Overview:
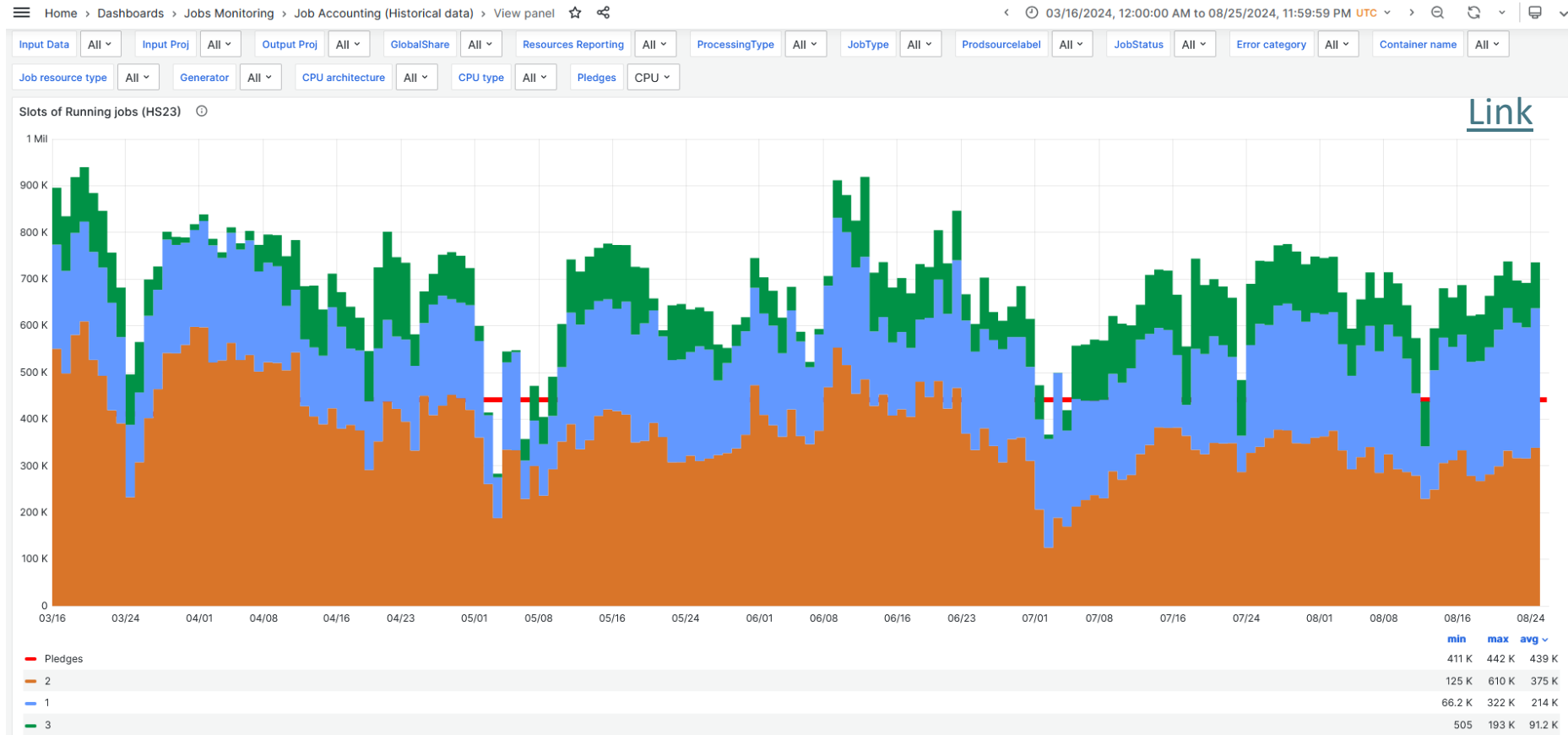

- ATLAS UK Cloud performance since GridPP51 (16th Mar to 25th Aug 2024)

- Updates from ATLAS UK Cloud sites.

- Updates from ATLAS ADC.

Which woodland critter gallops on the ground like it's late for a very important date?

Compute: Occupancy vs pledge

Delivered compute vs pledge at 155%

Tier	Average HS23
Pledge	439K
RAL Tier1	214K
Tier2s	375K
Tier3s	92K
Total	681K

What animal has a long, bushy tail for tree climbing?

Compute: Occupancy vs pledge

| Site (Federation)	Average HS23	Federation pledge HS23
RAL (Tier1)	**214K**	**237K**
UKI-LT2-QMUL	73.8K	35.2K
UKI-LT2-RHUL	11.3K	
UKI-LT2-IC-HEP	8.79K	
UKI-LT2-Brunel	5.7K	
UKI-NORTHGRID-MAN-HEP	82.8K	79.2K
UKI-NORTHGRID-LANCS-HEP	59.5K	
UKI-NORTHGRID-SHEF-HEP	14.3K	
UKI-NORTHGRID-LIV-HEP	10.8K	
UKI-SOUTHGRID-OX-HEP	40.9k	24.4k
UKI-SOUTHGRID-BHAM-HEP	8.96k	
UKI-SOUTHGRID-RALPP	5.70k	
UKI-SOUTHGRID-SUSX	3.52k	
UKI-SCOTGRID-DURHAM	73k	62.7k
UKI-SCOTGRID-GLASGOW	55.1k	
UKI-SCOTGRID-ECDF	10.2k	

RAL Tier1:
- Majority of ATLAS workloads are multicore.
- Changes in scheduling policy to favour Multicore jobs have shown increased occupancy of ATLAS jobs during last month.
- Expected to overdeliver in the next quarter.
- Details in Tom's talk from yesterday.

Which little predator loves to catch mice and birds?

Compute: Occupancy vs pledge

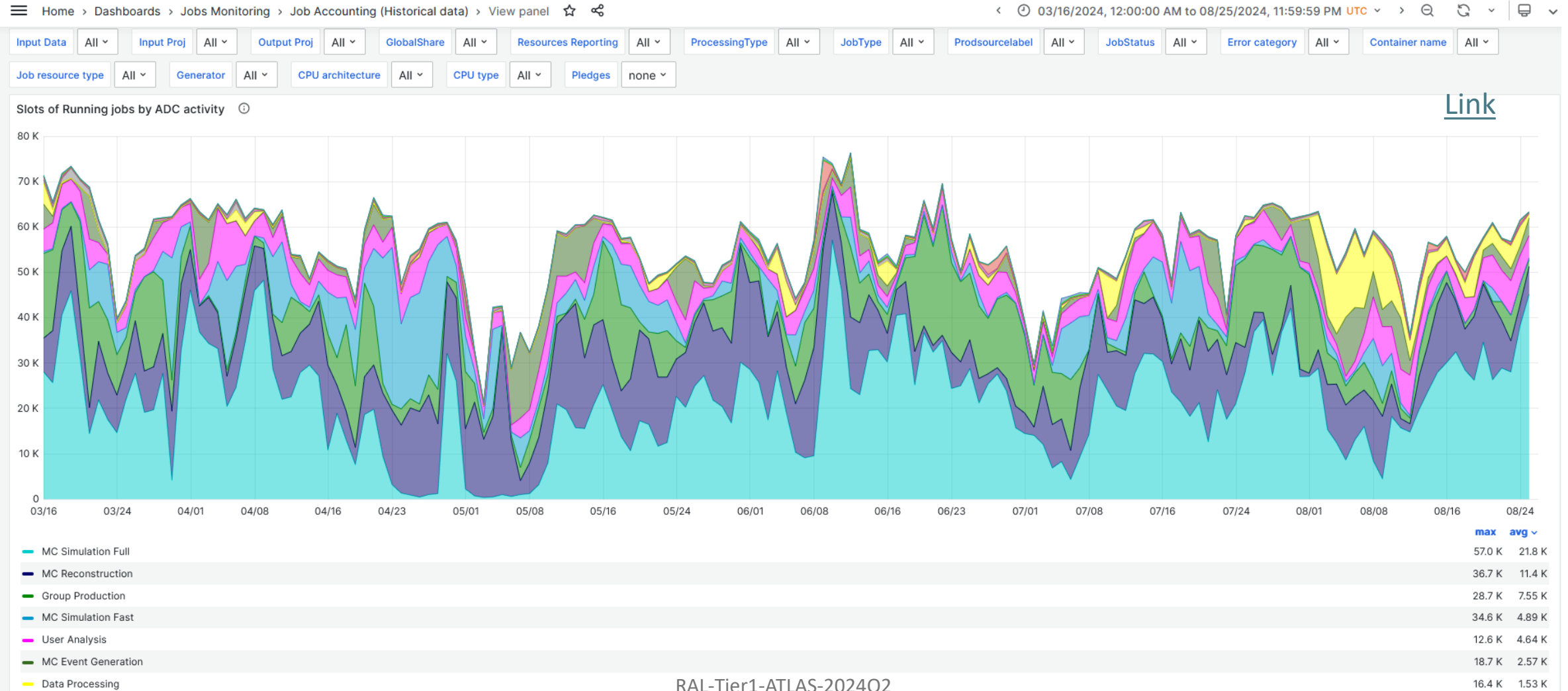## UK Cloud regions

QMUL downtime for DC refurbishment
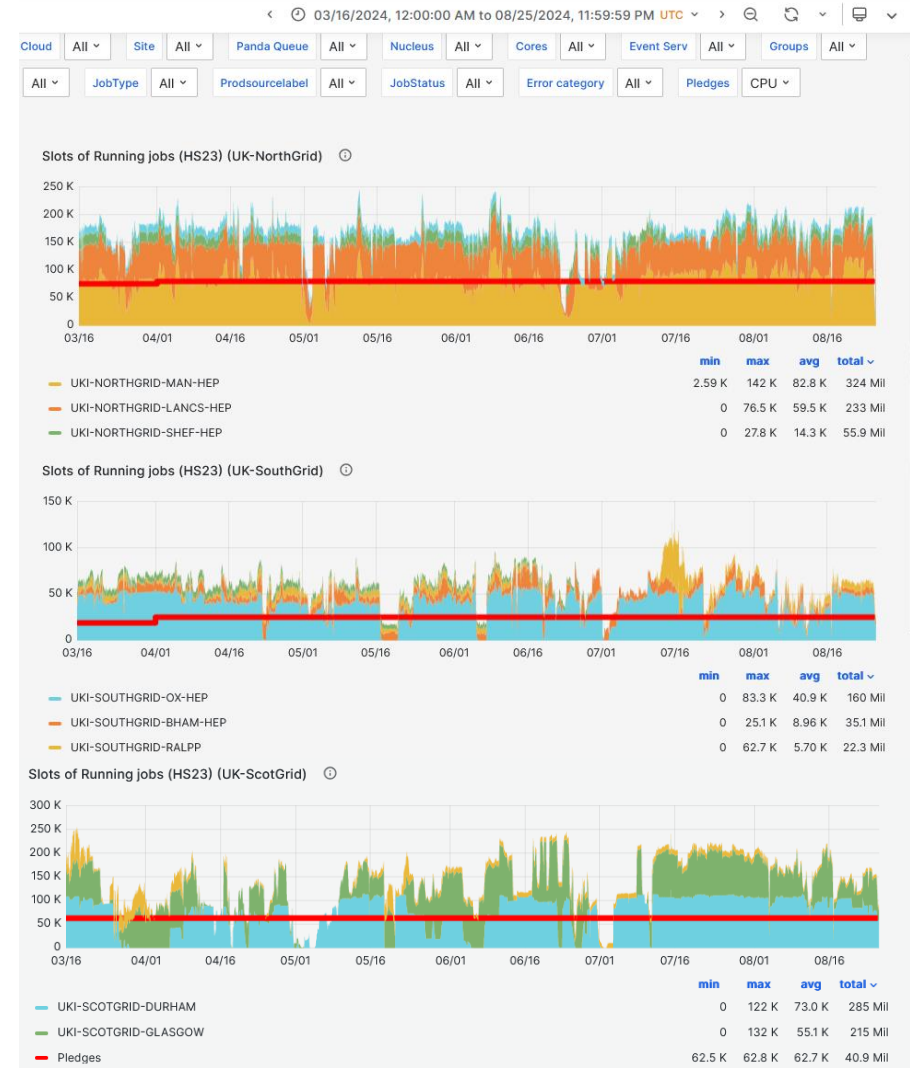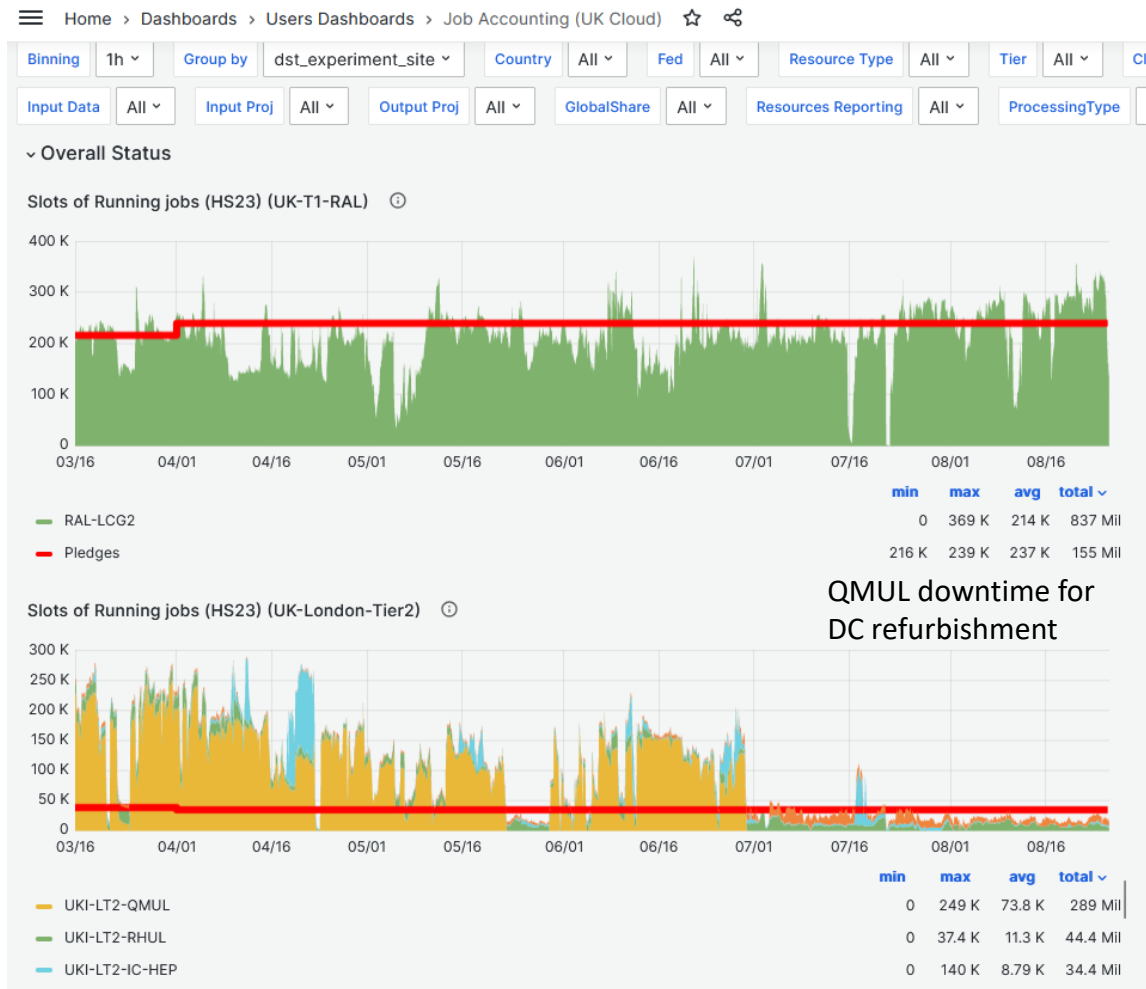
Compute: workload type

Slots of running jobs by ADC activity: Dominated by MC

What nimble creature can jump between trees at night?

RAL-Tier1-ATLAS-2024Q2

Compute: Efficiency

Across ATLAS: Average CPU efficiency of good jobs for various job types

Average CPU Efficiency Good jobs

Link Across ATLAS

90.4%   92.8%

avg ∨		
NL	0.928
DE	0.923
FR	0.914
RU	0.912
UK	0.904
IT	0.892
CERN	0.888
US	0.876
ES	0.870
CA	0.867
ND	0.806

(bar chart x-axis: US, UK, RU, NL, ND, IT, FR, ES, DE, CERN, CA)
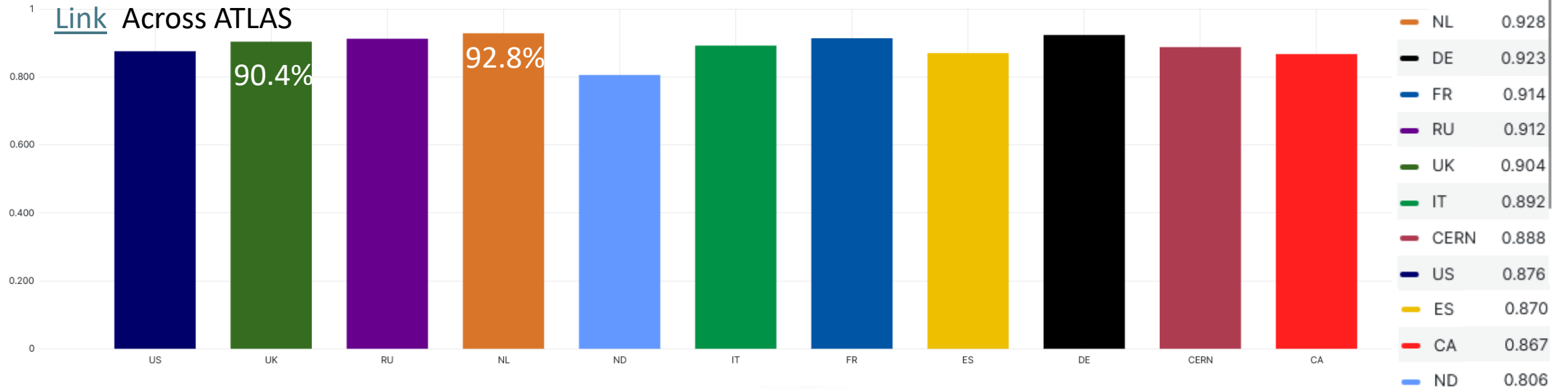
Link - UK

	Value	Percent
User Analysis	5.54 Mil	31%
MC Simulation Full	3.64 Mil	20%
MC Event Generation	1.61 Mil	9%
Testing	1.34 Mil	8%
MC Reconstruction	1.23 Mil	7%
MC Merge	1.18 Mil	7%
MC Simulation Fast	1.08 Mil	6%
Group Production	1.01 Mil	6%
Event Index	460 K	3%
Data Processing	330 K	2%

NL - Link
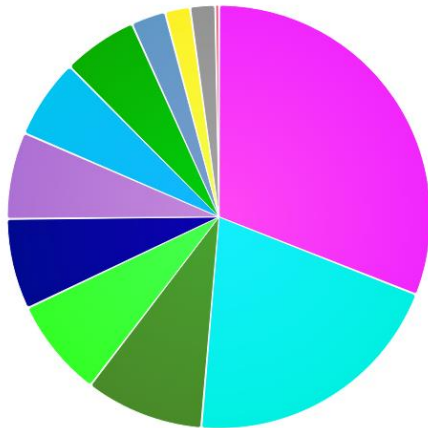
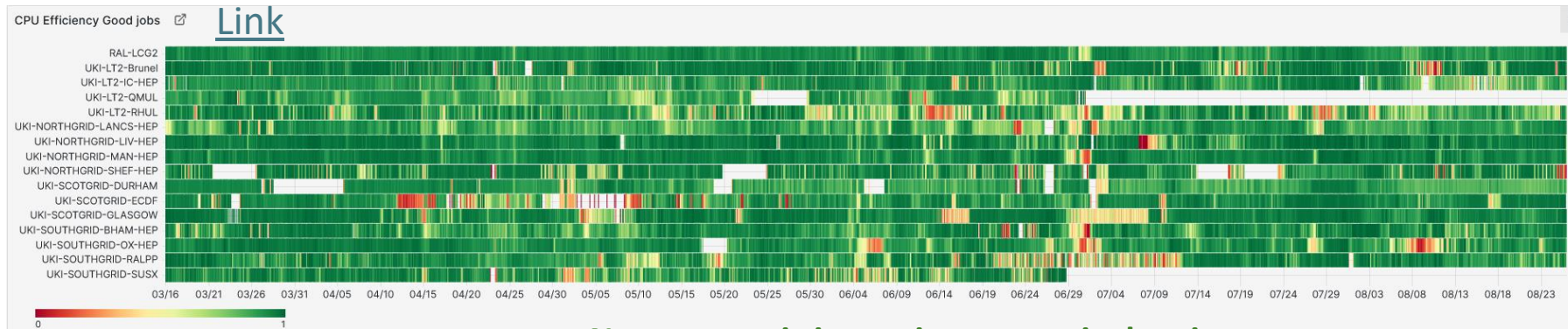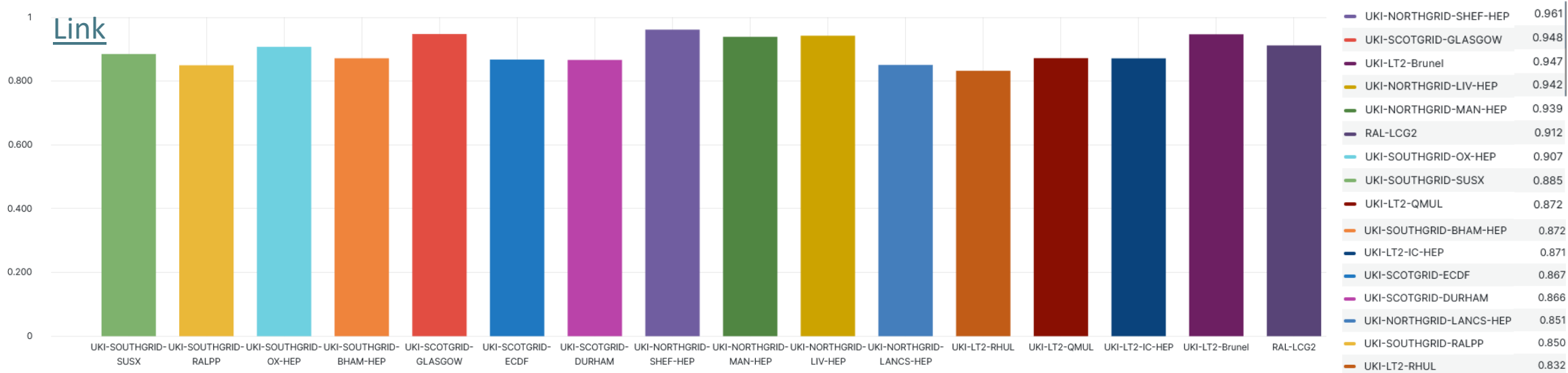|	Value	Percent
User Analysis	1.02 Mil	38%
MC Merge	310 K	12%
MC Simulation Full	270 K	10%
MC Event Generation	226 K	8%
Group Production	213 K	8%
Testing	183 K	7%
Group Analysis	143 K	5%
MC Reconstruction	121 K	5%
Event Index	83.3 K	3%
MC Simulation Fast	58.1 K	2%
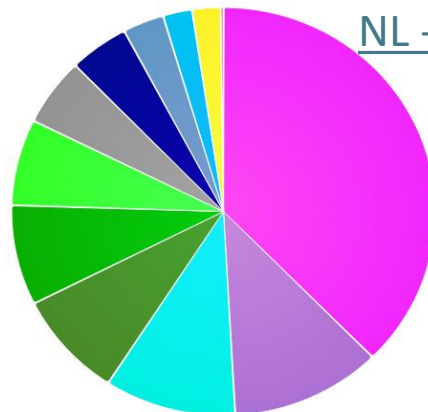
- Only marginal difference with top performers in the chat

- Difference not due to types of workflow allocation

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Compute: Efficiency

Average CPU Efficiency Good jobs

Link

	avg
UKI-NORTHGRID-SHEF-HEP	0.961
UKI-SCOTGRID-GLASGOW	0.948
UKI-LT2-Brunel	0.947
UKI-NORTHGRID-LIV-HEP	0.942
UKI-NORTHGRID-MAN-HEP	0.939
RAL-LCG2	0.912
UKI-SOUTHGRID-OX-HEP	0.907
UKI-SOUTHGRID-SUSX	0.885
UKI-LT2-QMUL	0.872
UKI-SOUTHGRID-BHAM-HEP	0.872
UKI-LT2-IC-HEP	0.871
UKI-SCOTGRID-ECDF	0.867
UKI-SCOTGRID-DURHAM	0.866
UKI-NORTHGRID-LANCS-HEP	0.851
UKI-SOUTHGRID-RALPP	0.850
UKI-LT2-RHUL	0.832

CPU Efficiency Good jobs Link

Link

T1 91.2 %   T2 90.9 %   T3 87.2 %

No systematic issues in any particular site
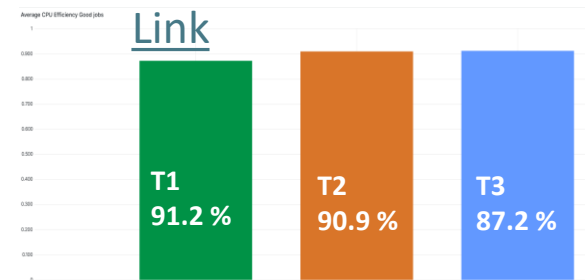
8

Compute: Efficiency

Average CPU efficiency of good jobs for various job types.

Average CPU Efficiency Good jobs

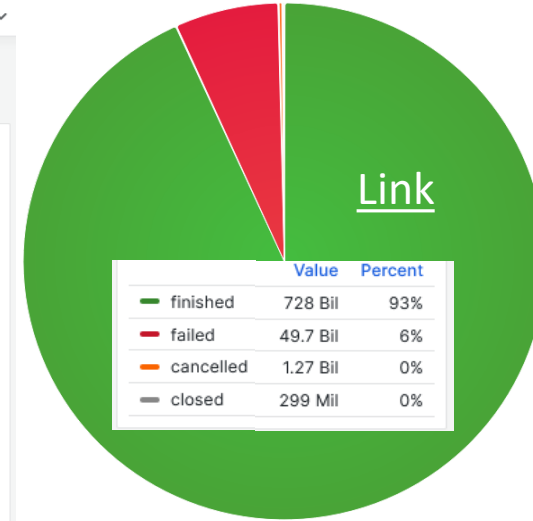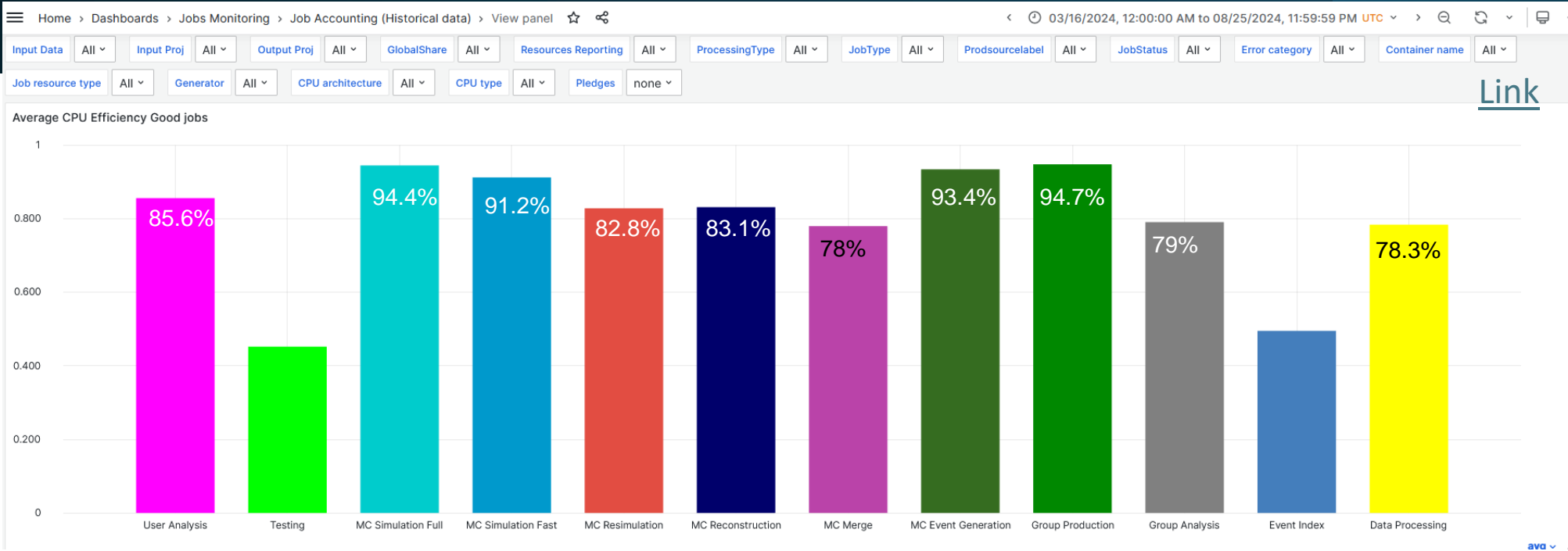| Job Type	Efficiency
User Analysis	85.6%
MC Simulation Full	94.4%
MC Simulation Fast	91.2%
MC Resimulation	82.8%
MC Reconstruction	83.1%
MC Merge	78%
MC Event Generation	93.4%
Group Production	94.7%
Group Analysis	79%
Data Processing	78.3%

Link

Link

	Value	Percent
finished	728 Bil	93%
failed	49.7 Bil	6%
cancelled	1.27 Bil	0%
closed	299 Mil	0%

- *At 6%, Failure rate is below the global average ATLAS failures of 7%*
- *For RAL Tier1 its 4%*

Link

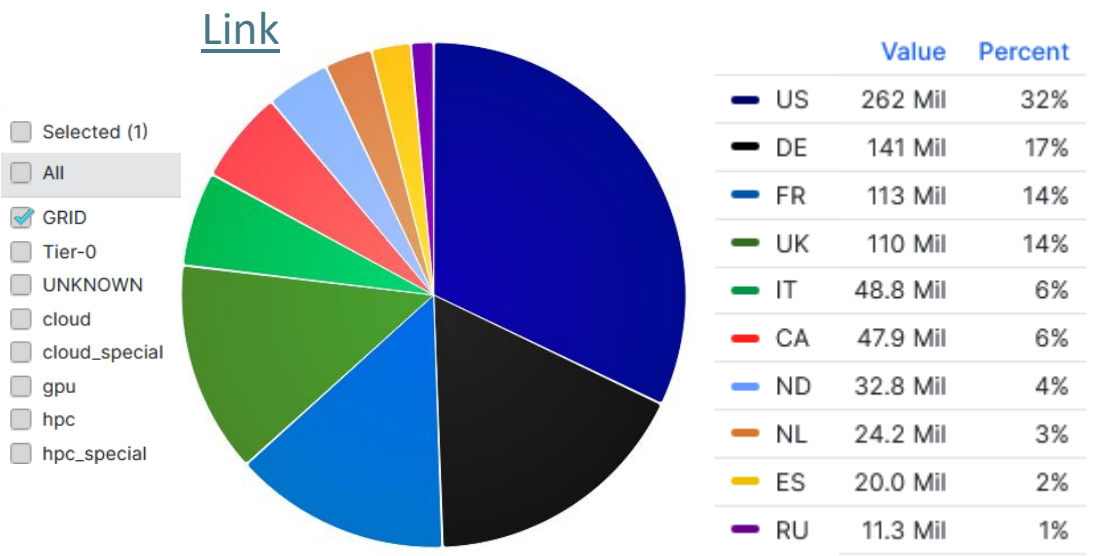**Some workflows are more efficient than others**
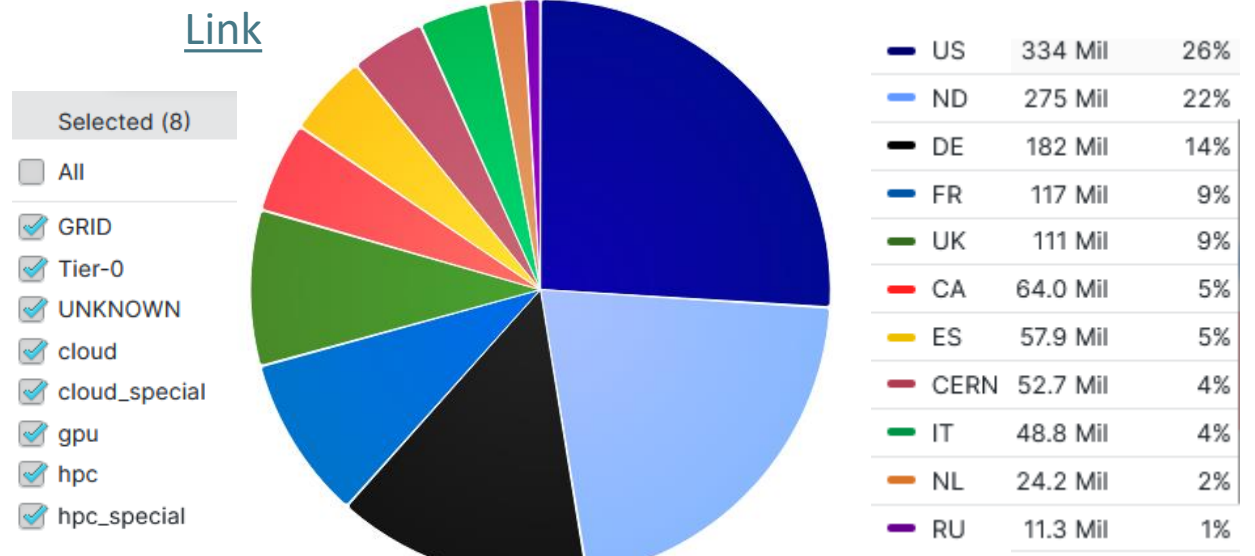
What small mammal can roam 20 miles in a single night?

9
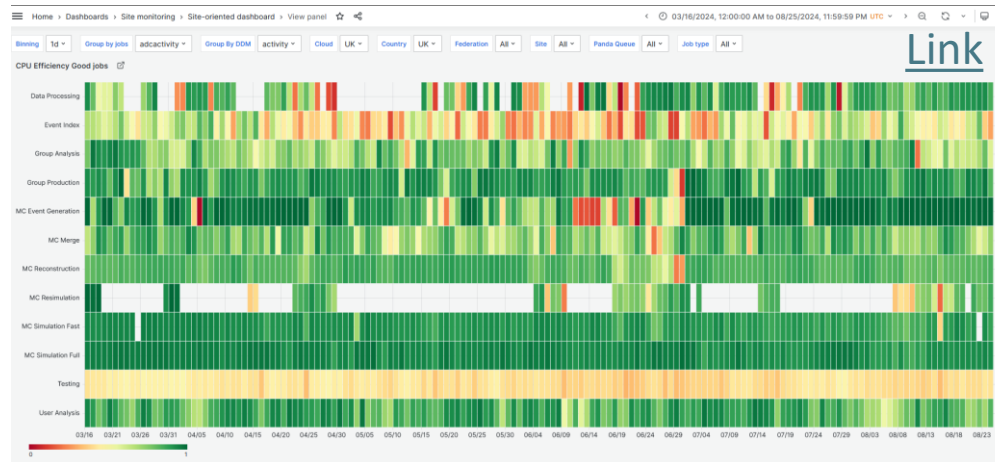
ATLAS Compute: resource types
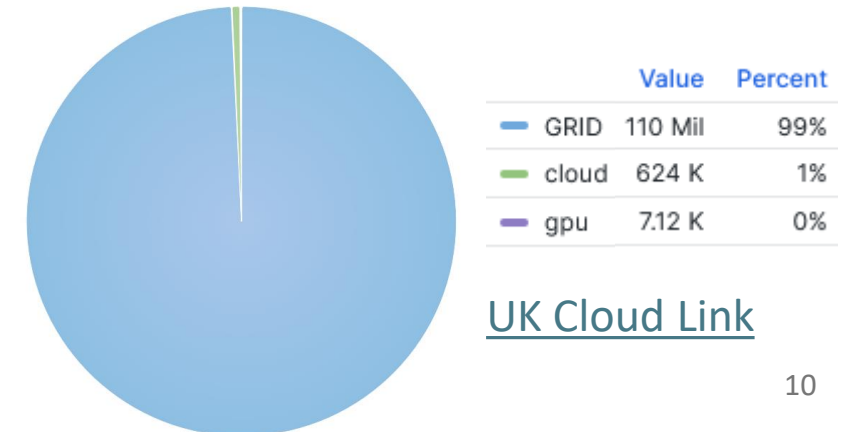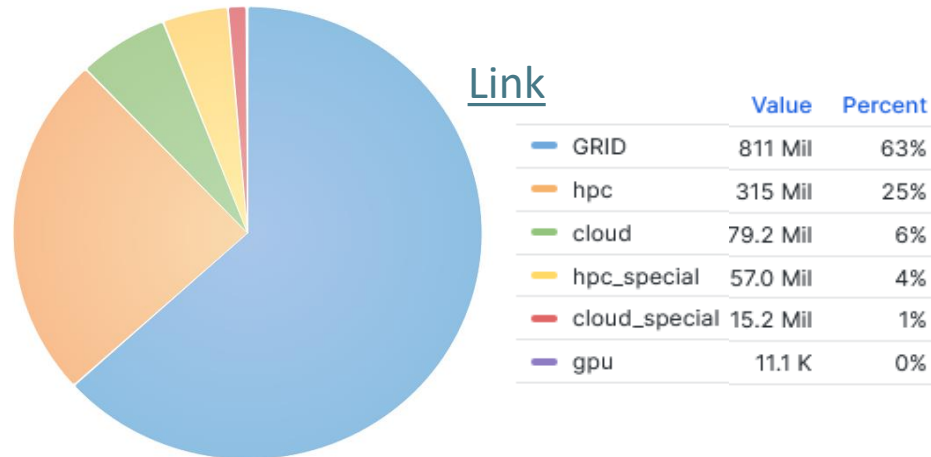
Significant (37%) non-grid compute resources in ATLAS

Link

	Value	Percent
US	262 Mil	32%
DE	141 Mil	17%
FR	113 Mil	14%
UK	110 Mil	14%
IT	48.8 Mil	6%
CA	47.9 Mil	6%
ND	32.8 Mil	4%
NL	24.2 Mil	3%
ES	20.0 Mil	2%
RU	11.3 Mil	1%

- Selected (1)
- All
- ☑ GRID
- Tier-0
- UNKNOWN
- cloud
- cloud_special
- gpu
- hpc
- hpc_special

Link

	Value	Percent
US	334 Mil	26%
ND	275 Mil	22%
DE	182 Mil	14%
FR	117 Mil	9%
UK	111 Mil	9%
CA	64.0 Mil	5%
ES	57.9 Mil	5%
CERN	52.7 Mil	4%
IT	48.8 Mil	4%
NL	24.2 Mil	2%
RU	11.3 Mil	1%

- Selected (8)
- All
- ☑ GRID
- ☑ Tier-0
- ☑ UNKNOWN
- ☑ cloud
- ☑ cloud_special
- ☑ gpu
- ☑ hpc
- ☑ hpc_special

Slots of running jobs HS23

Slots of running jobs HS23

Link

	Value	Percent
GRID	811 Mil	63%
hpc	315 Mil	25%
cloud	79.2 Mil	6%
hpc_special	57.0 Mil	4%
cloud_special	15.2 Mil	1%
gpu	11.1 K	0%

	Value	Percent
GRID	110 Mil	99%
cloud	624 K	1%
gpu	7.12 K	0%

UK Cloud Link

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Storage:

ATLAS total data breached one exabytes mark in rucio: at 120 PB, UK is at ~12% of total.

ATLAS UK Storage ~120 PB of total storage [Link](#)

Volume per experiment_site
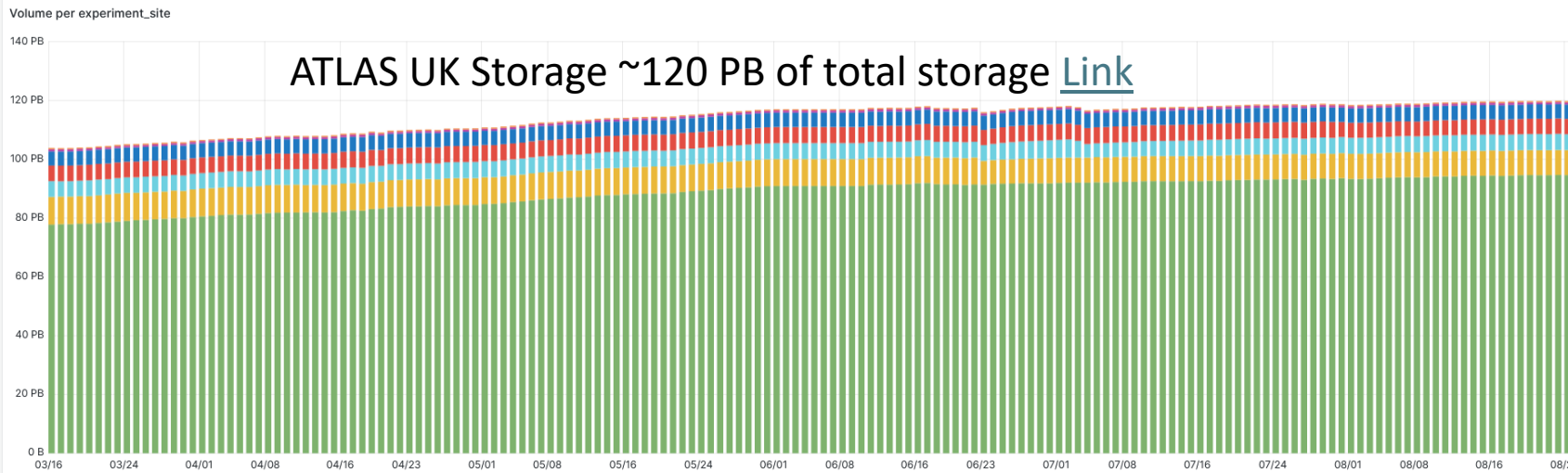
	min	max	avg	current ⌄
● RAL-LCG2	77.7 PB	94.6 PB	88.5 PB	94.6 PB
● UKI-LT2-QMUL	8.08 PB	9.54 PB	8.92 PB	8.51 PB
● UKI-NORTHGRID-LANCS-HEP	4.59 PB	6.16 PB	5.39 PB	5.40 PB
● UKI-NORTHGRID-MAN-HEP	4.97 PB	5.51 PB	5.38 PB	5.18 PB
● UKI-SCOTGRID-GLASGOW	4.81 PB	4.98 PB	4.87 PB	4.88 PB
● UKI-SOUTHGRID-RALPP	616 TB	788 TB	718 TB	727 TB
● UKI-NORTHGRID-LIV-HEP	327 TB	434 TB	394 TB	426 TB

@ RAL Tier-1: 97 PB on Tape and 25 PB on disk [Link](#)

Volume per rse (RAL-LCG2)
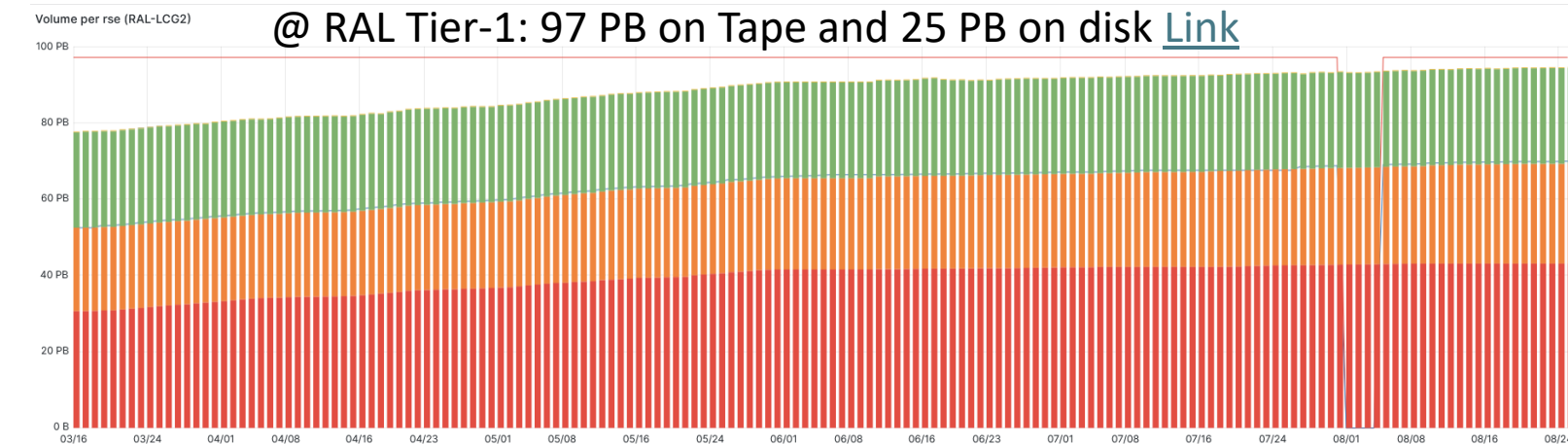
	min	max	avg	current ⌄
● Storage total	0 B	97.1 PB	94.7 PB	97.1 PB
● Storage used	0 B	69.9 PB	61.9 PB	69.9 PB
● RAL-LCG2_MCTAPE	30.6 PB	43.1 PB	39.4 PB	43.1 PB
● RAL-LCG2_DATATAPE	21.8 PB	26.3 PB	23.8 PB	26.3 PB
● RAL-LCG2-ECHO_DATADISK	24.8 PB	25.6 PB	25.1 PB	25.1 PB
● RAL-LCG2-ECHO_SCRATCHDISK	189 TB	200 TB	198 TB	199 TB
● RAL-LCG2-ECHO_TEST	3.22 TB	3.65 TB	3.38 TB	3.50 TB

RAL-Tier1-ATLAS-2024Q2

Data transfers:

ATLAS total data breached one exabytes mark in rucio: at 120 PB, UK is at 12% of total.

- **Very good data transfers efficiency at 94.6%**   Link
- **For RAL Tier1, transfers efficiency at 96%**
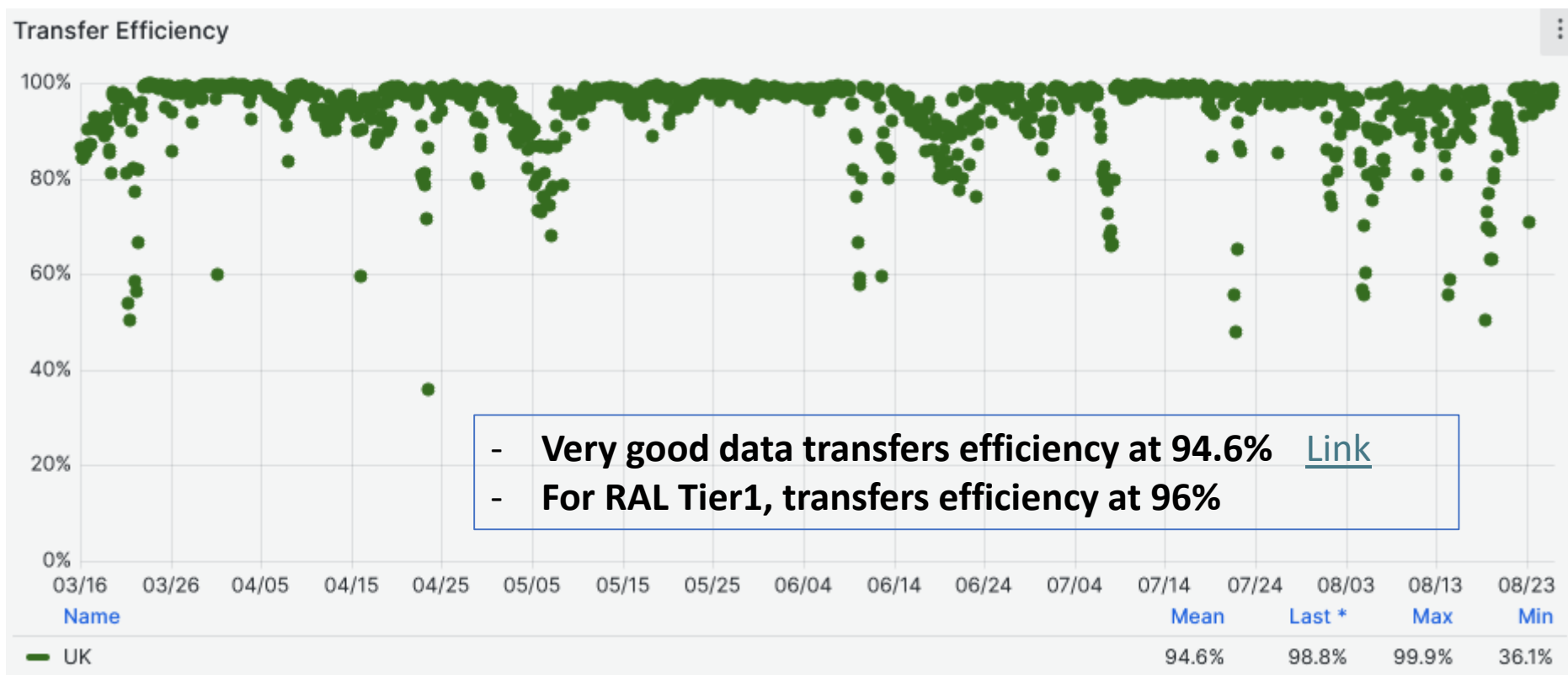
Who is a shy, solitary animal, except in mating season?

ATLAS UK Cloud: updates from sites

Based on inputs from sites (RAL, Lancaster, Liverpool, Oxford, QMUL, Glasgow, RHUL, Birmingham, Edinburgh) : Many thanks

Site	Major work undertaken since last GridPP meeting
General:	Completed the migration of OS and services from CentOS 7 to EL8 and EL9.
RAL	- Antares upgrade to CTAv5 and Arc-CE upgrades were successful, no intervention needed for ATLAS. - New Lenovo hardware in production (details in Alastair and Tom's talks).
Oxford	- Retired 48 "Guzzlers" worker nodes (1,536 cores).
QMUL	- Ongoing data center refurbishment. - Hardware upgrades for several service nodes. - Deployment planned for new Storm server hardware and new site switches (Sonic OS + LHCONE).
Glasgow	- Added 2,304 Ampere Altra Max M128-30 cores. - Set up a new heterogeneous endpoint with dual queues (ARM & x86) (details in Emanuele's talk).
RHUL	- Decommissioned old equipment. - Installed new Lenovo compute nodes. - Migrated provisioning system from Spacewalk+Puppet to The Foreman+Ansible.
Birmingham	- Completed removal of VAC; all jobs now run through CondorCE+Condor. - Commissioned new workers (+20% compute increase) and updated XCache storage.

Which woodland critter has soft, reddish-brown fur?

ATLAS UK Cloud: updates from sites

Based on inputs from sites (RAL, Lancaster, Liverpool, Oxford, QMUL, Glasgow, RHUL, Birmingham, Edinburgh) : Many thanks

Site	Major work undertaken since last GridPP meeting
Edinburgh	- Preparatory work for Exascale@ACF impacted wider research computing at UoE. - Major network upgrade at UoE, expected to finish in Q4 2024.
Manchester	- Storage migration from DPM to CEPH.

Site	Major Problems Faced and Resolved
General / RAL	- Challenges from Rocky/Alma (8/9) migration. Xrootd related gateway issues (details in Alex's LHCb talk)
Lancaster	- CEPH storage became full, resolved by clearing space and adding new storage. - Lancaster serves as a remote data site for Durham and Sheffield, with no significant strain on the system.
Liverpool	- University firewall misidentified external testing as port scanning, leading to the blocking of test server IPs.
Oxford	- Enabled tokens and resolved job failures due to vmem by using CGROUP_IGNORE_CACHE_MEMORY.

ATLAS UK Cloud: updates from sites

Based on inputs from sites (RAL, Lancaster, Liverpool, Oxford, QMUL, Glasgow, RHUL, Birmingham, Edinburgh) : Many thanks

Site	Major Problems Faced and Resolved
RHUL	- Difficulty automating network setup with network-manager on EL9. - Improved power efficiency by 3x with hardware changes, reducing from 0.71 to 0.23 W/HS (latest servers are at 0.14 W/HS).
Birmingham	- Encountered the 'annual' air conditioning problem and Alma9 xrootd gateway performance issues.

Site	Pending Issues and Plans for Resolution
Liverpool	- Reduced manpower is a challenge but is being managed with the current 1.5 FTE.
QMUL	- Major issue: Missing Storm EL9 update. - Plan: Deploy new Lustre (with new hardware) by April 2025. Limited funds will allow only the replacement of storage expected to be decommissioned over GridPP7.
RHUL	- Xcache instability, requiring container or host restarts to resolve service failures every few days. - IPV6 WNs and CE: Issues with DNS, network switch, host, and service configuration due to IPV4 being behind NAT.

ATLAS UK Cloud: updates from sites

Based on inputs from sites (RAL, Lancaster, Liverpool, Oxford, QMUL, Glasgow, RHUL, Birmingham, Edinburgh) : Many thanks

Site	Pending Issues and Plans for Resolution
Birmingham	- Issue upgrading the gateway to Alma 9 due to poor performance compared with CentOS7; upgrade needs to be completed.
Edinburgh	- Lack of person-power/time has resulted in heavily firewalling the old ARGUS service to continue on CentOS7. Need to be migrated to Alma9

Site	Projection of Resource Availability for Next Year
RAL Tier1	- Covered in Alastair's talk yesterday.
Lancaster	- Upgrading to a 100Gb connection to JANET in September, with xrootd gateways expanded accordingly. - Projected slight increase in storage capacity with upcoming purchases. Compute capacity will likely remain level, as acquisitions will balance hardware retirement, though surprises are possible.
Liverpool	- With new worker nodes being brought online and some older ones retired, total site capacity should be approximately 57k HS. - Additionally, ~600TB (raw) storage will be brought online, split between ATLAS, LHCb, and other VOs (to be determined).

ATLAS UK Cloud: updates from sites

Based on inputs from sites (RAL, Lancaster, Liverpool, Oxford, QMUL, Glasgow, RHUL, Birmingham, Edinburgh) : Many thanks

Site	Projection of Resource Availability for Next Year
QMUL	- Expected to provide 16,000 job slots and approximately 10PB of storage for ATLAS. - However, without additional funds, capacity will be lost as compute hardware fails, as all compute is now out of warranty. - New core switch planned during the GridPP7 time scale. - New Storm server hardware and new world-facing site switches to be deployed (plan for Sonic OS + LHCONE).
RHUL	- Total resources will increase from 73k HS (6.2k slots) to 111k HS (8.4k slots), with 10% reserved for Tier 3.
Birmingham	- No planned change to capacity, though a 5-10% loss in compute power is expected over the year due to the natural wastage of old workers.

Which critter helps control the vole and squirrel population?

Updates from ATLAS:

Legacy VOMS Update
- Legacy VOMS retired for ATLAS VO: transitioned from voms2.cern.ch to atlas-auth.cern.ch.

VP Queues Discussion
- Discussion on VP queues at ATLAS S&C week.
- Communicated the importance of this service and our readiness to support its continued availability.

Memory Management
- New memory management by ATLAS to increase high-memory slots without hardware changes Link.
- Increase granularity of pull_ups resource_types => update CRIC for MaxRSS
- Balance LO, HI, VHIMEM to keep below PQ.meanrss => update CRIC for MeanRSS

Token Migration Status status link
- For UK Cloud, only RALPP and Oxford CEs are passing token tests.

Testing Frameworks
- Need to streamline SAM/Experiments Test Framework (ETF) with HammerCloud.
- Issues: sites running production jobs successfully but failing SAM/ETF affect WLCG A/R reports.
- Expected improvements with new Arc-CE based SAM/ETF tests.

Preparing for HL-LHC and future analysis facilities.
- Useful experiences from DC24 and IRIS-HEP 200Gbps Challenge Infrastructure, at 25% of HL-LHC scale.

Thank you

- Compute resource delivery reached 155%, supported by stable storage and network operations, with the ATLAS UK Cloud's performance significantly exceeding pledged targets.
- The CentOS 7 migration milestone was successfully achieved with minimal impact on production services during the last quarter.

Rare species returns to Cumbria