ARCHER CSE Service Quarterly Report

Quarter 4 2017

1. Executive Summary

This report covers the period: 1 October 2017 to 31 December 2017 inclusive.

- Centralised CSE Team:
  - The CSE team has provided technical support to the ARCHER2 project working group around understanding memory use on ARCHER and comparative benchmarking across ARCHER and the national Tier-2 HPC systems. This will allow ARCHER2 to provide the most benefit to users by helping to optimise the service design.
  - In consultation with the NERC NCAS group we have added a parallel file system metadata server (MDS) benchmark (mdtest) to the set of ARCHER benchmarks. Much of the I/O performance variation users see on HPC systems is due to MDS performance and this additional benchmark will help us understand this better.
  - Members of the ARCHER CSE team are leading the development of PRACE Best Practice Guides on "Parallel I/O in HPC" and "HPC for Data Science" showcasing the world-leading expertise in the EPCC ARCHER CSE team.
  - Following the successful large-scale BCDR test in Q3 2017 a lessons-learned report has been produced and various improvements to the BCDR process have been implemented. This activity has increased the resiliency of the CSE service and the wider ARCHER service; as well as boosting ARCHER staff confidence in dealing with a future significant ARCHER-related incident.
- Training:
  - We delivered 15 days (306 student-days) of face-to-face training in the quarter at 5 different locations, with an average feedback score better than "Very Good".
  - We delivered a Software Carpentry course on request at Imperial College with the specific aim of training local helpers to deliver future courses themselves.
  - In order to help users make use of the new Tier 2 HPC systems, we offered access to Cirrus at EPCC for the first time as an alternative platform to ARCHER for the recent Hands-On Introduction to HPC course at the Alan Turing Institute.
  - In response to requests from course attendees who are not ARCHER users, we have set up a JISC mailing list where anyone can subscribe to e-mail bulletins related to ARCHER training.
- ARCHER Outreach Project:
  - Wee Archie continues to be a big draw at many outreach events, this quarter seeing two events in London, including New Scientist Live. Both events showcased the benefit of Supercomputing to society.
  - The Diversity in HPC website (http://www.hpc-diversity.ac.uk) now has a total of 45 'Faces of HPC' showcased on the website including 20 historical biographies and 25 interviews. The web site showcases HPC as an opportunity available to all.
  - WHPC held a variety of activities at the SC17 conference in November and made a significant impact. This included a workshop, mentorship scheme and two 'Birds of a Feather' sessions. The 'Birds of a Feather' sessions reached different groups in the community and aimed to help improve workplace inclusivity.
  - An area of the web site has been created to demonstrate the work of early career researchers on ARCHER and highlight their importance on the service. Case studies/highlights have been placed on this site. See: http://www.archer.ac.uk/community/earlycareer/earlycareerindex.php
- eCSE:
  - The eCSE programme has now delivered on our commitment to award 840 person months during the lifetime of the service (average of 14 FTEs across the 5 years). Over and above this, the not-for-profit commitment from EPCC has allowed a further 41 person months to be awarded. This has funded 6 additional projects in a broad range of scientific disciplines – further facilitating greater science output and impact from the ARCHER service.
  - In total, the project has awarded 90 projects, 83 which have started and 65 which have now completed.

2. Collaborations and Outputs Summary

- Presentations:
  - Andy Turner, UK HPC Facilities, 25 Oct 2017, University of Dundee
  - Andy Turner, UK HPC Facilities, 26 Oct 2017, Heriot-Watt University
  - Andy Turner and Simon McIntosh-Smith, A Survey of Application Memory Usage on a National Supercomputer: An Analysis of Memory Requirements on ARCHER, The 8th International Workshop on Performance Modeling, Benchmarking, and Simulation of High Performance Computer Systems (PMBS17), Supercomputing 2017, 13-17 Nov 2017, Denver, USA: http://sc17.supercomputing.org/presentation/?id=wkpr251&sess=sess426
  - Weronika Filinger, Creating Effective Learner Engagement in HPC Training and Beyond, Fourth SC Workshop on Best Practices for HPC Training, Supercomputing 2017, 13-17 Nov 2017, Denver, USA: http://sc17.supercomputing.org/presentation/?id=wksp120&sess=sess134
  - Andy Turner (Session Leader), HPC Carpentry: Practical, hands-on HPC Training, Birds of a Feather Session, Supercomputing 2017, 13-17 Nov 2017, Denver, USA: http://sc17.supercomputing.org/presentation/?id=bof125&sess=sess359
  - Toni Collis (Session Leader), Recruitment: how to build diverse teams, Birds of a Feather Session, Supercomputing 2017, 13-17 Nov 2017, Denver, USA: http://sc17.supercomputing.org/presentation/?id=bof189&sess=sess338
  - Weronika Filinger (Session Leader), From Outreach to Education to Researcher - Innovative Ways of Expanding the HPC Community, Birds of a Feather Session, Supercomputing 2017, 13-17 Nov 2017, Denver, USA: http://sc17.supercomputing.org/presentation/?id=bof155&sess=sess353
  - Andy Turner (Co-session Leader), Software Engineers: Careers in Research, Birds of a Feather Session, Supercomputing 2017, 13-17 Nov 2017, Denver, USA: http://sc17.supercomputing.org/presentation/?id=bof149&sess=sess354
  - Toni Collis (Co-session Leader), Non-Traditional Paths to HPC and How They Can and Do Enrich the Field, Birds of a Feather Session, Supercomputing 2017, 13-17 Nov 2017, Denver, USA: http://sc17.supercomputing.org/presentation/?id=bof190&sess=sess337
  - Rupert Nash, Hemodynamics with Lattice Boltzmann, EPCC-CCP Workshop, 7 Dec 2017, University of Tsukuba, Japan
  - David Scott, Introducing TPLS 3.0, 2nd Multiphase SIG, 8 Dec 2017, London
  - Andy Turner, ARCHER Update, Materials Chemistry Consortium General Meeting, 20 Dec 2017, UCL
- Meetings:
  - Andy Turner, UK Association of Research Software Engineers Committee Meeting, 5 Oct 2017, via Skype
  - Andy Turner, EPSRC HEC Chairs Meeting, 9 Oct 2017, via Skype
  - Andy Turner, EPSRC RAP Consolidation Meeting, 22 Oct 2017, Teleconference
  - Andy Turner, EPSRC Tier-2 Directors' Meeting, 27 Nov 2017, University of Bristol
  - Andy Turner, ARCHER/Tier-2 RSE Coordination Meeting, 8 Dec 2017, Videoconference
- Papers:
  - Brown N, Weiland M, Hill A, Shipway B. In situ data analytics for highly scalable cloud modelling on Cray machines. Concurrency Computat: Pract Exper. 2018;30:e4331. https://doi.org/10.1002/cpe.4331

3. Forward Look

- Centralised CSE Team:
  - We will publish an ARCHER white paper analysing the performance of the ARCHER benchmarks across ARCHER and the national Tier-2 HPC systems to help users choose the best resource for their research.
  - Using the new data feeds into SAFE from Cray RUR and ALPS we will analyse the use of centrally-installed software packages and libraries on ARCHER to help inform where support should be focussed going forwards on ARCHER and for any future services.
  - We plan to collaborate with the NCAS computational modelling support team to explore the performance of Lustre metadata servers (MDS) on ARCHER and other HPC systems in the UK.
- Training:
  - Following on from discussions with trainers from the US XSEDE programme, we will be offering a version of the MPI course online over four successive Wednesday afternoons from the end of January 2018. We plan to use the existing ARCHER champions and UKRSE networks to provide hands-on support at several local hubs in addition to online support from ARCHER experts.
  - We will publicise the January 2018 run of our free Supercomputing MOOC to the UK HPC community.
- Outreach:
  - The Ambassador's pack will be publicised and promoted during this quarter. The aim is to encourage uptake and seek input and feedback.
  - We plan to continue to add to the number of "Faces of HPC" on the website, looking to take this number to over 50. This will provide a critical mass of people, helping to demonstrate the diverse nature of the HPC community.
  - We will again be attending the Big Bang Fair in March, looking to build on previous years attendance, encouraging young people to seek careers in computational science and to understand the relevance of Supercomputing to them.
- eCSE:
  - With the completion of the eCSE calls, the team will focus on ensuring the outputs and successes of the eCSE programme are publicised and showcased. In addition to continuing to publish highlight pages for every completed eCSE, we will be looking to develop a broad set of full case studies from the eCSE programme. We will also be looking to analyse collective data from across the full programme, such as the data generated in the benefits realisation reports. This will ensure the benefits of the programme are fully realised and highlighted.

4. Contractual Performance Report

This is the contractual performance report for the ARCHER CSE Service for the Reporting Periods: October 2017, November 2017 and December 2017.

The metrics were specified by EPSRC in Schedule 2.2 of the CSE Service Contract.

CSE Query Metrics

- **QE1:** The percentage of all queries notified to the Contractor by the Help Desk in a Quarter that the Contractor responds to, and agrees a work plan with, the relevant End User within 3 working hours of receiving the notification from the Help Desk. *Service Threshold: 97%; Operating Service Level: 98%.*
- **QE2:** The percentage of all queries notified by the Help Desk to the Contractor that have been satisfactorily resolved or otherwise completed by the Contractor within a 4-month period from the date it was first notified to the Contractor. *Service Threshold: 80%; Operating Service Level: 90%.*
- **TA1:** The percentage of all technical assessments of software proposals provided to the Contractor by the Help Desk in any Service Period that are successfully completed by the Contractor within 10 days of the technical assessment being provided to the Contractor by the Help Desk. *Service Threshold: 85%; Operating Service Level: 90%.*
- **FB1:** The percentage of End User satisfaction surveys for CSE queries carried out in accordance with the Performance Monitoring System by the Contractor showing the level of End User satisfaction to be "satisfactory", "good" or "excellent". *Service Threshold: 30%; Operating Service Level: 50%.*

Period	Oct-17		Nov-17		Dec-17		Q4 2017	
Metric	**Perf.**	**SP**	**Perf.**	**SP**	**Perf.**	**SP**	**Perf.**	**Total**
QE1	100%	-2	100%	-2	100%	-2	100%	-6
QE2	100%	-2	100%	-2	75%	2	100%	-2
TA1	100%	-1	100%	-1	100%	-1	100%	-3
FB1	100%	-2	100%	-2	100%	-2	100%	-6
Total		-7		-7		-3		-17

Pink – Below Service Threshold
Yellow – Below Operating Service Level
Green – At or above Operating Service Level

The performance of QE2 in December 2017 was below the Service Threshold due to a single long-standing In Depth query (out of 4 closed in the period) being closed. The query in question was looking at the behaviour of threading within the Cray LibSci library and required deep investigations by the CSE and Cray CoE teams to understand where the odd behaviour was coming from. The complexity of the investigation led to the long time required to answer the question. The user was provided with a workaround (using Intel MKL) while the investigation was in progress so this did not delay their work.

Training Metrics

- **FB2:** The percentage of all training satisfaction surveys carried out in accordance with the Performance Monitoring System by the Contractor) in each Quarter that are rated "good", "very good" or "excellent". *Service Threshold: 70%; Operating Service Level: 80%.*

Period	Oct-17		Nov-17		Dec-17		Q4 2017	
Metric	Perf.	SP	Perf.	SP	Perf.	SP	Perf.	Total
FB2	100%	-1	95%	-1	100%	-1	100%	-3
Total		-1		-1		-1		-3

Pink – Below Service Threshold
Yellow – Below Operating Service Level
Green – At or above Operating Service Level

Two anonymous responses of "bad" were received for courses in November. Neither response contained any comment explaining what the issue was so we have not been able to follow up on these.

Service Credits

Period	Oct-17	Nov-17	Dec-17
Total Service Points	-8	-8	-4

5. CSE Queries

Queries Resolved in Reporting Period

Metric Descriptions

In-Depth	All technical queries passed to ARCHER CSE team
Course Registration	Requests for registration on ARCHER training courses
Course Enquiry	Enquiries about courses
Technical Assessment: <Category>	Request for Technical Assessments of applications for ARCHER time
eCSE Application	Queries relating to eCSE applications

A total of 269 queries were resolved by the CSE service in the reporting period.

Metric	Oct-17	Nov-17	Dec-17	Total
Course Registration	128	33	17	178
eCSE Application	5	13	9	27
In-Depth	5	11	4	20
Course Enquiry	6	9	4	19
Technical Assessment: Grant	5	5	6	16
Technical Assessment: Instant	3	2	2	7
Technical Assessment: RAP	1	1	0	2
Total	**153**	**74**	**42**	**269**

2 query feedback responses were received on In-depth queries in the reporting period. This represents a 10% return rate for feedback forms. 1 response registered a score of "Excellent" and 1 response registered a score of "Good". Work continues to implement SAFE functionality to send additional reminders to users on providing feedback responses to help increase the response rate

Resolved In-Depth queries fell into the following categories:

Category	Number of Queries	% Queries
3rd party software	10	50.0%
Compilers and system software	4	20.0%
User programs	2	10.0%
Batch system and queues	1	5.0%
Disks and resources	1	5.0%
Porting	1	5.0%
Performance and scaling	1	5.0%
Total	**20**	**100.0%**

In-Depth Query Highlights

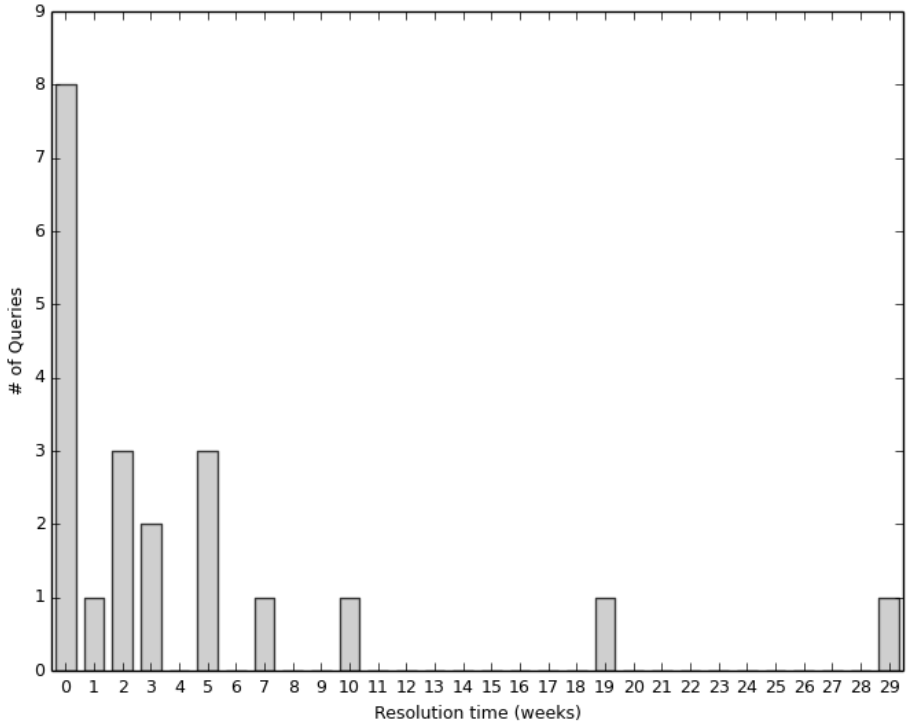
A small number of In-Depth queries have been selected to illustrate the work of the centralised CSE team over the reporting period.

Q934616, Q922443: CP2K statistical parameter sweeps
A research group using ARCHER wanted to exploit the large capacity of the service to perform statistical parameter sweeps using thousands of CP2K calculations. Initially, the CSE team helped the group set up a framework for launching and controlling large numbers of small CP2K calculations across ARCHER compute nodes – this is typically more difficult on the Cray XC architectures as it is designed to run small numbers of calculations with large core counts rather than large numbers of calculations with small core counts. Once this framework was running successfully the group found that they were seeing performance issues as the number of elements in their parameter sweeps increased. The CSE team tracked these issues down to the large amount of load being placed on the Lustre file system by the many calculations. We liaised with the CP2K developers and helped the users reduce their I/O load as much as possible within the constraints of the CP2K software. The users are now able to continue their research and we are in discussions with the CP2K team to understand if the I/O model in the software can be improved to reduce file system load still further.

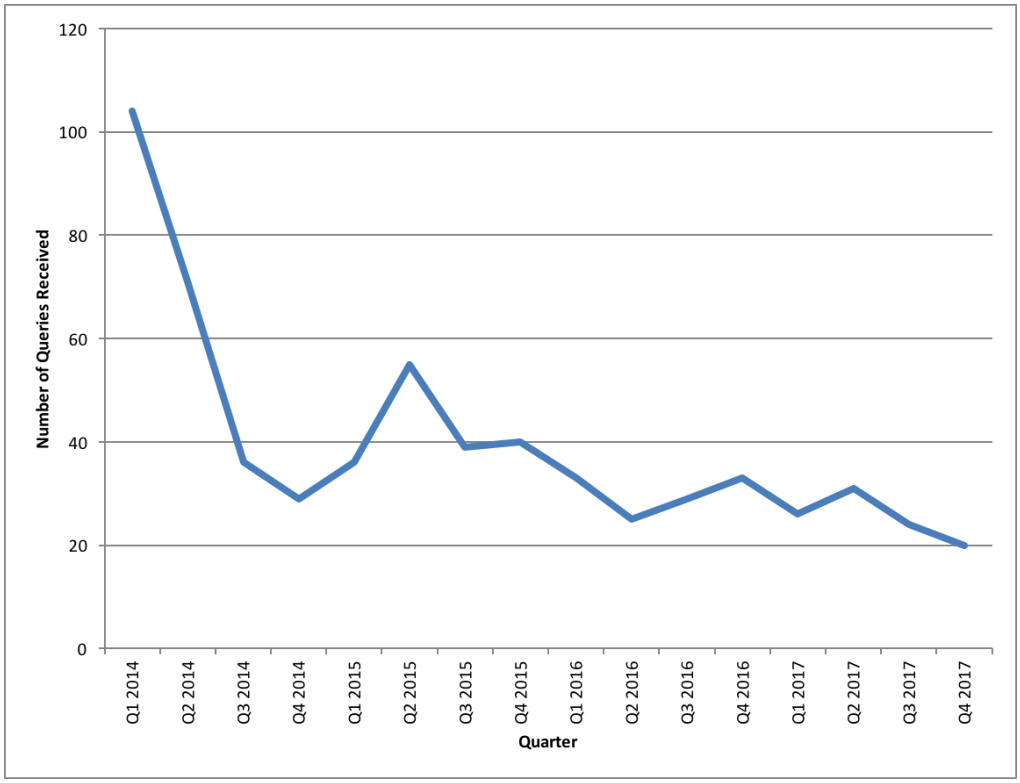
Q939828: OpenMP problem on KNL node
A user reported that they were seeing no speedup (and even slowdown) as they increased the number of OpenMP threads their application was using on the ARCHER KNL nodes. Discussions with the user revealed that they were using the Intel programming environment for their applications. The CSE team advised the user that OpenMP threads under Intel do not, by default, respect the thread-placement options on Cray XC and so all their threads were running on a single core – leading to the anomalous performance results. We showed the user how to use the advanced placement options on ARCHER to ensure that the Intel OpenMP threads were all running on different cores and this led to the expected performance gains when using multiple threads.

In-Depth Query Analysis

The histogram below shows the time to resolution for In-Depth queries in the current reporting period. The median resolution time during this period is 2 weeks (median resolution time since 1 Jan 2014 is 2 weeks).

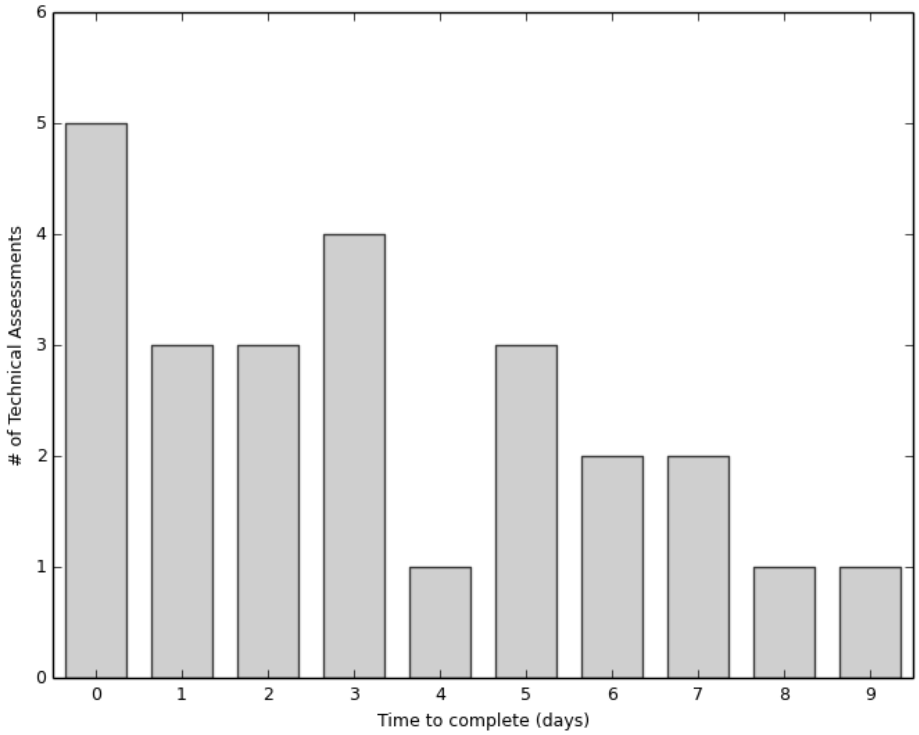


Plot of numbers of In-Depth queries received per quarter:

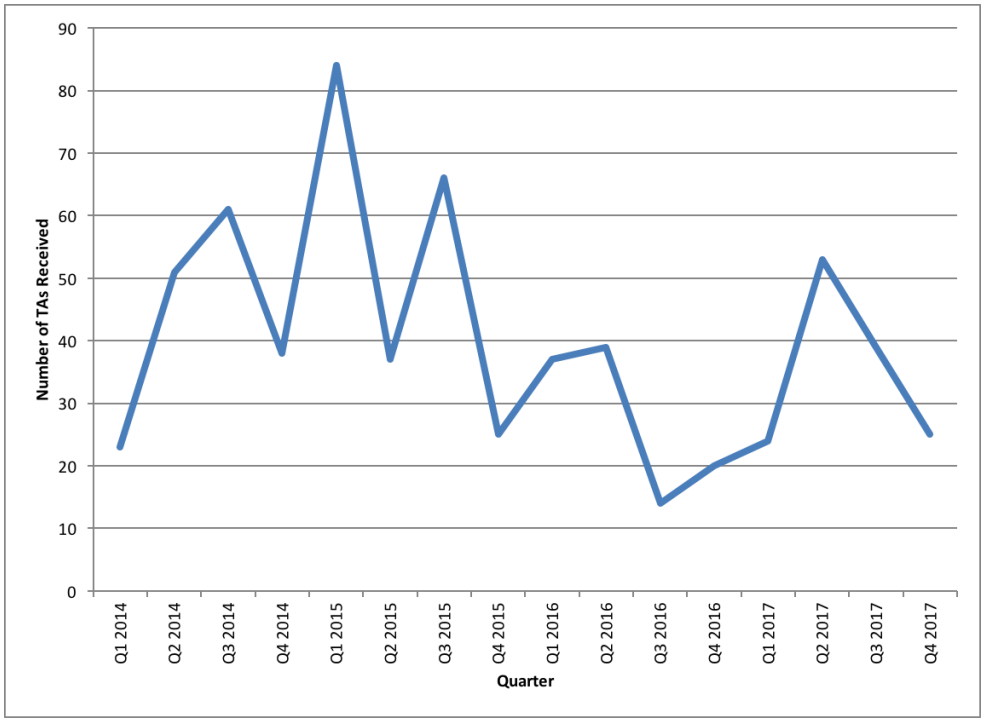


Technical Assessment Analysis

A histogram of the time to completion for Technical Assessments (see below) reveals that the median completion time for this quarter was 3 days (median completion time since 1 Jan 2014 is 3 days).



Plot of numbers of Technical Assessments received per quarter:



6. Centralised CSE Team: Strategic Priorities Progress

In collaboration with user groups and the other Service partners, the CSE service identified several priority areas to invest technical effort from the centralised CSE team. This section summarises progress in the reporting period in these areas.

Parallel I/O

Previous work on parallel I/O has focussed on understanding the performance in terms of *bandwidth* as this is the key metric for the use case of jobs reading/writing large amounts of data. This metric also reflects the design principles of parallel file systems for HPC: maximising the aggregate bandwidth that is available to/from the parallel file system.

The performance of the metadata server (MDS) component of parallel file systems is also key to the performance experienced by HPC users. For example, on ARCHER, many users can see large performance variations due to MDS load as they open and close files during their calculations. The MDS handles all queries on the status and properties of files on the parallel file system (used, for example, during open and close operations). However, the performance of this component is even less well understood than the bandwidth of parallel file systems.

The CSE team, in consultation with the NCAS ARCHER user community have initiated work to investigate and understand the MDS performance across a range of HPC systems and parallel file system technologies. The initial step in this work has been to identify a suitable benchmark to investigate MDS performance. We have decided to use the *mdtest* benchmark in the first instance as it formed part of the US Trinity benchmark suite used to procure the current generation of US DoE HPC systems. This means that its configuration is well understood and the benchmark is well tested.

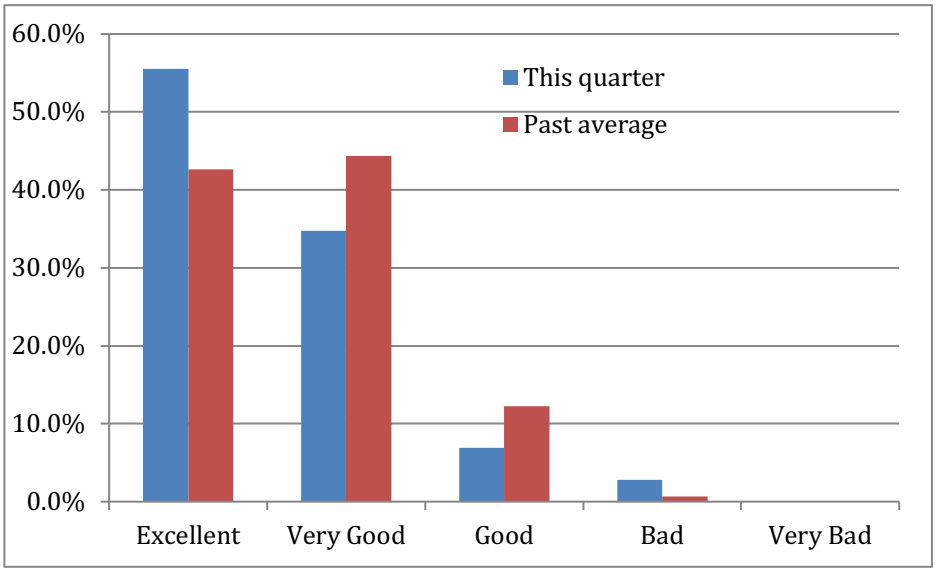
Initial results have revealed large MDS performance differences between different technologies and we plan to investigate these over the coming months and aim to produce a ARCHER white paper on the subject by the end of Q2 2017 with advice for users on how best to structure their HPC use to get the best performance from the various parallel file systems on UK HPC facilities.

7. Training

The CSE Service has provided a total of 15 days (306 student-days) of face-to-face training across 5 different locations and 1 day of interactive online tutorials (average attendance 12 per tutorial).

Month	Dates	Course	Location	Days	Attendees
Oct 2017	11	OpenFOAM	Online	0.5	
	16-17	Software Carpentry	Glasgow	2	20
	31 Oct – 1 Nov	Programming the Manycore Knights Landing Processor	Cambridge	2	15
Nov 2017	6-7	Single-Node Performance Optimisation	Oxford	2	19
	21-22	GPU Programming with CUDA	Daresbury	2	15
	4-5			2	31
Dec 2017	6	Hands-on Introduction to HPC	London Online	0.5	
	11-12	Women in HPC – Diversifying your Workforce		2	26
	12-14	Software Carpentry	London	3	17
		Advanced OpenMP	London		

On the feedback for face-to-face courses, attendees rate the course on a scale of 1-5 ("Very bad", "Bad", "Good", "Very good" and "Excellent"). The average feedback using this metric was 4.4, i.e. better than "Very Good". Users provided 72 feedback forms, a response rate of 50%.



16 days of face-to-face training are planned for the first quarter of 2018, plus 1.5 days online.

Month	Dates	Course	Location	Days	Attendee
Jan 2018	24	Parallel SPH (eCSE project)	Online	0.5	
	31	MPI online (on four consecutive Wednesday afternoons)	Online	2	
Feb 2018	TBC	Hands-on Intro to HPC	Edinburgh	2	
	28	Benchmarks of HPC	Online	0.5	
	TBC	Hardware	Daresbury	2	
	28 Feb – 1 Mar	OO Programming in Fortran Data Analytics with HPC	Belfast Oxford	2 1	
Mar 2018	8	Porting and Optimisation	Online	0.5	
	14	Wshop	Leicester	2	
	TBC	Virtual Tutorial (title TBC)	Southampton	3	
	20-22	Software Carpentry		2	
	TBC	Threaded Programming Efficient Parallel IO	Cambridge		

8. Outreach Project

Outreach

The last quarter has been a busy time for Outreach events. A highlight of the quarter is the New Scientist Live event in London. This saw between 1500-2500 people attend the booth. The audience was wider than school children and the focus was on explaining the benefits of Supercomputing to all of society.

In addition, we had a stall at the Institution of Engineering and Technology event on the 17th October in London. This involved around 300 school children and was focused on introducing Supercomputing to a school age audience.

We had a stall at the NERC UnEarthed Event at Dynamic Earth in Edinburgh. The event saw parties of school children attend, together with the weekend open to the public. This saw around 2000-3000 people participate at the booth and learn about the benefits of Supercomputing.

Finally, Wee Archie also visited SC17 in Denver in November. Displayed on the EPCC booth, Wee Archie generated a great deal of interest and showcased the UK's lead in Supercomputing outreach activities.

Diversity

The Diversity in HPC website (www.hpc-diversity.ac.uk) now has a total of 45 'Faces of HPC' showcased on the website including 20 historical biographies and 25 interviews.

Women in HPC

Women in HPC ran a number of events this quarter, with a big presence at Supercomputing. Key events included:

- Skills to Thrive: Careers in HPC workshop held in collaboration with EuroMPI/USA 2017 at Argonne National Laboratories, Illinois, USA on 25 September 2017. This half-day workshop was attended by 30 people and covered topics on work-life balance, Evidence Based Interventions to Address Implicit Bias and Improve Workplace Climate.
- WHPC held a variety of activities at the SC17 conference in November based around improving the representation of women and more generally on the importance and benefits of diversity. Activities included:
    - Women in HPC@SC17 workshop: diversifying the workforce: a full-day workshop with two themes: providing women with the skills to thrive, and helping employers improve the workplace to attract and retain a diverse workforce. We 12 invited contributors to the day and 16 early career women who presented their work as virtual posters.
    - Women in HPC Mentorship scheme: as part of SC17 our early career workshop presenters were all offered the opportunity to be provided with a mentor to prepare for their presentation and making the most of SC.

- Two ‘Birds of a Feather’ sessions on: “Non-Traditional Paths to HPC and How They Can and Do Enrich the Field” and “Recruitment: how to build diverse teams”. These sessions reached different groups in the community to help improve workplace inclusivity.
- Women in HPC evening reception: in collaboration with sponsors WHPC ran an evening cocktail reception focusing on careers.

Impact and Engagement

The focus this quarter has been on producing new case studies, with three new studies completed and added to the website. These include: a biomolecular simulation case study; a study based on the results of eCSE07-09 (magnetic materials); and a study from one of the winners of the US-UK travel competition on gas hydrates.

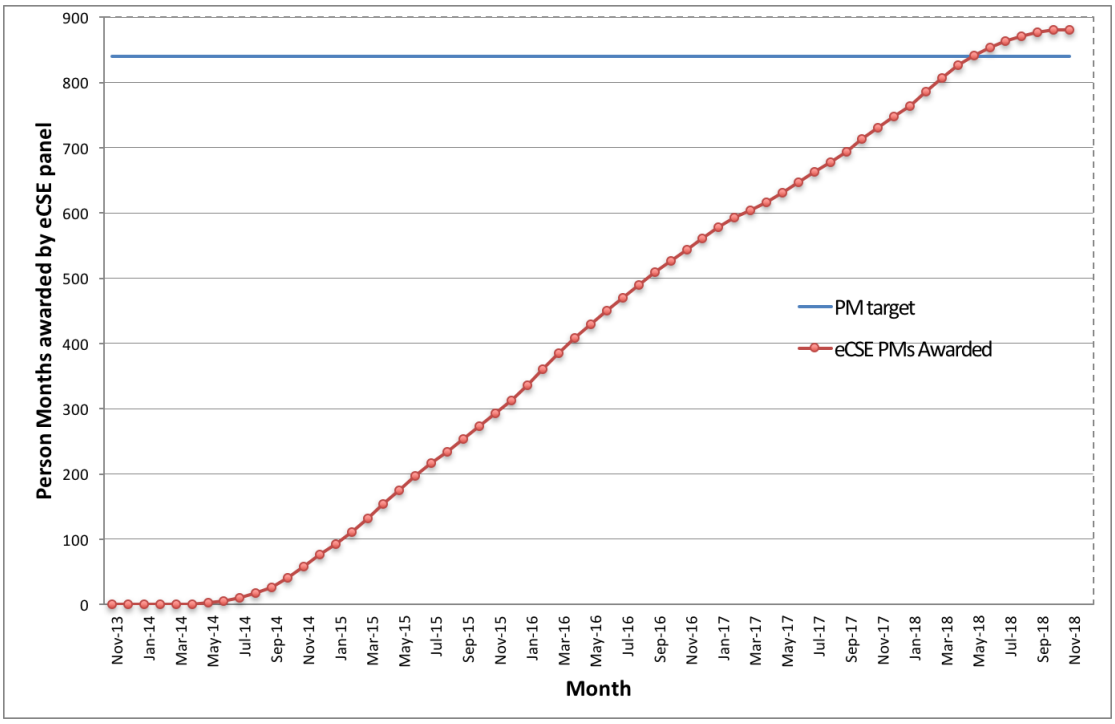
Following the success of the US/UK Competition, an area of the web site has been created to showcase the work of early career researchers on ARCHER. Case studies/highlights have been placed on this site for all the US/UK competition winners. See: http://www.archer.ac.uk/community/earlycareer/earlycareerindex.php

Flyers were distributed at the New Scientist Live, IET, NERC Showcase and SC17 events.

The next ARCHER Champions will take place in Bristol and will focus on both Tier-1 and Tier-2 sites. The tentative date is set to be Friday 6th April. The full agenda has not yet been finalised, but will likely include outputs from the ‘Scaling the HPC pyramid" workshop that ran at RSE 2017 to be fed through and developed during the Champions workshop, generating content for the HPC-UK website. This event will be an excellent opportunity for RSEs supporting local researchers on HPC facilities to meet and share experiences.

9. Embedded CSE (eCSE)

Overview of eCSE Effort



- The eCSE person months awarded up to and including the 12th eCSE call are shown in red.
- We committed to awarding at least 840 person months by the end of the project (14 FTEs for 5 years).
- 881 person months have been awarded so far over 90 awarded eCSE projects meaning an extra 41 person months were awarded at the final call.

eCSE Call 1 – Call 12

eCSE call	No. proposals	No. projects awarded	No. person months awarded	No. projects started	No. projects completed	No. final reports received	Notes
eCSE01	19	14	132	14	14	14	
eCSE02	17	9	82	9	9	9	
eCSE03	16	10	96	10	10	9	1 late final report is being pursued.
eCSE04	16	8	82	8	8	7	1 late final report is being pursued.
eCSE05	14	8	94	8	8	8	
eCSE06	9	5	47	5	5	4	

eCSE07	16	5	49	5	5	3	2 late final reports are being pursued.
eCSE08	21	8	88	8	6	2	1 late final report is being pursued, 2 have been given short extensions and 1 has recently finished with final report not yet due.
eCSE09	19	5	62	5	0	0	
eCSE10	13	6	59	6	0	0	
eCSE11	18	6	49	5	0	0	
eCSE12	23	6	41	0	0	0	
Total	**201**	**90**	**881**	**83**	**65**	**56**	

- A risk analysis identified all projects as being of either low or very low risk apart from the following which were identified as being of medium risk:
  - eCSE04-4: the person named to do the technical work was offered a position elsewhere
    - The member of staff originally named on the contract completed 1.5 of the 12 months of work before leaving to take up another post. With approval from the PI and eCSE Panel chair, we identified a new member of staff within the ARCHER CSE team who took on the work from 01/10/15. This project is now complete and the final report has been received. The report has received a favourable technical review and is awaiting the final panel review.
  - eCSE04-10: the PI indicated that the person named to do the technical work may not be available
    - This project went ahead with the original staffing. There was a short delay to the start of the project which started on 01/01/16. The project is now complete and we are awaiting the final report which is now overdue despite sending several reminders to the PI.
  - eCSE08-9: this project had a change of staffing
    - The new staff member was approved by the panel chair and the project has now finished. The final report is expected within the next reporting period.
  - eCSE08-10: there were issues raised by Cambridge University involving the IP and the relationship with the CASTEP group
    - The issues were resolved and the project went ahead with the final report having now been received. This report has received a favourable technical review and is awaiting the final panel review.
  - eCSE09-6: this project has terminated early after the recent death of Dr Karl Wilkinson who was one of the Co-Is together with the fact that the researcher doing the work resigned from his current post in Cambridge in November 2018
    - The PI confirms that the first work package is likely be completed and the project used half its allocated effort. Given the circumstances we

agreed to this early termination and the unused funds were used to award eCSE12 projects at the final panel meeting.

- eCSE09-8: this project was awarded 19 person months. This is a higher level of effort than awarded for other eCSE projects where 15 person months is the highest level of effort awarded so far
  - Of the 19 months awarded for this project, 7 are for a member of the ARCHER CSE team and the work will be monitored through EPCC's standard project monitoring processes. The remaining 12 are for an external member of staff at the PI's institution and will be monitored via regular contact with the PI.
- eCSE10-1: the contract has not yet been agreed
  - We will continue to pursue this via the legal teams within the University of Edinburgh and STFC.
- eCSE10-5: a change of staffing is required
  - We have discussed this with the PI and have agreed the project will be scaled back and re-staffed but will monitor the situation via regular contact with the PI. The unused funds were used to fund eCSE12 projects at the final panel meeting.
- eCSE10-10: the contract has not yet been agreed
  - We will continue to pursue this via the legal teams within the University of Edinburgh and STFC.
- eCSE11-3: the contract has not yet been agreed
  - We will continue to pursue this via the legal teams within the University of Edinburgh and the University of Bath.
- eCSE12-20: the project runs right up until 30/9/2018 – almost the end of the CSE contract
  - the project will be monitored via regular contact with the PI and we will discuss mitigation strategies for any late-running workpackages.