Belle II Computing

Italian Site Meeting
09 May 2024
Dr. Silvio Pardi

Belle II Status and Plan

Data taking started in 2019.

In July 2022 we started the Long Shutdown 1

Data taking restarted early 2024, first collision 20 February 2024.

A full copy of RAW Data is stored at KEK Tier0. The secondary copy was stored at BNL (100%) for the first years, then distributed over the following RAW Data Centers since April 2021. Nominal share:

- ○ BNL 30%
- ○ CNAF 20%
- ○ DESY 10%
- ○ KIT 10%
- ○ IN2P3CC 15%
- ○ UVic 15%

Belle II Computing Model

Similar to WLCG, but without using the term "Tier-N"

KEK = Host laboratory (cf. T0)
- To register detector data onto Grid
- Permanent store of 100% raw data
- Prompt processing
- incl. the activities below

Raw Data Centers (cf. T1)   **CNAF**
- Permanent store of replica raw data distributed over 6 sites
- Prompt processing and Reprocessing
- incl. the activities below

Regional Data Centers (cf. T1+T2)
- To host data for analysis   **Napoli, Pisa, Torino**
- incl. the activities below

MC Production Centers (cf. T1+T2+T3)
- To run MC production jobs and analysis jobs

Cosenza, Frascati, Legnaro, Roma3

DIRAC
- The main system with configuration, workload management + data I/O by jobs
  - We used to have a DIRAC extension for "dataset" distribution and deletion => switched to Rucio
- Hosted at KEK, BNL, and a few other sites

Rucio
- The distributed data management system
- File catalog + Metadata catalog
  - We used to use LFC, migrated to Rucio in 2021
  - We have been using AMGA, supported by KISTI, but now moving to Rucio
- Hosted at BNL

FTS
- To transfer files (protocol = mostly davs, in some cases srm+https, or root)
- Hosted at KEK and BNL

VOMS, IAM
- Hosted at KEK (VOMS replica at DESY for redundancy)
- Test IAM at CNAF, for early phase testing (very helpful)

2024.Feb.06 - BPAC annual review - Computing - Ueda I.

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# Belle II Computing Infrastructure (Site Report 2023)

- 55 sites providing pledged and opportunistic resources
- 29 Storages
- 5 Tape systems

TYPE	Resource provided
CPU Pledge	451.6 kHS06/kHS23
CPU Opport.	408.9 kHS06/kHS23
DISK	16.8 PB
TAPE	11.9 PB

For Production: 31 kjobslots pledged and 33 kJobslot opportunistic

*Additional storage under implementation in some of the sites

| TYPE	Resource provided
CPU	36,7 kHS06/HS23
DISK	550 TB
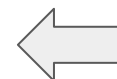
Resource for calibration

NEW CHALLENGES FOR SITES
- Token Based Authentication
- End-of-life of storage technologies (DPM, gsiftp, srm)
- Update the Operative system (RHEL9/Almalinux9)
- Network Operation (Link update, Jumbo Frame)

Activity in the first 4 months of 2024

Running jobs by Country
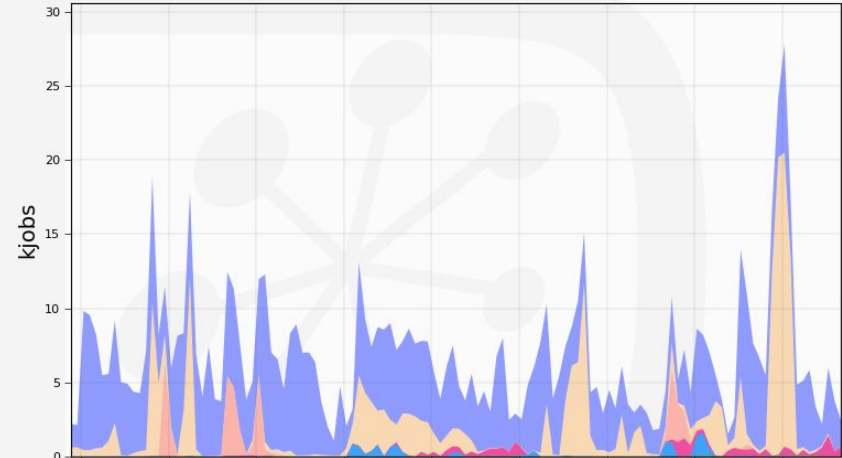### 17 Weeks from Week 53 of 2023 to Week 17 of 2024
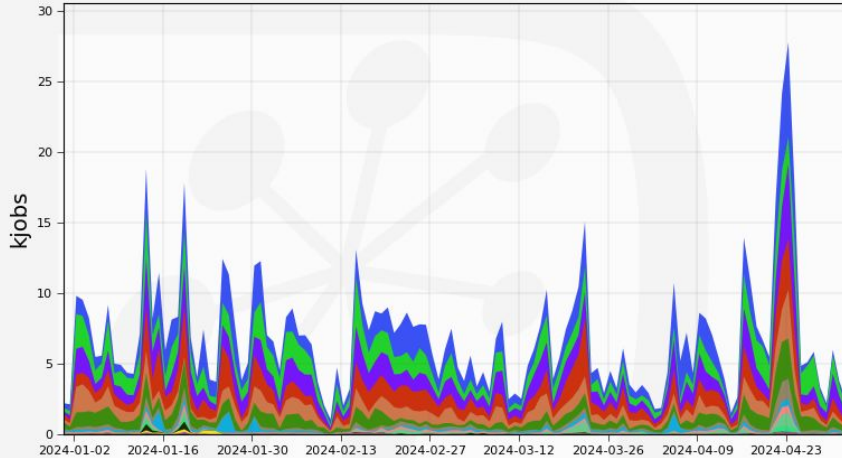
Max: 27.8, Min: 1.06, Average: 6.85, Current: 2.47

DE	19.8%	CA	9.8%	KR	0.3%	PL	0.0%
JP	17.5%	CZ	2.8%	CN	0.3%	ANY	0.0%
US	17.4%	FR	2.5%	TR	0.2%	IN	0.0%
IT	15.4%	AT	1.6%	IL	0.2%	MULTIPLE	0.0%
SI	10.9%	AU	1.2%	RU	0.1%	UK	0.0%

Generated on 2024-05-03 09:35:24 UTC

Running jobs by JobType
17 Weeks from Week 53 of 2023 to Week 17 of 2024

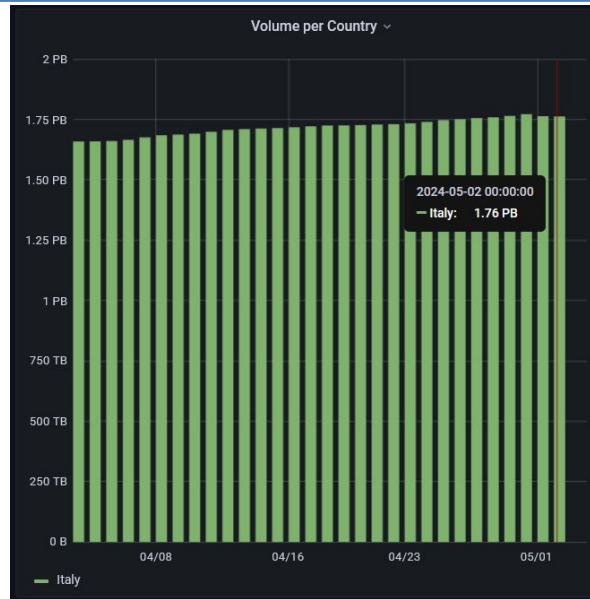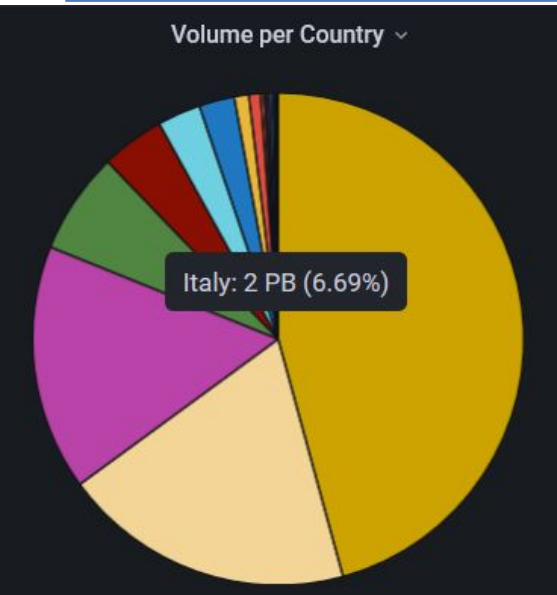Max: 27.8, Min: 1.06, Average: 6.85, Current: 2.48

User	66.3%	MCSkim	2.2%	UserScout	0.0%	unknown	0.0%
MCProduction	25.7%	DataSkim	1.3%	DataMerge	0.0%		
RawProcessing	4.4%	Merge	0.1%	Test	0.0%		

Generated on 2024-05-03 09:38:45 UTC

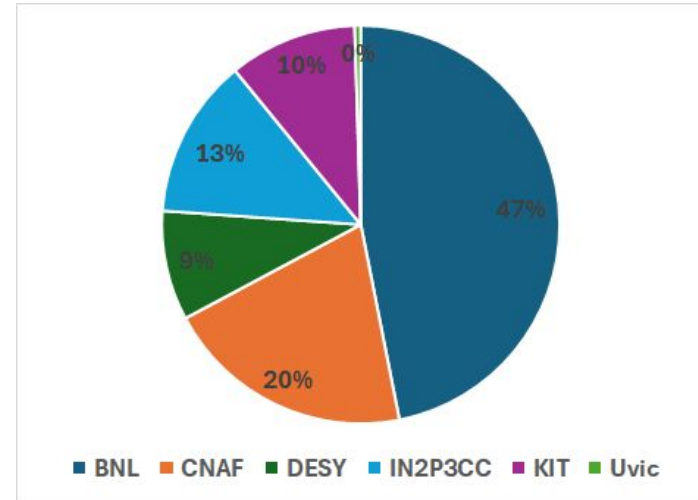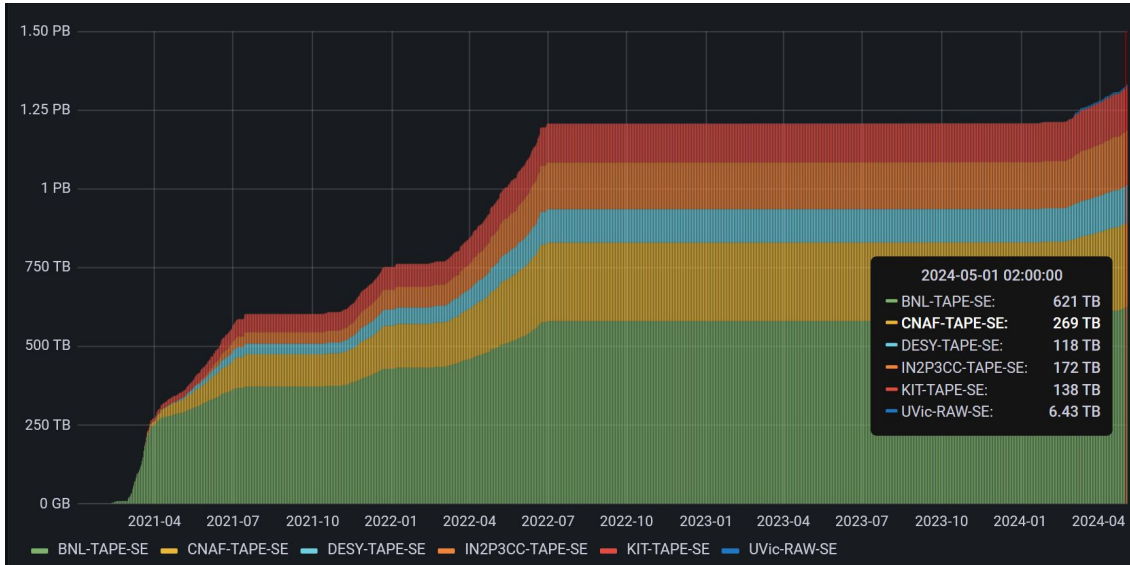**Milestone 2024 - 12%**

Italian Share in the first 4 months 15.4%

Storage Resources

SITE	TB
CNAF	**820**
Napoli	**590**
Pisa	**200**
Torino	**350**
Frascati	11
Roma3	2
Total Pledge	**1.973 TB**
Gran Toal	**1.986 TB**

Around 1.76 PB used. The pledged storage at CNAF 2023 (+200TB) and Pledged 2024 (+300TB) is not provided yet due some delays in the tendering process. New storage should be online in the second half of May 2024
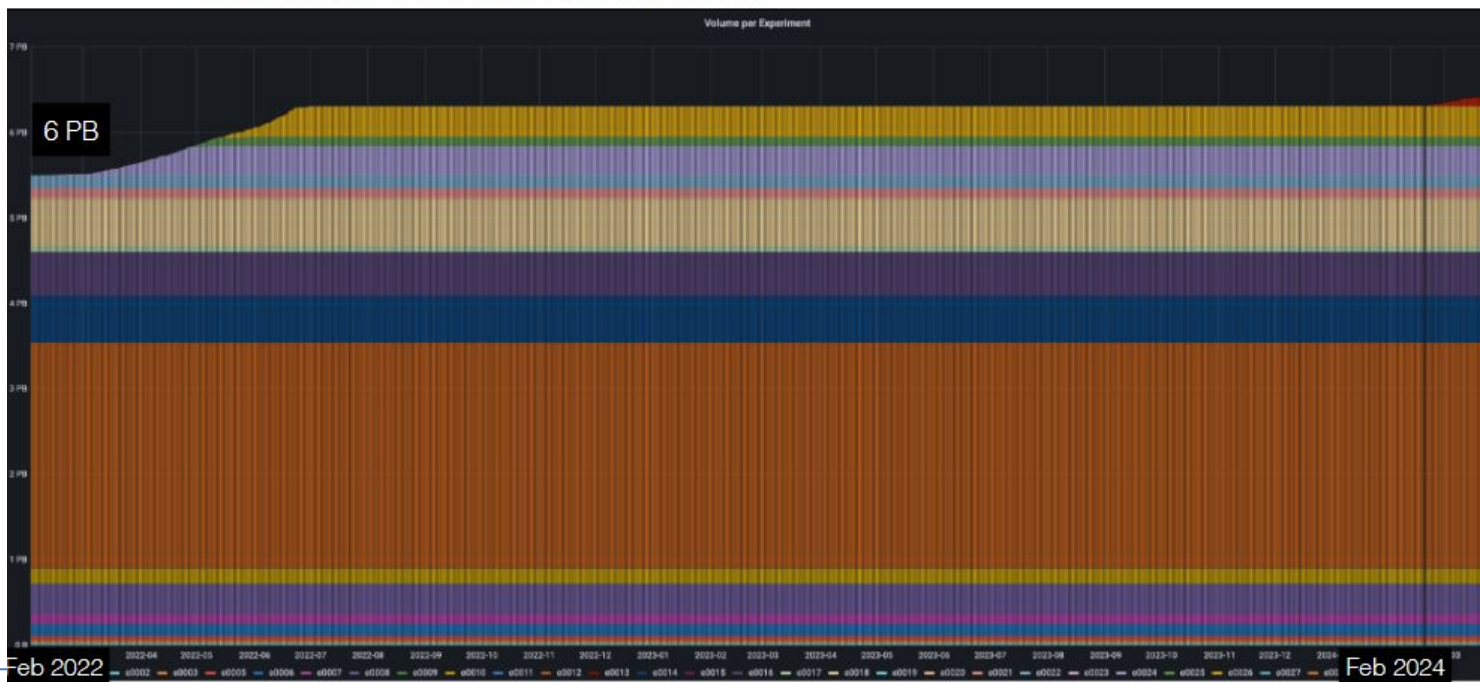
TAPE - Italian Share 20%

Milestone 2024 - 20% of RAW Data at CNAF

Belle II Data Volume: TAPE

More than 3 PB raw data accumulated
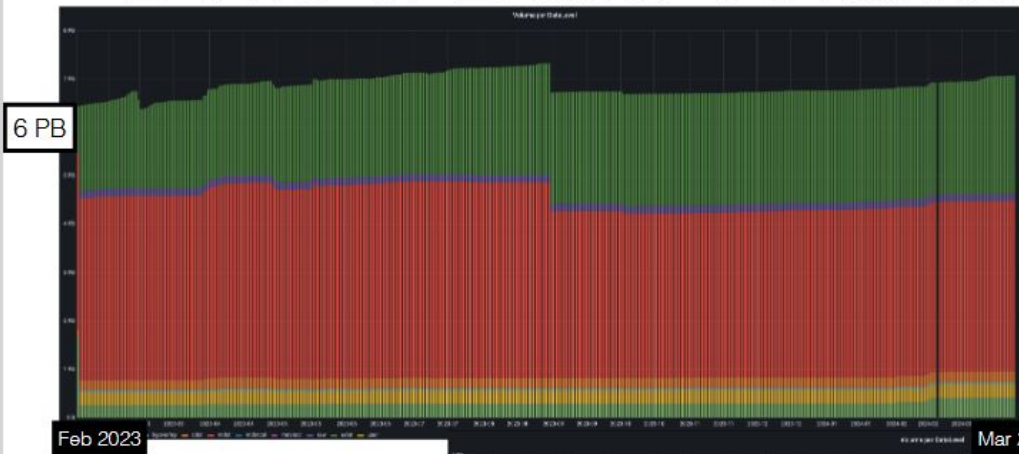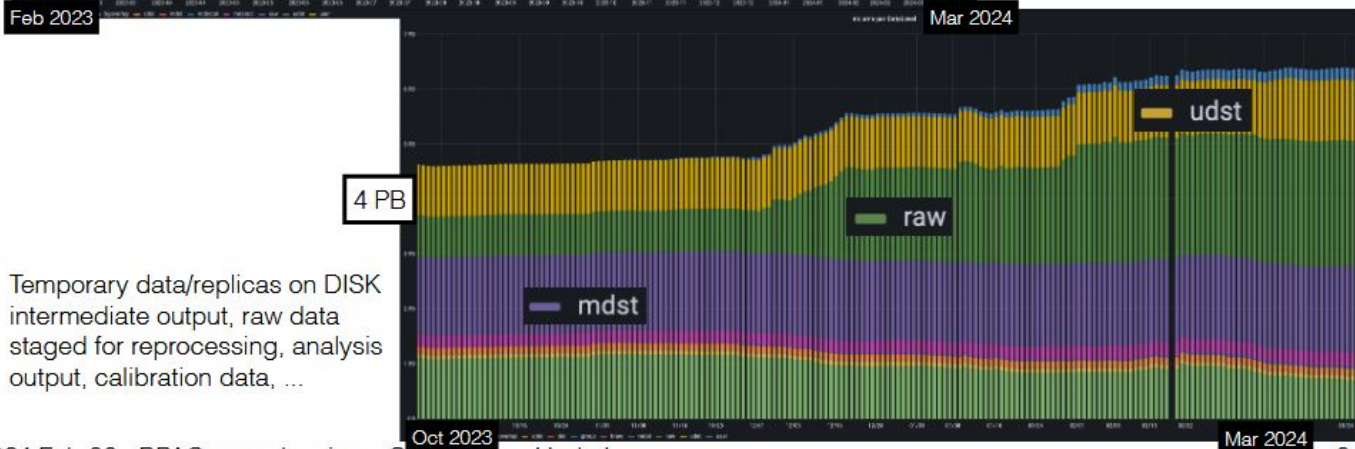
- Incl. skimmed raw data
- Duplicated over Raw Data Centers

Belle II Data Volume: DISK

Persistent data on DISK with life cycles based on data production/processing campaigns

6 PB

Feb 2023 — Mar 2024

Temporary data/replicas on DISK intermediate output, raw data staged for reprocessing, analysis output, calibration data, ...

4 PB

udst

raw

mdst

Oct 2023 — Mar 2024

DAVS Implementation for Third-Party-Copy

Wed Mar 13 03:26:26 CET 2024 - TEST HISTORY<

Green if Pull and Push tansfers have been completed successfully, Yellow if at least a Pull or a Push transfer have been completed successfully, Red if Pull and Push tansfers failed

DESTINATION

Succeeded Transfers by Protocol

12 Weeks from Week 53 of 2023 to Week 12 of 2024
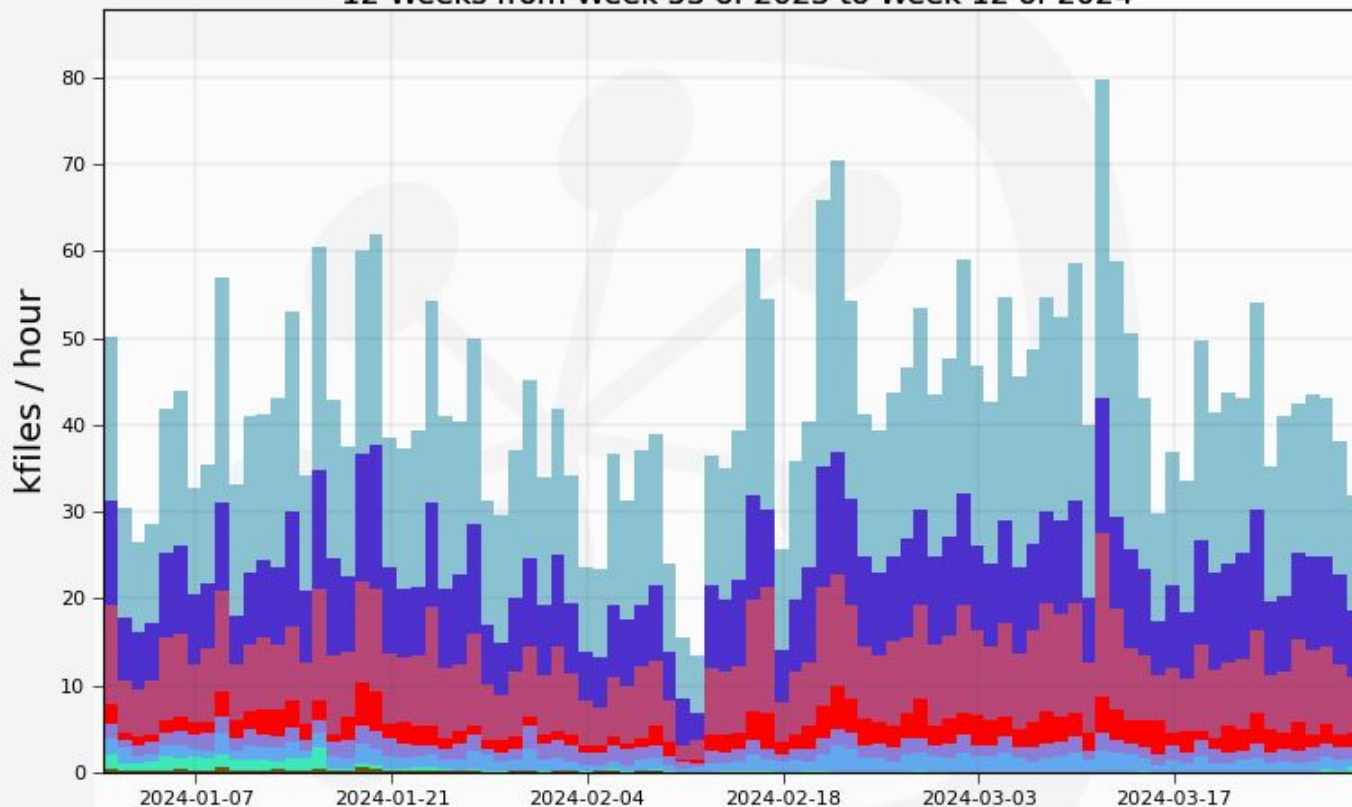
Max: 79.9, Min: 13.5, Average: 42.3, Current: 20.6

davs	43.8%	DataManager	20.2%	file	3.6%	srm	0.8%
dips	22.8%	Failed	5.3%	root	3.4%	gsiftp	0.3%

Generated on 2024-04-03 20:41:46 UTC

Belle II Data Challenge 2024 within WLCG DC24

What should be exercised during DC24:

Technology that can be stressed: Network, DDM, FTS, Storages, Monitoring System, Protocols, IAM

Main goal: Emulate data transfer conditions in a Belle II high-lumi scenario

Our current estimation for such scenario is 40 TB per day.

Transfers from KEK to RAW Data Centers according to our distribution schema (30%BNL, 20%CNAF, 15% IN2P3CC, 15%UVic, 10%DESY, 10%KIT)

Considering that the average speed needed to transfer 40TB/day is 3.7Gbit/s in outbound at KEK vs all the Raw Data Centers.

- Min - The target speed to achieve is 3x3.7Gbit/s = **11.1 Gbit/s**
- Max - The target speed to achieve is 5x3.7Gbit/s = **18.5 Gbit/s**

Traffic per Day vs Goals
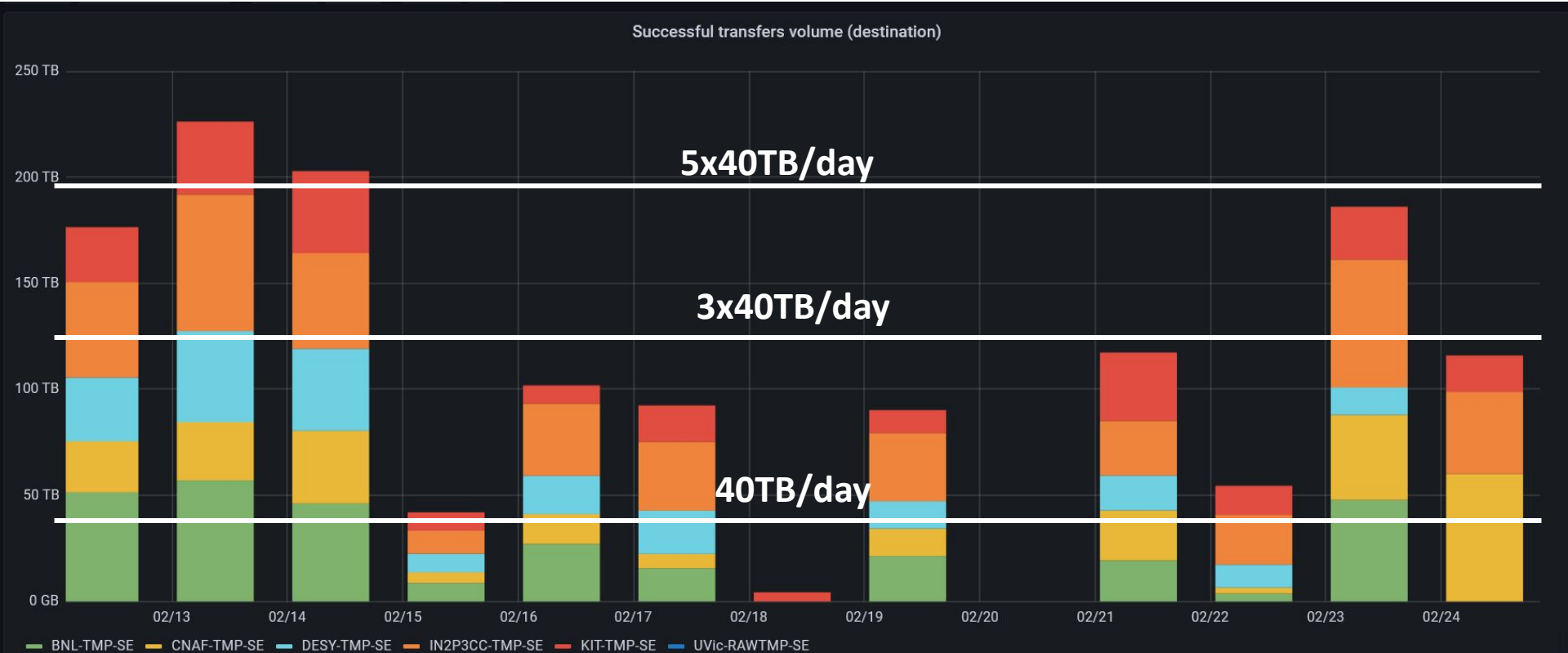
Belle II DIRAC

Tre istanze

Production DIRAC Versione attuale 7.3 non supporta token, supporta SSL ma un po macchinoso, proxy generati con keysize=1024

Certification DIRAC - Versione attuale 8.0 con BelleDIRAC 6.0.0 supporta SSL con una patch per semplificare il deploy. Supporta token (da provare), proxy generati con keysize=2048

Migration DIRAC -versioni successive di DIRAC

CentOS7 deprecation

CentOS 7 EoL coming very soon: June 30th 2024

- Migration to AlmaLinux/RHEL 9 encouraged in WLCG
- (EL8) AlmaLinux/RHEL 8 EoL on May 31st 2029
- (EL9)AlmaLinux/RHEL 9 EoL on May 31st 2032

Several sites have already scheduled the migration. Some of them directly to Alma/Rocky9 some other sites will pass to Alma/Rocky8 first.

KEK will migrate during the KEKCC renewal

Belle II Software

The Belle II Software is meant to work on any recent 64 bit Linux system but it is only tested and provided in binary form for a few select distributions

https://software.belle2.org/release-08-01-03/sphinx/build/tools_doc/index-01-tools.html

- Enterprise Linux 7 or CentOS 7 (el7)
- Enterprise Linux 8 or CentOS 8 (el8)
- Enterprise Linux 9 or AlmaLinux 9 (el9)
- Ubuntu 20.04 (ubuntu2004)
- Ubuntu 22.04 (ubuntu2204)

CentOS7 deprecation consequence on distributed computing

Sites have to reinstall/reconfigure their infrastructures.

EL9 loose the Grid Security Infrastructure support (authentication with x509+VOMS) because the htcondor 9.0.20 is released only for EL7 and EL8 based distribution.

VOMS-Admin, the interface for manage VOMS membership is not available for EL9.

Currently production DIRAC use proxy with keysize=1024 which is non accepted by default form the cryptopolicy of Alma8/9

Belle II Plans

Migration from DIRAC 7.3 to DIRAC 8.0 - Should be done in production by May. Needed to run pilot-jobs via Token.

Activation of IAM service that will release token and substitute VOMS server.

Implementing Token on Storage and Computing resources.

Token Status: IAM Service

- IAM server at KEK https://belle-auth.cc.kek.jp/ update completed to the version 1.8.4
- IAM server at CNAF https://iam-belle.cloud.cnaf.infn.it/ used for test.

The production IAM will be the one in KEK however has not been configured yet in production, still not configured for release VOMS attribute.

We plan to convert robot certificates to IAM user, using a set of mailing lists as different distinguish email.

KEK plans to maintain voms.cc.kek.jp for now, to be understand the situation in DESY.

Token for Computing

In order to use token for submit pilot Belle II needs to migrate the production infrastructure from DIRAC 7.3 to DIRAC 8.0

Migration is ongoing, is expected to be completed by the end of May.

29-31 May Computing meeting at KEK. During the meeting we will try to setup token.

For now SSL interface can be used, a specific patch to simplify the usage has been implemented on certification DIRAC 8.0. In order to use SSL in production DIRAC 7.3 still need some work.

So for now we would like to use GSI up to the implementation of DIRAC 8.0, then move to SSL and to TOKEN as soon as possible.

Storage Torino

- STORM di Torino non riesce a dialogare bene via davs con molti storage, tra cui il CNAF

Storage Torino

[spardi@ui-tier1 fixcnafreport]$ gfal-copy
davs://xfer-archive.cr.cnaf.infn.it:8443/webdav/belle/TMP/belle/test/TPC/10MB?copy_mode=push
davs://belle-se-01.to.infn.it:8443/belle/TMP/belle/test/TPC/10MB-push-CNAF-TMP-SE

Copying davs://xfer-archive.cr.cnaf.infn.it:8443/webdav/belle/TMP/belle/test/TPC/10MB?copy_mode=push   [FAILED] after 1s

gfal-copy error: 112 (Host is down) - TRANSFER ERROR: Copy failed (3rd push). Last attempt: copy HTTP 400 : Server Error

(base) [spardi@ui-tier1 fixcnafreport]$ gfal-copy
davs://xfer-archive.cr.cnaf.infn.it:8443/webdav/belle/TMP/belle/test/TPC/10MB?copy_mode=pull
davs://belle-se-01.to.infn.it:8443/belle/TMP/belle/test/TPC/10MB-push-CNAF-TMP-SE

Copying davs://xfer-archive.cr.cnaf.infn.it:8443/webdav/belle/TMP/belle/test/TPC/10MB?copy_mode=pull   [DONE] after 1s

CNAF

- Json file con l'accounting del CNAF non può essere scaricato da KEK. Dovuto a un problema di compatibilità tra la versione di gfal-2.21 e la configurazione di rete di KEK. Attualmente applicata una patch. Il json file viene copiato su un server http temporaneo e servito a DIRAC.
- A causa dello stesso problema KEK fallisce nell'interazione con lo storage del CNAF (e non solo) via davs. Attualmente stiamo utilizzando srm+gsiftp. Sugli altri storage stiamo utilizzando root in attesa che la release di gbasf2 (il software che gestisce il client DIRAC) integri la versione successiva di gfal che non da problemi.

- Passaggio dei CE del CNAF a HTCondorCE23. In testing i CE sul servizio DIRAC di certificazione.

Questionario

Stiamo raccogliendo le informazioni sullo stato delle risorse nei vari siti per il report annuale.

Inviato un questionario precompilato a tutti i siti da rivedere e compilare.

Prego tutti i siti di completare il documento entro il 15 maggio.