

JENNIFER3

WP5 on Computing

JENNIFER3 Kickoff Meeting

Jan 27 – 28, 2025

IFAE - Barcellona

Dr. Silvio Pardi for the Computing Group

Rationale

During the JENNIFER2 project, high value synergies were established among the computing groups of Belle2, T2K and Hyper-K.

A set of common tools has been defined and implemented by the experiments in their respective computing models.

This work has created several opportunities to extend the successful experience. Two main topics could be addressed in the context of the JENNIFER3 project:

- Cloud Technologies
- Networking

Involved People

Sophie King

Silvio Pardi

Nick Prouse

Mathieu Guigue

Marcko Bracko

Cristiano Bozza

Milestones for Jennifer3

Two main topics for Task 5.1 and Task 5.2

- Cloud Technologies
- Network Data Challenge

Milestones

D.5.1 Organization of a workshop on the usage of cloud computing technologies in the context of Belle II, T2K and Hyper-K (month 24)

D.5.2 Report on the joint Data Challenge Session testing the network links from Japan to the main EU Data Centres involved in Belle II and Hyper-K (month 36)

Task 5.1 Cloud Technologies

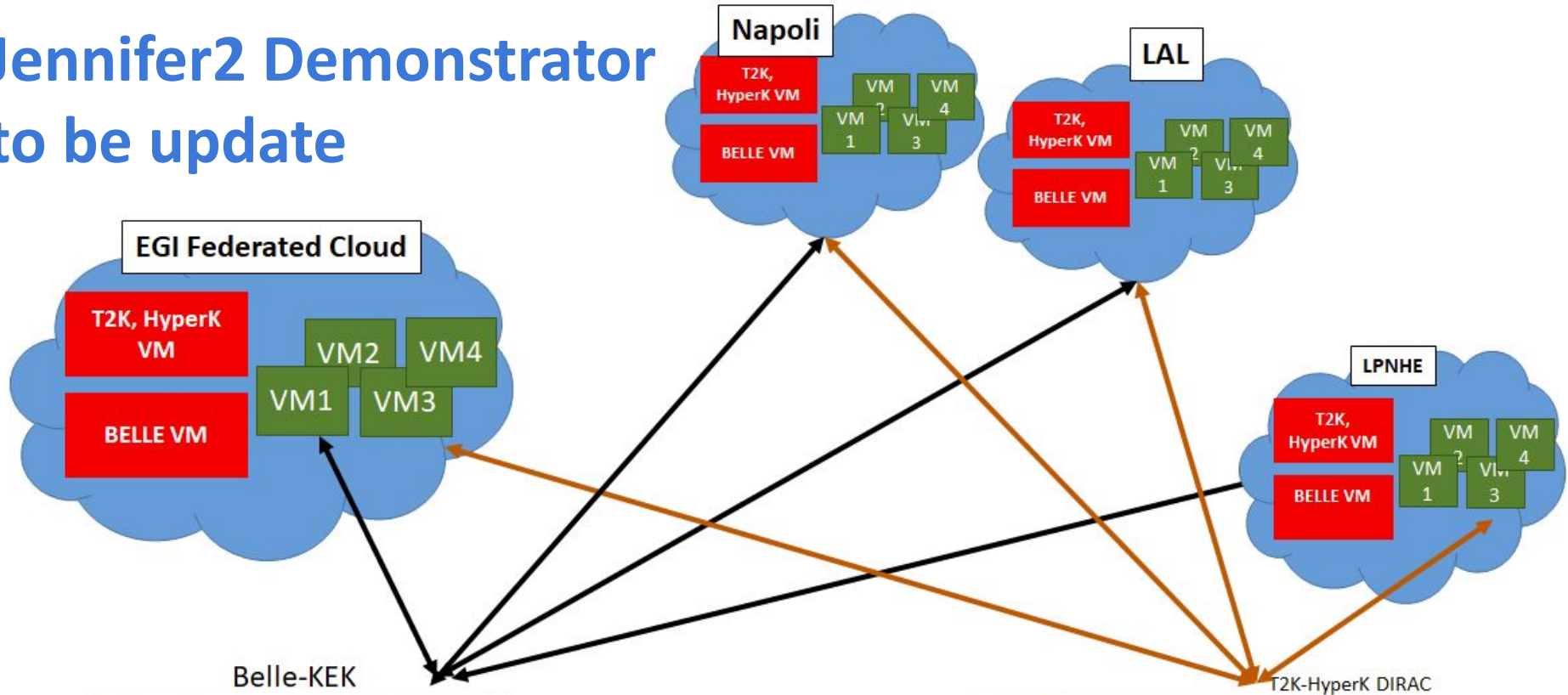
Investigate Cloud Computing for Analysis and MC

Study how to exploit the Cloud technologies by integrating resources, in a stable way, into the computing model of three experiments, Belle II, T2K and Hyper-K.

This can be done through the implementation of a common interface such as the DIRAC Cloud Computing Element, for integration of virtual machines into the MC factory and for testing the PaaS/SaaS services offered by INFN and CNRS Clouds.



Jennifer2 Demonstrator to be update



Job ID	Name	Status	Priority	Age	Time	Cost	VMs	CPUs	Mem	IO	Network	Storage	Other
12345	job_12345	Running	Normal	10m	1000s	1000000	4	4	16GB	100MB/s	100MB/s	100MB	
12346	job_12346	Running	Normal	10m	1000s	1000000	4	4	16GB	100MB/s	100MB/s	100MB	
12347	job_12347	Running	Normal	10m	1000s	1000000	4	4	16GB	100MB/s	100MB/s	100MB	
12348	job_12348	Running	Normal	10m	1000s	1000000	4	4	16GB	100MB/s	100MB/s	100MB	
12349	job_12349	Running	Normal	10m	1000s	1000000	4	4	16GB	100MB/s	100MB/s	100MB	

CLOUDS WORKS WITH TWO DIRAC WITH THE SAME VCYCLE SYSTEM NOW IN END OF LIFE

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12345	job_12345	Running	Normal	10m	1000s	1000000	4	4	16GB	100MB/s	100MB/s	100MB	
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12349	job_12349	Running	Normal	10m	1000s	1000000	4	4	16GB	100MB/s	100MB/s	100MB	

Cloud Technologies

The usage of Cloud for Code Testing/Development or Analysis is another hot topic in high energy physics.

A discussion could be open on the possible usage of PaaS/SaaS service.

Some interesting technologies: JupyterHub, Dask, Kubernetes, Cluster service on demand, distributed database application.

Possibility to make synergy with other tasks of WP5

Cloud Resources

INFN Cloud - PaaS Infrastructure

Napoli Open Stack Infrastructure

LPNHE Open Stack Infrastructure

EGI Federated Cloud - IPHC Open Stack Infrastructure

Task 5.2 Networking

A Joint Network Data Challenge:

The goal of this task is to test the speed of the international networks links connecting Japan vs EU institute, assess the efficiency and stability of the data management tools. It will be done by performing a set of joint stress tests sending data from storage to storage from the sites in Japan to the European-based Belle II and Hyper-K data centres such as CNAF, CC-IN2P3, DESY, KIT, SIGNET, NCBJ, Napoli and RAL.

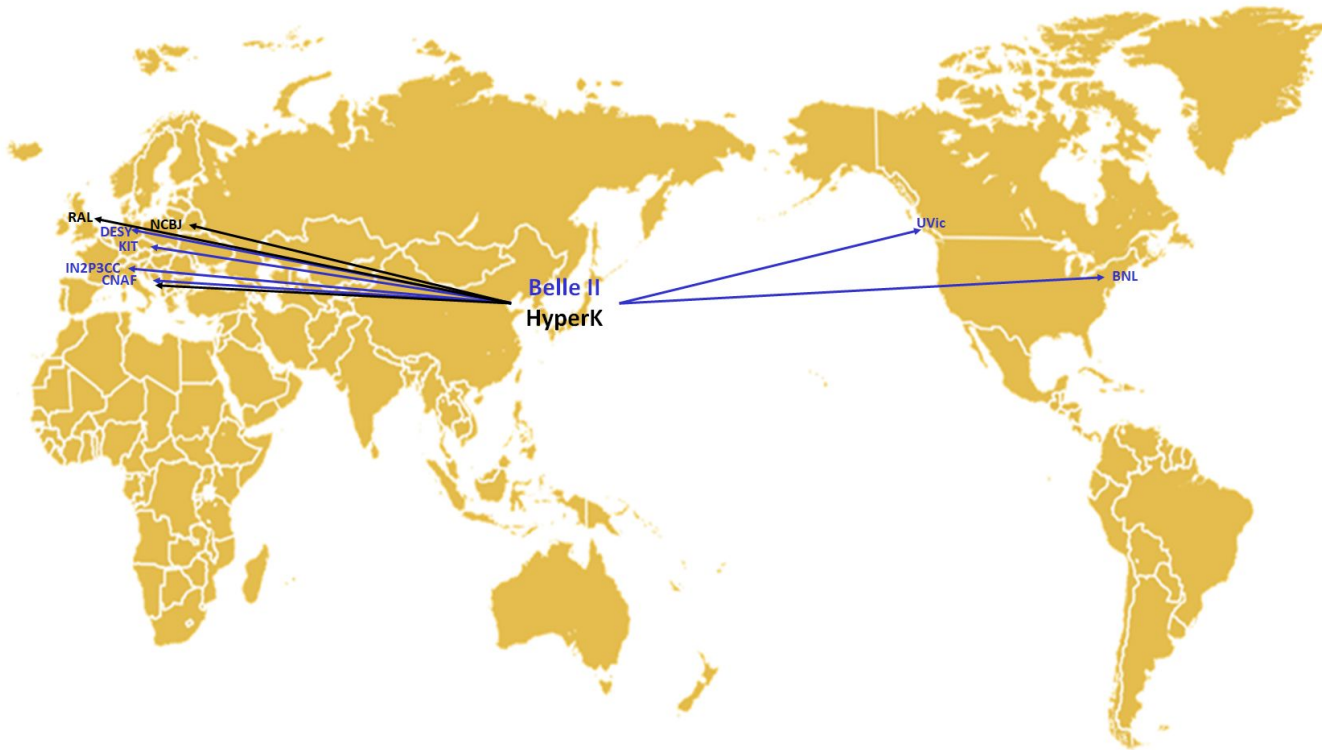
A set of common tools will be used to monitor the network links and the performance will be compared with the estimated requirements of the two experiments.

WLCG Data Challenge

- WLCG has mandated to execute data challenges (DC) for HL-LHC
 - Demonstrate readiness for expected HL-LHC data rates by a series of challenges
 - Increasing volume/rates
 - Increasing complexity (e.g. additional technology)
 - A data challenge roughly every two years
- DOMA is the coordination and execution platform
 - Data Organization Management & Access
 - Forum across all LHC experiments to address **technical** challenges
 - DC coordination across the LHC experiments and beyond
 - Suited dates
 - Reasonable targets
 - Functionalities
 - Help in orchestration
- No pressure on sites to increase their capacity
 - But can we improve the existing infrastructure?

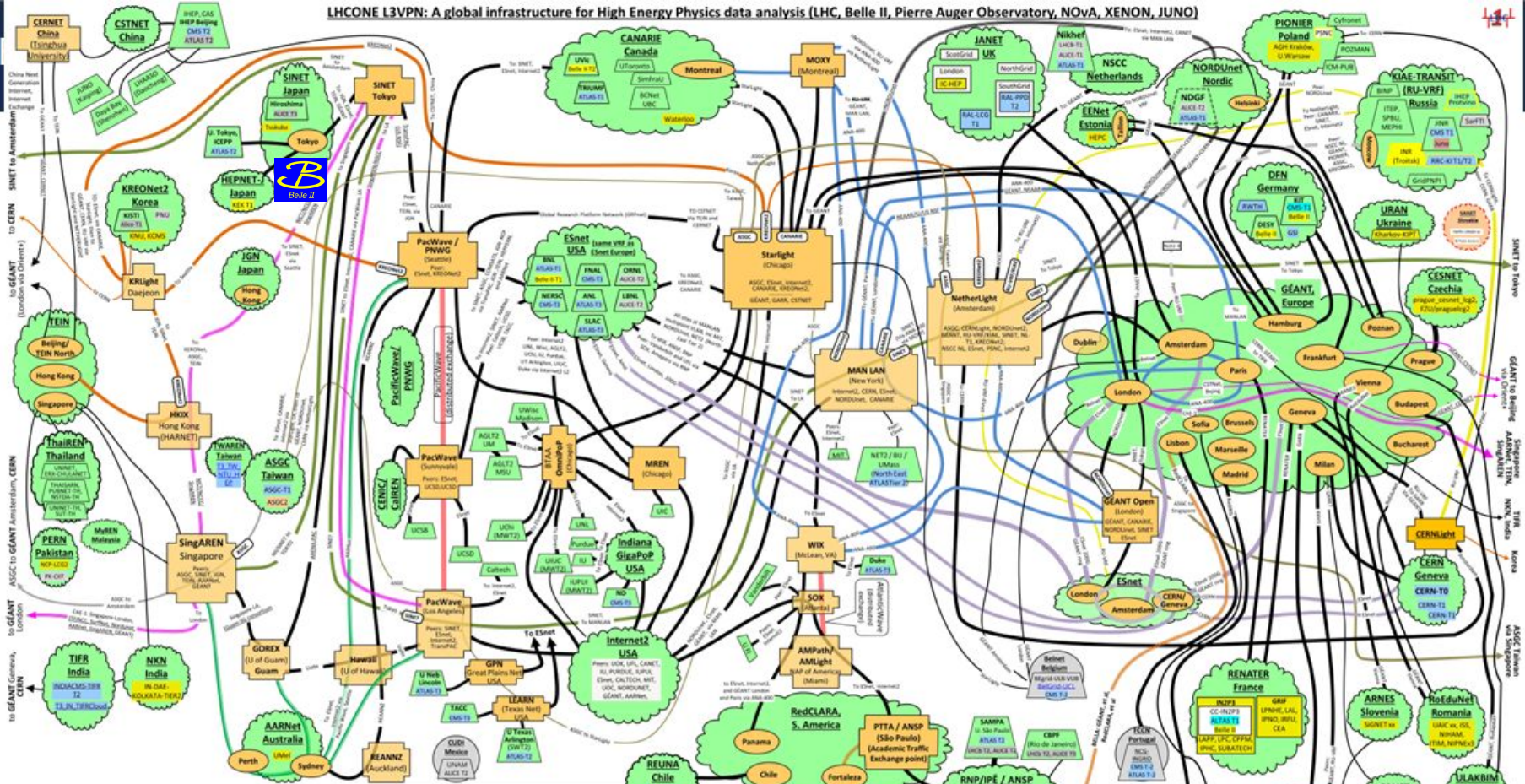
Year	% of HL-LHC
2021	10%
2024	25%
2027	50%
2028?	100%

Belle II and Hyper-K in DC27



The idea is to organize a joint Belle II/Hyper-K data challenge session and integrate these tests within the context of WLCG DC27. This will involve stressing the specific network links connecting Belle II and Hyper-K sites to Japan, concurrently with the traffic generated by LHC experiments.

LHCONE L3VPN: A global infrastructure for High Energy Physics data analysis (LHC, Belle II, Pierre Auger Observatory, NOVA, XENON, JUNO)



LHCONE Map Ver. 6.0, 2022-11-15 – WEJohnston, ESnet, wej@es.net

- Color coding:**
 - Green: LHCONE VRF domain/aggregator
 - Orange: Connector network – providers, e.g., an L2 path between VRFs.
 - Blue: Provider network PoP router
 - Grey: WLCG sites that are not connected to LHCONE
 - Yellow: Exchange point
- Line styles:**
 - Solid line: NREN/site router at exchange point
 - Dashed line: Communication links: 1/10, 20/30/40, and 1000Gb/s or N x 100G
 - Double dashed line: Underlined link information indicates link provider, not use
 - Double dash outline: Indicates distributed site
 - Circle with dot: Future site
- International infrastructure by provider/collaboration:**
 - Black: Various
 - Green: AARNet
 - Blue: GEANT
 - Red: SINET, Japan, global
 - Orange: ASGC, Taiwan
 - Yellow: ESnet transatlantic
 - Purple: NICT/NCCC/SingAI
 - Light Blue: ANA-300/400 – Vari
 - Dark Blue: GEANT, Internet2, NORDUnet, SURFnet, SINET/JUNO/NSF
 - Light Green: SINET
 - Light Blue: NORDUnet

From LHCONE to Multi-ONE

ICONE are shown on this diagram "Interpreting the LHCONE Map" at <https://www.icecube-wiki.org/wiki/ICONE> is a breakdown of the peering between their VRF and KJAE, as well as their connection to the LHCONE map.

WLCG Next Data Challenge 2027

The New WLCG Data challenge Campaign is under organization by WLCG

As Hyper-K is working to define which storages can be involved in the test

As Belle II already joined the DC24, for the DC27 will define new additional paths to test and will take the opportunity to test token based authentication.

Plans for Task 5.1 and Task 5.2

Kick-off meeting for the computing activities, probably in remote.

For the first milestone we will start the activities on cloud, also we will select a set of topics to bring in the Workshop and start to think in which place organize the event.

For the Data Challenge we will start to involve people, define the sites and the resources to be used and start to figure out how to organize a set of pre-test of incremental difficulty.

Backup

Belle II Data Challenge 2024

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 $3 \times 3.7 \text{ Gbit/s} = \mathbf{11.1 \text{ Gbit/s}}$
- Max - The target speed to achieve is $5 \times 3.7 \text{ Gbit/s} = \mathbf{18.5 \text{ Gbit/s}}$