UK Federation Plans and Initiatives

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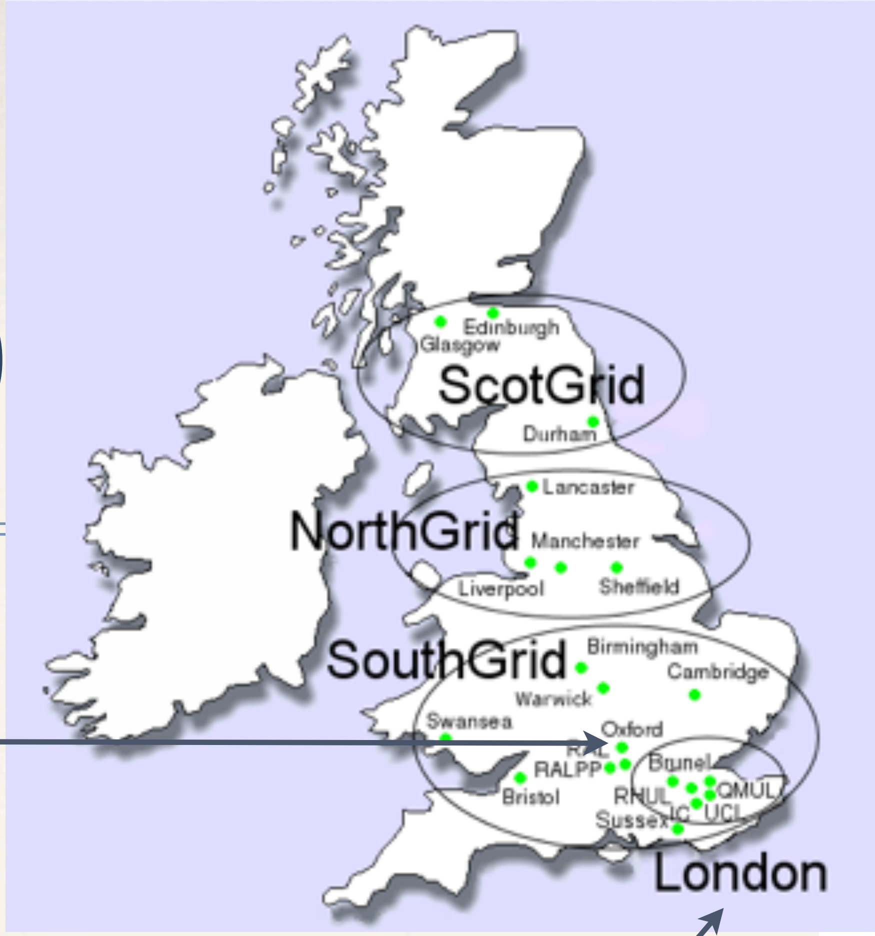
THE UNIVERSITY *of* EDINBURGH

GridPP
UK Computing for Particle Physics

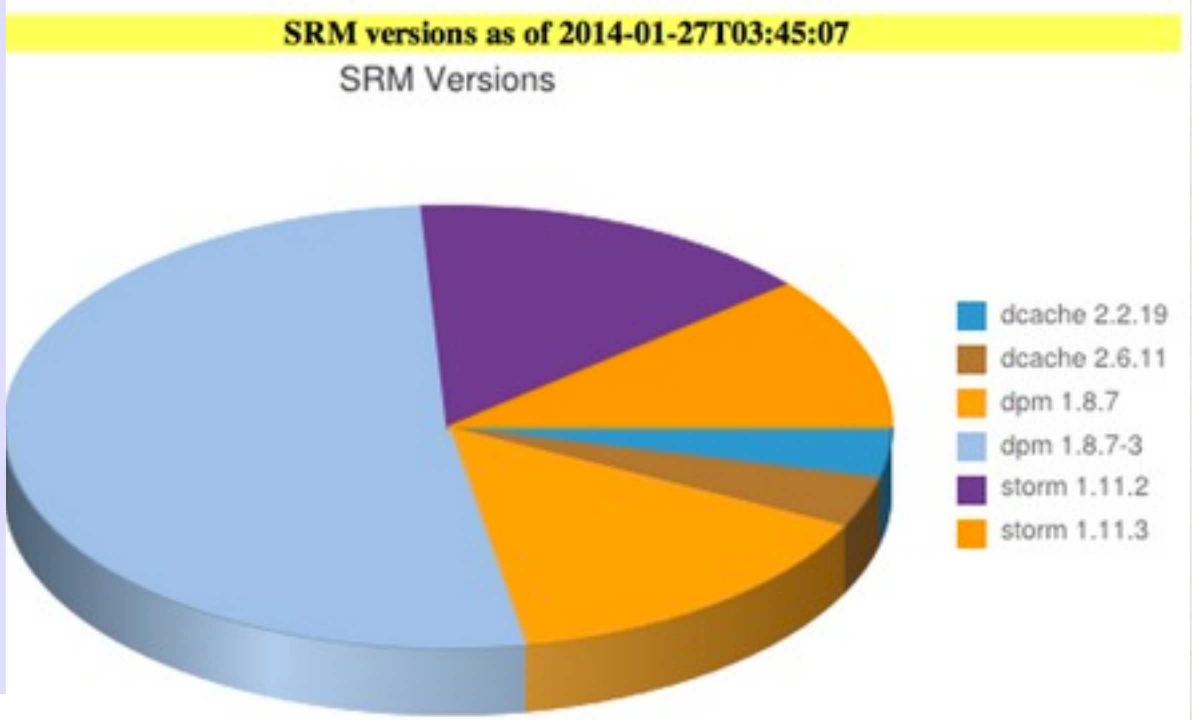
Data federations: a UK perspective

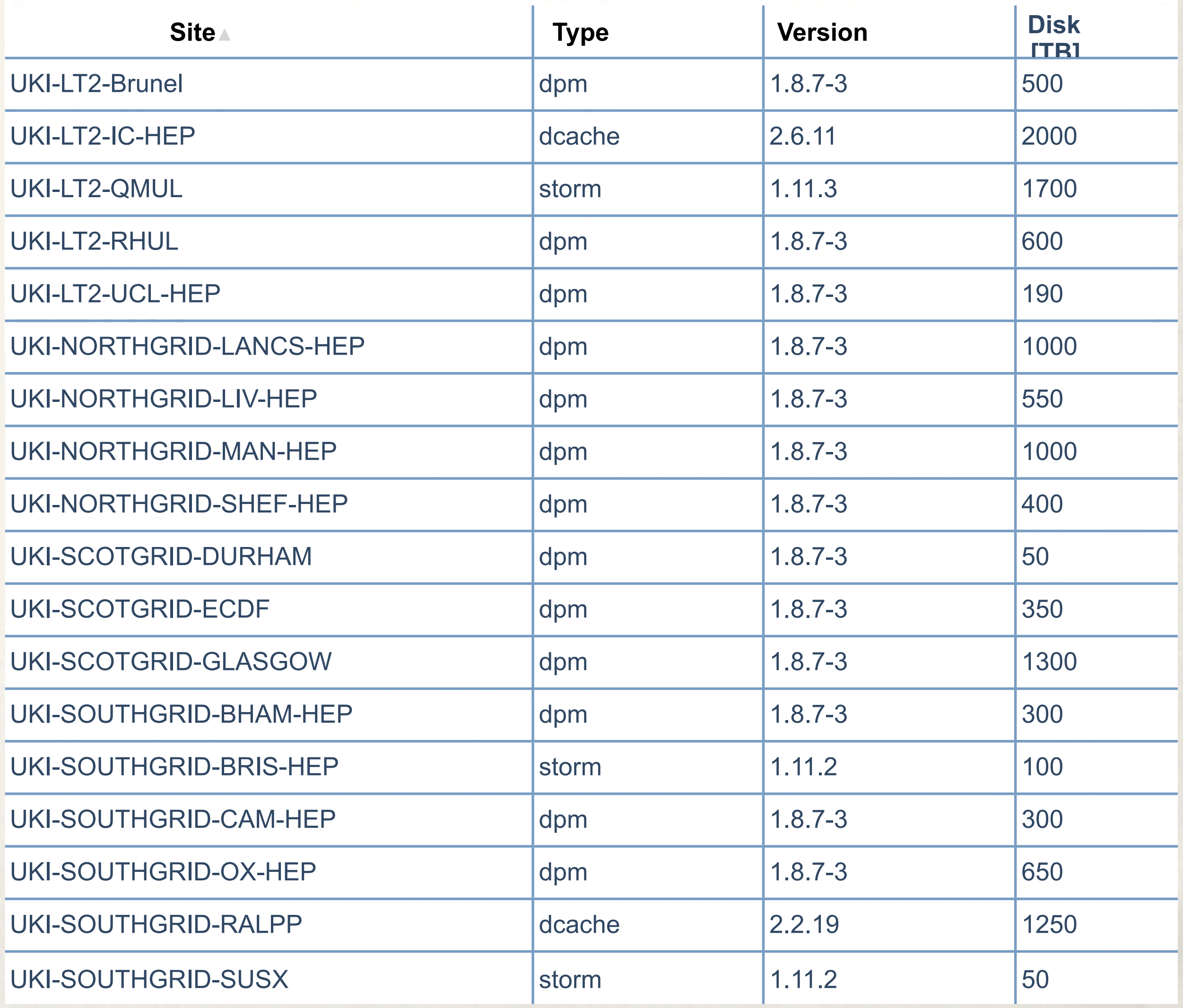
- ATLAS and CMS are using Federated Storage in production now and more so in Run 2:
    - The UK is heavily involved and largely deployed
- We need to consider impact on our infrastructure. So need to :
    - Compare experiences across experiments e.g. job profile and needs.
    - Get information on (projected) use: TEG said federation traffic would be <~10% of bandwidth; now see >10%, total expected traffic would also be interesting.
    - Conduct our own infrastructure tests and evaluate monitoring
- HTTP / DAV - promising ideas that will be realized during Run 2. Sites currently having to run both, need to know how this heterogeneous (xrd/http) landscape will evolve ...

The UK (1707-2014)



- Tier 1 (RAL) runs CASTOR (currently)
- Many Tier 2 sites, some small, grouped in "federated" T2s
- Most Tier2 sites run DPM
- Most sites support more than one experiment though focus on CMS (IC,RALPP, Brunel, Bris) or ATLAS (the rest). Bham is also an ALICE site.


SRM versions as of 2014-01-27T03:45:07



Site	Type	Version	Disk [TB]
UKI-LT2-Brunel	dpm	1.8.7-3	500
UKI-LT2-IC-HEP	dcache	2.6.11	2000
UKI-LT2-QMUL	storm	1.11.3	1700
UKI-LT2-RHUL	dpm	1.8.7-3	600
UKI-LT2-UCL-HEP	dpm	1.8.7-3	190
UKI-NORTHGRID-LANCS-HEP	dpm	1.8.7-3	1000
UKI-NORTHGRID-LIV-HEP	dpm	1.8.7-3	550
UKI-NORTHGRID-MAN-HEP	dpm	1.8.7-3	1000
UKI-NORTHGRID-SHEF-HEP	dpm	1.8.7-3	400
UKI-SCOTGRID-DURHAM	dpm	1.8.7-3	50
UKI-SCOTGRID-ECDF	dpm	1.8.7-3	350
UKI-SCOTGRID-GLASGOW	dpm	1.8.7-3	1300
UKI-SOUTHGRID-BHAM-HEP	dpm	1.8.7-3	300
UKI-SOUTHGRID-BRIS-HEP	storm	1.11.2	100
UKI-SOUTHGRID-CAM-HEP	dpm	1.8.7-3	300
UKI-SOUTHGRID-OX-HEP	dpm	1.8.7-3	650
UKI-SOUTHGRID-RALPP	dcache	2.2.19	1250
UKI-SOUTHGRID-SUSX	storm	1.11.2	50

Networking

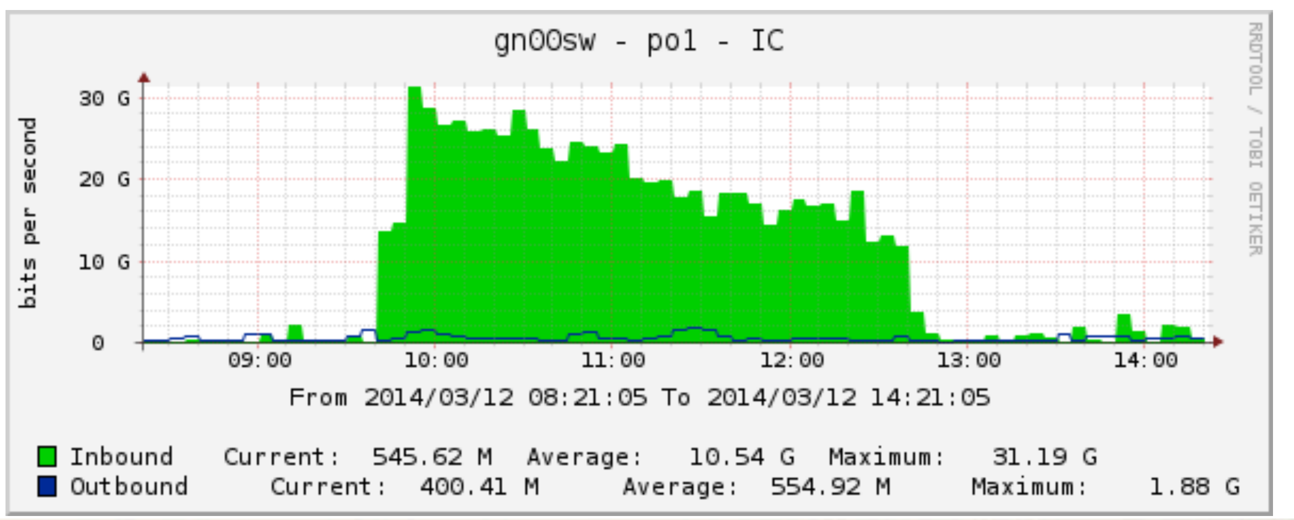
- Upgrades at Tier 1 (~now): will have resilient (dual) 40 Gbit/s connection to Janet-6 (the Tier2s)

- Most Tier2 sites have (shared or dedicated) 10 Gbit links to WAN and internally to disk servers. Planning for some 20 Gbit

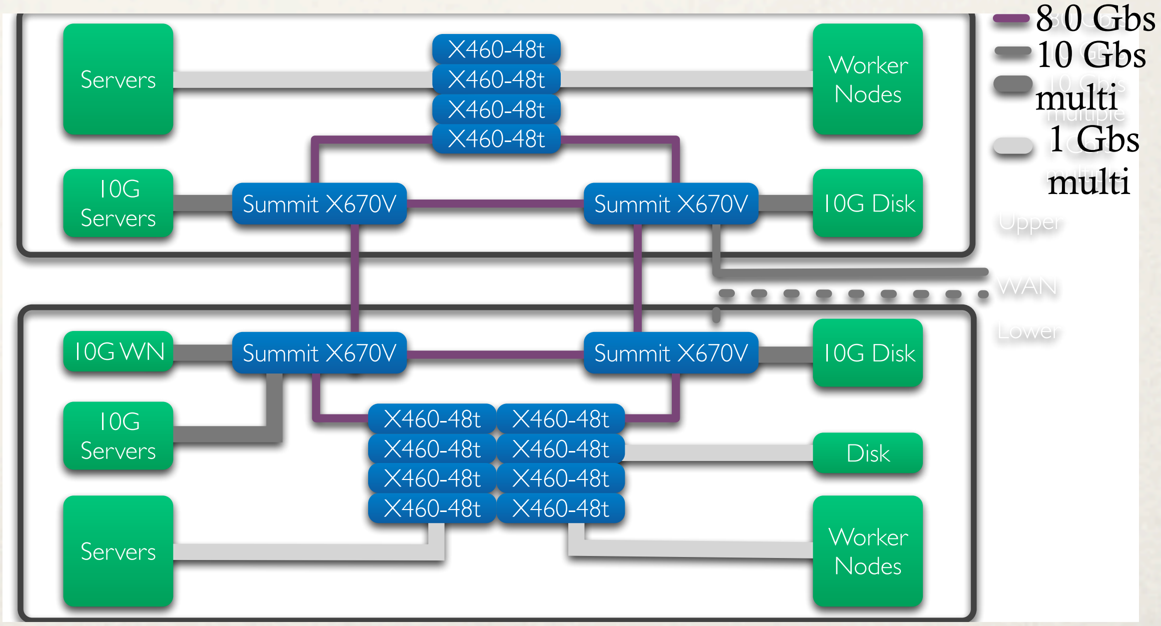
- But some have less. Also external WN traffic may go through NAT

- Not at US levels, but think per "federated" T2 or per TB ...

Our best connected Tier2 (IC):

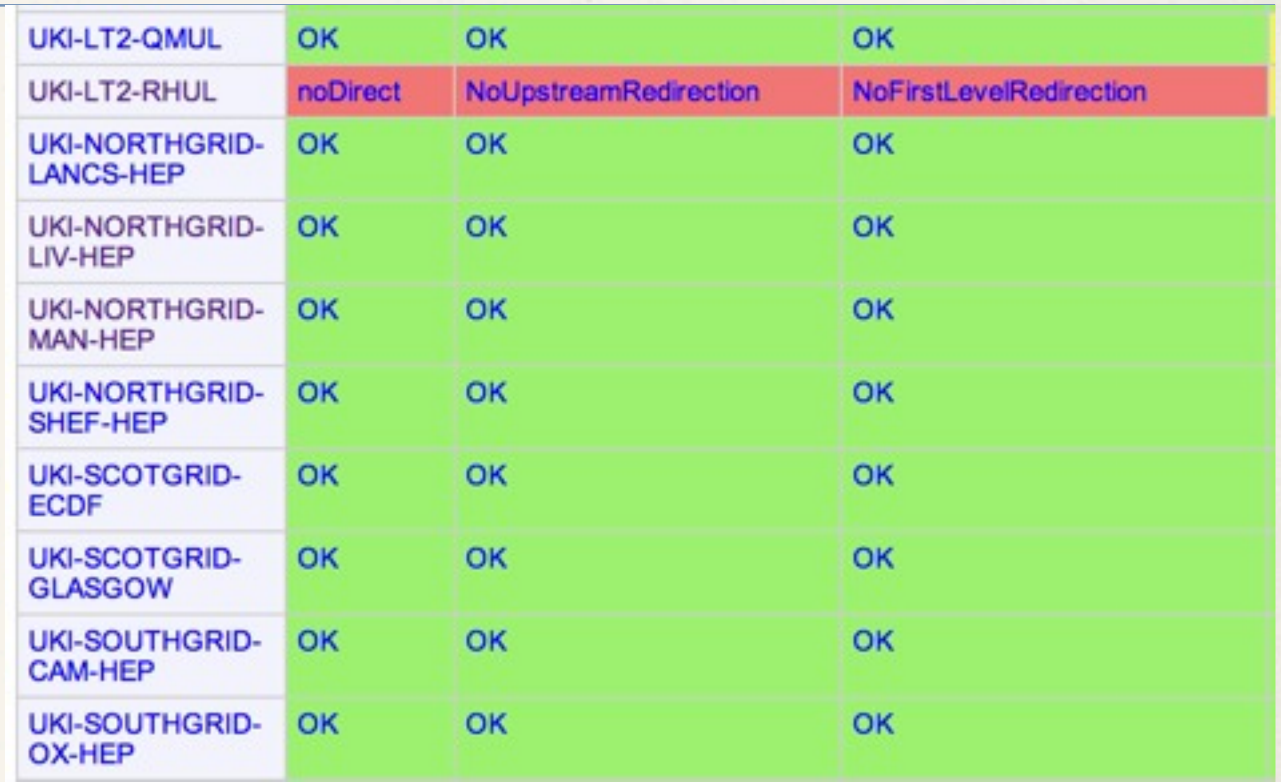


Another lucky one (Glasgow):



ATLAS UK - status and testing

- Tier1 and almost all larger ATLAS T2s are in FAX (one remaining site also supports ALICE …). Decent availability:



UKI-LT2-QMUL	OK	OK	OK
UKI-LT2-RHUL	noDirect	NoUpstreamRedirection	NoFirstLevelRedirection
UKI-NORTHGRID-LANCS-HEP	OK	OK	OK
UKI-NORTHGRID-LIV-HEP	OK	OK	OK
UKI-NORTHGRID-MAN-HEP	OK	OK	OK
UKI-NORTHGRID-SHEF-HEP	OK	OK	OK
UKI-SCOTGRID-ECDF	OK	OK	OK
UKI-SCOTGRID-GLASGOW	OK	OK	OK
UKI-SOUTHGRID-CAM-HEP	OK	OK	OK
UKI-SOUTHGRID-OX-HEP	OK	OK	OK

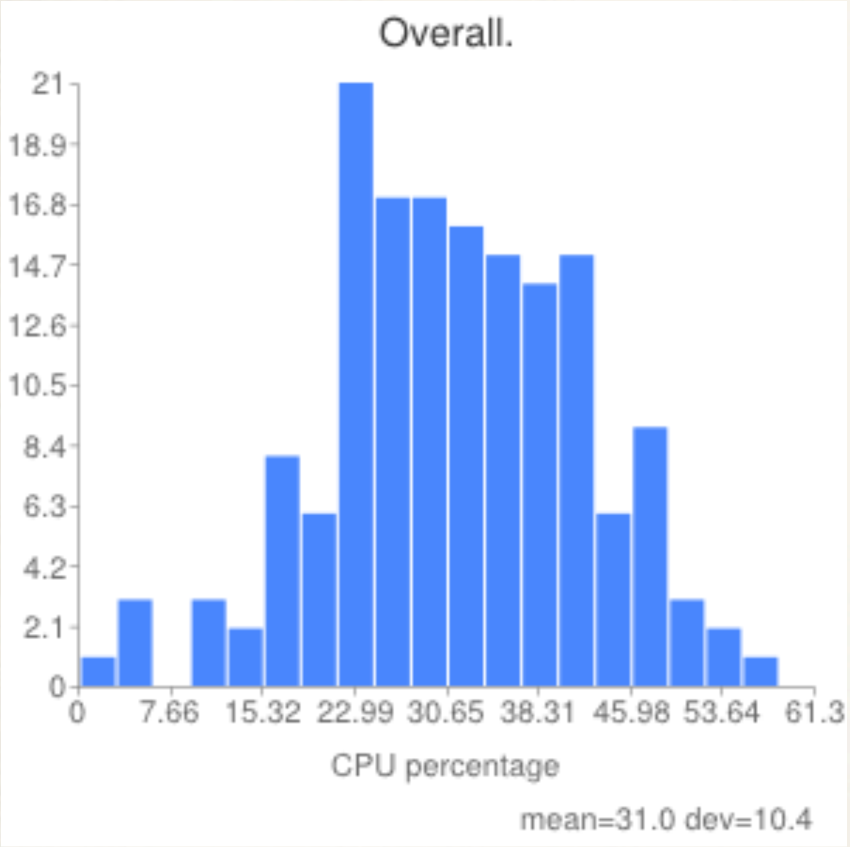
- Started to perform “stress” tests (similar to those done in US) on “standard” (user.flegger.*) FAX (SMWZ) D3PD dataset:
  - Direct reading in ROOT script (10% of events, 30 MB TTreeCache)
  - Real H->WW analysis via Hammercloud

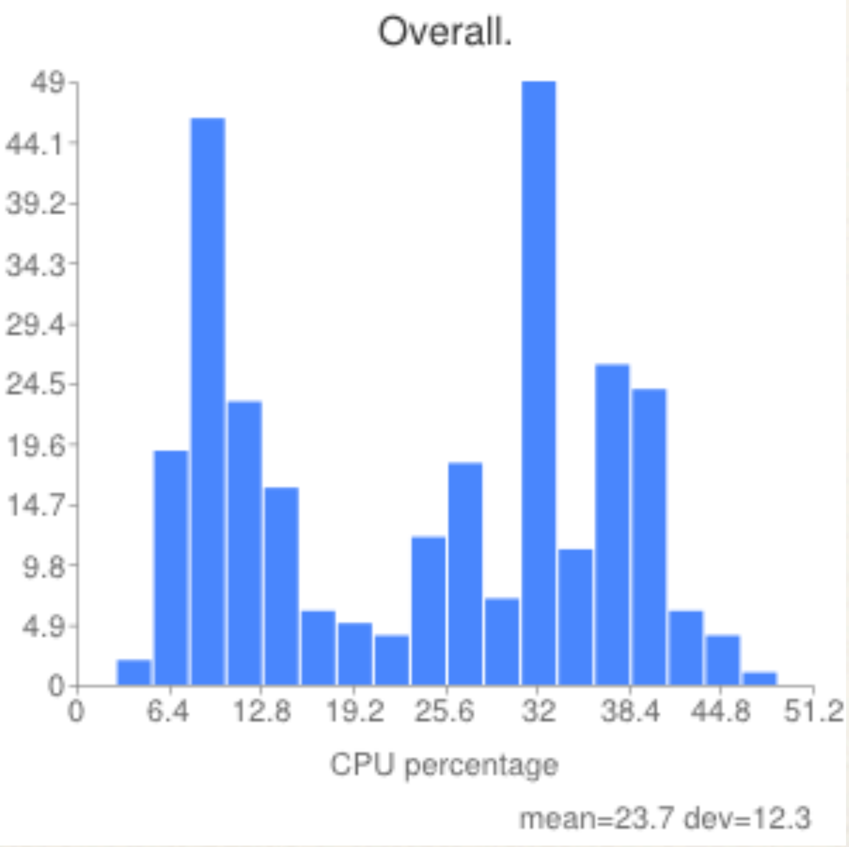
ATLAS UK testing

Initial results from DPM sites (100-200 H->WW jobs): performance is fine

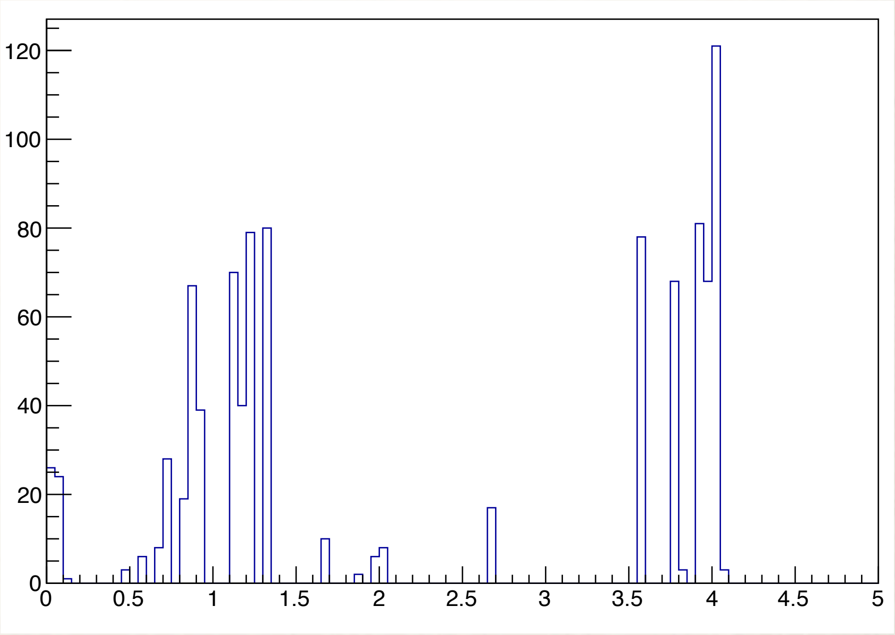
Oxford local read:

Oxford read from ECDF:



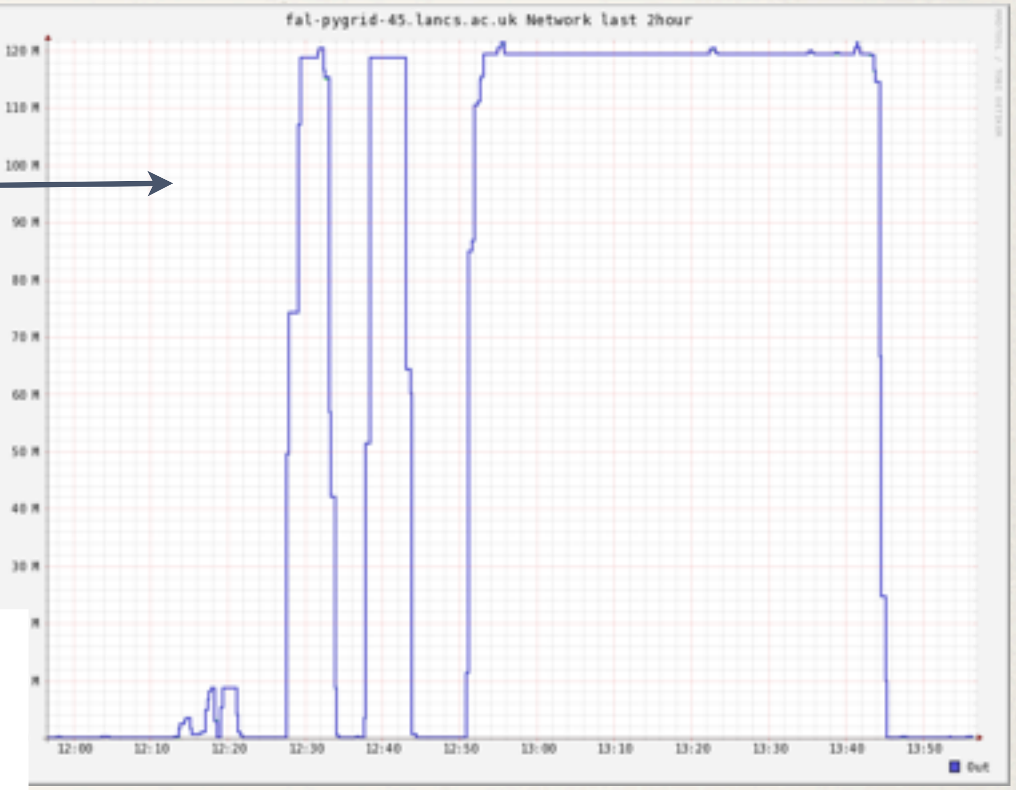


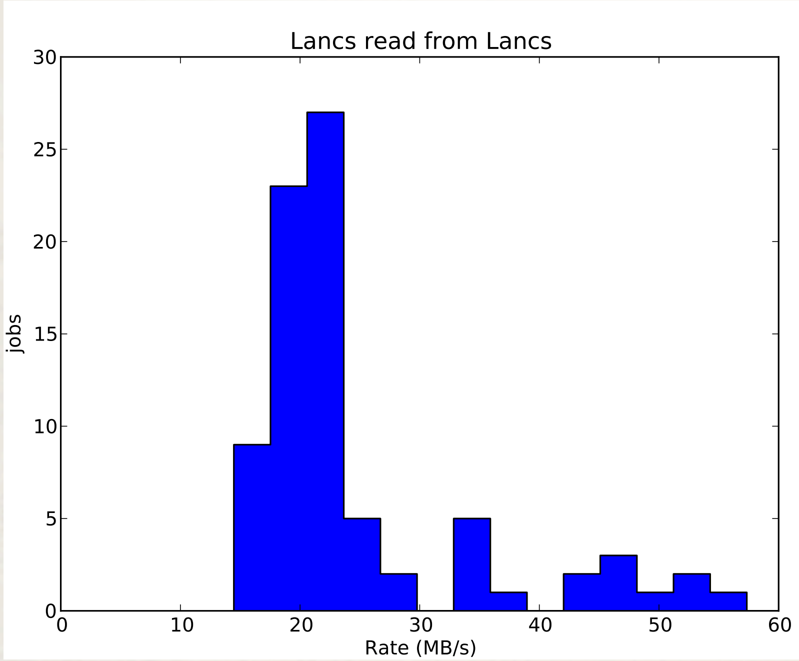
Data rate from xrootd monitoring (MB/s):

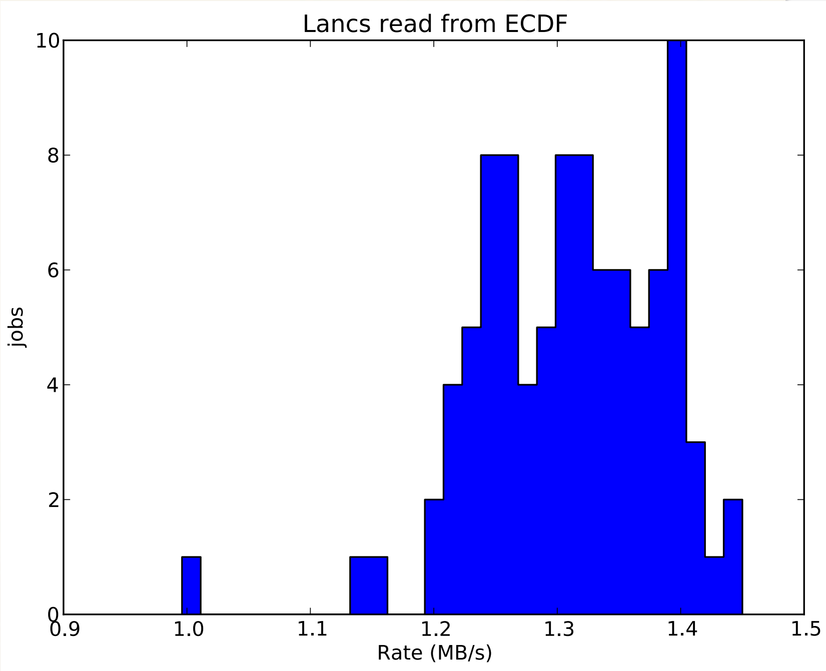


Finding bottlenecks…

- 1Gig NAT easily saturated (running 100 jobs with simple ROOT script on local batch)



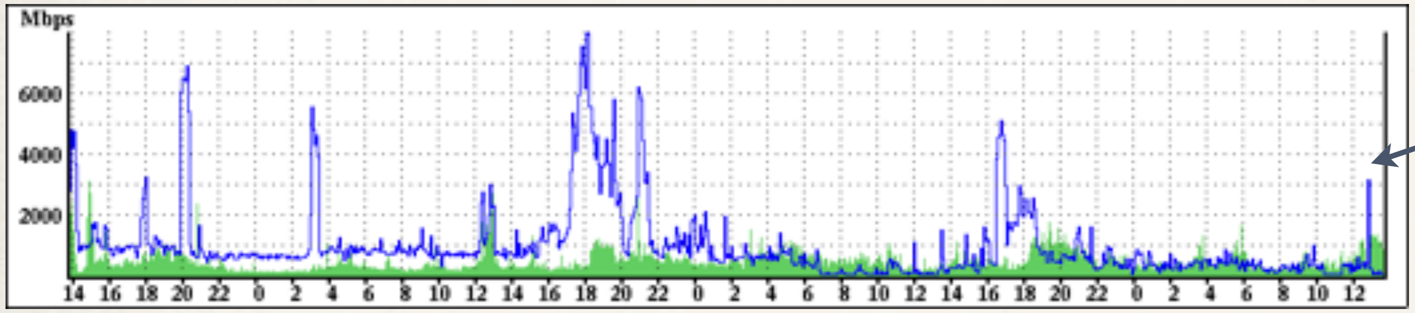




Local > 20 MB/s read, decreases externally to 1 Gig/s/Njobs (and time increases)

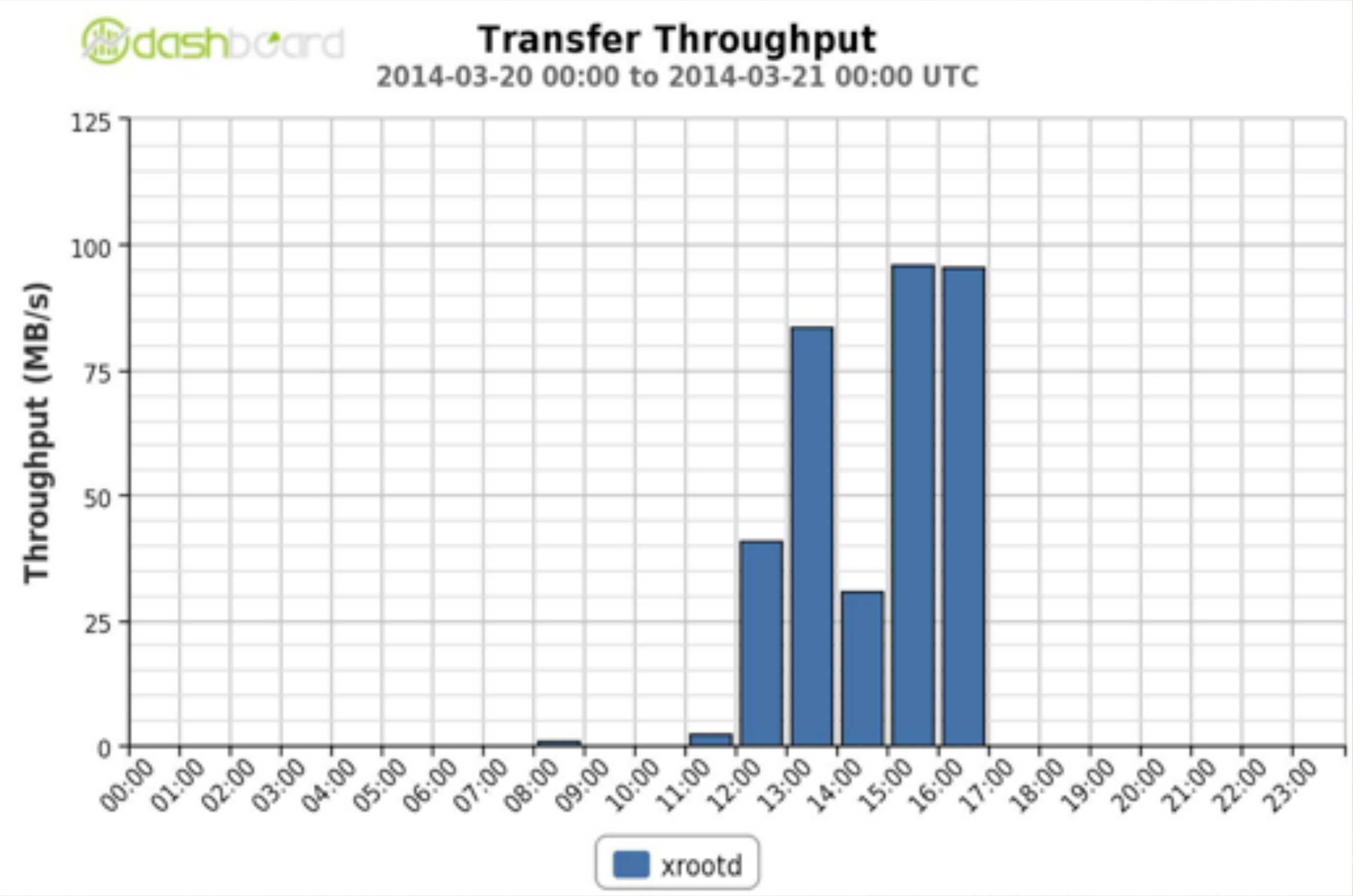
NAT box can be upgraded but it's there for a reason ...

Monitoring site activity



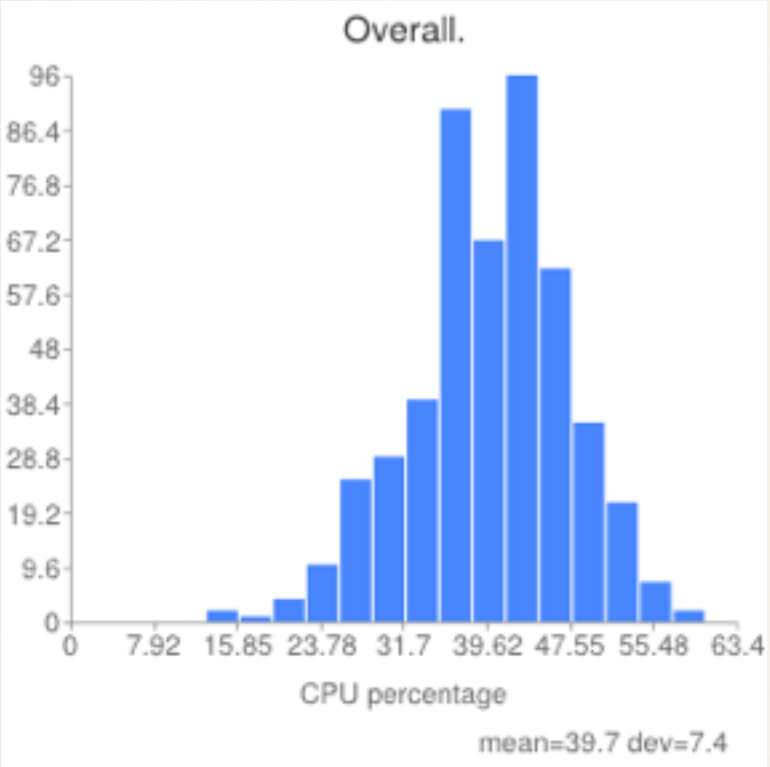
Impact of those tests at ECDF switch
(Outward is blue)
Not an issue compared to FTS rate

- Easily seen in WLCG dashboard (isolating src: Lancs, dest:ECDF)
- This “bottleneck” is also a “bandwidth limit” so if removed we may need another: eg. Proxy server (not available for DPM sites by default) or xrootd Plugin (also not available by default)

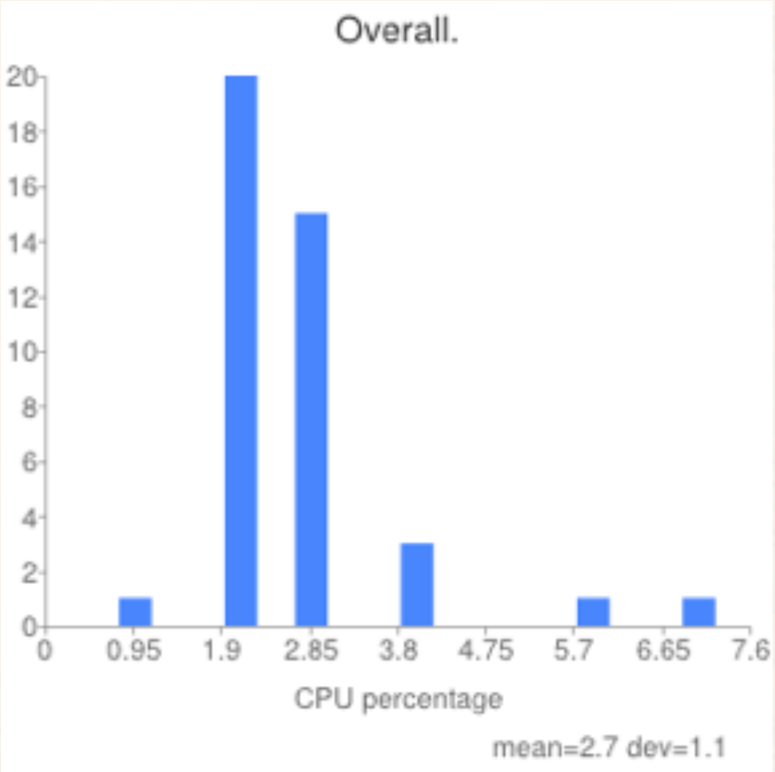


Finding bottlenecks (2)...

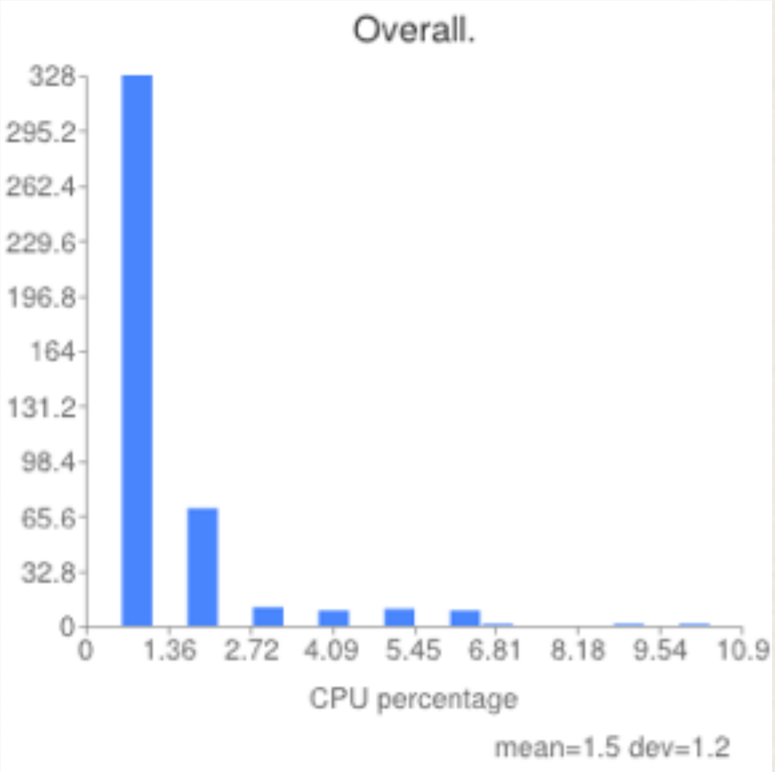
- QMUL has a performant local Lustre setup with 10Gig to each WN from 100+ disk servers (see also backup slide).
- Xrootd though currently is via a single (yet untuned) server...



QM local panda test



QM - local but via xrootd



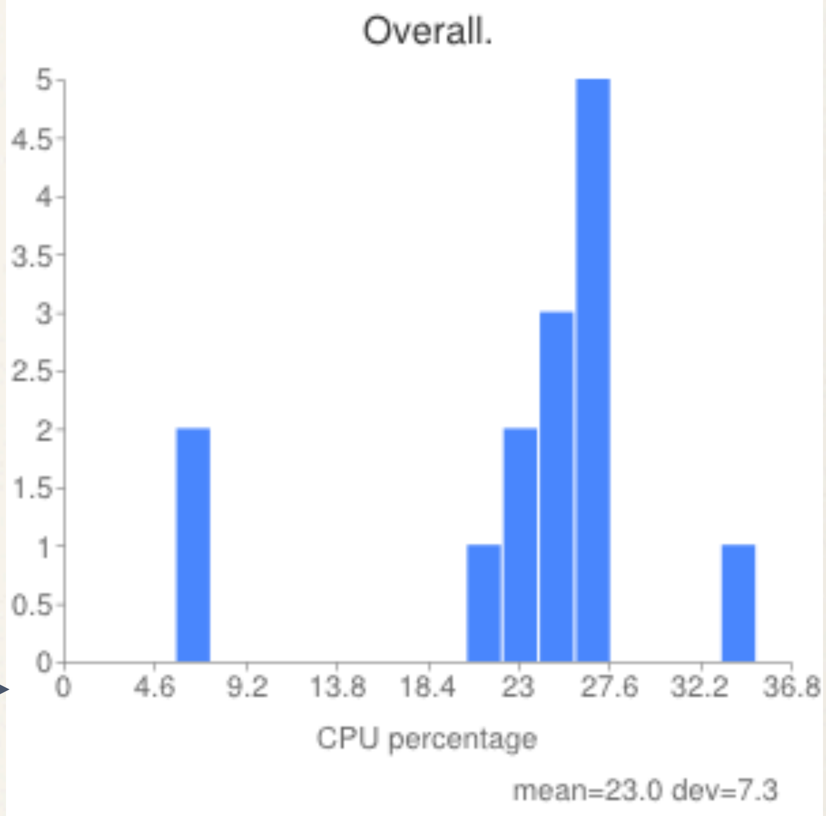
QM - from Oxford

- All this will be resolved, but shows it's worth testing...

Atlas UK plans and initiatives

Diskless Tier 2 at ANALY-UCL

- Limited local admin support ideally wouldn't maintain storage..
- Decent WAN Links
- Initial H->WW tests work



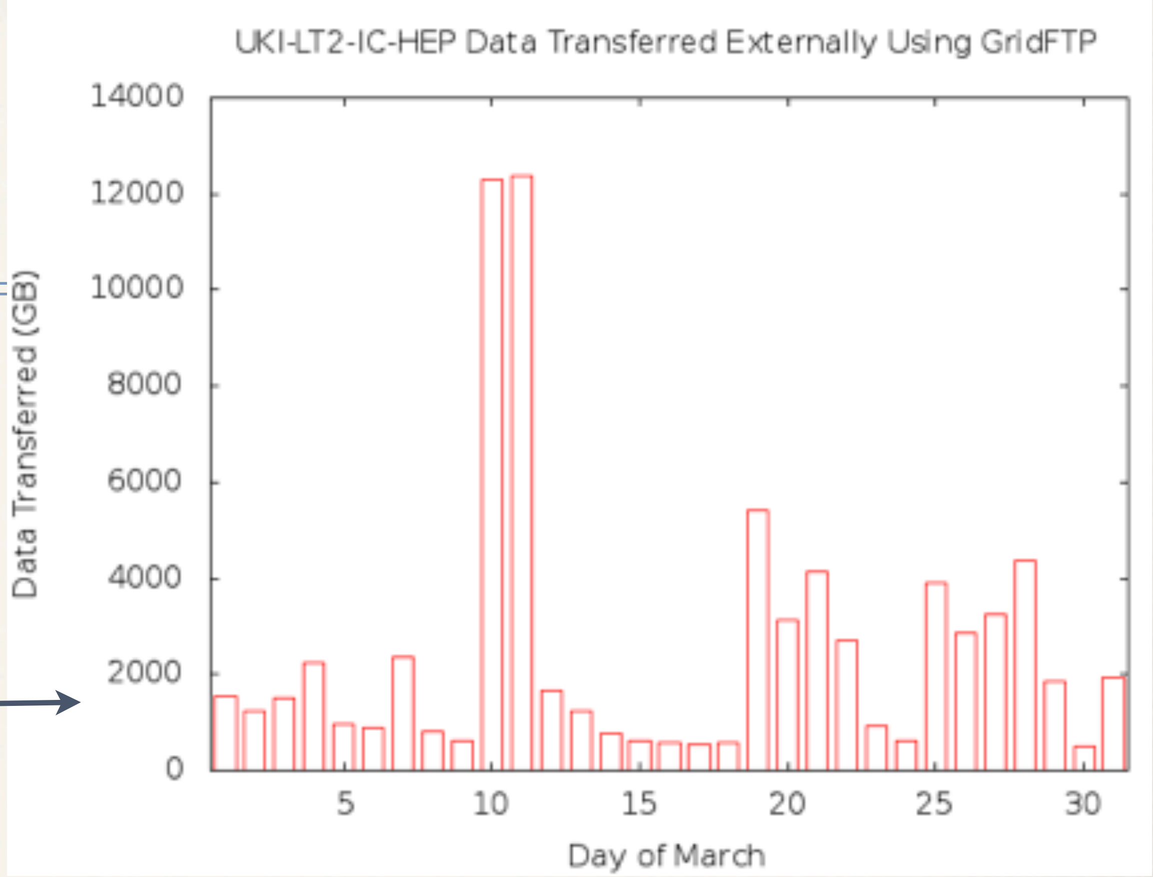
- Soon ready for production : but how to broker jobs properly?

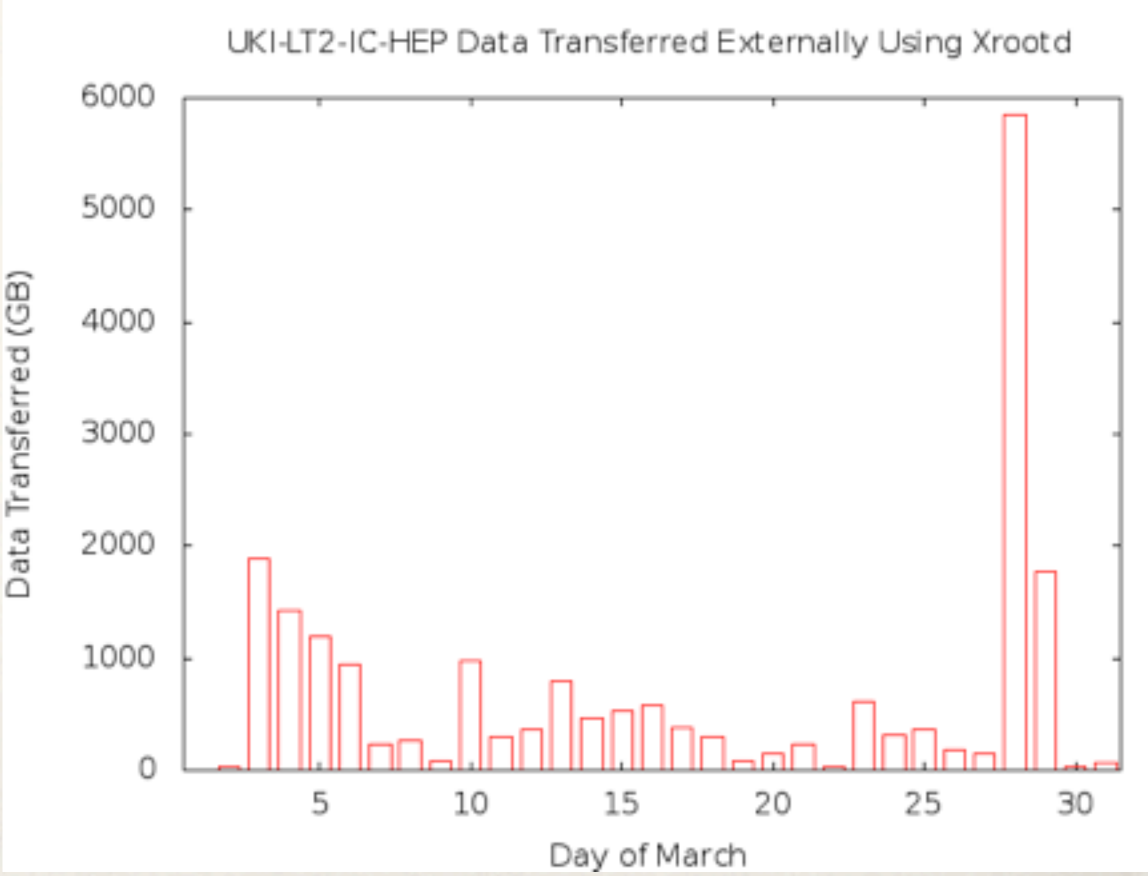
Plans in Edinburgh:

- Opportunistic compute (industry clusters)
- Opportunistic storage ("RDF" (20PB non-HEP store))

CMS - UK traffic

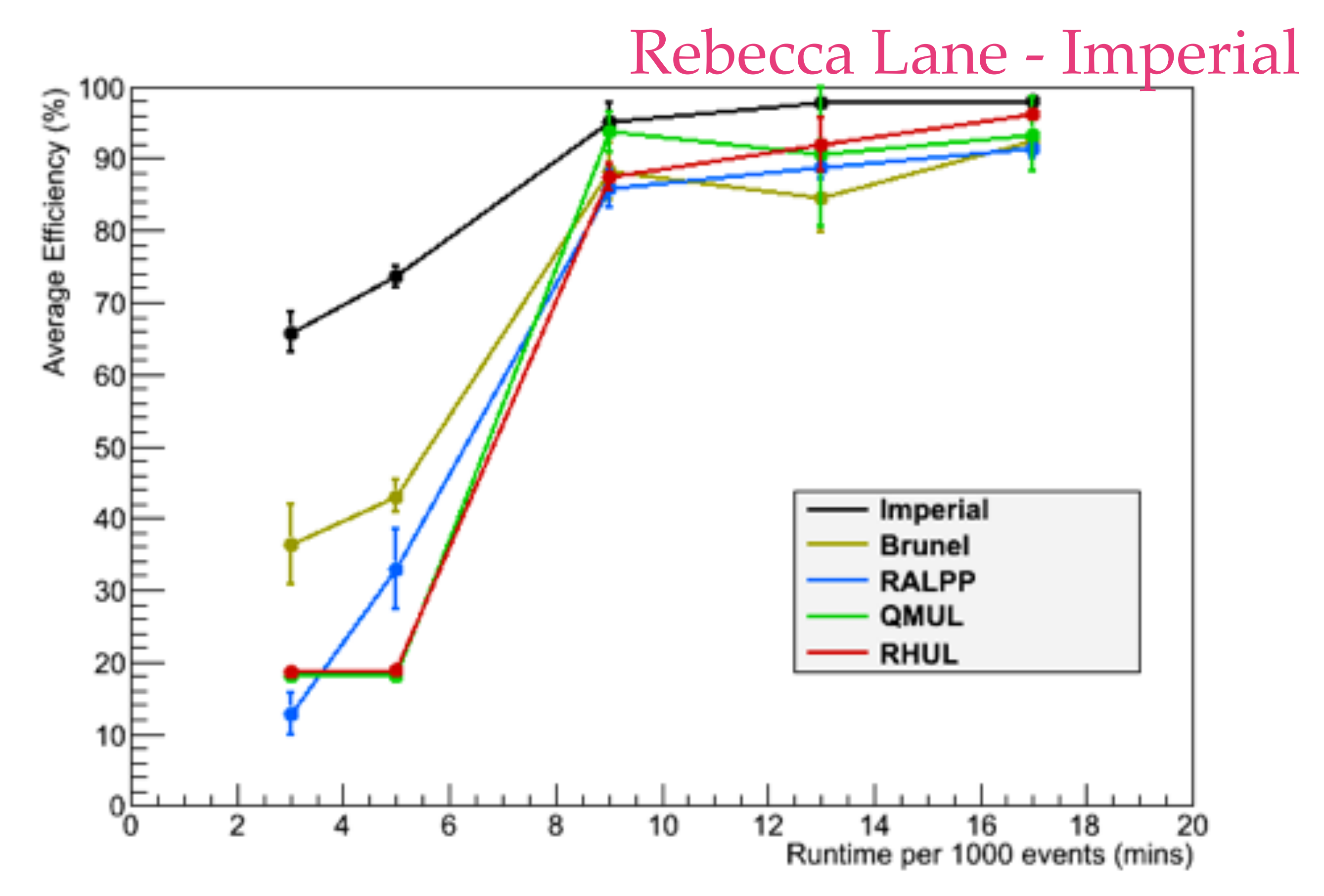
- Tier2 server sites for CMS are IC and RALPP (dCache), Brunel (DPM), others are clients.
- IC FTS/Xrootd traffic monitoring from billing logs
  - (Not in wlcg monitoring as they would prefer xrd monitoring plugin to be in dCache itself if it's required.)
  - gridftp out for March: 79 TiB
  - xrootd out for March: 21 TiB
  - Total WAN link traffic: 226 TiB (discrepancy users staging to home SE ?)





CMS UK tests and plans

- Tests of analysis jobs performed ~2 years ago
- 5 different tests reading same file from client at Imperial - leftmost just reading (most I/O), rightmost is most "realistic"


Rebecca Lane - Imperial

"Diskless" plans for "DICE" Hadoop cluster in Bristol :

- Decent 10 Gbit/s (upgradable to 20 Gbit) link
- User jobs running on data at RALPP now - rigorous testing planned..

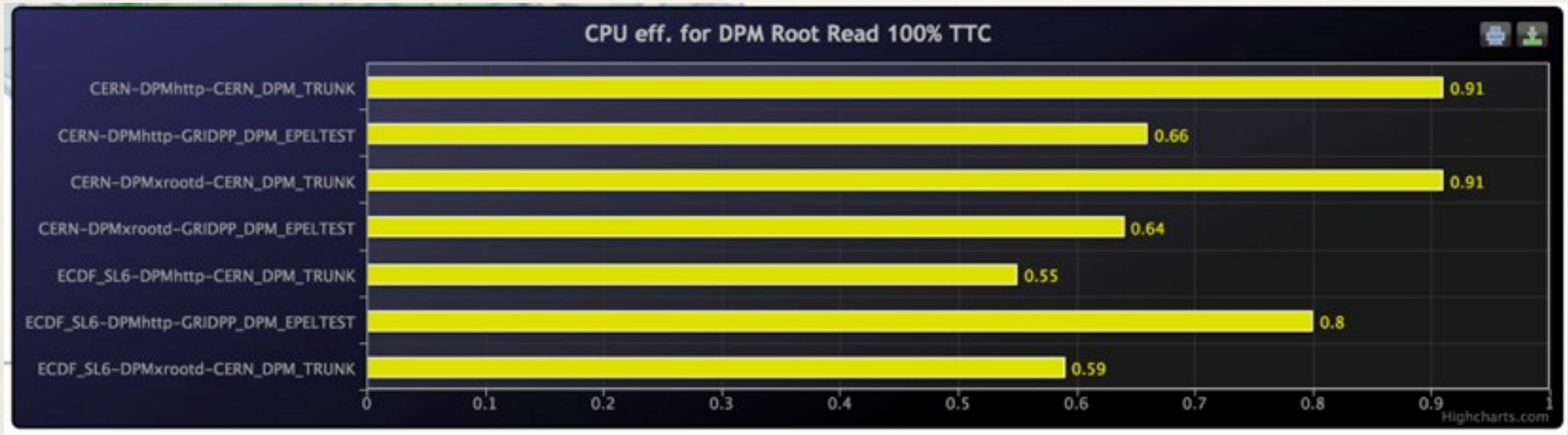
A word on ATLAS / CMS comparisons

- From email chain and subsequent discussion with Brian in ROOT I/O w/g ...:
    - CMS tell sites to plan for 1MB/s per analysis job; usage tends to average 500KB/s.
    - CPU efficiency is around 75-80%.
- Not the same as ATLAS: e.g. "H->WW" code needs 20 MB/s to be 100%
- CMS "analysis" can involve reconstruction - higher CPU:
    - Its not a flaw or surprise if ATLAS get 10% eff where CMS have 100%
    - Not the same impact and issues in using federations.
- But of course ATLAS can and should improve their I/O, and have an opportunity with xAOD (Run2 format): the optimisation work has begun..

Finally a word on HTTP

- Interest in HTTP from sites (mainly because its not HEP specific)
- Also from "small" experiments (again it's something they recognise..)
- Current uses (e.g. Rucio) are management ones (e.g. replace SRM...)
- But performance for data access also seems OK ..

(Single jobs, between ECDF (epel-test) and CERN (trunk) TEST boxes and using TWebFile not Davix)



Conclusions

- Production level federations in the UK for ATLAS, CMS (and ALICE).
  - ATLAS and CMS cannot be directly compared and ATLAS will be limited (a bit) by current bandwidth (not necessarily a problem)
  - Opportunistic and diskless sites starting to be used.
- Starting to understanding bottlenecks
  - Monitoring important (good to see a discussion later...)
  - But also need to exercise (some) control ... (plugins or proxies..)
- Http/DAV will be used for ATLAS Rucio and "small"VOs: need to evaluate if its a reasonable alternative for the above use cases.

Backups and background

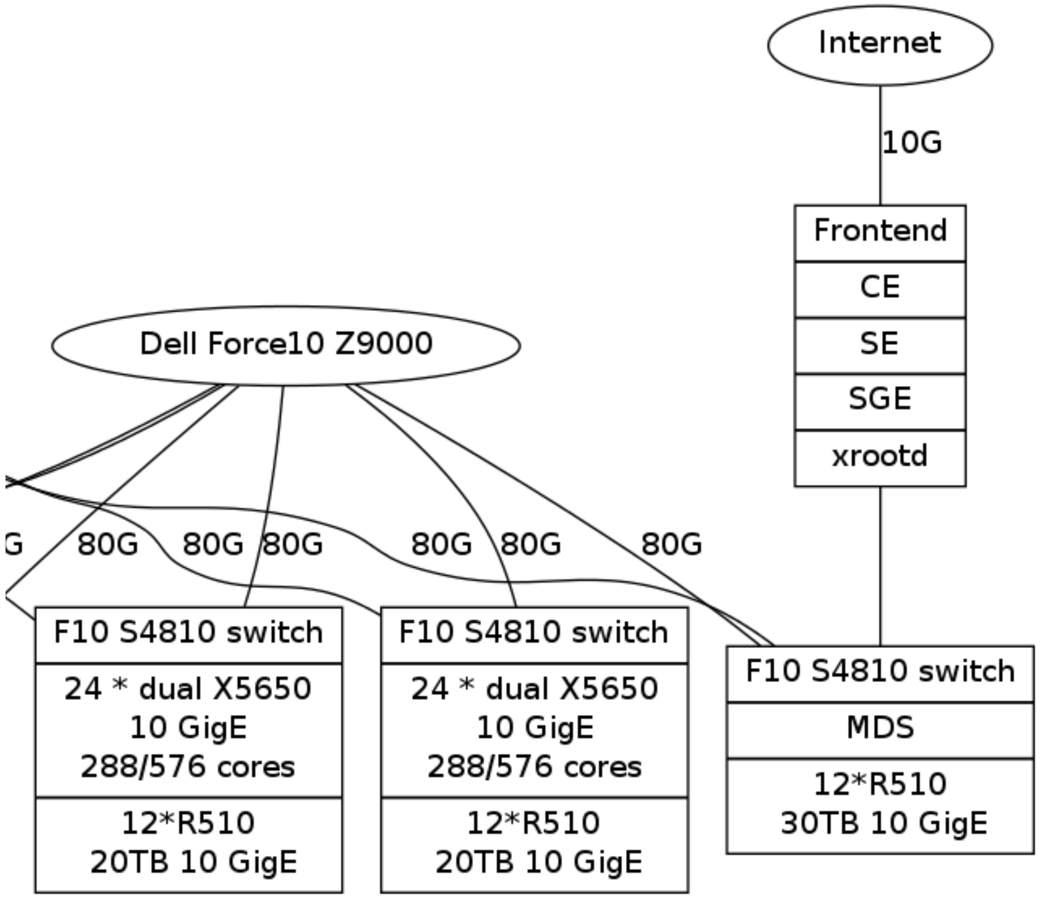
DPM

- UK been using xrootd/federations with DPM for a while
- DPM sites all have xrood redirector on the "headnode" along with other services (e.g. SRM)
- Data transfer requests (local or remote) are redirected to disk server itself so transfers benefit from full bandwidth
- Almost all UK DPM sites now using xrootd for local atlas and cms traffic

QMUL – Lustre and Storm

Highly optimized local access via Lustre will outperform xrootd access in current setup

- Local jobs reading from Lustre filesystem get the benefit of 10gig connections for WNs and the 100 disk servers
- Single xrootd server can only get 1/100 of this bandwidth to the servers.
- Xrootd not integrated with StoRM – r/o access for xrootd in atlas group.
- Traffic to WAN goes through a NAT.



QMUL Local: Chris Walker