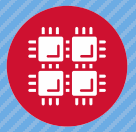
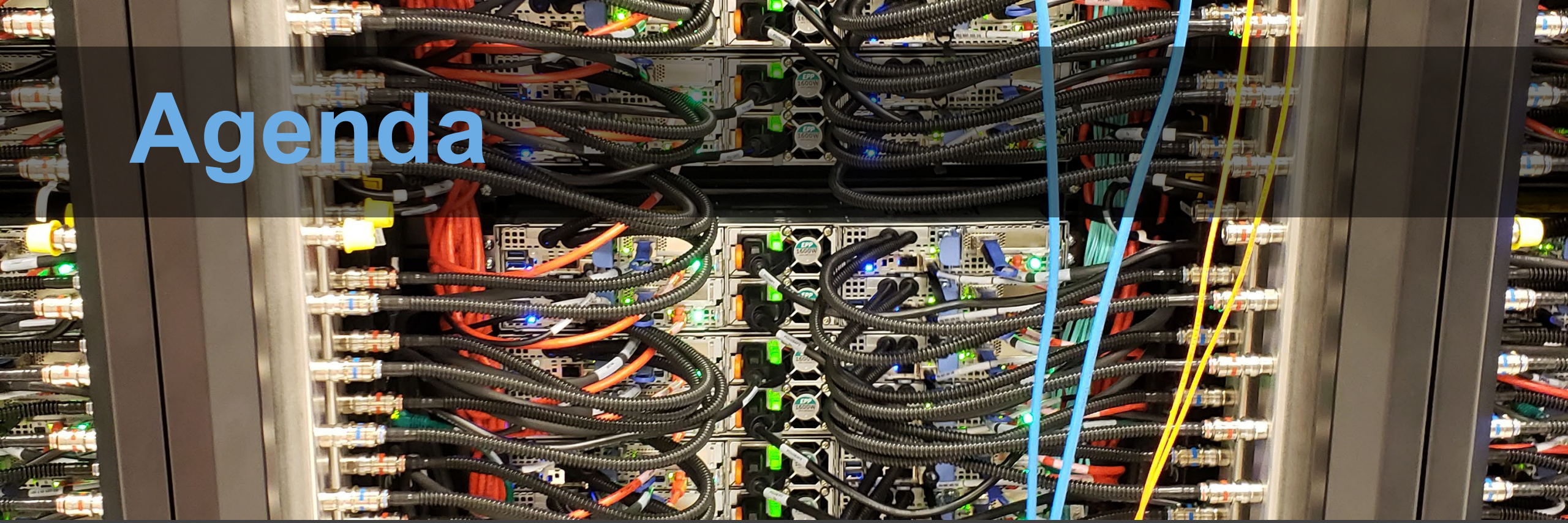
Please complete the OSC Client Survey at:

https://www.osc.edu/survey

SUG

April 17, 2019





Agenda

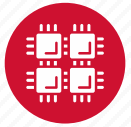
- Director’s Update
- Client Impact
- Software and Research Services
- Systems Overview
- Business Details

Director's Update

David Hudak, Executive Director

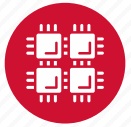
Organizational Update

- FY19-20 biennium capital allocation of $6.105M
  - Protected Data Environment
  - Research Data Archive
  - Production infrastructure refresh (Ruby replacement)
- FY20-21 biennium operating budget in Ohio Legislature
  - Governor's budget requests $4.388M/year (flat)
  - Budget to be finalized by July 1
- Welcome new employees!
  - Antonio Marcum (Client Services)
  - Meghan Hian (Administration)



National Landscape

- **Events**
  - CASC (National HPC Center Director's) Meeting, March 20-22, Alexandria, VA
    Open OnDemand, Globus Online, Cloud HPC, NSF roadmaps
- **Federal Strategy/Initiatives**
  - From NSF OAC, draft of "NSF's Blueprint for a National Cyberinfrastructure Ecosystem," https://osu.box.com/s/xv2egwuxyi3bqav4e38ivqwndd5tnric
  - Executive Order on Maintaining American Leadership in Artificial Intelligence," https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence/
- **National Resources**
  - Frontera System, early users this spring, https://www.tacc.utexas.edu/systems/frontera



A new vision…

An agile, integrated, robust, trustworthy and sustainable CI ecosystem that drives new thinking and transformative discoveries in all areas of S&E research and education.

Overarching principles:

View CI more holistically ~ seamlessly integrated spectrum of resources, tools, services, and expertise to enable transformative discoveries.

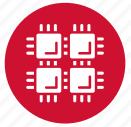
Support translational research ~ core innovations → development of community tools and frameworks → deployment and operation of sustainable production CI.

Balance innovation with stability ~ longer continuity in production computational capacity while fostering innovation and transition to production.

Couple discovery and CI innovation cycles ~ more rapidly address new challenges and opportunities in an era of disruptive technologies and evolving science needs.

Improve usability ~ ease pathways for discovering, accessing, understanding and using powerful CI capabilities and services to enhance researcher productivity and scientific impact.

Thanks to Manish Parashar, NSF Office of Advanced Cyberinfrastructure

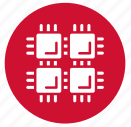


OSC Mission

OSC provides large-scale centralized research computing services, improving the quality and lowering the cost of research done in Ohio.

Access to OSC's advanced services allows clients to test and scale their work, while avoiding the effort of managing their own systems.

Making Ohio's universities and businesses more competitive and aid them in retaining and recruiting top faculty, students, and staff.



Client Impact

Brian Guilfoos, HPC Client Services Manager

Client Services

CY2018

23 Ohio universities

56 companies

36 universities outside of Ohio

3,185 researchers

301 new projects created

315 trainees

693 projects served

48 college courses used OSC

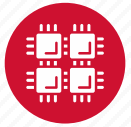
22 training opportunities

72 publications cited OSC

Client Distribution by University

CY2018

University	Users
Bowling Green State University	18
Case Western Reserve University	20
Cedarville University	3
Central State University	1
Cleveland State University	5
Kent State University	7
Kenyon College	13
Miami University	29
Mount Union College	1
Ohio State University	1,024
Ohio University	32
Otterbein College	1
University of Akron	13
University of Cincinnati	101
University of Dayton	17
University of Findlay	1
University of Toledo	14
Wittenberg University	5
Wright State University	11
Xavier University	1
Youngstown State University	7



Academic Course Enrollment

CY2018

Department	Users
BGSU Computer Science	23
Cedarville Engineering	14
Cedarville Engineering and Computer Science	8
Cleveland State Electrical Engineering and Computing Systems	8
Cleveland State Physics	8
Kenyon Chemistry	24
Miami Computer Science and Software Engineering	3
OSU Biomedical Engineering	13
OSU Biomedical Informatics	15
OSU Biomedical Informatics	0
OSU Chemical and Biomolecular Engineering	10
OSU Chemical and Biomolecular Engineering	24
OSU Chemistry	91
OSU Chemistry	129
OSU Chemistry	406
OSU Chemistry	170
OSU Chemistry and Biochemistry	10
OSU Chemistry and Biochemistry	14
OSU Computer Science and Engineering	24
OSU Computer Science and Engineering	3
OSU Computer Science and Engineering	2
OSU Computer Science and Engineering	33
OSU Computer Science and Engineering	73
OSU Computer Science and Engineering	17

Department	Users
OSU Computer Science and Engineering	60
OSU Evolution, Ecology and Organismal Biology	13
OSU Evolution, Ecology and Organismal Biology	23
OSU Evolution, Ecology and Organismal Biology	16
OSU Geography	9
OSU Horticulture and Crop Science	12
OSU Linguistics	11
OSU Materials Science and Engineering	4
OSU Materials Science and Engineering	20
OSU Mechanical and Aerospace Engineering	4
OSU Mechanical and Aerospace Engineering	10
OSU Physics	7
OSC Training	7
U. Cincinnati Biology	19
U. Cincinnati Chemistry	8
U. Cincinnati Electrical Engineering and Computing Systems	11
U. Cincinnati Electrical Engineering and Computing Systems	24
U. Cincinnati Electrical Engineering and Computing Systems	53
U. Cincinnati Electrical Engineering and Computing Systems	46
U. Cincinnati Physics	49
U. Dayton Mathematics	3
Wright State Psychology	11
Xavier Mathematics and Computer Science	20
Xavier Physics	11

10 Universities. 26 Departments. 48 courses.1,573 students.

Support Activities

User Documentation

- Services and Resources web pages, FAQs, HOW TOs, New User Guide…

Help Desk

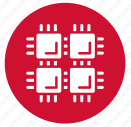
- Servicing reports of problems & requests for assistance
- Onboarding new users
- Providing system status updates
- Advanced support – debugging, software installation, workflow improvement, etc..

Data collection

- Job performance stats
- Software use

Office Hours

- Wed & Fri Pomerene Hall
- Every other Tuesday afternoon at Research Commons



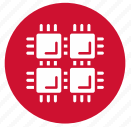
Training Activities

Recent Training

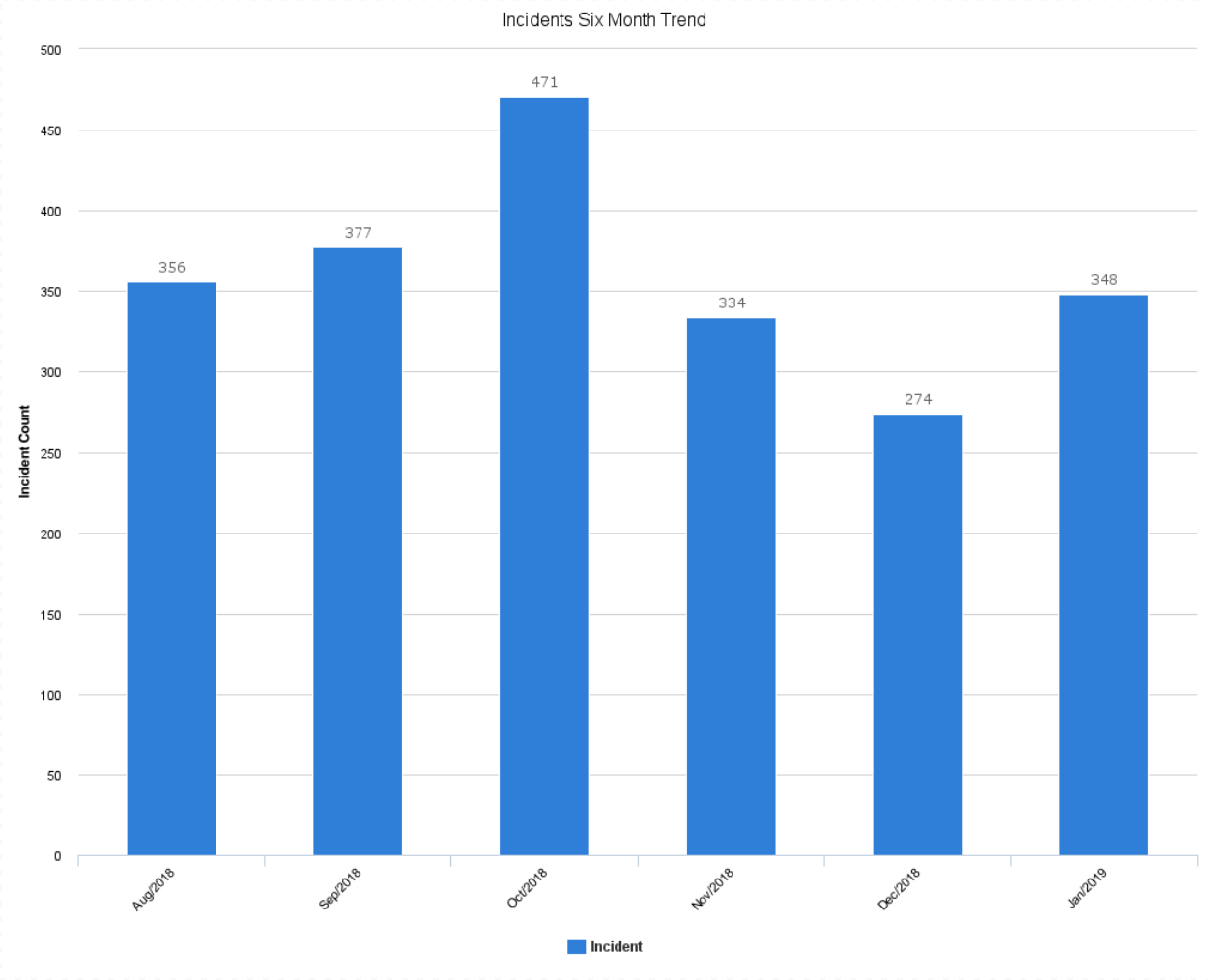
- 4 classroom presentations on OSC services (Feb)
- OSC Intro events at OSU/TDAI (Feb 18) & UC (Apr 3)
- HPC Carpentry workshop at OSU/TDAI (Mar 12)
- Campus visits: Shawnee State (Mar 22) & UC (Apr 3)
- Several XSEDE webcasts (ongoing monthly)

Upcoming Training

- OSC Intro (May 1) & HPC Carpentry (May 15) at OSU Wooster



Active Client Service Support Load



~350 tickets / month

~18 tickets / work day

Client Portal

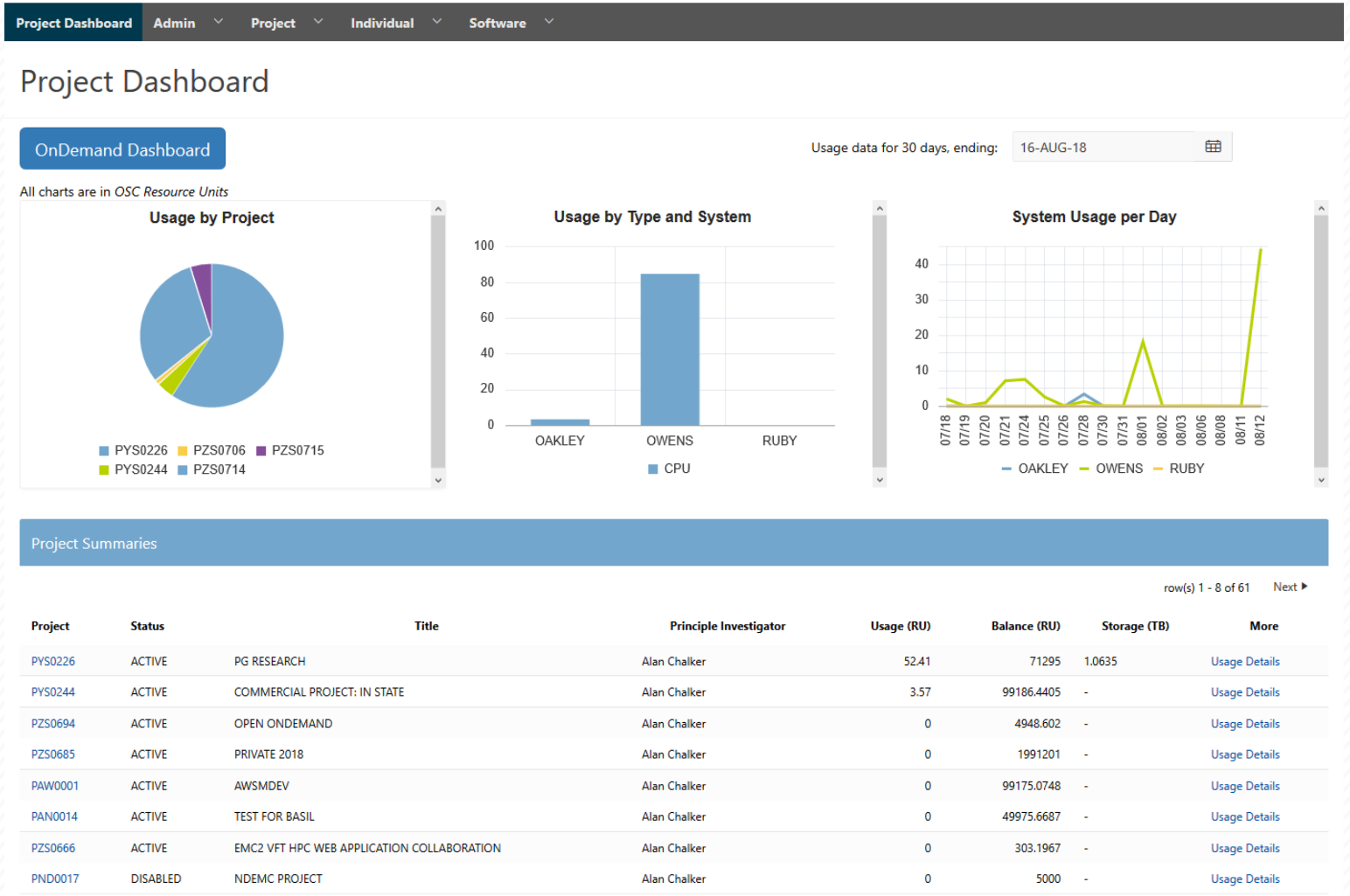
All new my.osc.edu

- Made available for all clients on October 23
- Streamlined account and project creation

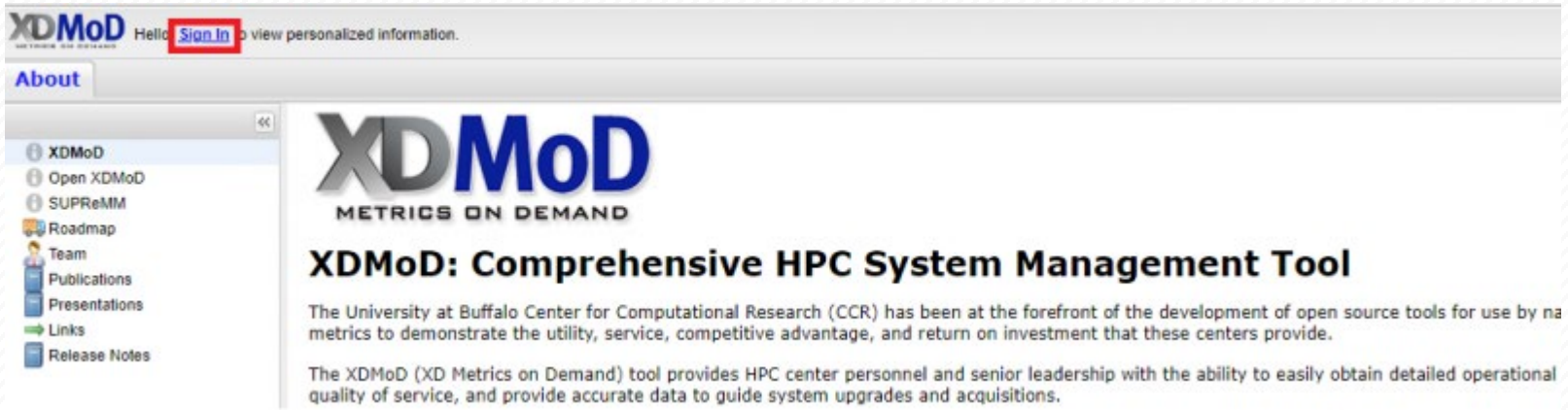
New reports.osc.edu

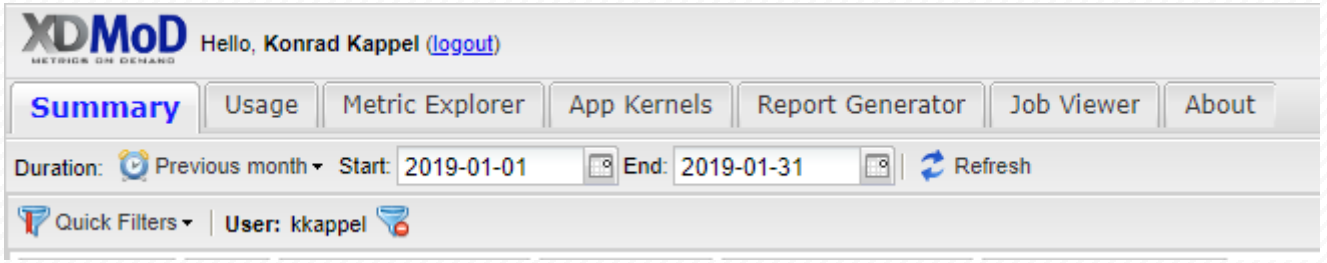
- Provides OSC staff with robust client usage and billing reporting capabilities

Phase 2 planned for summer 2019



XDMoD





Overview

- XDMoD (XD Metrics on Demand), is an NSF-funded open source tool that provides a wide range of metrics pertaining to resource utilization and performance of HPC resources

How to Access it

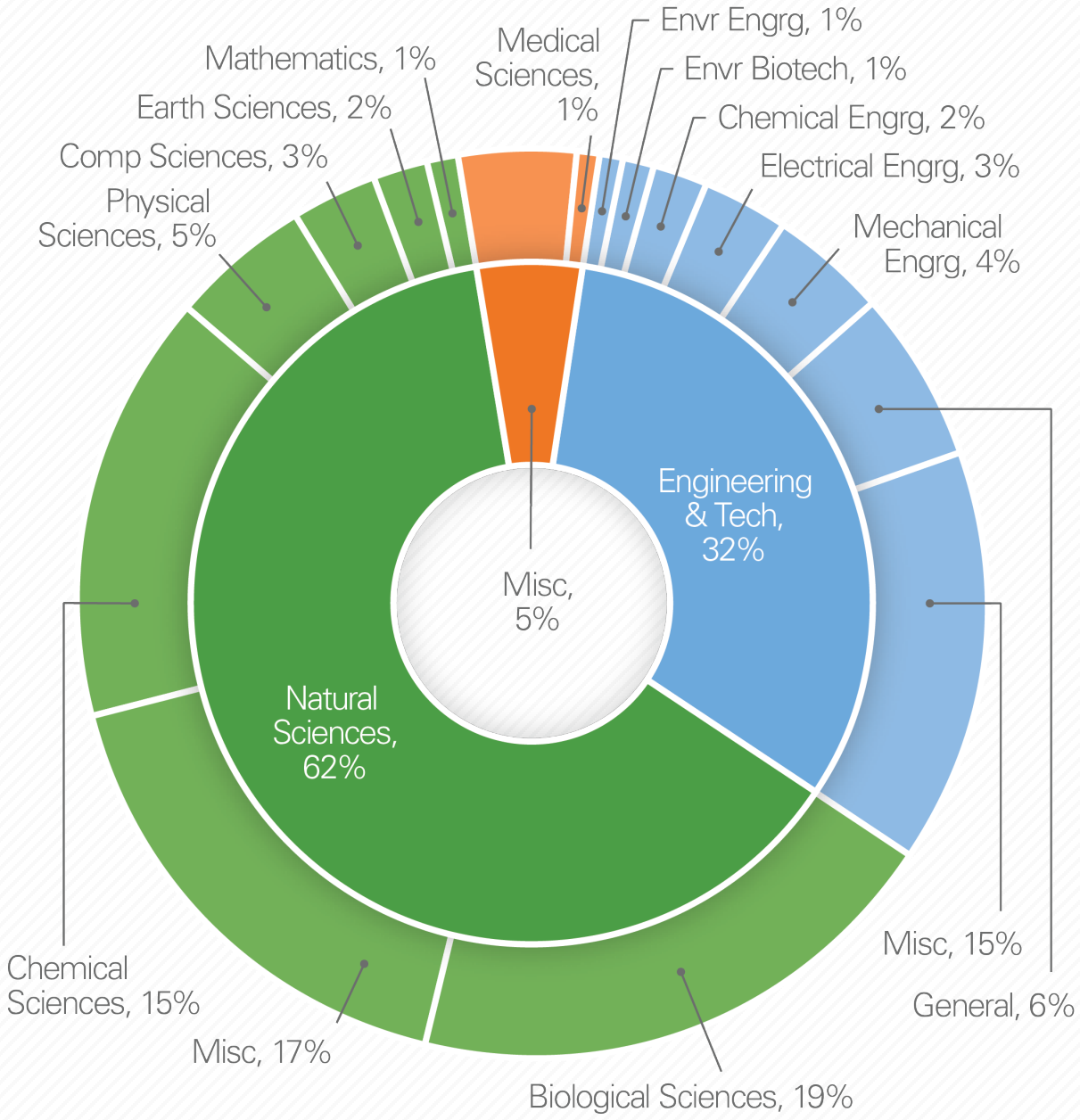
- xdmod.osc.edu
- Training available at https://www.osc.edu/supercomputing/knowledge-base/xdmod_tool

Software and Research Services

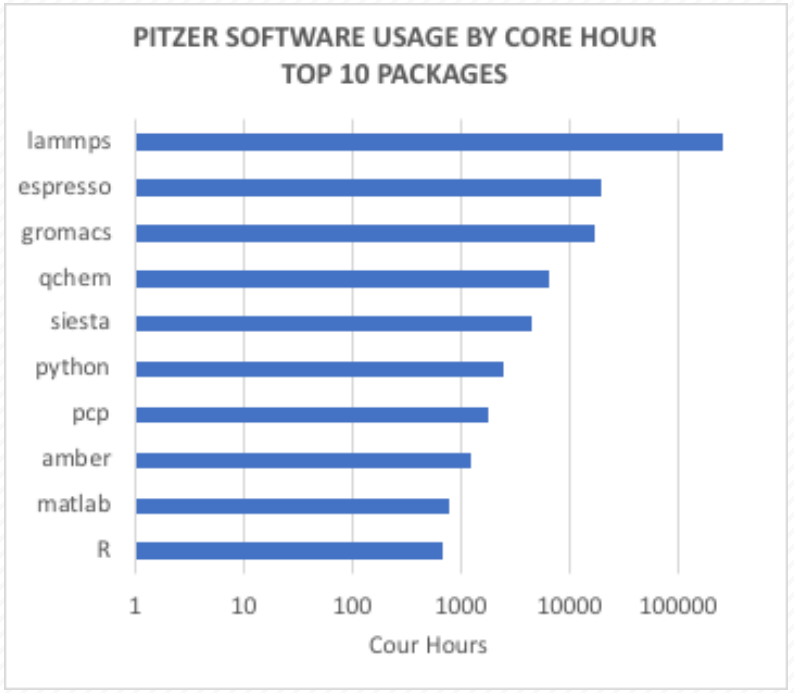
Karen Tomko, Director of Scientific Applications

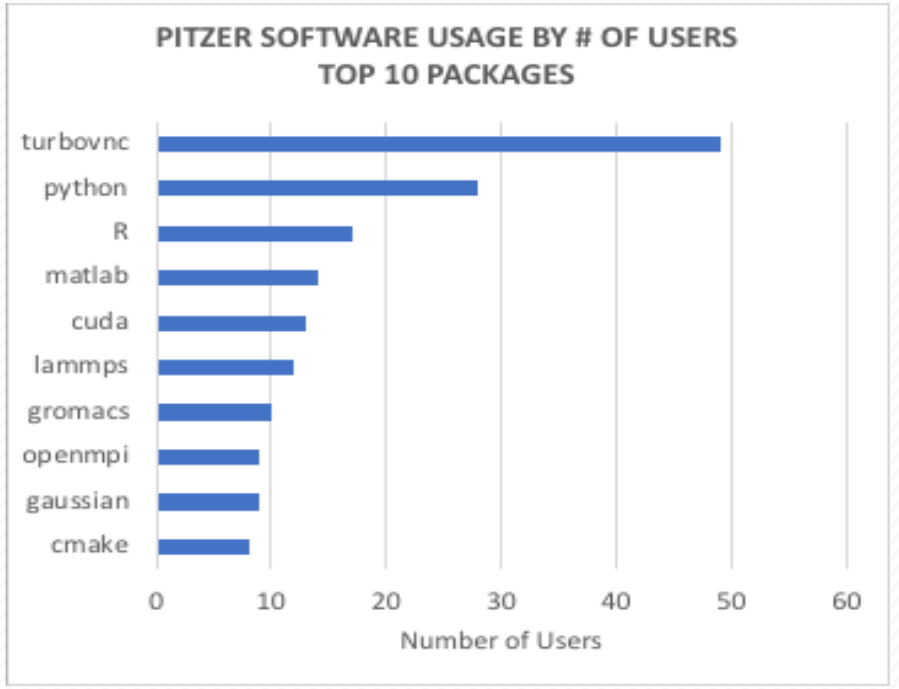
Utilization by Field of Science

CY2018



Software Resources and Use





- Software installed and maintained for users
  - ~145 software packages overall, see https://www.osc.edu/resources/available_software
  - Simulations, data analysis tools, numerical libraries, software development tools
  - Support for containers (via singularity) on Pitzer and Owens
- Mix of ISV, free and open source packages
  - 19 purchased software packages currently supported
  - More than $90K spent on license renewals/maintenance in 2018

Recent Software Initiatives

Machine Learning/Deep Learning and AI workloads

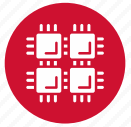
- ML/DL libraries from NVIDIA and Intel
- Popular ML/DL frameworks: TensorFlow, PyTorch, Caffe
- Support latest generation GPU with tensor cores
- Client assistance in managing I/O requirements

Productivity Software Environments

- Web access to notebook-style programming environments via OSC OnDemand
- Rstudio, Jupyter, Matlab (Live Editor)
- Languages: R, Python, Julia, Matlab

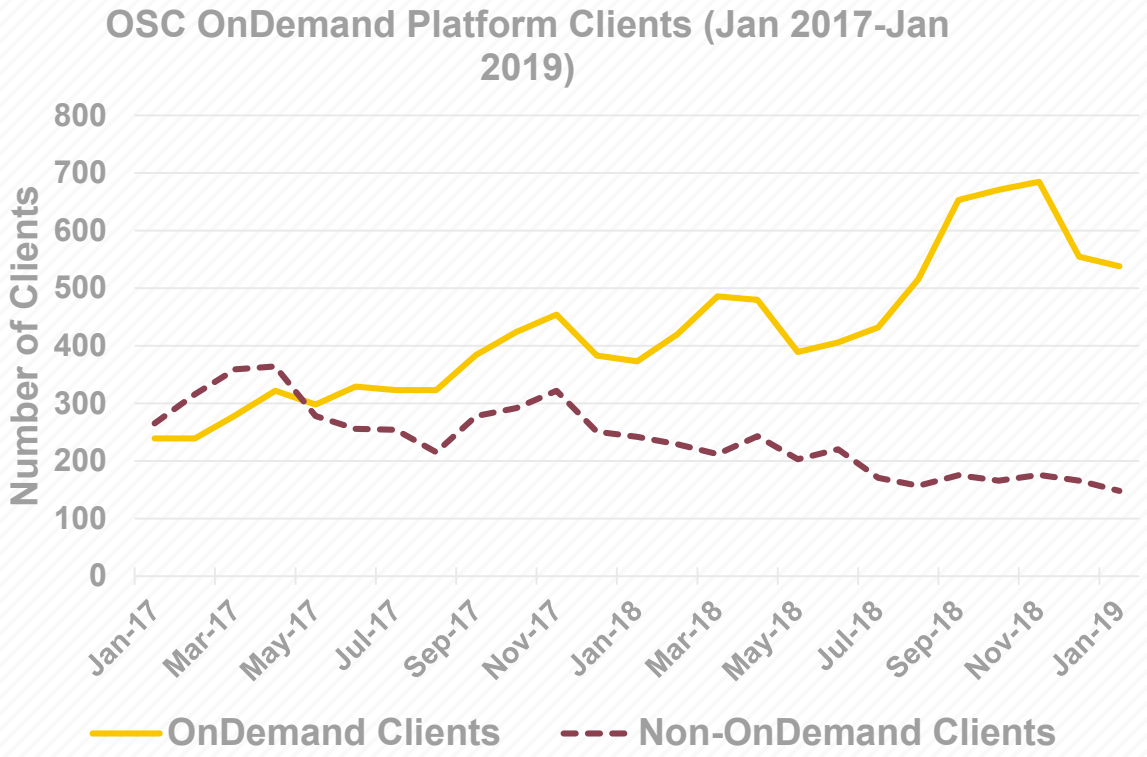
Containers

- Software containers supported on Owens and Pitzer
- We use Singularity containers developed for HPC systems
- Docker containers work with Singularity
- SUG Breakout section and upcoming training (date TBD)

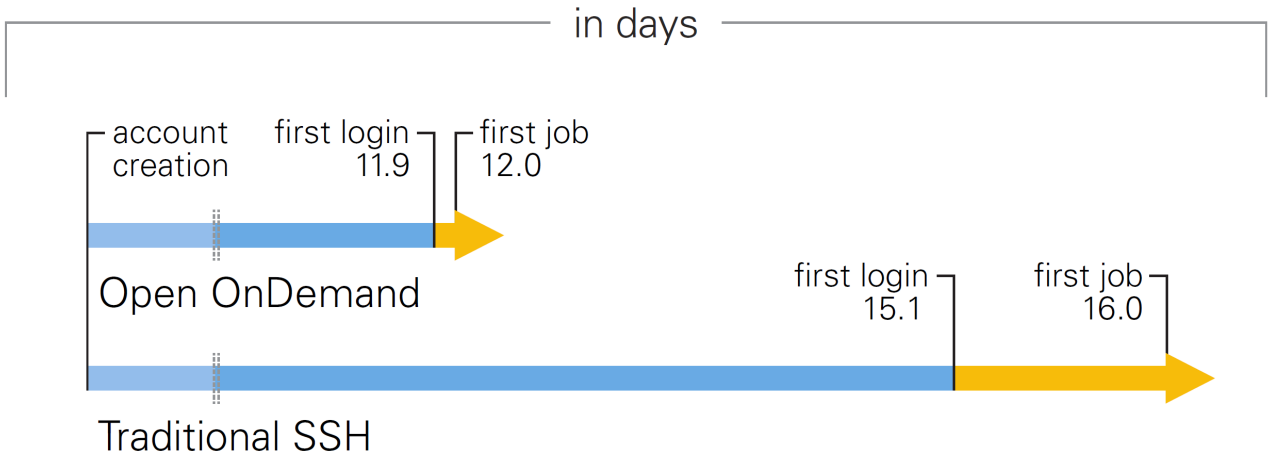


OSC OnDemand

- Web-based interactive access to OSC
- Launched Sep. 2016, serving OSC clients globally
- % of users has steadily increased since launch



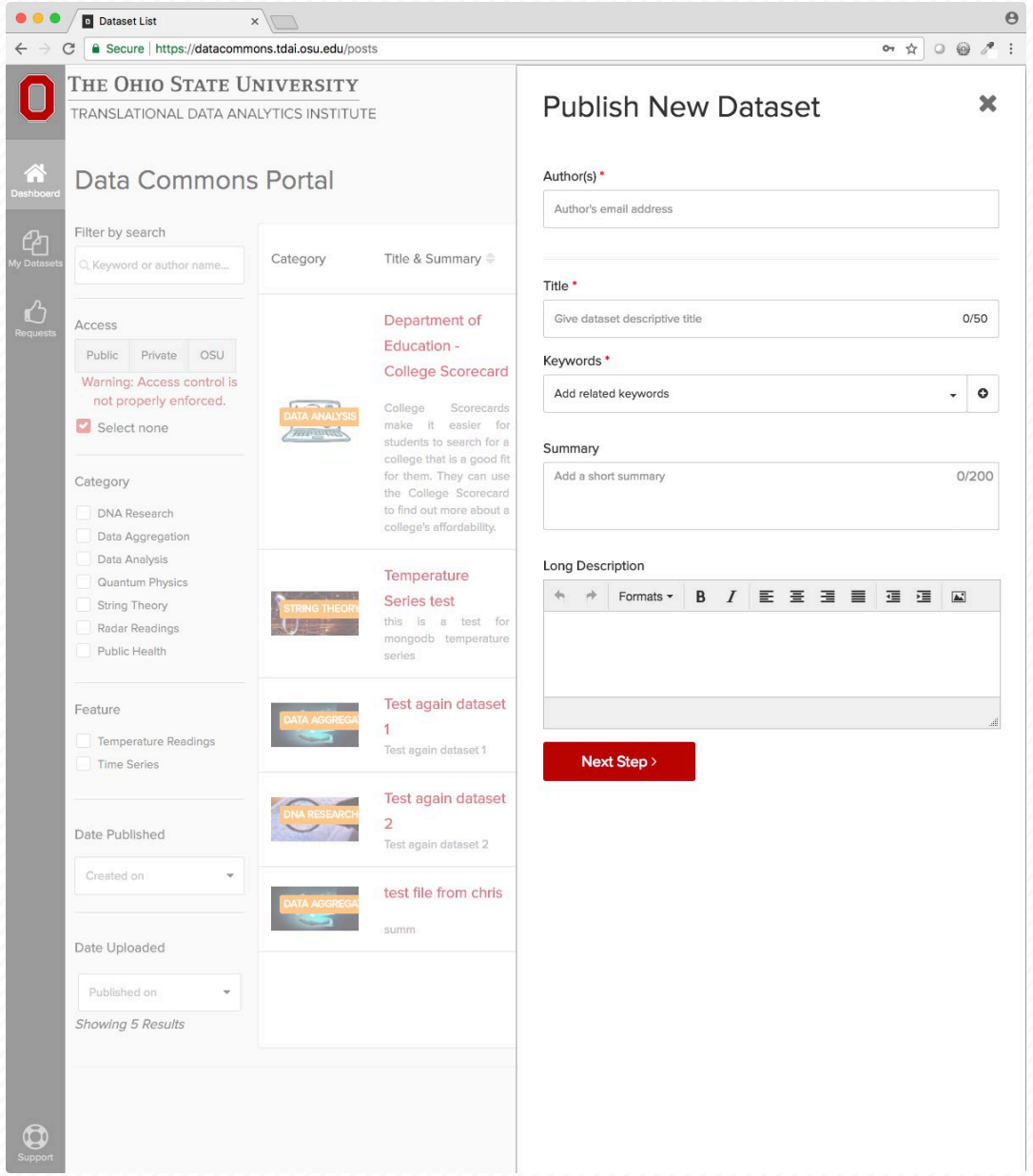
- OnDemand users start work faster than traditional users, both in terms of first login and job submission



Custom Portal Development

Recent Examples:

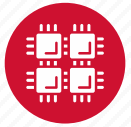
- OSC staff developed new OSU Data Commons service: datacommons.tdai.osu.edu
- R Shiny App server for OSU BMI department
- GoFly project CFD portal for TotalSim



Research Support and Partnership

- **Letters of commitment** - sufficient resources needed for your project
- **Boilerplate** text regarding computing and storage facilities and data retention policy
- **Quotes for specialized services** such as: dedicated computing resources, large amounts of storage, HPC consulting
- **Expertise** in areas such as: scientific software development, web software development and virtual environments by collaborating on proposals.
- **Outreach/Broader Impact** activities with OSC's K12 summer educational programs
- **Review of proposals** for research computing infrastructure or research software development

Recently hired Meghan Hian to help coordinate all these items



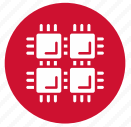
Client Funding and Publications

Collecting Data:

- Client funding and publications can be stored in the new my.osc.edu
- Currently have 1,100 funding and 2,103 publication records
- Investigating improvements to data collection to improve coverage by making it easier for PIs to upload data and require updates regularly

Initial Analysis

- 26 grants with start dates in the last year for a total of $12,039,860
- 35 publications published in the last year reported to OSC
    - Web of Science reports 194 Journal citations of OSC in 2018; so easier reporting to OSC would be of value



Systems Overview

Doug Johnson, Chief Architect

Production Capacity

CY2018

226,600,000+ core-hours consumed

85% average HPC system utilization

3,200,000+ computational jobs

3,044 TF of computational power available

99.2% up-time

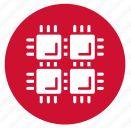
59% average storage system utilization

3+ PB data stored

2 PB data transferred

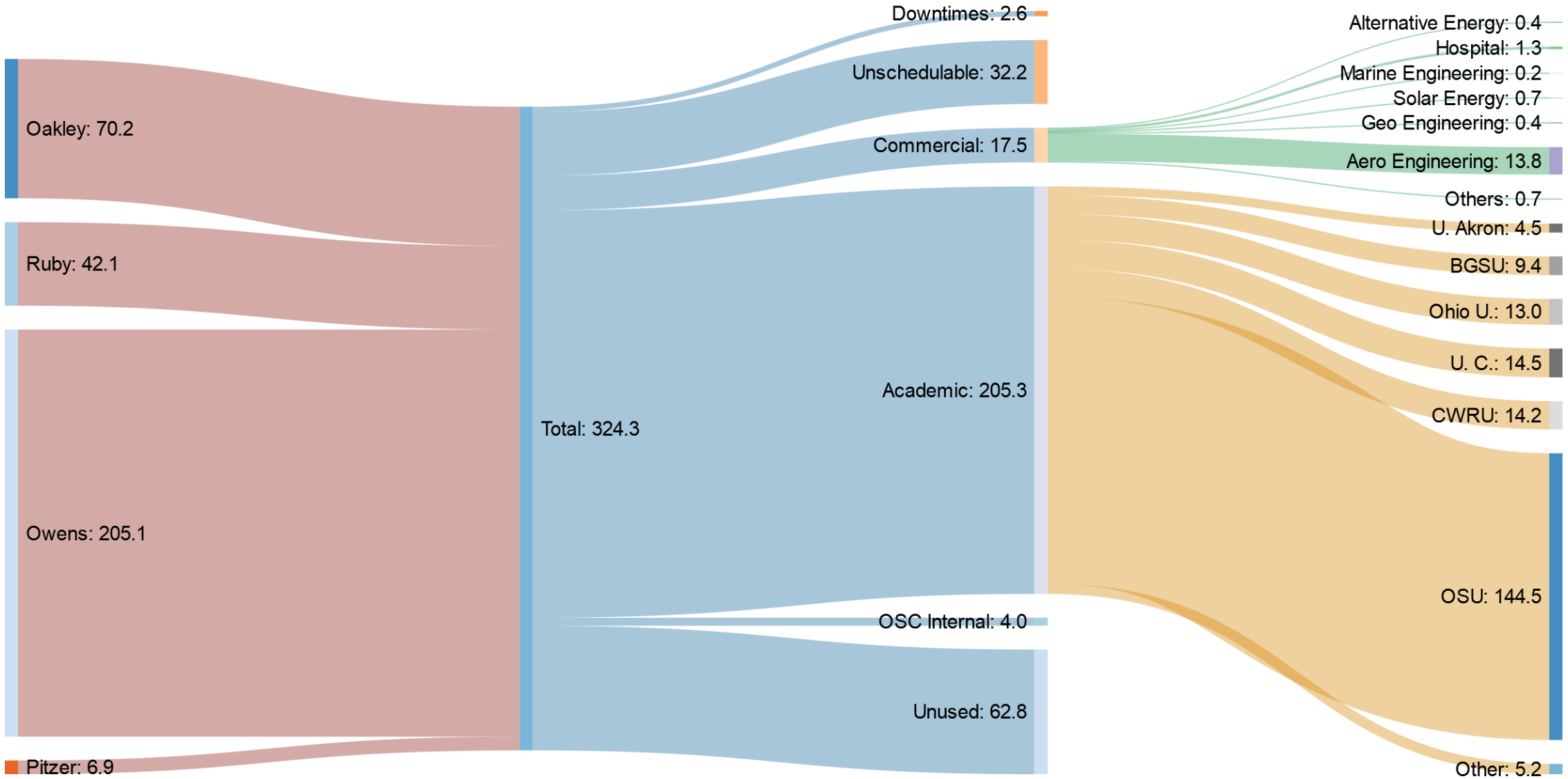
74% jobs started within 30 minutes

145 software packages



HPC Systems Core Hours

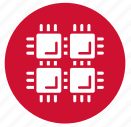
CY2018 (units: millions)



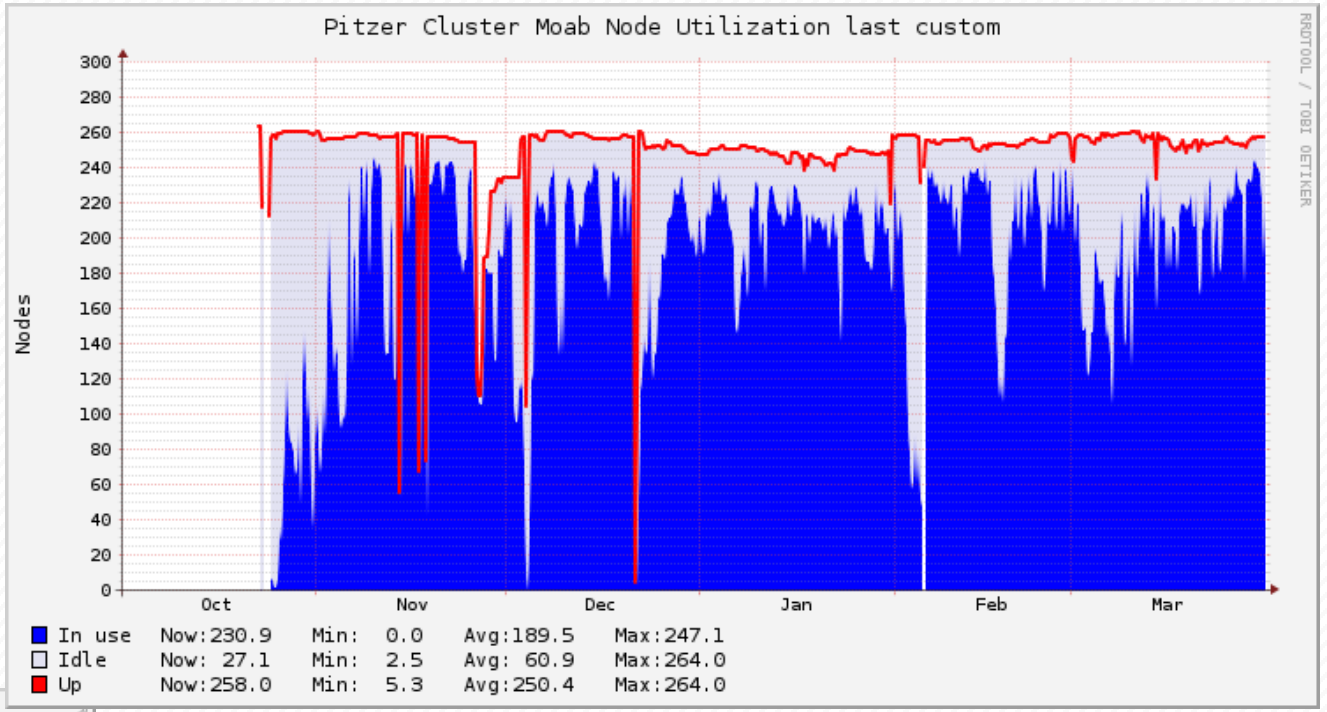
System Status (2019)

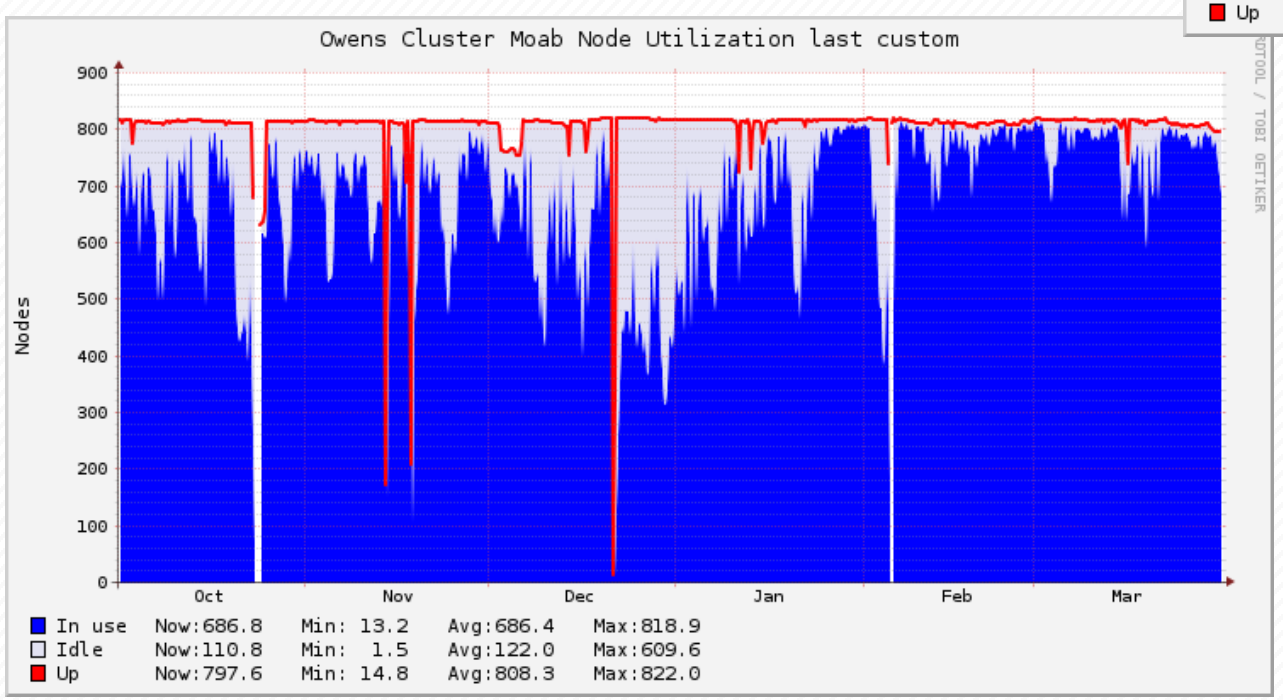
COMPUTE	Ruby	Owens	Pitzer
Date	2014	2016	2018
Cost	$1.5 million	$7 million	$3.35 million
Theoretical Perf.	~144 TF	~1600 TF	~1300 TF
Nodes	240	824	260
CPU Cores	4800	23392	10560
RAM	~15.3 TB	~120 TB	~ 70.6 TB
GPUs	20 NVIDIA Tesla K40	160 NVIDIA Pascal P100	64 NVIDIA Volta V100
	Total compute: ~3,044 TF		

STORAGE	Home	Project	Scratch	Tape Library
Capacity	0.8 PB	3.4 PB	1.1 PB	7+ PB
Current utilization April 18	60%	73%	72%	~50%



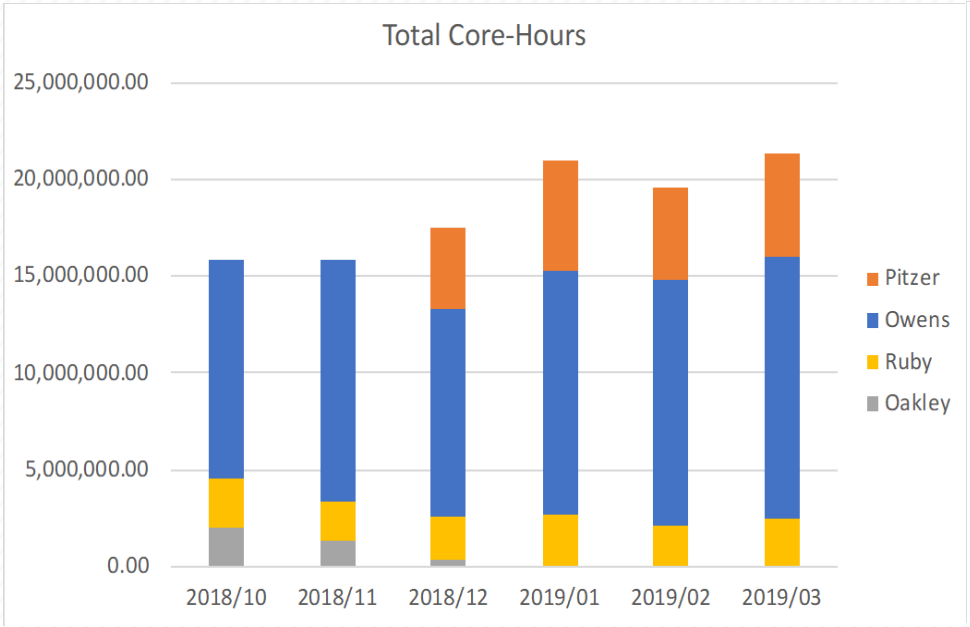
Owens and Pitzer 6 Month Utilization

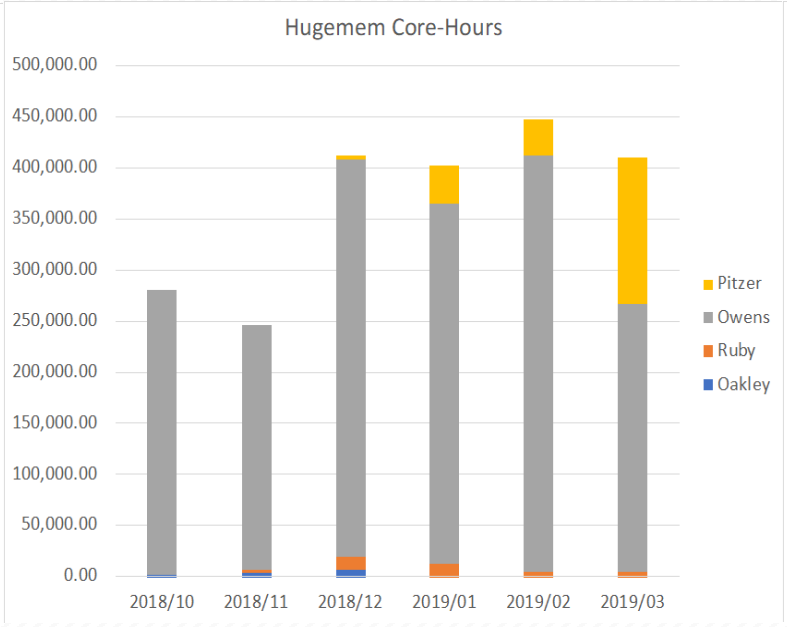


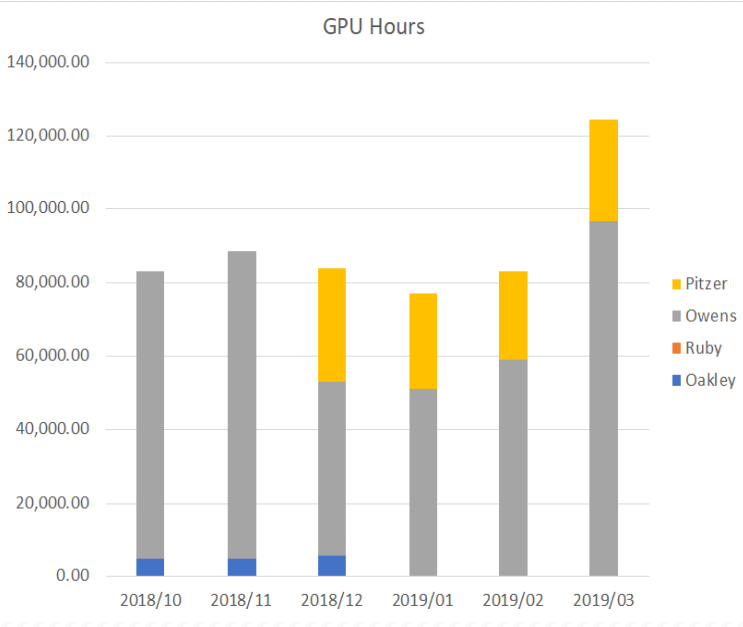


Visit https://xdmod.osc.edu

GPU and BigMem Usage (by core/GPU hour)







Storage Projects

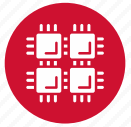
Backup servers and storage upgrade

- Installation of the new servers and storage hardware started in early April
- Production cutover by end of June
- Increased performance – target of >100TB/day sustained daily backup size

OSU Data Commons

NVMe/SSD based filesystems

- POC with NetApp and Systems Fabric Works with the BeeGFS file system
- DDN IME generally available for /fs/scratch file system
  - ~100GB/s read/write performance
  - Search for “IME” at https://www.osc.edu



Storage Projects (cont.)

Project storage metadata upgrade

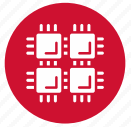
- 50% space increase, can now support ~1.5B files/directories

Storage expansion

- Finalizing storage expansion vendor choice
- Support for Protected Data Environment
  - File system audit capabilities
- 5.3 PB – 8.8 PB expansion
- New file systems, will not expand current Scratch and Project, changes to file system namespace

Research Data Archive

- Meet data management plans for sponsored research
- Provide publishing, management, and other alternative access capabilities
- Information gathering for remote data center choices for off-site copy of data and user requirements



Security Projects

Network firewall

- Deployment ongoing, shared resource with OH-TECH Shared Infrastructure

Protected Data Environment

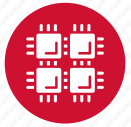
- Unique resource supporting HIPAA, ITAR, DFARS/CUI, or other sensitive data sets
- Initial requirements gathering (OSU Wexner Medical Center, Nationwide Children's Hospital)
- HIPAA Risk Assessment was conducted Nov-Dec 2018 by RSM-US (OSU-approved assessment firm)
    - Actively working on remediation items

Security Audits

- Partial IT controls audit by OSU Internal Audit is planned for 2019
- HIPAA gap assessment for Protected Data Environment

Staffing

- New security engineer has been on staff since October 2018



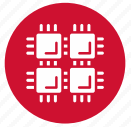
Globus Online Subscription Planned

Overview (from globus.org)

- Globus is a secure, reliable research data management service.
- With Globus, subscribers can move, share, & discover data via a single interface – whether your files live on a supercomputer, lab cluster, tape archive, public cloud or your laptop, you can manage this data from anywhere, using your existing identities, via just a web browser.

Key Features

- Third-party transfers – move data between Globus endpoints (fire-and-forget)
- Globus connect client – robust tool to download/upload data from your local computer (Mac, Windows, or Linux)
- Sharing data - fine grained control to allow sharing data with people who do not have OSC accounts
- Support for Box - unattended transfers directly between Box and OSC (planned feature, will be officially announced on May 1 at Globus World)
- Enhanced API support for integration in Web portals or Gateways



Business Details

Alan Chalker, Director of Strategic Programs

Current Fee Overview

Four product listings:

- Commercial
- Non-profit / government
- Academic condo (dept./faculty)
- Academic fee structure (institution)

Price sheets:

- Effective Dec 4th, 2018 with deployment of Pitzer
- Includes service catalog

Commercial Price Sheet

Startup Package

The initial startup package costs just $500 and includes:

- **Annual maintenance fee for initial project**
- **$250 credit toward additional services**
- **Unlimited basic technical support**
- **Up to 500GB of home directory storage per user**
- **Outside network connectivity** via general Internet connection
- **Access to appropriate software** according to licensing restrictions*

* Clients are responsible for obtaining licenses for any commercial software packages.

High Performance Computing Services	Ruby Cluster		Owens Cluster		Pitzer Cluster	
	per node hr	(per core hr)	per node hr	(per core hr)	per node hr	(per core hr)
Pay-as-you-go (Standard Nodes)	$0.76	($0.038)	$1.06	($0.038)	$1.64	($0.041)
Pay-as-you-go (Big Memory Nodes)	n/a	n/a	$8.21	n/a	$16.40	n/a
	[per GPU hr] (in addition to above prices)					
Add-on GPU	n/a		[$1.20]		[$1.50]	
Project maintenance fee	$250 per year per active project					

Monthly billing is based on usage of nodes/cores to the nearest minute.

Data Storage & Transfer Services	Price per TB per month
Home directories, parallel scratch and network transfer	$0
Project storage (high performance, high availability file system, includes backup)	$40

Monthly billing is based on the allocated storage quota to the nearest half TB.

Consulting Services	Price per 4 hour block
Advanced tech support (e.g. software development, code optimization, etc.)	$400

Discounts*	Percent
High volume (defined as >$5,000 billed in past 12 months)	25% off
Lease** (defined as dedicated compute nodes)	40% off

*Only 1 discount applied per customer. **Lease discount does not apply toward data storage services.

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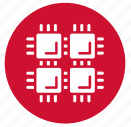
FY20 Fee Structure

Assumptions:

- $1M recovery target looks to be sufficient for FY20
- State subsidy remains flat

Finance Committee Recommendation:

- Keep model the same – $0.075 / RU with no charge for storage
  - $0.075 / RU = $0.0075 / core hour
- Continue to collect data on usage patterns
- Evaluate potential additional charges for storage / specialized services in FY21



Fee Structure FAQ

Motivation: Desire to share one central source of accurate information to address fee structure concerns and questions

FAQ Content

- www.osc.edu/content/academic_fee_structure
- Major sections: Overview and Background, Business and Financial Details, Client-specific Details

Institutional Contacts

- University of Akron: Kathryn Watkins (kwatkin@uakron.edu)
- Case Western Reserve University: Roger Bielefeld (rab5@case.edu)
- Ohio State University: Diane Dagefoerde (dagefoerde.2@osu.edu)
- Ohio University: Heather Gould (gouldh@ohio.edu)
- University of Cincinnati: Jane Combs (combsje@ucmail.uc.edu)
- Bowling Green State University: Thomas Kornacki (ospr@bgsu.edu)

Usage Comparisons

(Jul 2017- Mar 2018) vs (Jul 2018 – Mar 2019)

University	RUs 2017-2018	RUs 2018-2019	RUs % Diff
Ohio State University	8,618,694	10,410,265	+21%
Case Western Reserve University	1,208,297	154,288	-87%
University of Cincinnati	893,919	1,032,548	+15%
Ohio University	885,074	1,020,077	+15%
Bowling Green State University	726,854	384,282	-47%
University of Akron	182,783	119,466	-34%
Totals	**12,515,621**	**13,120,926**	**+5%**

Academic Fee Projections (FY2019)

University	Resource Units (RUs)	Billable RUs	Fees (Actual)	Fees (Projected)
Ohio State University	5,716,294	4,921,593	$369,119	**$734,000**
University of Cincinnati	640,080	534,110	$40,058	**$93,396**
Ohio University	542,284	488,264	$36,620	**$59,767**
Bowling Green State University	209,431	186,381	$13,979	**$20,012**
Case Western Reserve University	130,608	61,042	$4,578	**$15,104**
University of Akron	70,976	52,993	$3,974	**$11,110**
Miami University	35,432	13	$0	**$0**
Cleveland State University	34,165	22,958	$0	**$0**
University of Toledo	26,003	2,774	$0	**$0**
Youngstown State University	25,141	14,393	$0	**$0**
Wright State University	21,451	4,830	$0	**$0**
University of Dayton	16,408	0	$0	**$0**
Kent State University	14,787	2,103	$0	**$0**
Xavier University	5,137	0	$0	**$0**
Wittenberg University	129	0	$0	**$0**
Muskingum University	38	0	$0	**$0**
TOTALS	7,616,144	6,406,299	$468,328	**$933,389**

- Still evaluating trends and usage patterns
- Projections based on 6 months of usage

Comprehensive Value Proposition

Motivation:

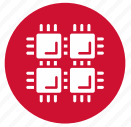
- Show difference between OSC costs and fees charged
- Illustrate value of university investment

General components:

- HPC compute hours consumed on each cluster
- Storage (Home, Scratch, Project, and Tape)

Services not currently included:

- Specific compute hardware types
- Software licensing
- Staff support



Comprehensive Value Proposition

		Actual Cost		Fees	
Service	**Usage**	**Unit Cost**	**Amount**	**Unit Fee**	**Amount**
High Performance Computing	Core-Hours / GPU-Hours				
Oakley/CPU	20,618	$ 0.0237	$ 489	$ 0.0038	$ 77
Oakley/Hugemem	0	$ 0.0237	$ 0	$ 0.0038	$ 0
Ruby/CPU	0	$ 0.0237	$ 0	$ 0.0038	$ 0
Ruby/Hugemem	0	$ 0.0327	$ 0	$ 0.0038	$ 0
Owens/CPU	313,704	$ 0.0209	$ 6,556	$ 0.0075	$ 2,353
Owens/GPU	0	$ 0.6050	$ 0	$ -	$ -
Pitzer/CPU	1,814	$ 0.0257	$ 47	$ 0.0075	$ 14
Pitzer/GPU	0	$ 0.8130	$ 0	$ -	$ -
Subsidized Usage (<10K RU's per Project)	-			$ (0.0750)	$ -
Total High Performance Computing			**$ 7,092**		**$ 2,444**
Storage	TB-months				
Project	-	$ 16.96	$ -	$ -	$ -
Tape	-	$ 1.95	$ -	$ -	$ -
Total Storage			**$ -**		**$ -**
Grand Total Usage			**$ 7,092**		**$ 2,444**
				Total Savings	**$ 4,648**

Compute Services

No Charge for Storage

Academic Fee Structure

Savings

Please complete the OSC Client Survey at:

https://www.osc.edu/survey

SUG

April 17, 2019