

# VMs implementation for the Fermi masterclass in Bari

E. Bissaldi, F. de Palma, F. Gargano, F. Giannuzzi,  
F. Loparco, S. Nicotri

*INFN Bari*

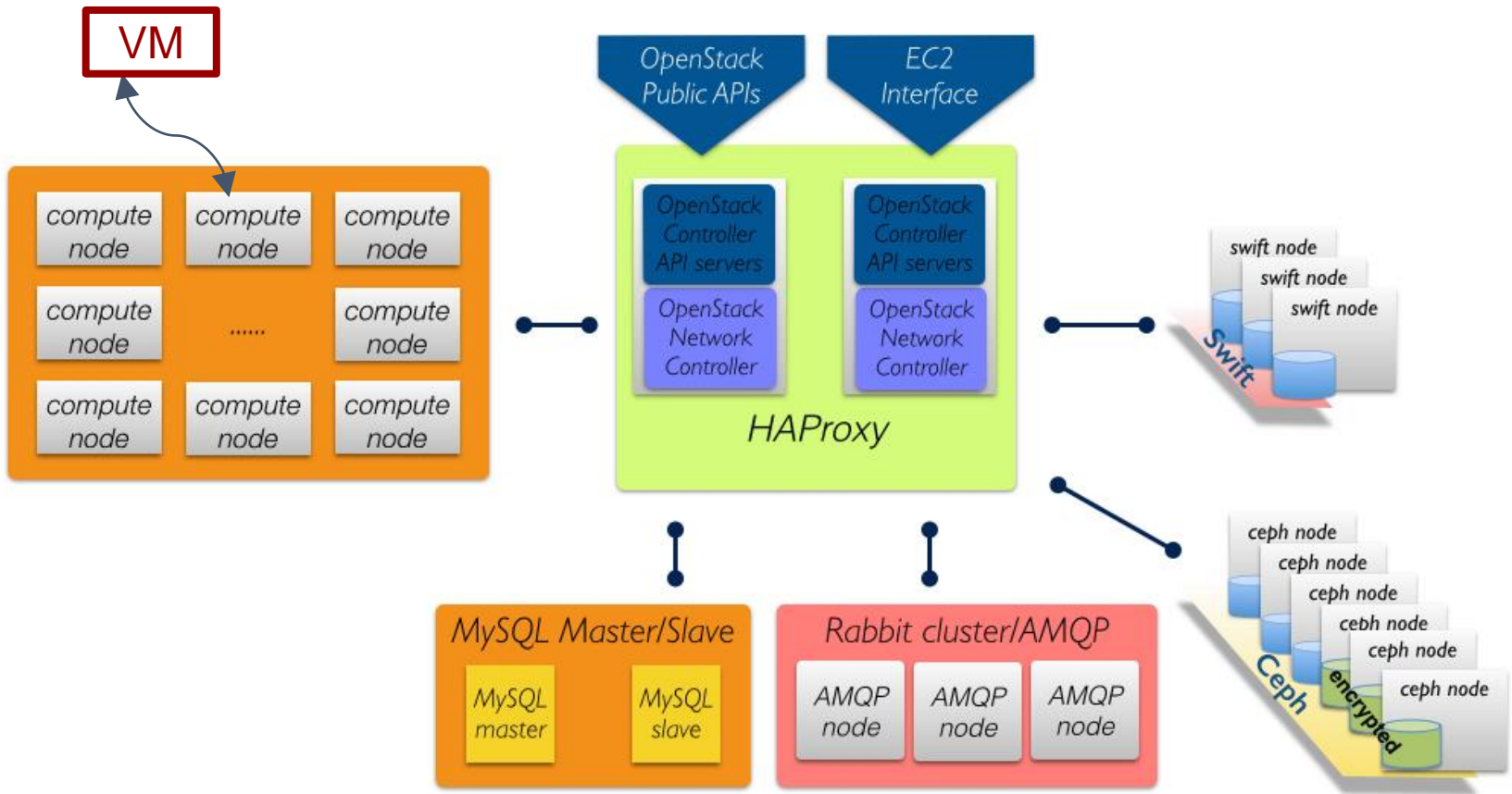
# The INFN Bari / UNIBA IaaS Cloud Platform

The IaaS (Infrastructure as a Service) cloud platform **Cloud@ReCaS-Bari**, hosted in the **ReCaS Bari** data centre, provides computing resources following the cloud paradigm

Its features are:

- 1300 CPU core
- 5 TB of RAM
- 10 Gbit/s network
- Layer 2 isolated VLAN with NAT
- Evolved Firewall
- 180 TB of replica 3 storage
- Based on open source software (OpenStack)
- Modular
- Highly Available (HA) services

# Cloud@ReCaS-Bari: physical architecture



# Virtual Machines

Computing resources are **VIRTUALISED** → servers (Virtual Machines, VM) and storage are created and used only when needed.

Virtual Machines (VM) are similar to standard hardware servers:

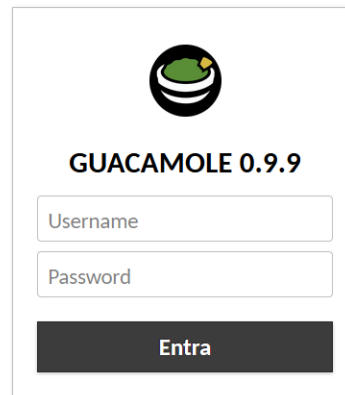
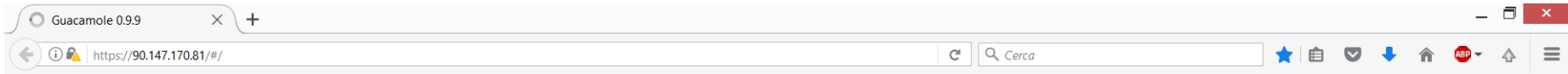
- They use familiar operating systems (OS), as Linux, Windows, etc.

- They can execute any software compatible with the OS

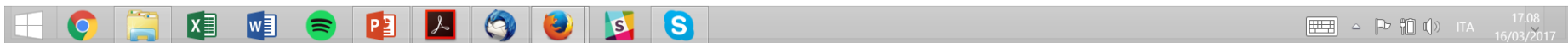
... but the hardware features (quantity of RAM, number of CPU cores, storage) are **VIRTUALISED**

VMs can be accessed through standard protocols (SSH, RDP, etc), as normal remote servers

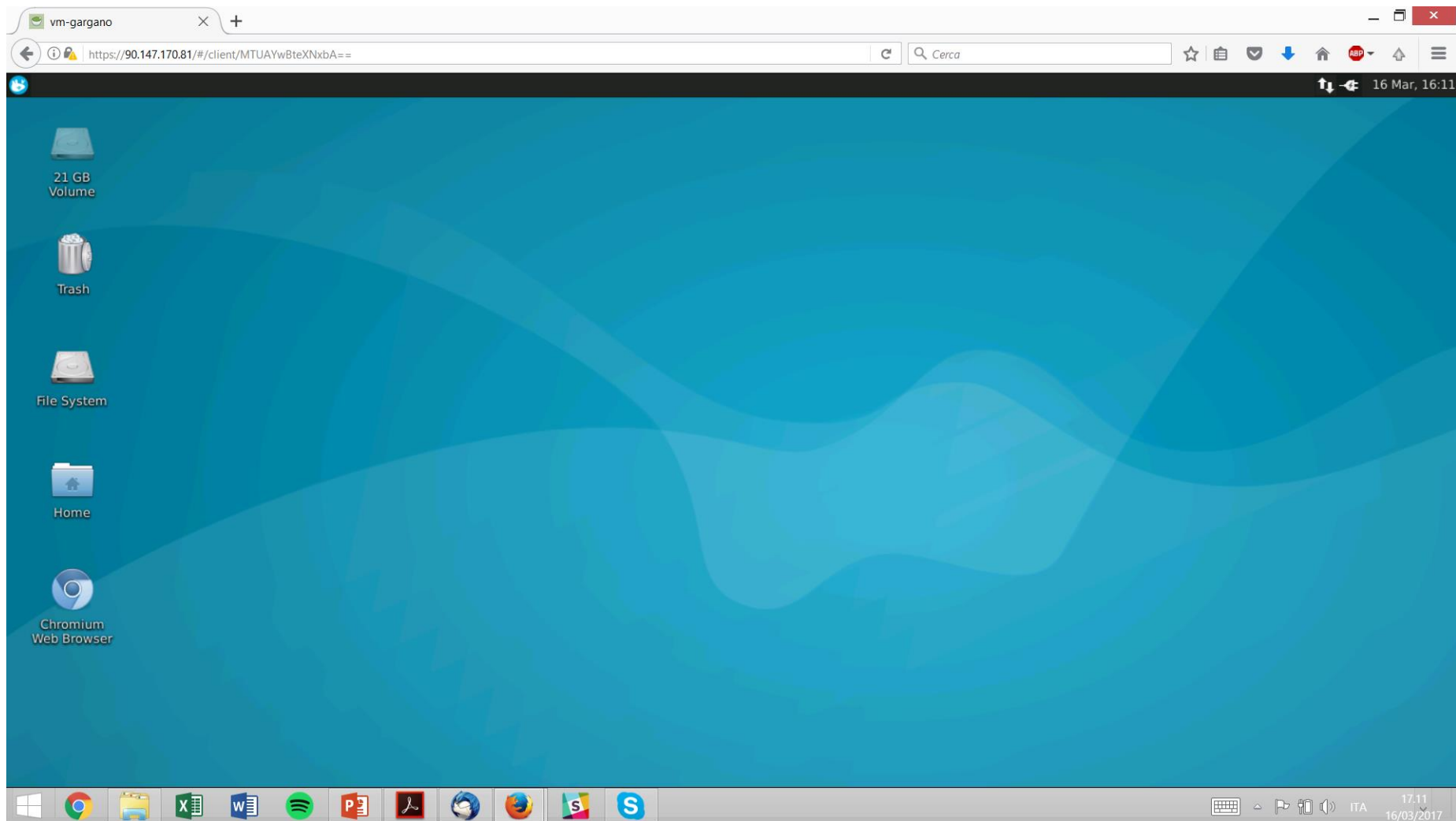
# Every student can login with his own credential in a browser running on every OS



The login form is centered on the page. It features a circular logo at the top with a green and black design. Below the logo, the text "GUACAMOLE 0.9.9" is displayed in a bold, black font. Underneath, there are two input fields: "Username" and "Password". At the bottom of the form is a dark grey button with the word "Entra" in white text.



# After the login you have Ubuntu 16.4 running in a tab of your browser



# Scientific Software installed

- Ds9
- Fv
- Public Science tools from FSSC (binary version)
- Ftools from heasarc (binary version)
- Astropy

# Students can easily replicate the aperture photometry tutorial on the FSSC.

The screenshot displays a desktop environment with a terminal window and two plot windows. The terminal window shows the following commands and output:

```
prompt> ftcalc lc_3C279.fits lc_3C279_rate.fits RATE 'counts/exposure'  
prompt> ftcalc lc_3C279_rate.fits lc_3C279_rate_error.fits RATE_ERROR 'error/exposure'
```

The text below the terminal indicates: "This is an example light curve for 3C 279 obtained from aperture photometry for the first 6 months of the mission." The terminal title bar reads "Terminal - standaruser@vm-gargano: ~".

Two plot windows are open:

- The top plot is titled "lc\_3C279\_rate\_error.fits (RATE\_1-183)". The y-axis is labeled "RATE" and ranges from 0 to  $2 \times 10^{-6}$ . The x-axis is labeled "TIME (s)" and ranges from  $2.4 \times 10^8$  to  $2.55 \times 10^8$ .
- The bottom plot is titled "lc\_3C279\_rate\_error.fits (COUNTS\_1-183)". The y-axis is labeled "COUNTS (Counts)" and ranges from 0 to 60. The x-axis is labeled "TIME (s)" and ranges from  $2.4 \times 10^8$  to  $2.55 \times 10^8$ .

A small inset window titled "POW (Build 1.514)" shows a zoomed-in view of the light curve data with a blue box highlighting a peak. The title bar of this window is "lc\_3C279\_rat...S\_1-183)\_0". The POW window also displays graph coordinates and pixel information.

The desktop background shows a web browser window with the URL <https://90.147.170.81/#/client/MTUAYwBteXNxbA==> and a terminal window with the title "Terminal - standaruser@vm-gargano: ~". The system tray at the bottom right shows the date and time: "17:24 16/03/2017".



# Comparing results

- Each student will analyze an interval of few days of data. He/she will report his/her spectral result in a google spreadsheet.
- With all this information we will create a local light curve and a general light curve of the source.
- Each student will also produce and compare counts maps. At the end we will try to create an animated gif.

