



HECToR Quarterly Report

January - March 2009

1. Introduction

This report covers the period from 1 January 2009 at 0800 to 1 April 2009 at 0800.

Section 3 summarises service availability and performance statistics for this quarter. Section 4 shows utilisation of the service for the last six months. Section 5 shows Helpdesk statistics. A summary table of the key performance metrics is given in the final section.

The Appendices define some of the terminology and incident severity levels and list the current HECToR projects together with their overall utilisation profile to date.

This report and the additional SAFE report are available to view online at <http://www.hector.ac.uk/about-us/reports/quarterly/1Q09.php>

2. Executive Summary

- XT utilisation in 1Q09 was 56%. This was on a par with 4Q08 at 57%. The quarter started slowly with utilisation at 42% in January, but this improved significantly through February and March with utilisation remaining above 60% in both months.
- There were 16 service failures in Q109. 14 failures were attributed to technology problems and there were two site related problems. Further details on the failures are available in Section 3.1. The overall MTBF decreased on 4Q08 from 200 to 137 hours.
- The volume of single node failures has remained comparable to the previous quarter. There were 63 node failures in 1Q09, as opposed to 64 in 4Q08. We are continuing to track and investigate the cause of all failures and an analysis of these can be found in Section 3.1 of this report.
- The X2 Vector system was very reliable in 1Q09. A decision was taken by the strategic management board to suspend accounting on the X2 during 1Q09 to increase utilisation. Charging for jobs on the X2 was suspended as of 23rd February for an initial trial period of 6 months. This resulted in a significant increase in utilisation. In January, utilisation of the X2 was 6%. This rose to 11% in February and 52% in March. The quarterly average was 23%. It is worth noting that the increase in utilisation came from two of the existing X2 projects. Further details on the impact of the suspension of X2 accounting are available in Section 4.4.
- The proposal for the HECToR Phase2 Upgrade was formally approved in 1Q09. HECToR will be upgraded to quad-core in 3Q09. A user meeting has been planned 22nd April to discuss Phase2.
- Plans to upgrade the HECToR operating system to CLE2.1 in 1Q09 were not completed as planned. The required tasks took longer to complete than expected. Key lessons have been taken from this and will be used in the planning of future maintenance tasks. The remaining operating system upgrade tasks will now be completed mid 2Q09 in preparation for the upgrade to quad-core. The delay in this OS upgrade causes no major issues for the users.
- The helpdesk statistics were again excellent. Positive user feedback has been received with regard to the support teams, although there has been some negative feedback in relation to system reliability. The volume and type of queries received at the helpdesk remained constant from 4Q08, with automatic and administrative queries accounting for over 70% of all requests.
- The HECToR website was updated in 1Q09 to facilitate easier navigation to the FAQ and dCSE areas. An internal style guide has now been generated for the support teams and the site checked to ensure all html validates against the W3C standard.

3. Availability

3.1 Failures

The monthly numbers of incidents and failures (SEV 1 incidents) are shown in the table below:

	<i>January</i>	<i>February</i>	<i>March</i>
Incidents	32	32	30
Failures	5	6	5

Technology Failures

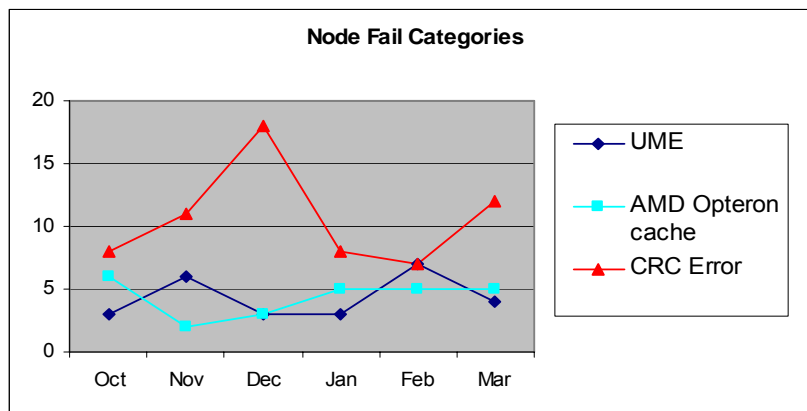
Cray technology has been responsible for a total of 14 Severity-1 incidents during 1Q09. Ten of these incidents have been due to hardware failures, eight of which were as a result of module failures. Investigation is ongoing into the cause of these failures, but there are early indications that approximately 50% of them could be addressed by firmware changes which could be implemented at the time of the quad-core upgrade. This is yet to be finalised. Software related problems accounted for 3 Severity-1 incidents. The upgrade to CLE2.1 in early May is hoped to address one of these problems. In comparison to 4Q08 there was a reduction in the number of Lustre problems seen (6 4Q08, 2 1Q09). Patches were applied in early January to address a number of Lustre problems. A configuration change is also due to be applied to HECToR on 15th April to address another of the software failures. One procedural problem was also identified and the associated site procedures have been modified to prevent a re-occurrence of the problem.

Service Provision Failures

There were 2 service provision failures in 1Q09. One of these related to the failure of the WWW server. This impacted the HECToR website, SAFE and the Helpdesk as opposed to the main service. The second failure was plant related.

Single Node Failures

There were 63 single node failures in 1Q09. This is comparable to 64 in 4Q08. The number of node failures as a result of Un-correctable memory error (DIMM failures) and AMD Opteron Cache errors has remained fairly constant over the past 6 months. The volume of Cyclic Redundancy Check (CRC) errors is less predictable. Work is ongoing at Cray with regard to code changes which may help to address the volume of node failures as a result of CRC errors. These code changes are still under development and are not expected to be available prior to version 2.2 of the operating system.



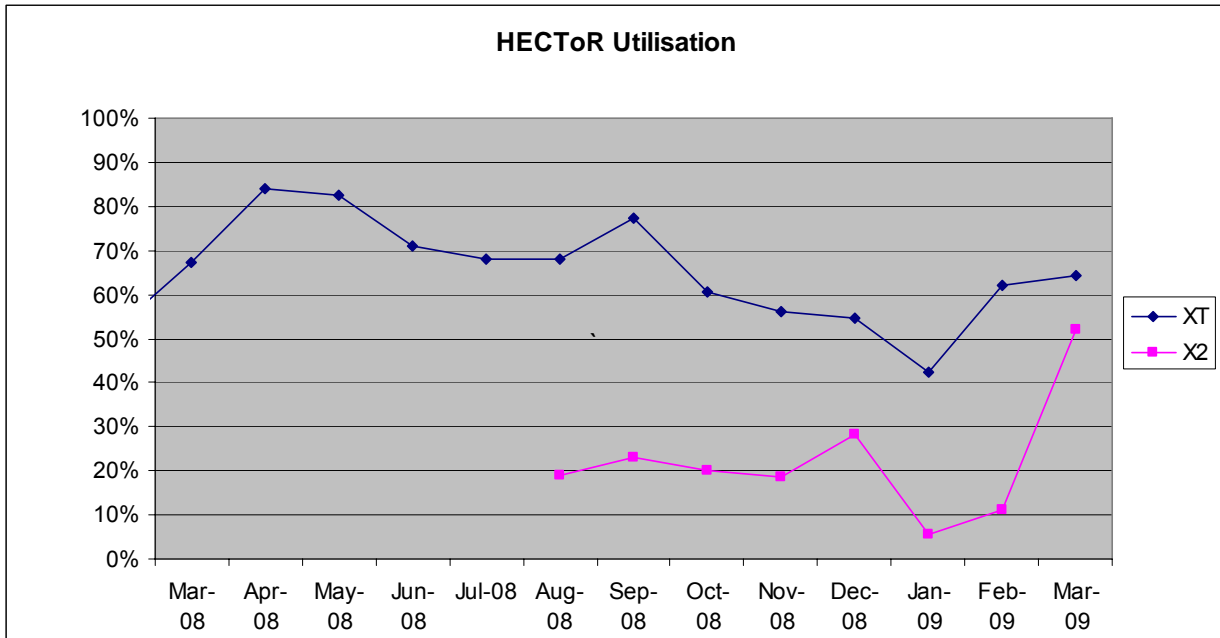
3.2 Performance Statistics

- $MTBF = (732)/(\text{number of failures in a month})$
 Quarterly $MTBF = (3 \times 732)/(\text{number of failures in a quarter})$

Attribution	Metric	January	February	March	Quarterly
Technology	Failures	4	5	5	14
	MTBF	183	146	146	157
Service Provision	Failures	1	1	0	2
	MTBF	732	732	∞	1098
External	Failures	0	0	0	0
	MTBF	∞	∞	∞	∞
Overall	Failures	5	6	5	16
	MTBF	146	122	146	137

4. HECToR Utilisation

4.1 Overall Utilisation

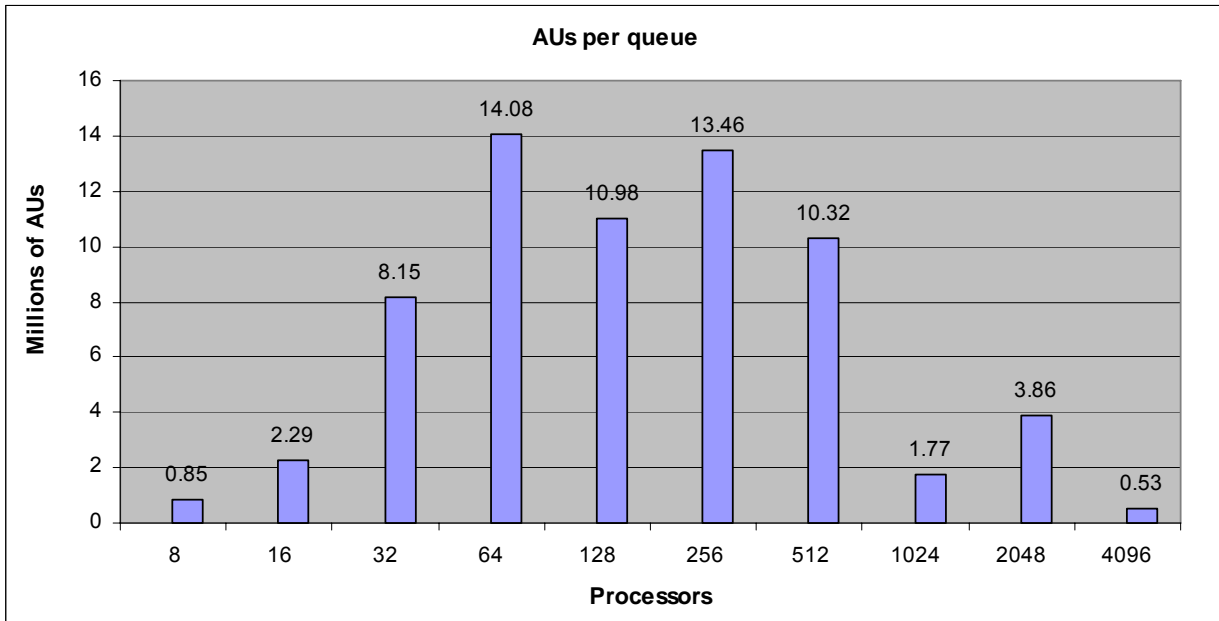


Despite a quiet start to the year, utilisation on the XT has started to improve. A number of new projects have been approved on HECToR recently and applications for technical assessments continue to be received at the helpdesk. In 1Q09, 23 Class1 technical assessments were completed and returned to prospective new users.

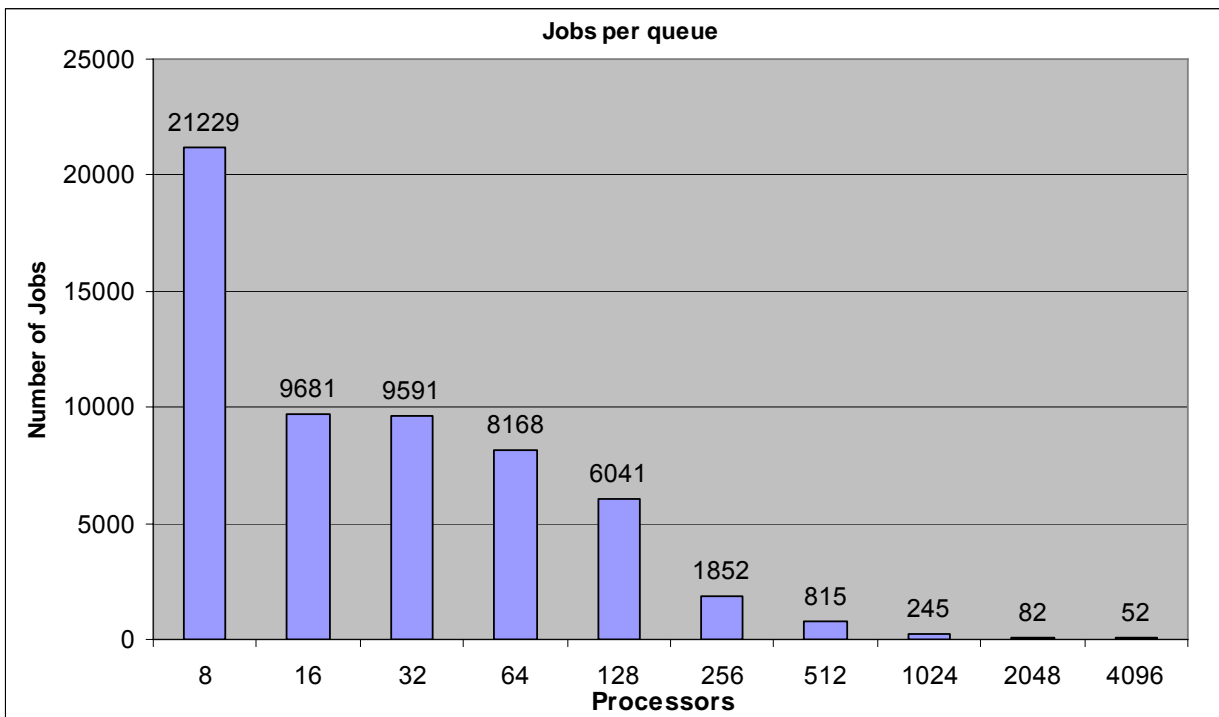
The X2 open access initiative has had a marked effect on the utilisation of the X2. This is discussed further in Section 4.4.

4.2 XT Utilisation

XT Utilisation by queue



XT Number of jobs per queue



XT4 Utilisation by Consortium

Project	Raw AUs	Number of Jobs	%age of Use	Utilisation
y01	38	27	0.0%	0.0%
y02	0	5	0.0%	0.0%
y03	215	1837	0.0%	0.0%
y05	81,179	757	0.1%	0.1%
y06	9	2858	0.0%	0.0%
y07	18	27	0.0%	0.0%
z01	240,142	1466	0.4%	0.2%
z02	1,462	125	0.0%	0.0%
z03	161,608	2857	0.2%	0.1%
z06	391	6	0.0%	0.0%
Internal Total	485,063	9965	0.7%	0.4%
c01	3,925,639	1490	5.9%	3.3%
e01	644	11	0.0%	0.0%
e05	4,205,640	3746	6.3%	3.6%
e10	83,663	163	0.1%	0.1%
e100	17	4	0.0%	0.0%
e101	37	4	0.0%	0.0%
e102	528,829	500	0.8%	0.5%
e107	5	92	0.0%	0.0%
e109	68,343	25	0.1%	0.1%
e110	404,355	258	0.6%	0.3%
e111	99,107	169	0.2%	0.1%
e24	2,343,102	871	3.5%	2.0%
e34	3,179	26	0.0%	0.0%
e35	94,915	151	0.1%	0.1%
e42	3,479,735	1507	5.3%	3.0%
e59	424,416	35	0.6%	0.4%
e63	2,549,431	1507	3.8%	2.2%
e68	3,756,928	1907	5.7%	3.2%
e69	50,575	55	0.1%	0.0%
e70	73,781	112	0.1%	0.1%
e71	4,486	7	0.0%	0.0%
e72	0	3	0.0%	0.0%
e74	0	1	0.0%	0.0%
e75	1,075,943	96	1.6%	0.9%
e76	4,375,408	132	6.6%	3.7%
e77	19,684	107	0.0%	0.0%
e79	12	15	0.0%	0.0%
e81	504	149	0.0%	0.0%
e82	28	18	0.0%	0.0%
e85	6,109	23	0.0%	0.0%
e88	42,014	11	0.1%	0.0%
e89	9,266,628	3909	14.0%	7.9%
e90	9,583	165	0.0%	0.0%
e92	23,577	31	0.0%	0.0%
e94	7	6	0.0%	0.0%
e96	0	7	0.0%	0.0%
e97	110,364	147	0.2%	0.1%
e98	1,168	85	0.0%	0.0%
e99	50,950	56	0.1%	0.0%

u02	0	5	0.0%	0.0%
u10	25,101	231	0.0%	0.0%
EPSRC Total	37,103,911	17837	56.0%	31.5%
n01	1,414,050	2058	2.1%	1.2%
n02	10,758,145	25075	16.2%	9.1%
n03	13,872,659	5143	20.9%	11.8%
n04	2,131,588	4183	3.2%	1.8%
NERC Total	28,176,442	36459	42.5%	23.9%
b01	2,137	56	0.0%	0.0%
b08	24,400	126	0.0%	0.0%
BBSRC Total	26,537	182	0.0%	0.0%
T01	106,172	257	0.2%	0.1%
x01	11,830	970	0.0%	0.0%
External Total	118,003	1227	0.2%	0.1%
d03	58,866	254	0.1%	0.1%
d04	81	235	0.0%	0.0%
d05	291,515	359	0.4%	0.3%
d07	33,364	6	0.1%	0.0%
d08	13,877	14	0.0%	0.0%
DirectorsTime Total	397,703	868	0.6%	0.3%
Total	66,307,657	66538	100.0%	56.2%

4.3 X2 Utilisation

X2 Utilisation by Consortium

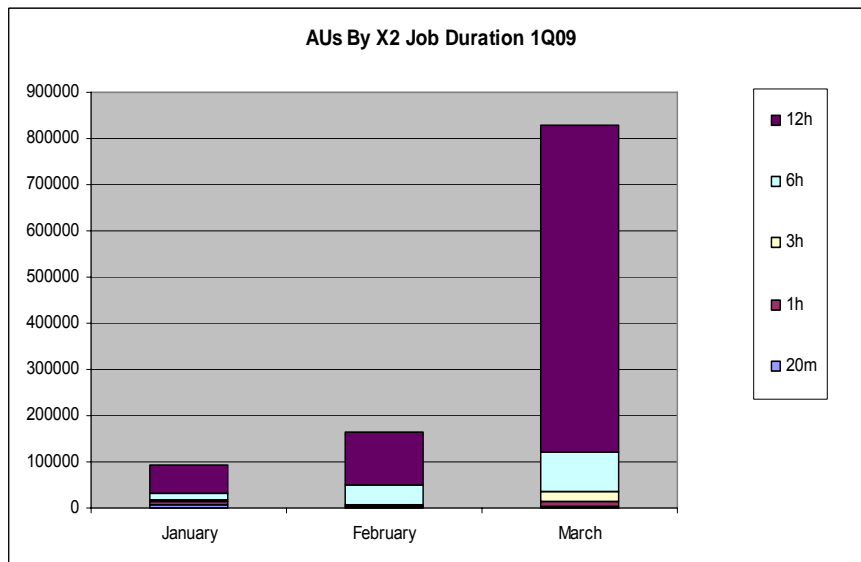
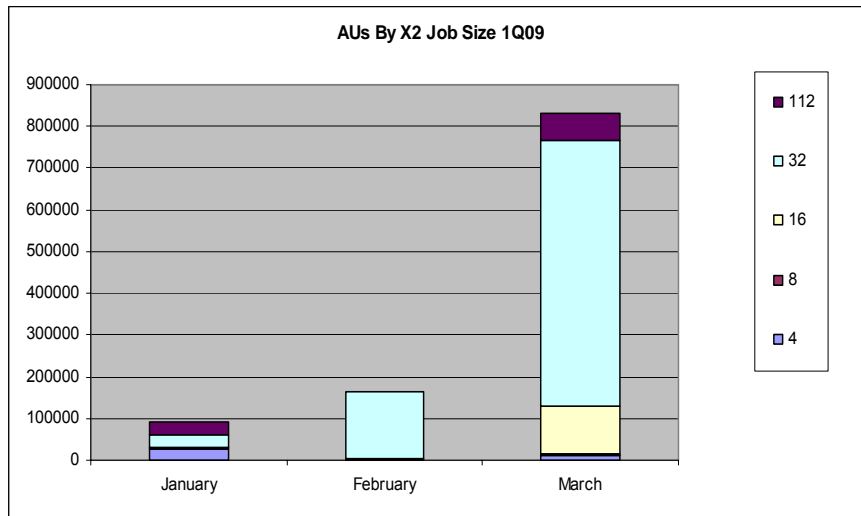
Project	Raw AUs	Number of Jobs	%age of Use	Utilisation
y02	5,407	199	0.50%	0.12%
y05	1,038	47	0.10%	0.02%
z01	1,602	107	0.15%	0.03%
z03	1,454	87	0.13%	0.03%
Internal Total	9,501	440	0.87%	0.20%
e01	608,305	429	56.02%	13.10%
e05	378,686	273	34.87%	8.16%
e10	33,213	41	3.06%	0.72%
e110	13	19	0.00%	0.00%
e24	10,874	61	1.00%	0.23%
e75	35,172	204	3.24%	0.76%
e99	1	2	0.00%	0.00%
EPSRC Total	1,066,264	1029	98.20%	22.97%
n01	0	2	0.00%	0.00%
n02	10,083	122	0.93%	0.22%
n03	1	1	0.00%	0.00%
NERC Total	10,084	125	0.93%	0.22%
Total	1,085,849	1594	100.00%	23.39%

4.4 X2 Open Access Initiative

Accounting was suspended on the X2 as of 23rd February.

Utilisation has increased from 6% in January to 52% in March as a result of this. It is worth noting that the increase in utilisation seen to date is from 2 consortia with existing X2 users. No new consortia were granted access to the X2 during the reporting period. 2 new consortia have subsequently been granted access to the X2 having completed the necessary technical assessments and the NAG training course.

Existing users have chosen to run longer jobs than previously. The graphs below illustrate the AU usage. There has been a marked increase in the volume of jobs submitted in the 12 hour queues (59 in February Vs 262 in March).



We will continue to monitor the effect of the X2 open access initiative and report on this in the next quarterly report.

5. Helpdesk

A total of 984 queries with a specified service metric were completed in this period.

Helpdesk Targets

Metric	Pass	Total	Fraction	Target
All queries finished in 1 day	821	823	99.8%	97%
Admin queries finished in 1 day	748	750	99.7%	97%
Queries assigned in 30 min	979	984	99.5%	97%
Technical assessments in 10 days	30	30	100%	97%

Queries by Service Metric

Service Metric	Queries	Percentage
Automatic	503	51.1%
Admin	247	25.1%
In-depth	131	13.3%
Technical	73	7.4%
Technical assessment class-1	23	2.3%
Technical assessment class-2	7	0.7%

Queries by Category

Query Category	Queries	Percentage
New User	148	15.0%
Set user quotas	119	12.1%
Set group quotas	94	9.6%
User behaviour	89	9.0%
Access to HECToR	69	7.0%
New Password	66	6.7%
3rd Party Software	58	5.9%
Add to group	49	5.0%
Node Failure	41	4.2%
None	36	3.7%
Compilers and system software	36	3.7%
Batch system and queues	36	3.7%
Disk, tapes, resources	32	3.3%
SAFE	19	1.9%
Other	19	1.9%
New Group	17	1.7%
Login, passwords and ssh	17	1.7%
User programs	11	1.1%
Courses	9	0.9%

Join Project	7	0.7%
Performance and scaling	4	0.4%
Static website	3	0.3%
Create certificate	2	0.2%
Remove account	1	0.1%
Porting	1	0.1%
Network	1	0.1%

Queries by Handler Category

Handlers	Total	Admin	Automatic	Technical	In-depth	Technical assessment class-1	Technical assessment class-2	Percentage
USL	346	236		49	47	7	7	35.20%
OSG	545	10	503	7	25			55.40%
CSE	79			63		16		8.00%
Cray Systems	14	1		12	1			1.40%

6. Summary of Performance Metrics

Metric	TSL(%)	FSL(%)	Jan-09	Feb-09	Mar-09	1Q09
Technology reliability (%)	85.00%	98.50%	98.4%	97.8%	98.4%	98.2%
Technology MTBF (hours)	100	126.4	146.4	122.0	146.4	137.3
Technology Throughput, hours/year	7000	8367	8472	8308	8433	8404
Capability jobs completion rate	70%	90%	N/A(*)	100.0%	100.0%	100.0%
Non in-depth queries resolved within 1 day (%)	85%	97%	100.0%	100.0%	99.7%	99.8%
Number of SP FTEs	7.3	8.0	8.2	8.2	8.1	8.2
SP Serviceability (%)	80.00%	99.00%	99.4%	98.5%	100.0%	99.3%

(*) No capability jobs ran in January

Colour coding:

Exceeds FSL	
Between TSL and FSL	
Below TSL	

Appendix A: Terminology

TSL	:	Threshold Service Level
FSL	:	Full Service Level
SDT	:	Scheduled Down Time
UDT	:	Unscheduled Down Time
WCT	:	Wall Clock Time
MTBF	:	Mean Time Between Failures = 732/Number of Failures
SP	:	Service Provision

SP Serviceability% = $100 * (WCT - SDT - UDT(SP)) / (WCT - SDT)$

Technology Reliability % = $100 * (1 - (UDT(Technology)) / (WCT - SDT))$

Incident Severity Levels

SEV 1 — anything that comprises a FAILURE as defined in the contract with EPSRC.

SEV 2 — NON-FATAL incidents that typically cause immediate termination of a user application, but not the entire user service.

The service may be so degraded (or liable to collapse completely) that a controlled, but unplanned (and often very short-notice) shutdown is required or unplanned downtime subsequent to the next planned reload is necessary.

This category includes unrecovered disc errors where damage to file systems may occur if the service was allowed to continue in operation; incidents when although the service can continue in operation in a degraded state until the next reload, downtime at less than 24 hours notice is required to fix or investigate the problem; and incidents whereby the throughput of user work is affected (typically by the unrecovered disabling of a portion of the system) even though no subsequent unplanned downtime results.

SEV 3 — NON-FATAL incidents that typically cause immediate termination of a user application, but the service is able to continue in operation until the next planned reload or re-configuration.

SEV 4 — NON-FATAL recoverable incidents that typically include the loss of a storage device, or a peripheral component, but the service is able to continue in operation largely unaffected, and typically the component may be replaced without any future loss of service.

Appendix B: Projects on HECToR

Code	Title	Funding Body	Class	PI	AUs allocated	AUs used	AUs left
EPSRC Projects							
c01	Support of EPSRC/STFC SLA	EPSRC	Class1	Dr Richard Blake	12,803,723	10,627,506	2,176,217
e01	UK Turbulence Consortium	EPSRC	Class1	Dr Gary N Coleman	3,107,500	1,767,281	1,340,219
e05	Materials Chemistry HPC Consortium	EPSRC	Class1	Prof C Richard A Catlow	1,129,267,228	10,263,918	1,119,003,310
e10	GENIUS	EPSRC	Class1	Prof Peter Coveney	9,257,856	5,458,088	3,799,768
e100	Large scale MD and quantum embedding for biological systems	EPSRC	Class2	Prof Zheng X Guo	100,000	27	99,973
e101	Optimization of HPCx LES code	EPSRC	Class2	Prof Michael Leschziner	100,000	37	99,963
e102	Numerical investigation of aerofoil noise	EPSRC	Class1	Dr Richard D Sandberg	5,000,000	544,126	4,455,874
e103	Micromagnetic simulations on HPC architectures	EPSRC	Class2	Dr Hans Fangohr	100,000	0	100,000
e104	Fluid-Mechanical Models applied to Heart Failure	EPSRC	Class1	Dr Nicolas Smiths	2,400,000	0	2,400,000
e105	Joint Euler/Lagrange Method for Multi-Scale Problems	EPSRC	Class1	Dr Andreas M Kempf	1,300,000	0	1,300,000
e106	Numerical Simulation of Multiphase Flow: From Mesoscales to	EPSRC	Class1	Prof Kai Luo	3,650,000	0	3,650,000
e107	Parallel Brain Surgery Simulation	EPSRC	Class1	Dr Stephane P. A. Bordas	6,000,000	5	5,999,995
e108	Unsteady Propeller Noise	EPSRC	Class2	Dr Sergey Karabasov	100,000	0	100,000

e109	Nonlinear modelling of tokamak plasma eruptions	EPSRC	Class2	Prof Howard Wilson	100,000	68,343	31,657
e110	Computational Aeroacoustics Consortium	EPSRC	Class1	Prof Paul Tucker	39,100,000	442,973	38,657,027
e111	The Modelling of New Catalysts for Fuel Cell Application	EPSRC	Class2	Prof Dario Alfe`	100,000	100,470	-470
e112	Assessment of the ONETEP code	EPSRC	Class2	Mr Andrew J Scott	100,000	0	100,000
e113	[dCSE] MRBV ? Massive Remove Batch Visualizer	EPSRC	Class2	Dr Martin Turner	85,440	0	85,440
e114	[dCSE] OpenFOAM	EPSRC	Class2	Mr Paul Graham	100,000	0	100,000
e115	Multiscale Modelling of Biological Systems	EPSRC	Class2	Prof Jonathan W Essex	100,000	0	100,000
e116	Scaling and Benchmarking Spectral Codes	EPSRC	Class2	Dr Benson Muite	100,000	0	100,000
e117	Getting started on HECTOR	EPSRC	Class2	Dr Carmen Domene	100,000	0	100,000
e118	Adaptive coupled radiation-transport and fluids modelling.	EPSRC	Class2	Prof Christopher Pain	100,000	0	100,000
e24	DEISA	EPSRC	Class1	Mrs Alison Kennedy	42,323,067	10,739,406	31,583,661
e34	Hydrogen vacancy distribution in magnesium hydride	EPSRC	Class2	Prof Nora de Leeuw	100,000	18,081	81,919
e35	Non-adiabatic processes	EPSRC	Class1	Dr Tchavdar Todorov	3,000,000	127,467	2,872,533
e42	Computational Combustion for Engineering Applications	EPSRC	Class1	Prof Kai Luo	32,000,000	7,267,473	24,732,527
e59	Turbulence in Breaking Gravity Waves	EPSRC	Class1	Prof Ian P Castro	708,922	440,737	268,185
e63	UK Applied Aerodynamics Consortium 2	EPSRC	Class1	Dr Nick Hills	13,500,000	6,113,985	7,386,015

e68	Hydrogenation Reactions at Metal Surfaces	EPSRC	Class1	Dr Angelos Michaelides	50,000,000	23,283,565	26,716,435
e69	Simulations of a Subsonic Cylindrical Cavity Flow	EPSRC	Class2	Dr Aldo Rona	125,000	123,995	1,005
e70	Computation of Electron Transfer Properties	EPSRC	Class1	Dr Jochen Blumberger	960,000	206,534	753,466
e72	Ultrascale Modelling of Materials	EPSRC	Class2	Dr Lee Margetts	8,622,547	8,459,578	162,969
e74	Quantum Monte Carlo Methods	EPSRC	Class1	Prof Dario Alfe`	30,008,735	32,477,320	-2,468,585
e75	Terascale DNS of Turbulence	EPSRC	Class1	Prof Christos Vassilicos	27,760,000	26,048,872	1,711,128
e76	HELIUM Developments	EPSRC	Class1	Prof Ken Taylor	6,000,000	6,058,303	-58,303
e77	Porting of DFT/GW Codes	EPSRC	Class2	Prof M Merlyne DeSouza	160,000	60,676	99,324
e79	SMEAGOL	EPSRC	Class1	Prof Colin Lambert	3,000,000	34	2,999,966
e81	e-Collision experiments using HPC	EPSRC	Class2	Prof NS Scott	200,000	606	199,394
e82	ONETEP: linear-scaling method on High Performance Computers	EPSRC	Class2	Dr Peter Haynes	100,000	90,756	9,244
e83	Ab initio study of high pressure disordered ice	EPSRC	Class2	Dr Simon P Bates	100,000	100,589	-589
e84	Vortical Mode Interactions	EPSRC	Class1	Dr Tamer Zaki	3,200,000	16	3,199,984
e85	Study of Interacting Turbulent Flames	EPSRC	Class1	Dr N Swaminathan	2,083,001	6,109	2,076,892
e86	Single molecule vibrational microscopy and spectroscopy	EPSRC	Class2	Prof Andrew Fisher	100,000	103,105	-3,105
e89	Support for UK Car-Parrinello Consortium	EPSRC	Class1	Dr Matt Probert	140,000,000	26,601,918	113,398,082

e90	Network modelling of wireless cities	EPSRC	Class2	Prof Jonathan M Pitts	100,000	11,212	88,788
e92	Dynamo Action In Compressible Convection	EPSRC	Class2	Mr Paul Bushby	75,000	74,433	567
e94	Porting the Linear Scaling DTF Code Conquest to HECToR	EPSRC	Class2	Dr David Bowler	100,000	6,201	93,799
e96	Materials Property Relationships	EPSRC	Class2	Dr Shoufeng Yang	100,000	0	100,000
e97	Discovery of innovative hydrogen storage materials	EPSRC	Class2	Prof Zheng X Guo	100,000	104,630	-4,630
e98	Non-linear magnetohydrodynamic modelling of tokamak plasmas	EPSRC	Class2	Mr Ian T Chapman	100,000	26,287	73,713
e99	New Developments in Modelling Electron Energy Loss Spectroscopy	EPSRC	Class2	Mr Andrew J Scott	150,000	155,613	-5,613
u02	Materials simulation using AIMPRO	EPSRC	Early use	Dr Patrick R Briddon	4,000,000	3,080,443	919,557
u03	DNS of NACA-0012 aerofoil at Mach 0.4	EPSRC	Early use	Dr Gary N Coleman	2,500,000	2,301,049	198,951
u10	Turbulent Plasma Transport in Tokamaks	EPSRC	Early use	Dr Colin M Roach	2,500,000	2,141,841	358,159
y08	Testing	EPSRC	Early use	Dr David Jenkins	1,000	0	1,000
NERC Projects							
n01	Global Ocean Modelling Consortium	NERC	Class1	Dr Thomas Anderson	9,830,000	7,205,306	2,624,694
n02	NCAS (National Centre for Atmospheric Science)	NERC	Class1	Dr Lois Steenman-Clark	52,500,000	36,932,904	15,567,096
n03	Computational Mineral Physics Consortium	NERC	Class1	Prof John P Brodholt	80,779,000	64,191,997	16,587,003
n04	Shelf Seas Consortium	NERC	Class1	Dr Roger Proctor	8,250,000	3,181,317	5,068,683

BBSRC Projects							
b01	Biomarkers for patient classification	BBSRC	Class2	Prof. Peter Ghazal	100,000	2,138	97,862
b08	Int BioSim	BBSRC	Class1	Mr Mark M Sansom	866,000	27,017	838,983
b09	Circadian Clock	BBSRC	Class1	Prof Andrew A Millar	2,000,000	0	2,000,000
STFC Projects							
p01	Atomic Physics for APARC	STFC	Class1	Dr Penny Scott	3,020,000	0	3,020,000
External Projects							
x01	HPC-Europa	External	Class1	Dr Judy Hardy	2,183,338	495,169	1,688,169
x02	BlueArc (TDS)	External	Service	Mr M W Brown	1,000	0	1,000
T01	NIMES: New Improved Muds from Environmental Sources.	External	Class1	Dr Chris Greenwell	4,113,669	116,889	3,996,780
Director's Time							
d03	EUFORIA	DirectorsTime	Service	Mr Adrian Jackson	1,200,000	76,330	1,123,670
d04	MSc Projects	DirectorsTime	Service	Dr David Henty	93,927	27,525	65,475
d05	Icon-DT	DirectorsTime	Service	Mr Paul Graham	320,000	322,097	-2,097
d07	Thermal ellipsoids and proton transfer	DirectorsTime	Service	Dr Carole A Morrison	1,116,000	296,951	819,049
d08	Oncology	DirectorsTime	Service	Mr Florian Scharinger	35,000	13,848	21,152

y09	Director's Time	DirectorsTime	Service	Prof Arthur S Trew	846,708	82,538	764,170
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