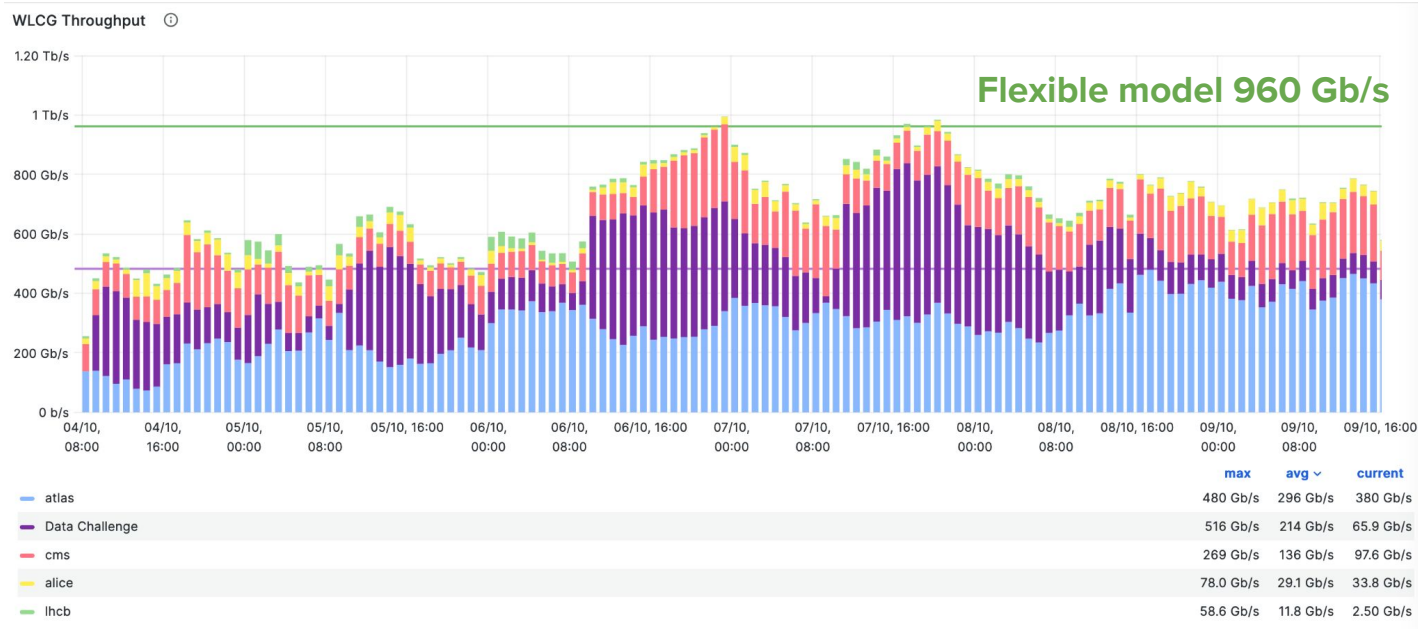# DC24 ATLAS retrospect

A. Forti,

GridPP51

27 March 2024
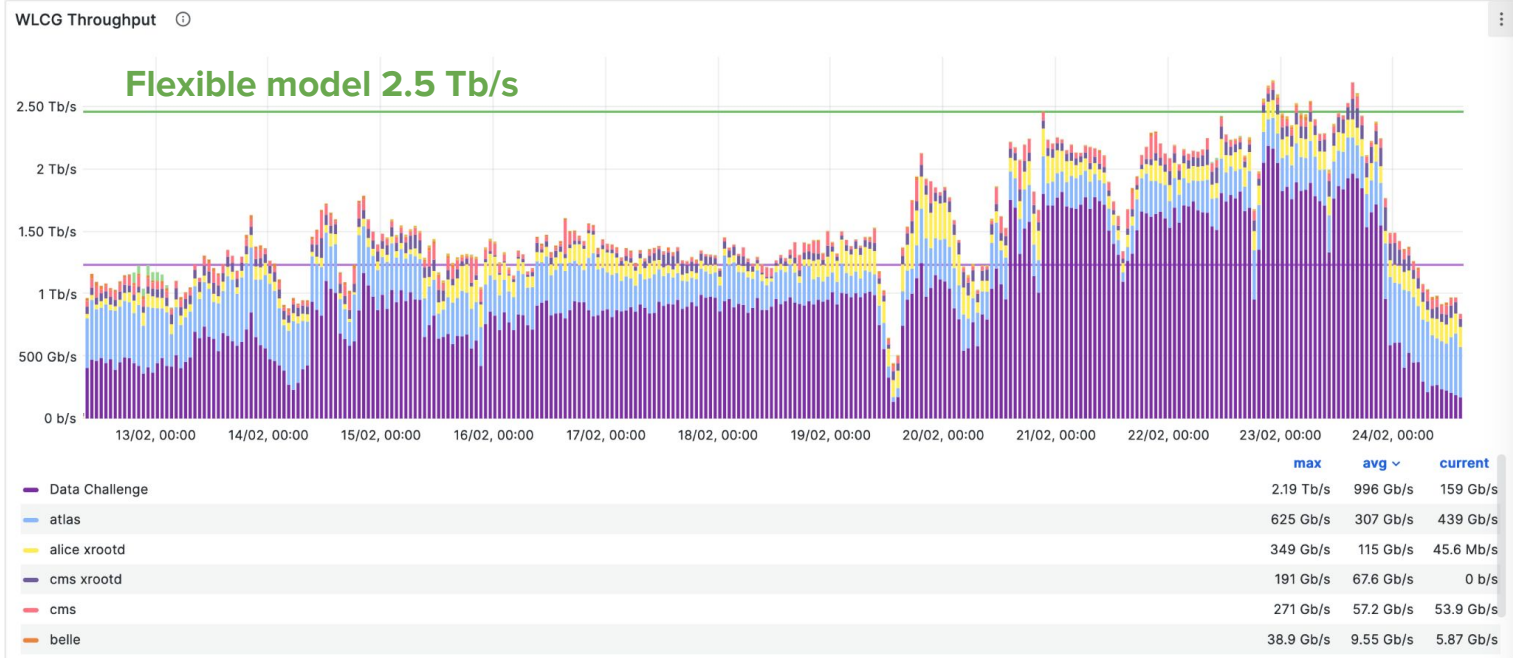
DC21 ➜ DC24

DC21: Production traffic dominant

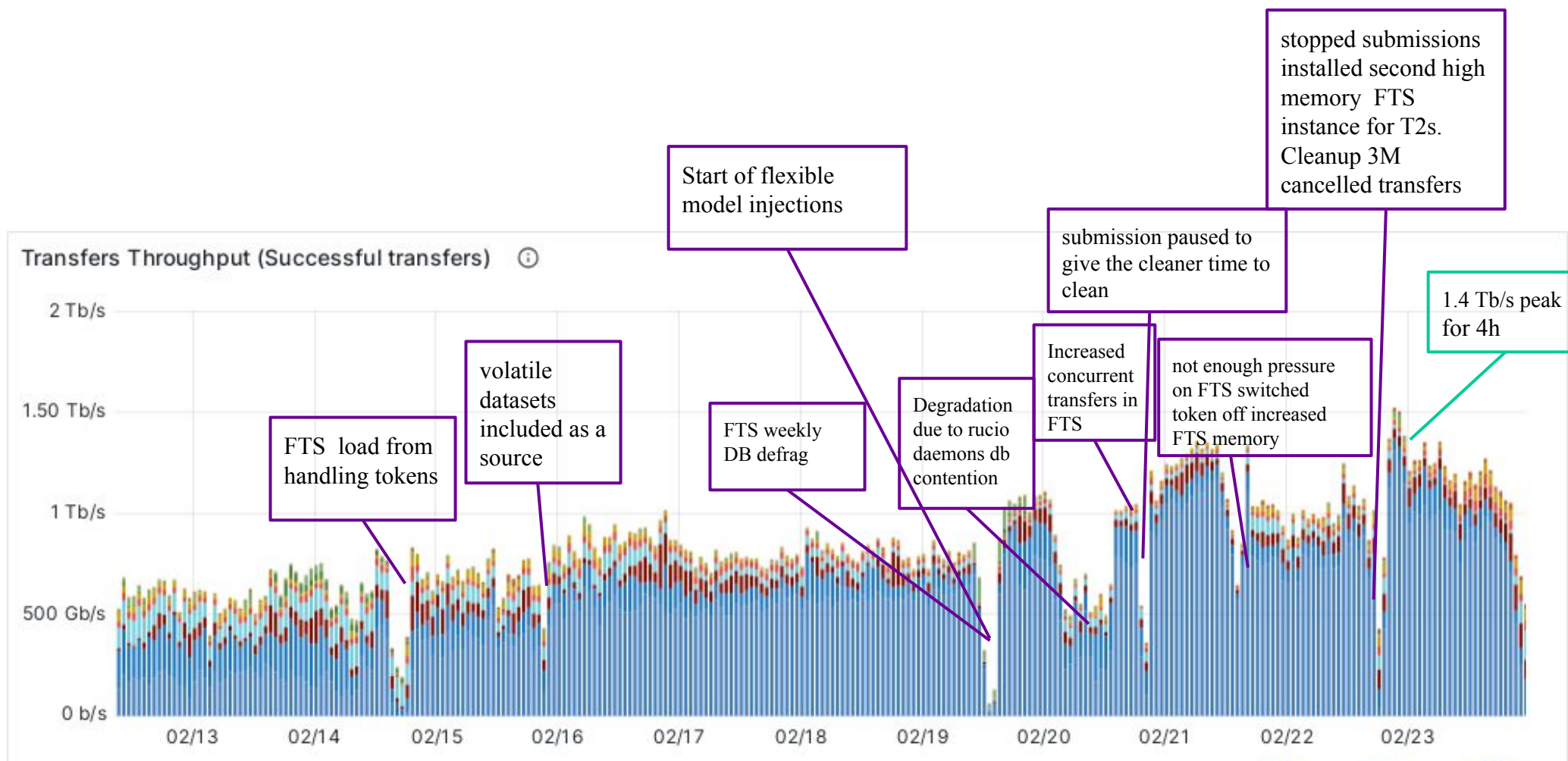DC24: DC traffic dominant

ATLAS

- Challenge pushed the whole system
  - Injections every 15 minutes on ~1200 links
    - ~2000 links if we include production
    - Pushed FTS really hard to orchestrate
  - Short datasets lifetime 1h -> 2h -> 3h to keep the space free
    - Pushed the deletions rates up
    - Pushed rucio to maintain a balance between submissions and deletions
    - 3h space was running out in some places
  - Data Challange traffic backfilling
- This helped highlighting problems that wouldn't have been seen otherwise in the whole infrastructure

Some explanations

Transfers Throughput (Successful transfers)

Start of flexible model injections

stopped submissions installed second high memory FTS instance for T2s. Cleanup 3M cancelled transfers

submission paused to give the cleaner time to clean

1.4 Tb/s peak for 4h

volatile datasets included as a source

Increased concurrent transfers in FTS

not enough pressure on FTS switched token off increased FTS memory

FTS load from handling tokens

FTS weekly DB defrag

Degradation due to rucio daemons db contention

FTS snowball

- **FTS orchestrates transfers per link over many links**
  - Doesn't orchestrate throughput
  - To increase throughput we had to increase the number of allowed parallel transfers by an over an order of magnitude
  - fts3-atlas 10k -> 25k concurrent transfers
- **Has a concept of fair share per activity**
  - Doesn't have a concept of links priorities within an activity, i.e. all links are equally treated T0-T1 same level as T2-T2
  - Doesn't prioritise faster transfers
- **Tokens put further load on the system**
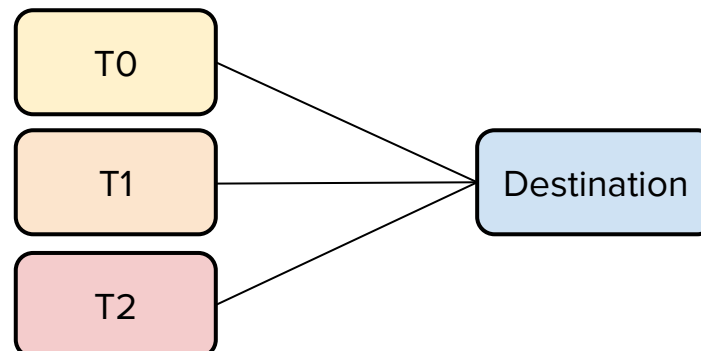
Sites

- **Some sites struggled mostly due to storage limitations.**
    - Either it wasn't possible to open enough parallel connections (IN2P3-CC)
    - they had a problematic bug (NDGF),
    - or a bottleneck on the gateways due to hardware limitations (RAL).
    - Rates exceeding the expected values and storage not coping (INFN-CNAF)
- **Some Tier2s also reported having problems**
    - Lancaster had to double the number of gateways from 4 to 8,
    - SWT2 and other sites had a long wave of jobs in transferring state
    - MILANO and other sites saw a large amount of timeouts.
- **Overall the number of problems reported, considering the amount of data pushed through, is reasonable**
    - 17 problems were reported or GGUS tickets open (list in backup slides)

Deletions

Deletion Average Duration
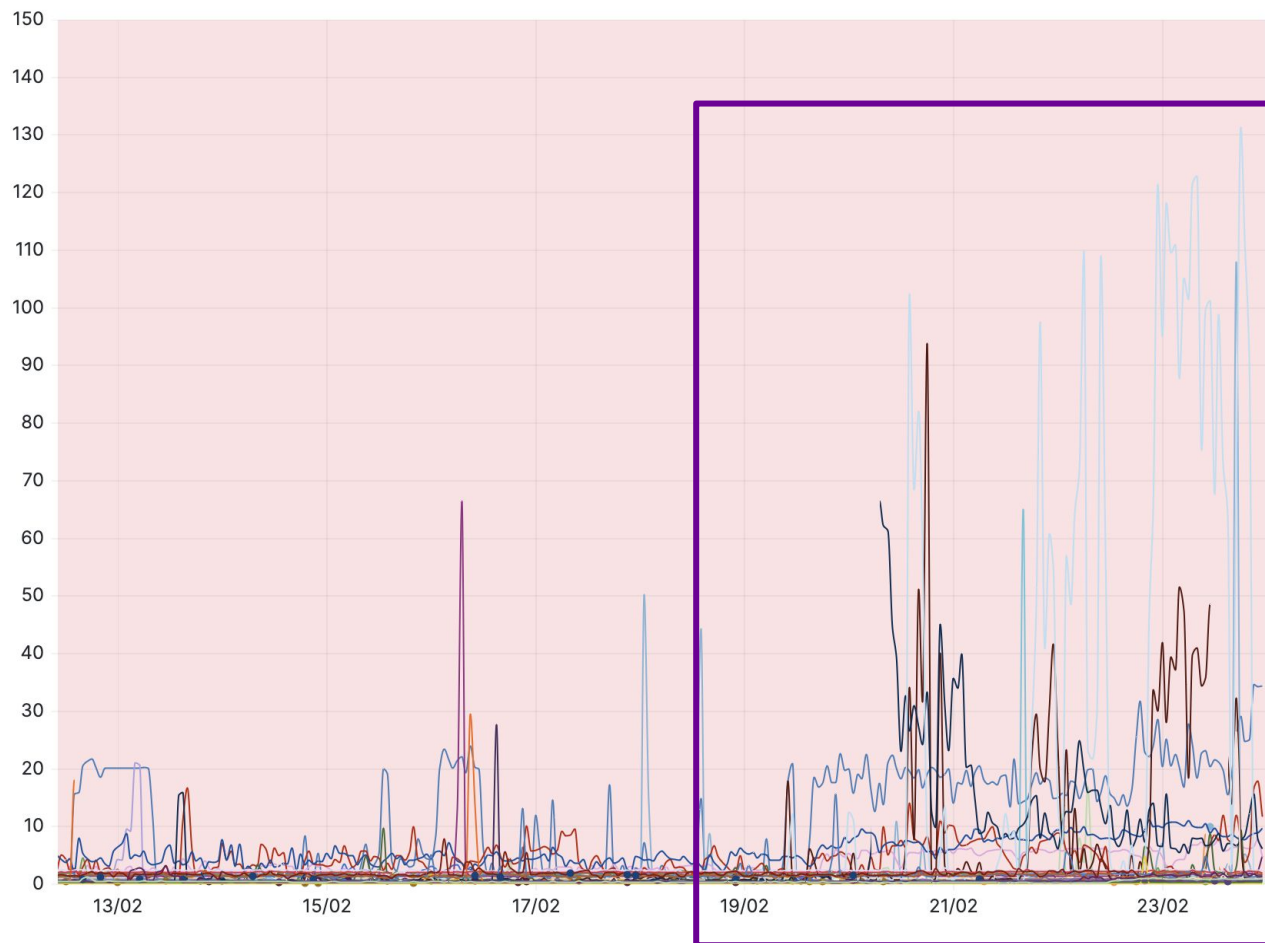
- Increase in deletion time particularly during the second week.
  - Problem was general but some sites had much higher times than others
    - It will need further investigation to see how it maps with storage types

T0 - T1

- **T0 export rates were not achieved**
  - Lack of prioritization in FTS
  - Increased concurrent transfers to all T1 to 5k and from T0 to 1k
- **T0 exports have been rerun one T1 at the time**
  - For at least 6h

Site	T0 Export	DC24 first 2 days	% of expected rates	T0-T1 single test	% of expected rates
CERN-PROD	310.7	197	-	-	-
BNL-ATLAS	68.4	31.5	46%	61.3	90%
FZK-LCG2	39	26.4	68%	42.2	108%
IN2P3-CC	44.2	43	97%	50.9	115%
INFN-T1	28.3	19.3	68%	33.5	118%
NDGF-T1	24.4	13.8	57%	28.2	116%
SARA-MATRIX	19.3	12.2	63%	274	1420%
pic	13.3	12.3	92%	18.1	136%
RAL-LCG2	44.4	15	34%	27.2	61%
TRIUMF-LCG2	29.3	23.9	82%	27.2	93%
T1 summary	310.6	197.4	64%	562.6	181%
T1 summary -SARA	291.3	185.2	64%	288.6	99%

- Testing T1s one by one shows in most cases the original problem was a congested FTS
- TRIUMF was slightly lower but very stable rates
- BNL tends to absorb data too quickly
- RAL will give more details for the WLCG report
  - Internal tape - disk traffic in both direction is always present at RAL
    - 40-50 Gb/s internal pushes any other traffic out
  - We tried both echo and antares for different reasons the rates were below
  - 27.2 Gb/s single test was the first 3h of the test
    - after that antares was stable at 10 Gb/s when we removed deletions
  - antares is not connected to LHCOPN yet

UK: RAL general
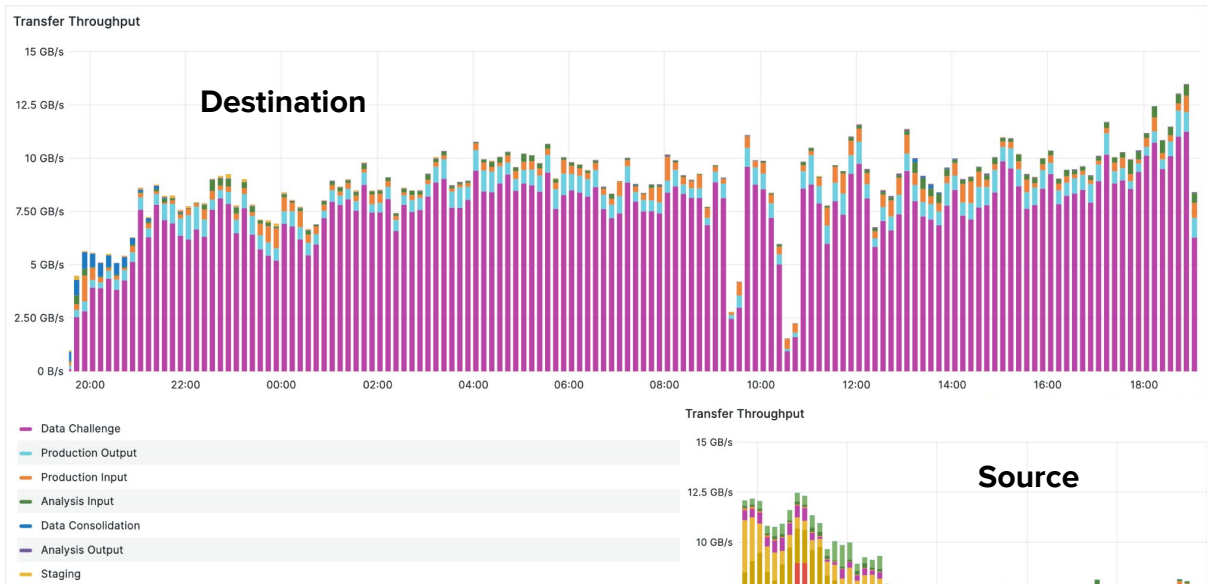
Destination

- Interval is that of the last day when ATLAS could push the rates higher and Tier2s were involved.

Legend:
- Data Challenge
- Production Output
- Production Input
- Analysis Input
- Data Consolidation
- Analysis Output
- Staging

Source

	min	max	avg ⌄	current
Data Challenge	690 MB/s	6.50 GB/s	3.88 GB/s	2.44 GB/s
Production Input	214 MB/s	3.32 GB/s	1.35 GB/s	228 MB/s
Analysis Input	329 MB/s	3.76 GB/s	1.09 GB/s	3.76 GB/s

- Destination traffic dominated by the data challenge
  - 70 Gb/s vs 97 Gb/s
- Source more mixed picture
  - 61.6 Gb/s vs 76 Gb/s
- Combined production traffic in other intervals after the challenge has reached Dc24 levels with peaks of 105 Gb/s
  - No doubt the DC24 tuning helped

105 Gb/s   105 Gb/s

UK: T2

Transfer Throughput — Destinations
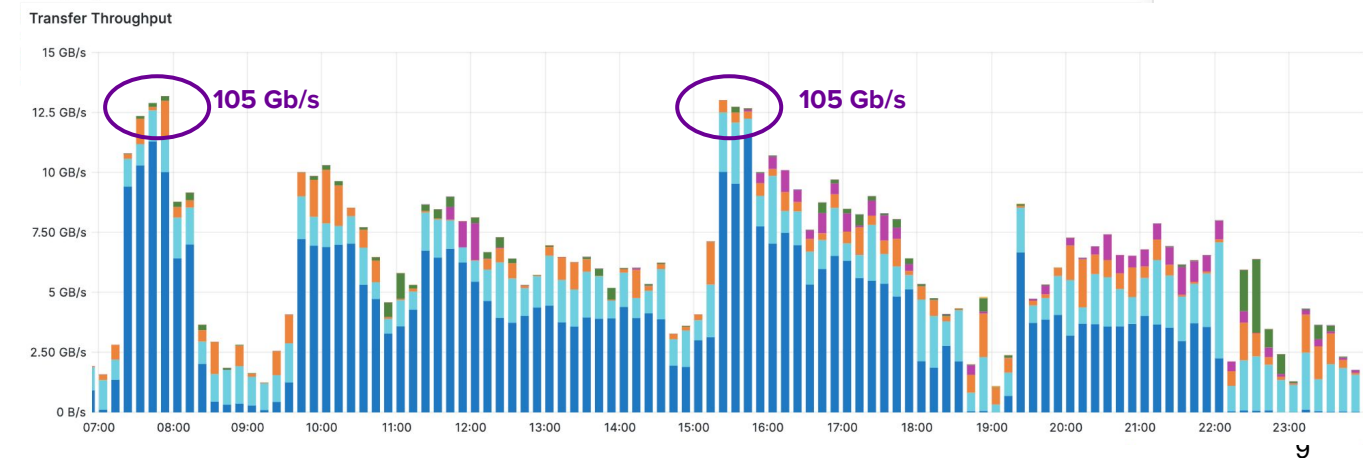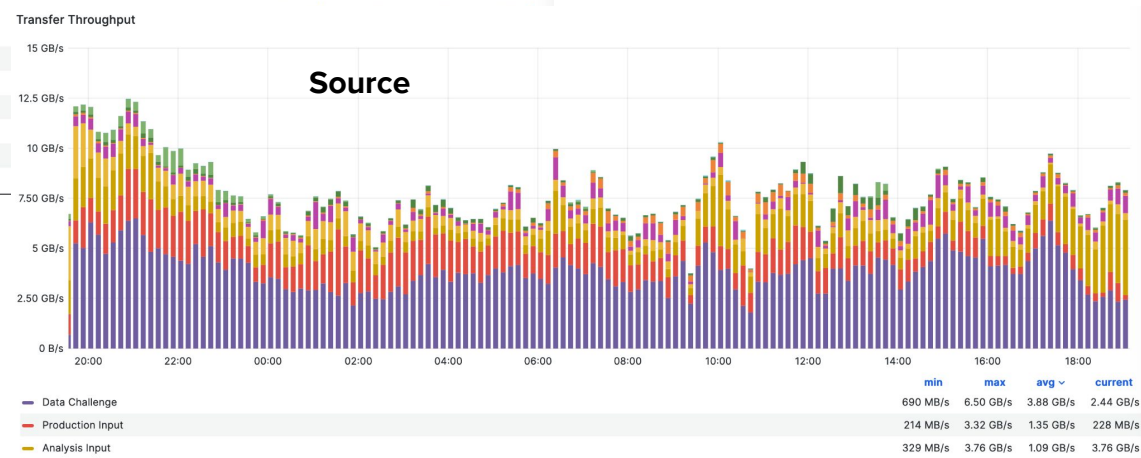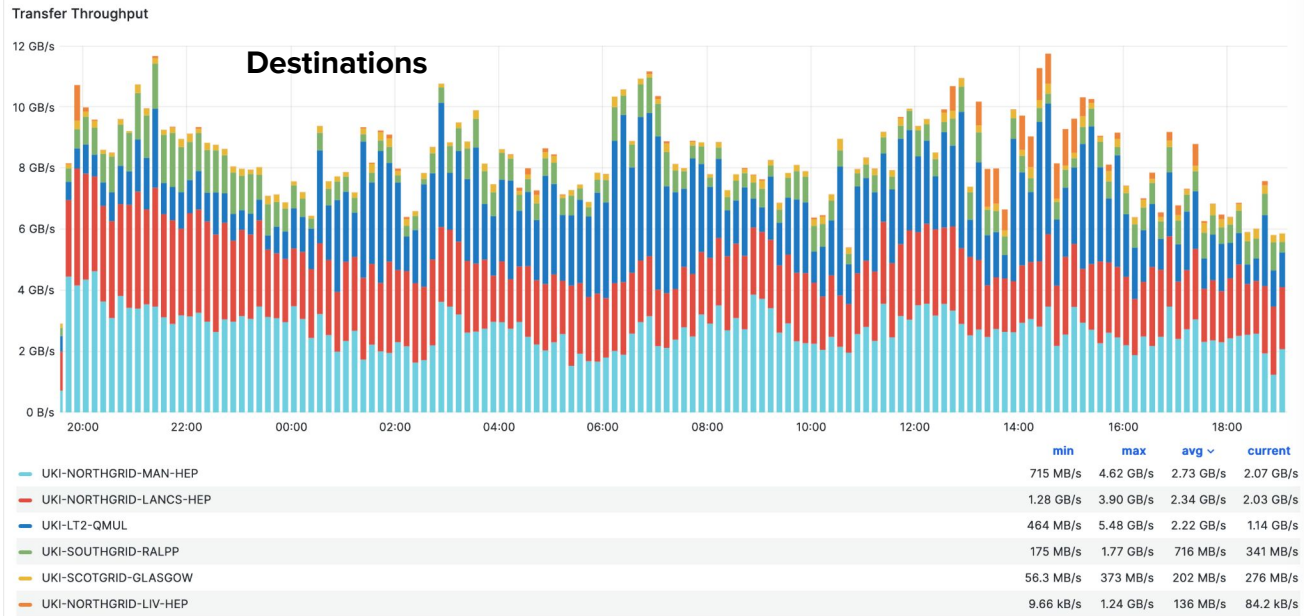
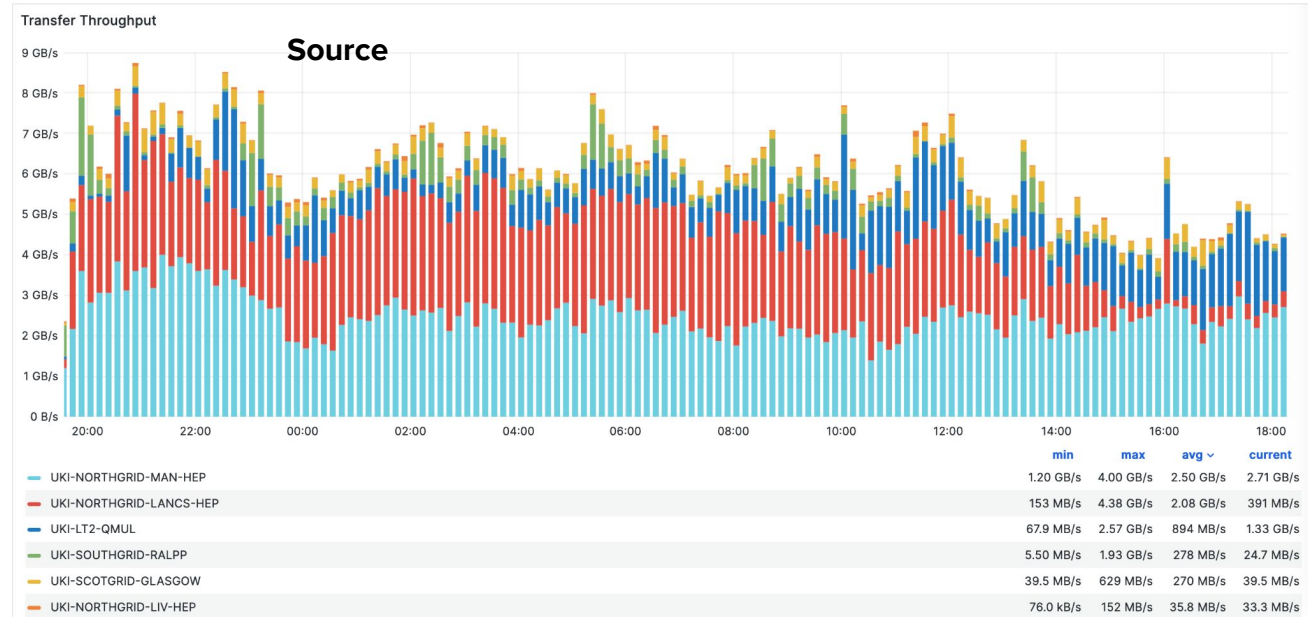| Site	Ingress	Egress
UKI-NORTHGRID-MAN-HEP	31.4	28.2
UKI-SOUTHGRID-RALPP	4.5	4.1
UKI-SCOTGRID-GLASGOW	13.5	12.2
UKI-LT2-QMUL	5.9	3.2
UKI-NORTHGRID-LANCS-HE	28.6	25.8
UKI-NORTHGRID-LIV-HEP	0.5	0.3

Green injected

Destinations legend:

	min	max	avg ⌄	current
UKI-NORTHGRID-MAN-HEP	715 MB/s	4.62 GB/s	2.73 GB/s	2.07 GB/s
UKI-NORTHGRID-LANCS-HEP	1.28 GB/s	3.90 GB/s	2.34 GB/s	2.03 GB/s
UKI-LT2-QMUL	464 MB/s	5.48 GB/s	2.22 GB/s	1.14 GB/s
UKI-SOUTHGRID-RALPP	175 MB/s	1.77 GB/s	716 MB/s	341 MB/s
UKI-SCOTGRID-GLASGOW	56.3 MB/s	373 MB/s	202 MB/s	276 MB/s
UKI-NORTHGRID-LIV-HEP	9.66 kB/s	1.24 GB/s	136 MB/s	84.2 kB/s

- QMUL traffic was production but ingress was at the rates of DC24
- RALPP concurrent CMS traffic
- Man/Lancs hit their bandwidth limits
- Glasgow should have been much higher

Transfer Throughput — Source

Source legend:

	min	max	avg ⌄	current
UKI-NORTHGRID-MAN-HEP	1.20 GB/s	4.00 GB/s	2.50 GB/s	2.71 GB/s
UKI-NORTHGRID-LANCS-HEP	153 MB/s	4.38 GB/s	2.08 GB/s	391 MB/s
UKI-LT2-QMUL	67.9 MB/s	2.57 GB/s	894 MB/s	1.33 GB/s
UKI-SOUTHGRID-RALPP	5.50 MB/s	1.93 GB/s	278 MB/s	24.7 MB/s
UKI-SCOTGRID-GLASGOW	39.5 MB/s	629 MB/s	270 MB/s	39.5 MB/s
UKI-NORTHGRID-LIV-HEP	76.0 kB/s	152 MB/s	35.8 MB/s	33.3 MB/s

Conclusions

- Positive: system was definitely stressed and it cracked in places
  - Aim of a challenge is finding bottlenecks not only achieve rates
  - Limitations of certain setups were highlighted and, where possible, corrected on the fly.
  - In other places it will require more thinking
- UK
  - RAL needs to do tuning
  - Tier2s generally well but in some cases already hitting the bandwidth
- My recommendation for WLCG is that these DC should be made more often and be less overloaded
  - UK could also agree to do internal challenges