Jennifer2 II Computing WorkShop - Task 5.1

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20 February 2024
Dr. Silvio Pardi on the behalf of Computing Group

INFN NAPOLI

JENNIFER 2

EU grant n.822070

Introduction

Belle II, T2K and Hyper-K are three large experiments who have experimental facilities located in Japan, working on the exploration of particle physics, searching for signals of new physics within flavour physics and neutrino physics respectively.

The tree collaborations are working together in the context of project JENNIFER2 funded under the Horizon2020 program of the European Union as a Marie Sklodowska Curie Action of the RISE program, under grant n.822070.

One of the goal is to exploiting computing and data handling technologies for the three experiments.

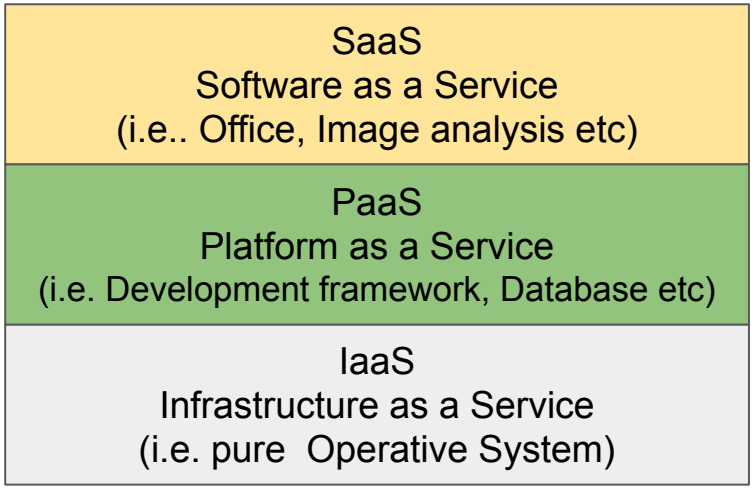
Demonstrator Startup

In order to define a set of common tools, the computing models of the three experiments were first thoroughly examined as follow during the first computing workshop at CERN 12 December 2019.
https://agenda.infn.it/event/20616/

As outcome of the event we decided to setup a common Cloud Computing infrastructure for the three experiments based on VCYCLE.

Cloud Computing

Cloud Computing is a technologies for resource provisioning under the paradigm of virtualization.



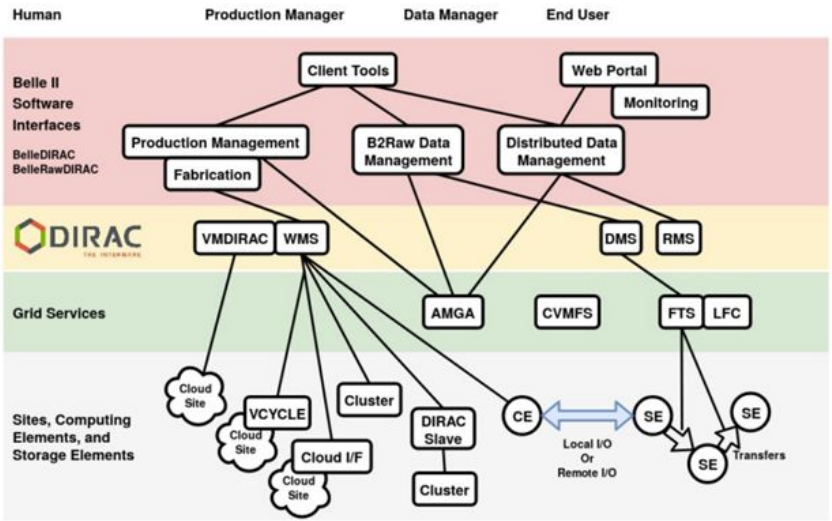
https://csrc.nist.gov/publications/detail/sp/800-145/final

DIRAC Framework for Belle II, T2K, HyperK

DIRAC is a framework for data and workload management. It enable users to submit jobs and retrive data over different computing resources distributed everywhere.
The three experiments Belle II, T2K, HyperK use DIRAC to perform MonteCarlo simulations, analysis, skimming over the GRID.

Through DIRAC is possible to send job vs several kind of resources via GRID interface, SSH, and cloud as well.

DIRAC
THE INTERWARE



M. Bračko, Jennifer2 CompWS, CERN, 2019/12/12

VCYCLE for Jennifer2 demonstrator

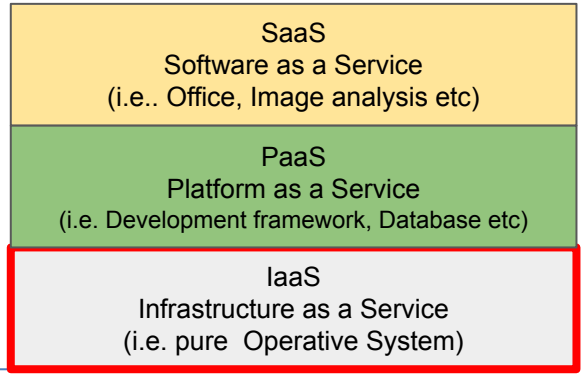
VCYLCE is VM lifecycle manager developed by GRIDPP, it is designed to create VMs on Cloud endpoints offering EC2, Openstack or Azure interface.

VCYCLE can be easily integrated in DIRAC and the accounting system is compliant with APEL. VCYCLE is uses in production by CERN experiment LHCb. It works at IaaS level

VCYCLE has been selected to be used as interface

for the Jennifer2 demonstrator

https://www.gridpp.ac.uk/vcycle/

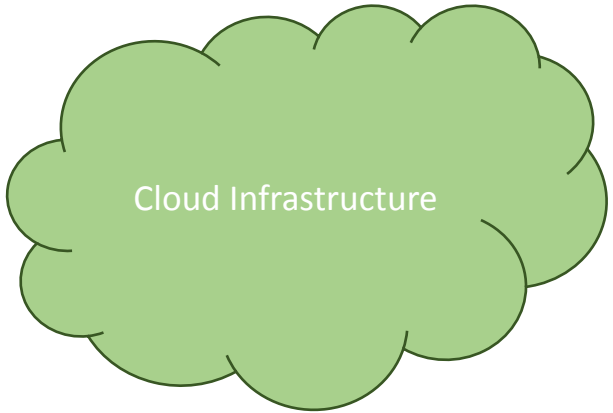


How VCYCLE works

VCYCLE VM FACTORY SERVICE

HTTP CONTEXTUALIZATION ENDPOINT

HTTP ENDPOINT FOR LOGGING



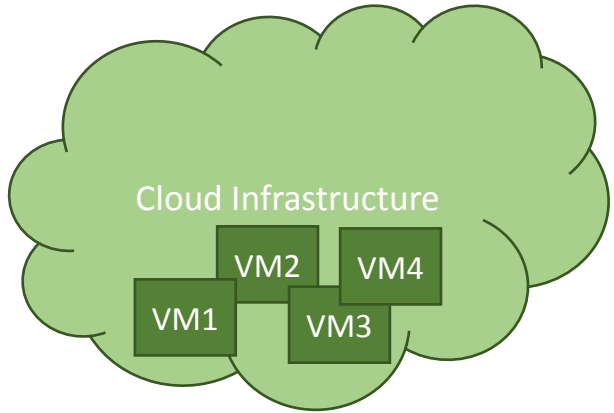
DIRAC SERVER

Belle II, T2K, HyperK User

How VCYCLE works

VCYCLE VM FACTORY SERVICE

VM Factory ask for create a VM over a cloud where he has an account and privileges to run



HTTP CONTEXTUALIZATION ENDPOINT

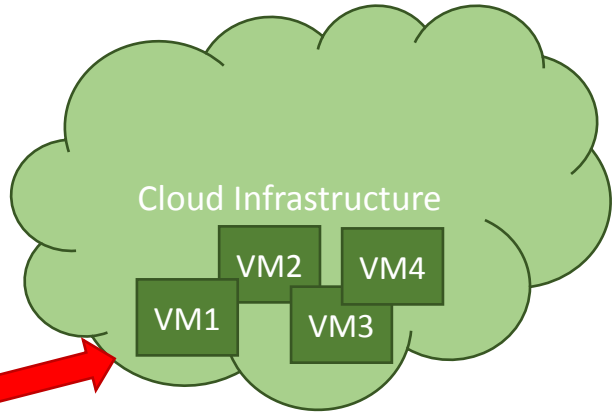
HTTP ENDPOINT FOR LOGGING

DIRAC SERVER

Belle II, T2K, HyperK User

How VCYCLE works

VCYCLE VM FACTORY SERVICE



HTTP CONTEXTUALIZATION ENDPOINT

FILES DOWNLOAD

At Boot time the VM1 Download the contextualization script and additional files needed to run a pilot job.

HTTP ENDPOINT FOR LOGGING

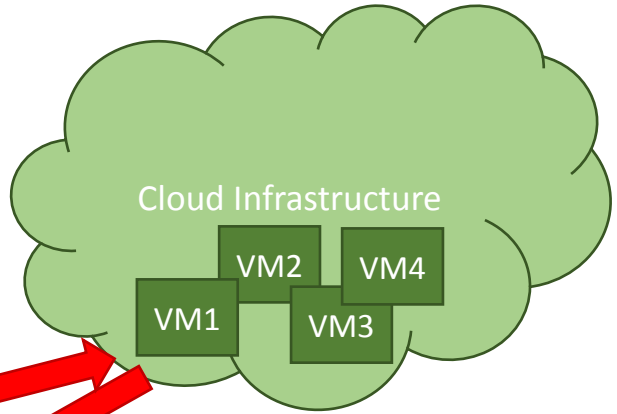
DIRAC SERVER

Belle II, T2K, HyperK User

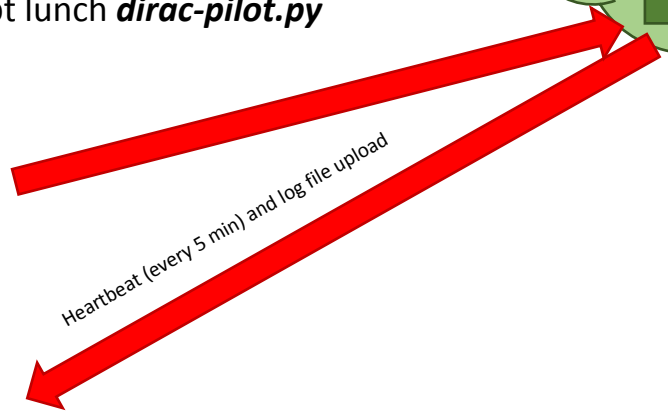
How VCYCLE works

VCYCLE VM FACTORY SERVICE

VM executes the ***user-data*** script that contextualize the machine, create the environment.
Then start to log on the http endpoint for logging.
The last command of the user-data script lunch ***dirac-pilot.py***



HTTP CONTEXTUALIZATION ENDPOINT

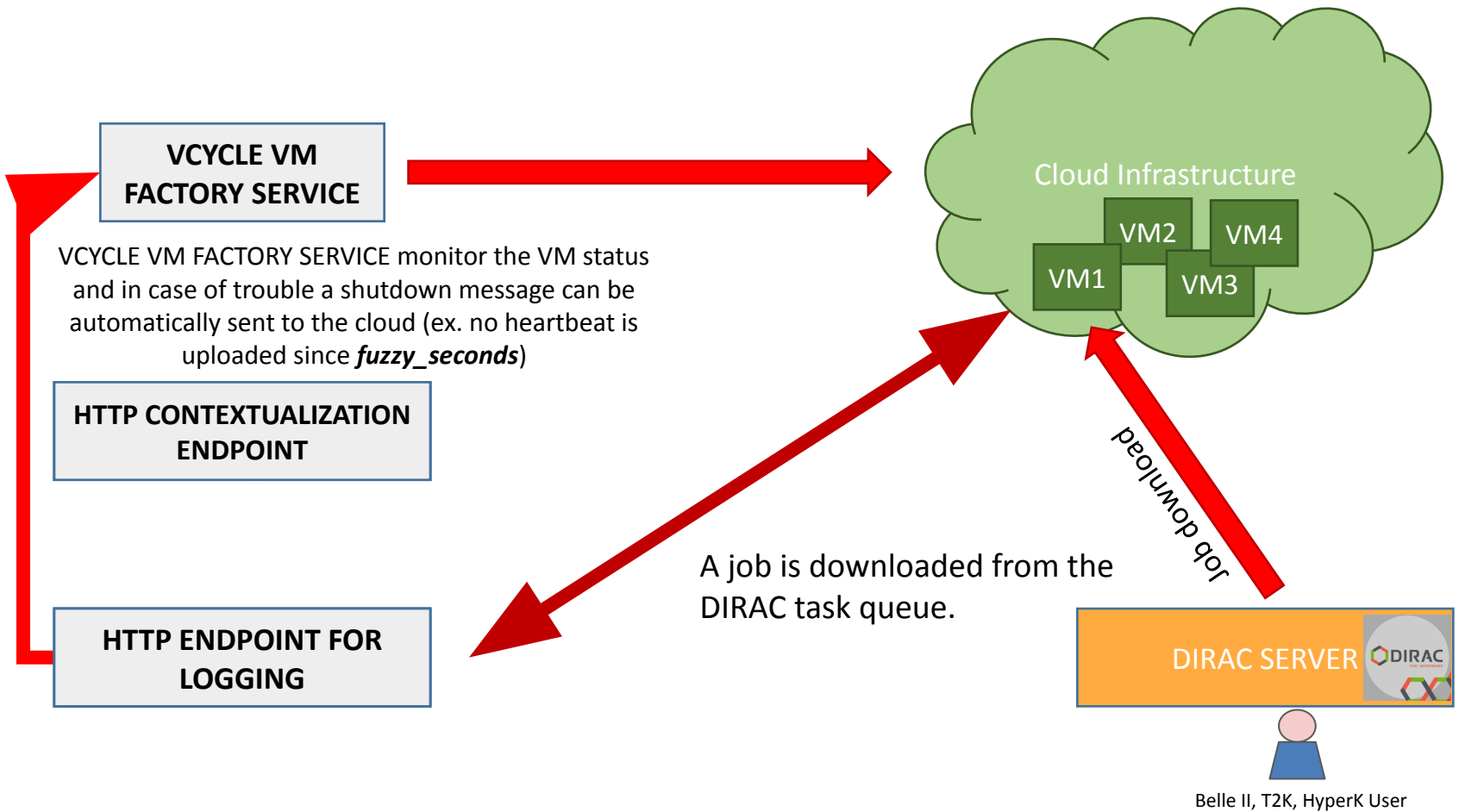


HTTP ENDPOINT FOR LOGGING

DIRAC SERVER

Belle II, T2K, HyperK User

How VCYCLE works

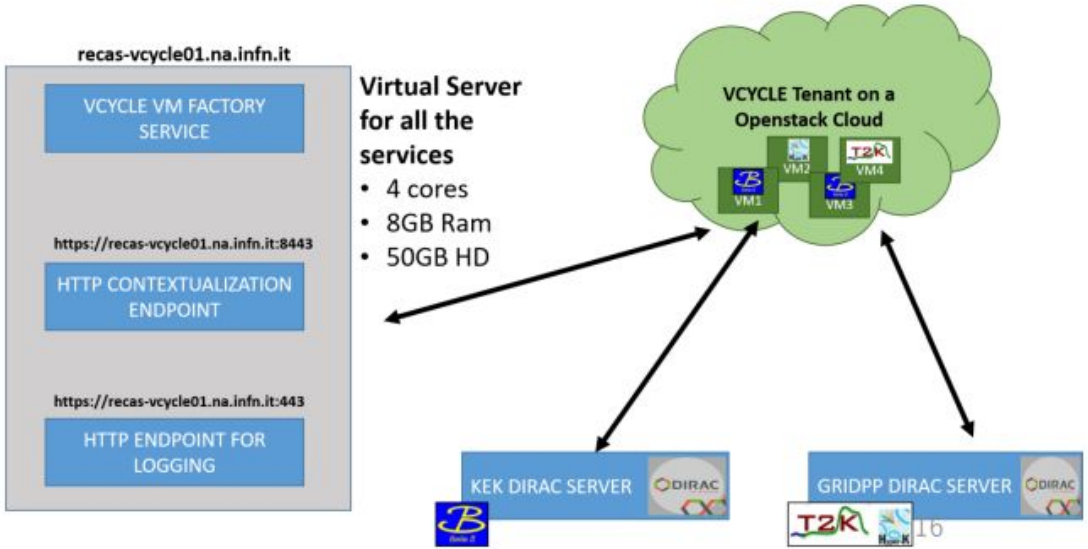


Jennifer 2 Cloud Demonstrator

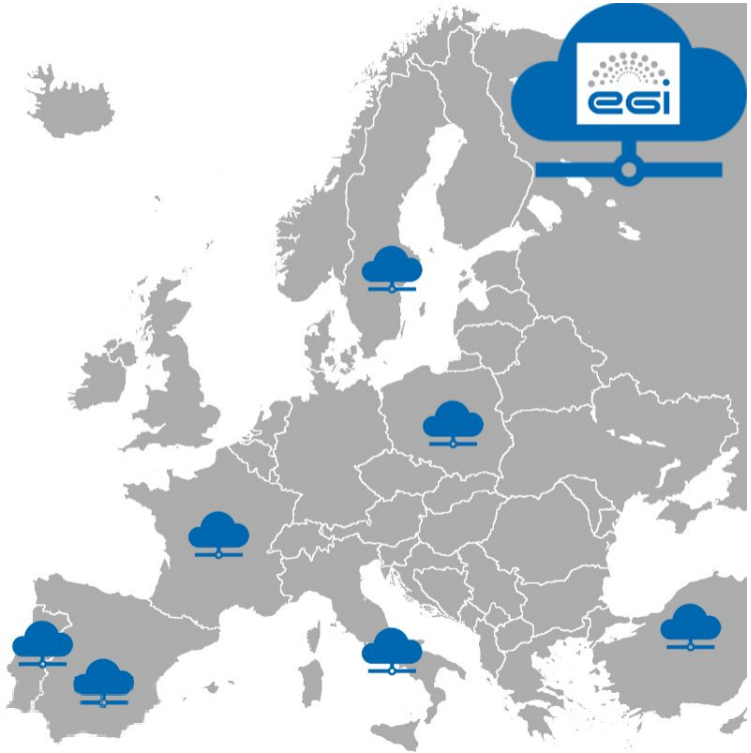
For the Jennifer2 demonstrator we created a single VCYCLE service infrastructure and we attached it to Different Openstack Clouds using a standard local account:

- LAL
- LPNHE-GRIF
- Napoli

We setup two profiles one for Belle II DIRAC, and one for T2K and HyperK DIRAC



EGI Federated Cloud



In order to expand the number of resources that the two community can use, we exploit the possibility to use the Federated Cloud of EGI (The European Grid Infrastructure)

In consist of a set of Cloud Endpoints distributed in several European Countries, glued together with the EGI Federation Tools.

EGI Federated Cloud

In order to use EGI resources several steps are needed:

- Join a community
- Share the golden VM image via EGI Tools
- Integrate EGI Interface (based on Token Authentication) in VCYCLE

Token Based Authentication

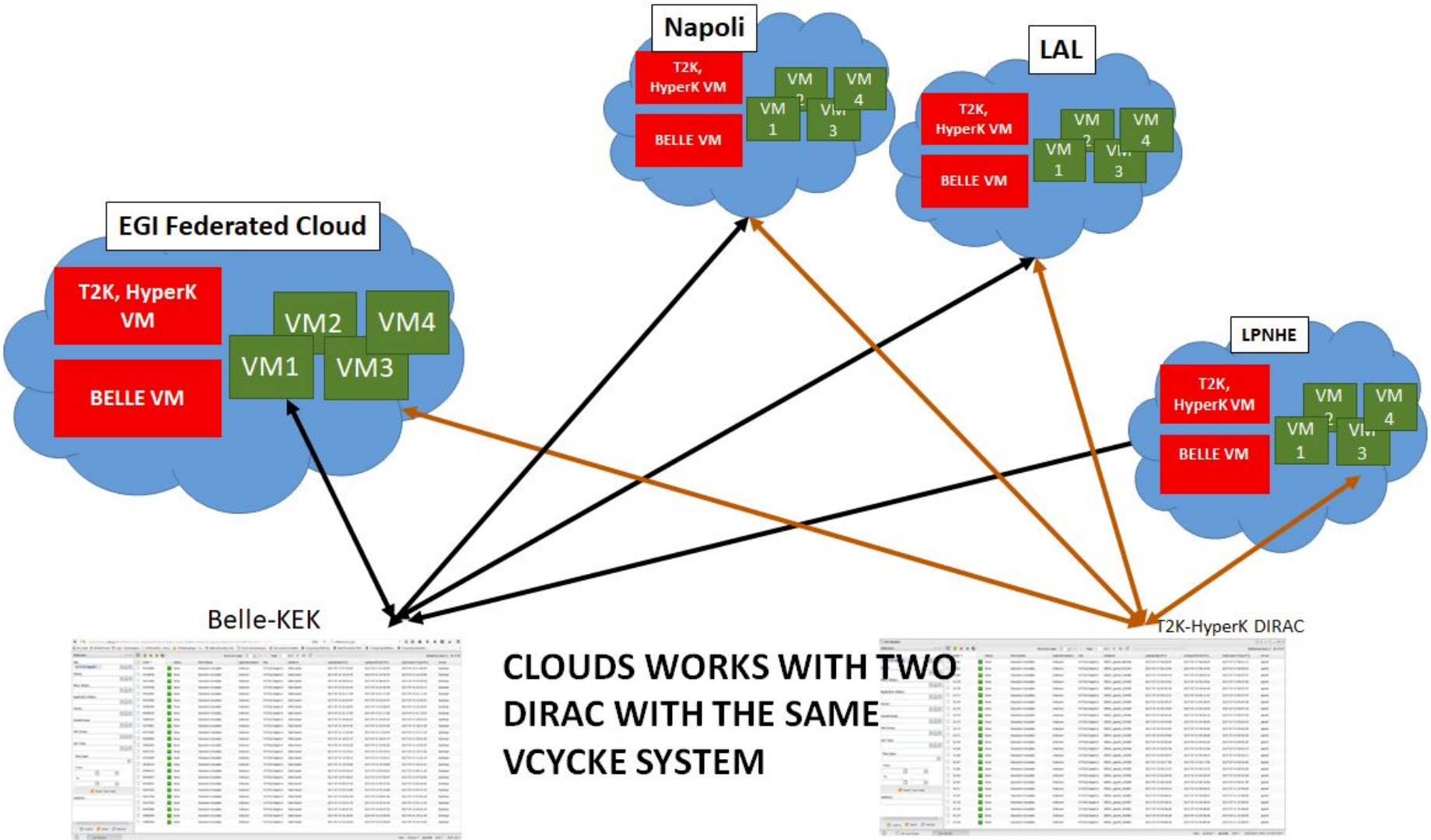
```
# Authentication for EGI FedCloud
 if self.egi_project_id:
  vcycle.vacutils.logLine('Auth with EGI Token')
  access_token = refresh_access_token(self.egi_checkin_client_id,self.egi_checkin_client_secret,self.egi_checkin_refresh_token,self.egi_checkin_url)
  vcycle.vacutils.logLine('EGI Access token created')
  ep = find_endpoint("org.openstack.nova", site=self.egi_site).pop()
  os_auth_url = ep[2]
  self.egi_token, _ = get_scoped_token(os_auth_url, access_token, self.egi_project_id)
  vcycle.vacutils.logLine('EGI scoped token created' + ' project  ' + self.egi_project_id )
  jsonRequest = { "auth": { "identity": { "methods" : ["token"],
                                "token": { "id": self.egi_token }},
                   "scope": {"project": {"id": self.egi_project_id }}
                  }
          }
```

Add EGI Federated Cloud Resources

VCYCLE has been expanded with a new authentication method. In the EGI testing environment we have access to three Openstack endpoints which are:

- CESGA
- IFCA LCG2
- INFN Catania

After a stress test phase, a stable cloud infrastructure has been integrated in the Jennifer2 demonstrator, provided by IN2P3-IRES institute which dedicated a set of resources for the project.



CLOUDS WORKS WITH TWO DIRAC WITH THE SAME VCYCKE SYSTEM

Cloud Demonstrator

EGI Conference:
https://indico.egi.eu/event/5000/contributions/14307/attachments/13236/16166/JENNIFER2-Demonstrator-Full-Presentation.pdf

The 11th International Conference on Engineering Mathematics and Physics (ICEMP22): http://www.icemp.org/

- Best presentation awarded
- Proceeding on *International Journal of Applied Physics and Mathematics*

Conclusions

The collaboration between the three experiments, T2K, Hyper-K and Belle II has been very successful and the milestone of the task 5.1 has been achieved.

This enables to integrate into their respective computing infrastructures, new cloud resources using a set of common tools and a shared Virtual Machine Manager system hosted in Napoli.

In addition, the development of the new authentication interface for VCYCLE enables it to expand the demonstrator over the EGI Federated Cloud, increasing the amount of opportunistic resources available for the collaborations.

This is the result of synergies created thanks to the JENNIFER2 initiative and will be the base for the next initiative JENNIFER3

THANK YOU FOR YOUR ATTENTION