ALICE participation in DC24

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DOMA DC24 retrospective

Planned data rates

Centre	Target rate GB/s
CNAF	0.8
IN2P3	0.4
KISTI	0.2
GridKA	0.6
NDGF	0.3
NL-T1	0.1
RAL	0.1
CERN	*10*

- **ALICE target rates are defined for Run3/4 and remain unchanged**
- All rates tested and achieved during data challenges and subsequently in 2022/2023 (real data transfers)
- Rates coordinated with T0/T1s custodial storage experts
- Data to be transferred during DC24 - 34PB from 2023 Pb-Pb run
- Other WAN load from normal activities (full T0/1/2-T0/1/2 mesh)

Targets: 2.5GB/s (T1s) + 10GB/s (T0)

Rates rationale

- The rates to T0/T1s - proportional to the pledged resources of the corresponding centre

- Data volume share: ⅔ to T0, ⅓ to T1s

- Largest contribution are the Compressed Time Frames (CTF) - the ALICE equivalent of RAW data in Run3+
  - All data are located on the O2 disk buffer at CERN prior to transfer
  - File sizes: 10GB/CTF file + tail of calibration files associated to the CTFs

- Most intensive transfer period - after the end of Pb-Pb data taking for the corresponding year
  - Copy the data to tape in 3-4 months after completion of data taking

DC24 transfer methodology

- Transfer of real Pb-Pb data collected in 2023 (copy to custodial storage)
  - Total size to copy 34 PB

- No software changes in the ALICE DM system foreseen
  - Transfer tools - xrd3cp (TPC) + JAliEn transfer scheduler + ALICE tokens
  - Transfer tuning - number of streams per target, proportional to file size

- TPC monitoring (xrootd) is available and good enough
 - Data is exported from MonALISA to common monitoring system

Average achieved rates (in the period of DC24)

| Centre	Target rate GB/s	Average achieved GB/s
CNAF	0.8	0.98 (+20%)
IN2P3	0.4	0.6 (+40%)
KISTI	0.2	0.25 (+22%)
GridKA	0.6	1.12 (+90%)
NDGF	0.3	0.35 (+15%)
NL-T1	0.1	0.25 (+150%)
RAL	0.1	0.58 (+500%)
CERN	*10*	*14.2 (+40%)*

- **The target rates were increased to most of the T1s on request from T1 experts to check the system capabilities**
- We did not observe any network instabilities or throughput issues
- All of the target rates were set by varying the number of parallel transfers

Averages: 3.75GB/s (T1s, +40%) + 14.2GB/s (T0, +40%)

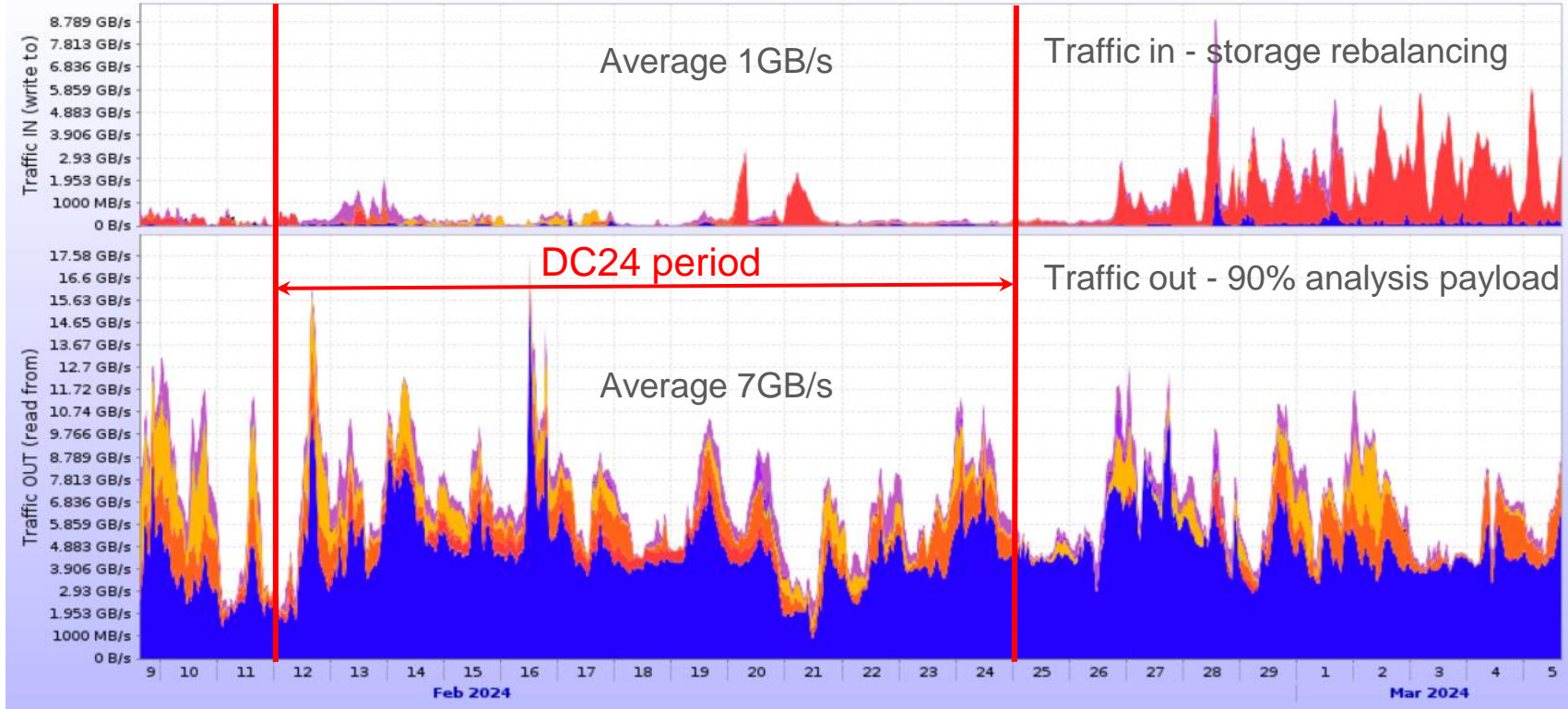# Time evolution T0
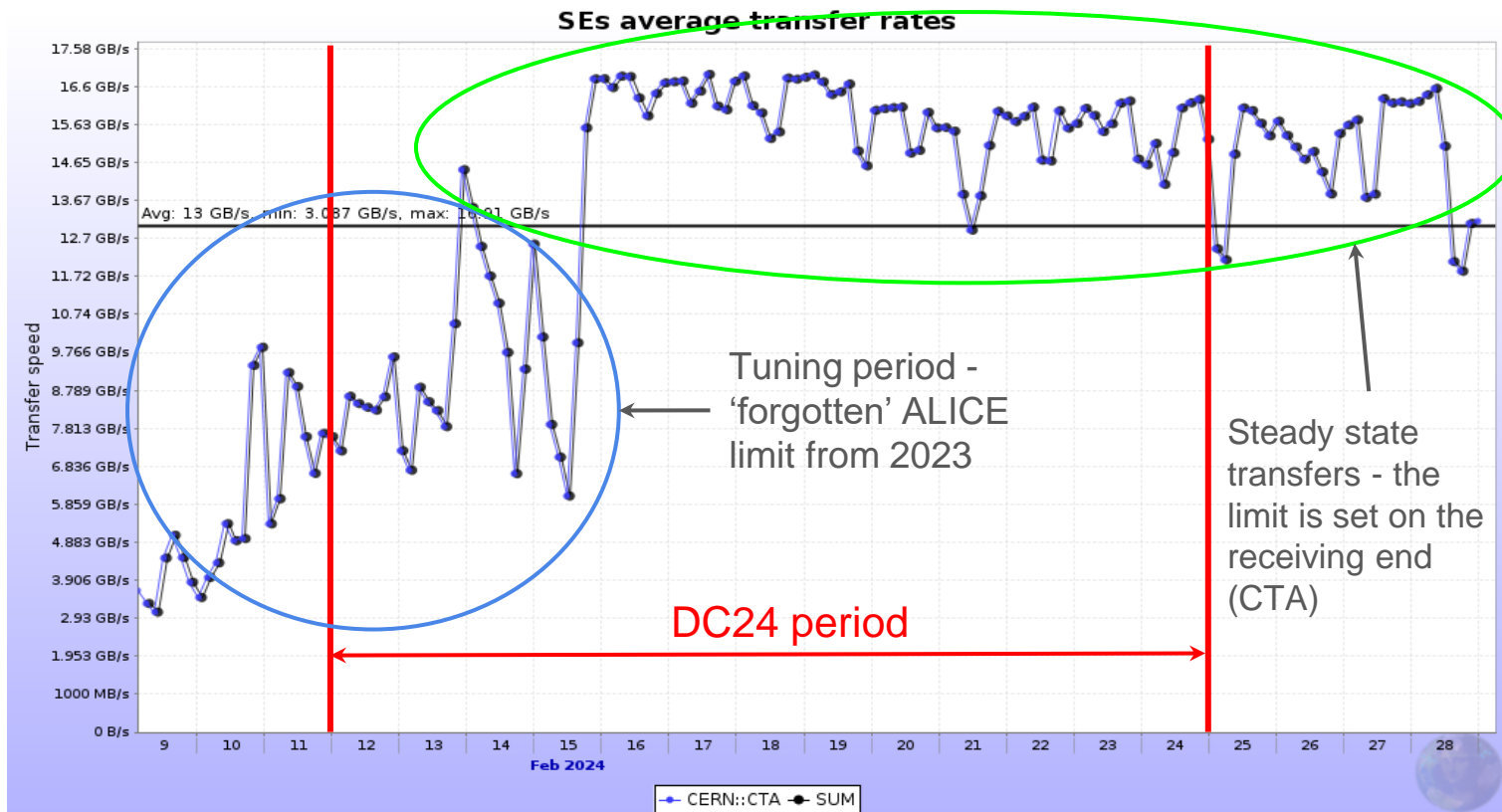
Time evolution T1s
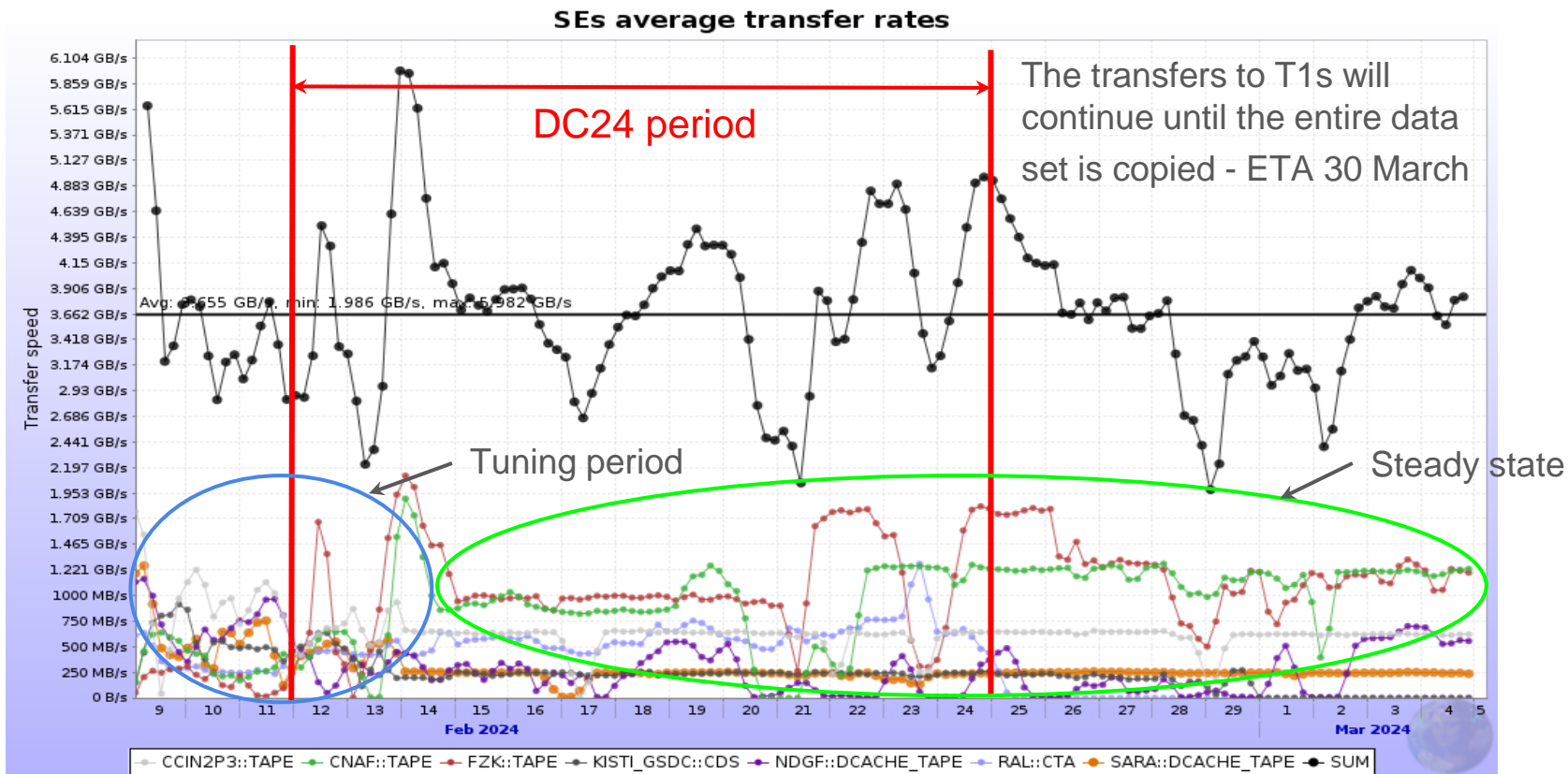
Incidents

- T0 rate - could not achieve 10GB/s in the first 3½ days
  - Reason - a limit of max active transfer threads was forgotten in the ALICE transfer system (self inflicted)
- 3h interruption of transfers to GridKA
  - Dead xrootd service on a disk buffer - repaired by restarting the service

- 24h interruption at CNAF
  - Too high rate observed on disk buffer, pinpointed to reads for md5sum calculation
  - Solved by adding SSD to the buffer

- All of the above are relatively trivial running issues, no structural or software problems identified

WAN traffic from data processing and analysis

WAN server traffic

Matrix of 38x38 sites

Average 1GB/s

Traffic in - storage rebalancing

DC24 period

Traffic out - 90% analysis payload

Average 7GB/s

Conclusions

- Used real data transfer in the exercise, i.e. tested the entire custodial storage chain - source, network, target storage and transfer software

- Target rates surpassed by 35% at T0 and 40% at T1s

- Steady transfers to all target storage elements, minimal intervention required in only two sites, zero network issues

- No interference observed from activities of other VOs, no effect on other activities within ALICE

- No errors during transfer

- **DC24 was successful for ALICE, many thanks to the sites and to the network!**