CTA Evaluation at JINR

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On behalf of the JINR storage team

3rd CTA Workshop

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Tape Storages at JINR

- 3 Tape Libraries

  - IBM TS3500 - 5961x2.5 TB tapes – LTO6, 12 drives (160 MB/s)

  - IBM TS4500 - 4500x20 TB 3592-JE tapes, 12 TS1160 drives (400 MB/s)

  - IBM TS3200 (Testbed) - 45x1.5 TB tapes, 4 drives (140 MB/s)

- EOS/CTA

  - TS3500 and TS4500

  - 432 TB all-flash buffer (6 servers)

- dCache/Enstore

  - TS4500

  - 2.65 PB HDD-based buffer (8 servers)

- Testbed

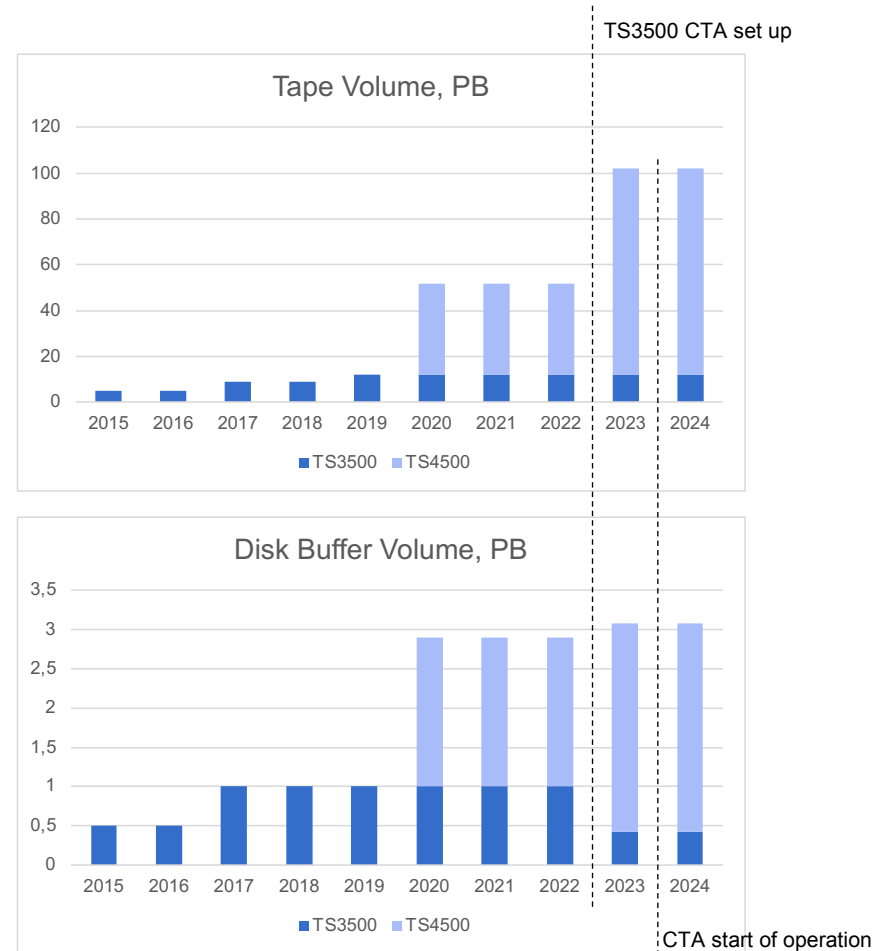 - IBM TS3200

  - 4 drives (140 MB/s), 45x1.5 TB tapes
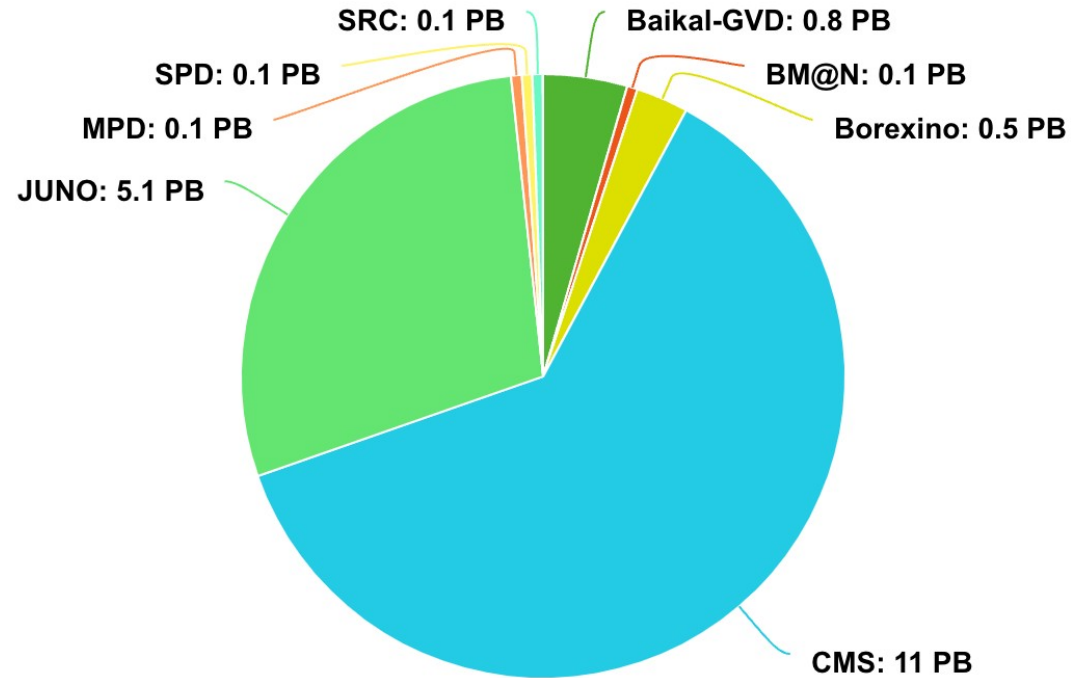
TS3500

TS4500

Currently Operating Libraries Timeline

- TS3500 in operation since 2015

  - Powered by Enstore till the end of 2023

  - CTA now

  - Changed HDD buffer to all-flash

- TS4500 in operation since 2021

  - Used by both dCache/Enstore and EOS/CTA

- TS3500 → TS4500 data migration

  - Took 365 days to finish (April 2020 – April 2021)

  - ~8 PB and ~3M files transferred

  - Only 3 files lost during migration

TS3500 CTA set up

Tape Volume, PB

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024

■ TS3500 ■ TS4500

Disk Buffer Volume, PB

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024

■ TS3500 ■ TS4500

CTA start of operation

Tape Usage

- LHC: CMS

- Experiments on NICA:
  - BM@N
  - MPD
  - SPD
  - SRC

- Neutrino experiments:
  - Baikal-GVD
  - JUNO
  - Borexino

- Non-experimental data (backups, etc)

Pie chart: SRC: 0.1 PB, Baikal-GVD: 0.8 PB, SPD: 0.1 PB, BM@N: 0.1 PB, MPD: 0.1 PB, Borexino: 0.5 PB, JUNO: 5.1 PB, CMS: 11 PB

EOS-CTA Configuration Overview

- In operation since Autumn 2023

- Uses both TS3500 and TS4500

- All-flash disk cache based on EOS

- Standard EOS configuration

  – Active-passive HA for MGM/MQ

  – RAFT HA for QuarkDB

  – Replica layout

- Software

  – Scientific Linux 7 everywhere

  – EOS 5.1.9

  – CTA 5.10

  – Postgres 14.0
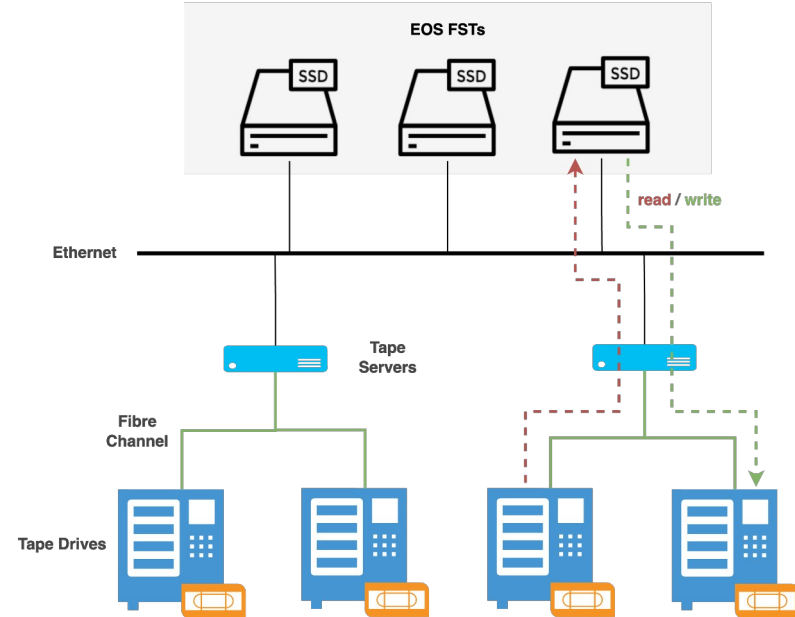
	CPU	Memory	Disk	Network
6 x Tape servers	2 x Xeon Gold 6126, 40 cores	128 GB	2 x 480 GB SSD (RAID1)	2 x 16 Gb/s FC, 40 Gb/s Ethernet
2 x Tape servers	1 x EPYC 7443P, 24 cores	128 GB	2 x 480 GB SSD (RAID1)	2 x 16 Gb/s FC, 40 Gb/s Ethernet
6 x EOS FST servers	2 x Xeon Gold 6348, 56 cores	256 GB	480 GB SSD (RAID1), 9 x 7.68 TB NVMe	100 Gb/s Ethernet

Humidity Issues

- Plot shows relative humidity (RH) in one of the cold aisle with near to constant temperature (~17 C)

- TS4500 triggers tape alert when RH goes out the allowable RH 20 – 50% range

  - TS4500 continues functioning
  - CTA blocks write operations

- We are working on improving environment conditions

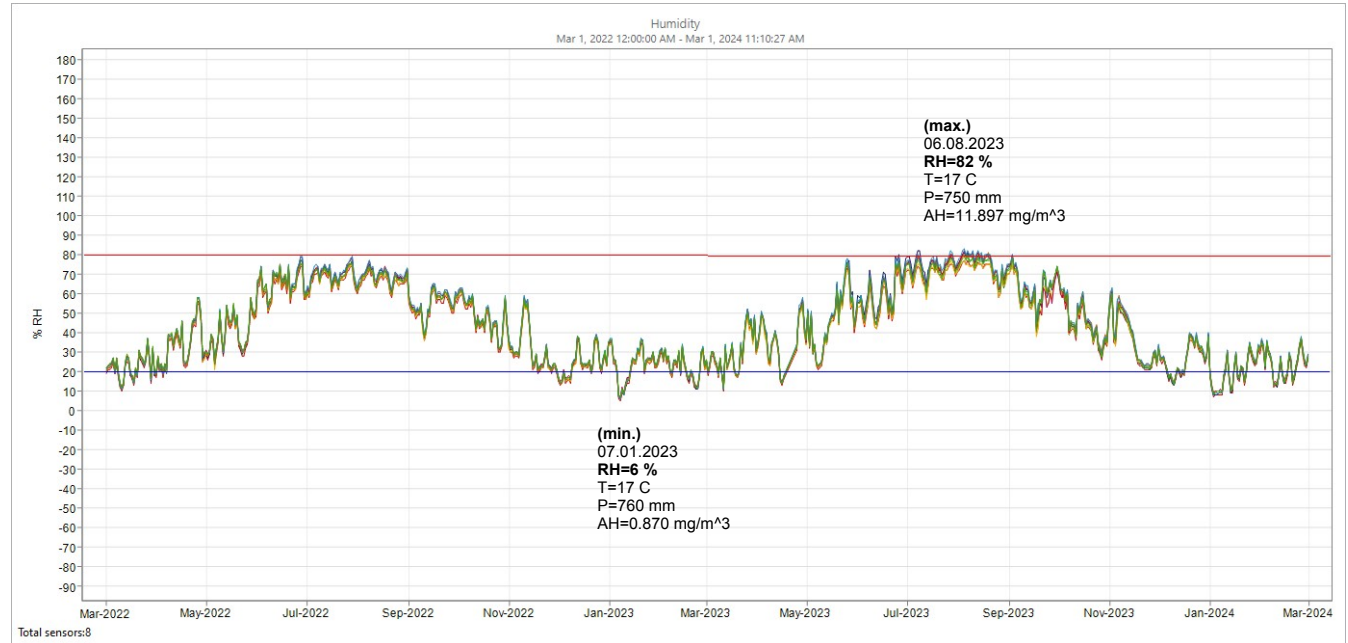- Meanwhile, it would be great if there was a way to make CTA ignore tape alerts

Humidity
Mar 1, 2022 12:00:00 AM - Mar 1, 2024 11:10:27 AM

(max.)
06.08.2023
RH=82 %
T=17 C
P=750 mm
AH=11.897 mg/m^3

(min.)
07.01.2023
RH=6 %
T=17 C
P=760 mm
AH=0.870 mg/m^3

Total sensors:8

Table 1-20   Equipment environment specifications for the TS4500 tape library

Product operation							Product power off	
Dry-bulb temperature[a]		Relative Humidity (Non-condensing)		Maximum Wet-bulb temp.	Maximum elevation	Dry-bulb temp.	Relative humidity (% RH)	Maximum Wet-bulb temp.
Allowable	Recommended	Allowable (% RH)	Recommended (% RH)					
16 - 32°C	16 - 25°C	20 - 80%	20 - 50%	26°C	3050 m	5 - 45°C	5 - 80%	28°C

a. Derate maximum dry-bulb temperature 1°C/300 m (1.8°F/984 ft.) above 900 m (2 953 ft.).

Tape Library Monitoring

- Environmental conditions control

- Visual control to track manually triggered operations and fallen tapes

- Software

  - Grafana

  - Prometheus

  - MariaDB

- Hardware

  - Raspberry Pi 3

  - DHT22 and BME280 Sensors

  - POE IP Camera

  - USB camera connected via Pi3

Tape Future at JINR and Conclusion

- We are considering 3 scenarios in context of Enstore discontinuation

    - Move from dCache/Enstore to EOS/CTA completely

    - Continue operating both configurations

    - Evaluate other disk-tapes configurations: EOS/Enstore and dCache/CTA

- We have already started porting Enstore to Python 3 and consider taking over its support

Conclusions

- Currently, it is too early to make any conclusions about EOS/CTA

- The only issue so far is TapeAlert flag treatment by CTA, we are interested in implementing a CTA option to ignore it

- We haven't given up on Enstore, there's light at the end of the tunnel

- We'll continue operating both dCache/Enstore and EOS/CTA for some time

- Move to new OS due to SL 7 EOL (presumably AlmaLinux 9)

Thanks!

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