Distributed open cloud computing, storage and network with WNoDeS and OpenStack: experience, patterns and evolution

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Overview

- WNoDeS State

- Main New Features

- Experiences and Involvement

- New Integrations and Collaborations

WNoDeS State

Key Characteristics

- Use of Linux KVM to virtualize resources on-demand that are available and customized for
  - direct job submissions by local users
  - **Grid job submissions** (with direct support for the EMI CREAM-CE and WMS components)
  - **instantiation of Cloud resources**
- Use of LRMS (a "batch system software") to handle VM scheduling
  - There is **no need** to develop special (and possibly inefficient) resource brokering systems
  - The LRMS is totally invisible to users for e.g. Cloud instantiations
- Do not Use of "Cloud over Grid" (or "Grid over Cloud")'s concept to handle resources
  - WNoDeS simply **uses all resources** and **dynamically presents them to users** as users want to see and access them

Key Advantages

- Use of a common pool of resources
  - There is **no need** to dedicate resources to "user interfaces", "Grid computing", "Cloud computing", "local users"
  - All types of resources are taken from a common pool, resulting in overall **better utilization of resources**

- Integrated support of old and new use cases (local access, Grid computing, Cloud computing)

- Re-use of ten years of worldwide development, expertise and resources brought about by Grid Computing applied to the key areas of **Authentication**, **Authorization**, **Accounting**, **Information Systems**, **Brokering**

- Flexibility and scalability
  - At the core of WNoDeS there is **a standard batch system** used for resource provisioning and policing a mature, stable piece of software found in any sizeable resource center
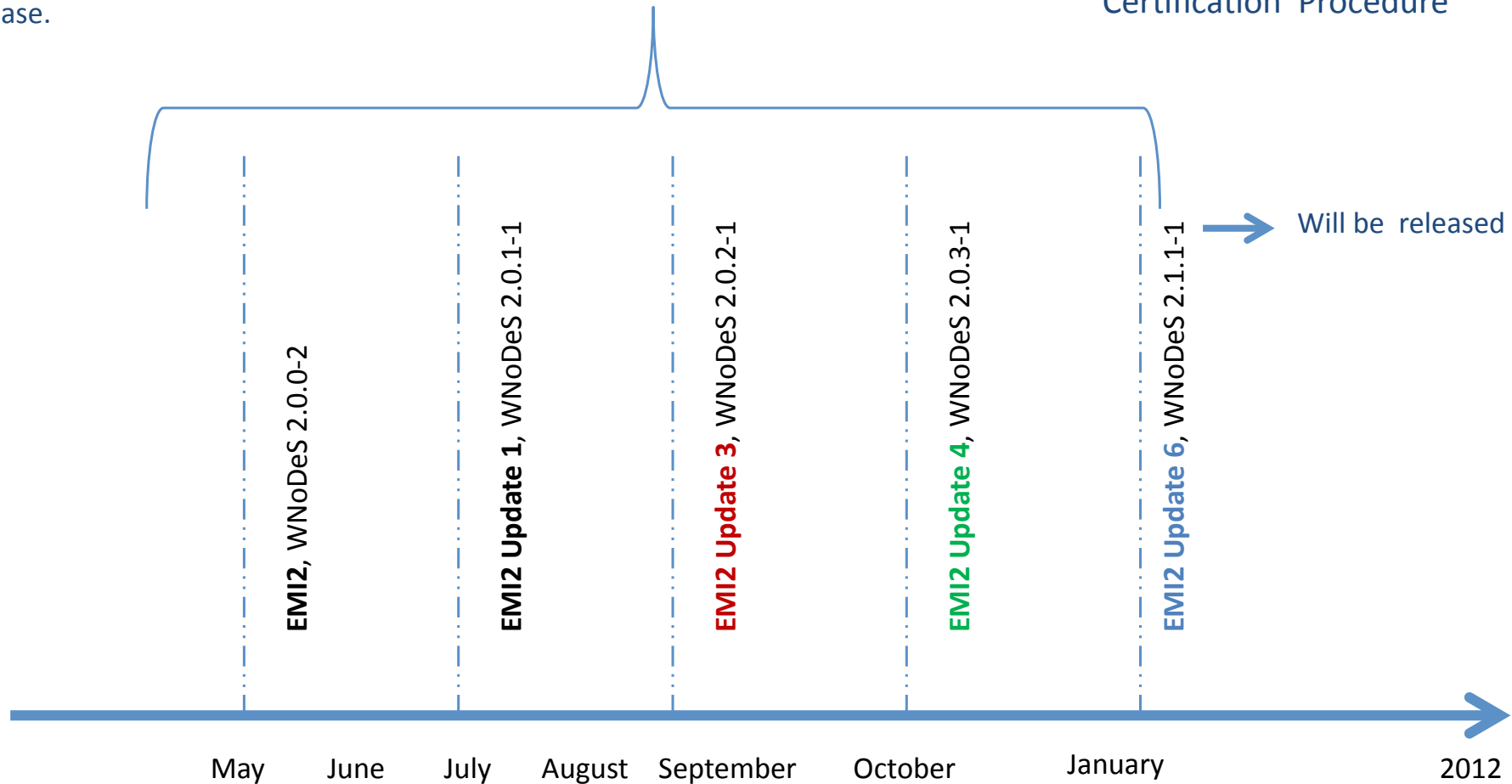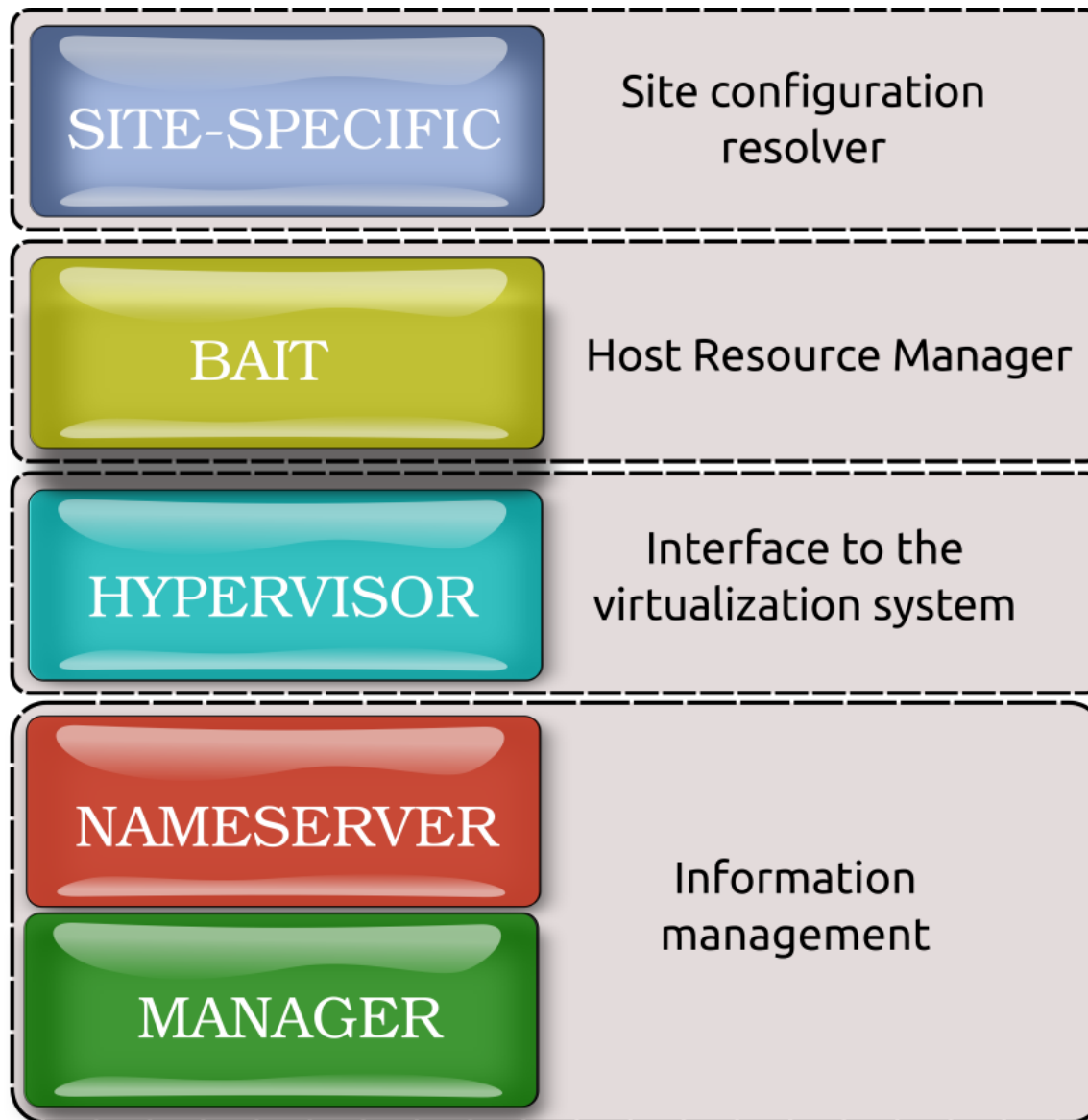
Plan

On December 2011
WNoDeS was accepted in
EMI and included in EMI2
release.

EMI2

Reliability
Quality
Certification Procedure

Will be released

EMI2, WNoDeS 2.0.0-2

EMI2 Update 1, WNoDeS 2.0.1-1

EMI2 Update 3, WNoDeS 2.0.2-1

EMI2 Update 4, WNoDeS 2.0.3-1

EMI2 Update 6, WNoDeS 2.1.1-1

May   June   July   August   September   October   January   2012

WNoDeS Core Components

|	
SITE-SPECIFIC	Site configuration resolver
BAIT	Host Resource Manager
HYPERVISOR	Interface to the virtualization system
NAMESERVER	Information management
MANAGER	

WNoDeS runs on top of a Batch System

- Testbed against LSF and Torque/ Maui
- *For EMI* certified and delivered to work with Torque/Maui
- *For Tier1* configured against LSF

Mixed Mode

- What
  - A WNoDeS configuration option allowing the use of physical resources as both traditional batch nodes and as hypervisors for the instantiation of virtual machines – on the same hardware, at the same time
  - VMs can be used to also run batch jobs or to provide cloud services

- Why
  - Some tasks are not suitable to be executed on virtual nodes – for example, jobs requiring GPGPU resources, or jobs with high I/O requirements: run them on physical nodes
  - On the same physical nodes, one can also offer virtualized services for those users requiring them> no need to set aside nodes for virtualized services

- Where
  - Mixed mode is included in the WNoDeS version released with EMI2 and can be administratively turned on or off

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Mixed Mode
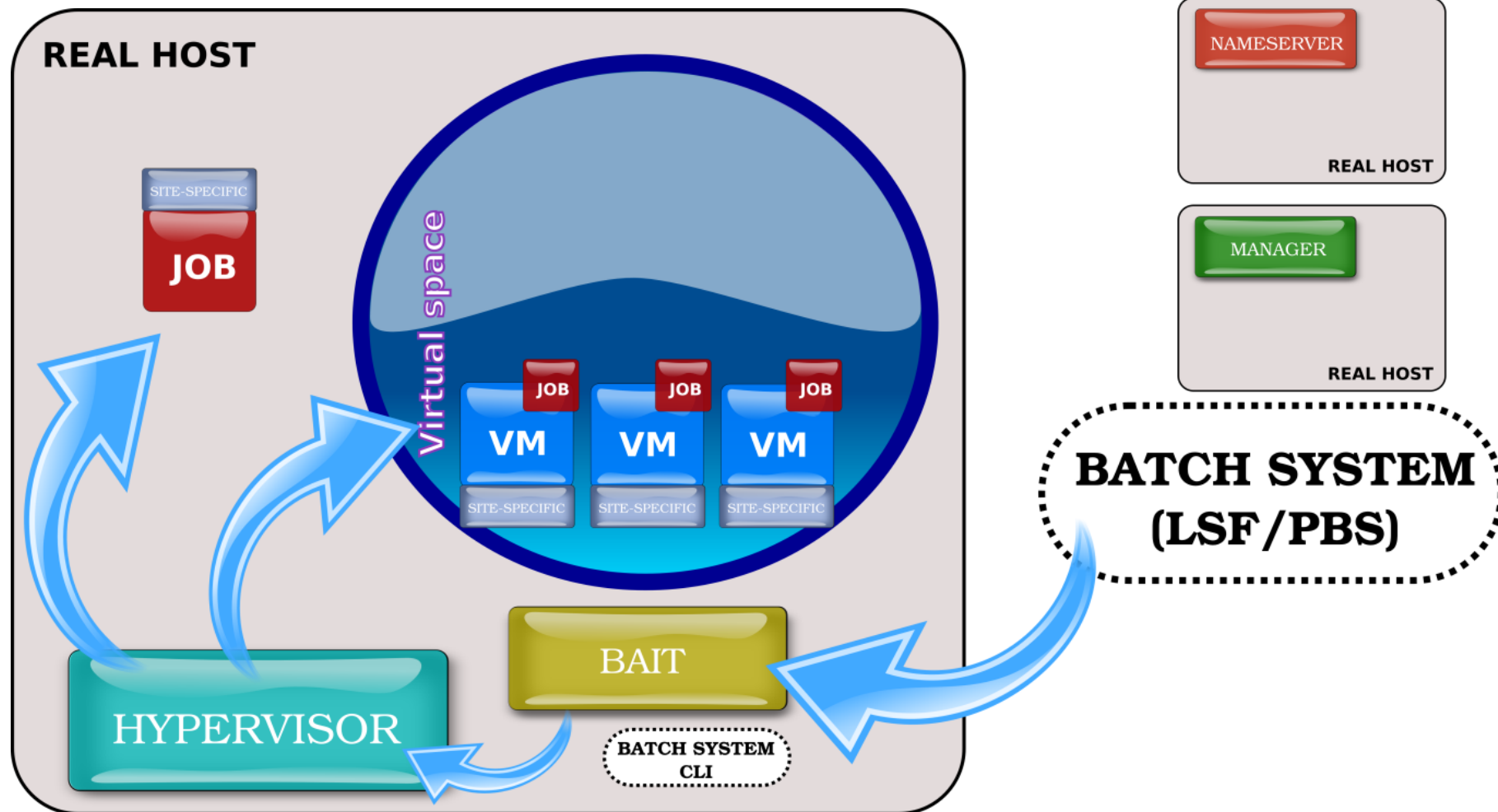
Pros

Progressively install WNoDeS in a farm without first having to decide which nodes will support virtualization and which not.

Add support e.g. for Cloud computing, interactive usage on custom VMs etc. in a traditional farm.

Direct jobs to VMs or to real hardware using LRMS policies and a simple pre-exec/prologue script (a template is supplied with the WNoDeS distribution). One can differentiate real vs. virtual requests/ jobs e.g. based on queues, users, requirements, Grid VOs, etc.
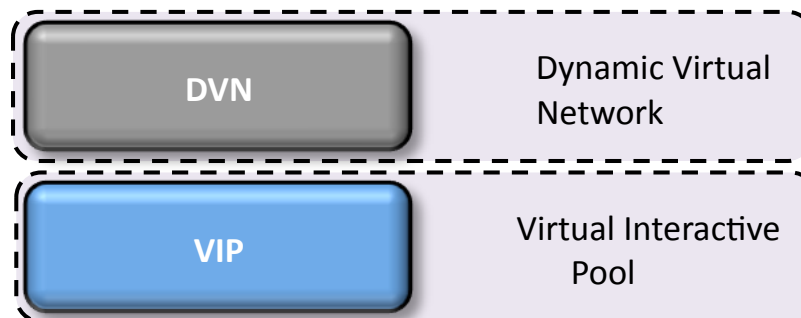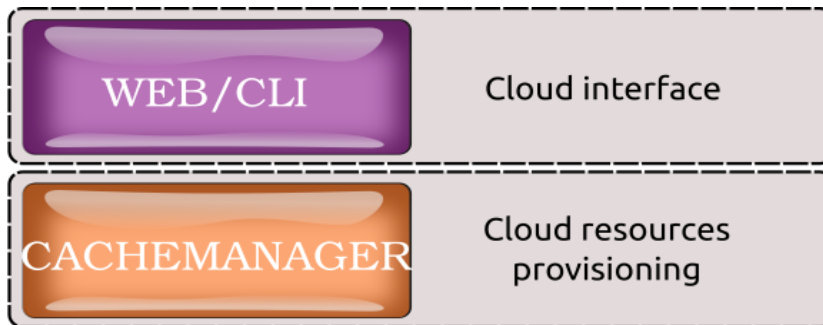
Cons

In a purely virtual farm set up, physical systems are only used as hypervisors, so they can be put e.g. in private address space. With mixed mode, they can also be used (like in a traditional farm) to run jobs and may need public access.
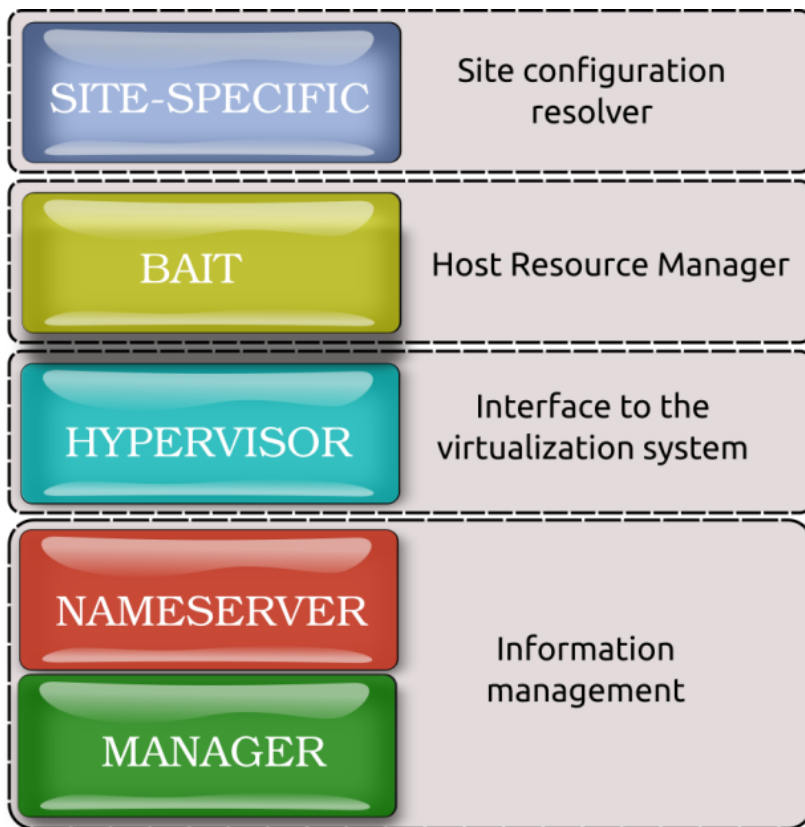
With mixed mode, a physical system is part of the LRMS cluster and may use up LRMS licenses proportionally to the number of its cores. If the same physical system is then also used to create VMs that become part of the LRMS cluster (e.g. to run batch or grid jobs), these VMs will also use up LRMS licenses and the total number of LRMS licenses used by a physical system may be O (2*cores). This can be a problem with some sites using commercial LRMS.

New Features

Further Components

WEB/CLI	Cloud interface
CACHEMANAGER	Cloud resources provisioning

DVN	Dynamic Virtual Network
VIP	Virtual Interactive Pool

EMI3

SITE-SPECIFIC	Site configuration resolver
BAIT	Host Resource Manager
HYPERVISOR	Interface to the virtualization system
NAMESERVER	Information management
MANAGER	

EMI2

Latest developments

- Cloud computing via **OCCI interface**
  - Will be compliant to OCCI 1.1 and accessible via a CLI
  - *See 'real' demo at the EGI TF Praga workshop, the 20th of September 2012* http://prezi.com/hrzwekguwfkx/virtualcing-cloud-demo-on-wnodes/

- Cloud computing via **IGI Portal**
  - *See **M. Bencivenni's presentation** at the GARR Rome Workshop, the 29th of November 2012*

- Cloud computing via **Web interface**

- **Dynamic virtual networks**
  - Won't require using 802.1q to partition networks and will allow dynamic instantiation of private VLANs (either local or across multiple sites) and address assignment for VM isolation – a much needed feature in cloud environments
    - *Also allowing possible provisioning of services like Cloud bursting (to other resource centers), or Cluster as a Service.*
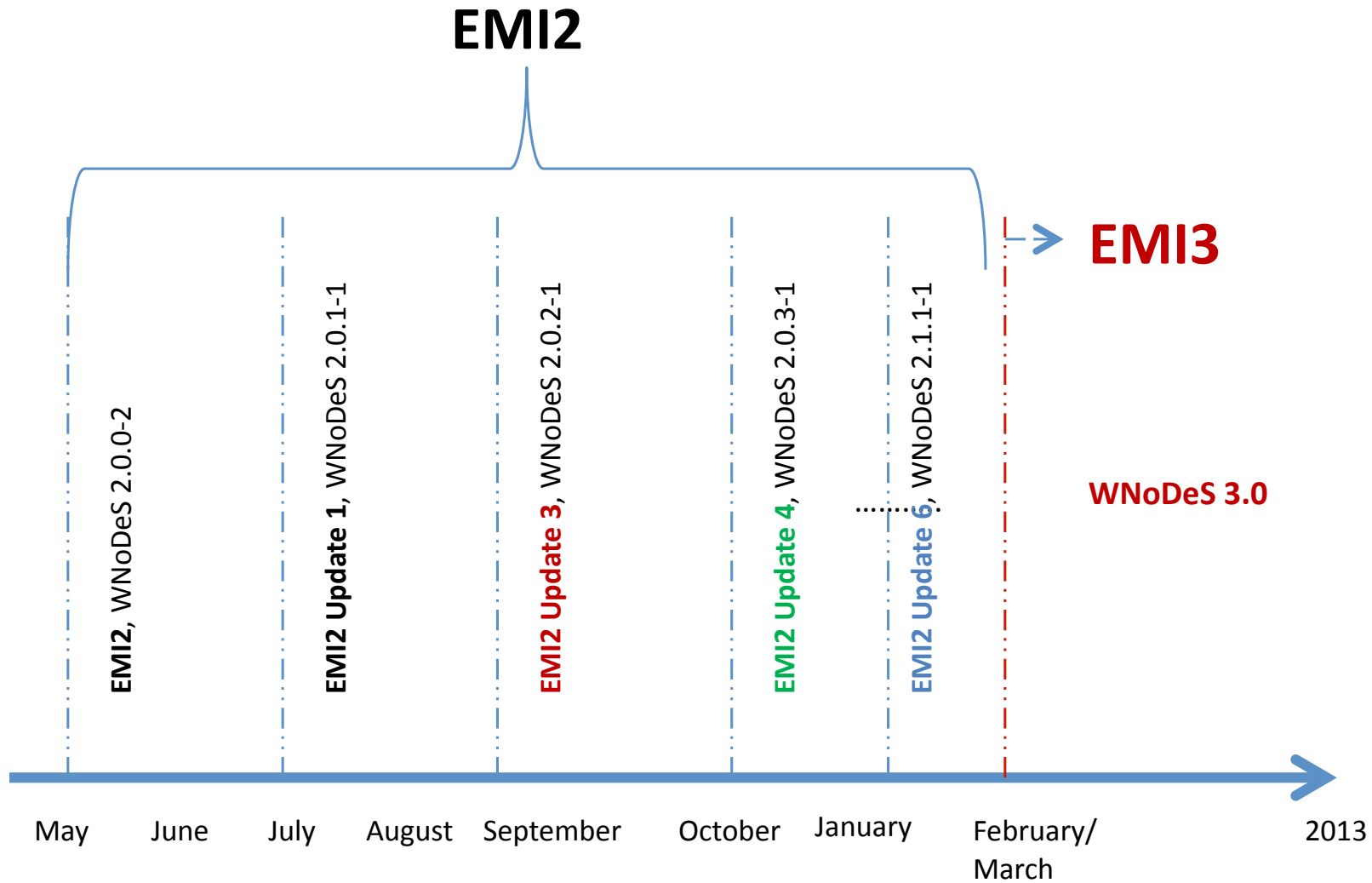
In the near future

- **Interactive usage**
  - We will use this at the INFN Tier-1 to support self-instantiation of VMs by local users. These VMs can be used for e.g. analysis tasks, testing purposes, etc.
    - *As with other WNoDeS services, resources can be taken from the general purpose Tier-1 farm (no service partitioning, unless one specifically configures it.)*

- **Integration of multiple authentication methods**
  - The current WNoDeS cloud Web application and OCCI interface use X.509 + VOMS; this will be extended to support federated access (already available in the IGI portal)

Plan

EMI2

EMI3

EMI2, WNoDeS 2.0.0-2

EMI2 Update 1, WNoDeS 2.0.1-1

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WNoDeS 3.0

May   June   July   August   September   October   January   February/ March   2013

Experiences and Integration

INFN Tier1

- WNoDeS on top of LSF and IBM GPFS is **in production** at INFN Tier-1 (CNAF, Bologna) since November 2009

- Currently WNoDeS is managing about 2000 on-demand Virtual Machines (VMs) there

- WNoDeS's mixed mode feature is turned on

- In this context, the Auger experiment (astro-particle physics) uses WNoDeS in order to reduce the number of accesses to mysql servers

WeNMR virtual research community

- Verified how WNoDeS enables scientists to perform NMR computations by using the OCCI cloud interface

- Supported Use Case:
  - Instantiate customized VMs in order to rebuild a given protein structure taken from a remote server where pushing back the produced output

- Will be shown another application at ISGC 2013 with the usage of the IGI portal and multi-WNoDeS sites

EGI Fed Cloud

- *Define a federation model for cloud computing based on open source solutions*

- **Identify and work** with resources providers, technology providers, and user communities.

- **Integration of cloud resources** within EGI's production infrastructure – e.g. monitoring, accounting and information publishing.

- **Identify** issues that need to be addressed by other areas of EGI – e.g. policies, operations, support and dissemination.

- **Blueprint document**: advice/full documentation to resource providers/ users on how to engage with the federated virtualised environment.

- **Test bed**: implement interfaces and services for a federated cloud on the basis of the Task Force blueprint and the available standards and technologies.

Federation Testbed

Composed of 4 services, 2 management interfaces, 7 cloud infrastructures operated by 6 Resource Providers. 3 more providers are in the process of being federated.

From PhD M. Turilli, EGI TF 18-21 September 2012, Prague

WNoDeS for EGI TF
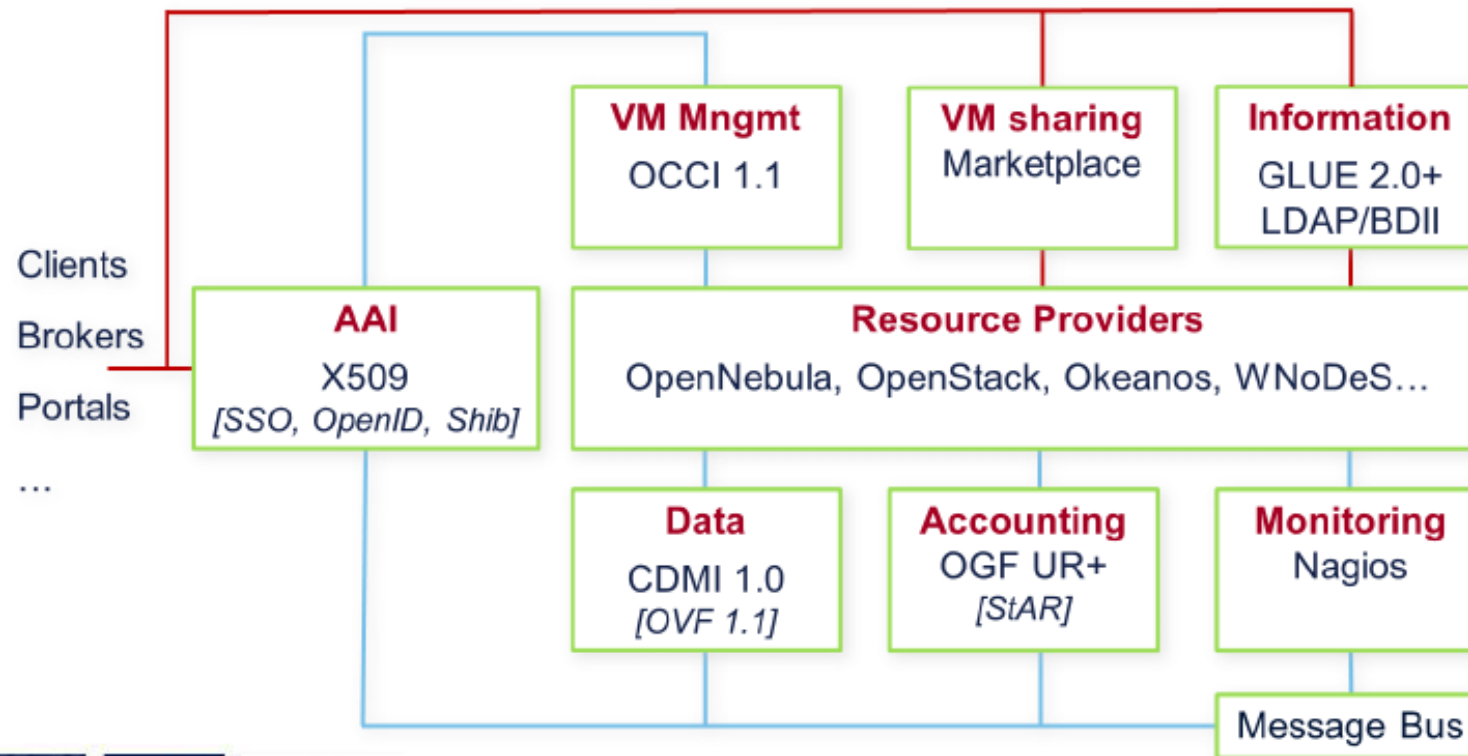
- Dedicated test bed with 24 cores (set up in collaboration with IGI)

- Published resource information on the EGI TF IS

- Registered image files in the Stratuslab marketplace

- On-going the monitoring of the OCCI server on the EGI TF Nagios

- On-going the deployment of the accounting script

New Integrations and Collaborations

OpenStack

- Add WNoDeS features to OpenStack in order to support scientific computation jobs by providing a WNoDeS plugin to be integrated into **OpenStack Nova**

- Extend the **OpenStack dashboard** to monitor and administer WNoDeS services

- Use the **Glance service** for discovering, registering, and retrieving virtual machine images

- Use **OZ** to create, update and contestualize images

- Allow VMs instantiated via WNoDeS to access storage defined through OpenStack

Collaboration with Projects
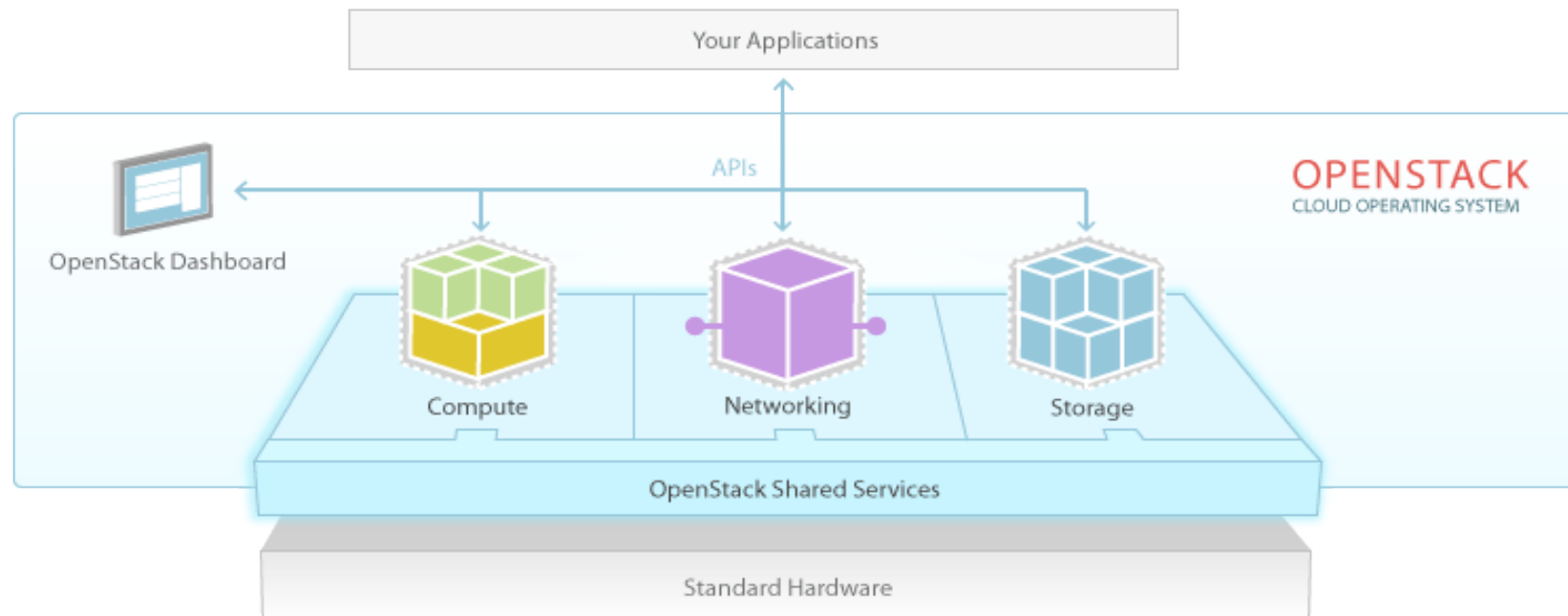
- The Marche Cloud project is interested in evaluating the WNoDeS' DVN (Dynamic Virtual Networks) solution, for dynamic, on-demand creation of virtual network infrastructures
  - *See also **P. Veronesi's presentation** at the GARR Rome Workshop, the 30th of November 2012*

- The approved P.O.N. called "Prisma" has WNoDes as one of its key building blocks, and is interested in working toward a solution for federated cloud access and brokering

- An additional couple of Smart Cities projects were recently submitted, aiming at extending WNoDeS to support PaaS and SaaS services for Public Administrations

Information

- For further information and questions

  WNoDeS mailing list, wnodes@lists.infn.it

- The WNoDeS Web site

  http://web.infn.it/wnodes

- Team

  D. Salomoni (INFN CNAF), A. Italiano (INFN Bari), G. Dalla Torre (INFN CNAF), D. Andreotti (INFN CNAF), G. Donvito (INFN Bari), E. Ronchieri (INFN CNAF), V. Ciaschini (INFN CNAF)

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[4] D. Salomoni, A. K. Calabrese Melcarne, A. Chierici, G. Dalla Torre, A. Italiano, "Performance improvements in a large scale virtualization system", PoS(ISGC 2011 & OGF 31)049

[5] D. Salomoni, D. Andreotti, L. Cestari, G. Potena, P. Solagna, "A Web-based portal to access and manage WNoDeS Virtualized Cloud resources", PoS(ISGC 2011 & OGF 31)054

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[7] D. Salomoni, E. Ronchieri, "A Dynamic Virtual Networks Solu6on for Cloud Compu6ng", NDM 2012, Salt Lake City, UT, USA

[8] M. Bencivenni, "Portale Web IGI Portal di accesso a risorse Grid e Cloud per le comunita' scientifiche", 29-30 Workshop Garr, 29-30 November 2012

[9] P. Veronesi, "Realizzazione di una infrastruttura Cloud pilota basata su OpenStack", 29-30 Workshop Garr, 29-30 November 2012

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