2023 Oak Ridge Leadership Computing Facility User Survey

Findings and Recommendations

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Executive Summary

In an effort to promote continual improvement at the Oak Ridge Leadership Computing Facility (OLCF), users were sent a survey soliciting their feedback regarding their experience as a user of the facilities and support services.

Respondents

At the end of the seven-week survey period, 786 users completed or partially completed the survey out of 1,508 possible respondents, giving an overall response rate of 52.1%. Respondents' projects were supported by Director's Discretion (35%), ECP (37%), INCITE (36%), and ALCC (18%) allocations.

Findings Highlights

Overall Evaluation

The proportions of all respondents satisfied or very satisfied with OLCF resources/services ranged from 82% to 100% for the five "overall" evaluation items. Specifically, ratings for these five major categories of resources/services were a) *OLCF* (94%), b) *Compute Resources* (92%), c) *Data Resources* (87%), d) *OLCF Support* (90%), and e) *OLCF Services* (90%). Overall, these ratings still reflect a generally high satisfaction among users. When "All" respondents are considered as a group, all items were rated as either *satisfied* or *very satisfied* by 82% or more of users.

Thematic analysis of open-ended comments identified *Compute power/HPC resources (scale, performance, speed, hardware, architecture)* (50%) and *Staff support responsiveness/expert knowledge and/or help desk/ticketing* (36%) as the most valued OLCF qualities.

The table below indicates satisfaction (*satisfied* or *very satisfied*) ratings. The color scale indicates the relative magnitude of cell values: high-medium-low = green-yellow-red. Examination of the table below suggests that **satisfaction was highest** (across respondent types) for *Data Liaisons* (100%), *Training* (97%), *Projects and Accounts* (96%), *User Assistance* (95%), *Issue Response* (95%), and *Andes* (95%); while the **lowest ratings** were reported for *Frontier* (82%) and *Orion* (86%).

High rating	Medium rating	Low rating

		PI Status		Project Allocation				Length of Time as an OLCF User		
	All	PI	Non-PI	INCITE	DD	ALCC	ECP	Less than 1 Year	1 – 2 Years	Greater than 2 Years
Max N responding:	763	110	653	276*	263*	139*	287*	180	149	434
OLCF	94%	96%	94%	94%	96%	96%	94%	91%	93%	96%
Compute Resources	92%	97%	91%	89%	96%	93%	92%	89%	87%	95%
Andes	95%	94%	95%	94%	95%	96%	100%	93%	90%	97%
Summit	94%	98%	94%	94%	95%	95%	94%	85%	96%	97%
Frontier	82%	86%	81%	78%	86%	83%	81%	85%	72%	83%
Data Resources	87%	86%	88%	86%	88%	93%	84%	83%	89%	88%
Data Transfer Nodes	88%	82%	89%	81%	92%	89%	81%	77%	94%	89%
HPSS	94%	95%	94%	94%	93%	91%	95%	75%	100%	96%
Alpine GPFS Scratch Filesystem	94%	92%	94%	94%	93%	97%	93%	91%	93%	95%
Orion Lustre Scratch Filesystem	86%	82%	87%	86%	85%	95%	85%	92%	78%	86%
OLCF Support	90%	95%	89%	91%	93%	92%	87%	86%	89%	92%
Projects and Accounts	96%	97%	95%	96%	94%	95%	96%	91%	98%	97%
User Assistance	95%	97%	94%	95%	96%	94%	94%	93%	99%	94%
INCITE Liaisons	94%	94%	93%	92%	95%	100%	91%	91%	96%	94%
Data Liaisons	100%	100%	100%	100%	100%	100%	100%	NA	100%	100%
Issue response	95%	99%	94%	95%	94%	96%	94%	94%	99%	94%
OLCF Services	90%	94%	90%	92%	92%	89%	85%	88%	93%	90%
myOLCF	92%	96%	90%	91%	92%	96%	87%	90%	88%	93%
Documentation	93%	97%	93%	92%	94%	96%	91%	90%	96%	93%
Website	90%	91%	90%	92%	89%	93%	89%	87%	85%	92%
Communications	93%	94%	93%	92%	94%	92%	92%	90%	94%	94%
Training	97%	97%	96%	97%	97%	100%	97%	86%	97%	99%
Min	**82%**	**82%**	**81%**	**78%**	**85%**	**83%**	**81%**	**75%**	**72%**	**83%**
Max	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**94%**	**100%**	**100%**

Note. The table above summarizes satisfaction (responses indicating satisfied or very satisfied) ratings. The color scale indicates the relative magnitude of cell values: high-medium-low values fill a green-yellow-red gradient. 23 users indicated they had not used any of the listed resources/services on the first page of the survey and therefore were not asked to provide ratings on overall items. *Some users are assigned to more than one project allocation.

OLCF Systems, Data Resources, and Compute Resources

Frontier, which became available to users in April 2023, was utilized by 54% of users; Summit was used by 76% of users, and Andes by 29% of users. Overall ratings for compute and data resources ranged from 82% (Frontier) to 95% (Andes) of users either satisfied or very satisfied. Users were also asked to rate four aspects of HPC compute and data resources that apply across systems, and were highly satisfied with *project disk space, bandwidth offered by the OLCF and sufficient notice of scheduled downtimes* (92%, 91%, and 91% satisfied respectively), but slightly less satisfied with *I/O performance* (87% satisfied).

Support Services

Users were asked to provide ratings of their satisfaction with support received from the wide variety of OLCF support and services available. Respondents reported the highest levels of satisfaction with *Data Liaisons* (100% satisfied), *Training* (97% Satisfied), *Project and Accounts* (96% satisfied), *User Assistance* (95% satisfied), and *Issue Response* (95% satisfied).

Communication with Users

93% of respondents were overall satisfied or very satisfied with how OLCF keeps them informed of changes, events, downtimes, and current issues.

Problem Resolution

Nearly three-quarters (74.1%) of respondents submitted between one and five queries to OLCF (via phone or email) in 2023. 95% of respondents were satisfied or very satisfied with OLCF's response to reported issues, with similarly high ratings for the *timeliness of responses to reported issues* (94% satisfied) and the *quality of technical advice given* (95% satisfied).

Website, myOLCF, and Documentation

51.9% of respondents indicated that they visited the OLCF website during 2023, while 45% used the myOLCF self-service portal and 55.6% used the Docs page. Respondents who visited the website or the myOLCF portal tended to visit these resources *less than once a month* (49.9% and 50.1% respectively). However, respondents who visited the OLCF Docs page tended to visit the page *once a month* or more frequently (*every day, twice a week, or once a week*; 76.3%). The highest rated aspect of the OLCF website was the *usefulness of content* (91% satisfied), while the lowest rated aspect was *search capabilities* (86% satisfied). The highest rated aspect of myOLCF was the *speed/responsiveness* of the application (91% satisfied), while the lowest rated aspect was the *design* (87% satisfied). The highest rated aspect of the OLCF Docs page was the *quality of the documentation* (93% satisfied), while the lowest rated aspect was *search capabilities* (88% satisfied).

Training

26% of respondents participated in training events or consulted training materials during 2023. 97% of all respondents were either *satisfied* or *very satisfied* with training overall. The highest rated specific aspects of OLCF training were *quality of the content of the training* and *usefulness of the online training archive* (both 96% satisfied), while the lowest rated aspect was *breadth of training events offered* (90% satisfied).

Workflow, Data Analysis, Visualization, and Publication

22.1% of respondents indicated they analyze most or all of their data at OLCF while 43.2% analyze most or all of their data elsewhere. 17.5% of respondents analyze about half of their data at OLCF and the other half elsewhere. When asked about the source of users' data, the largest proportion of users reported working with data that is primarily (most or all) sourced from OLCF jobs (59.4%).

59% of respondents indicated they plan on publishing the data generated from their studies and 41% of respondents do not plan on publishing their data. Respondents who do plan to publish their data were asked where they plan to publish their data. The majority of comments (58%) provided by these respondents referenced a *journal, scientific society, conference proceedings, or workshop*. Respondents who do not plan to publish their data were asked to explain. The top reason reported by respondents

for not publishing data was that their work *does not generate data, or data is used for unpublishable purposes like training/validation/testing/performance/software design* (32%).

16% of respondents indicated they use workflow management tools while 84% do not use these tools. The respondents who reported using workflow management software provided a wide variety of tools in their comments. Top reasons from users who indicated they do not use workflow management software were *no need/unnecessary/not relevant to current work* (45%) and *unfamiliar with tools and/or how to use them* (20%).

Respondents were also asked to provide their main data-related challenges. The top three data-related challenges reported by users were *Transferring/retrieving data, I/O, network* (46%), *Storage, purge policies, backup* (33%), and *Accessibility, sharing, permissions, security, compliance* (18%).

Summary of Recommendations

Recommendations offered here are based on examination of the relative satisfaction ratings, respondent reasons for dissatisfaction, and user recommendations for OLCF improvement. Note that since the satisfaction ratings across resources/services were relatively consistent and typically 90% or higher (with a few exceptions), recommendations for change are best found in the **expressed reasons** for user dissatisfaction in conjunction with their **suggestions for improvement**.

This year, many responses to open-ended questions noted issues with latency/lagging/bandwidth, tools/software/libraries/combability, performance issues, outages/downtimes, queue times/prioritization, and file systems. The two resources receiving the greatest number of follow-up comments after expressing dissatisfaction were Frontier (*N* = 52) and Summit (*N* = 25). The largest group of users reporting dissatisfaction with Frontier expressed discontent with job queue, prioritization, walltimes, and related policies. The second largest groups of users dissatisfied with Frontier reported being unhappy with performance issues and tools, software, and libraries/compatibility, compiling, and updates. Other frequent complaints from Frontier users were included the system having too much downtime and feeling the system was immature and buggy. Nearly half of the users expressing dissatisfaction with Summit cited discontent with tools, software, and libraries/compatibility, compiling, and updates while other frequent complaints related to Summit's architecture or job queue, prioritization, walltimes, and related policies. Although Summit received several follow-up comments from users who expressed dissatisfaction, 94% of users were either *satisfied* or *very satisfied* with the system.

Examination of Table 67. Summary of Overall Satisfaction with Aspects of OLCF by PI Status, Project Allocation, and Length of Time as an OLCF User suggests that the resources requiring the most attention include Frontier, the OLCF website, and data resources, specifically Data Transfer Nodes and Orion Lustre Scratch Filesystem. Another observation of potential interest to the OLCF is the tendency of newer OLCF users (1-2 years) being less satisfied with Frontier and Orion Lustre Scratch Filesystem (the lowest rated items across all items) than more experienced OLCF users (greater than two years). A similar observation is that users with less than one year of experience with the OLCF tended to be less satisfied with data resources, specifically Data Transfer Nodes and HPSS than users with more OLCF experience. Another noteworthy difference amongst satisfaction ratings is that PIs reported being more satisfied with Frontier than non-PIs, but less satisfied with data resources, specifically Data Transfer Nodes and Orion Lustre Scratch filesystem than non-PIs.

OLCF Evaluation

The following suggestions are offered with respect to the assessment of OLCF performance:

- Review questions that were added to the 2023 survey, to consider whether to make them permanent additions, revise them, or to swap them out for new questions next year, to continue probing specific areas of interest.
- Utilize the findings of the 2023 survey to make some minor adjustments to the 2024 survey.
- Maintain the survey at approximately its current length.
- Repeat the use of customized reminder emails, targeting both PIs and team members.
- Continue alerting the ORAU survey software support team in advance of distributing the survey.
- During annual survey refinement, highlight significant OLCF changes from the previous FY and planned/potential changes or rollouts in the upcoming FY, and ensure those areas are adequately probed by existing items in the survey.

Introduction

A survey was conducted to gather information from the users of the Oak Ridge Leadership Computing Facility (OLCF) at Oak Ridge National Laboratory (ORNL). The survey collected feedback about user needs, preferences, and experiences with OLCF and its support capabilities. Attitudes and opinions on the performance, availability, and possible improvements of OLCF resources/services were also solicited. The survey was created by the Assessment and Evaluation team within Oak Ridge Associated Universities (ORAU), in collaboration with OLCF staff. OLCF staff also provided email addresses and data on the characteristics of OLCF users.

This report first briefly describes the data collection and analysis procedures. It then presents findings with respect to user characteristics, patterns of OLCF resource use, and satisfaction ratings of OLCF resources/services. The report also provides some basic longitudinal comparisons of user responses from 2006 through 2023. Finally, recommendations for possible improvements are offered.

Data Collection and Analysis

Data Collection

The survey sampling frame was constituted by first collecting the names of individuals who had logged into an OLCF system between January 1, 2023, through September 30, 2023. OLCF staff and vendors, as well as individuals with invalid email addresses, were then removed from the list. Any users who did not have at least one project allocation categorized as INCITE, DD, ALCC, or ECP were also removed from the list, per guidance from OLCF indicating that additional project allocations were not intended for the annual user survey.

OLCF staff invited all OLCF users from this list to participate in the survey, which was hosted online beginning on October 9, 2023, and remained open for completion through November 27, 2023 (see Appendix B: Survey Administration Timeline and Appendix G: Survey). Since visitors to the OLCF website and others on OLCF distribution lists could access the survey, two additional users were identified and added to the user group after they had responded. 32 users were removed from the user group because their email addresses were unreachable at the time the survey was administered.

Overall, this process resulted in a sampling frame with 1,508 OLCF users. A total of 786 users completed or partially completed the survey, resulting in a response rate of 52.1%. Figure 16, within Appendix B: Survey Administration Timeline, highlights the value of each reminder email in increasing the response rate. Appendix A: Survey Invitations and Reminders provides the text of each reminder email. The reminders sent by Sheila Moore on October 25, 2023, and November 8, 2023, were particularly effective, resulting in response bursts each comprising approximately 20% of the total responses received. These reminders were specific to each project allocation and included user lists, so that OLCF was able to leverage the influence of PIs in encouraging their colleagues to respond. Based on this successful implementation, this reminder approach is recommended for future iterations of the survey.

The survey first asked respondents about their experience and patterns of use with OLCF resources/services, and then asked for their satisfaction with resources/services in the following main categories (bold) and subcategories (Appendix G: Survey):

OLCF (Overall)

OLCF Computing Resources

- Andes
- Summit
- Frontier

OLCF Data Resources

- Data Transfer Nodes (DTNs)
- HPSS
- Alpine GPFS Scratch Filesystem
- Orion Lustre Scratch Filesystem

OLCF Support (problem resolution and support from OLCF Staff) and OLCF Services

- Overall: OLCF Support
- Overall: OLCF Services
- Interactions with OLCF Staff Groups (Projects and Accounts, User Assistance, INCITE Liaisons, Data Liaisons)
- Response to reported issues
- OLCF website
- myOLCF Self-Service Portal
- OLCF documentation
- Communication
- OLCF training events and materials
- Data analysis, visualization, publication, and workflow

Data Analysis

The findings section typically presents results summarized numerically that report respondent levels of satisfaction. This is followed by a verbal summary of the open-ended comments from individuals who indicated being dissatisfied (via their scaled reply) with a resource or service (note: not all dissatisfied individuals supplied open-ended comments).

As noted, the survey assessed satisfaction with OLCF resources/services using a 5-point scale, from *very dissatisfied* (1) to *very satisfied* (5). These **closed-ended responses** were summarized using frequency distributions, proportions, means, and standard deviations. The proportion of respondents indicating either a 4 (s*atisfied*) or 5 *(very satisfied)* on an item was also typically reported as %Sat to provide a summary measure. This measure was also used to indicate the relative satisfaction with resources/services within categories. Respondents who were *very dissatisfied* or *dissatisfied* with OLCF resources/services were asked to provide comments explaining their dissatisfaction (see below).

In order to better understand the types of OLCF users and how needs and preferences varied, closed-ended responses were frequently broken out by **principal investigator** (PI) status, **project allocation**, and **length of time as an OLCF user**. Respondents were categorized according to the following project allocations:

INCITE The Department of Energy's Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program aims to accelerate scientific discoveries and technological innovations by awarding, on a competitive basis, time on supercomputers to researchers with large-scale, computationally intensive projects that address "grand challenges" in science and engineering;

DD The National Center for Computational Sciences' Director's Discretion (DD) program is designed to give new researchers an opportunity to carry out a program of scalability and productivity enhancements to their scientific codes;

ALCC The Advanced Scientific Computing Research (ASCR) Leadership Computing Challenge (ALCC) program is open to scientists from the research community in national laboratories, academia and industry, and allocates up to 20% of the computational resources at National Energy Research Scientific Computing Center (NERSC) and the Leadership Computing Facilities at Argonne and Oak Ridge for special situations of interest to the Department's energy mission, with an emphasis on high-risk, high-payoff simulations; and

ECP The Exascale Computing Project (ECP), which is near completion in 2024, is focused on accelerating the delivery of a capable exascale computing ecosystem that delivers 50 times more computational science and data analytic application power than possible with DOE HPC systems such as Titan (ORNL) and Sequoia (LLNL). The ECP is a collaborative effort of two U.S. Department of Energy organizations – the Office of Science (DOE-SC) and the National Nuclear Security Administration (NNSA).

Finally, tables and figures will include one or more of the following data elements:

- *N* = Total number of respondents who answered the question
- *n* = Total number of respondents who answered the specific item in the question or who provided a specific response
- *M* = the arithmetic average of respondents' scores from 1 (*very dissatisfied)* to 5 (*very satisfied)*
- *SD* = Standard deviation (indicating average deviation from the mean)
- *Var* = Variance, the square of the standard deviation, or the deviation from the mean in squared units; this statistic is included only in the overall summary tables, because it is reported by OLCF to the Department of Energy (DOE)
- *%Sat* = percentage of respondents indicating 4 (*satisfied*) or 5 (*very satisfied*) on satisfaction scales
- *%Agree* = percentage of respondents indicating 4 (*agree*) or 5 (*strongly agree*) on agreement scales, applicable only to the myOLCF Self-Service Portal

Color coding has been used in the report tables as below, unless otherwise noted:

- Cell values in **green** are the highest *%Sat* values in the column
- Cell values in **red** are the lowest *%Sat* values in the column

As noted above, **open-ended responses** were typically information provided by respondents who were dissatisfied with a service/resource (i.e., responded as *dissatisfied* or *very dissatisfied* on the satisfaction scale); other questions were open-ended invitations for suggestions or future needs. All open-ended responses were examined using categorical content analysis with complete thoughts in responses as the unit of analysis (note that percentages of response categories may add up to more than 100% when respondents provided multiple complete thoughts in a response).[1] Complete thoughts were sorted into categories for the purposes of counting, comparisons, and other forms of analysis.

Some response content categories were derived *a priori* from survey questions or OLCF website categories (e.g., *Summit* or *filesystem*). Other categories were developed inductively through an iterative process of grouping and regrouping similar content units (e.g., *queue time, turnaround time, and scheduling policy* or *environment and tools*). Subcategories were elaborated as new relevant concepts or useful distinctions were identified and are organized within major categories of closely related concepts. Table 1 provides a summary of major categories and subcategories used to organize open-ended replies. These form a foundation upon which analysis of all comments is built, with variations as needed to accommodate differences in the focus of specific questions and year-to-year differences in users' specific and technical responses.

Examples of the most prominent themes are provided in the Findings, and all open-ended responses are provided in one of Appendices C-F.

[1] Complete thoughts (CTs) were simply response text that could stand alone as a meaningful reply to survey questions. CTs were not limited to any specific grammatical unit and could vary from a single word, to a phrase, sentence fragment or complete sentence.

Table 1. Major Categories and Subcategories Used to Organize Open-Ended Responses

Hardware/Computing Resources
HPC resources
Systems (Andes, Summit, Frontier, etc.)
Management, infrastructure, and maintenance
Performance and speed
Stability/reliability and downtime
Running Jobs
Workflow and resources
Scheduling policy
Queue and turnaround
Wall/run time
Data Management
Data retention
Data storage
Data transfer and I/O
Data volumes
Reliability and data integrity
Filesystems
Software
Software stack/tools/modules/environment
Libraries
Updates and new versions
Specialized tools
User Support
Documentation
Staff and teams
myOLCF and allocation/usage management
Website
Support and ticketing
Communication
Example Additional Categories
Satisfaction
Miscellaneous
Unclear response
Survey suggestions
Accounts, security, and access

Findings

Respondents

76% of respondents were **affiliated with** either a university or a DOE/Government facility (Figure 1).

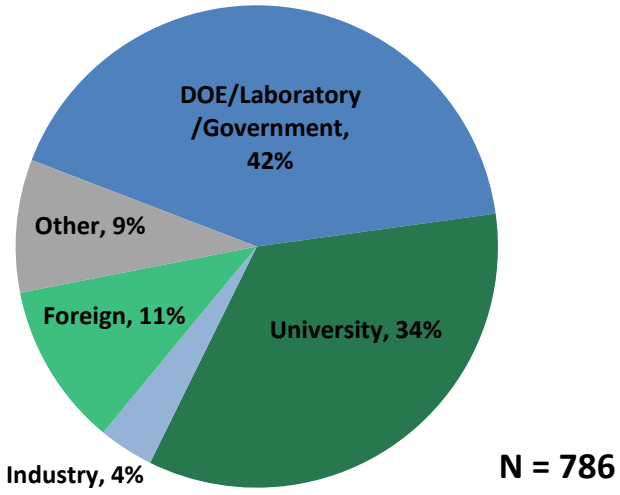

Figure 1. Respondent occupational affiliation
Note: Percentages may not add up precisely to 100% due to rounding in each category.

The distribution of OLCF users across **project allocations** is shown in Figure 2 and in detail in Table 2. There are no statistically significant differences between the respondent pool and the user pool for DD or INCITE; results of chi-square testing were not statistically significant at the $p < 0.01$ level. Significant differences ($p < 0.01$) were observed for ECP and ALCC. Fewer of the survey respondents had ECP project allocations than would be expected, and more of the respondents had ALCC allocations than would be expected. It is therefore possible that some level of bias exists in the findings due to the self-selection of survey respondents. To account for this, each allocation is reported separately in tables throughout this report.

Note that the table categories are not exclusive (e.g., the INCITE category includes individuals assigned to INCITE, but who may also have been assigned to DD, ALCC, or ECP projects). Note that 64% of respondents were assigned by OLCF to a single project allocation (i.e., assignment to only INCITE, only DD, only ALCC, or only ECP).

Table 2. Project Allocations by OLCF Users and Survey Respondents

	OLCF Users (*N* = 1,508)		Survey Respondents (*N* = 786)	
	Percentage	***n***	**Percentage**	***n***
ECP	41%	617	37%	293
INCITE	34%	506	36%	282
DD	35%	535	35%	272
ALCC	15%	224	18%	143

Note: Percentages add to more than 100% as users are often affiliated with multiple projects.

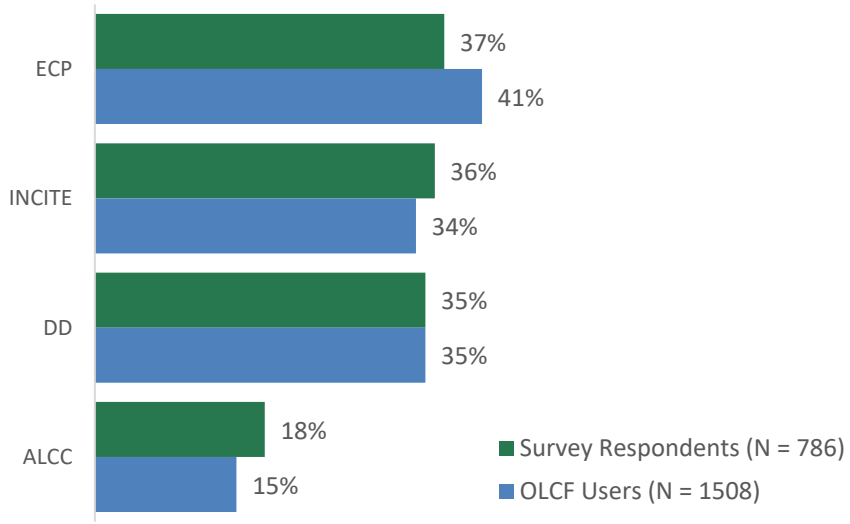

Figure 2. Project allocations for OLCF users and survey respondents
Note: Percentages add to more than 100% as users are often affiliated with multiple projects.

The proportions of OLCF users and of 2023 survey respondents with PI status on at least one project are displayed in Figure 3. The survey respondent pool slightly over-represents the PIs. Throughout this report, tables separately report findings from respondents with PI status from those without PI status.

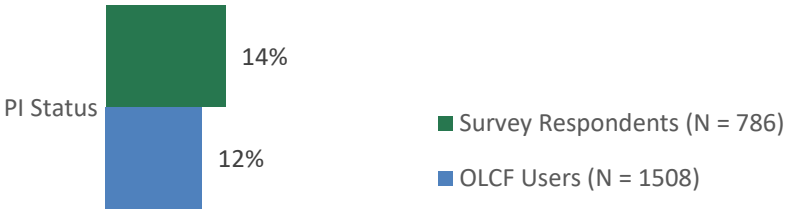

Figure 3. PI Status for OLCF users and survey respondents

Resource Utilization

Overall experience using the OLCF was dominated by those who had more than 2 years of experience using the facility (56%), with a nearly even split among the remainder (Figure 4).

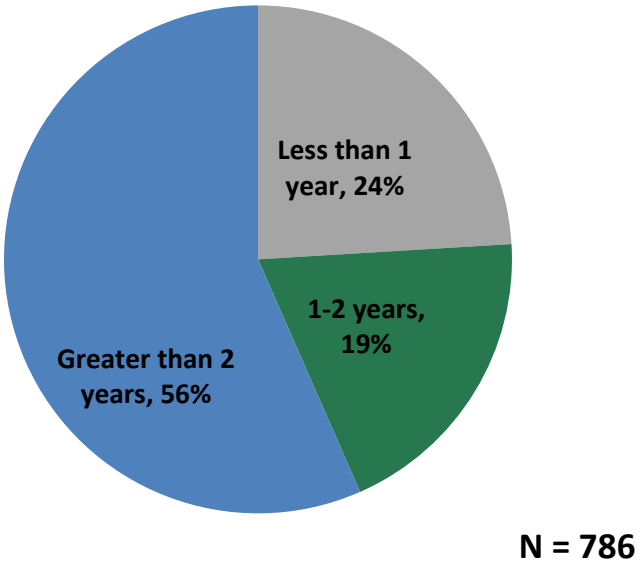

Figure 4. Experience using the OLCF
Note: Percentages may not add up precisely to 100% due to rounding in each category.

Respondents were asked to indicate **which OLCF HPC resources they utilized** during the 2023 calendar year along with **OLCF support services.** Across all respondents, the largest proportion of respondents indicated using Summit (76% of users); HPSS was utilized by the smallest proportion (18% of users). Only 3% of survey respondents indicated that they had not used any of the listed resources (Table 3 and Table 4).

The sections below report respondent **satisfaction ratings for OLCF resources/services** in four main categories (Overall Satisfaction, Computing Resources, Data Resources, and OLCF Support and Services) and their subcategories.

Table 3. HPC and Support Resources Used by PI status, Project Allocation, and Overall Totals

	PI Status		INCITE		DD		ALCC		ECP		Total	
	n	% Users	*n*	% Users	*n*	% Users	*n*	% Users	*n*	% Users	*n*	% Users
Andes	37	16%	110	47%	113	49%	50	22%	37	16%	231	29%
Summit	85	14%	236	40%	206	35%	112	19%	223	37%	595	76%
Frontier	72	17%	154	36%	117	28%	68	16%	229	54%	423	54%
Data Transfer Nodes	39	17%	109	47%	105	46%	55	24%	53	23%	229	29%
HPSS	37	26%	69	48%	72	50%	36	25%	38	26%	144	18%
Alpine GPFS	52	17%	143	46%	127	41%	65	21%	108	35%	311	40%
Orion Lustre	39	19%	89	43%	73	35%	38	18%	101	48%	208	27%
myOLCF Self-Service Portal	74	21%	128	36%	138	39%	73	21%	144	41%	354	45%
Documentation	70	16%	159	36%	161	37%	80	18%	173	39%	437	56%
OLCF Website	68	17%	141	34%	150	37%	78	19%	158	39%	408	52%
I have not used any of the listed resources/services	3	13%	6	25%	9	38%	4	17%	6	25%	23	3%

Note: Users add up to more than 100% because some used more than one system.

Table 4. HPC and Support Resources Used by Length of Time as an OLCF User

	Less than 1 Year		1 – 2 Years		Greater than 2 Years	
	n	% Users	*n*	% Users	*n*	% Users
Andes	42	18%	46	20%	143	62%
Summit	116	19%	115	19%	364	61%
Frontier	83	20%	68	16%	272	64%
Data Transfer Nodes	36	16%	35	15%	158	69%
HPSS	12	8%	17	12%	115	79%
Alpine GPFS	48	15%	46	15%	217	70%
Orion Lustre	28	13%	25	12%	155	74%
myOLCF Self-Service Portal	56	16%	52	15%	246	69%
Documentation	74	17%	78	18%	285	65%
OLCF Website	77	19%	65	16%	266	65%
I have not used any of the listed resources/services	10	42%	3	13%	10	42%

Note: Users add up to more than 100% because some used more than one system.

Overall Satisfaction

Users were asked to rate their **"overall" satisfaction with the OLCF**, and then with OLCF Compute Resources, Data Resources, Support, and Services. In these responses, individuals were not asked to consider the specific resources/services in a category, but rather report their general sense of satisfaction with the category. More than half of respondents reported being *very satisfied* in this overall sense for all categories of resources/services (Figure 5, which displays overall rating categories from *very satisfied* on the left to *very dissatisfied* on the right).

Table 5 summarizes descriptive statistics for these overall satisfaction ratings for all respondents and broken down by PI status, while Table 6 reports satisfaction statistics across project allocations, and Table 7 reports satisfaction statistics by length of time as an OLCF user. The tables also include ratings of **specific compute resources** (i.e., Summit, Andes, and Frontier), **data resources** (i.e., Data Transfer Nodes, HPSS, Alpine GPFS, and Orion Lustre), and both **support staff** and **support services** (i.e., support received via user assistance, accounts, INCITE Liaisons, Data Liaisons, as well as the myOLCF Self-Service Portal, OLCF website, communications, training events and documentation, and problem resolution). Across these 22 key items, which include the five "overall" ratings, and considering the entire group of "All" respondents, the tables show that:

- *%Sat* ranged from 82% to 100%,
- Mean satisfaction ratings ranged from 4.19 to 4.69, and
- SDs ranged from 0.48 to 0.82.

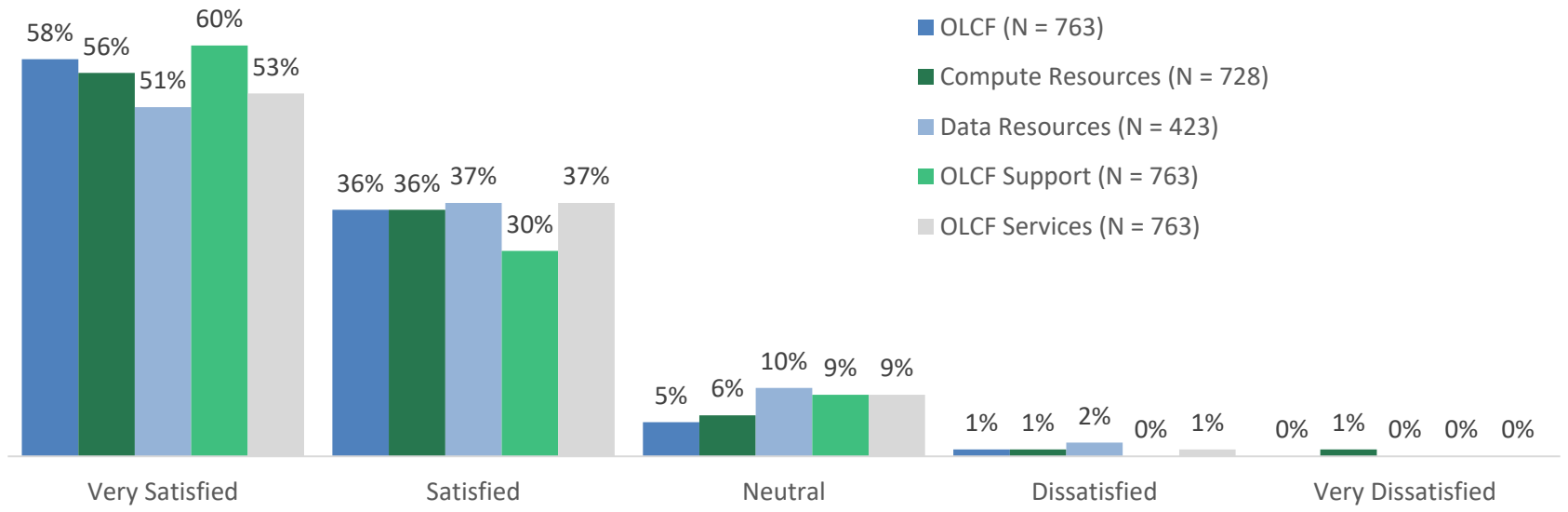

Figure 5. "Overall" satisfaction with OLCF and its major resources/services
Note: Percentages may not add up precisely to 100% due to rounding in each category.

Table 5. Overall Satisfaction with OLCF and Its Major Resources/Services by PI Status and Totals

	PI Status					Non-PI Status					Total				
	N	*M*	*Var.*	*SD*	*%Sat*	*N*	*M*	*Var.*	*SD*	*%Sat*	*N*	*M*	*Var.*	*SD*	*%Sat*
OLCF	110	4.70	0.32	0.57	96%	653	4.49	0.41	0.64	94%	763	4.52	0.40	0.63	94%
Compute Resources	105	4.61	0.39	0.63	97%	623	4.43	0.53	0.72	91%	728	4.46	0.51	0.71	92%
Andes	35	4.57	0.37	0.61	94%	185	4.57	0.39	0.62	95%	220	4.57	0.38	0.62	95%
Summit	82	4.66	0.28	0.53	98%	504	4.49	0.44	0.66	94%	586	4.52	0.42	0.65	94%
Frontier	70	4.23	0.58	0.76	86%	342	4.18	0.68	0.83	81%	412	4.19	0.66	0.82	82%
Data Resources	70	4.37	0.64	0.80	86%	353	4.35	0.58	0.76	88%	423	4.36	0.59	0.77	87%
Data Transfer Nodes	39	4.41	0.62	0.79	82%	187	4.36	0.64	0.80	89%	226	4.37	0.63	0.80	88%
HPSS	37	4.57	0.47	0.69	95%	103	4.44	0.41	0.64	94%	140	4.47	0.42	0.65	94%
Alpine GPFS Scratch Filesystem	51	4.45	0.65	0.81	92%	253	4.50	0.38	0.61	94%	304	4.49	0.42	0.65	94%
Orion Lustre Scratch Filesystem	38	4.26	0.69	0.83	82%	160	4.32	0.62	0.79	87%	198	4.31	0.63	0.79	86%
OLCF Support	110	4.65	0.34	0.58	95%	653	4.47	0.51	0.72	89%	763	4.49	0.49	0.70	90%
Projects and Accounts	88	4.75	0.26	0.51	97%	302	4.68	0.37	0.61	95%	390	4.69	0.35	0.59	96%
User Assistance	89	4.73	0.27	0.52	97%	352	4.63	0.48	0.69	94%	441	4.65	0.44	0.66	95%
INCITE Liaisons	34	4.71	0.34	0.58	94%	137	4.49	0.71	0.84	93%	171	4.53	0.64	0.80	94%
Data Liaisons	10	4.70	0.23	0.48	100%	17	4.65	0.24	0.49	100%	27	4.67	0.23	0.48	100%
Issue response	79	4.68	0.24	0.49	99%	338	4.58	0.46	0.68	94%	417	4.60	0.42	0.65	95%
OLCF Services	110	4.55	0.41	0.64	94%	653	4.41	0.48	0.69	90%	763	4.43	0.47	0.68	90%
myOLCF	72	4.60	0.33	0.57	96%	272	4.39	0.50	0.70	90%	344	4.43	0.47	0.68	92%
Documentation	68	4.59	0.31	0.55	97%	361	4.47	0.41	0.64	93%	429	4.49	0.40	0.63	93%
Website	65	4.52	0.44	0.66	91%	315	4.36	0.45	0.67	90%	380	4.38	0.45	0.67	90%
Communications	110	4.63	0.36	0.60	94%	647	4.48	0.39	0.62	93%	757	4.50	0.39	0.62	93%
Training	38	4.58	0.30	0.55	97%	167	4.49	0.32	0.57	96%	205	4.50	0.32	0.57	97%
Min	**10**	**4.23**	**0.23**	**0.48**	**82%**	**17**	**4.18**	**0.24**	**0.49**	**81%**	**27**	**4.19**	**0.23**	**0.48**	**82%**
Max	**110**	**4.75**	**0.69**	**0.83**	**100%**	**653**	**4.68**	**0.71**	**0.84**	**100%**	**763**	**4.69**	**0.66**	**0.82**	**100%**

Table 6. Overall Satisfaction with OLCF and Its Major Resources/Services by Project Allocation

	INCITE					DD					ALCC					ECP				
	N	*M*	*Var.*	*SD*	*N*	*M*	*Var.*	*SD*	*N*	*M*	*Var.*	*SD*	*N*	*M*	*Var.*	*SD*	*N*	*M*	*Var.*	*SD*
OLCF	276	4.51	0.44	0.66	94%	263	4.56	0.35	0.59	96%	139	4.55	0.36	0.60	96%	287	4.49	0.45	0.67	94%
Compute Resources	268	4.43	0.61	0.78	89%	251	4.51	0.39	0.62	96%	132	4.53	0.46	0.68	93%	276	4.42	0.55	0.74	92%
Andes	104	4.56	0.40	0.64	94%	107	4.54	0.38	0.62	95%	47	4.57	0.34	0.58	96%	32	4.56	0.25	0.50	100%
Summit	231	4.51	0.44	0.67	94%	201	4.53	0.38	0.62	95%	110	4.57	0.43	0.66	95%	221	4.50	0.43	0.66	94%
Frontier	149	4.12	0.70	0.84	78%	111	4.24	0.51	0.72	86%	66	4.32	0.62	0.79	83%	225	4.16	0.74	0.86	81%
Data Resources	177	4.33	0.61	0.78	86%	169	4.37	0.62	0.78	88%	86	4.45	0.44	0.66	93%	146	4.23	0.69	0.83	84%
Data Transfer Nodes	108	4.19	0.86	0.93	81%	102	4.44	0.49	0.70	92%	55	4.44	0.47	0.69	89%	52	4.27	0.79	0.89	81%
HPSS	69	4.43	0.43	0.65	94%	69	4.39	0.51	0.71	93%	35	4.46	0.55	0.74	91%	37	4.54	0.48	0.69	95%
Alpine GPFS Scratch Filesystem	139	4.47	0.41	0.64	94%	123	4.49	0.51	0.72	93%	65	4.51	0.38	0.62	97%	105	4.41	0.38	0.62	93%
Orion Lustre Scratch Filesystem	83	4.29	0.60	0.77	86%	66	4.29	0.58	0.76	85%	38	4.50	0.36	0.60	95%	98	4.22	0.67	0.82	85%
OLCF Support	276	4.50	0.48	0.70	91%	263	4.54	0.39	0.63	93%	139	4.57	0.44	0.66	92%	287	4.42	0.59	0.77	87%
Projects and Accounts	135	4.67	0.42	0.65	96%	161	4.66	0.44	0.66	94%	78	4.71	0.37	0.61	95%	146	4.62	0.35	0.59	96%
User Assistance	165	4.65	0.42	0.65	95%	170	4.69	0.40	0.63	96%	84	4.67	0.44	0.66	94%	170	4.55	0.52	0.72	94%
INCITE Liaisons	145	4.50	0.71	0.84	92%	58	4.60	0.70	0.84	95%	17	4.76	0.19	0.44	100%	33	4.48	0.76	0.87	91%
Data Liaisons	14	4.71	0.22	0.47	100%	15	4.67	0.24	0.49	100%	4	4.75	0.25	0.50	100%	8	4.38	0.27	0.52	100%
Issue response	156	4.60	0.35	0.59	95%	158	4.65	0.34	0.59	94%	77	4.65	0.31	0.56	96%	168	4.51	0.57	0.76	94%
OLCF Services	276	4.46	0.43	0.66	92%	263	4.43	0.44	0.66	92%	139	4.44	0.52	0.72	89%	287	4.36	0.56	0.75	85%
myOLCF	124	4.43	0.46	0.68	91%	132	4.48	0.45	0.67	92%	72	4.56	0.33	0.58	96%	142	4.27	0.58	0.76	87%
Documentation	156	4.44	0.44	0.66	92%	157	4.48	0.39	0.63	94%	79	4.57	0.33	0.57	96%	171	4.46	0.44	0.66	91%
Website	132	4.41	0.41	0.64	92%	138	4.40	0.46	0.68	89%	73	4.45	0.39	0.62	93%	147	4.33	0.47	0.68	89%
Communications	274	4.48	0.42	0.65	92%	259	4.55	0.36	0.60	94%	137	4.47	0.41	0.64	92%	286	4.44	0.40	0.63	92%
Training	68	4.60	0.30	0.55	97%	86	4.45	0.32	0.57	97%	33	4.67	0.23	0.48	100%	89	4.49	0.32	0.57	97%
Min	**14**	**4.12**	**0.22**	**0.47**	**78%**	**15**	**4.24**	**0.24**	**0.49**	**85%**	**4**	**4.32**	**0.19**	**0.44**	**83%**	**8**	**4.16**	**0.25**	**0.50**	**81%**
Max	**276**	**4.71**	**0.86**	**0.93**	**100%**	**263**	**4.69**	**0.70**	**0.84**	**100%**	**139**	**4.76**	**0.62**	**0.79**	**100%**	**287**	**4.62**	**0.79**	**0.89**	**100%**

Table 7. Overall Satisfaction with OLCF and Its Major Resources/Services by Length of Time as an OLCF User

	Less than 1 Year					1 – 2 Years					Greater than 2 Years				
	N	***M***	***Var.***	***SD***	***%Sat***	***N***	***M***	***Var.***	***SD***	***%Sat***	***N***	***M***	***Var.***	***SD***	***%Sat***
OLCF	180	4.39	0.44	0.66	91%	149	4.42	0.43	0.66	93%	434	4.61	0.35	0.60	96%
Compute Resources	168	4.36	0.59	0.77	89%	140	4.30	0.64	0.80	87%	420	4.55	0.42	0.64	95%
Andes	40	4.43	0.51	0.71	93%	42	4.57	0.45	0.67	90%	138	4.61	0.33	0.57	97%
Summit	114	4.26	0.67	0.82	85%	112	4.52	0.41	0.64	96%	360	4.60	0.32	0.56	97%
Frontier	80	4.26	0.55	0.74	85%	65	4.02	0.73	0.86	72%	267	4.21	0.68	0.82	83%
Data Resources	72	4.17	0.65	0.80	83%	73	4.42	0.53	0.72	89%	278	4.39	0.58	0.76	88%
Data Transfer Nodes	35	4.00	0.71	0.84	77%	34	4.56	0.38	0.61	94%	157	4.41	0.64	0.80	89%
HPSS	12	4.00	0.55	0.74	75%	16	4.63	0.25	0.50	100%	112	4.50	0.41	0.64	96%
Alpine GPFS Scratch Filesystem	47	4.38	0.50	0.71	91%	44	4.55	0.39	0.63	93%	213	4.50	0.41	0.64	95%
Orion Lustre Scratch Filesystem	26	4.35	0.40	0.63	92%	23	4.22	0.81	0.90	78%	149	4.32	0.65	0.81	86%
OLCF Support	180	4.37	0.54	0.73	86%	149	4.43	0.54	0.74	89%	434	4.57	0.44	0.67	92%
Projects and Accounts	89	4.63	0.53	0.73	91%	64	4.70	0.24	0.49	98%	237	4.71	0.31	0.55	97%
User Assistance	99	4.61	0.57	0.75	93%	75	4.73	0.28	0.53	99%	267	4.64	0.43	0.66	94%
INCITE Liaisons	35	4.40	0.72	0.85	91%	27	4.67	0.31	0.55	96%	109	4.54	0.70	0.83	94%
Data Liaisons	0	NA	NA	NA	NA	4	4.75	0.25	0.50	100%	23	4.65	0.24	0.49	100%
Issue response	84	4.60	0.36	0.60	94%	75	4.64	0.31	0.56	99%	258	4.59	0.48	0.69	94%
OLCF Services	180	4.32	0.53	0.73	88%	149	4.43	0.38	0.62	93%	434	4.48	0.47	0.68	90%
myOLCF	52	4.33	0.50	0.71	90%	50	4.42	0.49	0.70	88%	242	4.46	0.46	0.68	93%
Documentation	73	4.32	0.47	0.68	90%	76	4.58	0.33	0.57	96%	280	4.51	0.39	0.62	93%
Website	69	4.28	0.53	0.73	87%	59	4.31	0.53	0.73	85%	252	4.43	0.41	0.64	92%
Communications	177	4.40	0.44	0.67	90%	148	4.55	0.37	0.61	94%	432	4.53	0.37	0.60	94%
Training	37	4.27	0.48	0.69	86%	35	4.46	0.31	0.56	97%	133	4.58	0.26	0.51	99%
Min	**0**	**4.00**	**0.36**	**0.60**	**75%**	**4**	**4.02**	**0.24**	**0.49**	**72%**	**23**	**4.21**	**0.24**	**0.49**	**83%**
Max	**180**	**4.63**	**0.72**	**0.85**	**94%**	**149**	**4.75**	**0.81**	**0.90**	**100%**	**434**	**4.71**	**0.70**	**0.83**	**100%**

Twenty-six respondents reported **dissatisfaction with the OLCF overall or with any of its major resources/services,** and 24 of these individuals provided explanations. User responses cited dissatisfaction with file systems, compute resources, OLCF support, myOLCF, documentation, data transfer, downtime, and allocation/resource issues. Illustrative examples include:

> *"Alpine is getting slow."*
>
> *"The Orion filesystem is very frustrating."*
>
> *"Andes, Summit, and Frontier users on login nodes experience heavy lag and slowdowns all the time."*
>
> *"Frontier is very frustrating to work with. OLCF staff is very responsive, yet in the end I need to find my own solutions to issues."*
>
> *"The staff deleted my account since they thought it was inactive, while in fact I was using it regularly, they then could not solve this and I have to go through the entire vetting procedure again, taking another month of my time."*
>
> *"The documentation is really good, BUT the myOLCF portal is extremely limited and feels more like an excuse than actual control panel."*
>
> *"I tried to implement parallel scripting of paraview and visit using GPU but there weren't enough resources or tutorial and the one that I found were not working."*
>
> *"Data Transfer from Orion to Alpine via Globus is laggy, not very user-friendly and most a hassle. Also, the Endpoints regularly "broke" and crashed data transfers."*
>
> *"Several times the Frontier system and the Orion Data resources have been down."*
>
> *"In bringing our ECP project to a close, we experienced great difficulty getting the resources we needed. We had planned to use the reservation system to gather the necessary resources for a series of tests and our final demonstration, as per the agreement between ECP and DOE, so we were placed in a difficult situation when OLCF did not grant reservations beyond our earliest scaling tests despite our explanations and appeals."*

All open-ended responses are provided in Appendix D: User Dissatisfaction Explanations.

Finally, respondents described what they perceived to be "**the best qualities of OLCF**." Responses praised multiple OLCF elements. Examples follow:

> *"The OLCF clearly demonstrates that it cares about its users. Top notch documentation, service, training, help. At every turn, the OLCF makes us feel heard and taken care of. Combining cutting edge compute with an even more impressive human element. I hope that more scientific research is able to go through the OLCF and that research teams can benefit from the economies of scale that it offers."*
>
> *"The OLCF's leadership class computing resources are crucial to being able to conduct large-scale DFT calculations on technologically important material science problems. One key quality of OLCF is the good availability of the computing resources, and high-quality technical support for troubleshooting and application performance related issues."*
>
> *"World-class supercomputing resources, exceptional support staff, and a commitment to scientific advancement."*
>
> *"As incredible as the systems themselves are, the staff is far and away the most valuable resource at the OLCF. From leadership to liaisons to support folks to admin staff, everyone is always a great pleasure to work with and has enabled our group to take on problems we would not normally dream of attempting elsewhere."*
>
> *"OLCF enables leadership scale high-fidelity simulations that are not possible on any other systems to improve our capabilities to analyze and design next generation aerospace vehicles. The hardware, software, and systems are the best and latest in the world, pushing the frontiers of HPC for the future."*
>
> *"Top-flight computational power, reasonable queue times for the majority of the year, excellent documentation, excellent uptime."*
>
> *"The user documentation of the OLCF systems (Summit, Frontier etc.) is superb. The module environment on all systems is stable and dependable. The scheduler is reliable. The debug queue is indispensable. Having used many machines where these features are not prioritized, or even missing entirely, I have learned to appreciate them all the more. As a result, working with OLCF systems has been a dream."*
>
> *"I cannot say enough about the OLCF facility and staff. OLCF has been an integral part of my research activities for the past several years, and it has been invaluable in supporting my research. The types of calculations that I have been a part of (or that others that I collaborate with have executed) would not have been possible without the continued support of OLCF and the Department of Energy. Moreover, as we have encountered some difficulties resulting in node reboots during this past year on Frontier, the OLCF staff has been attentive and informative in helping us diagnose and remedy this issue. The support staff at OLCF is as world class as the hardware itself."*

Thematic analysis of user responses identified *Compute power/HPC resources (scale, performance, speed, hardware, architecture)* (50%) and *Staff support responsiveness/expert knowledge and/or help desk/ticketing* (36%) as the most valued qualities of the OLCF (Table 8; see Appendix C: Best Qualities of the OLCF for all responses by category; *N* = 543). Appreciation for the power and performance of the facilities has been expressed in user surveys across several years, as has the high frequency of positive references to the OLCF. These responses were re-examined, excluding individual responses that mentioned **only** computing performance as the best quality (removing 113 responses). The relative frequency of comments reported by this group (*N* = 430), excluding references to computing power/HPC resources is shown in the last column of Table 8. When the responses are examined in this way, *Staff support* (46%) and *Documentation, website information, and training* (22%) emerge as the best OLCF qualities. There is significant spread across other categories and variety in responses.

For example:

Staff support responsiveness/expert knowledge and/or help desk/ticketing	*"The help desk, always supportive. Thanks a lot!"* *"Quick response on support tickets."* *"Good people. Responsive support staff and also a range of experts who can provide useful training."* *"OLCF staff are the best HPC team in the world."*
Documentation, website information, and training	*"Excellent online documentation"* *"Good machines with great documentation."* *"Documentation for the systems"*
Availability/uptime	*"Resource availability"* *"Minimal downtime"* *"Availability of the computing facilities"*
Management/maintenance/facility efficiency/general services	*"System resources and professionalism in the management of the systems."* *"This is the best managed supercomputer in the US that I have ever worked with."* *"The organization and professional management of the computing resources is excellent."*
Environment and tools (software stack, libraries, visualization, etc.)	*"Your high quality, and relatively standardized, machine configuration and software ecosystem, that allow somewhat seamless transition from one system to the next."*

"A rich set of libraries is provided and they're usually very reliable."

"The access to very large scale computing resources is the primary benefit. I also appreciate the quality of the software stack available on OLCF systems."

Table 8. Best Qualities of OLCF (ordered by % of all respondents, high to low)

	All Responses (*N* = 543)	**Responses Excluding Computing Performance (*N* = 430)**
Compute power/HPC resources (scale, performance, speed, hardware, architecture)	50%	--
Staff support responsiveness/expert knowledge and/or help desk/ticketing	36%	46%
Documentation, website information, and training	17%	22%
Availability/uptime	10%	13%
Management/maintenance/facility efficiency/general services	9%	11%
Environment and tools (software stack, libraries, visualization, etc.)	7%	9%
Queue time, turnaround, allocations, and scheduling policy	6%	8%
Stability/reliability	5%	7%
Data storage/disk space	4%	5%
Supports open science, demanding research problems, broad user community	4%	5%
Accessibility	4%	5%
Communication	3%	4%
Ease of use	3%	4%
Summit	3%	4%
Frontier	3%	4%
General satisfaction	3%	3%
Data transfer, I/O, filesystem, networking	3%	3%
Early access systems, new systems, hackathons	2%	2%
Andes	0%	0%
Accounts management or new user setup	0%	0%
Criticisms or suggestions	1%	2%
Miscellaneous	1%	2%

Note: Percentages total to more than 100% because responses could mention more than one theme. Due to rounding, *Andes* (*n* = 2) and *Accounts management or new user setup* (*n* = 2) are displayed in the *All Responses* column as 0%. These response categories make up 0.4% of responses each without rounding (*N* = 543). In the *Responses Excluding Computing Performance* column, these response categories make up 0.5% of responses each without rounding (*N* = 430).

Compute and Data Resources

Respondents provided satisfaction ratings for several specific computing and data resources features:

- Sufficient notice of scheduled downtimes
- Sufficient project disk space
- Bandwidth offered by the OLCF
- I/O performance

Table 9 reports satisfaction for these features by PI status and overall, Table 10 reports ratings by project allocation, and Table 11 reports ratings by length of time as an OLCF user. The highest satisfaction rating (all respondents) was for sufficient disk space (92%). The lowest overall mean rating was for I/O performance (87% satisfied).

25 respondents indicated **dissatisfaction with one or more aspects of the OLCF HPC resources,** and 20 of these individuals provided explanations for their dissatisfaction. Several complaints related to latency, file system stability, and/or bandwidth. Other cited issues including downtime and associated communications; disk space and purge policies; and performance issues. Select examples are provided below, and all open-ended responses are provided in Appendix D: User Dissatisfaction Explanations.

> *"Frontier often goes down with no warning or is left running when there was an advertised downtime. The /ccs/proj filesystem is excruciatingly slow on Frontier."*
>
> *"I/O is not very good this year."*
>
> *"The alpine filesystem was often very slow to respond to commands like cd and ls."*
>
> *"Transfer of data from Alpine to Orion is progressing extremely slow."*
>
> *"Always can use more space. File transfers can be an issue when transferring to HPSS or the newer systems off of the about to be decommissioned file systems."*
>
> *"I/O operations crash regularly, specifically in the gpfs area. For example, accessing or copying files in some directories within gpfs freeze the log-in node."*
>
> *"User home directories are small. Other options are large but purged periodically. Modern software seems to have outgrown the old disk size limits."*
>
> *"50Gb for the user home is a bit insufficient to keep multiple applications."*
>
> *"Bandwidth offered by the OLCF: Compute interconnect can always be faster. I/O performance: working on large-scale high-performance machine learning applications often requires copying a lot of data. While Alpine's performance of 100-300 MB/s is strong, faster I/O would undoubtedly improve research latency. Moreover, as filesystem's ability to perform for all users under peak load is also of great importance to minimize filesystem-related downtimes."*

Table 9. Satisfaction Ratings for OLCF HPC Compute & Data Resources by PI Status and Overall Totals

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Sufficient notice of scheduled downtimes	106	4.69	0.50	98%	610	4.48	0.69	90%	716	4.51	0.67	91%
Sufficient project disk space	106	4.69	0.59	93%	601	4.52	0.68	92%	707	4.55	0.67	92%
Bandwidth offered by the OLCF	106	4.66	0.58	94%	589	4.49	0.67	90%	695	4.52	0.66	91%
I/O performance	103	4.50	0.71	91%	581	4.36	0.79	86%	684	4.38	0.78	87%

Table 10. Satisfaction Ratings for OLCF HPC Compute & Data Resources by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Sufficient notice of scheduled downtimes	266	4.48	0.73	89%	246	4.57	0.61	95%	130	4.51	0.63	93%	270	4.44	0.70	88%
Sufficient project disk space	265	4.57	0.67	92%	249	4.63	0.60	94%	127	4.61	0.56	96%	261	4.44	0.73	90%
Bandwidth offered by the OLCF	257	4.53	0.67	91%	243	4.55	0.66	91%	125	4.55	0.65	91%	257	4.46	0.68	89%
I/O performance	255	4.35	0.83	86%	242	4.42	0.77	90%	125	4.41	0.73	90%	248	4.29	0.82	83%

Table 11. Satisfaction Ratings for OLCF HPC Compute & Data Resources by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Sufficient notice of scheduled downtimes	161	4.42	0.69	89%	139	4.50	0.75	88%	416	4.55	0.64	93%
Sufficient project disk space	161	4.37	0.77	88%	138	4.64	0.63	93%	408	4.59	0.63	94%
Bandwidth offered by the OLCF	153	4.29	0.78	83%	135	4.59	0.61	93%	407	4.58	0.61	93%
I/O performance	158	4.28	0.81	84%	132	4.46	0.72	88%	394	4.39	0.79	88%

Compute Resources

Andes

Andes was used by 29% of respondents during the 2023 calendar year (231 out of 786 responding). Andes users were asked to provide satisfaction ratings for multiple aspects of the system, and descriptive statistics of these ratings are shown in Table 12, which also reports satisfaction statistics by PI status. 95% of respondents were either *satisfied* or *very satisfied* with the system overall. Table 13 summarizes these satisfaction statistics by project allocation and Table 14 reports these statistics by length of time as an OLCF user. The highest rated specific aspect of Andes was the *programming environment* (96% satisfied), and the lowest rated feature was the *availability of libraries* (92% satisfied).

Six **Andes users expressed dissatisfaction**, and all six provided explanatory comments related to tools, software, and libraries/compatibility, queue times, and other cited issues:

> *"No proper access to JupyterHub/Jupyter Notebook."*
>
> *"It is frustrating that output from Frontier is not available from Andes."*
>
> *"The only system that allows for more long compute time on a small number of compute nodes (36 hours on a single node vs 2 for Frontier / Summit), yet a tiny amount of hours are allocated by comparison. Some workflows require a long runtime on a few nodes (e.g., single-cell RNA-seq alignment to large genomes). Either stop the 2 hours max for small numbers of nodes on Frontier and Summit or allocate more Andes hours (which was done in the past)."*
>
> *"This is probably me wanting the moon, but it is not practical to get more than 2 Andes nodes for an interactive job for, say, an interactive session with ParaView or VisIt. This can get problematic when attempting to visualize large data sets that might not fit within 2 nodes."*
>
> *"It had issues connecting to Orion right when I needed it to. I ended up having to use Crusher for data analysis which isn't ideal. Dask also only kind of works on Andes. It crashes instead of exiting cleanly and doesn't seem to work with more than 256 processes."*
>
> *"I was trying to use Paraview for processing of large data (+visualization). For some reason the visual response on my desktop didn't allow to operate and process the data. It may be a Paraview issue."*

Table 12. Satisfaction Ratings of Andes by PI Status and Overall

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Scheduling turnaround	35	4.60	0.65	97%	175	4.54	0.61	94%	210	4.55	0.62	94%
System availability	35	4.63	0.55	97%	184	4.51	0.65	93%	219	4.53	0.64	94%
Availability of tools	35	4.63	0.49	100%	180	4.51	0.67	92%	215	4.53	0.65	93%
Availability of libraries	35	4.63	0.49	100%	181	4.49	0.66	91%	216	4.51	0.64	92%
Programming environment	35	4.63	0.55	97%	173	4.57	0.58	95%	208	4.58	0.58	96%
Overall satisfaction with Andes	35	4.57	0.61	94%	185	4.57	0.62	95%	220	4.57	0.62	95%

Table 13. Satisfaction Ratings of Andes by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Scheduling turnaround	100	4.56	0.64	94%	102	4.48	0.67	92%	45	4.51	0.66	96%	29	4.45	0.69	97%
System availability	104	4.55	0.67	92%	106	4.51	0.64	96%	47	4.47	0.62	94%	31	4.45	0.57	97%
Availability of tools	103	4.58	0.57	96%	104	4.46	0.70	92%	46	4.50	0.62	93%	31	4.52	0.57	97%
Availability of libraries	102	4.52	0.64	92%	104	4.47	0.64	92%	47	4.47	0.65	91%	31	4.45	0.62	94%
Programming environment	98	4.57	0.59	95%	100	4.56	0.59	95%	45	4.53	0.59	96%	30	4.50	0.57	97%
Overall satisfaction with Andes	104	4.56	0.64	94%	107	4.54	0.62	95%	47	4.57	0.58	96%	32	4.56	0.50	100%

Table 14. Satisfaction Ratings of Andes by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Scheduling turnaround	37	4.38	0.68	89%	39	4.51	0.64	92%	134	4.60	0.59	96%
System availability	40	4.48	0.55	98%	41	4.46	0.71	88%	138	4.56	0.64	95%
Availability of tools	39	4.51	0.60	95%	42	4.52	0.74	90%	134	4.54	0.63	94%
Availability of libraries	39	4.38	0.71	87%	42	4.55	0.63	93%	135	4.53	0.62	93%
Programming environment	37	4.49	0.56	97%	40	4.58	0.59	95%	131	4.60	0.58	95%
Overall satisfaction with Andes	40	4.43	0.71	93%	42	4.57	0.67	90%	138	4.61	0.57	97%

Summit

Summit was used by 76% of respondents during the 2023 calendar year (595 out of 786 responding). Summit users were asked to provide satisfaction ratings for multiple aspects of the system, and descriptive statistics of these ratings are shown in Table 15, which also reports satisfaction by PI status. 94% of all respondents were either *satisfied* or *very satisfied* with the system overall. Table 16 summarizes these satisfaction statistics by project allocation and Table 17 reports these statistics by length of time as an OLCF user. The *system availability* was the highest rated specific aspect of Summit (93% satisfied), and the lowest rated specific aspect was *scheduling turnaround* (88% satisfied).

31 **Summit users expressed dissatisfaction**, and 25 of them provided explanations for their dissatisfaction. The largest group of dissatisfied users (*n* = 11) expressed discontent with *Tools, software, and libraries/compatibility, compiling, and updates.* Representative comments include:

> *"Everything is great. The problem is that it does not support Jax. I work in machine learning, and Jax offers some unique tools that TensorFlow or PyTorch do not. For this reason, I have not been able to use the system."*
>
> *"Summit's unique architecture made it difficult to get a lot of software to compile and run correctly."*
>
> *"Nonstandard OS limits python tools available."*
>
> *"As pre-compiled packages are not always available for POWER9 architecture, installing software, e.g., such as PyTorch latest version was quite hard. Since compilation from source was needed, that led to a lot of difficulties. Concretely, in my case, I had a lot of compilation errors and I had to modify the code source of PyTorch to make it finish compiling without errors."*
>
> *"Many DOE software such as Petsc and dakota are not available and are not easy to build on a PowerPC."*

The next largest groups of dissatisfied users included those unhappy with *Summit's architecture* and (*n* = 9) and those unhappy with *Job queue, prioritization, walltimes, and related policies* (*n* = 7). For example:

Summit's architecture	*"As a machine learning researcher, I work in a field with a plethora of existing resources that enable fast innovation. However, summit poses a serious bottleneck in this regard as the architecture is based on PowerPC, while most ML frameworks are written to work on X86. This requires a significant amount of code porting in the past year which significantly slowed down our research efforts."* *"Working within the Power9 ecosystem is limiting for some compute environments like Python. However, this can be worked around."* *"Many of the issues with summit have to do with its cpu architecture (powerpc) and there is not much that can be done about it. The randomness of the system availability can also be very discouraging."*

	"Power9 makes the system much more cumbersome to use." *"I dislike the Power9 architecture."*
Job queue, prioritization, walltimes, and related policies	*"The wait time for jobs execution was very long."* *"Hard to get availability for high-priority projects."* *"Need longer queue times on small jobs and debug queues for 1-2 nodes for development."* *"Getting small interactive debug jobs to go through is super slow, slow enough that I gave up and just used other, less optimal, resources."*

All open-ended responses are provided in Appendix D: User Dissatisfaction Explanations.

Table 15. Satisfaction Ratings of Summit by PI Status and Overall

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Scheduling turnaround	79	4.56	0.55	97%	491	4.34	0.75	87%	570	4.37	0.73	88%
System availability	82	4.68	0.49	99%	502	4.46	0.66	93%	584	4.49	0.65	93%
Availability of tools	77	4.58	0.64	92%	482	4.43	0.70	90%	559	4.45	0.70	90%
Availability of libraries	77	4.58	0.61	94%	490	4.40	0.76	88%	567	4.42	0.75	89%
Programming environment	78	4.58	0.59	95%	484	4.38	0.78	88%	562	4.41	0.76	89%
Overall satisfaction with Summit	82	4.66	0.53	98%	504	4.49	0.66	94%	586	4.52	0.65	94%

Table 16. Satisfaction Ratings of Summit by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Scheduling turnaround	224	4.39	0.72	89%	194	4.43	0.70	90%	109	4.42	0.68	91%	216	4.30	0.76	86%
System availability	229	4.52	0.66	93%	200	4.52	0.63	95%	110	4.49	0.66	93%	221	4.42	0.71	90%
Availability of tools	219	4.46	0.71	89%	193	4.44	0.67	91%	106	4.56	0.66	92%	209	4.43	0.69	89%
Availability of libraries	221	4.42	0.75	88%	193	4.36	0.74	88%	109	4.52	0.75	93%	212	4.44	0.70	91%
Programming environment	218	4.39	0.81	89%	190	4.35	0.83	86%	106	4.48	0.71	92%	217	4.40	0.73	88%
Overall satisfaction with Summit	231	4.51	0.67	94%	201	4.53	0.62	95%	110	4.57	0.66	95%	221	4.50	0.66	94%

Table 17. Satisfaction Ratings of Summit by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Scheduling turnaround	110	4.25	0.75	84%	108	4.31	0.79	85%	352	4.42	0.70	91%
System availability	113	4.38	0.65	91%	112	4.48	0.66	93%	359	4.53	0.64	94%
Availability of tools	107	4.25	0.83	83%	108	4.51	0.69	91%	344	4.50	0.64	92%
Availability of libraries	110	4.15	0.93	77%	110	4.45	0.79	87%	347	4.50	0.65	93%
Programming environment	108	4.16	0.91	80%	105	4.39	0.80	88%	349	4.49	0.68	92%
Overall satisfaction with Summit	114	4.26	0.82	85%	112	4.52	0.64	96%	360	4.60	0.56	97%

Frontier

Frontier became available to OLCF users in April 2023, and was used by 54% of respondents during the 2023 calendar year (423 out of 786 responding). Frontier users were asked to provide satisfaction ratings for multiple aspects of the system, and descriptive statistics of these ratings are shown in Table 18, which also reports satisfaction by PI status. 82% of all respondents were either *satisfied* or *very satisfied* with the system overall. Table 19 summarizes these satisfaction statistics by project allocation and Table 20 reports these statistics by length of time as an OLCF user. The *availability of tools* and *availability of libraries* were the highest rated specific aspects of Frontier (both 83% satisfied), and the lowest rated specific aspect was *scheduling turnaround* (73% satisfied).

61 **Frontier users expressed dissatisfaction**, and 53 of them provided explanations for their dissatisfaction. The largest group of dissatisfied users (*n* = 28) expressed discontent with *Job queue, prioritization, walltimes, and related policies.* Representative comments include:

> *"Long wait time even for very small allocations."*
>
> *"The waiting times on Frontier are extremely long. For instance, my 40-node/2-hour batch jobs started within an hour (sometimes minutes) on Summit. However, 30-node/2-hour batch jobs sometimes take more than a day to start on Frontier. This makes running and debugging the simulations very difficult."*
>
> *"Extremely long queue times for small debug jobs for which resources are clearly available."*
>
> *"For smaller node jobs, it is extremely challenging to obtain a meaningful amount of walltime on Frontier. The queue priority makes it very challenging to execute jobs without a very large number of nodes being used."*
>
> *"We encountered significant delays in running large jobs that requested almost full set of nodes."*
>
> *"…Basically, I see that Frontier serves a single mode of operation: very large jobs that use 2000-8000 nodes where the user is willing to wait 3 or more days for the job to run. Our needs this year were very different; first we had a couple of months with significant needs for smaller jobs (such as 256 nodes) for development and scale up work. Here the experience was terrible--we still had to wait our 3 days in the queue which significantly slowed down our project. Secondly, even at full scale our future compute needs are bursty---we need large node counts such as 5120 nodes, but we need them at a specific time, that could only be satisfied with a reservation. Our experience in FY23 indicates that OLCF/Frontier is not a good fit for our science, as we asked for a reservation and were denied."*

The next largest groups of dissatisfied users included those unhappy with *Tools, software, and libraries/compatibility, compiling, and updates* (*n* = 15) and those unhappy with *Performance issues* (*n* = 15). For example:

Tools, software, and libraries/compatibility, compiling, and updates	*"No Jupyter service connected to the same file system as the HPC."* *"AMD compilers were immature for Fortran, Cray Compiler stack is better but fairly brittle and buggy."* *"Compilers need significant improvement - Cray in particular, but soon GNU and others."*
Performance issues	*"The libraries are buggy, even things as simple as BLAS. Either MPICH or the network has major issues. A code that runs fine on a bunch of platforms seems to fail 1/3 to 1/2 the time on Frontier."* *"Node stability is better now than it was last Spring, which prevented us from running a project requiring a few hundred nodes. But the failure rate due to the network and disk storage (Orion), suggests room for further improvement. The queues have become so crowded that our projects will unfortunately not achieve even modest production goals by the end of the calendar allocation year leaving a large unused allocation on the table."* *"Overall issues when using GPU-Aware MPI. Specifically, jobs hanging and running out of memory during a job."*

All open-ended responses are provided in Appendix D: User Dissatisfaction Explanations.

Table 18. Satisfaction Ratings of Frontier by PI Status and Overall

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Scheduling turnaround	68	4.10	0.92	78%	334	3.97	0.95	72%	402	3.99	0.94	73%
System availability	70	4.21	0.83	86%	338	4.05	0.90	75%	408	4.08	0.89	77%
Availability of tools	67	4.40	0.65	91%	326	4.23	0.80	81%	393	4.26	0.78	83%
Availability of libraries	67	4.43	0.63	93%	332	4.22	0.82	81%	399	4.25	0.79	83%
Programming environment	68	4.40	0.85	90%	335	4.15	0.88	79%	403	4.19	0.88	81%
Overall satisfaction with Frontier	70	4.23	0.76	86%	342	4.18	0.83	81%	412	4.19	0.82	82%

Table 19. Satisfaction Ratings of Frontier by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Scheduling turnaround	146	3.95	0.95	68%	108	4.10	0.91	80%	66	3.91	1.05	68%	220	3.97	0.93	75%
System availability	147	4.08	0.90	77%	110	4.26	0.77	85%	66	4.03	1.01	76%	223	4.07	0.91	77%
Availability of tools	143	4.25	0.79	83%	106	4.29	0.76	86%	65	4.40	0.77	86%	213	4.23	0.77	82%
Availability of libraries	142	4.23	0.85	82%	107	4.25	0.83	82%	66	4.38	0.76	86%	218	4.23	0.76	83%
Programming environment	147	4.15	0.95	80%	108	4.14	0.93	78%	65	4.40	0.81	83%	220	4.18	0.88	82%
Overall satisfaction with Frontier	149	4.12	0.84	78%	111	4.24	0.72	86%	66	4.32	0.79	83%	225	4.16	0.86	81%

Table 20. Satisfaction Ratings of Frontier by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Scheduling turnaround	78	4.09	0.90	79%	65	3.80	0.99	60%	259	4.01	0.94	74%
System availability	78	4.05	0.90	76%	65	3.91	1.01	66%	265	4.13	0.85	80%
Availability of tools	76	4.28	0.81	83%	62	4.18	0.78	84%	255	4.27	0.77	83%
Availability of libraries	76	4.25	0.82	83%	65	4.17	0.80	82%	258	4.28	0.78	83%
Programming environment	76	4.26	0.84	83%	63	4.03	0.88	79%	264	4.21	0.89	81%
Overall satisfaction with Frontier	80	4.26	0.74	85%	65	4.02	0.86	72%	267	4.21	0.82	83%

Data Resources

Data Transfer Nodes

DTNs were used by 29% of respondents during the 2023 calendar year (229 out of 786 responding), and 88% were either *satisfied* or *very satisfied* with the DTNs (Table 21, Table 22, and Table 23). Of the six respondents indicating **dissatisfaction with DTNs**, four explained their reasons:

> *"There are not enough nodes."*
>
> *"When we try to transfer data to from OLCF to NERSC using globus, we get some files, then the transfer hangs. When reported to OLCF, we were told to "keep trying"."*
>
> *"Globus was unstable and slow."*
>
> *"There were frequent issues trying to use Globus to transfer data from OLCF to other computing resources. It was also inconvenient to not have the Orion Lustre scratch system accessible from Andes (until recently), so that I had to copy data from Lustre to GPFS in order to analyze the data."*

HPSS

HPSS was used by 18% of respondents during the 2023 calendar year (144 out of 786 responding). HPSS users were asked to provide satisfaction ratings for multiple aspects of the system, and descriptive statistics of these ratings are shown in Table 24, which also reports satisfaction statistics by PI status. 94% of respondents were overall either *satisfied* or *very satisfied* with the system. The highest rated specific aspect of HPSS was *reliability (data integrity)* (96% satisfied). The lowest rated specific aspect was the *frequency of outages* (86% satisfied). Table 25 summarizes these satisfaction statistics by project allocation and Table 26 reports these statistics by length of time as an OLCF user.

Of the eight respondents indicating **dissatisfaction with HPSS,** seven explained their reasons:

> *"Globus was better years ago, but it's (modern, whitespace-is-more-important-than-content, mouse-only) interface these days is awful for anyone dealing with more than a few files. Coupled with latency and frequent error messages trying to get directory listings (often on Orion), it can take an hour to queue the transfers I want."*
>
> *"I tried globus once. After waiting a week for it to finish what hsi/htar can do in a day I decided to stick with hsi/htar."*
>
> *"Poorly designed and un-explained errors occurred frequently."*
>
> *"I feel that outages are too frequent."*
>
> *"Lots of outages."*
>
> *"We have needed the globus software updated for months and it has not happened. We have had meetings and people are 'looking into it' but it doesn't happen."*
>
> *"The speed at which it takes to place or download data from HPSS is extensive, especially for large amounts of data. The interface using hsi is also clunky compared to standard Linux command line operation."*

Table 21. Satisfaction Ratings of Data Transfer Nodes by PI Status and Overall

	PI Status				Non-PI Status				Total			
	N	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***
Overall satisfaction with data transfer nodes	39	4.41	0.79	82%	187	4.36	0.80	89%	226	4.37	0.80	88%

Table 22. Satisfaction Ratings of Data Transfer Nodes by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***
Overall satisfaction with data transfer nodes	108	4.19	0.93	81%	102	4.44	0.70	92%	55	4.44	0.69	89%	52	4.27	0.89	81%

Table 23. Satisfaction Ratings of Data Transfer Nodes by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***
Overall satisfaction with data transfer nodes	35	4.00	0.84	77%	34	4.56	0.61	94%	157	4.41	0.80	89%

Table 24. Satisfaction Ratings of HPSS by PI Status and Overall

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
hsi/htar interface	31	4.65	0.61	94%	78	4.28	0.74	88%	109	4.39	0.72	90%
Globus interface	35	4.49	1.04	89%	92	4.45	0.75	89%	127	4.46	0.83	89%
Ability to store/retrieve files	37	4.62	0.64	92%	100	4.52	0.61	96%	137	4.55	0.62	95%
Reliability (data integrity)	36	4.69	0.58	94%	98	4.59	0.59	97%	134	4.62	0.59	96%
Time to store/retrieve files	37	4.54	0.69	89%	102	4.43	0.72	90%	139	4.46	0.71	90%
Frequency of outages	36	4.47	0.81	86%	102	4.28	0.74	85%	138	4.33	0.76	86%
Overall satisfaction with HPSS	37	4.57	0.69	95%	103	4.44	0.64	94%	140	4.47	0.65	94%

Table 25. Satisfaction Ratings of HPSS by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
hsi/htar interface	55	4.31	0.74	87%	54	4.37	0.78	89%	25	4.36	0.81	88%	28	4.43	0.79	89%
Globus interface	61	4.38	0.90	87%	66	4.50	0.83	89%	34	4.56	0.70	94%	29	4.38	0.86	83%
Ability to store/retrieve files	67	4.51	0.66	94%	70	4.50	0.68	93%	34	4.56	0.70	94%	35	4.60	0.65	97%
Reliability (data integrity)	65	4.63	0.55	97%	67	4.58	0.55	97%	35	4.66	0.59	94%	35	4.57	0.65	97%
Time to store/retrieve files	67	4.46	0.72	90%	70	4.37	0.75	87%	35	4.51	0.82	86%	37	4.54	0.69	89%
Frequency of outages	68	4.28	0.77	84%	70	4.27	0.74	86%	33	4.33	0.78	88%	35	4.46	0.74	86%
Overall satisfaction with HPSS	69	4.43	0.65	94%	69	4.39	0.71	93%	35	4.46	0.74	91%	37	4.54	0.69	95%

Table 26. Satisfaction Ratings of HPSS by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
hsi/htar interface	8	4.00	0.93	88%	13	4.38	0.65	92%	88	4.42	0.71	90%
Globus interface	10	4.10	0.88	90%	16	4.56	0.73	88%	101	4.48	0.84	89%
Ability to store/retrieve files	11	4.27	0.65	91%	16	4.69	0.48	100%	110	4.55	0.63	95%
Reliability (data integrity)	11	4.55	0.52	100%	16	4.69	0.48	100%	107	4.62	0.61	95%
Time to store/retrieve files	12	4.00	1.13	75%	16	4.63	0.50	100%	111	4.49	0.67	90%
Frequency of outages	12	4.17	0.94	83%	15	4.27	0.70	87%	111	4.36	0.75	86%
Overall satisfaction with HPSS	12	4.00	0.74	75%	16	4.63	0.50	100%	112	4.50	0.64	96%

Alpine GPFS Scratch Filesystem

Alpine GPFS Scratch Filesystem was used by 40% of respondents during the 2023 calendar year (311 out of 786 responding). Alpine GPFS users were asked to provide satisfaction ratings for multiple aspects of the system, and descriptive statistics of these ratings are shown in Table 27, which also reports satisfaction statistics by PI status. 94% of respondents were overall either *satisfied* or *very satisfied* with the system. The *size* and *i/o bandwidth* were the highest rated specific aspects of Alpine GPFS (both 94% satisfied), and the lowest rated feature was the *frequency of outages* (83% satisfied). Table 28 summarizes these satisfaction statistics by project allocation and Table 29 reports these statistics by length of time as an OLCF user.

22 users indicated **dissatisfaction with at least one aspect of the Alpine GPFS Scratch Filesystem**, and 17 provided reasons for their dissatisfaction, primarily related to filesystem outages or lag. Representative comments include:

> *"Frequency of outages: As the Alpine filesystem work as the backbone of all scientific innovation on summit, it is important that the filesystem be "always available" for researchers. Scheduled downtimes are fine, however, extremely slow processing on summit due to peak filesystem usage significantly slows research progress and caused us many lost afternoons or mornings of work over the past year. Limiting such outages would greatly improve my satisfaction. I/O bandwidth: This could be improved but is not the most important."*
>
> *"I have issues with this file system hanging for extended times at least once a week."*
>
> *"The filesystem freezes me out more often than I would like."*
>
> *"Hangs frequently for an indeterminate time."*
>
> *"GPFS has been down a lot lately."*
>
> *"The file system would periodically hang on the login nodes, particularly when editing files."*
>
> *"Lots of outages."*

All open-ended responses are provided in Appendix D: User Dissatisfaction Explanations.

Table 27. Satisfaction Ratings of Alpine GPFS Scratch Filesystem by PI Status and Overall

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Size	51	4.67	0.59	94%	252	4.59	0.61	94%	303	4.60	0.61	94%
I/O bandwidth	51	4.55	0.64	92%	244	4.50	0.64	94%	295	4.51	0.64	94%
File and directory operations	51	4.47	0.81	88%	250	4.50	0.67	93%	301	4.49	0.70	92%
Reliability (data integrity)	51	4.47	0.83	86%	250	4.56	0.66	93%	301	4.54	0.69	92%
Frequency of outages	51	4.33	0.89	84%	247	4.27	0.87	83%	298	4.28	0.87	83%
Overall satisfaction with Alpine GPFS Scratch Filesystem	51	4.45	0.81	92%	253	4.50	0.61	94%	304	4.49	0.65	94%

Table 28. Satisfaction Ratings of Alpine GPFS Scratch Filesystem by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Size	139	4.58	0.60	94%	124	4.62	0.63	92%	65	4.63	0.52	98%	104	4.55	0.65	91%
I/O bandwidth	134	4.47	0.65	93%	122	4.53	0.66	94%	64	4.55	0.56	97%	102	4.44	0.68	91%
File and directory operations	138	4.47	0.70	91%	123	4.53	0.69	93%	65	4.45	0.75	91%	105	4.42	0.74	90%
Reliability (data integrity)	138	4.49	0.74	90%	122	4.52	0.74	90%	65	4.57	0.64	92%	106	4.52	0.65	93%
Frequency of outages	138	4.21	0.87	80%	123	4.29	0.93	83%	63	4.27	0.92	81%	103	4.26	0.80	83%
Overall satisfaction with Alpine GPFS Scratch Filesystem	139	4.47	0.64	94%	123	4.49	0.72	93%	65	4.51	0.62	97%	105	4.41	0.62	93%

Table 29. Satisfaction Ratings of Alpine GPFS Scratch Filesystem by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Size	47	4.62	0.53	98%	44	4.55	0.70	89%	212	4.61	0.60	94%
I/O bandwidth	43	4.37	0.76	93%	44	4.48	0.66	91%	208	4.55	0.61	95%
File and directory operations	43	4.42	0.73	91%	44	4.52	0.70	93%	214	4.50	0.69	93%
Reliability (data integrity)	45	4.47	0.66	91%	43	4.60	0.69	93%	213	4.54	0.70	92%
Frequency of outages	45	4.13	0.89	78%	43	4.16	1.00	81%	210	4.33	0.84	85%
Overall satisfaction with Alpine GPFS Scratch Filesystem	47	4.38	0.71	91%	44	4.55	0.63	93%	213	4.50	0.64	95%

Orion Lustre Scratch Filesystem

Orion Lustre Scratch Filesystem was used by 27% of respondents during the 2023 calendar year (208 out of 786 responding). Orion Lustre users were asked to provide satisfaction ratings for multiple aspects of the system, and descriptive statistics of these ratings are shown in Table 30, which also reports satisfaction statistics by PI status. 86% of respondents were overall either *satisfied* or *very satisfied* with the system. The *size* was the highest rated specific aspect of Orion Lustre (93% satisfied), and the lowest rated feature was the *frequency of outages* (79% satisfied). Table 31 summarizes these satisfaction statistics by project allocation and Table 32 reports these statistics by length of time as an OLCF user.

18 users indicated **dissatisfaction with at least one aspect of the Orion Lustre Scratch Filesystem**, and 15 provided reasons for their dissatisfaction, primarily related to performance issues and lag. Other issues touched on outages. Representative comments include:

> *"Orion provides high bandwidth but very low metadata operations per second."*
>
> *"The pitiful I/O performance on Orion has given me more grief than any other system I have worked with. About 4 months ago, I found that my MPI application ran on Frontier much faster on a single node than on multiple (e.g., 8), caused by extremely slow pwrite() calls to a shared file (at different locations per rank). At that time, I also encountered significant problems launching short-running applications at scale (i.e., >4K nodes), I did not find/read the "Tips for Launching at Scale" documentation at the time, but I would have struggled to follow those "tips" for my experiments anyway (HPCToolkit + LAMMPS, both Spack-built)."*
>
> *"We experience lots of hangs and variability in speed with IO operations."*
>
> *"We are seeing the same frequent hangs on Orion that plague Alpine."*
>
> *"The file system hangs very frequently and often goes down without notice."*
>
> *"More so than the compute systems I really need Orion to be stable. If one of the compute systems is down, I can usually still do some kind of work on another system but if Orion goes down I can't do anything since all my tasks involve I/O from Orion."*

All open-ended responses are provided in Appendix D: User Dissatisfaction Explanations.

Table 30. Satisfaction Ratings of Orion Lustre Scratch Filesystem by PI Status and Overall

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Size	38	4.55	0.69	89%	160	4.58	0.61	94%	198	4.57	0.62	93%
I/O bandwidth	38	4.45	0.69	89%	155	4.34	0.88	86%	193	4.36	0.84	87%
File and directory operations	38	4.34	0.85	87%	159	4.36	0.80	87%	197	4.36	0.81	87%
Reliability (data integrity)	38	4.45	0.72	87%	154	4.53	0.64	94%	192	4.51	0.66	92%
Frequency of outages	38	4.26	0.86	74%	154	4.19	0.88	80%	192	4.20	0.87	79%
Overall satisfaction with Orion Lustre Scratch Filesystem	38	4.26	0.83	82%	160	4.32	0.79	87%	198	4.31	0.79	86%

Table 31. Satisfaction Ratings of Orion Lustre Scratch Filesystem by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Size	84	4.60	0.58	95%	66	4.52	0.64	92%	38	4.76	0.49	97%	99	4.57	0.61	94%
I/O bandwidth	80	4.43	0.78	91%	65	4.35	0.84	88%	38	4.58	0.60	95%	97	4.28	0.91	84%
File and directory operations	82	4.32	0.86	87%	67	4.36	0.81	88%	38	4.47	0.80	92%	99	4.28	0.82	87%
Reliability (data integrity)	81	4.46	0.73	89%	65	4.49	0.66	91%	38	4.61	0.59	95%	96	4.48	0.62	94%
Frequency of outages	78	4.22	0.86	79%	65	4.20	0.87	77%	38	4.37	0.88	84%	99	4.17	0.81	81%
Overall satisfaction with Orion Lustre Scratch Filesystem	83	4.29	0.77	86%	66	4.29	0.76	85%	38	4.50	0.60	95%	98	4.22	0.82	85%

Table 32. Satisfaction Ratings of Orion Lustre Scratch Filesystem by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Size	26	4.38	0.64	92%	23	4.43	0.73	87%	149	4.62	0.60	94%
I/O bandwidth	23	4.22	0.74	91%	23	4.26	0.86	83%	147	4.40	0.86	87%
File and directory operations	25	4.32	0.80	88%	23	4.22	0.85	83%	149	4.39	0.80	88%
Reliability (data integrity)	25	4.40	0.58	96%	23	4.48	0.67	91%	144	4.53	0.67	92%
Frequency of outages	25	4.28	0.74	84%	22	4.00	1.07	64%	145	4.22	0.86	80%
Overall satisfaction with Orion Lustre Scratch Filesystem	26	4.35	0.63	92%	23	4.22	0.90	78%	149	4.32	0.81	86%

OLCF Support and Services

Overall Satisfaction with OLCF Support and Services

Users were asked to provide their overall satisfaction with OLCF Support (support from OLCF staff and problem resolution) and OLCF Services (tools, training, documentation, myOLCF, etc.) Most respondents were either *satisfied* or *very satisfied* with OLCF Support and OLCF Services (both 90%; see Table 33, Table 34, and Table 35).

OLCF Support Groups

61.4% of respondents interfaced with OLCF staff during the 2023 calendar year (478 out of 778 responding). Respondents were asked to provide satisfaction ratings for multiple OLCF groups (Table 36, Table 37, and Table 38). 96% of all respondents were either *satisfied* or *very satisfied* with the Projects and Accounts Team and 95% were either *satisfied* or *very satisfied* with User Assistance. 32.4% of respondents were users on an INCITE project during the 2023 calendar year (252 out of 778 responding). 94% of these respondents were either *satisfied* or *very satisfied* with the INCITE Liaisons they interacted with. 3.5% of respondents received assistance from a Data Liaison during the 2023 calendar year (27 out of 773 responding). 100% of these respondents were either *satisfied* or *very satisfied* with the Data Liaisons they interacted with.

Based on comments received, it is possible that up to three users mistakenly provided ratings of 'Very dissatisfied" instead of "Very satisfied" with various user groups (projects and accounts team, user assistance, and INCITE liaisons). If ratings were reversed, the mean for satisfaction with the project and accounts team would increase from 4.69 to 4.70, the mean for satisfaction with user assistance would increase from 4.65 to 4.66, and the mean for satisfaction with INCITE liaisons would increase from 4.53 to 4.61. However, to present the most conservative findings possible, Tables 36, 37, and 38 include the responses provided by users.

There were 12 users who reported **dissatisfaction with OLCF support groups with which they interacted** in 2023, but only seven provided explanations for their dissatisfaction. Representative comments include:

> *"The individuals I interacted with were as helpful as they could be, sometimes going above and beyond to try to get our needs met (thank you Suzanne), but ultimately OLCF policies were limiting. Some things that should be addressable by individual staff members require unusual levels of additional review and authority, which limits staff's ability to respond effectively to issues."*
>
> *"The assistance towards software compilation to use the resources well is insufficient."*
>
> *"Account got deleted since they thought it was inactive which it was not. They admitted the mistake but were unable to fast-track reactivating it which will take me additional 1 month of time to get it back."*

All open-ended responses are provided in Appendix D: User Dissatisfaction Explanations.

Table 33. Satisfaction Ratings of OLCF Support and Services by PI Status and Overall

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
OLCF Support (problem resolution and support from OLCF Staff)	110	4.65	0.58	95%	653	4.47	0.72	89%	763	4.49	0.70	90%
OLCF Services (tools, training, docs, myOLCF, etc.)	110	4.55	0.64	94%	653	4.41	0.69	90%	763	4.43	0.68	90%

Table 34. Satisfaction Ratings of OLCF Support and Services by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
OLCF Support (problem resolution and support from OLCF Staff)	276	4.50	0.70	91%	263	4.54	0.63	93%	139	4.57	0.66	92%	287	4.42	0.77	87%
OLCF Services (tools, training, docs, myOLCF, etc.)	276	4.46	0.66	92%	263	4.43	0.66	92%	139	4.44	0.72	89%	287	4.36	0.75	85%

Table 35. Satisfaction Ratings of OLCF Support and Services by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
OLCF Support (problem resolution and support from OLCF Staff)	180	4.37	0.73	86%	149	4.43	0.74	89%	434	4.57	0.67	92%
OLCF Services (tools, training, docs, myOLCF, etc.)	180	4.32	0.73	88%	149	4.43	0.62	93%	434	4.48	0.68	90%

Table 36. Satisfaction Ratings of OLCF Groups by PI Status and Overall

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Projects and Accounts Team (accounts@ccs.ornl.gov)	88	4.75	0.51	97%	302	4.68	0.61	95%	390	4.69	0.59	96%
User Assistance (help@olcf.ornl.gov)	89	4.73	0.52	97%	352	4.63	0.69	94%	441	4.65	0.66	95%
INCITE Liaisons	34	4.71	0.58	94%	137	4.49	0.84	93%	171	4.53	0.80	94%
Data Liaisons	10	4.70	0.48	100%	17	4.65	0.49	100%	27	4.67	0.48	100%

Table 37. Satisfaction Ratings of OLCF Groups by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Projects and Accounts Team (accounts@ccs.ornl.gov)	135	4.67	0.65	96%	161	4.66	0.66	94%	78	4.71	0.61	95%	146	4.62	0.59	96%
User Assistance (help@olcf.ornl.gov)	165	4.65	0.65	95%	170	4.69	0.63	96%	84	4.67	0.66	94%	170	4.55	0.72	94%
INCITE Liaisons	145	4.50	0.84	92%	58	4.60	0.84	95%	17	4.76	0.44	100%	33	4.48	0.87	91%
Data Liaisons	14	4.71	0.47	100%	15	4.67	0.49	100%	4	4.75	0.50	100%	8	4.38	0.52	100%

Table 38. Satisfaction Ratings of OLCF Groups by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Projects and Accounts Team (accounts@ccs.ornl.gov)	89	4.63	0.73	91%	64	4.70	0.49	98%	237	4.71	0.55	97%
User Assistance (help@olcf.ornl.gov)	99	4.61	0.75	93%	75	4.73	0.53	99%	267	4.64	0.66	94%
INCITE Liaisons	35	4.40	0.85	91%	27	4.67	0.55	96%	109	4.54	0.83	94%
Data Liaisons	0	--	--	--	4	4.75	0.50	100%	23	4.65	0.49	100%

OLCF Website

51.9% percent of survey respondents indicated that they had visited the OLCF website during 2023 (408 out of 786 responding). Before indicating their satisfaction with various aspects of the website, these users were asked how frequently they visit the OLCF website (http://olcf.ornl.gov); 399 users provided responses to this item, as displayed in Figure 6.

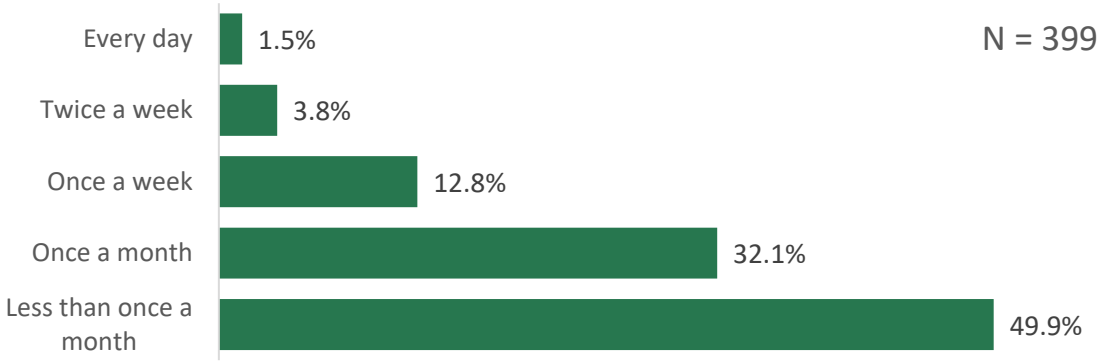

Figure 6. Frequency with which OLCF users visit the OLCF website
Note: Percentages may not add up precisely to 100% due to rounding in each category.

Users rated several aspects of the website (Table 39, Table 40, and Table 41). 90% of respondents were either *satisfied* or *very satisfied* overall with the website. The highest rated specific aspect of the website was *usefulness of content* (91% satisfied), while the lowest rated aspect was *search capabilities* (86% satisfied).

Five users reported **dissatisfaction with the website,** and four of them provided reasons for their dissatisfaction, primarily related to the search feature:

> *"Search on project usage per user (in spreadsheet/csv format) would be most useful."*
>
> *"Search is not particularly useful for technical topics. Maybe consider more structure and organization, contributions from the user community, etc."*
>
> *"Searches invariably bring up news and updates from years ago more prominently than the up-to-date information I'm searching for, e.g., the announcement of a system coming online rather than its current specs. Many searches ended up pointing me back to central pages I had already visited as well."*
>
> *"Very limited information on the web page."*

myOLCF Self-Service Portal

45% percent of survey respondents indicated that they had used the myOLCF Self-Service Portal during 2023 (354 out of 786 responding). Before indicating their satisfaction with their experiences, these users were asked how frequently they use the Portal (https://my.olcf.ornl.gov); 349 users provided responses to this item, as displayed in Figure 7.

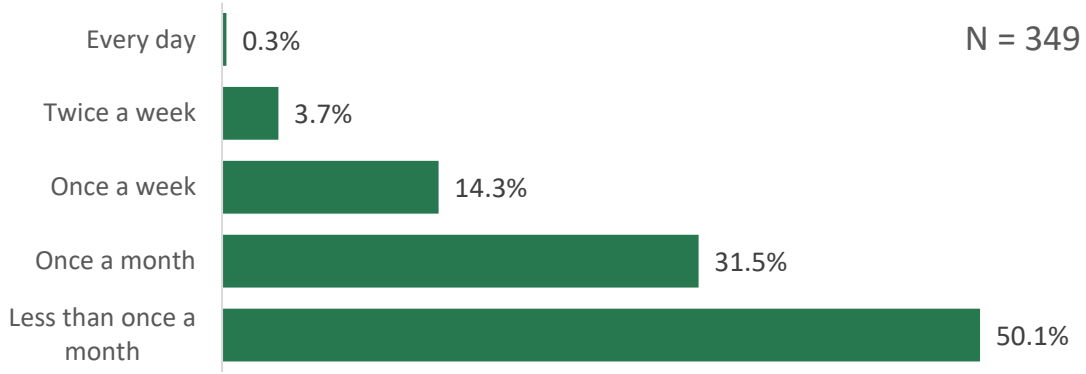

Figure 7. Frequency with which OLCF users visit the myOLCF Self-Service Portal
Note: Percentages may not add up precisely to 100% due to rounding in each category.

Users rated satisfaction with several aspects of the myOLCF Self-Service Portal (Table 42, Table 43, and Table 44). 92% of respondents were either *satisfied* or *very satisfied* overall with myOLCF. The highest rated specific aspect of the myOLCF portal was *speed/responsiveness of the application* (91% satisfied), while the lowest rated aspect was *design* (87% satisfied).

Eight users reported **dissatisfaction with one or more aspects of the myOLCF Self-Service Portal** and seven offered explanations:

> *"I never know which password to use for the site. Is it the password by itself or combined with the RSA token or just the token."*
>
> *"In my opinion there is barely anything to be satisfied or dissatisfied - myOLCF is just very basic and devoid of features or data to check."*
>
> *"It is hard to find the tab to apply for a new allocation, e.g., DD allocation."*
>
> *"Some of the website features don't seem to do anything, e.g., the page that lists jobs. Also, the page always opens on a past project that is no longer active."*
>
> *"I cannot see any allocation details for my project."*
>
> *"The website seems to take a lot of resources on a standard Firefox browser and is quite slow."*
>
> *"The application can only be saved to browser cache and cannot be found in the myOLCF account. It is quite inconvenient."*

Survey respondents were also asked to provide feedback, suggested improvements, or additional functionality for myOLCF, which is presented in User Suggestions for Improvement.

Table 39. Satisfaction Ratings of the OLCF Website by PI Status and Overall Totals

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Ease of navigation	64	4.45	0.71	88%	312	4.37	0.67	90%	376	4.38	0.68	90%
Search capabilities	60	4.42	0.74	85%	300	4.30	0.74	86%	360	4.32	0.74	86%
Usefulness of content	65	4.58	0.61	94%	311	4.37	0.67	90%	376	4.40	0.66	91%
Overall satisfaction with the OLCF website	65	4.52	0.66	91%	315	4.36	0.67	90%	380	4.38	0.67	90%

Table 40. Satisfaction Ratings of the OLCF Website by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Ease of navigation	130	4.42	0.66	91%	137	4.39	0.67	90%	71	4.44	0.67	93%	146	4.34	0.69	89%
Search capabilities	124	4.35	0.73	86%	133	4.32	0.72	86%	68	4.44	0.70	91%	139	4.24	0.78	83%
Usefulness of content	130	4.44	0.63	92%	137	4.42	0.66	91%	72	4.47	0.60	94%	145	4.34	0.69	89%
Overall satisfaction with the OLCF website	132	4.41	0.64	92%	138	4.40	0.68	89%	73	4.45	0.62	93%	147	4.33	0.68	89%

Table 41. Satisfaction Ratings of the OLCF Website by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Ease of navigation	69	4.29	0.73	87%	57	4.30	0.73	84%	250	4.43	0.65	92%
Search capabilities	66	4.18	0.82	80%	56	4.27	0.80	82%	238	4.37	0.70	89%
Usefulness of content	68	4.26	0.75	85%	59	4.32	0.71	86%	249	4.46	0.62	93%
Overall satisfaction with the OLCF website	69	4.28	0.73	87%	59	4.31	0.73	85%	252	4.43	0.64	92%

Table 42. Satisfaction Ratings with the myOLCF Self-Service Portal by PI Status and Overall Totals

	PI Status				Non-PI Status				Total			
	N	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***
Speed/responsiveness of the application	72	4.58	0.60	94%	269	4.42	0.67	91%	341	4.45	0.66	91%
Ease of use	72	4.58	0.60	94%	271	4.35	0.72	87%	343	4.40	0.71	88%
Design	72	4.53	0.65	92%	270	4.33	0.73	86%	342	4.37	0.71	87%
Functionality	72	4.53	0.63	93%	270	4.33	0.76	87%	342	4.37	0.74	88%
Overall satisfaction with myOLCF	72	4.60	0.57	96%	272	4.39	0.70	90%	344	4.43	0.68	92%

Table 43. Satisfaction Ratings with the myOLCF Self-Service Portal by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***
Speed/responsiveness of the application	123	4.42	0.71	89%	131	4.44	0.68	91%	71	4.52	0.67	90%	140	4.36	0.70	89%
Ease of use	123	4.44	0.68	89%	131	4.48	0.67	90%	72	4.49	0.71	90%	142	4.22	0.74	82%
Design	123	4.39	0.72	88%	131	4.41	0.72	88%	71	4.45	0.69	89%	142	4.22	0.76	81%
Functionality	123	4.39	0.67	89%	131	4.44	0.68	89%	71	4.46	0.73	92%	142	4.18	0.83	82%
Overall satisfaction with myOLCF	124	4.43	0.68	91%	132	4.48	0.67	92%	72	4.56	0.58	96%	142	4.27	0.76	87%

Table 44. Satisfaction Ratings with the myOLCF Self-Service Portal by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***
Speed/responsiveness of the application	52	4.35	0.65	90%	50	4.42	0.67	90%	239	4.48	0.65	92%
Ease of use	52	4.37	0.66	90%	50	4.32	0.77	82%	241	4.42	0.70	89%
Design	51	4.27	0.72	84%	50	4.32	0.74	84%	241	4.40	0.71	88%
Functionality	51	4.29	0.81	88%	50	4.38	0.75	84%	241	4.38	0.72	89%
Overall satisfaction with myOLCF	52	4.33	0.71	90%	50	4.42	0.70	88%	242	4.46	0.68	93%

OLCF Documentation

55.6% percent of survey respondents indicated that they had used the OLCF documentation page during 2023 (437 out of 786 responding). Before indicating their satisfaction with various aspects of documentation, these users were asked how frequently they visit the Docs page (https://docs.olcf.ornl.gov); 431 users provided responses to this item, as displayed in Figure 8.

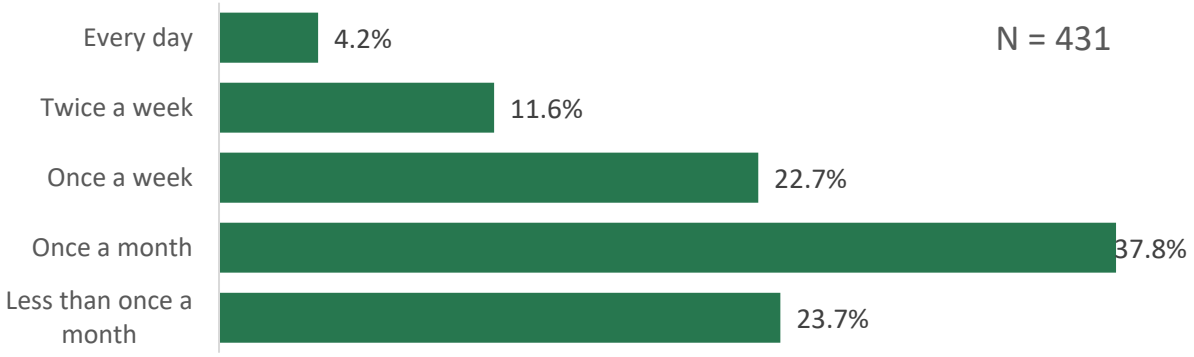

Figure 8. Frequency with which OLCF users visit the OLCF Docs page
Note: Percentages may not add up precisely to 100% due to rounding in each category.

Users rated several aspects of OLCF documentation (Table 45, Table 46, and Table 47). 93% of respondents were either *satisfied* or *very satisfied* overall with the documentation. The highest rated specific aspect of OLCF documentation was *quality of the documentation* (93% satisfied), while the lowest rated aspect was *search capabilities* (88% satisfied).

There were seven users who reported **dissatisfaction with one or more aspects of the OLCF Docs page**, and three provided explanations:

> *"I think there are a few areas where the documentation can be more clear and specific. I felt that the documentation with regard to sbatch and salloc was not very clear."*
>
> *"Putting all information about Frontier in basically a single, giant page does not seem very intuitive to me."*
>
> *"How are there not exhaustive lists of all possible slurm/jsrun arguments that work for e.g., frontier in a single place? Just google slurm options and you have exactly that - but which of those will actually work on frontier?"*

Table 45. Satisfaction Ratings of the OLCF Docs Page by PI Status and Overall Totals

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Ease of navigation	68	4.49	0.68	90%	360	4.44	0.67	91%	428	4.45	0.67	91%
Search capabilities	64	4.41	0.71	88%	348	4.34	0.71	88%	412	4.35	0.71	88%
Quality of the documentation	68	4.57	0.58	96%	360	4.52	0.65	93%	428	4.53	0.64	93%
Overall satisfaction with the OLCF documentation	68	4.59	0.55	97%	361	4.47	0.64	93%	429	4.49	0.63	93%

Table 46. Satisfaction Ratings of the OLCF Docs Page by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Ease of navigation	156	4.42	0.73	88%	156	4.43	0.67	92%	79	4.49	0.66	94%	170	4.44	0.65	91%
Search capabilities	150	4.35	0.73	86%	151	4.32	0.71	87%	77	4.45	0.66	94%	162	4.35	0.71	88%
Quality of the documentation	155	4.49	0.66	92%	156	4.49	0.66	94%	79	4.62	0.56	96%	171	4.47	0.69	90%
Overall satisfaction with the OLCF documentation	156	4.44	0.66	92%	157	4.48	0.63	94%	79	4.57	0.57	96%	171	4.46	0.66	91%

Table 47. Satisfaction Ratings of the OLCF Docs Page by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Ease of navigation	74	4.23	0.73	85%	75	4.49	0.67	91%	279	4.49	0.65	93%
Search capabilities	72	4.14	0.74	82%	73	4.36	0.71	86%	267	4.41	0.70	90%
Quality of the documentation	73	4.41	0.66	93%	76	4.62	0.59	95%	279	4.53	0.65	93%
Overall satisfaction with the OLCF documentation	73	4.32	0.68	90%	76	4.58	0.57	96%	280	4.51	0.62	93%

Communication with Users

Most respondents (93%) were either *satisfied* or *very satisfied* with OLCF communication (Table 48, Table 49, and Table 50). No respondents expressed **dissatisfaction with communication.**

Training

26% of respondents participated in OLCF training events or consulted training materials during the 2023 calendar year (208 out of 786 responding). Respondents were asked to provide satisfaction ratings for multiple aspects of training (Table 51, Table 52, and Table 53). 97% of all respondents were either *satisfied* or *very satisfied* with training overall. The highest rated specific aspects of OLCF training were *quality of the content of the training* and *usefulness of the online training archive* (both 96% satisfied), while the lowest rated aspect was *breadth of training events offered* (90% satisfied).

Two users reported **dissatisfaction with training,** and one provided the following explanation:

> *"I took classes on AMD GPUs. It went very slowly and didn't help much. Better to read the docs."*

Table 48. Satisfaction Ratings of Communication by PI Status and Overall Totals

	PI Status				Non-PI Status				Total			
	N	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***
Overall communications	110	4.63	0.60	94%	647	4.48	0.62	93%	757	4.50	0.62	93%

Table 49. Satisfaction Ratings of Communications by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***
Overall communications	274	4.48	0.65	92%	259	4.55	0.60	94%	137	4.47	0.64	92%	286	4.44	0.63	92%

Table 50. Satisfaction Ratings of Communication by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***
Overall communications	177	4.40	0.67	90%	148	4.55	0.61	94%	432	4.53	0.60	94%

Table 51. Satisfaction Ratings of the OLCF Training Program by PI Status and Overall Totals

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Number of training events offered	34	4.41	0.78	88%	157	4.38	0.63	92%	191	4.39	0.65	92%
Breadth of training events offered	34	4.32	0.81	85%	158	4.37	0.64	91%	192	4.36	0.67	90%
Quality of the content of the training	36	4.50	0.65	92%	159	4.50	0.58	97%	195	4.50	0.60	96%
Usefulness of the online training archive	36	4.61	0.60	94%	160	4.57	0.57	96%	196	4.58	0.57	96%
Overall satisfaction with OLCF training	38	4.58	0.55	97%	167	4.49	0.57	96%	205	4.50	0.57	97%

Table 52. Satisfaction Ratings of the OLCF Training Program by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Number of training events offered	65	4.52	0.62	94%	79	4.34	0.64	91%	29	4.52	0.57	97%	84	4.43	0.65	94%
Breadth of training events offered	65	4.45	0.69	89%	80	4.34	0.64	91%	30	4.53	0.57	97%	84	4.39	0.68	92%
Quality of the content of the training	65	4.58	0.58	95%	82	4.46	0.59	95%	31	4.65	0.49	100%	85	4.49	0.59	98%
Usefulness of the online training archive	65	4.63	0.63	92%	82	4.54	0.55	98%	31	4.55	0.57	97%	86	4.62	0.54	98%
Overall satisfaction with OLCF training	68	4.60	0.55	97%	86	4.45	0.57	97%	33	4.67	0.48	100%	89	4.49	0.57	97%

Table 53. Satisfaction Ratings of the OLCF Training Program by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***	***N***	***M***	***SD***	***%Sat***
Number of training events offered	34	4.15	0.74	79%	32	4.47	0.57	97%	125	4.43	0.64	94%
Breadth of training events offered	34	4.12	0.73	79%	32	4.47	0.57	97%	126	4.40	0.67	91%
Quality of the content of the training	35	4.34	0.76	89%	32	4.41	0.56	97%	128	4.57	0.54	98%
Usefulness of the online training archive	35	4.29	0.67	89%	37	4.49	0.61	95%	124	4.69	0.50	98%
Overall satisfaction with OLCF training	37	4.27	0.69	86%	35	4.46	0.56	97%	133	4.58	0.51	99%

Problem Resolution

Figure 9 shows how frequently respondents **submitted queries** to OLCF (via phone or email) in 2023. The majority of respondents submitted between one and five requests, while 14.4% **had not submitted any queries at all.**

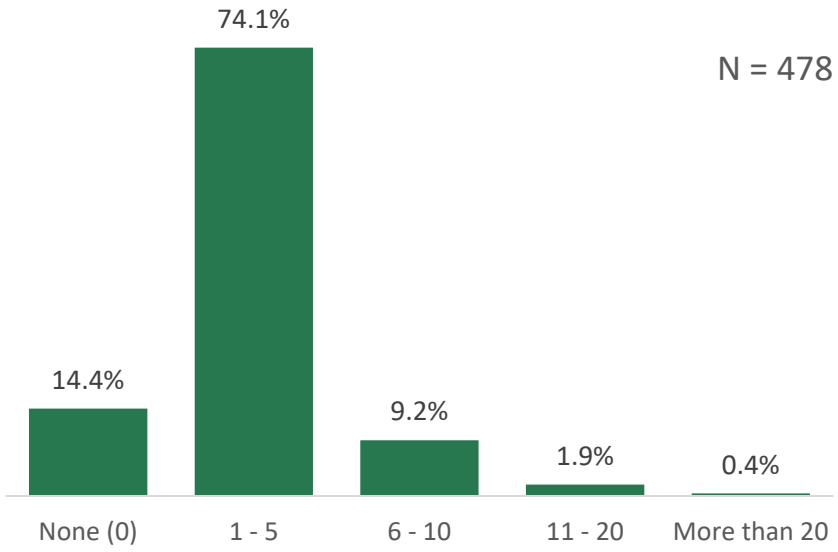

Figure 9. Distribution of number of queries submitted to OLCF in 2023.
Note: Percentages may not add up precisely to 100% due to rounding in each category.

Users were asked to provide satisfaction ratings for their overall satisfaction with OLCF's problem resolution and two specific aspects (Table 54, Table 55, and Table 56). 95% of respondents were overall either *satisfied* or *very satisfied* with problem resolution. The highest rated specific aspect of OLCF's problem resolution was *quality of technical advice given to reported issues* (95% satisfied), while the lowest rated aspect was *timeliness of responses to reported issues* (94% satisfied).

Twelve respondents indicated **dissatisfaction with OLCF problem resolution**, and ten provided explanatory comments. In general, dissatisfaction centered on the timeliness of resolution. Representative comments follow:

> *"It took multiple reminders to get new user accounts added to the project."*
>
> *"The response was very slow."*
>
> *"Some responses, although useful, came way to late i.e., after a WEEK."*
>
> *"I had reached out to the OLCF help desk about a bug in a vendor library (including a minimum working example). But they didn't provide any useful help for about a month and a half, at which point I was told that I needed to setup Office Hours to report bugs in vendor libraries."*
>
> *"The response took up to a month to resolve the issue."*

All open-ended responses are provided in Appendix D: User Dissatisfaction Explanations.

Table 54. Satisfaction Ratings of OLCF's Problem Resolution by PI Status and Overall

	PI Status				Non-PI Status				Total			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Quality of technical advice given to reported issues	78	4.68	0.50	99%	336	4.60	0.62	95%	414	4.61	0.60	95%
Timeliness of responses to reported issues	79	4.62	0.67	95%	341	4.60	0.68	94%	420	4.60	0.68	94%
Overall satisfaction with OLCF's response to reported issues	79	4.68	0.49	99%	338	4.58	0.68	94%	417	4.60	0.65	95%

Table 55. Satisfaction Ratings of OLCF's Problem Resolution by Project Allocation

	INCITE				DD				ALCC				ECP			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Quality of technical advice given to reported issues	153	4.60	0.63	93%	157	4.65	0.55	96%	76	4.64	0.58	95%	168	4.57	0.63	95%
Timeliness of responses to reported issues	156	4.58	0.70	93%	159	4.61	0.68	94%	77	4.64	0.61	96%	170	4.53	0.72	93%
Overall satisfaction with OLCF's response to reported issues	156	4.60	0.59	95%	158	4.65	0.59	94%	77	4.65	0.56	96%	168	4.51	0.76	94%

Table 56. Satisfaction Ratings of OLCF's Problem Resolution by Length of Time as an OLCF User

	Less than 1 Year				1 – 2 Years				Greater than 2 Years			
	N	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*	*N*	*M*	*SD*	*%Sat*
Quality of technical advice given to reported issues	85	4.58	0.61	94%	75	4.67	0.53	97%	254	4.61	0.62	95%
Timeliness of responses to reported issues	87	4.59	0.76	93%	75	4.71	0.54	96%	258	4.58	0.69	94%
Overall satisfaction with OLCF's response to reported issues	84	4.60	0.60	94%	75	4.64	0.56	99%	258	4.59	0.69	94%

Workflow, Data Analysis, Visualization, and Publication

This section of the survey was displayed to all respondents unless they indicated at the beginning of the survey that they had not used any of the listed OLCF resources/services.

Users were asked to indicate where they analyze data. Figure 10 shows that the largest proportions of users analyzed their data mostly elsewhere and the smallest proportions analyzed their data mostly at OLCF or only at OLCF.

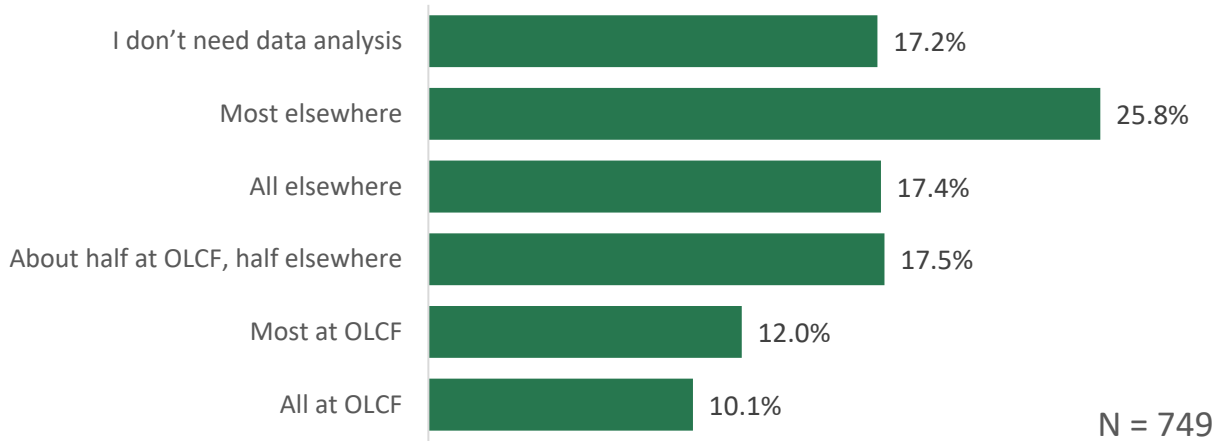

Figure 10. Locations for analysis of data by OLCF users

Note: Percentages may not add up precisely to 100% due to rounding in each category.

To put these results in context, users were also asked about the source of their data, displayed in Figure 11. The largest proportion of users are working with data that is mostly sourced from outside OLCF. However, an almost equal proportion work with data mostly sourced from OLCF.

Figure 11. Source of user data

Note: Percentages may not add up precisely to 100% due to rounding in each category.

When asked "How do you organize, search for, share, and move data (e.g., data management tools, transfer tools, web services, processes, other)?", 366 respondents supplied comments (Table 57). Responses fell into three broad themes: *Data moving/formatting/organizing/searching/synchronizing; Data location: generation, collection source, active work, storage;* and *Other.* Select comments from the top two categories within each theme are given below. See Appendix F: User Comments on Data Analysis, Visualization, and Workflow for all responses by category.

Data moving/formatting/organizing/ searching/synchronizing	**Globus**	*"I mostly use rsync and scp, but for larger transfers I will use Globus. I recently moved 100TB from OLCF to Princeton using Globus without any issues!"* *"Globus"* *"Mostly Globus"*
	ssh (rsync, scp, putty)	*"SSH/rsync"* *"…I only use SSH connection tools (scp, rsync) to move data, because the data of measured calculation speed (csv, txt) are only needed for our current purpose."* *"SCP (Secure Copy Protocol)"*
Data location: generation, collection source, active work, storage	**Data generated on or moved to or from external location (local computer/system, other organization/lab/ institution/public repository)**	*"Just transfer the data outside OLCF."* *"I postprocess data on OLCF, then transfer it to a local machine via Globus."* *"Copy data to local machine."* *"Mostly careful directory structure for organizing and Andes to work with data."*
	Various directories (project, home, etc.) or folders	*"The data size of my project is small. It is under my user directory."* *"Shared project folders on OLCF, then download."*
Other	**Update necessary for Globus**	*"Globus, which y'all need to update the endpoint or it won't work after December. Sometimes I use sftp but not much."* *"I author transfer software for the ESGF project which uses parallel https*

	Miscellaneous	*downloads and globus if OLCF will ever update the software stack."* *"Other."* *"I have just started using OLCF and so far find it very convenient."* *"As per requirement. I download the data."*

Table 57. Users' Responses for How They Organize, Search For, Share, and Move Data

Category	***N* = 366**	**Percentage**
Data moving/formatting/organizing/searching/ synchronizing, *n* = 428		
Globus	146	40%
ssh (rsync, scp, putty)	142	39%
DTNs	20	5%
Git/GitHub and associated services	20	5%
Open-source software/open-source libraries	19	5%
sftp	17	5%
Transfer tools	13	4%
Python	12	3%
hsi/htar	10	3%
WinSCP	8	2%
Linux command line	8	2%
Web services	7	2%
shiftc	4	1%
Data management tools	2	1%
Data location: generation, collection source, active work, storage, *n* = 108		
Data generated on or moved to or from external location (local computer/system, other organization/lab/institution/public repository)	27	7%
Various directories (project, home, etc.) or folders	16	4%
HPSS/Archive	10	3%
Jupyter	10	3%
Data handled internally with OLCF	8	2%
Summit	7	2%
Alpine/GFPS, Orion Lustre, or scratch space	7	2%
Cloud storage	7	2%
Andes	6	2%
Manual	6	2%
Frontier	4	1%

Other, *n* = 26		
Update necessary for Globus	2	1%
Miscellaneous	24	7%

Note: Percentages total to more than 100% because responses could mention more than one type of improvement.

When asked whether they planned on publishing the data generated from their study, 681 users responded. 59% (399 out of 681 responding) responded Yes, of which 358 supplied comments indicating where they would publish their data (Table 58). 41% (282 out of 681 responding) responded No, of which 152 provided comments indicating why they did not plan to publish (Table 59). See Appendix F: User Comments on Data Analysis, Visualization, and Workflow for all responses by category. Select comments from the top three categories among those planning to publish include:

Journal, scientific society, conference proceedings, or workshop	*"Peer-reviewed journals such as Nature, Physical Review Letters, Physics Letters B, Physical Review, European Physical Journal and others."* *"AIAA conferences"* *"Scientific journals"*
Unsure	*"We have not decided on this yet."* *"Not determined yet."* *"TBD"*
zenodo.org	*"Zenodo"* *"Maybe on Zenodo. Usually, it is a reduced form of the production data."* *"Computational performance data on Zenodo."*

Select comments from the top three categories among those not planning to publish include:

Does not generate data, or data is used for "unpublishable" purposes like training/validation/testing/performance/software design	*"I do not generate data in my experiments."* *"I'm not involved in generating data. I'm only working on improving our dynamics code."* *"As a software engineer, the data generated by my work on Summit is for model testing only."*

	"Not responsible of publishing the data."
Data sharing is someone else's decision/responsibility	*"I'm not sure if we will publish or not. I am not in charge of that decision."* *"I am in a support position; others will be publishing."*
No plan yet to share/undecided about sharing/will make available upon request	*"I am not sure right now, perhaps in the future."* *"No intentions of publication."* *"We provide data to other researchers upon reasonable request."*

Table 58. Users' Responses for Where they Plan to Publish Data

Category	*N* = 358	Percentage
Journal, scientific society, conference proceedings, or workshop	209	58%
Unsure	50	14%
zenodo.org	37	10%
Other repository, archive, database, or project/university/organization website	32	9%
GitHub	16	4%
Constellation	13	4%
OSTI.gov	6	2%
Figshare.com	5	1%
Materials Data Facility	4	1%
Other venue for sharing	4	1%
Data sharing is someone else's decision/responsibility	3	1%
Technical reports	3	1%
arXiv	3	1%
TACC DesignSafe	2	1%
Dataspace	2	1%
Hugging face	2	1%
ESGF	2	1%
dbGaP	2	1%

Note: Percentages total to more than 100% because responses could mention more than one type of publication.

Table 59. Users' Responses for Why they Do Not Plan to Publish Data

Category	*N* = 152	Percentage
Does not generate data. Data is used for "unpublishable" purposes like training/validation/testing/performance/software design	48	32%
Data sharing is someone else's decision/responsibility	19	13%
No plan yet to share/undecided about sharing/will make available upon request	18	12%
Data is not ready for publication. Immature project/lack of data.	15	10%
Analyzed/summarized data will be published, not raw data	14	9%
Data is/will be published or shared by public portal	11	7%
Large data size is an impediment to sharing	10	7%
Data is sensitive/private/protected	7	5%
Other reason for not sharing data	6	4%
No value of sharing data in given community	5	3%
Uses already published/publicly available data	3	2%
Not a priority	3	2%
Unclear answer	8	5%

Note: Percentages total to more than 100% because responses could mention more than one reason for not publishing data.

When asked whether they use workflow management tools, 682 users responded. 16% (108 out of 682 responding) responded Yes, of which 103 supplied comments indicating the tools they use (Table 60). 84% (574 out of 682 responding) responded No, of which 357 supplied comments indicating why they did not use such tools (Table 61). See Appendix F: User Comments on Data Analysis, Visualization, and Workflow for all responses by category. Select comments from the top categories of those using workflow management tools include:

Other tools	*"bitbucket"* *"Monday.com"* *"Swift/T"*
Custom/in-house tools	*"I have write my own set of tools that I use to manage my workflow."* *"We developed our own version of workflow management software."* *"Custom"*
Git/GitHub/GitLab and related capabilities	*"GitLab"* *"Git/gitlab/github"* *"Continuous integration as part of Github"*

Representative explanations for why respondents do not use workflow management tools from the top categories include:

No need/unnecessary/not relevant to current work	*"I did not need it."* *"Not needed for my research."* *"Don't find it necessary."*
Unfamiliar with tools and/or how to use them	*"I don't know what's available."* *"I am not aware of such software."* *"Not yet, would like to know more about them."*
Workflow is not complex/other approaches are sufficient	*"It would be overkill for what we are doing at the moment."* *"The workflow is simple."* *"I'm not running complex workflows that would require it."*

Table 60. Users' Responses for Workflow Management Software

Category	*N* = 103	Percentage
Other tools	21	20%
Custom/in-house tools	18	17%
Git/GitHub/GitLab and related capabilities	17	17%
RADICAL Cybertools, EnTK, and related capabilities	9	9%
Signac	7	7%
NEXUS, QMCPACK, and related capabilities	7	7%
Maestro, Flux, and related capabilities	6	6%
Pegasus, Condor, and related capabilities	4	4%
Jira	4	4%
Trello	3	3%
Notion	3	3%
Python scripting, PARSL	2	2%
Slurm	2	2%
Teams	2	2%
pyiron	2	2%
Curifactory	2	2%
nnodes	2	2%
Miscellaneous	4	4%

Note: Percentages total to more than 100% because responses could mention more than one type of software.

Table 61. Users' Responses for Why they Do Not Use Workflow Management Software

Category	*N* = 357	Percentage
No need/unnecessary/not relevant to current work	161	45%
Unfamiliar with tools and/or how to use them	72	20%
Workflow is not complex/other approaches are sufficient	53	15%
Custom script/workflow approach	25	7%
Inertia: not enough time and/or learning is too complicated	15	4%
Do not understand benefits of using/not a priority	13	4%
Planning to/may use in future	12	3%
Small team/project	5	1%
Workflow tools lack flexibility/have not found one that works well enough	5	1%
Other reason	5	1%
Other team members use workflow management tools	2	1%
Unclear response/misunderstood question	11	3%

Note: Percentages total to more than 100% because responses could mention more than one type of reason.

When asked "What are your main data-related challenges (e.g., data provenance, audit trails, publishing, security, metadata management, access, transfer, sharing, storage, io speeds, tooling, services, other)?", 301 individuals (Table 62) supplied comments. Among these responses, *Transferring/retrieving data, I/O, network* (*n* = 139) and *Storage, purge policies, backup* (*n* = 99) were mentioned most frequently, followed by *Accessibility, sharing, permissions, security, compliance* (*n* = 54). See Appendix F: User Comments on Data Analysis, Visualization, and Workflow for all responses by category. Select comments include:

Transferring/retrieving data, I/O, network	*"Transferring to Orion is taking very long time."* *"The main challenge is managing the vast quantities of data (~100s of PBs) that we generated and finding intelligent ways to subset it, or failing that, efficient ways to transfer it to our long-term archive storage. We were not able to transfer all of the data out of OLCF we would have liked before our project closed due to the large volume. Perhaps OLCF would consider training on best practices for transferring data out of OLCF in future (using Globus or otherwise), if this does not already exist."* *"Transfers, io speeds"*
Storage, purge policies, backup	*"Storage"* *"Data backup."* *"The main data-related challenge I have is storing and organizing performance measurement data efficiently for a long period of time."*

Accessibility, sharing, permissions, security, compliance	*"Accessing data because of security."* *"PHI rules compliance, data ingress and egress."* *"Sharing"*

Table 62. Users' Stated Data-Related Challenges

Category	*N* = 301	Percentage
Transferring/retrieving data, I/O, network	139	46%
Storage, purge policies, backup	99	33%
Accessibility, sharing, permissions, security, compliance	54	18%
Large volume of data	43	14%
Audit trails, provenance, metadata, versioning, organization, querying, and/or management	43	14%
Processing, compression, formatting, analysis, and/or visualization	30	10%
Environment, tools, software	24	8%
Publishing/making data public	14	5%
Scheduling, queues, workflows/efficient use of computational resources, checkpointing, staging, and/or available memory	9	3%
No or limited challenges	3	1%
Training/OLCF support	2	1%
Miscellaneous	12	4%

Note: Percentages total to more than 100% because responses could mention more than one type of improvement.

User Suggestions for Improvement

This section summarizes the suggestions provided by respondents with respect to potential improvements in OLCF resources/services, which includes additions or changes.

OLCF Experience

When asked "What can the OLCF do to better serve you?", 40 respondents supplied comments. Among those expressing a need or preference, *Tools, software, libraries, installations, and updates* was mentioned most frequently, followed by *Documentation, training, tutorials, and community communication, Frontier or Summit, Staff support, ticketing, and communication/notification,* and additional themes (Table 63). See Appendix E: User Suggestions for Improvement for all responses by category. Select comments include:

Tools, software, libraries, installations, and updates	*"Please enable Jax support for machine learning."* *"Provide more software support."* *"Provide the support for distributed learning frameworks (PyTorch, TensorFlow, Horovod) on Frontier."*
Documentation, training, tutorials, and community communication	*"Adding documentation of using Jupyter-server."* *"More step-by-step tutorials for various applications including running md simulations, submitting python jobs, etc."* *"It would be good to have training and examples on using OpenACC in Fortran codes on Frontier."*
Frontier or Summit	*"Network noise in Frontier is a serious issue which need improvement."* *"Our code appears to run much slower on Summit as compared to earlier. Not sure what is causing this."* *"We encountered a known bug for Summit which affected MIMD abilities. This bug affected our ability to run simulations. The support that was provided was very helpful and timely but unfortunately the bug could not be overcome."*
Staff support, ticketing, and communication/notification	*"I usually will receive the notice when the OLCF is down. Some of them are scheduled maintenance, and others may not be expected. Is it possible to add the approximate up time if those down time is on schedule?"* *"I'm not an expert but I've noticed the GPU have extremely small cache compared to the ones I used before. I think this should be mentioned or accentuated somewhere, because I have not realized it before and it slowed down my code written on another machine IMMENSLY."* *"I have lost data due to the purging that happens every 90 days after my last login. If possible, I would like to get an email reminder whenever my next purge is approaching."*

Table 63. Users' Suggestions for Additional Services and/or Resources Needed to Enhance Their Experience at the OLCF

Category	*N* = 40	Percentage
Tools, software, libraries, installations, and updates	12	30%
Documentation, training, tutorials, and community communication	12	30%
Frontier or Summit	7	18%
Staff support, ticketing, and communication/notification	5	13%
Job queue and scheduling policy	3	8%
Purge policy	2	5%
Jupyter	2	5%
Filesystem, I/O, and data transfer	2	5%
Miscellaneous	6	15%

Note: Percentages total to more than 100% because responses could mention more than one type of improvement.

Compute or Data Resources

When asked, "Please describe how the OLCF can improve your experience using any of the HPC resources (i.e., Andes, Summit, Frontier, DTNs, HPSS, Alpine GPFS, Orion Lustre) and/or tell us if any additional resources are needed," 65 respondents provided comments. The highest proportions of users provided suggestions related to *Environment (software, tools, modules, etc.)* (37%), *Frontier* (29%), and *Job queue, prioritization, node limits, allocations, and related policies* (18%). See Appendix E: User Suggestions for Improvement for all responses by category. Refer to Table 64 for all themes identified.

Select comments include:

Environment (software, tools, modules, etc.)	*"We rely heavily on OLCF's Jupyter hub to analyze data and had to transfer data from Orion to Alpine to do so, which leads to additional transfer, is time consuming and error prone. Direct access to Orion scratch from OLCF's Jupyter hub would of course be much better."* *"Though they are difficult to install, it would be nice to have lmod modules of R or even a base R environment with tidyverse and devtools installed."* *"This is probably on your radar already, but it is hard to be at the cutting edge of AI on Summit when we cannot easily install some of the latest versions of PyTorch, transformers, xformers, flash-attn, and more. Now some of these are due to the V100s not being really supported by some of those libraries, but some of it is due to other incompatibilities."*
Frontier	*"Some details about the modules on Frontier would be useful: 1) Which modules are compatible? 2) Which modules are recommended and work on Frontier? I found the Hackathon very useful."*

	"We need upgrades in the performance and size of storage systems commensurate with the Exascale size of Frontier." *"My primary recommendation would be to ensure small batch jobs are scheduled to run much more quickly. Interactive debugging and small-scale tests are currently not really possible on Frontier. Second, Frontier in particular needs hardening. Performance is variable across nodes and there are still many unexpected issues and node failures."*
Job queue, prioritization, node limits, allocations, and related policies	*"There are times when I observe through the jobstat command that Summit usage is very low. I understand that Summit prioritizes large jobs over optimal efficiency, but sometimes there are enough free nodes for the highest priority large job to run, but that job does not start running for several hours. I'm not sure what is the scheduling algorithm is causing this to happen, but I think there is room to improve efficiency without sacrificing the priority of large jobs."* *"Some resources for using a small number of nodes for longer times could be useful."* *"The only system that allows for more long compute time on a small number of compute nodes (36 hours on a single node vs 2 for Frontier/Summit), yet a tiny amount of hours are allocated by comparison. Some workflows require a long runtime on a few nodes (e.g., single-cell RNA-seq alignment to large genomes). Either stop the 2 hours max for small numbers of nodes on Frontier and Summit or allocate more Andes hours (which was done in the past)."*

Table 64. Users' Suggestions for Improvements to HPC Compute and Data Resources

Category	*N* = 65	Percentage
Environment (software, tools, modules, etc.)	24	37%
Frontier	19	29%
Job queue, prioritization, node limits, allocations, and related policies	12	18%
Performance/ Reliability/ Stability/ Hanging	11	17%
Orion Lustre	11	17%
Summit	9	14%
OLCF support, documentation, user information, and communication/notice	7	11%
Andes	6	9%
Alpine GFPS	5	8%
Downtimes	4	6%
Disk space, data retention, purge policy, and related communications	4	6%
Positive comments	3	5%
Data transfer	2	3%
Miscellaneous	5	8%

Note: Percentages total to more than 100% because responses could mention more than one type of improvement.

myOLCF Self-Service Portal

When asked, "Please share your feedback on how we can improve myOLCF, including requests for additional functionality," 54 users responded. Twenty-eight percent of the responses were *positive comments/appreciation* for myOLCF (*n* = 15). Twenty percent of the recommendations proposed *Adding usage/job/project display/filtering options (n* = 11*)* and 17% of the recommendations proposed improvements to myOLCF's *Ease of use/navigation* (*n* = 9). See Appendix E: User Suggestions for Improvement for all responses by category. Refer to Table 65 for all themes identified.

For example:

Positive comments/appreciation	*"It's very good. Thank you!"* *"This is a user-friendly tool that helps me keep in touch with my allocation."* *"I think the myOLCF resource is great, easy to use, and informative."*
Add usage/job/project display/filtering options. Information accuracy.	*"I have trouble either figuring out how to view allocations (spent vs. unspent) or figuring out how to interpret what I do find."* *"It would be nice if I could access more detailed statistics about the jobs I ran. For example, some systems I use enable the download of a CSV file with start time, end time, number of nodes, and queue for all jobs that a user runs."* *"Show ALL the projects, even the restricted ones, so I can track progress of applications, status etc."*
Ease of use/navigation	*"It's sometimes a little clunky to show the reports I want. Also, I always have to search around a little bit for the report I'm looking for since there are several places to look at hours used and jobs run, each with slightly different results."* *"The directionality of how to get to specific menus is a bit confusing. Especially when related to hours consumed, I am often not sure if I am on the right place."* *"It's clunky to navigate between different projects, since they remain hidden in the dropdown menu."*

Table 65. Users' Suggestions for Improvements to myOLCF

Category	*N* = 54	Percentage
Positive comments/appreciation	15	28%
Add usage/job/project display/filtering options.	11	20%
Ease of use/navigation	9	17%
Inaccurate/missing/outdated/timeliness of information	5	9%
Applications/project renewals	5	9%
Communication about required actions/notifications	4	7%
Ability to manage users/groups	3	6%
Account addition/approval/renewal process	2	4%
OLCF support/documentation	2	4%
Miscellaneous	5	9%

Note: Percentages total to more than 100% because responses could mention more than one type of improvement.

Workflow, Data Analysis, Visualization, and Publication

When asked, "What additional data analysis, visualization, and/or workflow services would you like the OLCF to provide?" 46 users responded. Among those users, the largest proportions were interested in a variety of *Analysis and visualization capabilities* in addition to *Jupyter* and tools for *Workflow, debugging, or containers*. *ParaView, Remote visualization, remote access, and cloud visualization Tecplot, and VisIt* were specifically mentioned by a small number of respondents and broken out as separate categories. A range of other themes were addressed by comments (Figure 12).

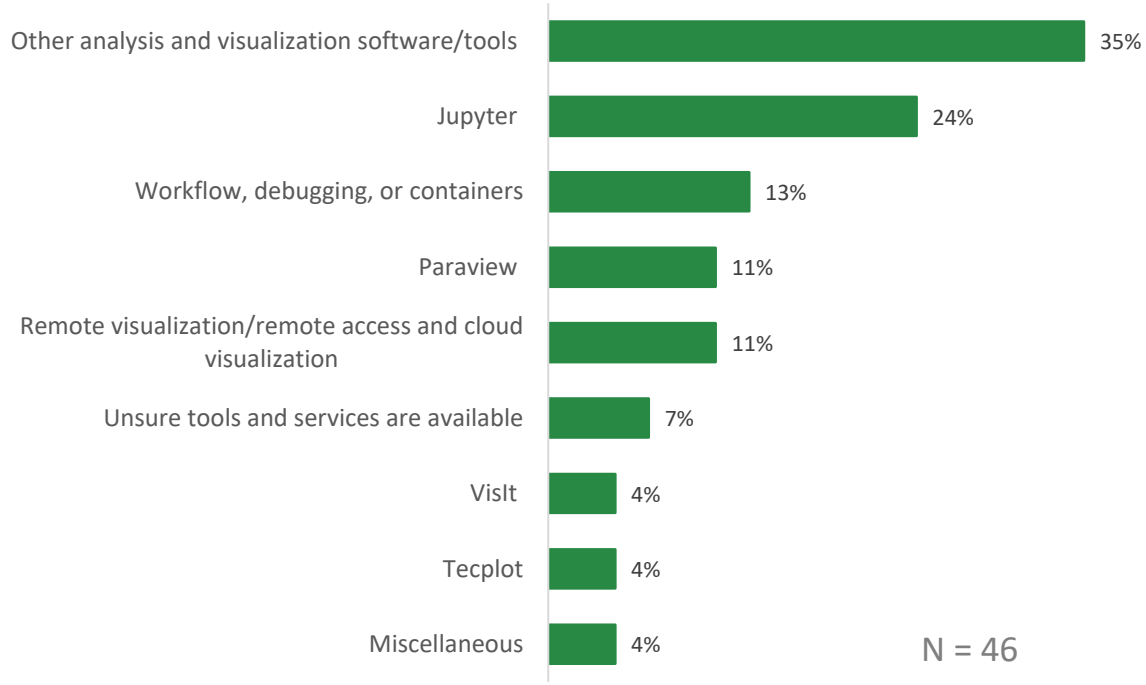

Figure 12. Users' suggestions for additional data analysis, visualization, and/or workflow services
Note: Percentages total to more than 100% because some provided more than one theme in their response.

Example replies in the most frequently reported categories are provided below (see Appendix E: User Suggestions for Improvement for all responses by category).

Other analysis and visualization software/tools	*"Julia on OLCF JupyterHub."* *"Dakota, Petsc, gmsh."* *"I would like increased support for molecular graphics programs to run on Frontier, such as ChimeraX or VMD."*
Jupyter	*"Jupyter on Frontier/Orion"* *"Jupyter."* *"Jupyter access on Orion."*
Workflow, debugging, or containers	*"Streamlit server"* *"It would be nice to have virtual desktops to run Jupyter Notebooks with access to GPUS. That is quite useful for debugging."* *"vscode"*

Other OLCF Issues

When asked to comment on any additional areas of importance not covered elsewhere in the survey, 53 individuals replied. The largest proportion expressed *Satisfaction, thanks, positive remarks* (43%), followed by comments related to *Frontier* (17%), and *Allocations, queue length, job prioritization, and related policies* (15%). Other comments were distributed as seen in Table 66 (refer to Appendix E: User Suggestions for Improvement for text of these comments).

Example replies in the most frequently reported categories are provided below.

Satisfaction, thanks, positive remarks	*"Thanks for all your efforts to maintain a great system."* *"Thank you for your continuous support! Highly appreciated!"* *"There have certainly been growing pains this year on Frontier, which we have outlined in our recent INCITE status reports. We appreciate all of the toilsome efforts at OLCF to continue maturing the system - they do not go unnoticed! It is a privilege to stress the system with applications of relevance to our organization and we hope to continue to have that opportunity going forward. Thanks for everything."*
Frontier	*"Demand for time and resources on Frontier is obviously large, but it seems like smaller scale tests (requiring a few to 10's of nodes) can take a very long time."*

	"The frontier hackathons were great!" *"It would be great to keep a Crusher-like TDS for code development related to Frontier."*
Allocations, queue length, job prioritization, and related policies	*"An exemplar batch file for large jobs which is continually updated as things improve would have been helpful."* *"I feel that computational resources available to the ORNL people are limited. Most of the projects I worked on had resources from DD (up to 20000 units), which deplete very fast!"* *"As I said elsewhere, queue time."*

Table 66. Respondent Comments on Other Issues Not Addressed within the Survey

Category	***N* = 53**	**Percentage**
Satisfaction, thanks, positive remarks	23	43%
Frontier	9	17%
Allocations, queue length, job prioritization, and related policies	8	15%
Performance, capabilities, maintenance, downtimes, system updates	5	9%
Account and project applications, renewals, and approvals	5	9%
Environment (software, libraries, tools, processing, visualization, etc.)	4	8%
Andes	3	6%
Orion	3	6%
Account access, credentials, and security	3	6%
Staff support/vendor support	3	6%
Crusher	2	4%
Summit	2	4%
Miscellaneous or unclear response	7	13%

Note: Percentages total to more than 100% because responses could mention more than one issue.

Summary of Survey Observations

In most respects, users were satisfied with the OLCF resources/services. Table 67 summarizes satisfaction (*satisfied* or *very satisfied*) ratings. The color scale indicates the relative magnitude of cell values: high-med-low = green-yellow-red. Examination of the table suggests that **satisfaction was highest** (across respondent types) for Data Liaisons, Training, Projects and Accounts, User Assistance, Issue Response, and Andes; while the **lowest ratings** were reported for Frontier and Orion. Overall, these ratings still reflect a generally high satisfaction among users. When "All" respondents are considered as a group, all items were rated as either *satisfied* or *very satisfied* by 82% or more of users.

Table 67. Summary of Overall Satisfaction with Aspects of OLCF by PI Status, Project Allocation, and Length of Time as an OLCF User

		PI Status		Project Allocation				Length of Time as an OLCF User		
	All	PI	Non-PI	INCITE	DD	ALCC	ECP	Less than 1 Year	1 – 2 Years	Greater than 2 Years
Max N responding:	763	110	653	276*	263*	139*	287*	180	149	434
OLCF	94%	96%	94%	94%	96%	96%	94%	91%	93%	96%
Compute Resources	92%	97%	91%	89%	96%	93%	92%	89%	87%	95%
Andes	95%	94%	95%	94%	95%	96%	100%	93%	90%	97%
Summit	94%	98%	94%	94%	95%	95%	94%	85%	96%	97%
Frontier	82%	86%	81%	78%	86%	83%	81%	85%	72%	83%
Data Resources	87%	86%	88%	86%	88%	93%	84%	83%	89%	88%
Data Transfer Nodes	88%	82%	89%	81%	92%	89%	81%	77%	94%	89%
HPSS	94%	95%	94%	94%	93%	91%	95%	75%	100%	96%
Alpine GPFS Scratch Filesystem	94%	92%	94%	94%	93%	97%	93%	91%	93%	95%
Orion Lustre Scratch Filesystem	86%	82%	87%	86%	85%	95%	85%	92%	78%	86%
OLCF Support	90%	95%	89%	91%	93%	92%	87%	86%	89%	92%
Projects and Accounts	96%	97%	95%	96%	94%	95%	96%	91%	98%	97%
User Assistance	95%	97%	94%	95%	96%	94%	94%	93%	99%	94%
INCITE Liaisons	94%	94%	93%	92%	95%	100%	91%	91%	96%	94%
Data Liaisons	100%	100%	100%	100%	100%	100%	100%	NA	100%	100%
Issue response	95%	99%	94%	95%	94%	96%	94%	94%	99%	94%
OLCF Services	90%	94%	90%	92%	92%	89%	85%	88%	93%	90%
myOLCF	92%	96%	90%	91%	92%	96%	87%	90%	88%	93%
Documentation	93%	97%	93%	92%	94%	96%	91%	90%	96%	93%
Website	90%	91%	90%	92%	89%	93%	89%	87%	85%	92%
Communications	93%	94%	93%	92%	94%	92%	92%	90%	94%	94%
Training	97%	97%	96%	97%	97%	100%	97%	86%	97%	99%
Min	**82%**	**82%**	**81%**	**78%**	**85%**	**83%**	**81%**	**75%**	**72%**	**83%**
Max	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**94%**	**100%**	**100%**

Note. The table above summarizes satisfaction (responses indicating satisfied or very satisfied) ratings. The color scale indicates the relative magnitude of cell values: high-medium-low values fill a green-yellow-red gradient.
*Some users are assigned to more than one project allocation.

Longitudinal Comparisons of User Responses

This section reviews the results from the 2006 through 2023 OLCF User Surveys and reports information about long-term response trends related to respondent years of experience with OLCF, project allocations, and overall satisfaction with OLCF.

OLCF Users

Figure 13 shows that **length of time using OLCF** (i.e., experience as an OLCF user) reported by most survey respondents has changed substantially between 2006 and 2023. Prior to 2009, about half of respondents reported using OLCF less than one year, and this category comprised the largest proportion of users. However, between 2009 and 2011, the largest proportion of respondents indicated having greater than two years of experience at OLCF. In 2012, user experience shifted back to the largest proportion of respondents reporting using OLCF less than one year. From 2013 to 2023, users who had been with OLCF for more than two years once again made up the greatest proportion of respondents.

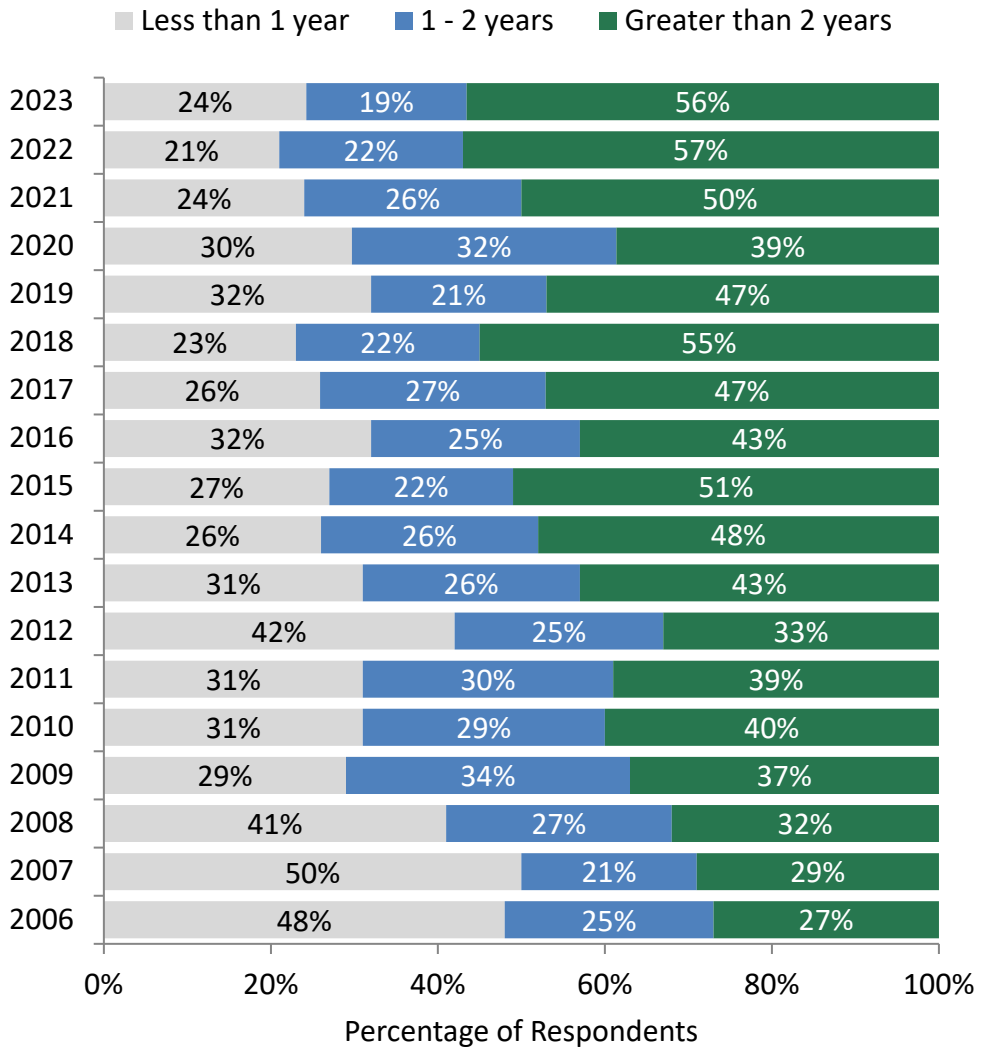

Figure 13. Respondent years of experience with OLCF, 2006-2023

Note: Percentages may not add up precisely to 100% due to rounding in each category.

With respect to **project classifications** (Figure 14), *survey respondent* data is available from 2007 to the present year, and OLCF data for *the entire pool of OLCF users* is available from 2014 to present. The figure shows these side-by-side and indicates that the distribution of respondents has tracked the overall user pool. In 2018, the ECP project allocation was added to the dataset. Note that this longitudinal tracking excludes "other" project classifications, such as NOAA projects, General projects, Staff projects, and 2019's Early Science (ES) projects.

Generally,

- Until 2017, INCITE projects have shown a downward trend in share of both the respondent and the user pool. In 2017 through 2019, INCITE projects grew modestly in the user pool before shrinking in 2020, 2021, and 2022. However, in 2023 the number of INCITE projects in the respondent pool and user pool increased.
- Director's Discretion (DD) projects remained relatively constant between 2007 and 2011 for respondents, and generally trended upward between 2012 and 2018 before reversing course in 2019. Notably, in both 2019 and 2020, DD was noticeably underrepresented among survey respondents. DD grew in its share of respondents in 2021, 2022, and 2023 despite decreasing somewhat in the user pool.
- ASCR Leadership Computing Challenge (ALCC) supported projects began in 2010 and supported only 2% of respondents but grew significantly by 2014. Among both users and respondents, there has been a dip since 2018.
- Exascale Computing Project (ECP) supported projects began in 2018 and have grown since then among both users and respondents, other than a small decrease in respondents in 2021 and 2022. ECP is near completion in 2024.

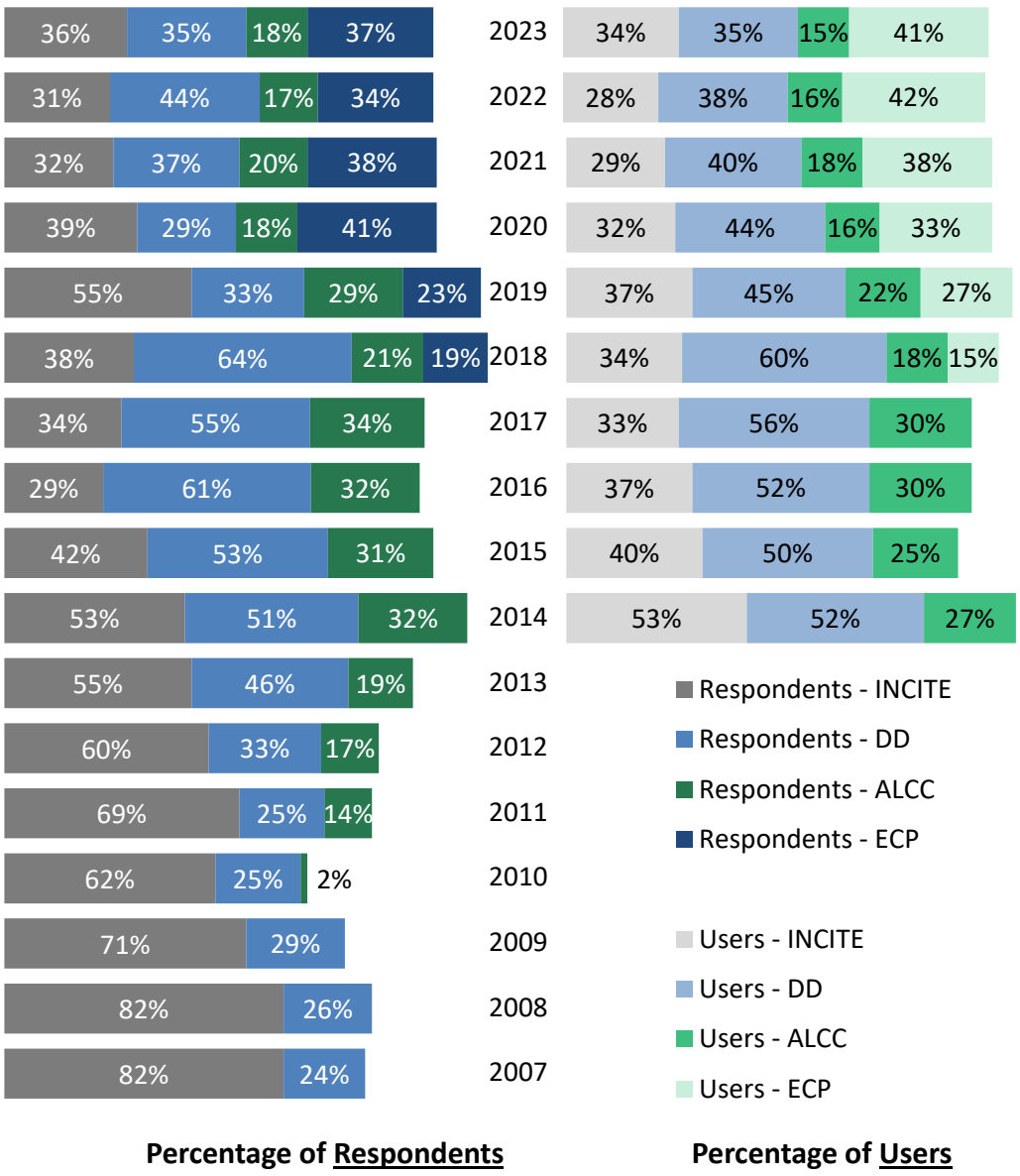

Figure 14. Survey respondent project allocations, 2007- 2023, and OLCF user project allocations, 2014-2023

Note: Percentage total to more than 100% as users are often affiliated with multiple projects.

Satisfaction with OLCF Overall

With regard to **overall satisfaction with OLCF**, the percent of *very satisfied* respondents showed a nearly uninterrupted trend upward from 2007 to 2018. The proportion of *very satisfied* respondents more than doubled from the 2007 value to 69% in 2017 and 70% in 2018 (Figure 15). The exceptions to this trend were moderate decreases in 2011 and 2012. In 2019 and again in 2020, the proportion of *very satisfied* respondents dropped to 59%, with a noticeable shift toward respondents selecting the *satisfied* option. The overall proportion of respondents indicating satisfaction (*satisfied* and *very satisfied* responses) has grown as well, from 91% in 2012 to 94-97% in each year from 2013 to 2023. The proportion of respondents indicating satisfaction was 94% in 2023.

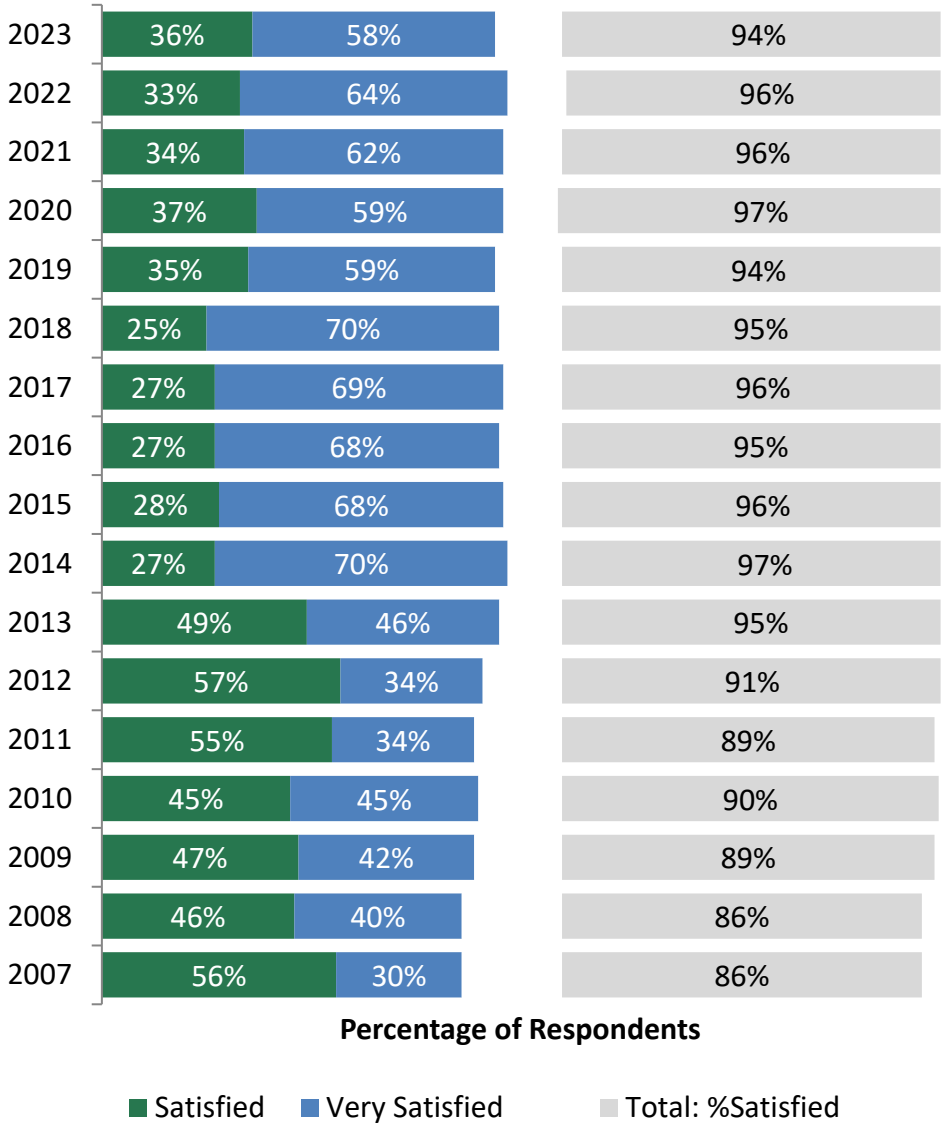

Figure 15. Proportion of respondents reporting being *satisfied* and *very satisfied* overall with OLCF and the total of %Sat respondents, 2007-2023

Note: Indicated percentages may not add up precisely to %Satisfied due to rounding in each category. In 2020, 37.4% and 59.3% of respondents, respectively, were *satisfied* or *very satisfied*; this rounds to 97% satisfaction.

Recommendations

OLCF Resources/Services

Recommendations offered here are based on examination of the relative satisfaction ratings, respondent reasons for dissatisfaction, and user recommendations for OLCF improvement. Note that since the satisfaction ratings across resources/services were relatively consistent and typically 90% or higher (with a few exceptions), recommendations for change are best found in the **expressed reasons** for user dissatisfaction in conjunction with their **suggestions for improvement**.

This year, many responses to open-ended questions noted issues with latency/lagging/bandwidth, tools/software/libraries/combability, performance issues, outages/downtimes, queue times/prioritization, and file systems. The two resources receiving the greatest number of follow-up comments after expressing dissatisfaction were Frontier (*N* = 52) and Summit (*N* = 25). The largest group of users reporting dissatisfaction with Frontier expressed discontent with job queue, prioritization, walltimes, and related policies. The second largest groups of users dissatisfied with Frontier reported being unhappy with performance issues and tools, software, and libraries/compatibility, compiling, and updates. Other frequent complaints from Frontier users were included the system having too much downtime and feeling the system was immature and buggy. Nearly half of the users expressing dissatisfaction with Summit cited discontent with tools, software, and libraries/compatibility, compiling, and updates while other frequent complaints related to Summit's architecture or job queue, prioritization, walltimes, and related policies. Although Summit received several follow-up comments from users who expressed dissatisfaction, 94% of users were either *satisfied* or *very satisfied* with the system.

Examination of Table 67. Summary of Overall Satisfaction with Aspects of OLCF by PI Status, Project Allocation, and Length of Time as an OLCF User suggests that the resources requiring the most attention include Frontier, the OLCF website, and data resources, specifically Data Transfer Nodes and Orion Lustre Scratch Filesystem. Another observation of potential interest to the OLCF is the tendency of newer OLCF users (1-2 years) being less satisfied with Frontier and Orion Lustre Scratch Filesystem (the lowest rated items across all items) than more experienced OLCF users (greater than two years). A similar observation is that users with less than one year of experience with the OLCF tended to be less satisfied with data resources, specifically Data Transfer Nodes and HPSS than users with more OLCF experience. Another noteworthy difference amongst satisfaction ratings is that PIs reported being more satisfied with Frontier than non-PIs, but less satisfied with data resources, specifically Data Transfer Nodes and Orion Lustre Scratch filesystem than non-PIs.

These findings reflect a range of open-ended comments that called attention to the ever-changing nature of both HPC and the OLCF, and the challenges users face as systems, tools, and scientific needs shift over time.

Additionally, OLCF should consider the following areas of emphasis:

Support Services	
Website	Although only a handful of respondents reported dissatisfaction with the OLCF website, it was the lowest-rated OLCF service (90% satisfaction). The largest group of users visited the site less than once a month (49.9%). Search capabilities were the lowest-rated aspect in 2021 and 2022, and continue to be the lowest-rated aspect of the website in 2023 (86% satisfied). Most of the comments from dissatisfied users cited search capabilities as the reason for their dissatisfaction. OLCF may want to consider their other knowledge of users' experiences with the website, and potentially ask deeper questions about the website next year to more fully understand users' interests.
myOLCF	Only 45% of respondents indicated using myOLCF, and of those, the majority used it once a month or less. OLCF should consider how to make the portal more useful for all types of users. As far as suggestions for improvement or additional functionality, myOLCF users would be interested in the portal providing more information about, different displays of, or filtering options for usage as well as enhancements to the ease of use and navigation.
User Community	While only suggested by a few OLCF users in their open-ended comments, there may be a great interest from other OLCF users as well in an online community where OLCF users could share experiences, seek guidance, and troubleshoot common issues together.
Problem resolution	While very few users provided explanations for their dissatisfaction with problem resolution, their concerns centered around support queries that went unanswered or were slow to be addressed. While there are a small number of such comments, they do suggest that some support tickets do not receive a complete or satisfactory response.
Compute and Data Resources	
File system and data transfer	On Alpine GPFS, Orion Lustre, and HPSS, *frequency of outages* received the lowest user ratings (83%, 79%, and 86% satisfaction respectively. Twelve Alpine GPFS users, 14 Orion Lustre users, and three HPSS users who expressed dissatisfaction with one or more aspects of these file systems provided follow-up comments which cited filesystem outages/lag, crashes, errors, and responsiveness of the system. OLCF should explore the reasons for freezing, non-responsiveness, or slowness issues related to system lag that have affected data transfer and use of these file systems.

Tools/Software/Libraries/ Installations and Updates	*Tools/software/libraries/installations and updates* were tied for the most common suggestion for additional services or resources needed to enhance users' experience at the OLCF. The comments address a large breadth of specific tools and requests. The OLCF should review all comments and consider which items could be addressed to enhance user experience.
Documentation, training, tutorials, and community communication	*Documentation, training, tutorials, and community communication* were tied for the most common suggestion for additional services or resources needed to enhance users' experience at the OLCF. Users suggested a variety of documentation that would be useful in their roles, while also indicating that some documentation was outdated, or could be clearer. The OLCF should review all comments and consider which items could be addressed to enhance user experience.
Environment (software, tools, modules, etc.)	The most common suggestions for improvement to compute and data resources were related to *Environment (software, tools, modules, etc.)*. Many users strongly suggested that Jupyter needs to be connected to Frontier and Orion Lustre and that their data analysis workflows contain extra/unnecessary steps due to this environmental barrier. Users suggested a variety of other software, tools, and updates and the OLCF should review all comments and consider which items could be addressed to enhance user experience with compute and data resources.
Workflow, Data Analysis, Visualization, and Publication	
Data-related challenges	By far, the most frequently cited challenge was *transferring/retrieving data, I/O, network* (46% of respondents). The next most common challenge was *storage and backup of datasets, including OLCF purge policies* (33% of respondents).
Workflow management	Only 16% of OLCF users are currently using workflow management tools. Nearly one-fifth of respondents who indicated that they did not use workflow management tools cited a *lack of familiarity with tools or how to use them*, and others (7%) have been *using a custom script or other manual approach*, which may be an opportunity for the OLCF to provide further training or further functionality in these areas. Of those users who do use tools, they cited and shared quite a range; OLCF may want to consider how to provide support for some of the most common tools (such as Git-related tools) or examine the custom or home-brewed solutions from similar facilities.

OLCF may want to consider these findings carefully, identify priority areas of performance for improvement, and potentially highlight those areas on the next survey in 2024 in order to understand the impact of OLCF's efforts over the next year.

OLCF Evaluation

The following suggestions are offered with respect to the assessment of OLCF performance:

- Minor changes or adjustments were made to the survey in 2023, which will merit review and re-adjustment in 2024:
    - The beginning of the survey has been successfully restructured to ask about use across many systems *and* services, so that users were only asked to respond to questions about tools they had used. Review this list and the survey logic to ensure compatibility with any other changes to next year's survey.
    - Multiple open-ended questions related to data and workflow were added to gather fresh insights in 2021. This section was modified slightly for the 2022 and 2023 surveys, but only one question was removed. Open-ended questions add more of an analysis and interpretation burden for OLCF, as well as a greater response burden to OLCF users. If these questions have now been satisfactorily addressed, they could be removed from the survey (or revisited on a regular cadence, every few years). Alternatively, the responses to these questions over the years may have provided a thematic structure that can be used to ask more closed-ended questions about some of the topics, such as challenges with data or tools used for workflow management.
    - Questions about Slate and Constellation were removed from the 2023 survey as reported usage was extremely low on the 2022 survey (only 3% of respondents reported using Slate and only 2% of respondents reported using Constellation in 2022). Consider whether usage of these services ever increases enough to merit their inclusion on another future OLCF user survey.
    - Questions about Frontier, which became available to users in April 2023, and the Orion Lustre scratch filesystem were added to the 2023 user survey. Across all items, these resources were rated the lowest in terms of satisfaction across all user groups (82% satisfied with Frontier, 86% satisfied with Orion). The open-ended comments supplied by dissatisfied users as well as user suggestions for improvement (summarized in the body of the report) help provide the OLCF insight for these ratings. Some open-ended comments suggested the issues they experienced with Frontier had improved by the time they were completing the survey. While these lower satisfaction ratings may be attributed to the complexities of standing up new resources at the OLCF, the OLCF should consider whether there are more specific questions that should be added to the 2024 survey to probe about user experience with these resources.
- Utilize the findings of the 2023 survey to make some minor adjustments to the 2024 survey, including:
    - Consider asking respondents whether they have any suggestions for how the OLCF can improve the myOLCF Self-Service Portal and only provide the open-ended question requesting those suggestions after respondents indicate they have feedback to share. This suggested format is used in many other sections of the survey and would simplify the analysis and interpretation burden for OLCF, and reduce response burden to OLCF users who feel the need to provide input but do not have useful or related comments to share.

    - Revise the format of the satisfaction questions for INCITE Liaisons and Data Liaisons from radio button style questions to matrix style questions as there were up to three respondents who likely misinterpreted the scale since they provided dissatisfied ratings, but supplied positive open-ended comments when asked to explain their reasons for dissatisfaction.
    - Consider a special block of questions, rotating topics from year to year, to get more in-depth feedback about key elements of the user experience. This year, many questions focused on challenges and other details related to users' experiences with data and workflows. These items could potentially be cycled and replaced with questions about a different focus area in 2024. For instance, dissatisfaction with Data Transfer Nodes was one of the lowest-rated items in 2023, but little direct feedback or commentary was received. A block of questions in the 2024 survey could get feedback on an area of interest such as this but would not need to be repeated in the future.
- Maintain the survey at approximately its current length, which encouraged participation, streamlined analysis, and did not attract negative comments.
    - Survey participation can be encouraged by continuing to cite the highly reduced completion time.
    - The OLCF can also consider highlighting their use of the survey findings to encourage users to complete the survey; the ORAU evaluation team was interested and encouraged to learn about this proactive use of findings, and users may be similarly enthusiastic.
- The evaluation team alerted the Novi software support team at ORAU in advance of launching the 2023 OLCF Annual User Survey to avoid any potential outages. The team will continue to initiate these notifications in future years of the evaluation as well.
- Repeat the use of customized reminders, targeting both PIs and team members on project allocations, to boost the response to the survey. These reminders continue to be the most effective tool ever used for this survey process with OLCF users. The survey response rate increased from 45.5% in 2022 to 52.1% in 2023.
- During annual survey refinement, highlight significant OLCF changes from the previous FY and planned/potential changes or rollouts in the upcoming FY, and ensure those areas are adequately probed by existing items in the survey. Consider any additional questions that are needed regarding the startup of new systems or the sunsetting of existing systems.