ARCHER2
SP Quarterly Report

April – June 2023
EPCC
The University of Edinburgh

Document Information and Version History

Version:	1.0
Status	Release
Author(s):	Clair Barrass, Jo Beech-Brandt, Stephen Booth, Paul Clark, Daniel Gleed, Kieran Leach, Alan Simpson, Anne Whiting
Reviewer(s)	Alan Simpson

Version	Date	Comments, Changes, Status	Authors, contributors, reviewers
0.1	22/06/2023	Template created	Jo Beech-Brandt
0.2	06/07/2023	Various updates, including updated EPCC logo	Paul Clark, Daniel Gleed
0.3	10/07/2023	Added data, graphs, narrative	Jo Beech-Brandt
0.4	12/07/2023	Complete draft	Jo Beech-Brandt
0.5	13/07/2023	Reviewed	Alan Simpson
1.0	14/07/2023	Version for UKRI	Jo Beech-Brandt, Alan Simpson

1 The ARCHER2 Service

This is the report for the ARCHER2 SP Service for the Reporting Period: 1st April – 30th June 2023.

1.1 Service Highlights

- ARCHER2 underwent a major software upgrade from Friday 19th May at 1400 to Monday 12th June at noon. Users were kept informed of the details of the upgrade through the ARCHER2 website, user mailings and a virtual User Forum. The User forum was hosted by both EPCC and HPE staff and included details of new features and changes to the user environment following the upgrade. A recording is available to users who were unable to attend.

- The Test and Development Service (TDS) was available for nominated consortia users to access and test their code ahead of the full ARCHER2 service upgrade. The EPCC and HPE team worked together to ensure access and testing for the nominated users was successful. The users reported no issues but did note that they were unable to test their code at scale due to the limited size of the TDS.

- As agreed with EPSRC, each EPSRC project had a 1-month extension applied to the project allocation to compensate for the outage period of three weeks.

- The SP team was actively involved in a recent major incident test, with a rogue actor scenario presented. Both UKRI and various groups within the University engaged in the process allowing for a realistic simulation to be performed.

- We request user feedback when we close ARCHER2 queries. For this quarter all the feedback received has been positive and rated good, very good or excellent. Any feedback rated below good is counted as a complaint and is escalated to management to be addressed and the user communicated with to resolve any issues. We donate £1 to our chosen charity Save the Children for every response received; this Quarter £72 was donated as a result of feedback on SP queries.

- Members of the SP team attended the Cray User Group (CUG) meeting. The team delivered a very well received presentation which demonstrated how we manage slurm on our large scale HPC systems.

- Motorised valve replaced as part of the infrastructure works in prC to allow automation of water flow via the Building Management System controllers rather than manually.

- Engaged with our Mechanical and Electrical contractors to complete a review of the supporting ARCHER2 infrastructure at the ACF. This has developed into a multi-point plan to make improvements over the next year to our free cooling capabilities and lower running costs. This augments the work carried out on the changes to clock frequency and default settings on ARCHER2 as part of a wider Net Zero strategy.

- The underlying software stack of the storage platform which underpins RDFaaS was upgraded at the start of June. Performance improvements seen over the older software.

1.2 Forward Look

- We are currently preparing for our annual external ISO certification audit. This covers quality service delivery, information security, and business continuity and disaster recovery. We aim to apply best practice in the delivery of our services to our users, and the continued drive over certification demonstrates this.

- As part of the continued improvements to the underlying infrastructure at the ACF, there will be some disruption while we upgrade our network in the next quarter. This will impact the ability of users to access the service while the work is carried out, expected over a number of days, but all running work will continue in the background.

- As a follow on from the Mechanical and Electrical planning works, we expect to carry out some improvements to the underpinning infrastructure over the next quarter.   These will be communicated via the Change Advisory Board process, and is not expected to be service impacting.

- We are investigating the implementation of Globus online to facilitate better data transfer to and from the Service.

2 ARCHER2 Performance Report

This is the contractual performance report for the ARCHER2 SP Service for the Reporting Periods from 1 April 2023 until 30 June 2023.

2.1 Service Points and Service Credits

The Service Levels and Service Points for the SP service are defined by EPSRC in Schedule 2.2 of ARCHER2 SP Service Contract.

The Working Day (WD) for the ARCHER2 Service is 10 Working Hours (WH) as the Service operates from 0800-1800. The Median Time to Resolution is measured in WD.

- **Availability**: *Service Threshold: <=96.5%; Operating Service Level: >98.0%, ≤ 98.5%.*
- **ARCHER2_SP_Level1 (MTR)**: The Median Time to Resolution, of all SP queries falling within Level 1 resolved by the Contractor in the Reporting Period. *MTR Service Threshold: >1 WD; Operating Service Level: >0.3 WD, ≤ 0.45 WD.*
- **ARCHER2_SP_Level2 (MTR)**: The Median Time to Resolution, of all SP queries falling within Level 2 resolved by the Contractor in the Reporting Period. *MTR Service Threshold: >8 WD; Operating Service Level: >2 WD, ≤4 WD.*
- **ARCHER2_SP_Level3 (MTR)**: The Median Time to Resolution, of all SP queries falling within Level 3 resolved by the Contractor in the Reporting Period. *MTR Service Threshold: >25 WD; Operating Service Level: >12 WD, ≤16 WD.*
- **Initial Response to Queries (%):** The percentage of the total number of SP queries assigned to the Contractor in the Reporting Period responded to within 3 Working Hours. *Service Threshold: <96.00%; Operating Service Level: 98.00 – 98.99%.*
- **Query User Satisfaction (%):** The percentage of the total number of query satisfaction surveys completed in each Reporting Period, rating the quality of the resolution of Queries by the Contractor as "Good", "Very Good" or "Excellent". *Operating Service Level: 82.00 – 87.99%*

2.1.1 Service Points

Metric	Apr 2023		May 2023		Jun 2023		Q2 2023	
	Perf	**Points**	**Perf**	**Points**	**Perf**	**Points**	**Perf**	**Points**
Availability	100%	-3	100%	-3	100%	-3	100%	**-9**
SP_Level1 (MTR)	0.00	-2	0.00	-2	0.00	-2	**0.00**	**-6**
SP_Level2 (MTR)	0.04	-2	0.06	-2	0.07	-2	**0.06**	**-6**
SP_Level3 (MTR)	0.002	-2	0.00	-2	4.17	-2	**4.08**	**-6**
Initial Response (%)	100%	-1	100%	-1	100%	-1	**100%**	**-3**
Query Satisfaction (%)	100%	-2	100%	-2	100%	-2	**100%**	**-6**
Total		**-12**		**-12**		**-12**		**-36**

2.1.2 Service Credits

As the Total Service Points are negative (-36), no Service Credits apply in 23Q2.

2.2 SP Query Statistics

The metrics were specified by EPSRC in Schedule 2.2 of ARCHER2 SP Service Contract.
- **Assigned:** The number of SP queries assigned to the Contractor within each query resolution category in the Reporting Period.

- **Resolved:** The number of SP queries resolved by the Contractor within each query resolution category in the Reporting Period.
- **Backlog:** The number of SP queries assigned to the Contractor that remained unsolved within each query resolution category in the Reporting Period
- **Correspondence:** The average number of pieces of correspondence generated for SP queries in each query resolution category.
- **First Response:** The average time taken for the Contractor to first respond to the Originator of the SP query.

April 2023					
Service level	Assigned	Resolved	Backlog	Correspondence	First Response
SP_Level1	961	961	0	0.122	0:02:53
SP_Level2	62	60	2	7.7	0:13:54
SP_Level3	1	1	0	3	0:00:35
May 2023					
Service level	Assigned	Resolved	Backlog	Correspondence	First Response
SP_Level1	321	319	2	0.12	0:00:49
SP_Level2	77	72	31	7.76	0:19:40
SP_Level3	2	0	2	0	0:00:00
June 2023					
Service level	Assigned	Resolved	Backlog	Correspondence	First Response
SP_Level1	838	840	0	0.09	0:00:48
SP_Level2	83	79	35	7.32	0:15:23
SP_Level3	3	2	3	12.5	0:03:30
Q2 2023					
Service level	Assigned	Resolved	Backlog	Correspondence	First Response
SP_Level1	2120	2120	0	0.11	0:01:51
SP_Level2	222	211	35	7.58	0:16:26
SP_Level3	6	3	3	9.33	0:02:31

2.3 Query Resolution

Metric	Apr 2023		May 2023		Jun 2023		Q2 2023	
Service Level	MTR	Resolved	MTR	Resolved	MTR	Resolved	MTR	Resolved
SP_Level1	0:00:42	961	0:00:08	319	0:00:50	840	0:00:39	2120
SP_Level2	0:24:29	60	0:35:49	72	0:43:08	79	0:33:12	211
SP_Level3	0:01:03	1	0:00:00	0	41:44:59	2	40:50:08	3
Total		**1022**		**463**		**922**		**2334**

A total of 2334 queries were resolved by the ARCHER2 SP Service in the Reporting Period. The percentage of user queries responded to within 3 hours was 100%.

2.4 Query Feedback

During April, there were 23 feedback scores received during this period. 100% were Good, Very Good or Excellent with 83% given the highest score of Excellent.

During May, there were 25 feedback scores received during this period. 100% were Good, Very Good or Excellent with 84% given the highest score of Excellent.

During June, there were 24 feedback scores received during this period. 100% were Good, Very Good or Excellent with 75% given the highest score of Excellent.

2.5 Maintenance and Outages

| Type	Start	End	Duration	User Impact	Reason	Attributable
Full Maintenance	19/05/23 1400	12/06/23 noon	3 weeks	Users are unable to connect to ARCHER2 and no compute nodes are available	Major Software Upgrade	HPE
Partial Outage	12/06/23 12:55	12/06/23 17:30	4.5 hrs	Unavailability of work fs3 prevented users on the filesystem from running work.	Problematic OST (Object Storage Target) was switched out and user asked to remove jobs for further investigation.	HPE

3 ARCHER2 Service Statistics

3.1 Utilisation

Utilisation from 1 April – 30 June is 90% which is slightly decreased from 93% the previous quarter. Utilisation for April was 94%, for May 94% and for June 81%.

Please note there was the extended outage during this period from 19th May – 12th June for the major software upgrade. The outage period has been excluded when calculating the utilisation.
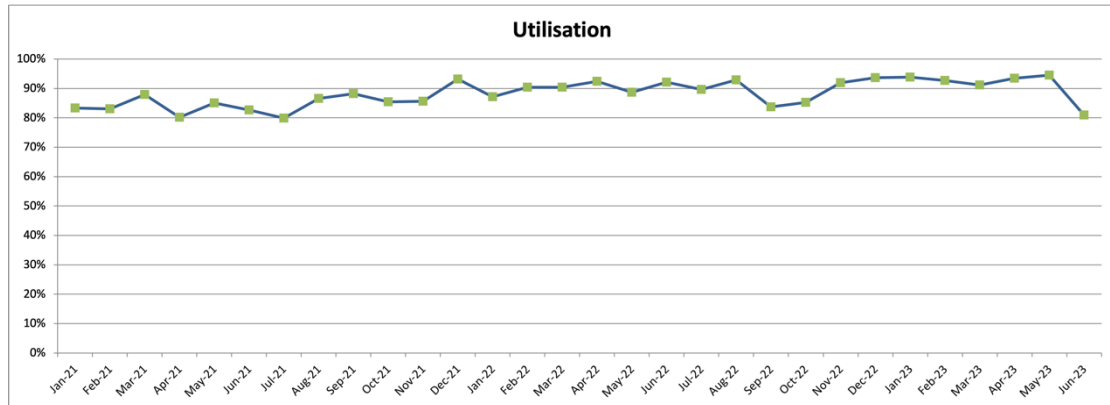
The utilisation by the Research Councils, relative to their respective allocations, is presented below. This bar chart shows the usage of ARCHER2 by the two Research Councils presented as a percentage of the total Research Council allocation on ARCHER2. It can be seen that EPRSC exceeded their target this quarter with their usage being at 78.8% (against their target of 66.8%) but NERC missed their target with utilisation being 9.2% (against their target of 18.2%). It should be noted that the outage period due to the major software upgrade was excluded when producing this graph.
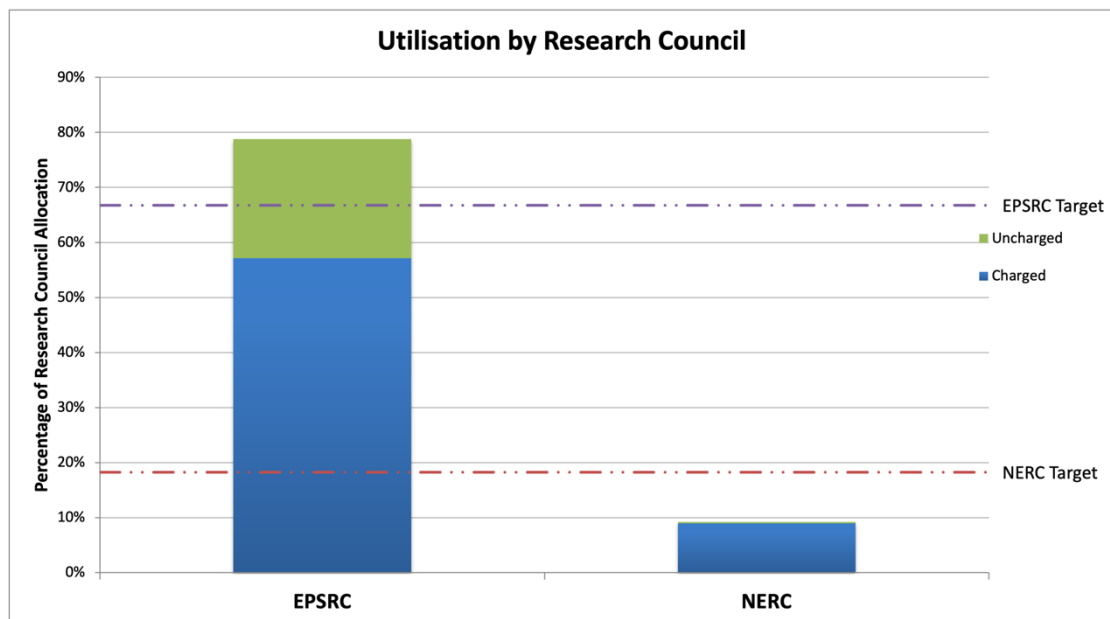
3.2 Scheduling Coefficient Matrix

The colour in the matrix indicates the value of the Scheduling Coefficient. This is defined as the ratio of runtime to runtime plus wait time. Hence, a value of 1 (green) indicates that a job ran with no time waiting in the queue, a value of 0.5 (pale yellow) indicates a job queued for the same amount of time that it ran, and anything below 0.5 (orange to red) indicates that a job queued for longer than it ran. As may be expected, the system is very busy and users are having to queue for longer than on ARCHER2. Measures were introduced to try to alleviate the queue such as limiting the large, long jobs and placing limits on the number of jobs that one user can run at any time.

The matrix was generated for the full period without excluding the outage period for the major software upgrade.

Scheduling Coefficient Matrix (numbers are numbers of jobs)

The usage heatmap below provides an overview of the usage on ARCHER2 over the quarter for different job sizes/lengths. The colour in the heatmap indicates the number of CUs expended for each class, and the number in the box is the number of jobs of that class.
The matrix was generated for the full period without excluding the outage period for the major software upgrade.

Usage Matrix
(Colours indicate CUs usage and boxes contain number of jobs)
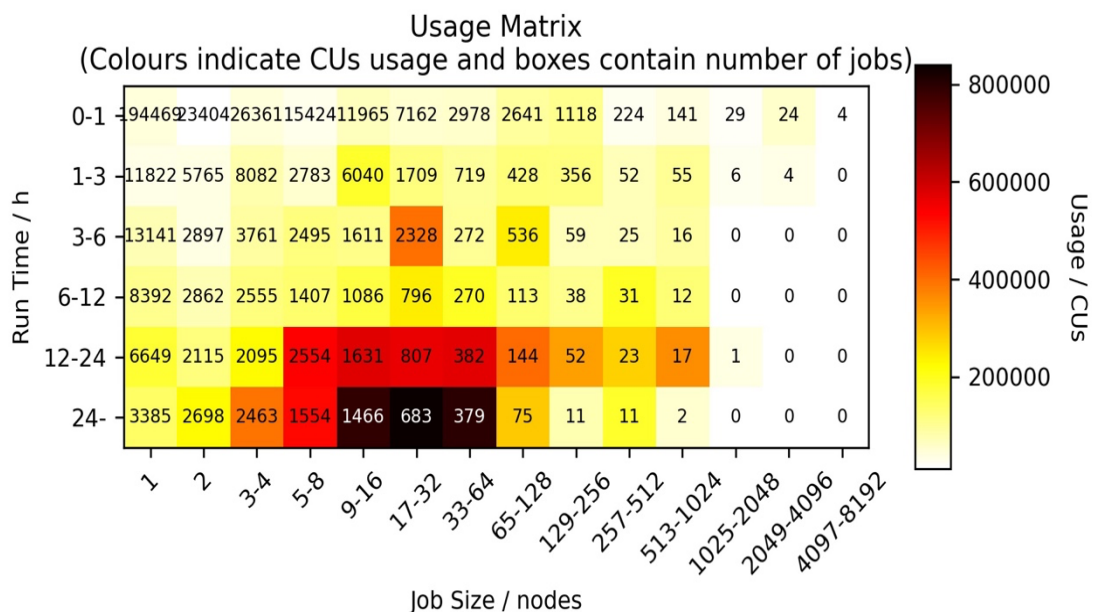
Appendix: Critical Success Factors

1. Context

EPCC have been asked by UKRI to provide quarterly data for a number of critical success factors:
- CSF04 Implementation of environmentally considerate energy policies
- CSF07 Deliver and maintain a reliable data I/O function
- CSF08 Be cost-effective, cost-efficient and drive towards lowering of operational costs

In the sections below, please find the relevant metrics and data.

2. CSF04 Implementation of environmentally considerate energy policies

Implementation of environmentally considerate energy policies with a drive to reducing costs and environmental impacts.

All electricity provided to the ACF and ARCHER2 is on a 100% green, renewable energy tariff.

Environmentally considerate policies: 3

Since the start of full Service, EPCC have worked on implementing the following policies:
- Move from High Performance Mode to Low Power Mode: reduced average power draw from 3.2 MW to 2.9 MW (9%) with negligible input on performance [May 2022]
- Reduced default processor frequency: further reduced average power to around 2.5 MW (19%) [December 2022]
- Increase in coolant temperatures: this will result in an increase in passive cooling ("free cooling") [ongoing]

Power Usage

	4Q21*	1Q22	2Q22	3Q22	4Q22	1Q23	2Q23
Average Power	3.31	3.16	3.15	2.86	2.90	2.51	2.56

* Partial

So far, the average power draw has been reduced by around 0.7MW (21%) which will reduce electricity usage by up to 6M kWh per annum, significantly reducing annual running costs.

# 3. CSF07 Deliver and maintain a reliable data I/O function

The compute resource will deliver and maintain an efficient, effective and reliable data I/O function which meets the requirements of users and their software. It will evolve and expand to accommodate new software or hardware architectures as required by the Service or its user base.

Data Transferred

EPCC monitor the data transfer rates in and out of the ARCHER2 system. Based on this, we now estimate the total amount of data transferred on and off ARCHER2 each Quarter.

Measure	4Q21*	1Q22	2Q22	3Q22	4Q22	1Q23	2Q23
Data Transferred **to** ARCHER2 (TB)	534	163	68	220	44	67	42
Data Transferred **from** ARCHER2 (TB)	236	582	667	822	834	1231	1022

* Partial
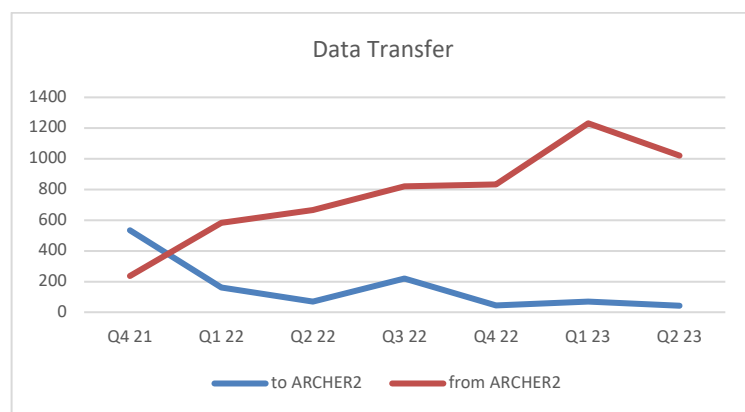
Benchio Benchmark

We also now monitor the IO rate between the compute nodes and the work filesystems using benchio. This benchmark uses the settings recommended in the ARCHER2 documentation and so should be reasonably representative of what a user should be able to achieve for IO performance.

Benchio MPI-IO medium (GiB/s)	1Q23	2Q23
fs1	8.2	7.6±0.5
fs2	8.5	7.3±0.6
fs3	8.3	9.6±0.7

4. CSF08 Be cost-effective, cost-efficient and drive towards lowering of operational costs

The Service shall be cost-effective and cost-efficient across its elements during its lifetime and drive towards lowering of operational costs by seeking efficiencies in delivery such that TCO presents an acceptable and cost-effective solution for the public. The Service will monitor and report its Power Usage Effectiveness (PUE) and strive to make efficiency savings where possible.

Relative Research Output

Measure	11/2021 – 5/2022	5/2022 – 12/2022	1Q23	2Q23
Relative Research Output per kWh	100	109	115	115

We define the initial measure of research output per KWh on ARCHER2 to be 100, and then estimate how this has changed with the introduction of the various environmentally considerate policies discussed under CSF04. This is estimated using applications benchmarks similar to those defined by UKRI for the procurement.

Energy Used per CU Delivered

	4Q21*	1Q22	2Q22	3Q22	4Q22	1Q23	2Q23*
Energy per CU (kWh)	0.719	0.713	0.728	0.715	0.650	0.590	0.606

*partial

Energy Cost per CU Delivered

	4Q21*	1Q22	2Q22	3Q22	4Q22	1Q23	2Q23*
Cost per CU (£)	£0.089	£0.090	£0.098	£0.096	£0.088	£0.080	£0.147

*partial

The two tables above are calculated using the total CUs delivered by ARCHER2, the total kWh of electricity consumed, and the unit cost for kWh. The increase in "Energy Cost per CU Delivered" for 2Q23 is caused by a significant increase in the unit cost of electricity from April 2023.