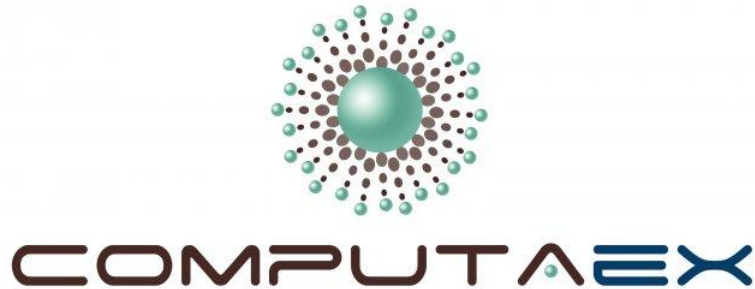




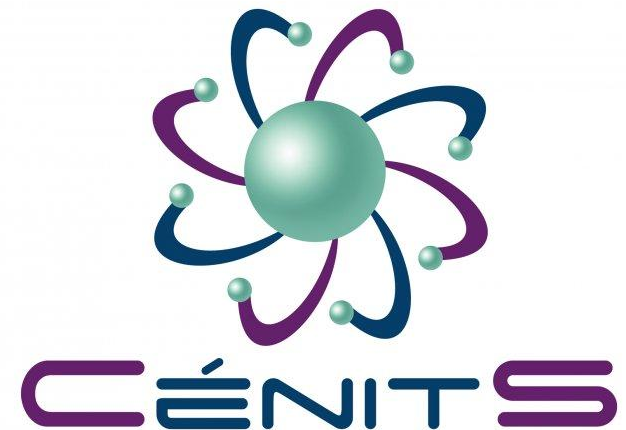
IMPLANTACIÓN DEL MODELO CLOUD COMPUTING EN UN CENTRO DE SUPERCOMPUTACIÓN

**TRABAJO FIN DE MÁSTER
MÁSTER DIRECCIÓN TIC
JAIME RIVERO RAMOS**

INTRODUCTION: Context



Fundación Computación y Tecnologías Avanzadas de Extremadura was established by the **Junta de Extremadura** as an organization in nature non-profit foundation. Its main aim is to promote the development of **information technologies**, the use of **intensive computing** and **advanced communications** as tools for sustainable socioeconomic development.



INTRODUCTION: OBJECTIVES

- **MAIN OBJECTIVE**

Implanting a system that allows to offer services of Cloud Computing in its form of Infrastructure as a Service (IaaS) in the Fundación COMPUTAEX across its supercomputing center CénitS.

- **STEPS**

- To define Cloud Computing and its different modalities.
- To explain Cloud Computing positive and negative factors.
- Managerial report → Making the explanation about the steps followed in Fundación COMPUTAEX to start offering Cloud Computing.
- Technical report → Discussing the existing technology offerings in the market of open source software.
- Opportunity study → Economic impact through a practical assumption.

CLOUD COMPUTING

National Institute of Standards and Technology (NIST):



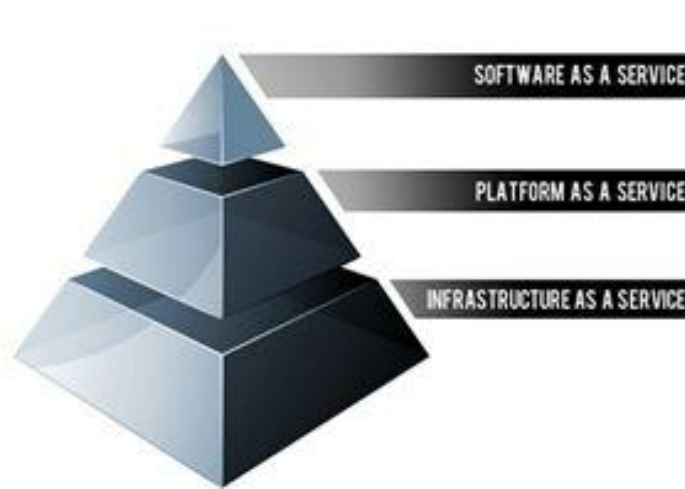
“Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

CHARACTERISTICS

- Self service on demand
- Resource sharing
- Agile scalability
- Measured services
- Unrestricted access via the internet

CLOUD COMPUTING: TIPOS

SERVICE MODELS



HPC2 High Performance Cloud Computing



FORMS OF DEPLOYMENT



CLOUD COMPUTING: OPORTUNIDADES



EMPRESAS



**ECONOMÍA
GLOBAL**



**ADMINISTRACIÓN
PÚBLICA**



**INVESTIGACIÓN
CIENTÍFICA E
INNOVACIÓN**



CIUDADANÍA



**PAISES EN VÍAS
DE DESARROLLO**

CLOUD COMPUTING: DESAFÍOS



INFORME EMPRESARIAL: Situación Actual

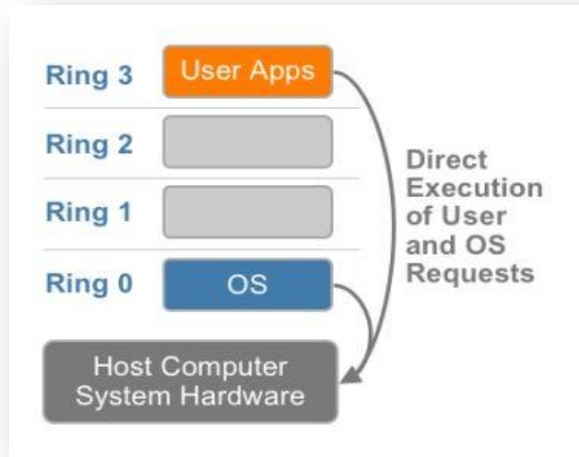


INFORME EMPRESARIAL: HACIA EL CLOUD COMPUTING

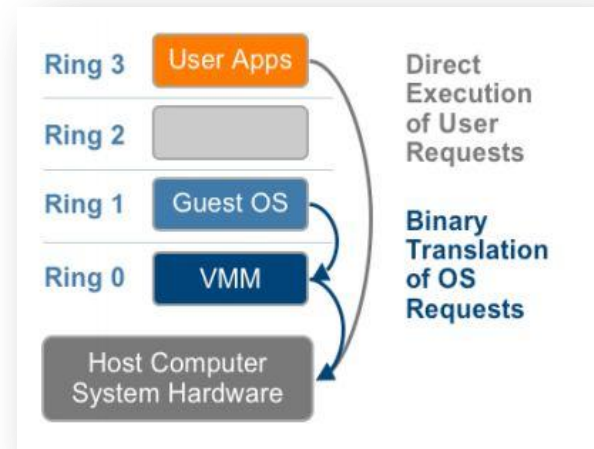


INFORME TÉCNICO: Virtualización

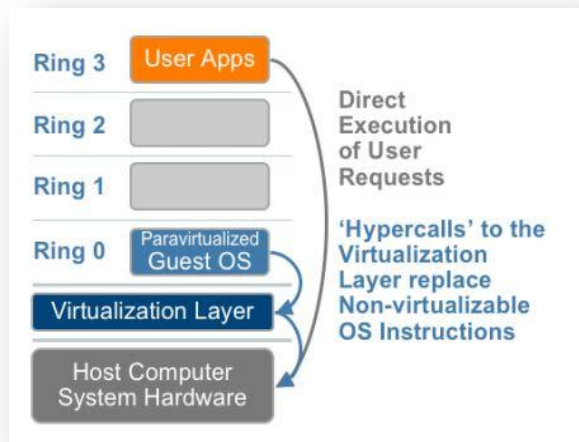
SIMPLE VIRTUALIZATION



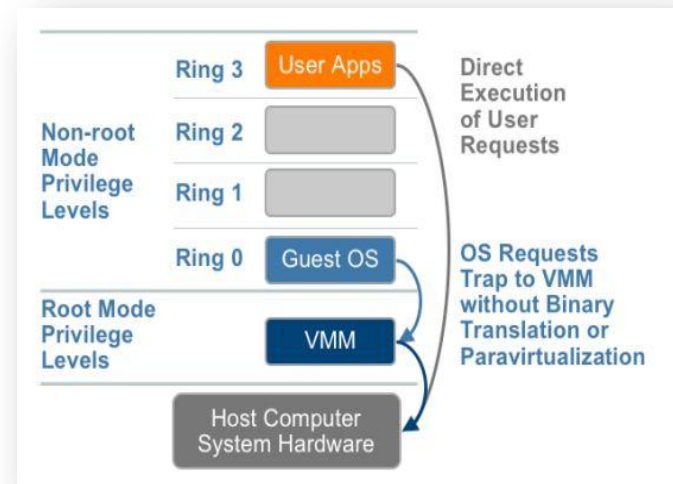
FULL VIRTUALIZATION



PARAVIRTUALIZATION



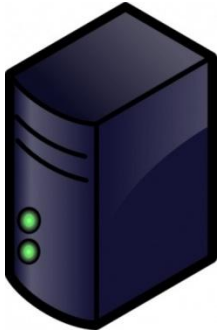
H.A. VIRTUALIZATION



INFORME TÉCNICO: SOFTWARE GESTIÓN CLOUD

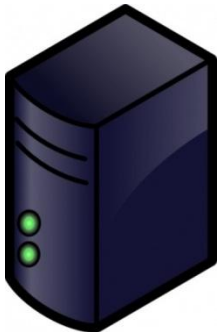
CARACTERÍSTICAS	cloudstack	EUCLYPTUS	OpenNebula	 openstack
MÁQUINAS VIRTUALES	9	6	9	8
NODOS	10	9	9	7
ALMACENAMIENTO	10	7	8	9
REDES	7	9	7	6
USUARIOS	10	9	7	7
PLANTILLAS	6	9	10	9
IMÁGENES ISO	9	8	10	8
CLÚSTERES	10	9	9	4
SEGURIDAD	8	9	8	9
MONITORIZACIÓN	7	6	8	7
COMPATIBILIDAD	9	10	10	7
INTERFAZ	9	7	10	6
TOTAL	104	98	107	88

IMPLANTACIÓN: Infraestructura disponible



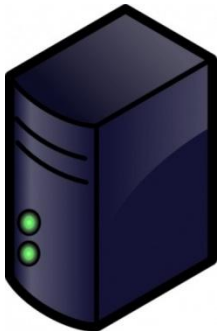
SERVIDOR A

8xCPU
24 GB RAM



SERVIDOR B

16xCPU
32 GB RAM



SERVIDOR C

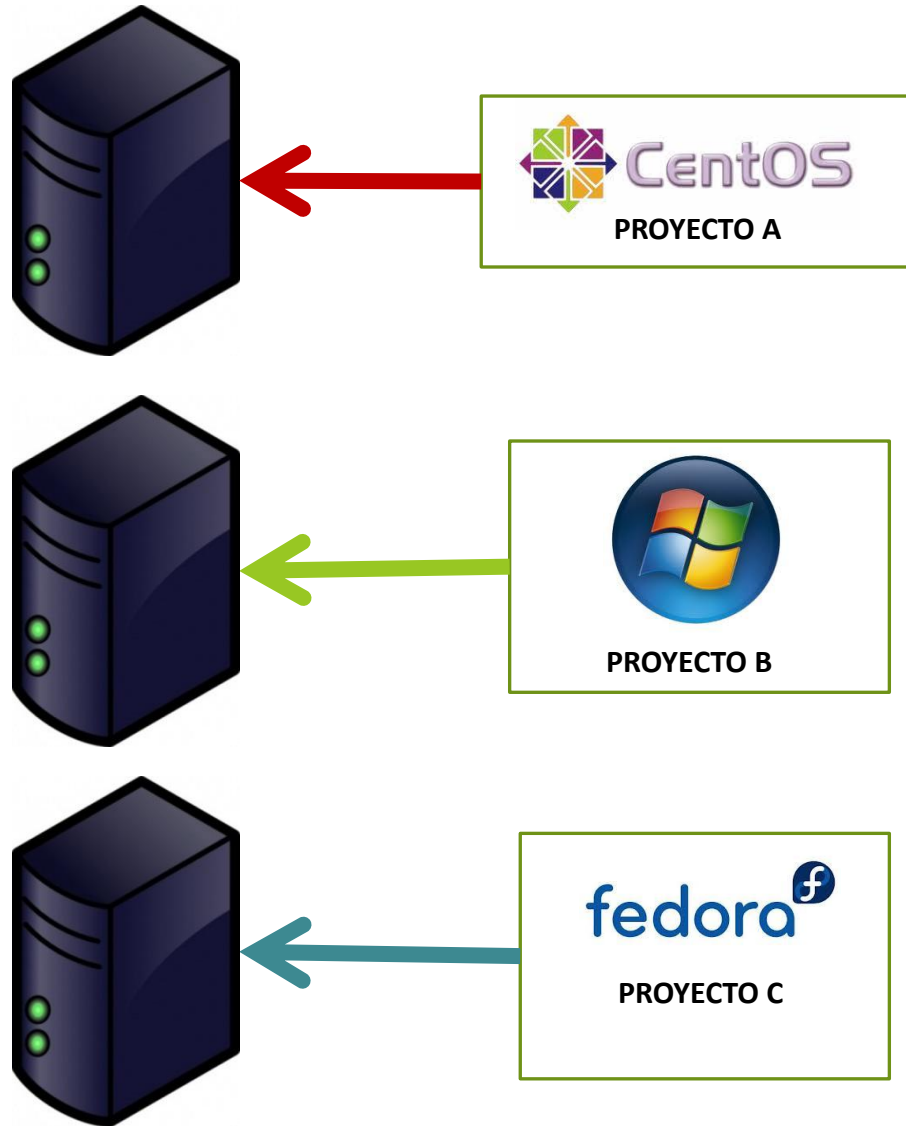
16xCPU
64 GB RAM



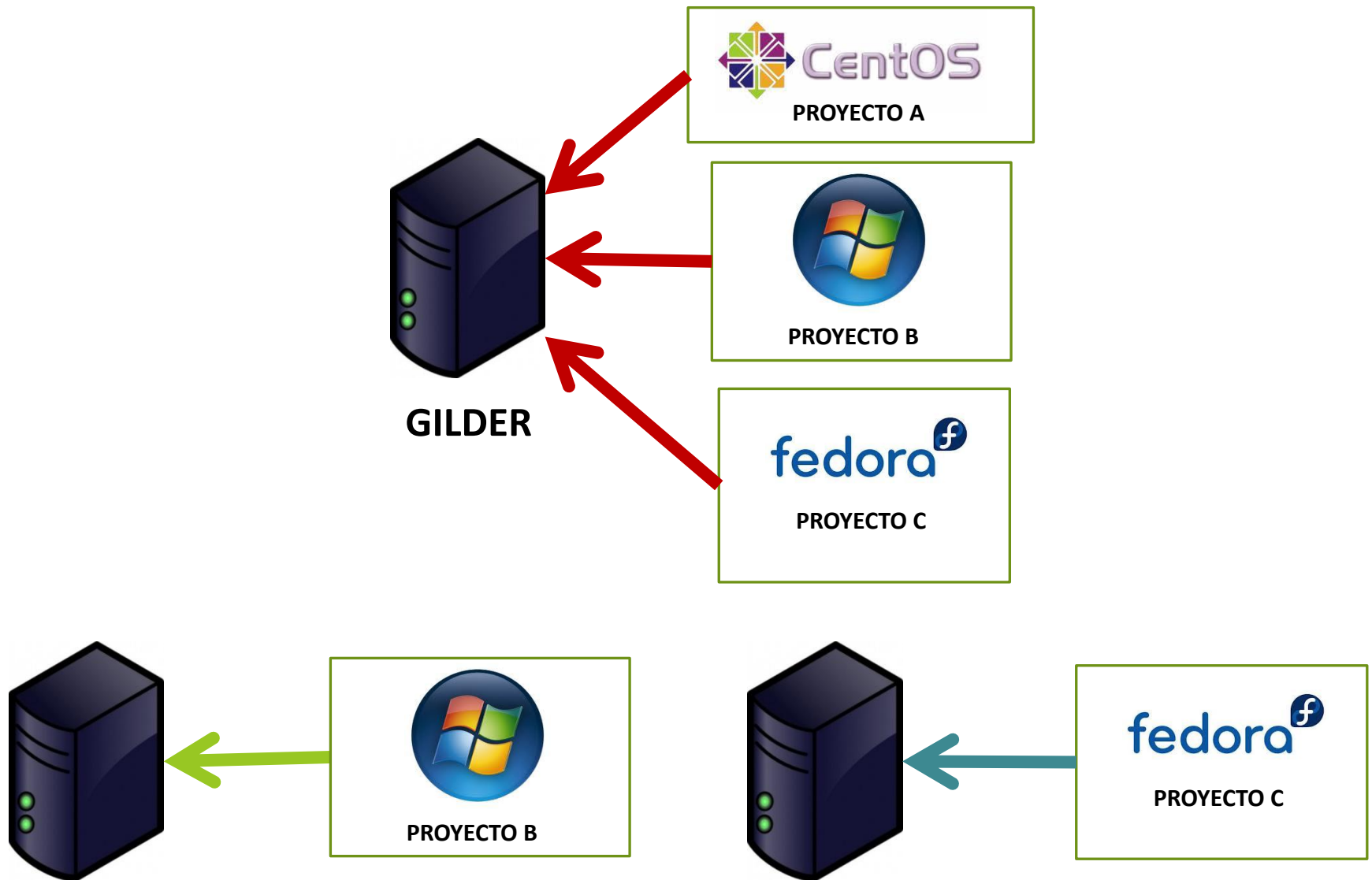
ALMACENAMIENTO

2 x EVA 8100
(208 x FC x 450GB)
+
(128 x FATA x 1TB)
aprox. **260 TB** HDD

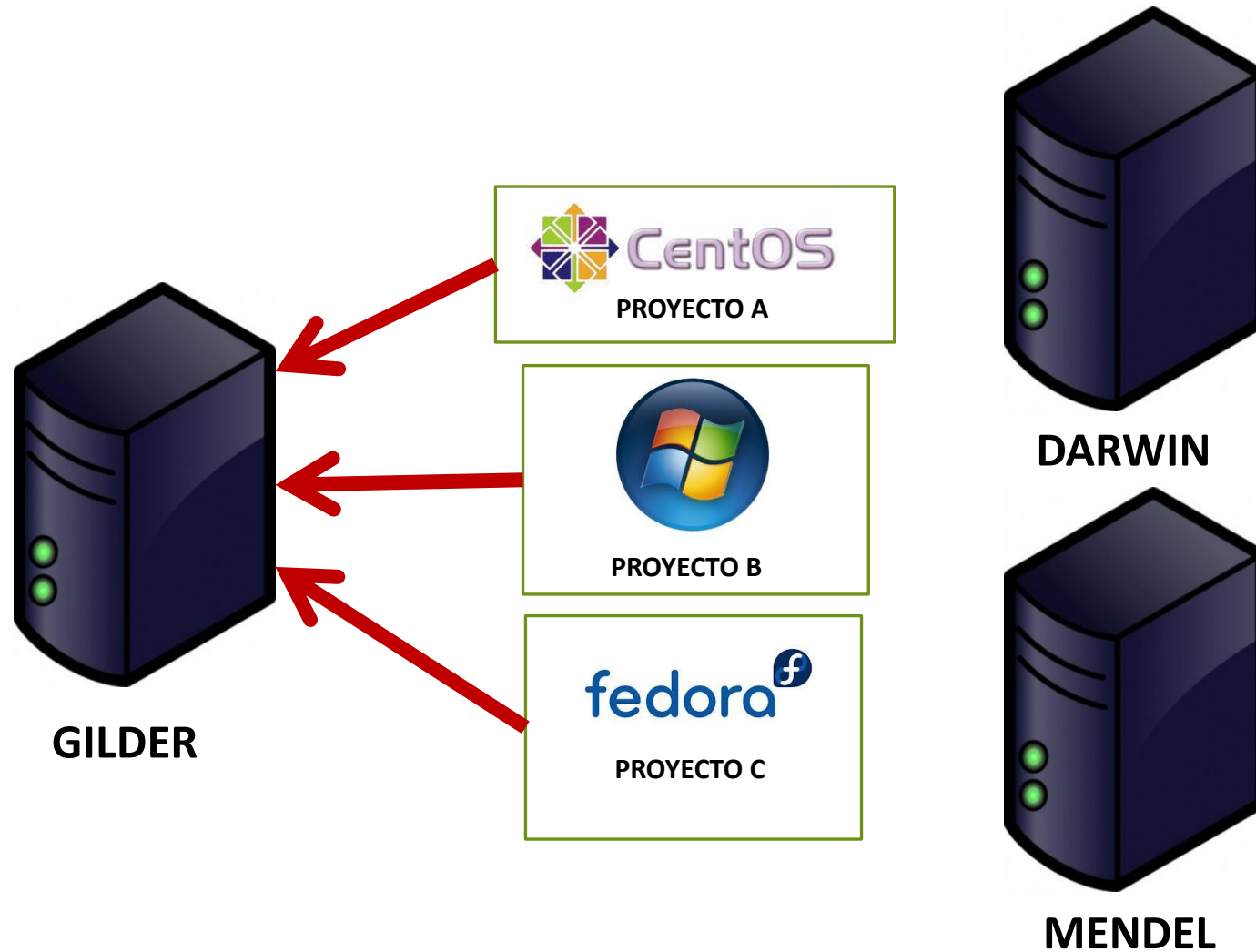
Nivel 0: Inicio



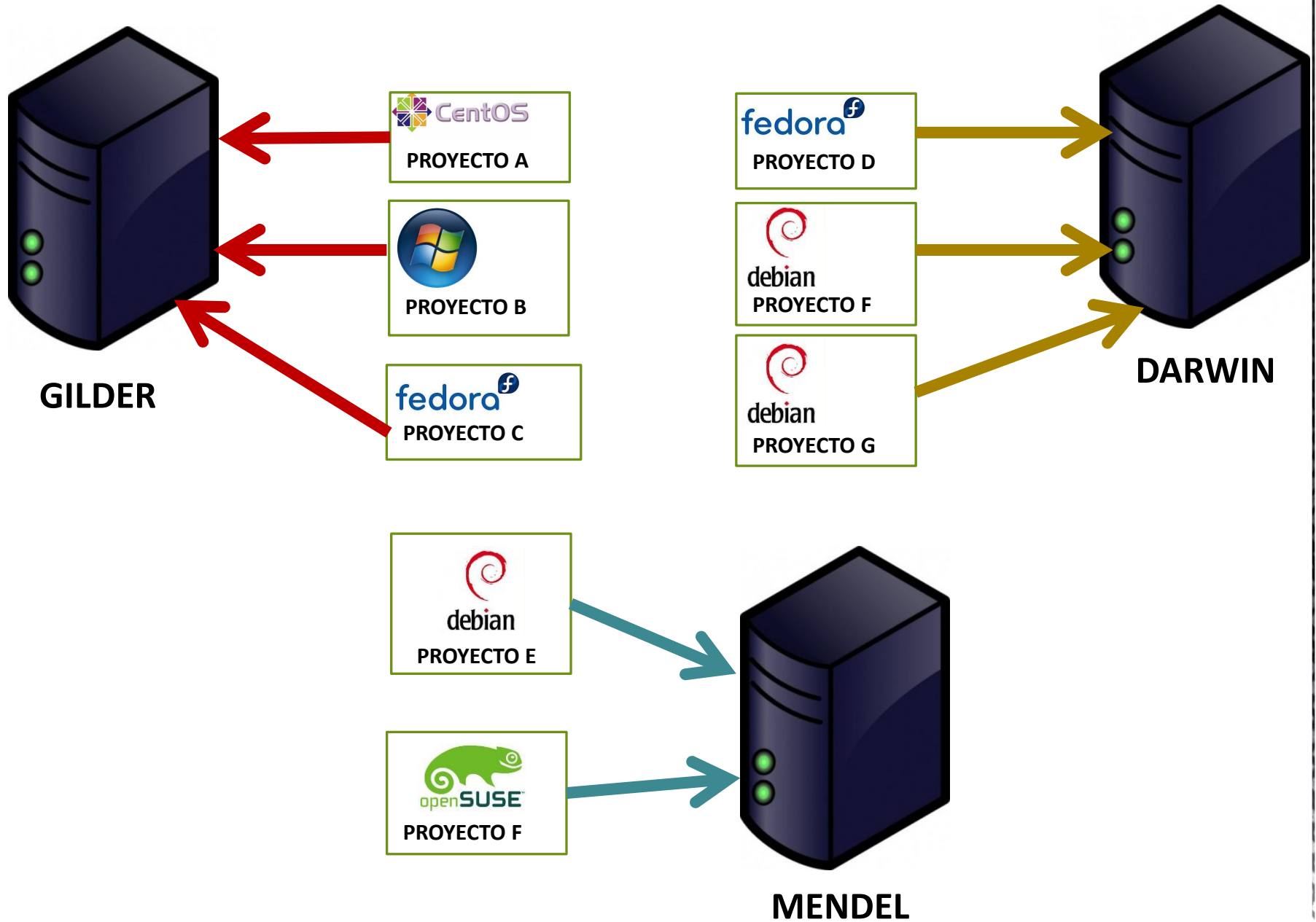
Nivel 1a: Migración parcial



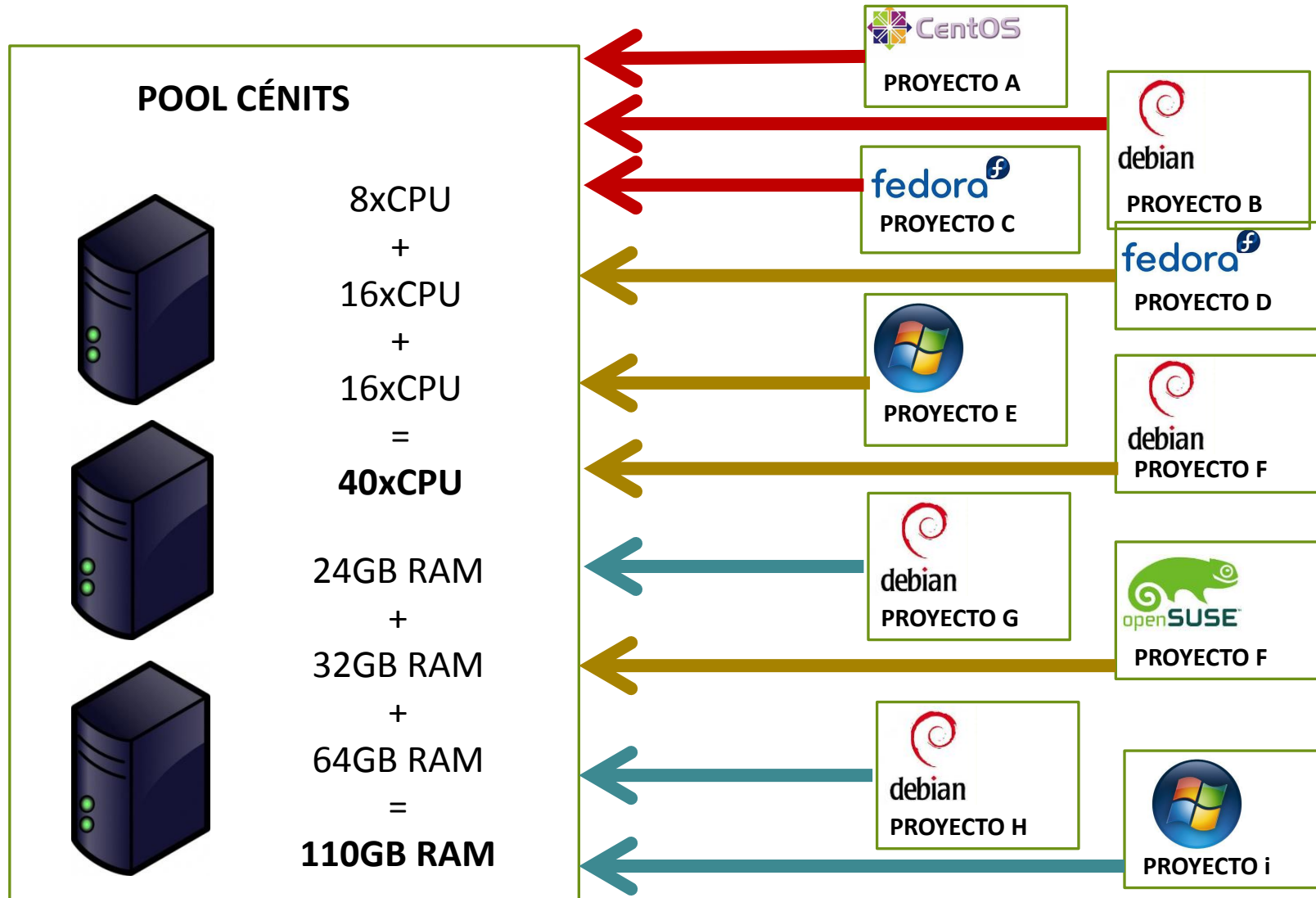
Nivel 1b: Migración parcial



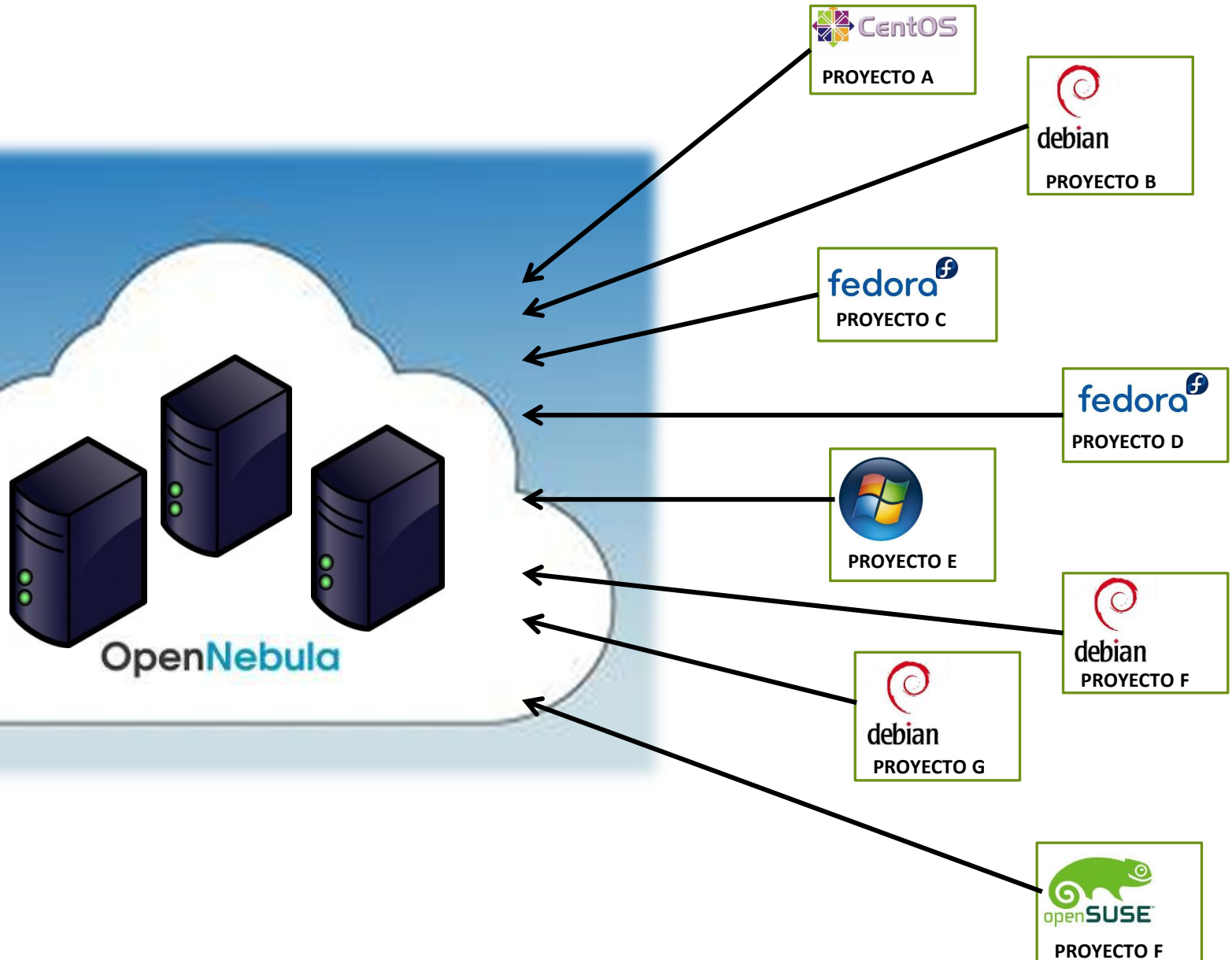
Nivel 2: Migración Completa



Nivel 3: Virtualización escalada



Nivel 4: Cloud Computing



SUPUESTO PRÁCTICO: Oferta de servicios

SERVICIO	TIPO SERVICIO	CPU (unit)	RAM (GB)	DISCO (GB)
SIMPLE o BÁSICO	50 €	1-4	1-4	20 - 1024
		0,1 €	0,05 €	0,0002 €
MEDIO	150 €	4-8	4-10	1024 - 2048
		0,15 €	0,1 €	0,00023 €
COMPLETO	300 €	+8	+10	+2048
		0,2 €	0,2 €	0,0006 €

SUPUESTO PRÁCTICO: Servicios desplegados

NOMBRE	CPU	RAM	HDD
S1	16	24 GB	2 TB
S2	8	8 GB	400 GB
S3	1	2 GB	50 GB
S4	1	4 GB	200 GB
S5	1	4 GB	200 GB
S6	1	2 GB	50 GB
S7	2	4 GB	30 GB
S8	2	4 GB	2 TB
S9	4	32 GB	200 GB
S10	1	1 GB	100 GB

NOMBRE	CPU	RAM	HDD
S11	1	2 GB	80 GB
S12	2	2 GB	1,5 TB
S13	2	2 GB	20GB
S14	1	1 GB	40 GB
S15	1	1 GB	8 GB
S16	1	2 GB	20 GB
S17	2	4 GB	2 TB
S18	2	4 GB	50 GB
S19	2	4 GB	50 GB
S20	1	2 GB	100 GB
S21			5 TB

CPU: 40 DISPONIBLE – 52 UTILIZADO = - 12 SOBREEXPLOTACIÓN → Capacidad crecimiento **NULA**
RAM: 110 GB DISPONIBLE – 100 GB UTILIZADO = 10 GB LIBRES → Capacidad crecimiento **POBRE**
HDD: 260 TB DISPONIBLE – ~14 TB UTILIZADO = MÁS DE 200 TB LIBRES → Capacidad crecimiento **ALTA**

SUPUESTO PRÁCTICO: Variables económicas

GASTOS

VARIABLE	COSTE
PERSONAL	6.720 €
INFRAESTRUCTURA	12.600 €
TOTAL TEÓRICO	19.320 €

COSTE REAL = PERSONAL + INF_{real}
= 6.720 + 600 = **7.320 €**

INGRESOS

21 SERVICIOS

52 CPU's

100 GB RAM

~14 TB HDD

11.726,37 €

ROI

$$ROI = \frac{\text{Ingresos} - \text{Costes Reales}}{\text{Costes Reales}}$$

$$ROI = 0,6$$

BENEFICIOS POTENCIALES

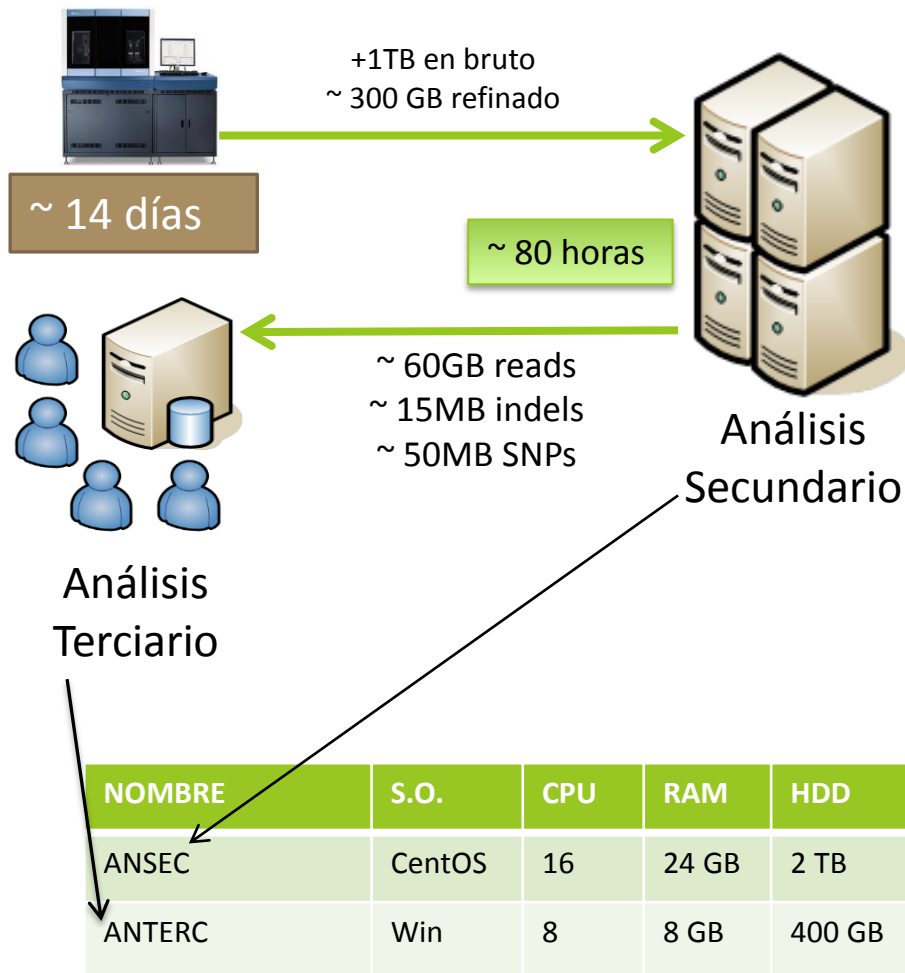
$$BP = \text{Costes Potenc.} - \text{Costes Reales}$$

$$CP_{inf} = 15.500€$$

$$CR_{inf} = 12.600€$$

$$BP = 2.900€$$

CASO DE USO: HPC2 Y LA SECUENCIACIÓN GENÉTICA EN CÉNITS



¿Es posible ofrecer un servicio de este tipo en la nube?

Sí

Infraestructura virtualizada: XenServer

Plataforma Cloud: OpenNebula

Adaptación de servicios de genética: Bioscope, Lifescope, IGV, ChAS ...

¿Está ofreciéndose actualmente en la nube?

No

Escasez de recursos

CPU: - **12 SOBREENPLOTAÇÃO**

RAM: 10 GB LIBRES

HDD: MÁS DE 200 TB LIBRES

No hay capacidad hardware para albergar una sola máquina más con este tipo de servicio

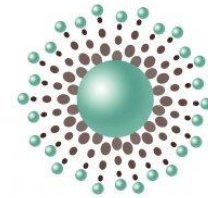
FINAL REMARKS

- **The steps for any company who wants to start offering Cloud Computing have been defined.**
- **Cloud Computing is being promoted and set as a priority objective by the public entities and the ICT area companies.**
- **It's needed an important improve focused on security, privacy and data protection issues.**
- **The technical report can conclude that OpenNebula is the most adapted to CénitS circumstances.**
- **The opportunity study can conclude that this model is cost effective into this assumed business environment.**
- **HPC2 has been set as the next step for CénitS.**
- **Fundación COMPUTAEX is going to invest in infrastructure to increase the resources for this service.**

AGRADECIMIENTOS



Escuela Politécnica



COMPUTAEX

**IMPLANTACIÓN DEL MODELO
CLOUD COMPUTING
EN UN CENTRO DE
SUPERCOMPUTACIÓN**