo, Intel Atom, Intel Atom Inside, Intel Core, Intel Inside, Intel Inside Logo, Intel vPro, Itanium, Itanium Inside, Pentium, Pentium Inside, vPro Inside, Xeon, Xeon Phi, Xeon Inside, and Intel Optane are trademarks of Intel Corporation or its subsidiaries in the U.S. and/or other countries.

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To:McCann, James M <mark@ocean.tamu.edu>;

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eQuote Description	EDEX secondary server 12-core
Authorized Buyer	
Notes/Comments	
Account Name	Texas A&M University
Contract Code	C000000383106

eQuote Summary

Description	Quantity	Unit Price	Subtotal
PowerEdge R640	**1**	**$3,761.28**	**$3,761.28**

eQuote Subtotal	$3,761.28
Shipping*	$0.00
Shipping Discount*	$0.00
Tax*	$0.00
Environmental Disposal Fee*	$0.00

eQuote Total* **$3,761.28**

*The eQuote total, including applicable taxes and additional fees, may be viewable online.

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eQuote Details

Description	Quantity	Price
pe_r640_12232 | PowerEdge R640	**1**	**$6,217.00**
Premier Discount		**$2,455.72**
		$3,761.28

Module	Description	Product Code	Sku	ID
PowerEdge R640	PowerEdge R640 Server	R640	[210-AKWU]	1
Motherboard	PowerEdge R640 MLK Motherboard	G6WH1S2	[329-BEIJ]	1536
Trusted Platform Module	No Trusted Platform Module	NTPM	[461-AADZ]	1574
Chassis Configuration	3.5” Chassis with up to 4 Hard Drives and 3PCIe slots	5101045	[321-BCQF]	1530
Shipping	PowerEdge R640 Shipping	DSHIP	[340-BKNE]	1500
Shipping Material	PowerEdge R640 x4 and x10 Drive Shipping Material	GRIWC9J	[340-COPR]	1690
Processor	Intel Xeon Silver 4214 2.2G, 12C/24T, 9.6GT/s, 16.5M Cache, Turbo, HT (85W) DDR4-2400	G5V29WO	[338-BSDL]	1550
Additional Processor	No Additional Processor	1P	[374-BBBX]	1551
Processor Thermal Configuration	Standard Heatsink for 1 CPU	5099132	[370-ADNM] [412-AAIQ]	1697
Memory DIMM Type and Speed	2933MT/s RDIMMs	GQZKY4H	[370-AEPP]	1561
Memory Configuration Type	Performance Optimized	PEOPT	[370-AAIP]	1562
Memory Capacity	(2) 16GB RDIMM, 2933MT/s, Dual Rank	G0E3NPR	[370-AEQF]	1560
RAID Configuration	C1, No RAID for HDDs/SSDs (Mixed Drive Types Allowed)	5098866	[780-BCDI]	1540
RAID/Internal Storage Controllers	HBA330 12Gbps SAS HBA Controller (NON-RAID), Minicard	12GBRC	[405-AAJU]	1541
Hard Drives	1TB 7.2K RPM SATA 6Gbps 512n 3.5in Hot-plug Hard Drive	5103894	[400-ASHH]	1570

Hard Drives	960GB SSD SATA Read Intensive 6Gbps 512e 2.5in HYB CARR S4510 Drive, 3.5in 1 DWPD,1752 TBW	GHE0C2Q	[400-BDOG]	1570
Operating System	No Operating System	NOOS	[619-ABVR]	1650
OS Media Kits	No Media Required	NOMED	[421-5736]	1652
Embedded Systems Management	iDRAC9, Express	5099557	[385-BBKS]	1520
Group Manager	iDRAC Group Manager, Disabled	5100926	[379-BCQY]	1692
Password	iDRAC,Factory Generated Password	5101343	[379-BCSF]	1693
PCIe Riser	Riser Config 4, 2x16 LP	5101341	[330-BBGY]	1510
Network Daughter Card	Broadcom 57416 Dual Port 10GbE BASE-T & 5720 Dual Port 1GbE BASE-T, rNDC	5100009	[540-BBUK]	1518
Internal Optical Drive	No Internal Optical Drive	5101077	[429-ABBF]	1600
Fans	5 Standard Fans for R640	5099559	[384-BBPR]	1531
Power Supply	Single, Hot-plug Power Supply (1+0), 495W	495NR	[450-ADWP]	1620
Power Cords	NEMA 5-15P to C13 Wall Plug, 125 Volt, 15 AMP, 10 Feet (3m), Power Cord, North America	125V10	[450-AALV]	1621
Bezel	Standard Bezel for x4 and x8 chassis	5099012	[325-BCHH] [350-BBJS]	1532
Quick Sync 2 (At-the-box mgmt)	No Quick Sync	5101881	[350-BBKB]	1695
BIOS and Advanced System Configuration Settings	Performance BIOS Setting	HPBIOS	[384-BBBL]	1533
Advanced System Configurations	UEFI BIOS Boot Mode with GPT Partition	UEFIB	[800-BBDM]	1534
Rack Rails	ReadyRails™ Sliding Rails Without Cable Management Arm	RDYRL	[770-BBBC]	1610
System Documentation	No Systems Documentation, No OpenManage DVD Kit	NODOCS	[631-AACK]	1590
Shipping Information	US No Canada Ship Charge	USNONE	[332-1286]	111
Remote Consulting Services	Declined Remote Consulting Service	NORCS	[973-2426]	735
Regulatory	PowerEdge R640 CE, CCC, BIS Marking	G1784PM	[389-DSVE]	1507
Dell Services: Hardware Support	5 Years Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite	NBD5	[813-9255] [813-9257]	29
Deployment Services	No Installation	NOINSTL	[900-9997]	714

eQuote Subtotal	$3,761.28
Shipping*	$0.00
Shipping Discount*	$0.00
Tax*	$0.00
Environmental Disposal Fee*	$0.00

eQuote Total* **$3,761.28**

*The eQuote total, including applicable taxes and additional fees, may be viewable online.

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eQuote Description	EDEX server 24-core
Authorized Buyer	
Notes/Comments	
Account Name	Texas A&M University
Contract Code	C000000383106

eQuote Summary

Description	Quantity	Unit Price	Subtotal
PowerEdge R640	**1**	**$4,455.82**	**$4,455.82**

eQuote Subtotal	$4,455.82
Shipping*	$0.00
Shipping Discount*	$0.00
Tax*	$0.00
Environmental Disposal Fee*	$0.00

eQuote Total* **$4,455.82**

*The eQuote total, including applicable taxes and additional fees, may be viewable online.

Note: Your order may contain one or more items which are billed on a recurring basis. See Important Notes for details on your specific offering and, for customers with auto-renewing subscriptions, how to turn off automatic renewal.

eQuote Details

Description	Quantity	Price
pe_r640_12232 | PowerEdge R640	**1**	**$7,365.00**
Premier Discount		**$2,909.18**
		$4,455.82

Module	Description	Product Code	Sku	ID
PowerEdge R640	PowerEdge R640 Server	R640	[210-AKWU]	1
Motherboard	PowerEdge R640 MLK Motherboard	G6WH1S2	[329-BEIJ]	1536
Trusted Platform Module	No Trusted Platform Module	NTPM	[461-AADZ]	1574
Chassis Configuration	3.5” Chassis with up to 4 Hard Drives and 3PCIe slots	5101045	[321-BCQF]	1530
Shipping	PowerEdge R640 Shipping	DSHIP	[340-BKNE]	1500
Shipping Material	PowerEdge R640 x4 and x10 Drive Shipping Material	GRIWC9J	[340-COPR]	1690
Processor	Intel Xeon Silver 4214 2.2G, 12C/24T, 9.6GT/s, 16.5M Cache, Turbo, HT (85W) DDR4-2400	G5V29WO	[338-BSDL]	1550
Additional Processor	Intel® Xeon® Silver 4214 2.2G, 12C/24T, 9.6GT/s, 16.5M Cache, Turbo, HT (85W) DDR4-2400	G2ALB8Z	[338-BSDL] [379-BDCO]	1551
Processor Thermal Configuration	Standard Heatsink for 2 CPU	5099793	[370-ABWE] [412-AAIQ] [412-AAIQ]	1697
Memory DIMM Type and Speed	2933MT/s RDIMMs	GQZKY4H	[370-AEPP]	1561
Memory Configuration Type	Performance Optimized	PEOPT	[370-AAIP]	1562
Memory Capacity	(2) 16GB RDIMM, 2933MT/s, Dual Rank	G0E3NPR	[370-AEQF]	1560
RAID Configuration	C1, No RAID for HDDs/SSDs (Mixed Drive Types Allowed)	5098866	[780-BCDI]	1540
RAID/Internal Storage Controllers	HBA330 12Gbps SAS HBA Controller (NON-RAID), Minicard	12GBRC	[405-AAJU]	1541
Hard Drives	1TB 7.2K RPM SATA 6Gbps 512n 3.5in Hot-plug Hard Drive	5103894	[400-ASHH]	1570

Hard Drives	960GB SSD SATA Read Intensive 6Gbps 512e 2.5in HYB CARR S4510 Drive, 3.5in 1 DWPD,1752 TBW	GHE0C2Q	[400-BDOG]	1570
Operating System	No Operating System	NOOS	[619-ABVR]	1650
OS Media Kits	No Media Required	NOMED	[421-5736]	1652
Embedded Systems Management	iDRAC9, Express	5099557	[385-BBKS]	1520
Group Manager	iDRAC Group Manager, Disabled	5100926	[379-BCQY]	1692
Password	iDRAC,Factory Generated Password	5101343	[379-BCSF]	1693
PCIe Riser	Riser Config 4, 2x16 LP	5101341	[330-BBGY]	1510
Network Daughter Card	Broadcom 57416 Dual Port 10GbE BASE-T & 5720 Dual Port 1GbE BASE-T, rNDC	5100009	[540-BBUK]	1518
Internal Optical Drive	No Internal Optical Drive	5101077	[429-ABBF]	1600
Fans	8 Standard Fans for R640	5101073	[384-BBQJ]	1531
Power Supply	Single, Hot-plug Power Supply (1+0), 495W	495NR	[450-ADWP]	1620
Power Cords	NEMA 5-15P to C13 Wall Plug, 125 Volt, 15 AMP, 10 Feet (3m), Power Cord, North America	125V10	[450-AALV]	1621
Bezel	Standard Bezel for x4 and x8 chassis	5099012	[325-BCHH] [350-BBJS]	1532
Quick Sync 2 (At-the-box mgmt)	No Quick Sync	5101881	[350-BBKB]	1695
BIOS and Advanced System Configuration Settings	Performance BIOS Setting	HPBIOS	[384-BBBL]	1533
Advanced System Configurations	UEFI BIOS Boot Mode with GPT Partition	UEFIB	[800-BBDM]	1534
Rack Rails	ReadyRails™ Sliding Rails Without Cable Management Arm	RDYRL	[770-BBBC]	1610
System Documentation	No Systems Documentation, No OpenManage DVD Kit	NODOCS	[631-AACK]	1590
Shipping Information	US No Canada Ship Charge	USNONE	[332-1286]	111
Remote Consulting Services	Declined Remote Consulting Service	NORCS	[973-2426]	735
Regulatory	PowerEdge R640 CE, CCC, BIS Marking	G1784PM	[389-DSVE]	1507
Dell Services: Hardware Support	5 Years Basic Hardware Warranty Repair: 5x10 HW-Only, 5x10 NBD Onsite	NBD5	[813-9255] [813-9257]	29
Deployment Services	No Installation	NOINSTL	[900-9997]	714

eQuote Subtotal	$4,455.82
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