Low cost private cloud with *OpenNebula*

Federico Zani - INFN Roma Tor Vergata *(federico.zani@roma2.infn.it)*
Luca Mazzaferro - INFN Roma Tor Vergata *(luca.mazzaferro@roma2.infn.it)*
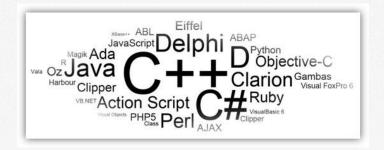
Tor Vergata case history…

Few money

Heterogeneous (*and quite old*) hardware

Several different analysis requirement

I have a dream…

Take advantage of every single core

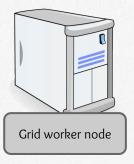High availability for core services

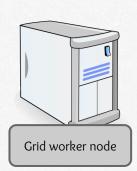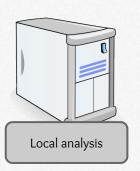Easy farm management

Scalability

Quick integration of new hardware

The beginning of time...

One physical host for each service

| Grid worker node | Grid worker node | Local analysis | Storage frontend | Bastion host | Web server |

The beginning of time...
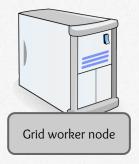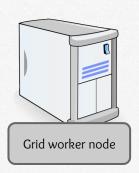
Pros

(STILL SEARCHING FOR SOME...)

Cons

- No core service high availability
- No easy scalability
- Complex management
- Pretty "old-style" node cloning...
- ...and backup
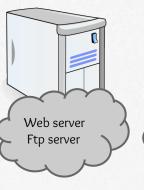- Slow integration of new hardware
- [...] (you name it)

The middle age...

Computing nodes on physical hosts
Virtualization of core services

| Grid worker node | Grid worker node | Local analysis | Web server Ftp server | Bastion host | Grid UI NIS server |

The middle age...

Pros

- improved service availability
- easier core services backup
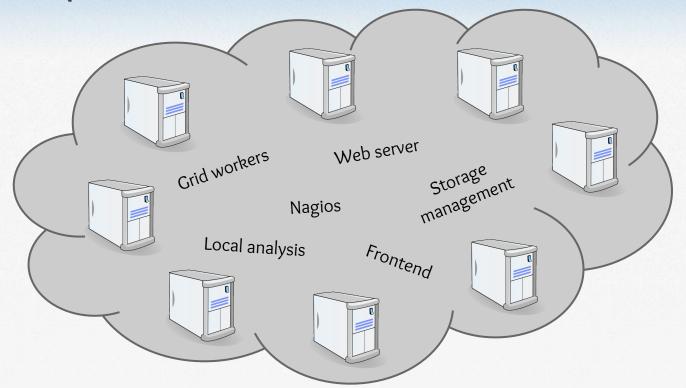- reduced deployment time for new services

Cons

- still missing easy migrations, backup and node scalability
- no frontend to manage the whole infrastructure

Modern era...

OpenNebula private cloud

Grid workers

Web server

Nagios

Storage management

Local analysis

Frontend

Modern era...

Pros

- easy service deploy
- centralized farm management
- node cloning with contextualization
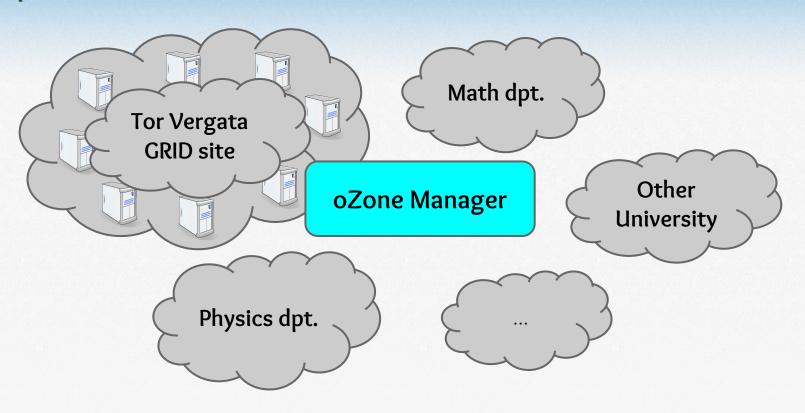- Integration of new hardware is as quick as installing base os

Cons

- shared file system might become a single point of failure

The future…?

OpenNebula distributed datacenter with oZones

Tor Vergata GRID site

Math dpt.

oZone Manager

Other University

Physics dpt.

…

Some annoying tech details...

Physical hosts
- 11 physical hosts
- 126 virtual cores
- 106 GB ram

Network layout
- 1 gigabit ethernet for external connectivity
- 1 gigabit ethernet for private communication and storage access

Storage
- 1 SAN with 4TB dedicated to VM disk images, attached via iScsi to cloud frontend
- 1 NAS with 32TB dedicated to analysis data, mounted via nfs on all computing nodes

More annoying tech details...

Non shared file system

- Higher performance, but no live migration
- Avoid single point of failure
- Does not overload private network, already used for analysis

Cloud frontend/scheduler is a VM itself

- Avoid (another) single point of failure
- Easily migrate frontend on another physical host in case of hw issue

Contextualized nodes

- Easily deploy multiple worker node instances, using OpenNebula virtual networks and ip leases
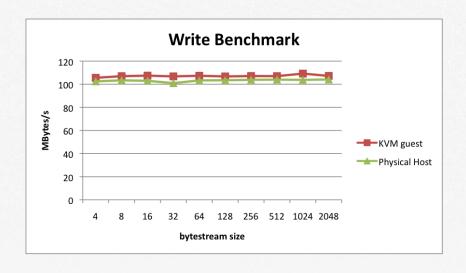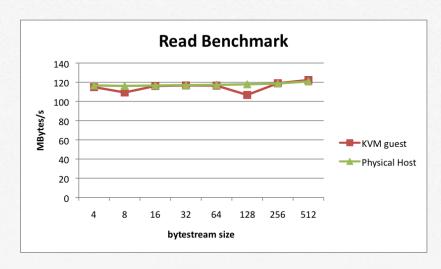
Some *(even more)* annoying benchmark...

CPU benchmark

	Intel Xeon E5504 @ 2.00GHz	KVM guest (same CPU)
OpenSSL	44.7 AU	43.2 AU
SciMark 2	478.36 Mflops	472.71 Mflops
GCrypt	4833 Microseconds	4680 Microseconds

Some *(even more)* annoying benchmark...

NFS mounted I/O benchmark

Question time *(and applauses)…*