WORKSHOP GARR 2021

NET MAKERS

La cloud federata GARR:

visione, modello, realizzazione ed evoluzione della community cloud italiana per la ricerca

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CODICE MENTI per le Domande

9489 0567

motto

"Trattenere le nuvole"

(hold onto the clouds)

Re-cap of GARR mission and infrastructure

- [...] fornire servizi per favorire **__l'armonizzazione__, __l'implementazione__ e la gestione delle e-Infrastructure a vantaggio della comunità scientifica e accademica** nazionale; [...]
- [...] sostenere e **__stimolare lo sviluppo__ di strumenti atti a facilitare l'accesso** alle risorse di calcolo, supercalcolo e storage a livello nazionale ed internazionale, **fornendo gli opportuni metodi, interventi e funzionalità** necessari a mantenere le e-Infrastructure ai livelli degli standard internazionali; [...]
- [...] svolgere le connesse attività di ricerca tecnologica, sperimentazione, trasferimento tecnologico e **__formazione__ del personale**. [...]

- **Role**:
  - resource **aggregator** (federation)
- **Goals**:
  - Simplify provisioning of storage and computing
  - Serve different organizations
  - Simplify experience (empower users/administrators)

...lovely picture but how…?

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T.E.C.nica (Tempo Esperienza Costanza)

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(hold onto the clouds)

GARR cloud

- Established
- Tested (even against mid-summer *thunders*)
- Stable and resilient
- and...

up since 2016

(1^{st} production)

IaaS: OpenStack

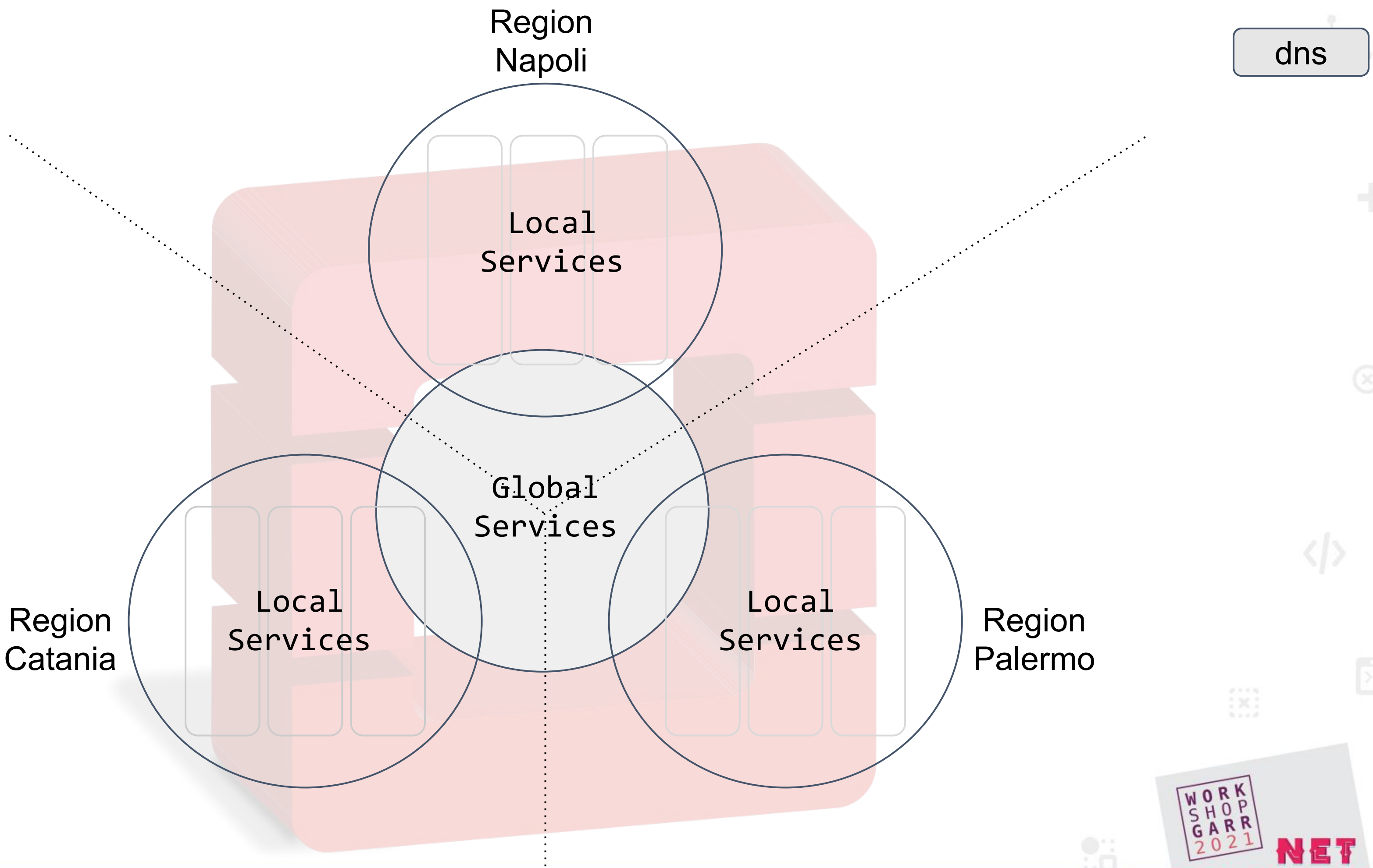
- OpenSource
- no lock-in
- general-purpose (long tail of science)
- sviluppo di competenze
- attenzione a UX (Idem subscription/login, VDC in few seconds, application credentials security...)
- declarative automation (i.a.a.c. esportabile e generalizzabile)

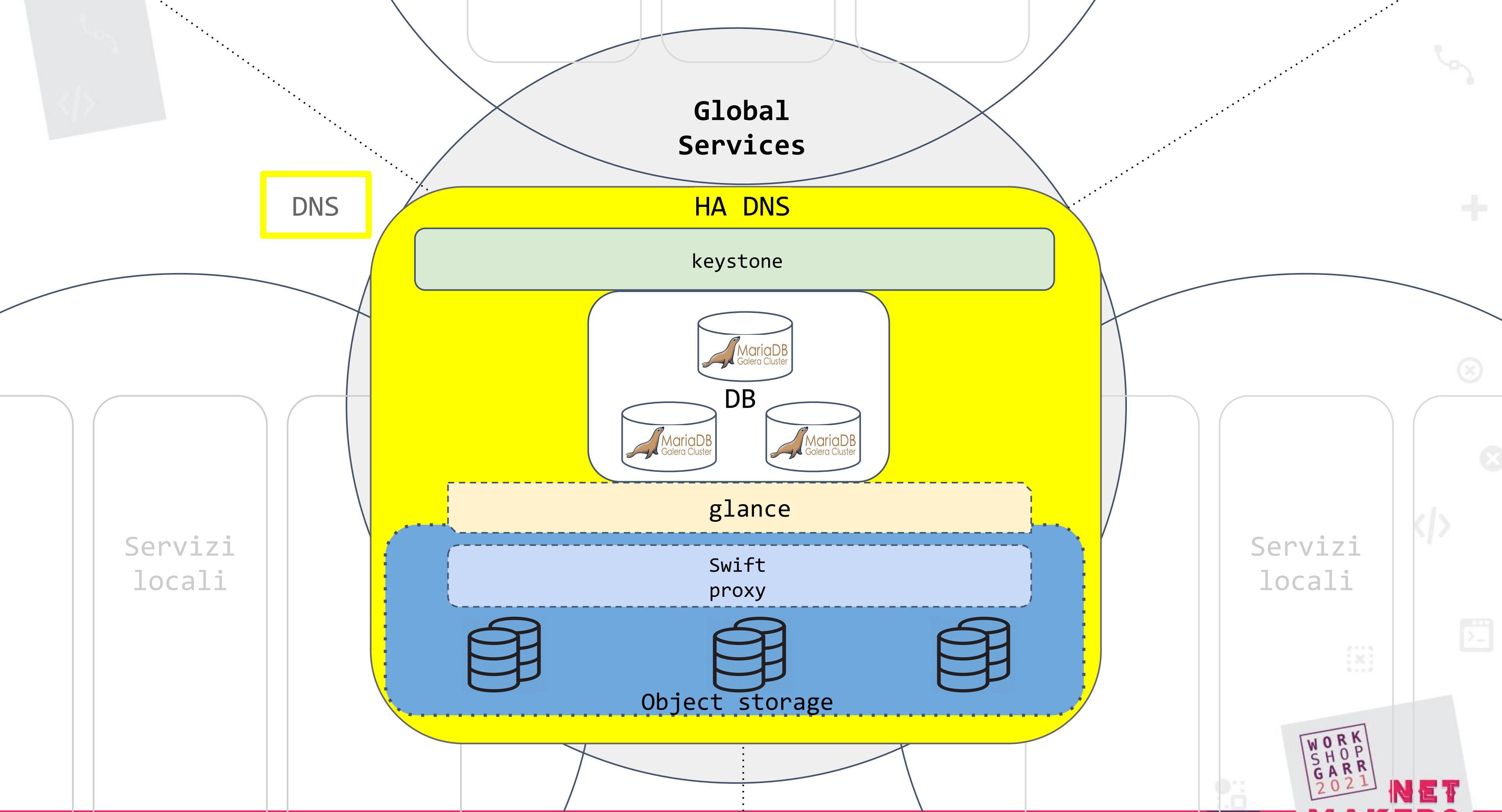
7000 core

10 PB

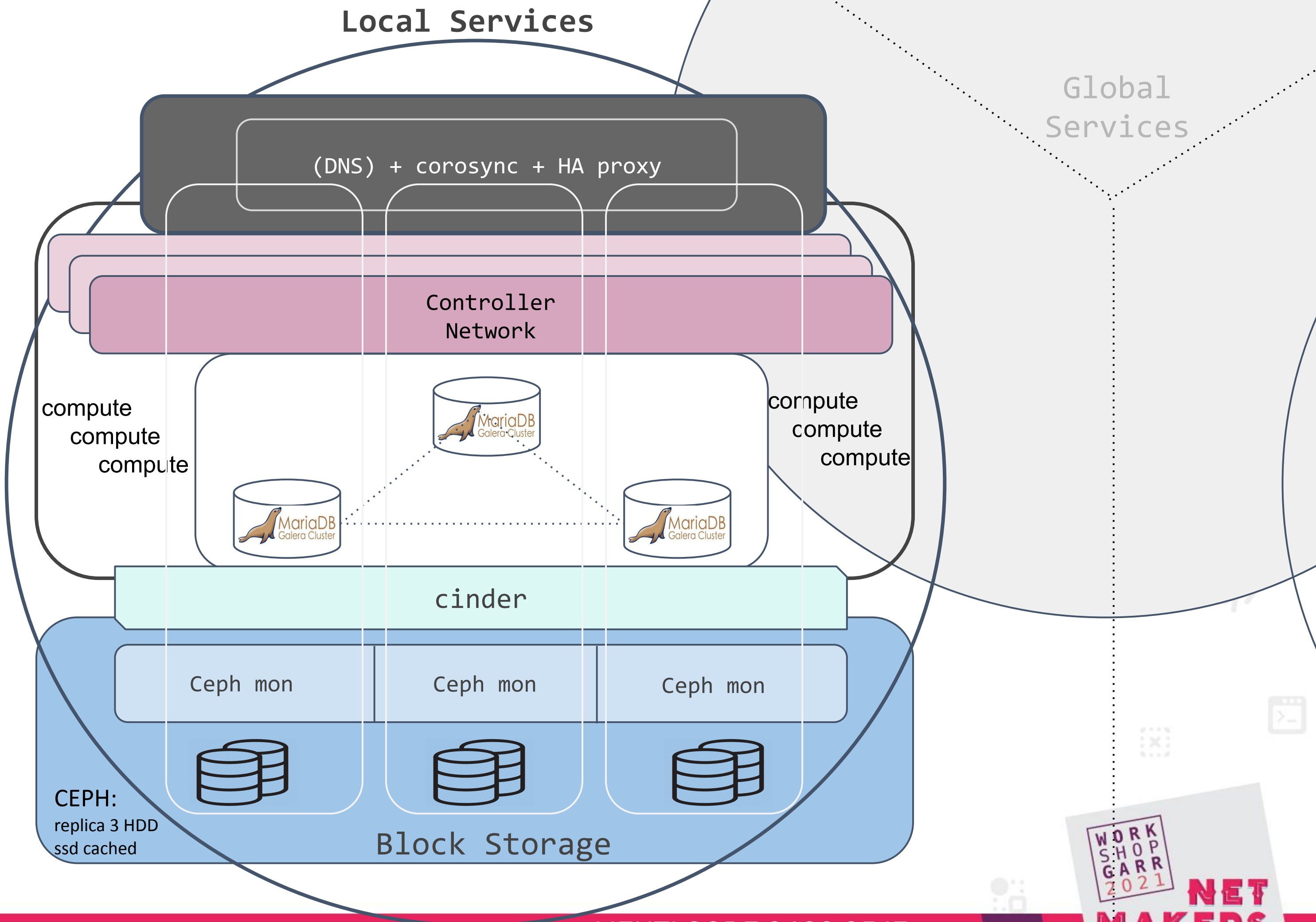
8 GPU

... 8 rack/CSD-modules


Region
Napoli
dns
Local
Services
Global
Services
Region
Catania
Local
Services
Local
Services
Region
Palermo


Global
Services
DNS
HA DNS
keystone
MariaDB
Galera Cluster
DB
glance
Swift
proxy
Object storage
Servizi
locali
Servizi
locali

GARR = 3x


Local Services
(DNS) + corosync + HA proxy
Controller
Network
compute
compute
compute
compute
compute
compute
MariaDB Galera Cluster
MariaDB Galera Cluster
MariaDB Galera Cluster
cinder
Ceph mon
Ceph mon
Ceph mon
CEPH:
replica 3 HDD
ssd cached
Block Storage
Global
Services

SDS CEPH: agility + stability

gestisce **tutto** lo storage

>12 server/sito, **~3PB** (raw sito)

- a blocchi (replica 3) hdd & ssd
- a blocchi ssd + hdd backend (Erasure Coded)
- a oggetti (Erasure Coded)

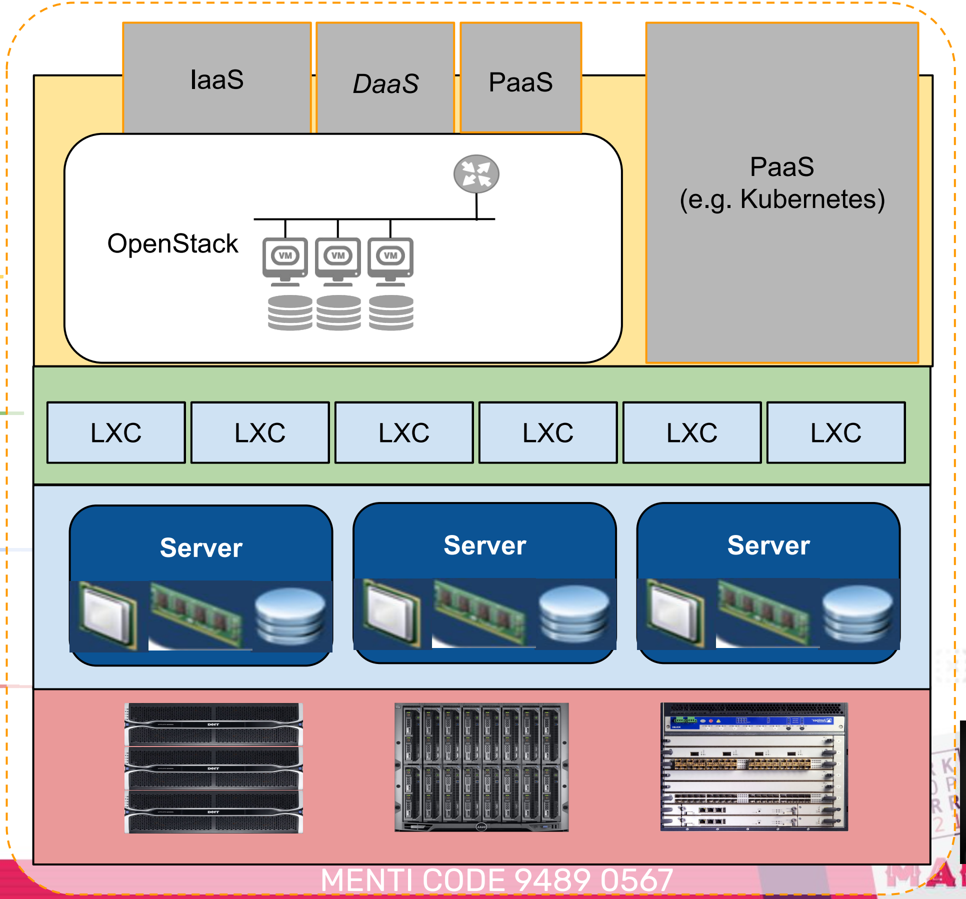
Automazione

via *ceph-ansible* → juju

Messa in produzione dei nuovi server storage, CT

4 Layers recipe:

1. Application Services
2. Infrastructure *Virtualization*
3. Operating System
4. Physical resources



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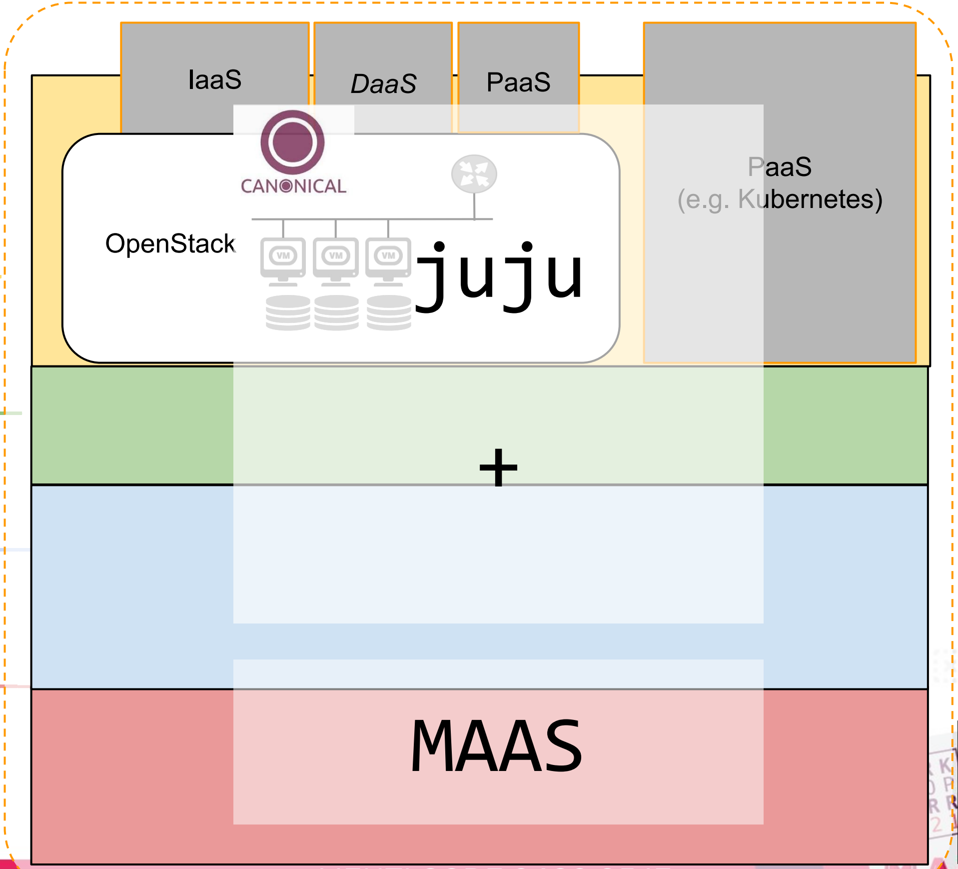


BETTY GILLIS

Multiregion OpenStack federation: iaas user view

- Regioni a disposizione
- Progetti utente
- Risorse per Region

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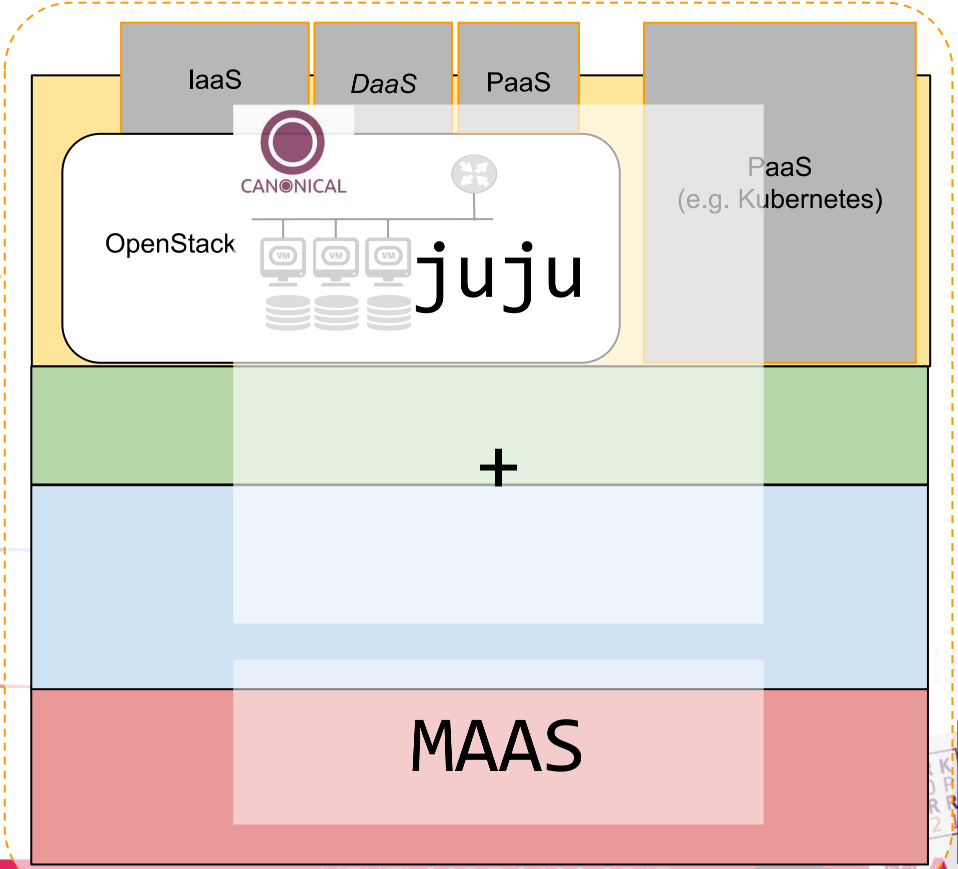


Container platform: Kubernetes for users

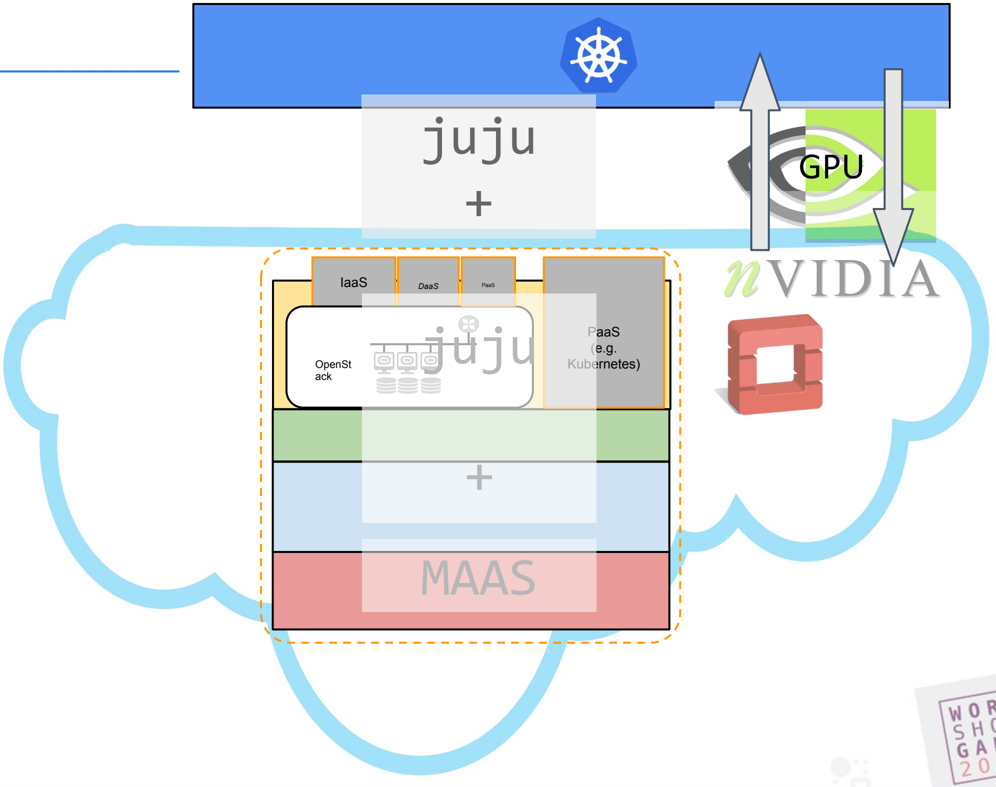
- bare metal cluster 200CPU @ Palermo
- Storage class @ CEPH cluster
- 4 GPU con scheduling per utenti
- HELM charts per package management (ongoing)
- Accesso integrato con I.a.a.S. via application credentials
    - sviluppo fatto in CSD e inserito in main stream O~S
    - integrato con dashboard O~S per UX

Container platform (Kubernetes): la comunità la usa spesso per GPU

- principali users: Università, IRCCS, Virgo...

Stacking the Stack (k8s over O~S)

- Deployment Services
- Cloud GARR



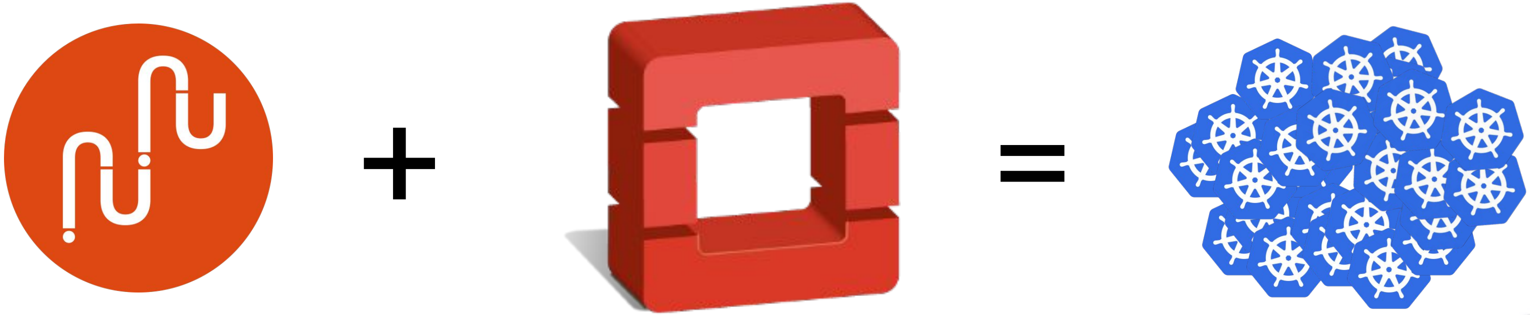
Kubernetes as a Service for *pro-users*

- cluster on demand o self-service
- OpenStack project backend (possibile any backend)

amazon webservices

Google Cloud Platform

Azure



+ = D.a.a.S.

Deployment as a Service:

self service user-oriented *complex* deployments

T.E.C.nica

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T.E.C.nica

keystone (Identity), glance (image)*, *swift* (obj storage)*

*optional

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Join the **Federation:**

"show me the **incentives** and I will show you the **outcome**" Charlie Munger

Target:

- Fornire un modello di cloud aperto e replicabile
- Facilitare Migrazione workload su cloud (circolari AgID / Certificazioni ISO)
- Creare comunità/know how/formazione intorno alle tecnologie cloud

Come:

- Reference architecture
- Modello "*I.a.a.C*" che porti da HW connesso a datacenter virtualizzato
- Workshop: amministratori
- Tutorial: utenti e amministratori
- Hackathon: giovani utenti/studenti

Primo ente federato: PoliTO

Enti federandi: UniTO, Emso, INGV and *counting*

Enti esterni con il nostro modello: INGV sale sismiche

(Architettura modificata su requisiti), EaP

*optional

Fed GARR region : modello *from 0 to everyKing*

senza alcuna cessione di sovranità

Prerequisiti per la federazione:

- Hardware montato e “spina inserita”
- Accesso alla **rete** per l’installazione del software
- ILO accessibile via IPMI-over-LAN (o se volete stare in sala macchine un paio di cuffie antirumore)

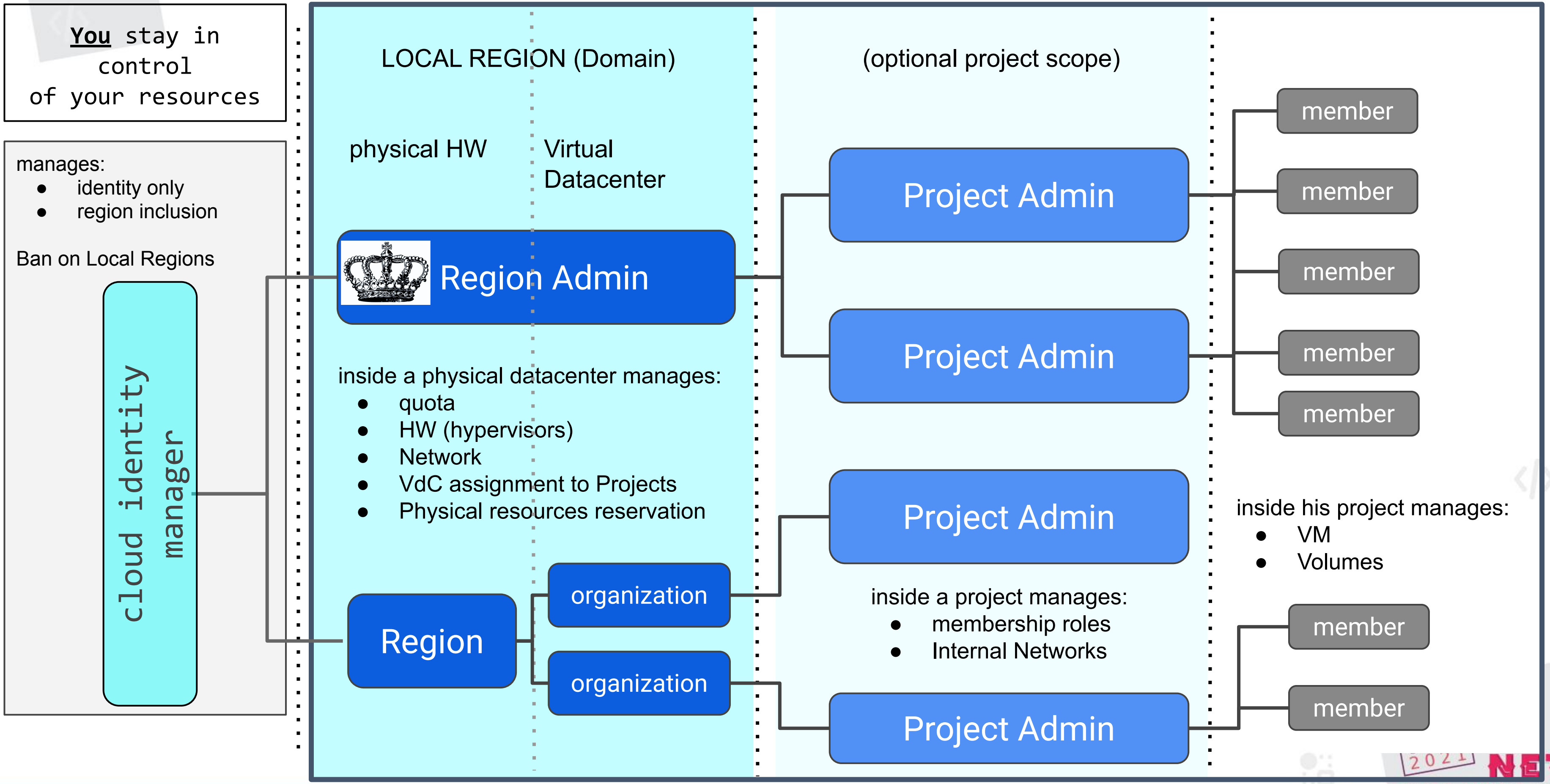
Ricetta in 3 *ingredienti*:

- Installazione e configurazione dei tool di automazione di seconda generazione (MAAS e Juju)
- deploy e configurazione della regione OpenStack (via Juju in modo dichiarativo)
- **Trasferimento endpoint URL nella regione keystone/identity che fa da catalogo (procedura ad-hoc)**

Operation/Administration: **per ogni** *REGION*

- **1 King** (amministratore della region che possa assegnare e suddividere le risorse come con l’HW di un datacenter fisico verso i gruppi di ricerca)
- i *cavalieri* possono registrarsi con credenziali idem (ma anche OIDC e user-pass)

delegation of authority (via domains, policy and metadata filters)



what is available till now: quite a lot...

- 5 + 2 regions up and running
- 4 deployments openstack for a total of about **20.000 vcpu** (and counting till 100k - 120k)
- more than **500** users (demo account for 6 months)
- **Virtual Data Centers** delivery in minutes (~500)
- **Physical Data Center** administrative **delegation** (you administer what you own and offload to other regions)
- ***DaaS*** for advanced PaaS or simplified IaaS (via juju with OpenStack cloud backend)
- **Kubernetes** container platform 4 NVIDIA GPUs on bare metal
- **Kubernetes** container platform over O~S virtual clusters for admin/advanced purposes
- **Federated access** (SAML-idem and OIDC-google)

but the important thing is…

- simple **Federation *recipe*** (git and knowledge base available, references later)
- Reference **architecture** with use cases
- **Deployment** of OpenStack bare metal (+LXD) region up & running in a **few hours**
- **5** federated regions (**3** federations successfully using GARR architecture) regions (and counting...):
  - Politecnico To
  - GARR Torino (pre-production)
  - HPC4AI project (architecture)
  - 3 INGV region (ad hoc architecture for external federation)
  - EAPConnect (East EU Nren, external federation)

next steps

- kubernetes virtualization completa (cfr precedenti slide): flessibilità vs GPU, accesso/gestione admin
- network upgrade: ipv6, DVR, provider network
- HW upgrade: migrazione sui nuovi srv, ampliamento dello storage, incremento GPU
- governance
- altre reference architecture
- ampliare services portfolio

(la discussione su FED proseguirà anche nella TF I.C.D.I.)

- accounting (cross owner region): billing, reciprocità, analisi trend di utilizzo e valutazione crescita
- beyond federation: federation sharding (keystone to keystone trust mesh)

photo by: Guylaine Bégin

federation recipe:

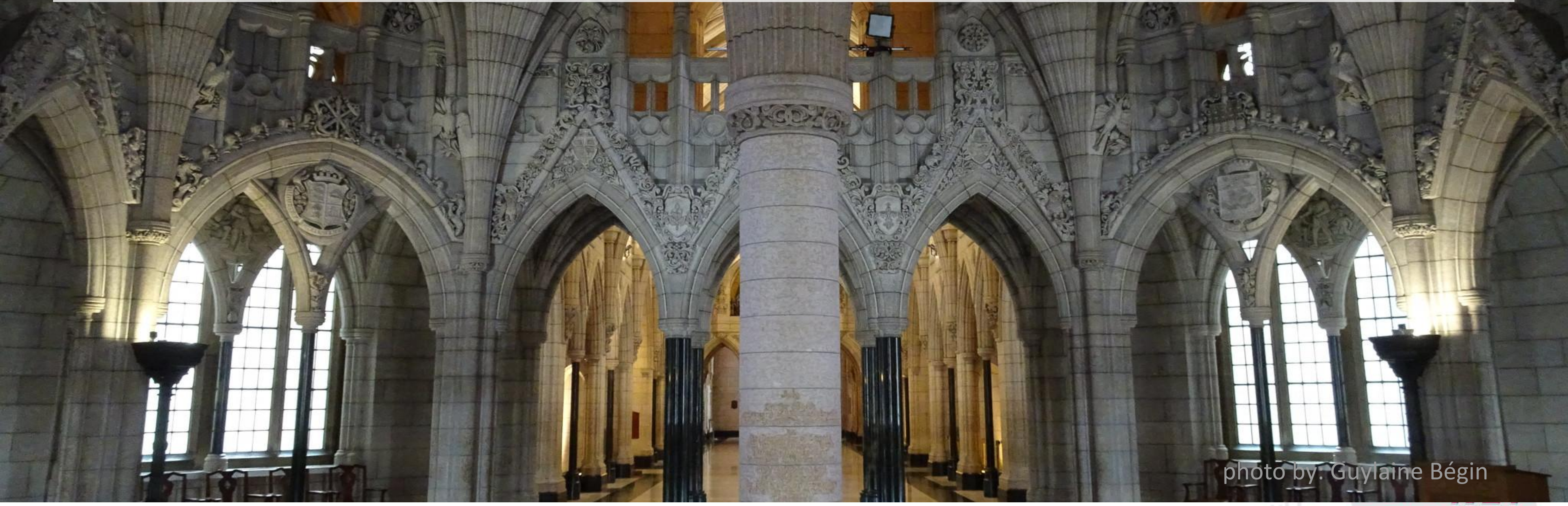
knowledge base: https://cloud.garr.it

useful code: https://git.garr.it/cloud/federation

photo by: Guylaine Bégin

Grazie

drop us a line for specific info: cloud-support@garr.it



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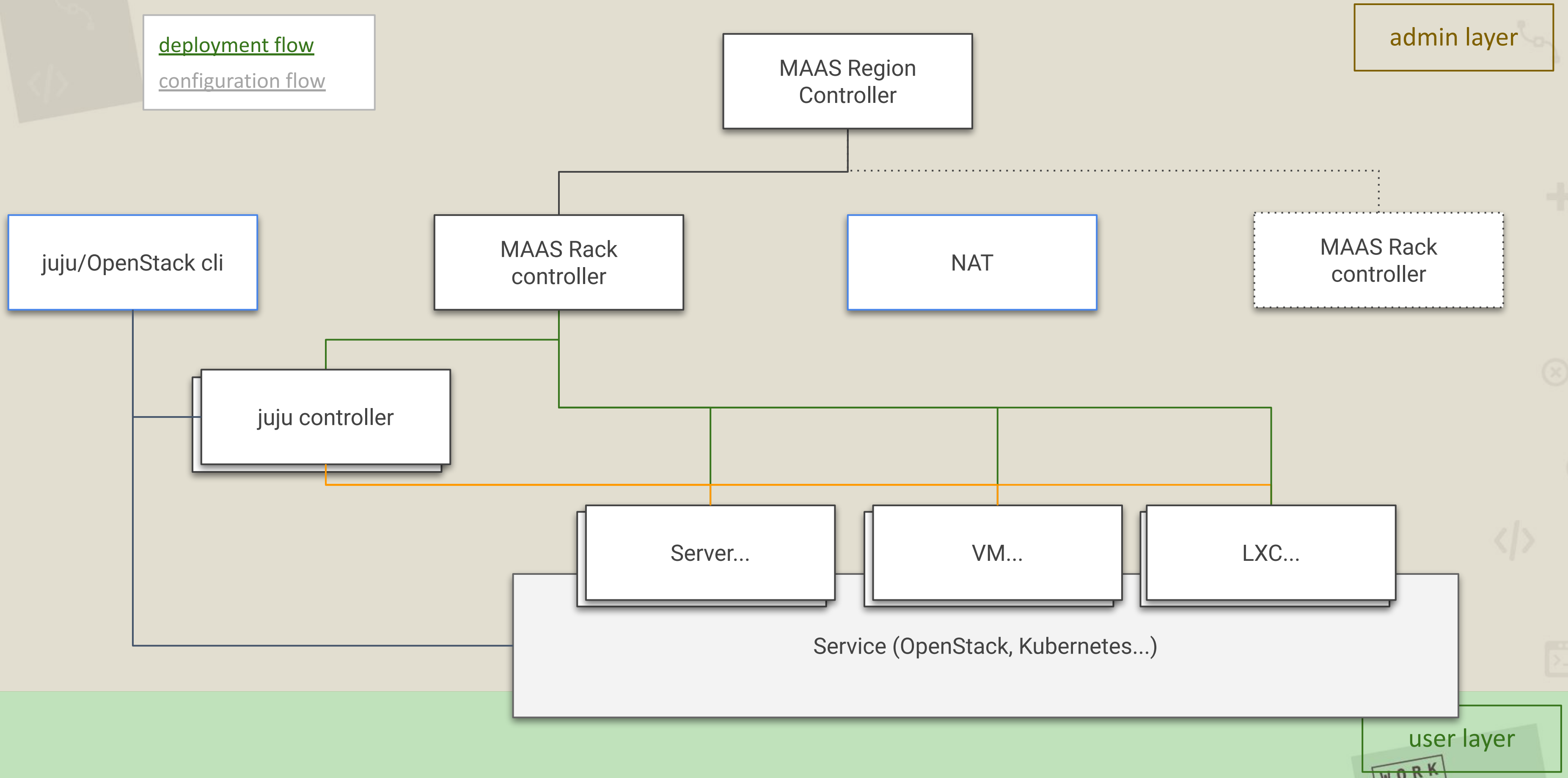
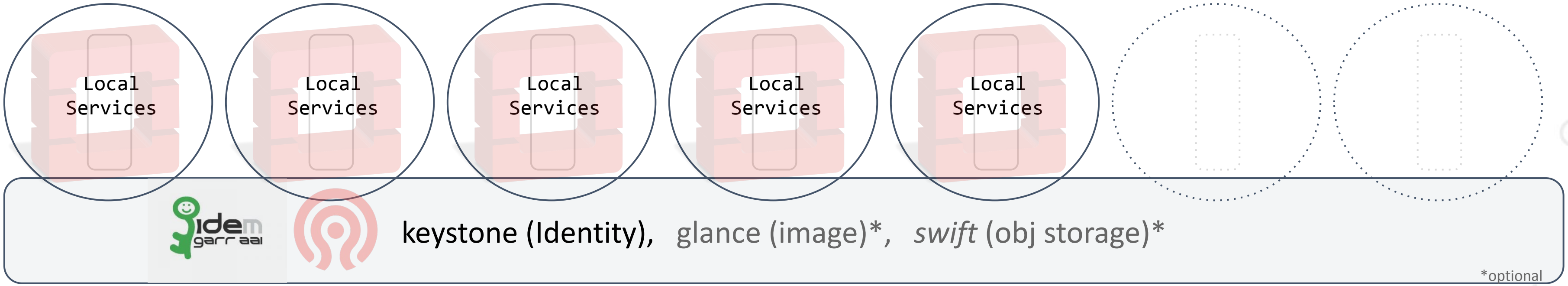

deployment flow
configuration flow
admin layer
MAAS Region Controller
juju/OpenStack cli
MAAS Rack controller
NAT
MAAS Rack controller
juju controller
Server...
VM...
LXC...
Service (OpenStack, Kubernetes...)
user layer

our concept of building a *Federation*

the **simplest** (for federated region admin) the **better**

the **less** requirements the **more** inclusive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idem garr aai
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Procedure of inclusion

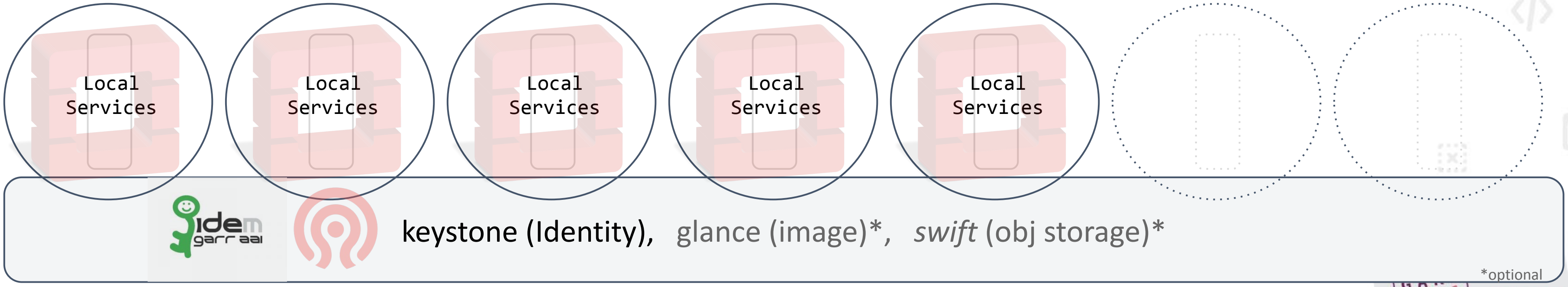
- Bundle OpenStack - attaches to validation cluster
- Validation in “DMZ” cluster
- **No cleartext credentials exchange**

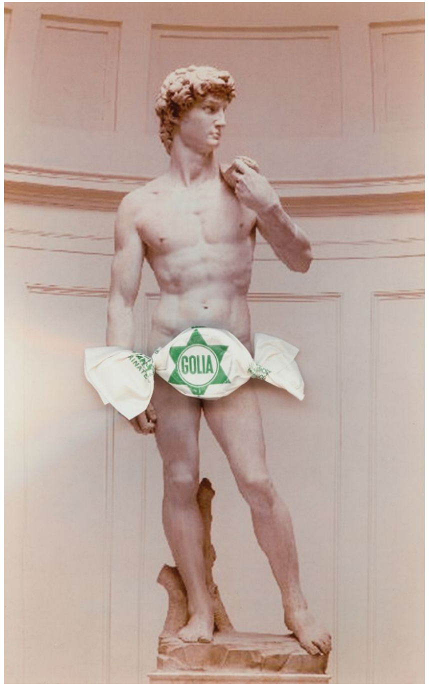
for research institutes:

1. You own HW, but have no manpower/knowledge (yet)
2. You already have an OpenStack deployment (keystone/identity compatible one)

everything is publicly available (see next) and we contribute to community projects:

- Horizon
- K8s-keystone-auth
- juju charms: ceph, keystone saml/sso, default gw, moodle…




GOLIA