The Road to EMI

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Personal views based on direct personal experience.
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The foundation of the grid (Social and political)

- At the end of 90's 4 important initiatives have provided a favourable background for the foundation of a distributed grid infrastructure

1. F. Gagliardi action to prepare an EC project for the LHC computing
2. The launch of the eScience program in UK
3. The publication of the Book "The Grid " from Ian Foster and Karl Kesselmann in summer 1999
4. The action of the INFN Presidency setting up the CNTC the Committee for the new technologies for LHC

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1. The preparatory actions

- EU-NSF discussions on transatlantic collaboration on IT subjects
- EU-US workshop on large scientific data bases and archives in USA in September ‘99
- Meeting between EU and HEPCCC in November ‘99
- Kick-off meeting at CERN for an EC project proposal on Jan 11, 2000

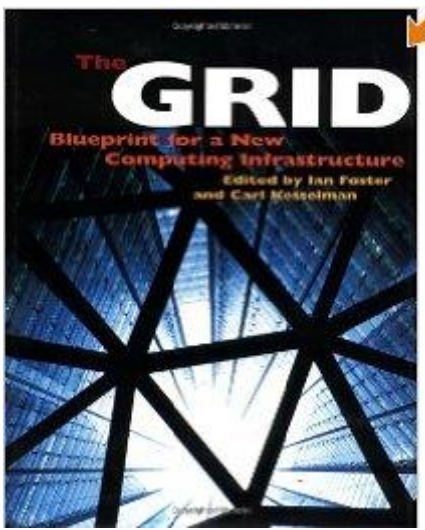
2. The eScience program in UK

- **The e-Science** program was launched by John Taylor, the Director General of the United Kingdom's Office of Science and Technology of the Blair Cabinet in 1999
- Large funding initiative planned to start in November 2000 to create new computational tools and infrastructures to support scientific discovery.
- Particle physics took the lead in the program for the preparation of LHC

3. The set up of CNTC in Italy

- At the end of ’90s the INFN Presidency took the initiative of setting up a Committee (CNTC) for developping the new technologies necessary for the preparation of the Computing for LHC
- All INFN experts collected in a unique board to discuss and plan a general solution for the lHC computing
- The INFN Grid project was proposed by CNTC at the end of ‘99 and approved for funding by the INFN Board of Directors in February 2000

Spring ‘99 :The Grid Book



The Grid: Blueprint for a New Computing Infrastructure

Ian Foster (Editor), Carl Kesselman (Editor)

-> A. Ghiselli mentioned this book to me (President CNTC) in July ‘99

The technological revolution

- At the end of ‘ 80s, beginning of ’90s the commodity personal workstation had reached a level of reliability, cpu power and network bandwith sufficient to be able to use them to build computing clusters
  - The Aleph Farm showed that clusters could be used for data acquisition and event filtering
  - The Delphi Farm proved in ‘91 that a Digital cluster was as effective as a mainframe for event reconstruction and simulation at a cost ten times lower . The era of Mainfraimes was at the end !

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Distributed Computing

Distributed computing - 1990's - locally distributed systems

- Clusters
- Parallel computers (IBM SP)
- Advances in local area networks, cluster management techniques

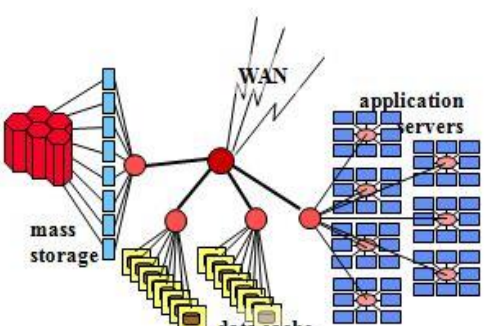
→ 1,000-way clusters widely available

Computing activities become distributed but the experiment's model remail central

Distributed Computing – 2000's

- Giant clusters → *fabrics*
  - New level of automation required
- Geographically distributed systems
  - Computational models

- Key areas for R&D
  - Fabric management
  - Grid middleware
  - High-performance networking
  - Grid operation



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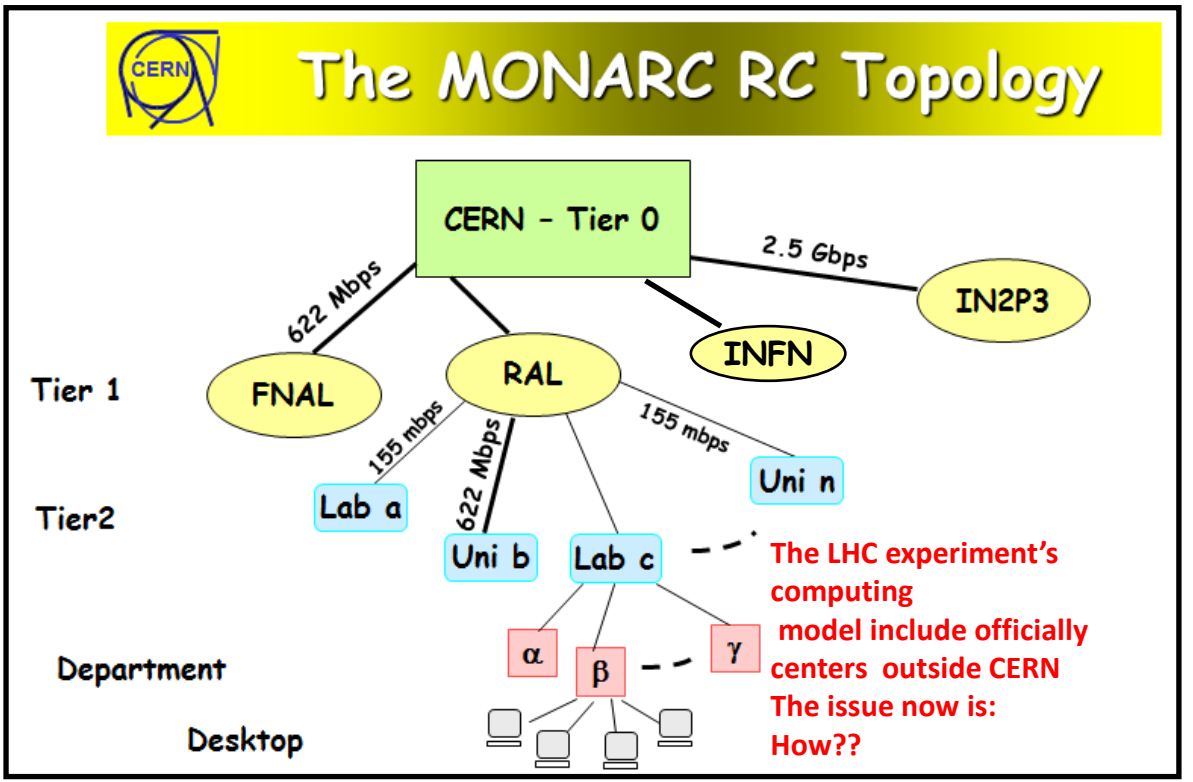
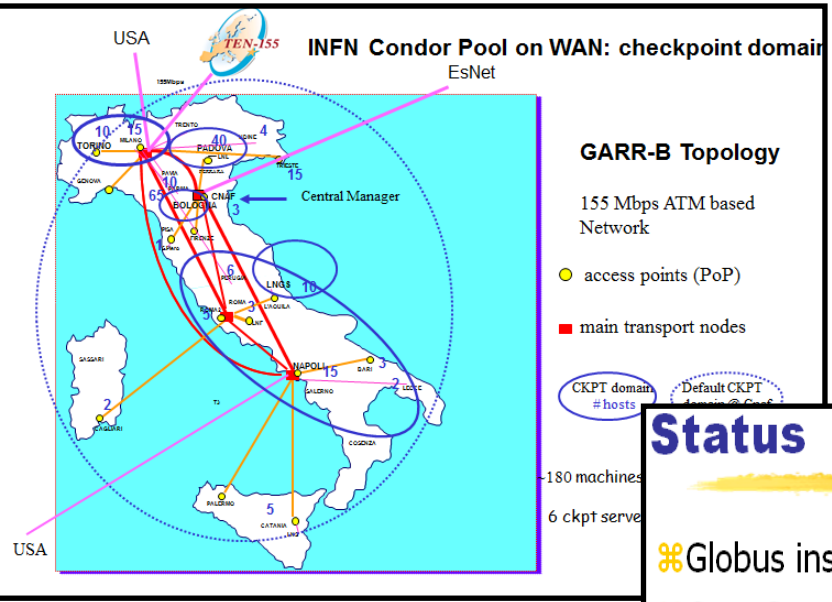


‘99 n INFN Condor Pool and Globus testing



In late ‘90s first hands-on experience in INFN on Distributed Computing: Development of Condor on WAN

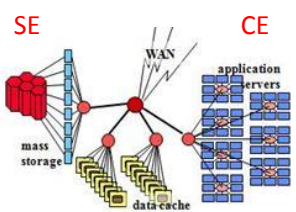
Launch of Globus tests in INFN
In September 1999

Status

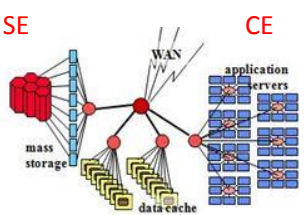
- Globus installed in 5 Linux PCs in 3 sites
- Globus Security Infrastructure
  - works !!
- MDS
  - Initial problems accessing data (long response time and time out)

The open issues in ’99 in HEP

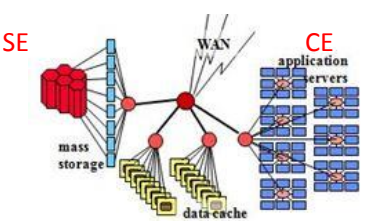
- Data Centers based on all sort of different legacy tools
  - *Batch Systems (Fork, LSF, PBS, Condor, NQE.....)*
  - *Storage Systems (all sort of combinations of different tools)*
  - *Tape storage systems (many solutions)*
- Need for Security , delegation to access different services...
- Centers Directors not willing to change their legacy solutions and the current way user were working
- Not easy !



Center A



Center B



Center C

The start : CHEP 2000 in Padova

- LHC with its regional centre architecture (MONARC) becomes the driver of the establishment of a new type of Distributed Infrastructure in Europe and Worldwide
- Ian Foster and Karl Kesselman invited by me on Saturday and Sunday after the conference (in agreement with Les Robertson) to explain Globus
  - 100 people remained there during the week end
- Confirmed the choice for an EC project

  -> Launch of the DataGrid proposal
- Start Globus test program coordinated by CERN

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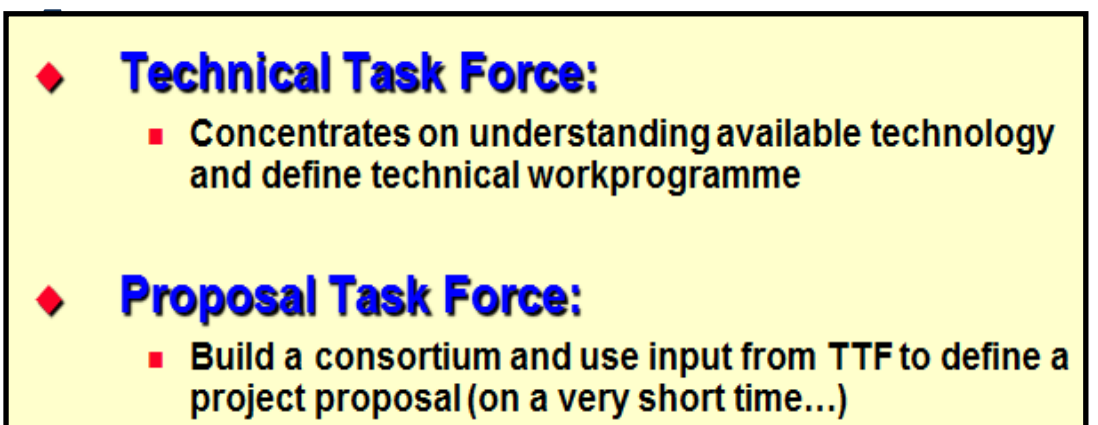
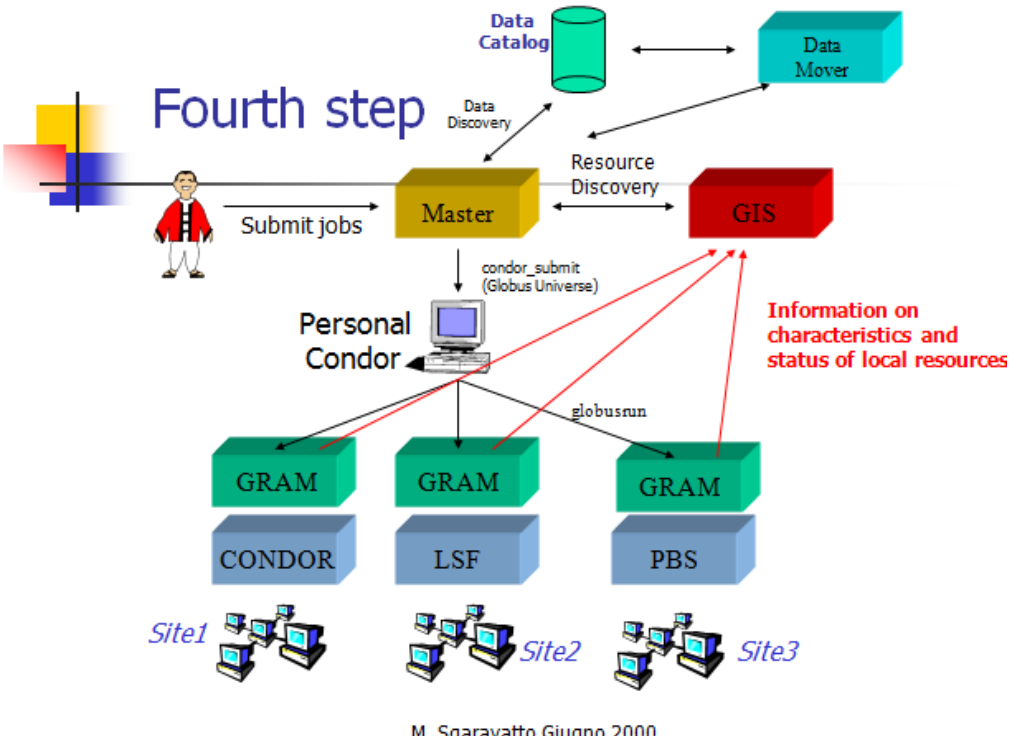
2000. DataGrid preparation

- The workshop at the end of CHEP with Foster, Kesselman became a real no return point towards the constitution of the Italian and European Grid
- The definition of DataGrid proposal lead by F. Gagliardi/CERN started with the launch of 2 Task



6/2000: the Datagrid architecture



INFN in DataGrid

The DataGrid Project

DataGrid is a project funded by European Union. The objective is to build the next generation computing infrastructure providing intensive computation and analysis of shared large-scale databases, from hundreds of TeraBytes to PetaBytes, across widely distributed scientific communities.

INFN was responsible of leading the work on workload management

Integration of Condor and Globus into a system that is batch system independent → the Compute Element concept is conceived

DataGrid Project Outline

- Focus on:
  - management of large amount of data
  - high throughput computing
  - automated management of both local computing fabrics and wide-area GRID
- Middleware development
  - Start of a middleware open source community in Europe aiming at producing general solutions valid for all Science and beyond
- All steps with true testbeds demonstrators
- Very clear guidance from user communities :HEP, ESA , Bio
- Very different from today!

The developments

- Standardization
- Interoperability
- Workload Management
- Data Management
- Authorization

The Global Grid Forum

- In October 2001 after the approval of Datagrid international agreement to create the Global Grid Forum (mainly Research a Academia people) taking over previous Grid Forum activities
- Transformed in Open Grid Forum in 2006 (+industry)
- Balanced management between EU and US
- “The GGF working groups are investigating best practices for the design and interoperation of distributed systems, and the development of recommendations regarding the implementation of grid software”
- Since then some successes but still missing interoperabilty “standard” worldwide adopted

Information Modelling and Resource Discovery

- Starting with the DataTag (2002) project and in collaboration with C. Kesselman, INFN has defined the grid information model as the cornerstone for information discovery across multiple infrastructures
- S. Andreozzi is co-author of the GLUE standard specification at the Global Grid Forum
  - *GLUE is still today the foundation of Information discovery, one of the EGI core infrastructure services*
- One example of successful specifications of GGF/OGF

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The Storage Resource Manager-SRM

- The interface to Storage took more time than Globus GRAM-Condor and it came only in 2006/7 thanks to a very long period of test of SRM v2.2 interface implementation (F. Donno et al.CERN)
  - Space reservation
  - Direct access to reserved storage space
  - Space management policies
- SRM V2.2 implemented for:
- BeStMan (LBNL), CASTOR (CERN and RAL), dCache (DESY and FNAL), DPM (CERN), and StoRM (INFN and ICTP).
- Not much progress since then but SRM deserve probably some more attention!

The VO Membership Service

- The Virtual Organization Membership Service is today a cornerstone of EGI and OSG security infrastructures and allows authorized access to resources based on user membership
- Inspiring principle : Centers managers remain always in control of their resources
- Alternative to Globus CAS: resource allocated to VO once
- The service which implements the VO membership management (VOMS) is deployed across all EGI resource infrastructures
- Nice example with STORM and ARGUS of evolution from an initial national development to a wider usage

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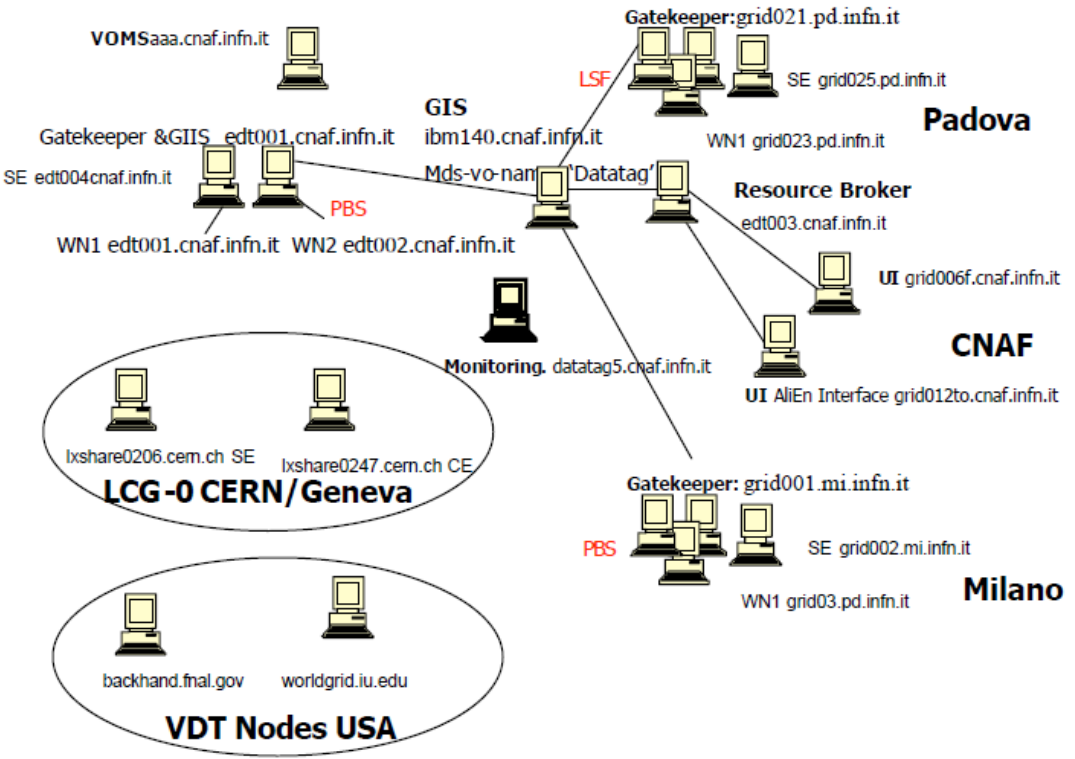
DataTag 2003: The first VOMS testbed



2002. The Grid.it project

- Grid attracts the interest of the Italian Ministry and other Italian Research communities
- The Grid.it national project (funded by MIUR for a cost of 12 M€) supports the development of a national Grid infrastructure in Italy
  - INFN, CNR, Astrophysics, Geophysics ,Universities, Compute Science…
  - Software development ,Prototyping of operations centre services, User requirement driven
  - Extension of service functionality for non HEP sciences
    - *VO membership service (VOMS), SRM(StoRM) for parallel file systems, authorization framework* ***(G-BOX->ARGUS)***

2003. Start of EGEE operation model

- Definition of the European Grid tiered operations model
  - Local support delegated to Regional Operations Centres (ROCs)
  - Central support (CERN originally, later distributed)
- Work is distributed
  - C. Vistoli becomes Coordinator of the EGEE ROCs
  - GGUS is proposed and realized as central incident Management system of EGEE located il Karlsruhe

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2006. The National Grid Infrastructures

National Grid Infrastructures develop all around Europe

The Italian Grid Infrastructure is a mature production computing infrastructure

Including INFNGrid resources and operated by the Grid Operations team at CNAF

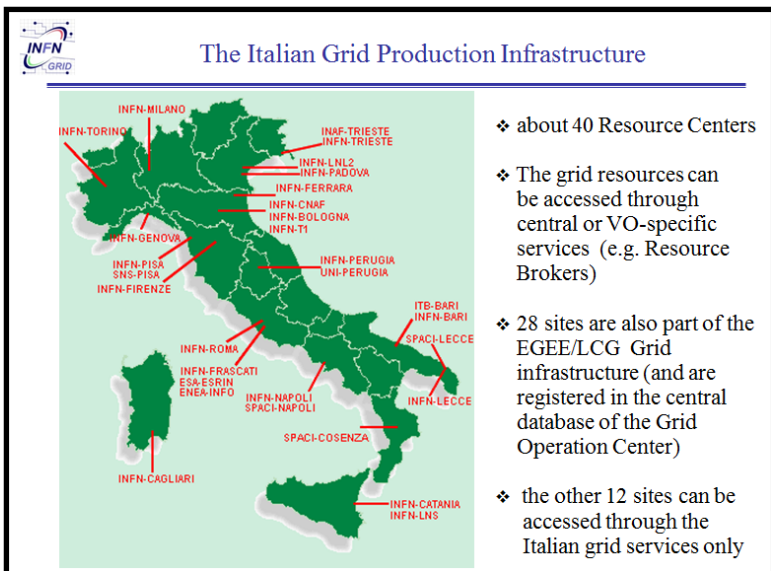
Grid monitoring, accounting, user and operations support, on duty support teams

Multiple operations services at CNAF

23 multidisciplinary VOs

40 resource centres

28 EGEE sites



2001-2013: The florishing of projects

…..but not real progress in architecture and services compared to Datagrid/EGEE I

The difficult route to interoperability

- OMII Europe
  - First attempt to introduce OGF standards in European middleware components and interoperability
- Several difficulties:
  - Not interest from user communities as WLCG and Data Centers to contribute
  - Not interest/involvement from US teams
  - OGF standard specifications often immature and not adequate to guarantee interoperability

The seocnd EMI attempt in 2010 (my view)

- Continue to provide middleware components to EGI satisfying the general prescription of open distributions
- Armonize the European middleware, guarantee interoperability and consolidate an open software community in Europe to make the next steps
- Move to new technologies and introduce new components to expand the user base and to make acess easier

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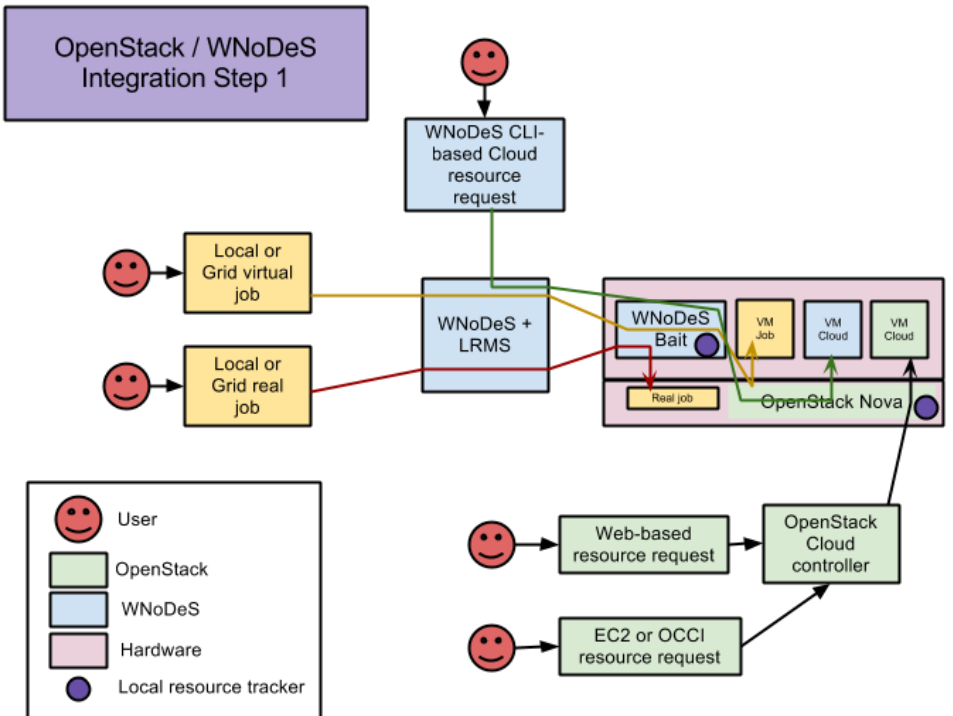
EGI and EMI

- In 2010 the European infrastructure operation and management and the grid middleware development separate from each other and from user communities
  - EGI managed by new organizations (NGIs)
  - EMI carried out by software development teams
- After 3 years 93.7 percent of EGI users are still coming from LHC
- Innovation limited to formal little improvements
- The architecture of the EMI middleware is still the one defined in 2001
- No real serious discussion over he past 3 years on how to move forward and tackle current issues
- No more mobilization/generalization of national efforts

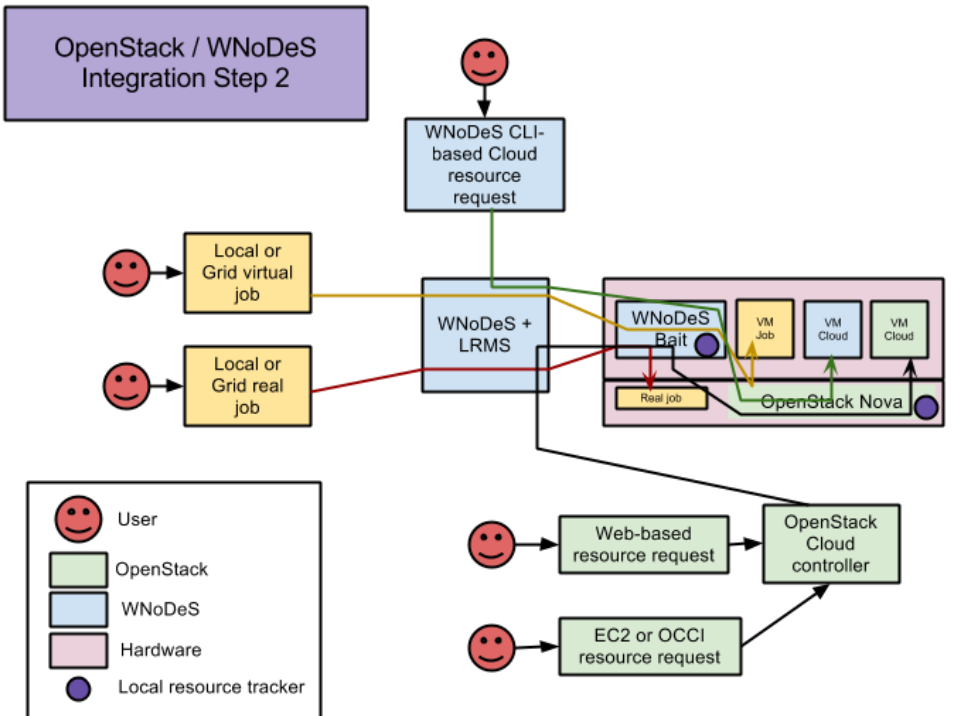
1. WNODES from INFN/IGI

- WNODES today allow to istantiate cloud resources(in addition to the support local and grid job, both on bare metal and on a VM), using a CLI
- New developments will be carried out thanks to the funding of the new PRISMA project for Smart Cities and Social Communities (27.5 Meuro)
  - INFN lead the developments of an open source IaaS platform
- It is amazing to see how many common requirements exist between Public Administrations and Research for a Federated Distributed Infrastructure

WNoDES: Next step 1



WNoDES : next step 2



2. Web Portal for Grid&Cloud

- The Cloud CLI allows users to access different Cloud platforms (OpenStack, OpenNebula and WNoDeS) transparently, and to gather providers, sites and images information from the BDII and MarketPlace services
- In addition to offering usual grid services:
  - Federated identities,
  - certificates,
  - VO membership,
  - Grid Job and Data services
- The new INFN/IGI Portal service is already available
  - https://portal.italiangrid.it/

Media: Future challenges

- After 13 years need a new general vision for the commodity Distributed Computing and Data infrastructure in Europe and Worldwide with focus to:
  - Re-establish effective working relations between Users, Mw providers, Centers and mobilization of national efforts
  - make a next step in the transparent access to the infrastructure
  - Guarantee the availability of spare resources to users
  - re-involve users directly driving developments
- Need to introduce new technologies and architecture including cloud and virtualization to overcome current limits
  - Without disrupting current user way of working
- Need to consolidate the open source middleware development community in Europe and connect world-wide
- Need to re-establish effective coordination with the open source middleware community in US for eScience

The MEDIA workshop

is a good opportunity

to discuss all this

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