

**iTHEPHY**  
Innovative Team - Teaching  
for Physics

# The iTHEPHY project and its software platform

Enhancing remote teacher-student collaboration



Istituto Nazionale di Fisica Nucleare



ALMA MATER STUDIORUM A.D. 1088

**UNIVERSITÀ DI BOLOGNA**

CNAF Bologna

# Agenda



**01**

## **iTHEPHY EU funded Project**

Originating idea and project development

**02**

## **ISHEP Cargese school and TANDEM Project**

Practical implementation

**03**

## **IaaS ICT e-learning platform**

ICT infrastructure

**04**

## **PaaS migration and software maintenance**

New ideas for next steps

Co-funded by the  
Erasmus+ Programme  
of the European Union



**iTHEPHY**  
Innovative Team - Teaching  
for Physics

Project funded by the European Community / AGENZIA NAZIONALE INDIRE  
Budget: **368990** euro - Coordinator: **UNIBO** - PI: Angelo Carbone

Who is funded?

universities  
research Institutions  
industries

Aim?

improve the teaching quality  
increase the collaboration among European institutions  
promote the usage of information technologies tools  
ensure education and research are mutually reinforcing  
promote internationalization and mobility

KA2 - Cooperation for Innovation and the Exchange of Good Practices  
KA203 - Strategic Partnerships for Higher Education



The idea to apply for this project started after 3 years of collaboration between Bologna, the University of Dortmund and the University of Clermont-Auvergne

Three editions (2015/16/17) of the ISHEP spring school (Cargese, Corsica) for students enrolled in the master degree of the three universities (and PhD students)

We also received funding for 15k euro from the Franco-German University for the Spring School and for the 2017 and 2018 editions

The project is also co-funded (about 20k euro) by the University of Bologna to include non-EU students

**tu** technische universität dortmund



**UCA**  
UNIVERSITÉ Clermont Auvergne

**IN 2 P 3**

INSTITUT NATIONAL DE PHYSIQUE NUCLÉAIRE  
ET DE PHYSIQUE DES PARTICULES



The consortium: a synergy between Universities and research institutions

# iTHEPHY project



## Main idea:



Team of students (2<sup>nd</sup> year of master degree) from each university to work together to a real research project

Each team will be supervised by a teacher/researcher from the consortium

## Goal:



Increase the internationalization level of the master degree

Give to the students team-work skills

Promote international mobility



## The project foresees 3 Intellectual Outputs:

Guided exercises with solution to be implemented on e-learning platform

**exercise with full and partial solutions**

A web-based platform to support the team during the project

**Video web-conference plugin**

**Chat room**

**Shared area**

**Scheduler/agenda for planning meetings between teachers and students and between students**

**A project management tool for tracking projects, assigning sub-tasks and tracking their progress...**

A final document that reports the experience with the aim of replicability of the project in other master degrees (not only in physics)



# Summer/Spring Schools (Cargese, Corsica)

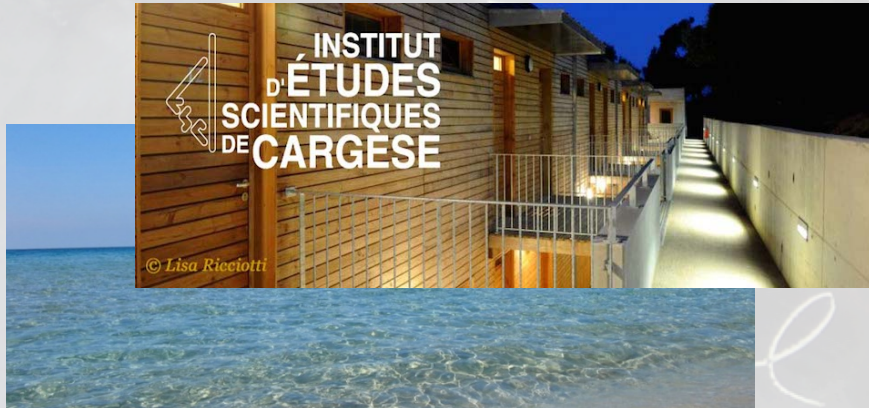


We received funds for the organization of two editions of the International School of High Energy Physics (ISHEP)

2018-edition focused on testing the new e-learning materials developed and the new web-based platform

2019-edition dedicated to present results of the teams (tandem). Students and supervisor meet in person to develop the project

Both schools included lectures and seminars



# Summer/Spring Schools: new models for physics teaching

Introduction and Theory

## Analysis strategy in the $H \rightarrow \gamma\gamma$ channel:

Selection:

- trigger
- diphoton vertex
- light and isolated photons

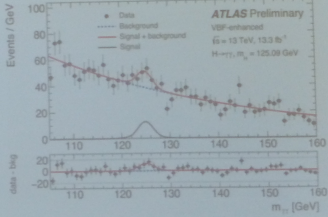
- $m_{\gamma\gamma} \in [105, 160] \text{ GeV}$
- $p_T$  cuts

Discriminative variable  $m_{\gamma\gamma}$

Backgrounds:

- continuum background
- SM H backgrounds

Define limits based on  $m_{\gamma\gamma}$



ATLAS-CONF-2016-067

Chröder (TU Dortmund) BCD ISHEP '17 April 5th, 2017 3



# TANDEM: What's all this about?

The idea of the whole project is to allow students to “emulate” what researchers do in their activity *in an international context*

What are the ingredients to perform a research program?

**Project:** an idea which will be developed and transformed in something “real”

**Target:** a starting date and a completion date

**Timeline:** organize a calendar, considering all the intermediate steps, indicating when it's time to show preliminary results to other colleagues, to your supervisors etc

**Document:** product where you describe the details of your method, what you did and what you obtained

**Present final results** to an international conference: the students have this possibility.

It will be the **ISHEP school** in Cargese...



# Tandem project in practice

But the students are not (yet) real researchers! They are (still) students... and by the way this a teaching activity, not a real research, so they need:

**Supervisors**, which will guide them in the various steps of the project

**Tools**, which will allow them to communicate, exchange files, material, documents... ideas

They will not see results published on Nature, but they will see results transformed in **ECTS credits**, after a formal examination

Last year **16+2 students** were on board:

10 from Unibo, 4 from CF, 2 from TUD

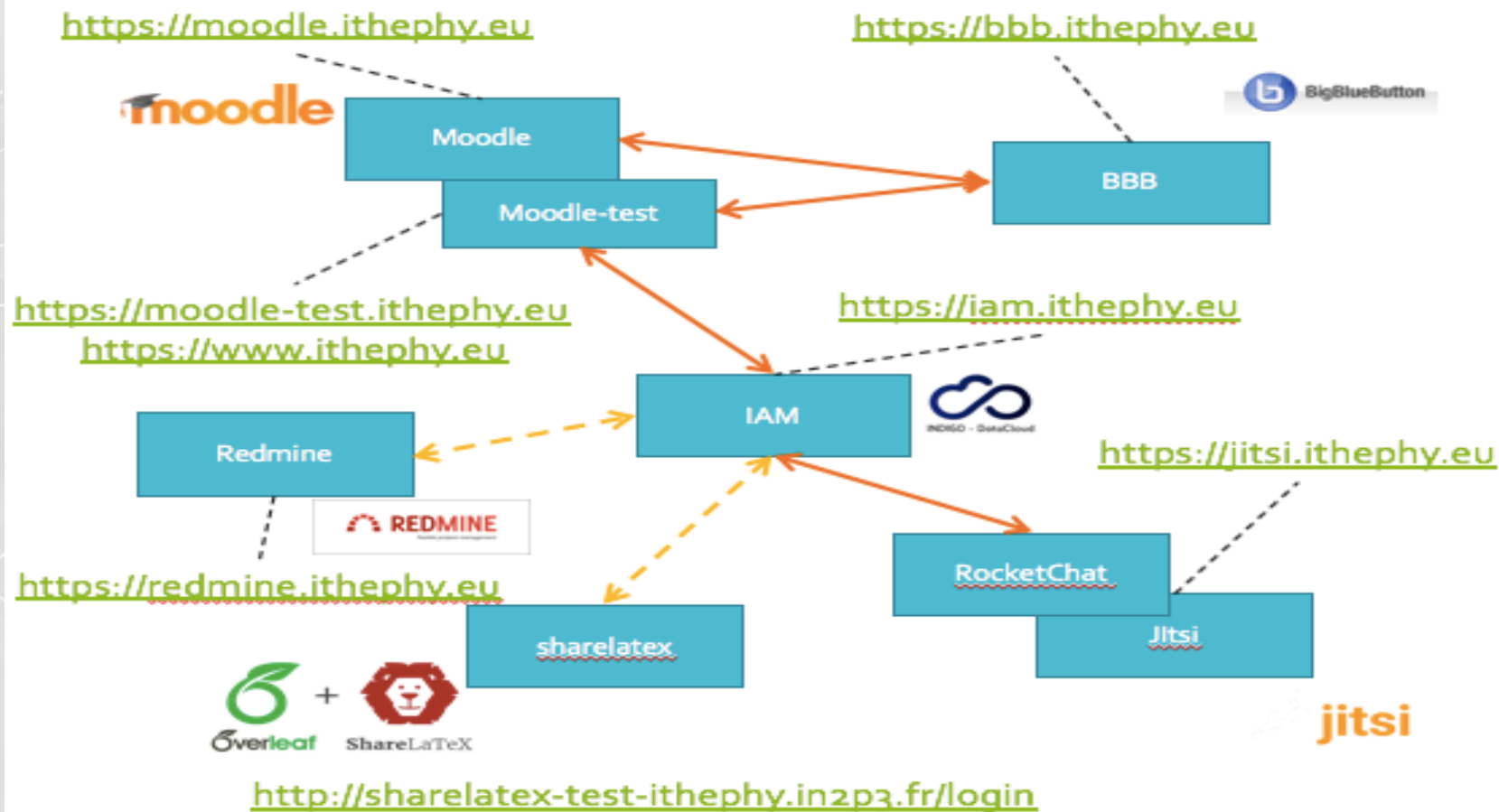
1 from Colombia and 1 from Russia

2019/2020 is starting right now



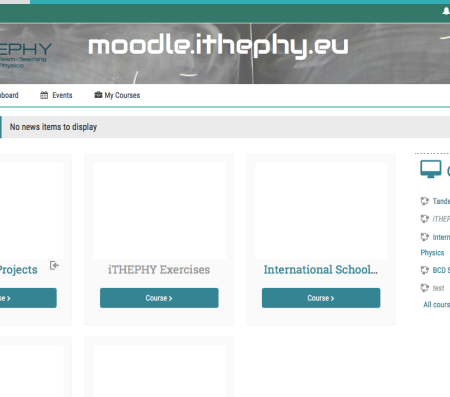
# Section 3-4

IaaS and PaaS platform



# iTHEPHY IO1

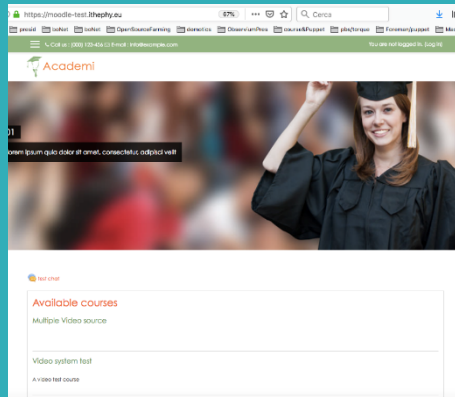
e-learning and collaborative platform



## moodle

[https://docs.moodle.org/35/en/Installation\\_quick\\_guide](https://docs.moodle.org/35/en/Installation_quick_guide)

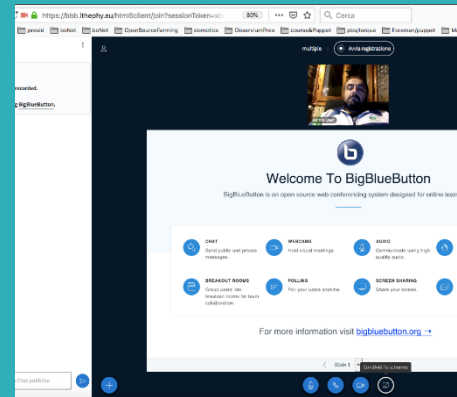
*Moodle is a free, online Learning Management System with a big community*



## moodle-test

[https://docs.moodle.org/37/en/Installation\\_quick\\_guide](https://docs.moodle.org/37/en/Installation_quick_guide)

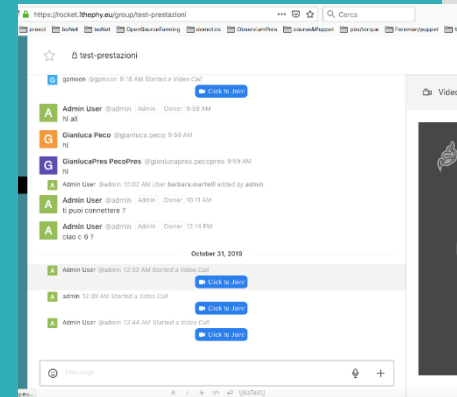
Latest stable for developing and course testing purpose  
New theme and innovative plugins



## BigBlueButton

<http://docs.bigbluebutton.org/2.2/install.html>

A video lesson tool with interactive collaboration whiteboard, online chat module and video recording session



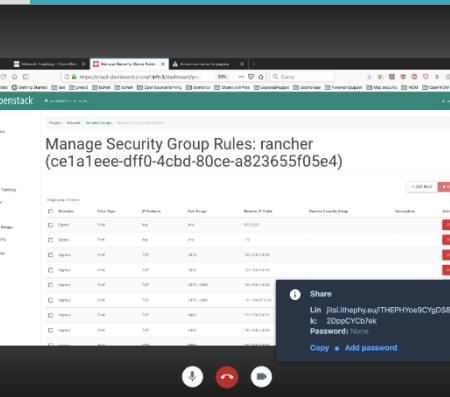
## Rocket.Chat

<https://rocket.chat/docs/installation/docker-containers/>

Chat, channel, room, bot, video, audio flexible app

# iTHEPHY IO1

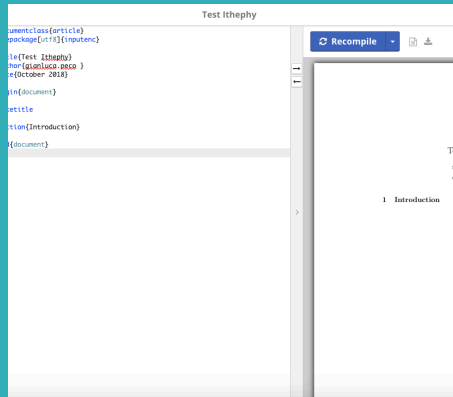
e-learning and collaborative platform



## JITSI-MEET

<https://github.com/jitsi/jitsi-meet/blob/master/doc/manual-install.md>

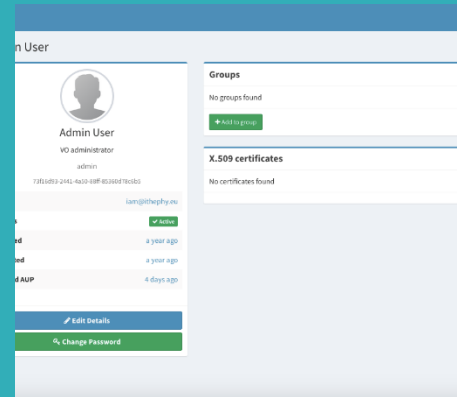
*Jitsi is a set of open-source projects that allows you to easily build and deploy secure videoconferencing solutions*



## SHARELATEX

<https://github.com/overleaf/overleaf/wiki/Quick-Start-Guide>

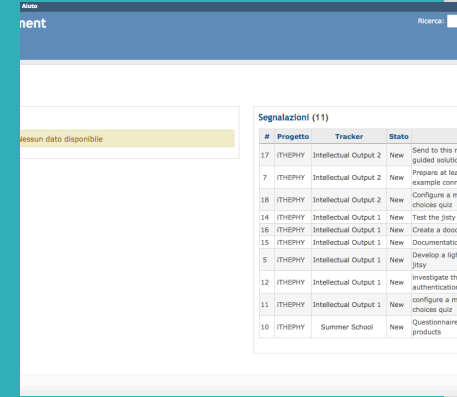
Now overleaf is an online latex collaborative suite. Edit and compile directly on your web browser



## INDIGO IAM

[https://indigo-iam.github.io/docs/v/current/admin-guide/basic\\_conf.html](https://indigo-iam.github.io/docs/v/current/admin-guide/basic_conf.html)

A layer where identities, enrollment, group membership and authorization policies can be managed in an homogeneous way



## REDMINE

<https://www.redmine.org/projects/redmine/wiki/RedmineInstall>

Redmine is a flexible project management web application written using Ruby on Rails framework.

# RedHat Ovirt on-premise HA

Vms: [x] [☆] [Q]

- Data Centers
- Clusters
- Hosts
- Networks
- Storage
- Disks
- Virtual Machines
- Pools
- Templates
- Volumes
- Users
- Events

**System**

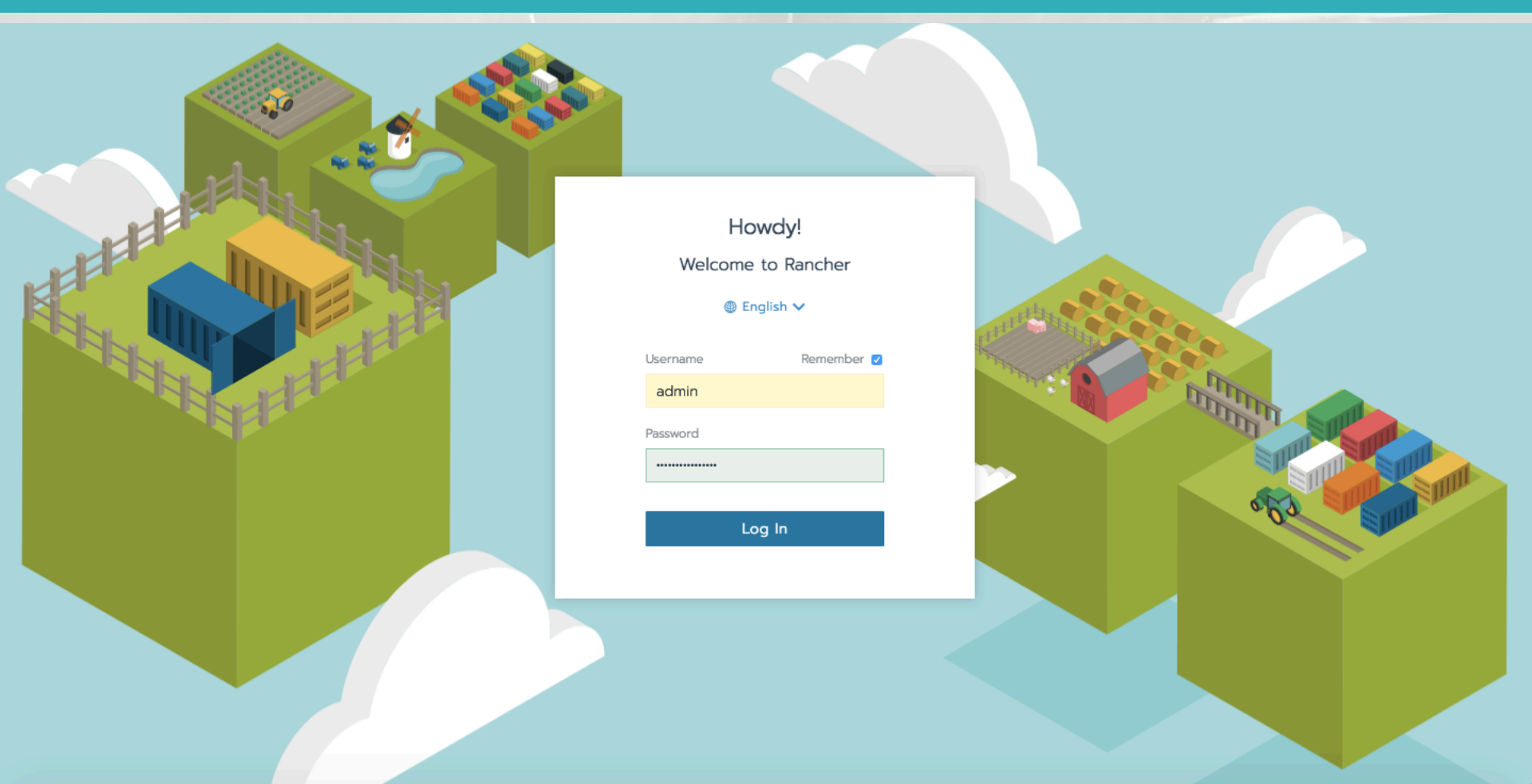
Expand All Collapse All

- System
  - Data Centers
    - Default
      - Storage
      - Networks
      - Templates
      - Clusters
  - External Providers
    - ovirt-image-repository
  - Errata
  - Guest Information

Name	Comment	Host	IP Address	FQDN	Cluster	Data Center	Memory	CPU	Network	Graphics	Status
bbb.bo.infn.it		bcksrv3.bo.infn.it			Default	Default	0%	2%	0%	SPICE ...	Up
ithephy1.bo.infn.it		bcksrv3.bo.infn.it			Default	Default	0%	0%	0%	SPICE	Up
ithephy2.bo.infn.it		bcksrv2.bo.infn.it			Default	Default	0%	0%	0%	VNC	Up
jitisi.bo.infn.it		bcksrv2.bo.infn.it			Default	Default	0%	27%	0%	SPICE ...	Up
papub.bo.infn.it		bcksrv3.bo.infn.it			Default	Default	0%	0%	0%	SPICE	Up
redmine.bo.infn.it		bcksrv2.bo.infn.it			Default	Default	0%	0%	0%	SPICE	Up
rocket		bcksrv3.bo.infn.it			Default	Default	0%	4%	0%	VNC	Up

- General
- Network Interfaces
- Disks
- Snapshots
- Applications
- Host Devices
- Vm Devices
- Affinity Groups
- Guest Info
- Errata
- Permissions
- Events

Name:	ithephy1.bo.infn.it	Defined Memory:	8192 MB	Origin:	oVirt
Description:		Physical Memory:	2730 MB	Run On:	Any Host in Cluster
Template:	Blank	Guaranteed:		Custom Properties:	Not Configured
Operating System:	Red Hat Enterprise Linux 7.x x64	Guest OS Memory:	Not Configured	Cluster Compatibility:	3.6
Graphics protocol:	SPICE	Free/Cached/Buffered:		Version:	
Video Type:	QXL	Number of CPU Cores:	4 (4 Socket(s), 1 Core(s) per Socket)	VM Id:	b6ad366b-8dd2-4cbf-9d4c-51b355800edf
Priority:	Medium	Guest CPU Count:	N/A		
		Highly Available:	Yes		
		Number of Monitors:	1		
		USB Policy:	Disabled		



Howdy!

Welcome to Rancher

English

Username

Remember

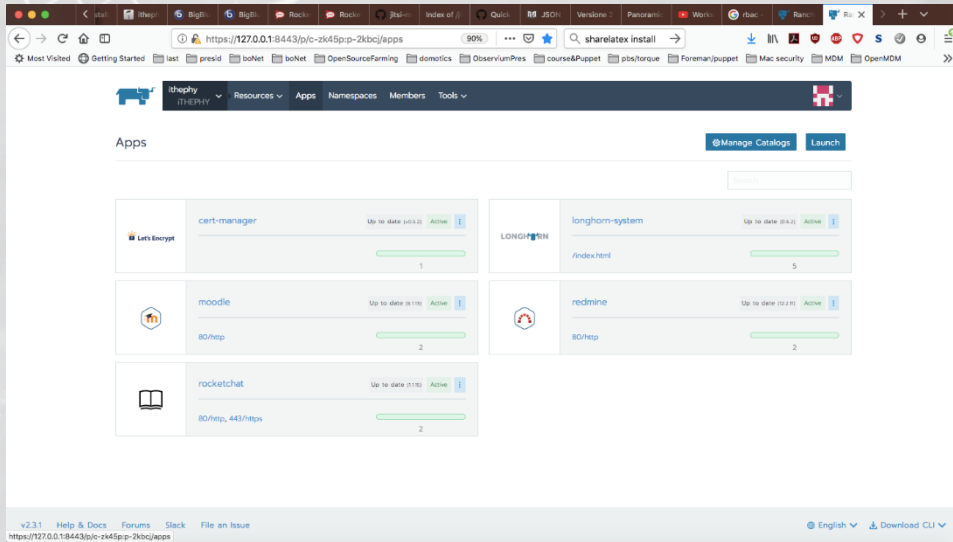
admin

Password

.....

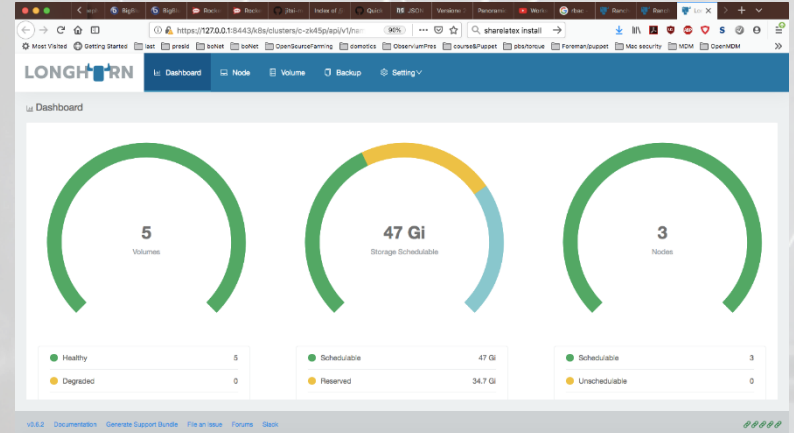
Log In

# Rancher on Cloud@CNAF



The screenshot shows the Rancher UI's 'Apps' page. At the top, there are navigation tabs for 'Resources', 'Apps', 'Namespaces', and 'Members'. Below this, a search bar and 'Manage Catalogs' and 'Launch' buttons are visible. The main content area is a grid of application cards. Each card shows the application name, its status (e.g., 'Up to date'), and a progress indicator. The applications listed are:

- cert-manager**: Up to date (v1.12.0), Active, 1 instance.
- moodle**: Up to date (v3.11.0), Active, 2 instances (80/http).
- rocketchat**: Up to date (v1.15.0), Active, 2 instances (80/https, 443/https).
- longhorn-system**: Up to date (v2.4.2), Active, 5 instances (Index.html).
- redmine**: Up to date (v5.2.7), Active, 2 instances (80/http).



The screenshot shows the Longhorn UI Dashboard. It features three large circular gauges representing key metrics:

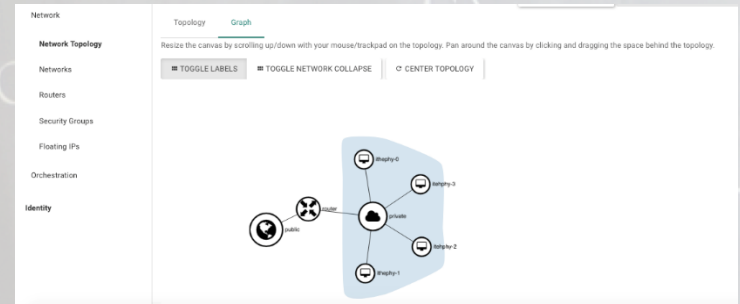
- Volumes**: 5 total, all Healthy.
- Storage**: 47 Gi total, with 34.7 Gi Reserved and 12.3 Gi Available.
- Nodes**: 3 total, all Schedulable.

Below the gauges, a legend indicates the status of each metric: Healthy (green), Degraded (yellow), Schedulable (green), Reserved (yellow), and Unschedulable (yellow).

## Rancher 2.3.1

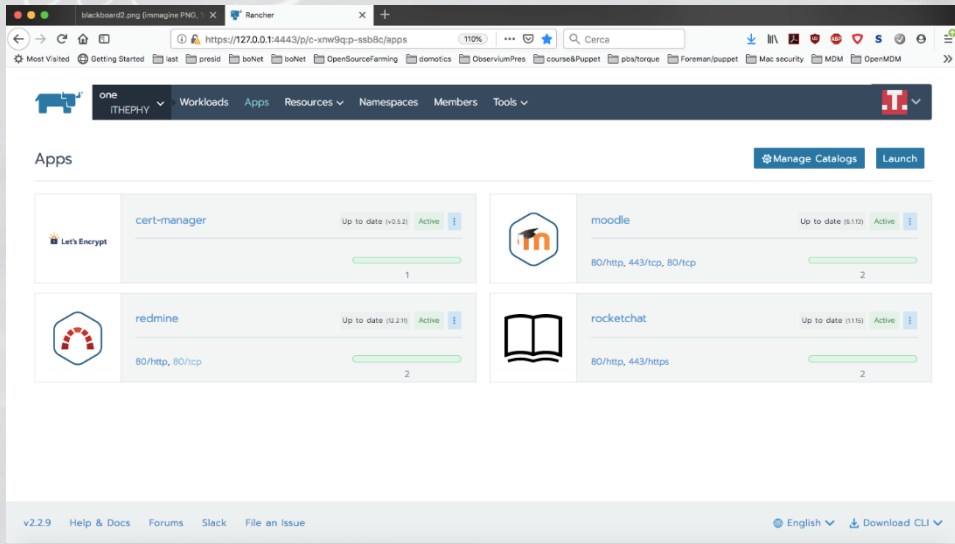
Openstack resources manually provisioned

Persistent storage with Longhorn software hyperconverged block device using hosts available resources. Necessity of manual configuration of L4 load balancer and security groups on Openstack. Integration of moodle, redmine and rocket.chat with public jitsi. Rancher server run in a cluster node



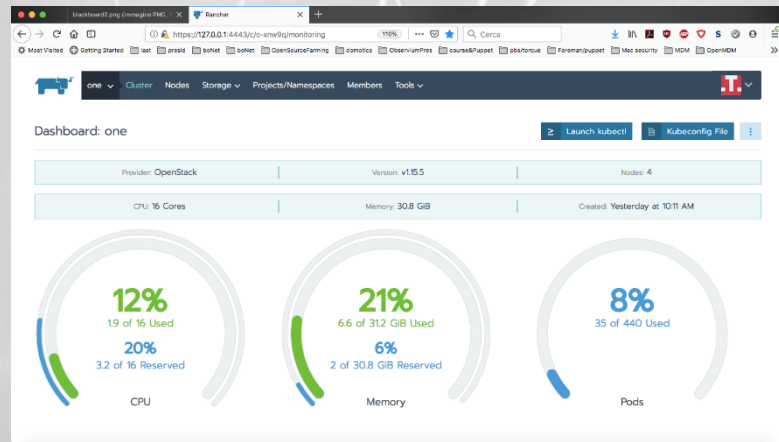


# Rancher on INFN Corporate Cloud



Apps

- cert-manager (1 instance)
- moodle (2 instances)
- redmine (2 instances)
- rocketchat (2 instances)



Dashboard: one

Provider	Version	Nodes
OpenStack	v1.15.5	4

CPU: 16 Cores

Memory: 30.8 GiB

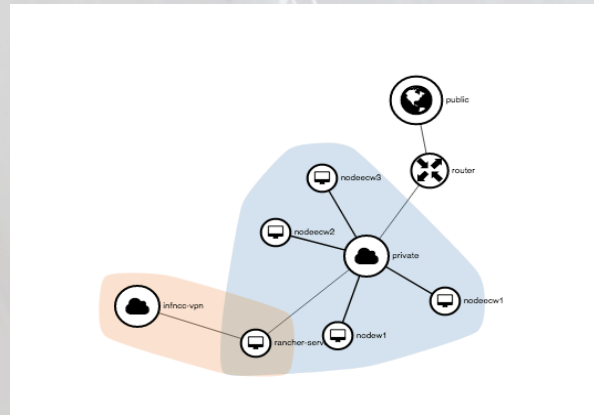
Created: Yesterday at 10:11 AM

- CPU: 12% (19 of 16 Used), 20% (32 of 16 Reserved)
- Memory: 21% (6.6 of 30.8 GiB Used), 6% (2 of 30.8 GiB Reserved)
- Pods: 8% (35 of 440 Used)

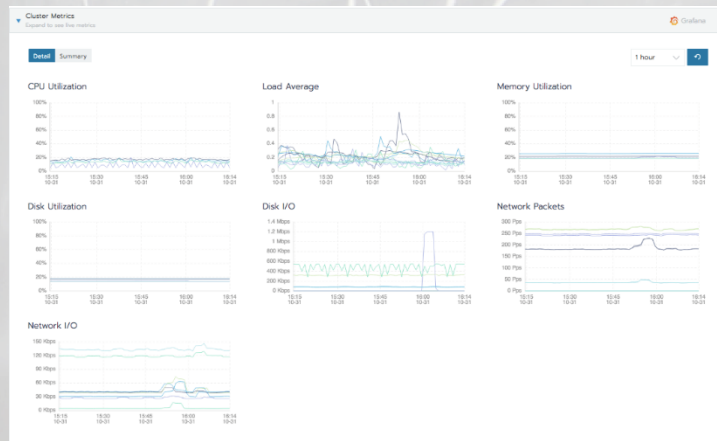
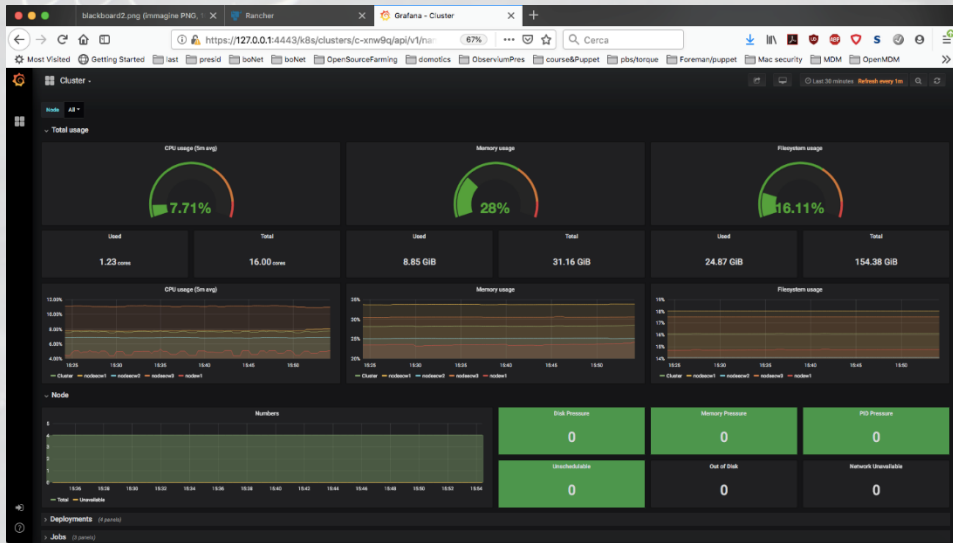
## Rancher 2.2.9

Openstack instance automatic provision

After the rancher plugin for openstack configuration, every necessary resource from compute node to L4 load balancer and persistent storage resource are automatically provisioned. Resource monitoring and application logging are embedded in rancher resource and service configuration. Rancher server run in a dedicated node



# Rancher on INFN Corporate Cloud



## Monitor & YAML conf

Enabled monitor with Prometheus and Grafana

Some configuration file necessary to plugin configuration

```
cloud_provider:  
  name: 'openstack'  
  
openstackCloudProvider:  
  block_storage:  
    ignore-volume-az: false  
    trust-device-path: false  
  global:  
    auth-url: 'https://keystone.cloud.infn.it:5000/v3'  
    domain-name: 'default'  
    region: 'berl'  
    tenant-name: 'tenant name'  
    username: 'username'  
    password: '....'  
  load_balancer:  
    create-monitor: false  
    monitor-delay: '0'  
    monitor-max-retries: 0  
    monitor-timeout: '0'  
    use-octavia: false  
    manage-security-groups: true  
  floating-network-id: '0bf53e9-f24e-42f7-a234-52b5865d518f'  
  metadata:  
    request-timeout: 0  
  route:  
    router-id: 'c34ee609-5765-4a9d-9c3a-24aee20153d0'
```

```
1 ---  
2 ingress:  
3   enabled: "True"  
4 hosts:  
5   - "moodle.domain.com"  
6 serviceType: "ClusterIP"  
7 moodleUsername: "admin"  
8 moodlePassword: "password"  
9 mariadb:  
10   mariadbRootPassword: "secretpassword"  
11
```

# Next Steps (beyond the iTHEPHY IO1)

- Develop and distribute a rancher (k8s too) receipt for every platform deployment
- Consolidate a service for the automatic provisioning of iTHEPHY (iTHEPHY as a Service)
- R&D of new functionalities based on FOSS software (interesting inputs form MALT experience)
- R&D on the new security paradigm applied to k8s and Rancher PaaS/KaaS solution

# Conclusions

- ✓ The iTHEPHY project proposes an innovative and an unconventional approach to teaching
  - ✓ Based on project-working teaching
  - ✓ Complementary to frontal lectures
- ✓ The iTHEPHY promotes internationalization
- ✓ European and non-EU students are involved
- ✓ FOSS software ecosystem
- ✓ Structure IO1 based on virtualization easily to reproduce in house
- ✓ Evolution based on containerization easily interoperable with various private/public provisioning from bare-metal to KaaS
- ✓ If you are interested in replicating this activity in your institute feel free to contact us

<https://www.facebook.com/IthePHY>

<https://twitter.com/IThePHY>

<https://www.ithephy.eu/>

<https://iam.ithephy.eu/register>



# Thank you

And many thanks to:

Federico Zani for Rancher consulting

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