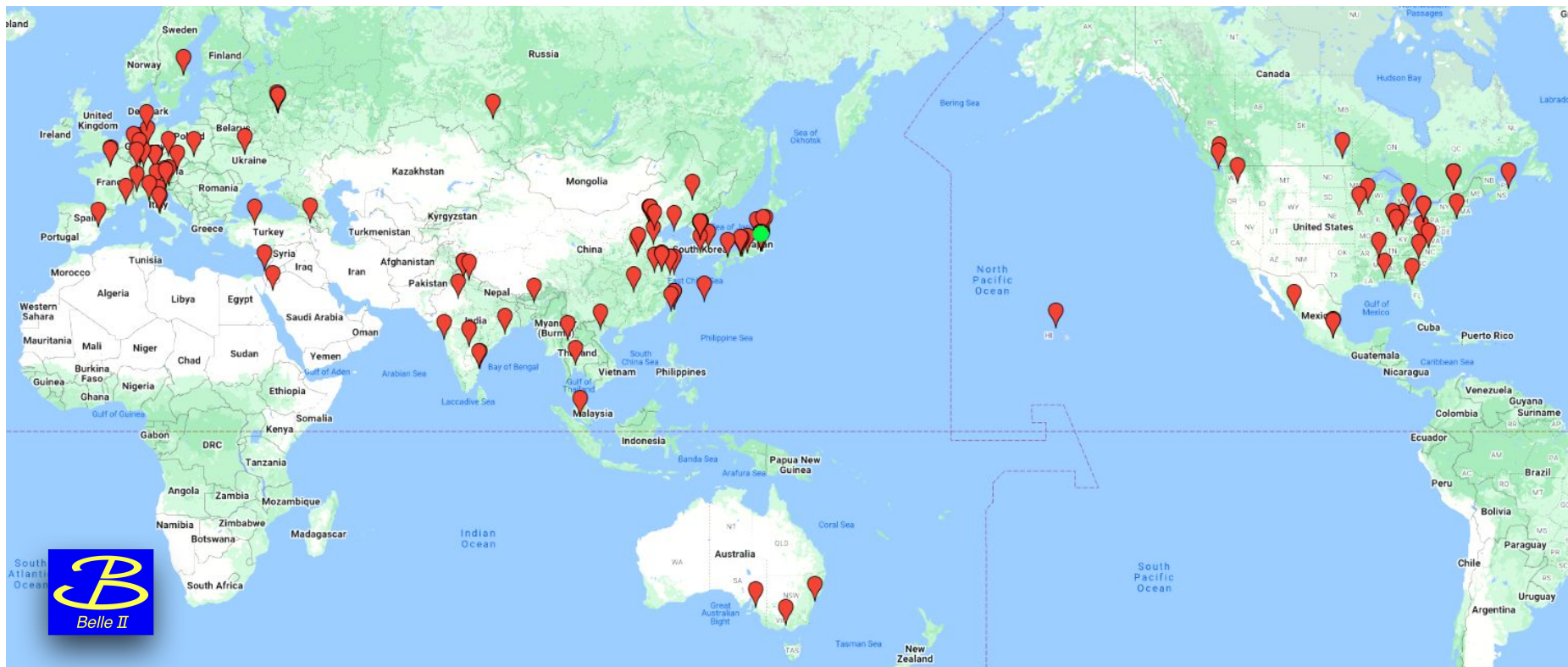# Belle II

Data Challenge 2024 Workshop
Dr. Silvio Pardi
CERN - 09 November 2023

The Belle II Experiment Overview
~1170 members, 122 institutions, 28 countries
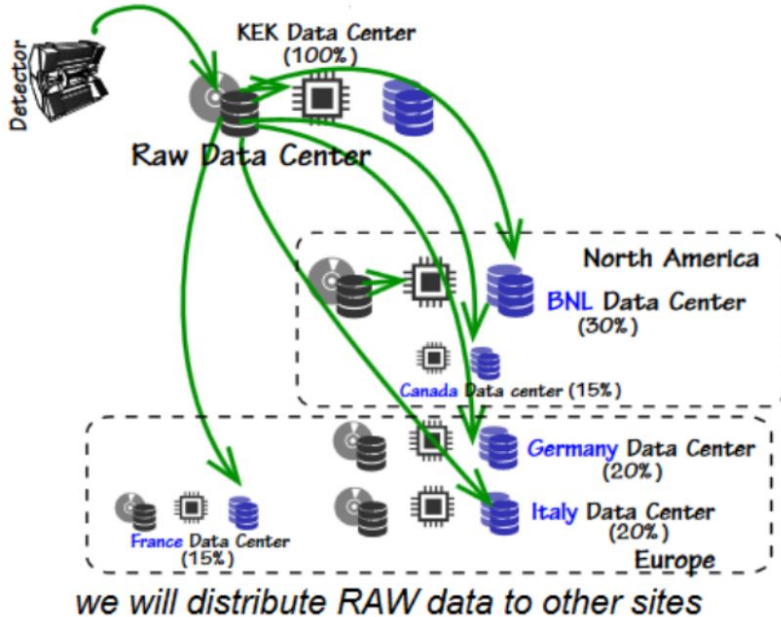
RAW Data Center

KEK Data Center (100%)

Detector

Raw Data Center

North America

BNL Data Center (30%)

Canada Data center (15%)

Germany Data Center (20%)

Italy Data Center (20%)

France Data Center (15%)

Europe

we will distribute RAW data to other sites

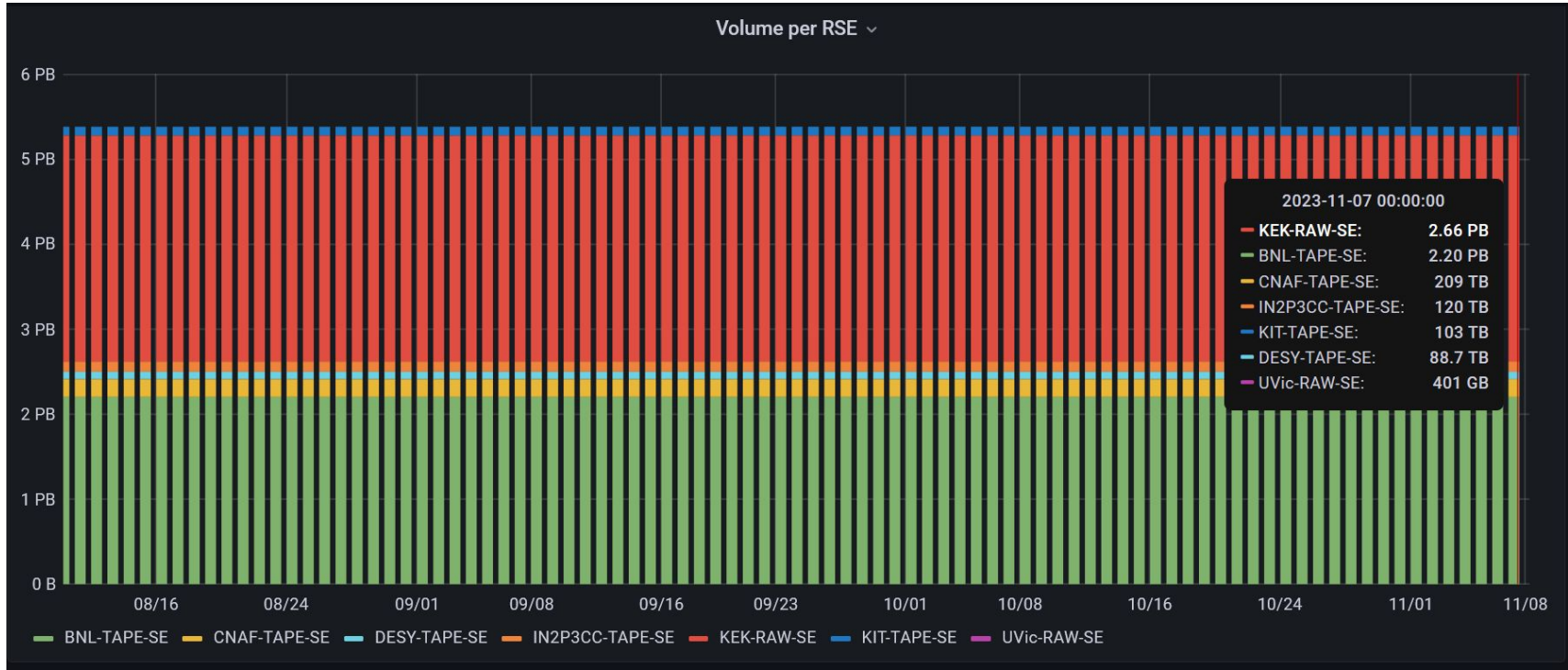Around 2.66PB of RAW Data collected since 2019

A full copy of RAW Data is stored at KEK Tier0, the secondary copy is distributed over the following RAW Data Centers according with the following nominal share:

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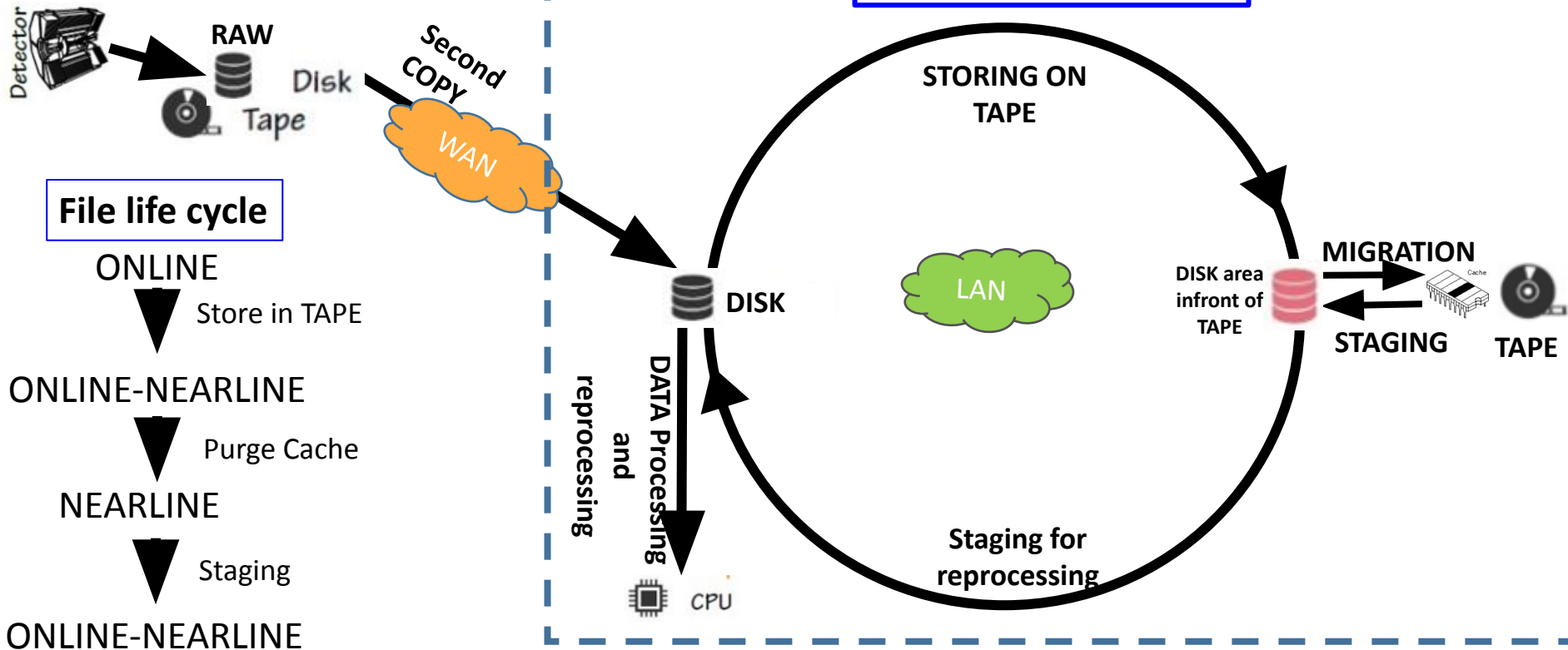- ○ DESY 10%
- ○ KIT 10%
- ○ IN2P3CC 15%
- ○ UVic 15%

Currently we are in Long Shutdown(LS1)

Belle II Status and Plan

RAW Data lifecycle at RAW Data Center

File life cycle

ONLINE
↓ Store in TAPE

ONLINE-NEARLINE
↓ Purge Cache

NEARLINE
↓ Staging

ONLINE-NEARLINE

RAW DATA CENTER

STORING ON TAPE

MIGRATION

DISK area infront of TAPE

STAGING   TAPE

Staging for reprocessing

DATA Processing and reprocessing

DISK

LAN

CPU

RAW Data lifecycle at RAW Data Center

File life cycle

ONLINE

▼ Store in TAPE

ONLINE-NEARLINE

▼ Purge Cache

NEARLINE

▼ Staging

ONLINE-NEARLINE

This part will be exercice during DC24

RAW DATA CENTER

STORING ON TAPE

LAN

DISK area infront of TAPE

MIGRATION

STAGING

TAPE

Staging for reprocessing

DATA Processing and reprocessing
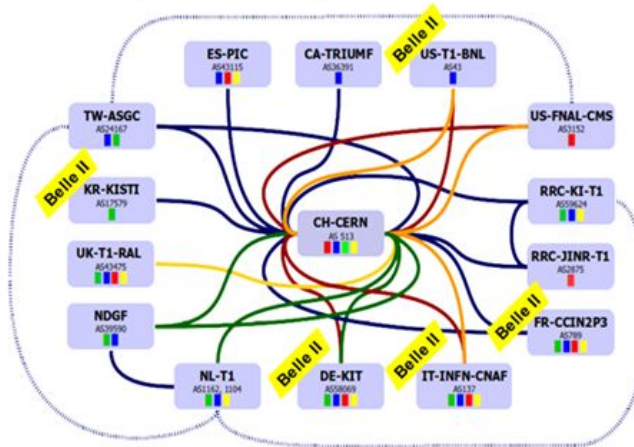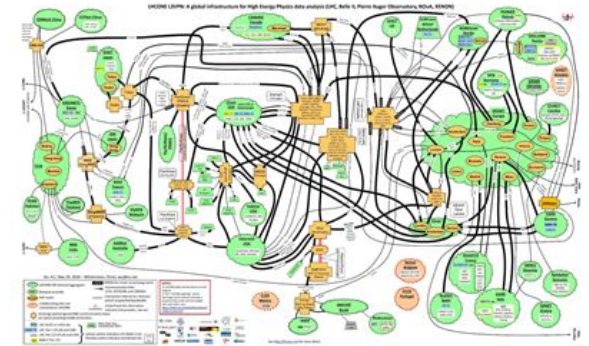
CPU

DISK

Second COPY

WAN

Belle II Network

**100G Global Ring
via SINET**

LHCOPN Optical
infrastructure that can
be used without
jeopardizing resources

LHCONE L3 VPN
Connecting all the major
Data Centres

Belle II Data Challenge 2024

What should be exercised during DC24:

Technology that can be stressed: Network, DDM (RUCIO server at BNL) 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.

● Hypothesis 1 - The target speed to achieved is 5x3.7Gbit/s = **18.5 Gbit/s**

● Hypothesis 2 - The target is sent **5x40TB in one day**, 5 times bigger than the expected amount of data

Secondary Tests

Packet Marking Test

Test the python-flowd library for packet marking with a set of storages. Interest to run the test from multiple site.

Other SITE to SITE transfers

- Could be interesting test BNL/IN2P3CC/CNAF/KIT traffic during WLGC Test because those traffic goes through LHCOPN
- Traffic vs other storages (i.e. Napoli and SIGNET)

WLCG Data Challenge 2024 - Schedule

October -Data Set Creation, Start site assessment.

November - Early test with FTS + Start activities to setup packet marking

December - Full topology definition, Test Rucio roules creation, basic test.

January - Second round basic test

February - Data Challenge Tests.

Site Involved

Belle II Tier 0

KEK

All the RAW Data Centers:

BNL

CNAF

DESY

KIT

IN2P3CC

UVic

In addition other sites can be involved for a set of secondary tests:

Napoli

SIGNET

Data Set Creation, site assessment.

A primary dataset of 8.000 of 5GB files for a total of 40TB has been created at KEK and registered in RUCIO.

SITE	Nomial Share %	Share (TB)	#5Gfiles	#10Gfiles
BNL	30	12.000	2.400	1.200
CNAF	20	8.000	1.600	800
KIT	10	4.000	800	400
DESY	10	4.000	800	400
IN2P3CC	15	6.000	1.200	600
Uvic	15	6.000	1.200	600
	100	40.000	8.000	4.000

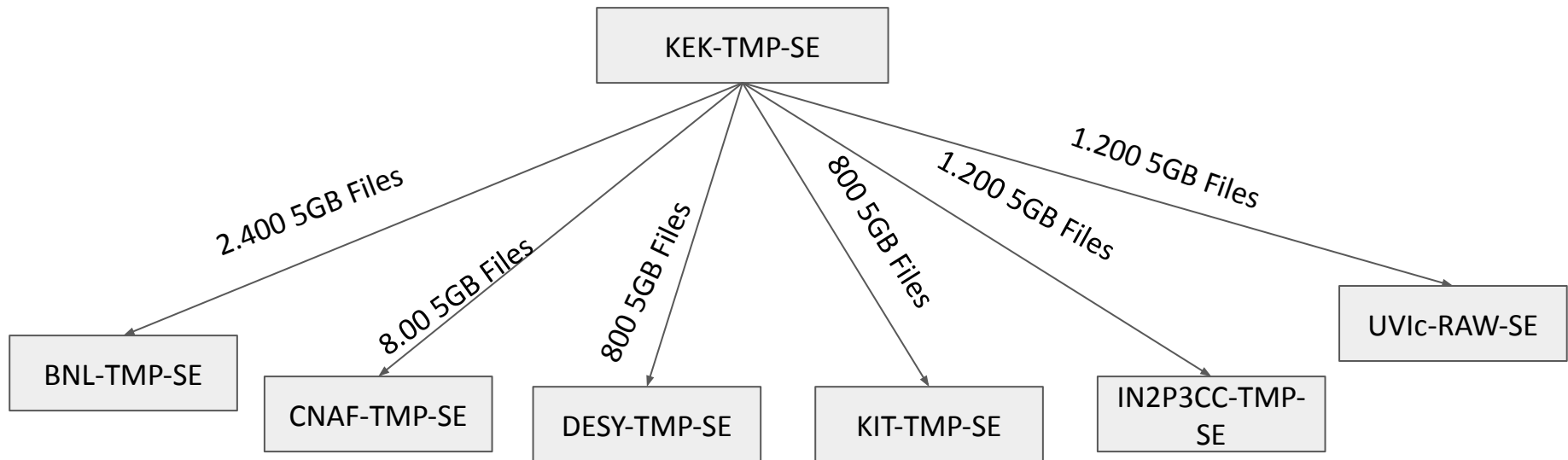A secondary data test with 10GB file could be created if needed.

The idea is to send and delete the same dataset multiple time up to 5.

Site assessment Ongoing

For the Data Challenge we will not exercice TAPE system, only DISK area

Site	Country	Technology	Storage Connection	WAN	PacketMarking	TOKEN Authentication
KEK	JP	STORM	Multiple WebDAV doors.	80Gb/s LHCONE 20Gb/s GenIP	TBD	TBD
BNL	US	DCACHE	3 WebDAV doors. Each door 2x25Gbps	300Gb/s (site report)	Interested	TBD
CNAF	IT	STORM	WebDAV doors, each 50 Gb/s	240Gb/s (shared)	Interested	Testing IAM configured
DESY	DE	DCACHE	Multiple WebDAV doors. Each door 2x10Gbps	100G to LHCONE	TBD	Testing IAM configured prod in configuration
KIT	DE	DCACHE	2 WebDAV doors. Each door 80Gbps	2x100G to GEANT 2x100G to CERN	Interested	TBD
IN2P3CC	FR	DCACHE	WebDAV door 10Gb/s	LHCOPN: 100Gb/s LHCONE:100Gb/s	Interested	Testing IAM configured
UIVc	CA	xrootd	1 door	10Gb/s (site report)	Interested	TBD
Napoli	IT	DCACHE	4 WedDAV doors. Each doors 25Gbps	100G to LHCONE 20G to General IP	Interested	TBD
SIGNET	SL	DCACHE	TBD	25Gb/s SIGNET 100Gb/s EuroHPC	TBD	TBD

Main Test Topology (RAW DC)

```
                         KEK-TMP-SE


   2.400 5GB Files                                        1.200 5GB Files

              8.00 5GB Files          800 5GB Files    1.200 5GB Files

                        800 5GB Files

                                                                      UVIc-RAW-SE
  BNL-TMP-SE
                CNAF-TMP-SE    DESY-TMP-SE    KIT-TMP-SE    IN2P3CC-TMP-
                                                              SE
```

Data Challenge Rate (average in 1 day)

Site	Country	#5G Files	Replica Factor	Total TB	Ingress (Gb/s)	Egress (Gb/s)
KEK	JP	8000	5,0	200	0,0	18,5
BNL	US	2400	5,0	60	5,6	0
CNAF	IT	1600	5,0	40	3,7	0
DESY	DE	800	5,0	20	1,9	0
KIT	DE	800	5,0	20	1,9	0
IN2P3CC	FR	1200	5,0	30	2,8	0
UIVc	CA	1200	5,0	30	2,8	0
Napoli	IT	TBD	TBD	TBD	TBD	TBD
SIGNET	SL	TBD	TBD	TBD	TBD	TBD

Early test with FTS in November

In november a set of early test with FTS will be performed to check the low level workflow.

Test will be done with a set of scripts developed at BNL and already run by Hiro for Atlas.

After we will run the test via RUCIO (script already available)

Packet marking.

Already started the investigation for run a set of test for packet marking using the python-flowd library.

Several sites are available to explore packet marking.

Some of the site already involved in the challenge at SC23

Monitoring Tools

Belle II Rucio Monitoring

https://monitoring.sdcc.bnl.gov/pub/grafana/d/belle2xfers/belle-ii-transfers-and-deletions?orgId=1

WLCG Grafana (show data from BNL/KEK FTS but some discrepancy has been compared with Rucio monitoring) https://monit-grafana-open.cern.ch/d/000000759/fts-transfers?orgId=16

GEANT/ESTnet/CANARIE monitor

NREN (checking with GARR if they may provides some dedicate view)

Summary

Belle II will join DC24 by exercising the main flow related to RAW Data Copy from KEK to RAW Data Center.

Other tests including additional traffic flow, Packet Marking and Token Based Authentication are under investigation.

Several activities are ongoing and almost in line with the designed scheduled.

Large effort which involve several people of the collaboration and from the site.

Thank you very much to every one!