

**XTREMWEB-HEP**  
**A BEST EFFORT**  
**VIRTUALIZATION**  
**MIDDLEWARE**

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# HIGH ENERGY PHYSIC



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Geneva

# XTREMWEB-HEP

- Introduction
- Security
- Virtualization
- Internode connection
- Intergrid connection
- Applications
- Platform access
- Discussion

# VOLUNTEER COMPUTING

	Volunteer cluster	Volunteer computing			
	Condor	Boinc	OurGrid	XtremWeb	XWHEP
volunteer ressources	✓			✓	
multi OSes	✓			✓	
type	cluster			desktop grid	
deployment	per domain			global	
firewall bypassing	✗			✓	
shared FS	✓			✗	
authentication	delegated			included	
authorization	delegated	✗	✓	✗	✓
Open ID	✗	✗	✗	✗	✓
X509	✗	✗	✓	✗	✓
Sandbox	✓	✓	✓	✓	✓
Heartbeat signal	✗	✗	✗	✓	✓
data	✓	✓	✗	✗	✓
multi users	✓	✗	✓	✓	✓
multi applications	✓	✗	✓	✓	✓
volunteer experience	✓	✓	✗	✗	✗
large deployment	✗	✓	✗	✗	✗

# XWHEP: A SECURED BEST EFFORT VIRTUAL CLUSTER

## Informations

- since 2006
- 600K€ E.U. funded
- 300K€ ANR funded

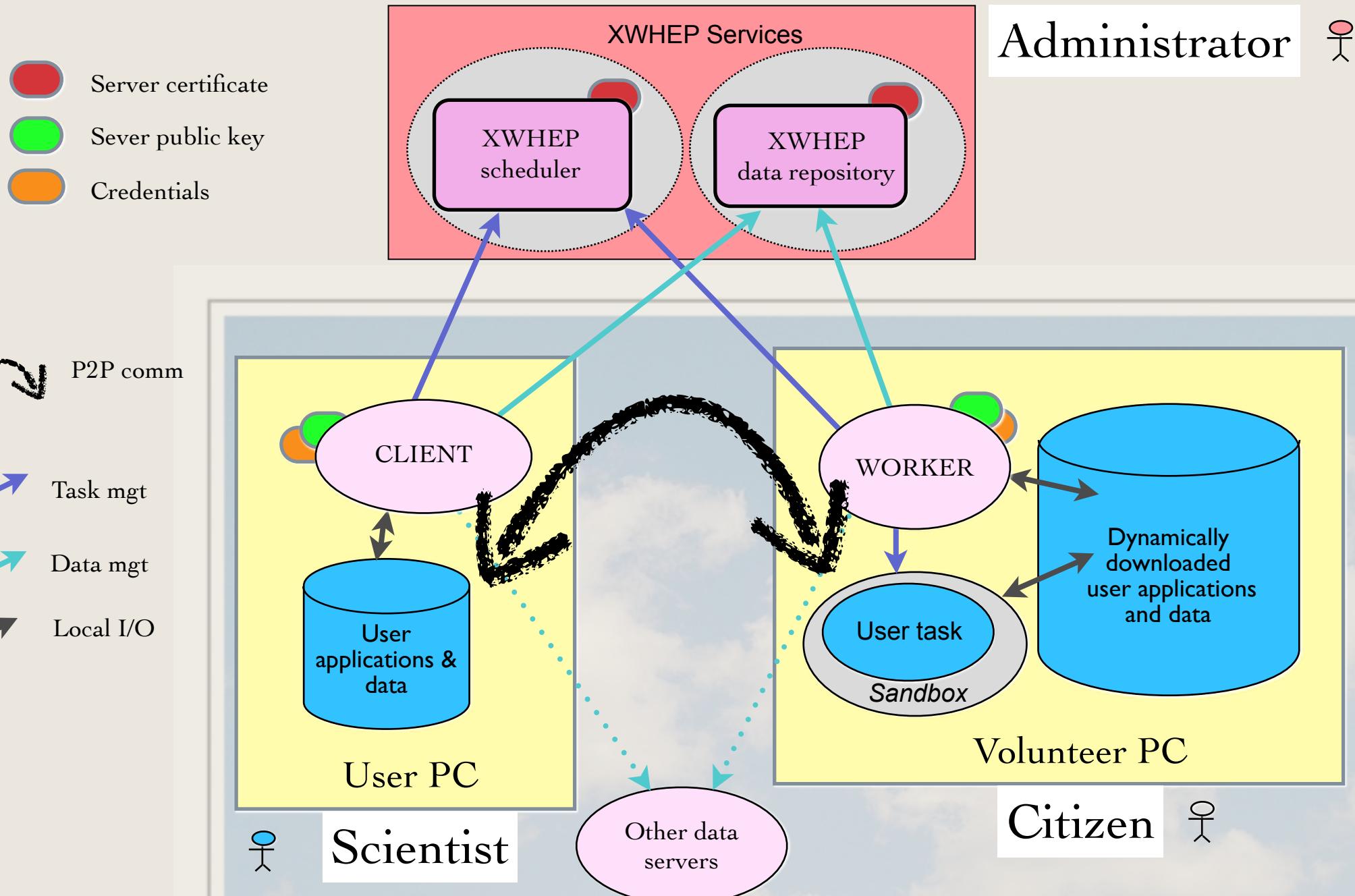
## Main features

- multi applications
- multi users
- certified server
- TSL communications
- authentication
  - ✓ X509 cert
  - ✓ OpenId
- authorisations
- access rights
- confinement
- virtualization
- p2p communications

## Goals

- secured ressource broker
- grid interconnection
- virtualization
- p2p communications
  - C/S
  - M/W
  - MapReduce

# XTREMWEB-HEP : A 3 TIERS ARCHITECTURE

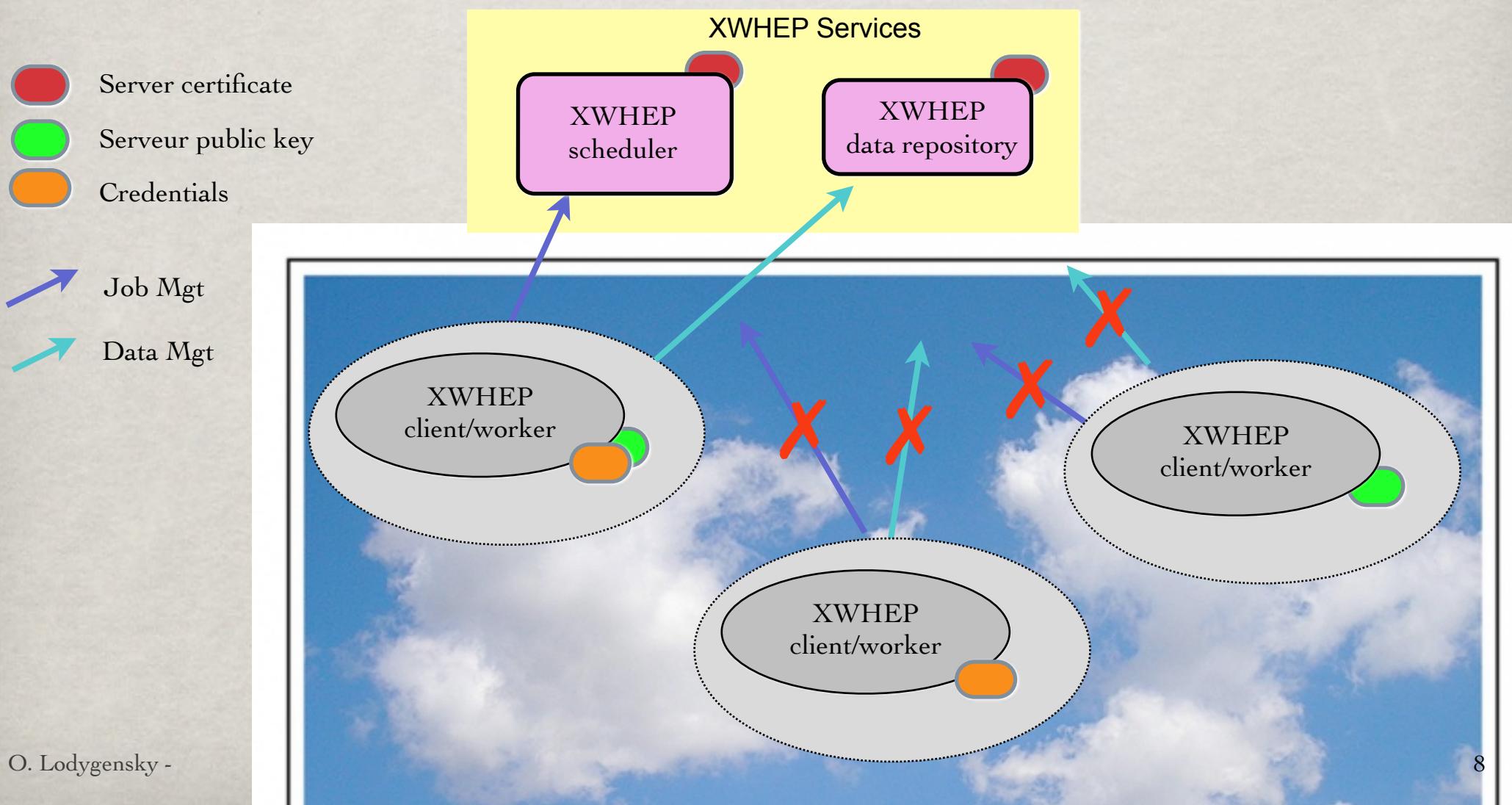


# XTREMWEB-HEP

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  - ✓ authentication
  - ✓ authorization
  - ✓ access rights
  - ✓ confinement
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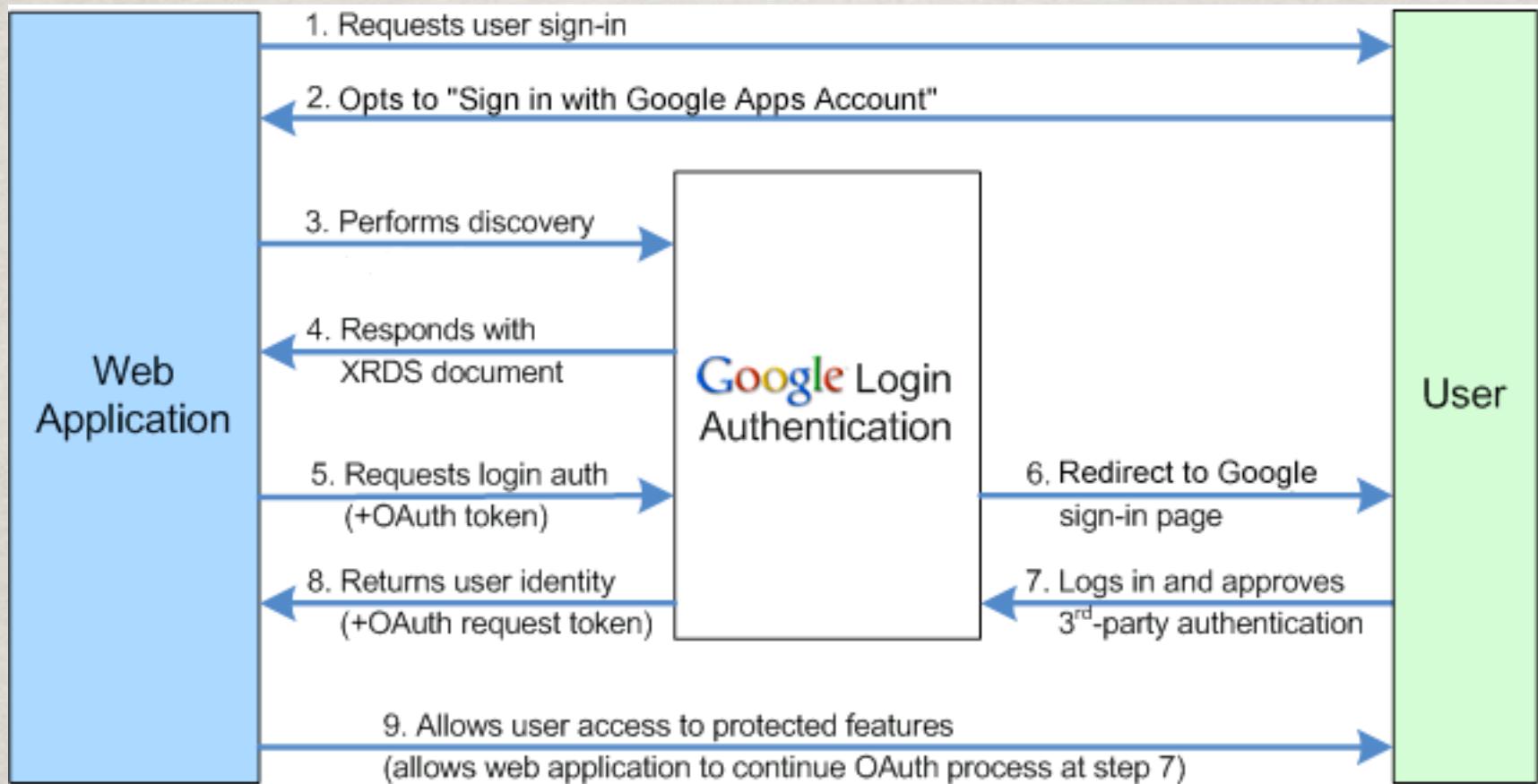
# AUTHENTICATION: CERTIFICATES

Distributed parts connect using services public key and must present valid credentials



# ATHENTICATION : OPENID

Credentials may be certified by a third party



<https://developers.google.com/accounts/docs/OpenID>

# AUTHORIZATION

Credential is associated to a usage level.

## Administrator

- manage public applications
- manage jobs, datas etc.
- manage users and usergroups
- manage workers

## Standard user

- manage private applications
- manage its own jobs and datas

## Group Administrator

- manage its group
  - ▶ applications
  - ▶ users
  - ▶ jobs
  - ▶ datas

## Worker user

This is used to deploy workers

- **no action allowed**
- user rights delegation
  - ▶ can compute user job
  - ▶ can update user job
  - ▶ can upload user job results

# ACCESS RIGHTS

Request completions depend on **access rights**.

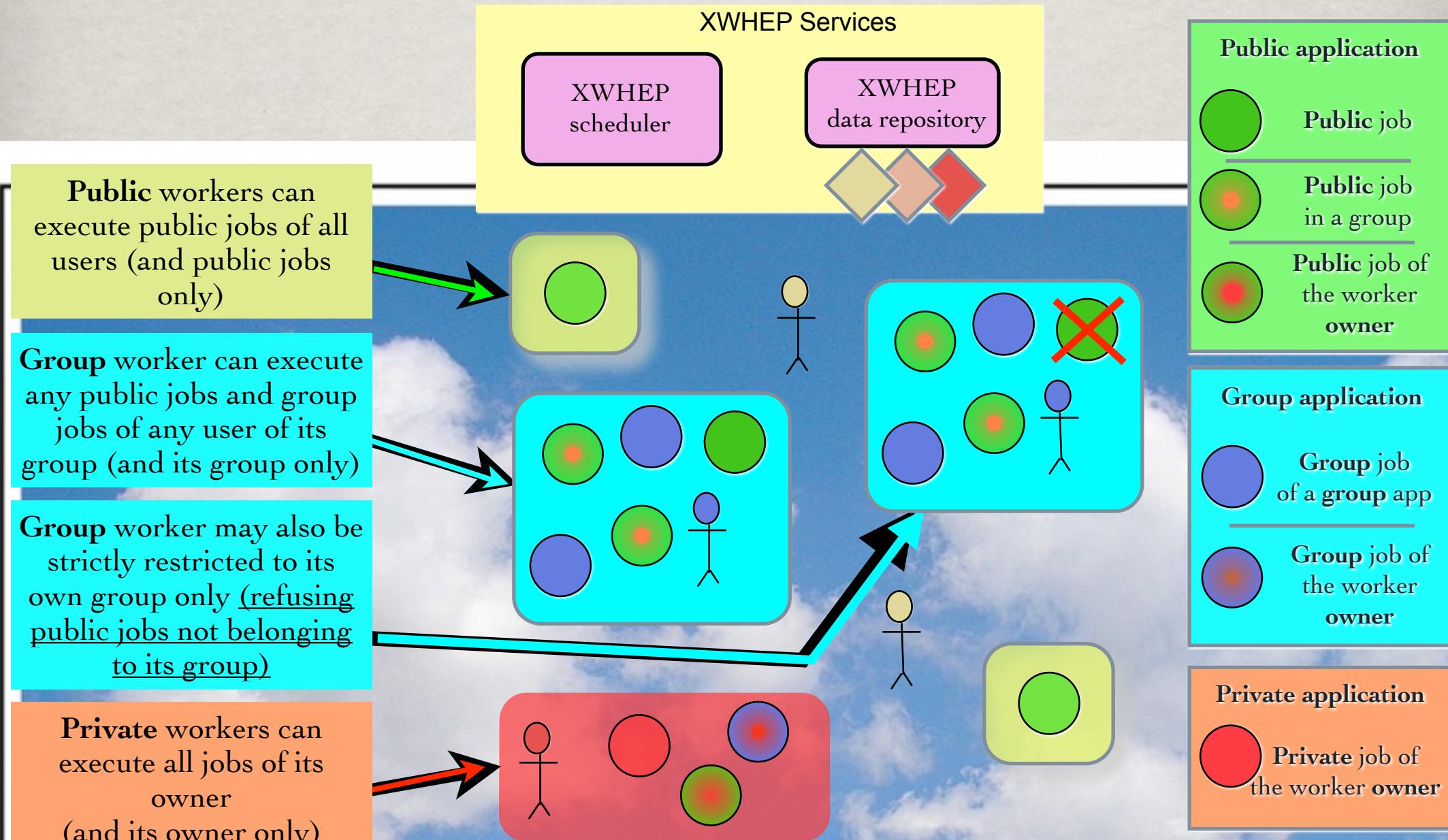
All objects (applications, datas, users, jobs, usergroups etc) are associated to access rights (AR) that allow/deny accesses (read, write, execute).

Access rights define access types

Access Types	Default Access Rights	Min Authz
Private	700	Std user
Group	750	Group admin
Public	755	Admin

# CONFIDENTIALITY

Authorisations and access rights define confinement levels



# XTREMWEB-HEP

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- Virtualization
  - ✓ contextualization
  - ✓ security
  - ✓ use cases
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# VIRTUALIZATION



Real

**PayPal™**

 moneo

Virtuel

# VM OVER XWHEP

StratusLab  
proposes  
distributions  
with the IaaS  
paradigms.

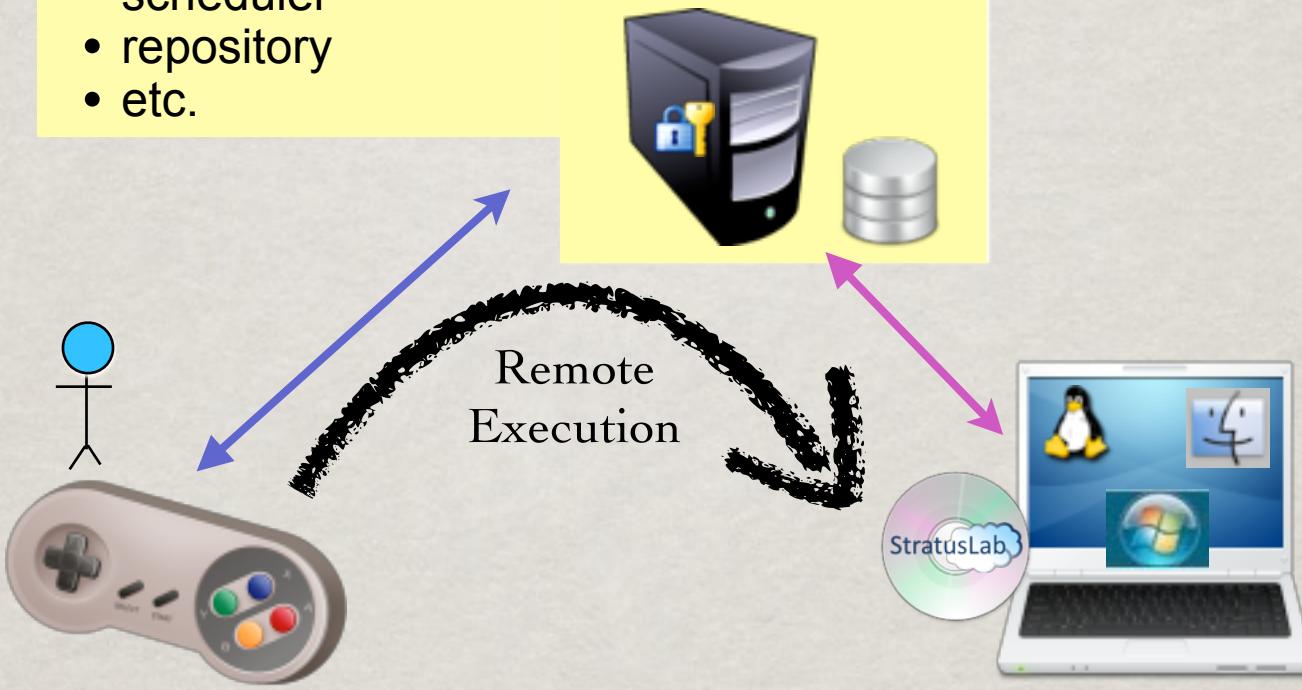


## Distributed User

- submit a virtualbox job with a virtual disk

Centralized and securized services store applications and data

- scheduler
- repository
- etc.



Distributed ressource may declare the virtualbox application.



## Distributed ressource (volunteer PC)

- download the virtual disk
- create and run a new VM inside its local VirtualBox

# VM : CONTEXTUALIZATION

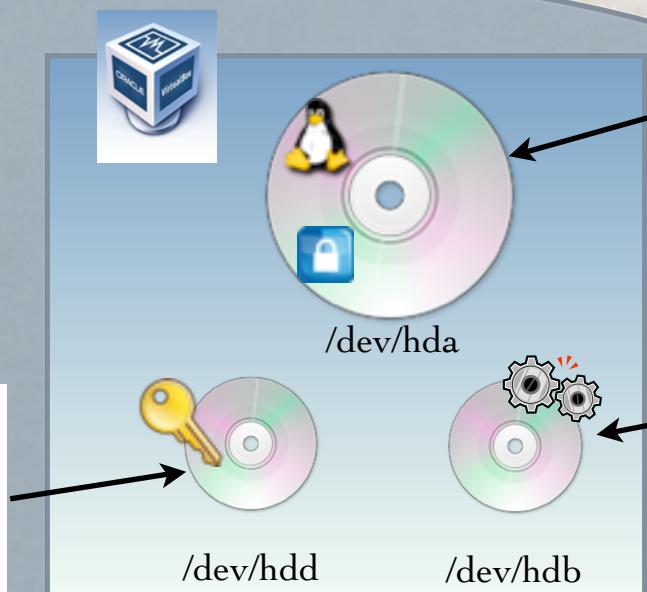
Following HEPiX Virtualization Working Group recommendation

*“Contextualization is defined as the process by which a Virtual Machine instance is configured based on a master Virtual Machine Image. In general, contextualization consists in passing arbitrary data to the Virtual Machine at boot time”*

## XWHEP worker



- contextualization VD
- if exists, mounted on /context
- if exists, /context/context.sh executed at the end of boot process



- bootable VD
- typically a live CD (350Mb)

- created on the fly by the worker (=> not downloaded)
- mounted on /scratch
- typically 8Gb
- this is a variable size file => upload size then depends on result size (max: 8Gb - hopefully less)

User may require some ports (ssh, http...)

## VM : SECURITY

All XWHEP security paradigms apply

- authentication
- authorization
- access rights

Virtual machines :

- recent OS including last known bugs and security corrections
- root access denied
- “sudo” usage disabled
- no access to LAN
- connection only using electronic keys

## VM : USE CASE

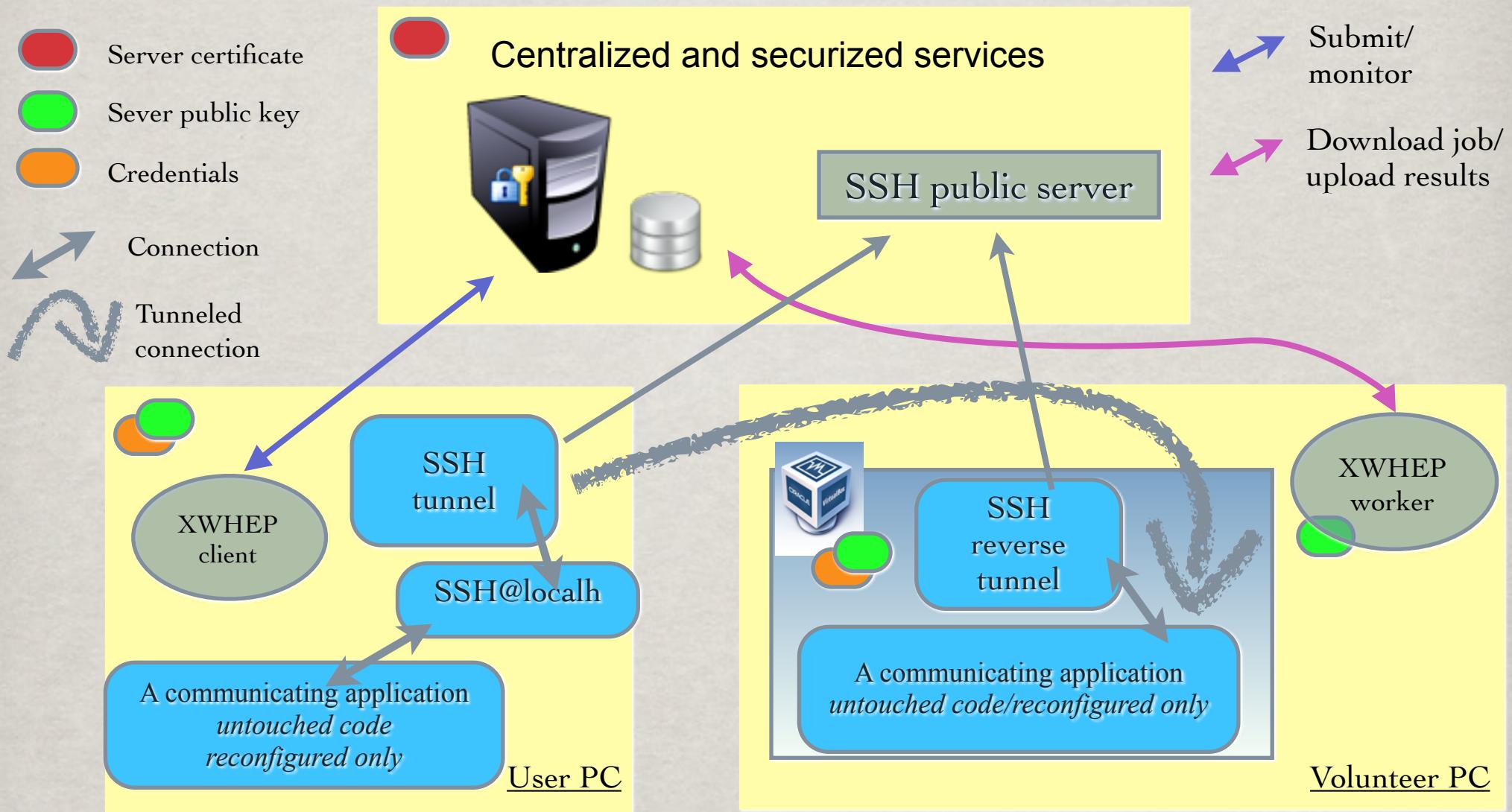
- 
- HEP applications are linked to ROOT (<http://root.cern.ch>)
  - DG resources don't have ROOT
    - submitted jobs will not run
  - ✓ Deploy a VM with ROOT and XWHEP worker
  - ✓ Submit such VM on the fly
    - the native worker shares VirtualBox
    - the native worker launches the VM
      - the virtualized worker shares ROOT
      - the virtualized worker run HEP jobs

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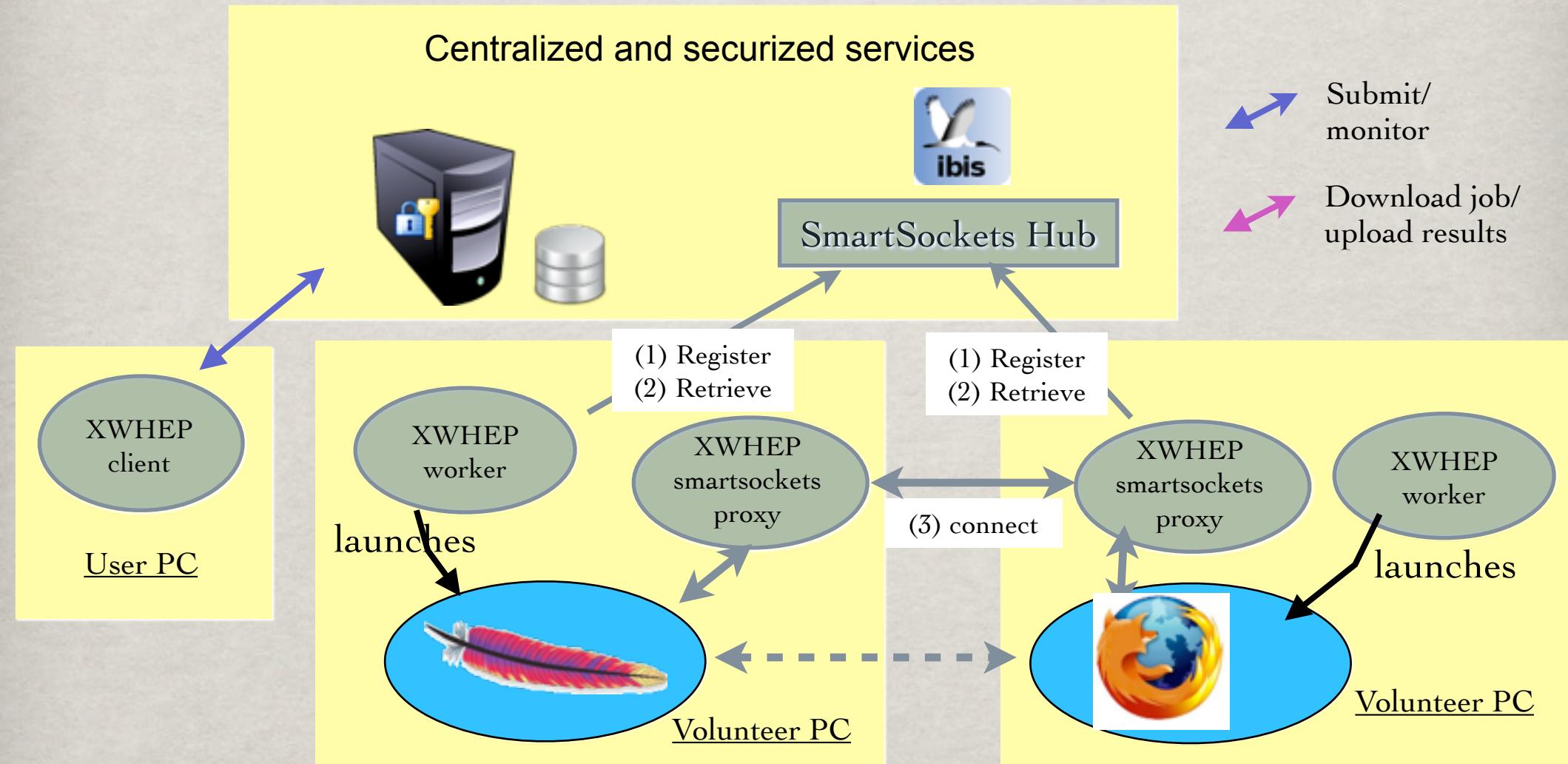
## INTERNODE COMMUNICATIONS

# Interconnect jobs and applications over DG



# INTERNODE COMMUNICATIONS

Interconnect jobs running on volunteer resources



# XTREMWEB-HEP

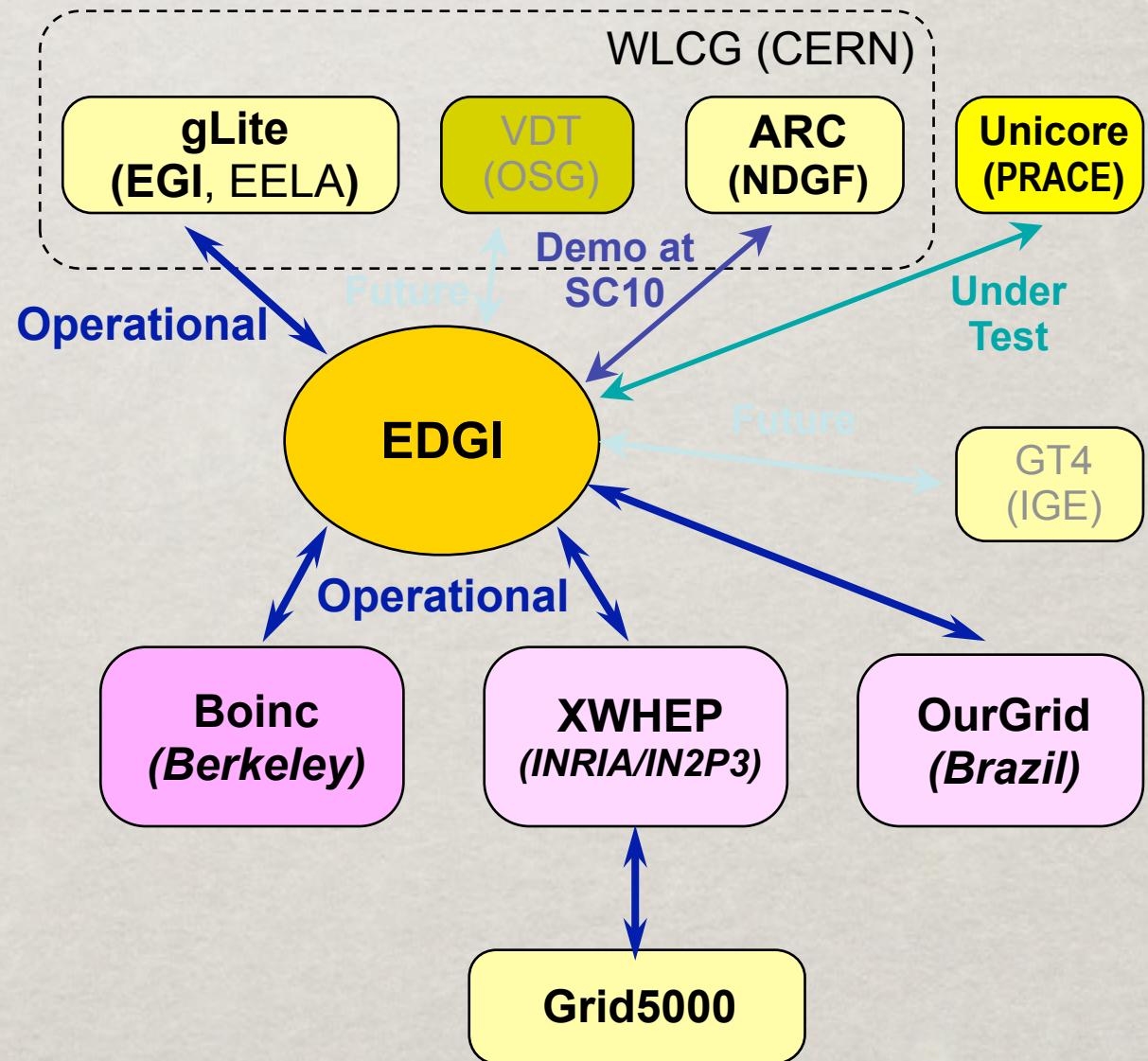
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# INTER GRID CONNECTIONS



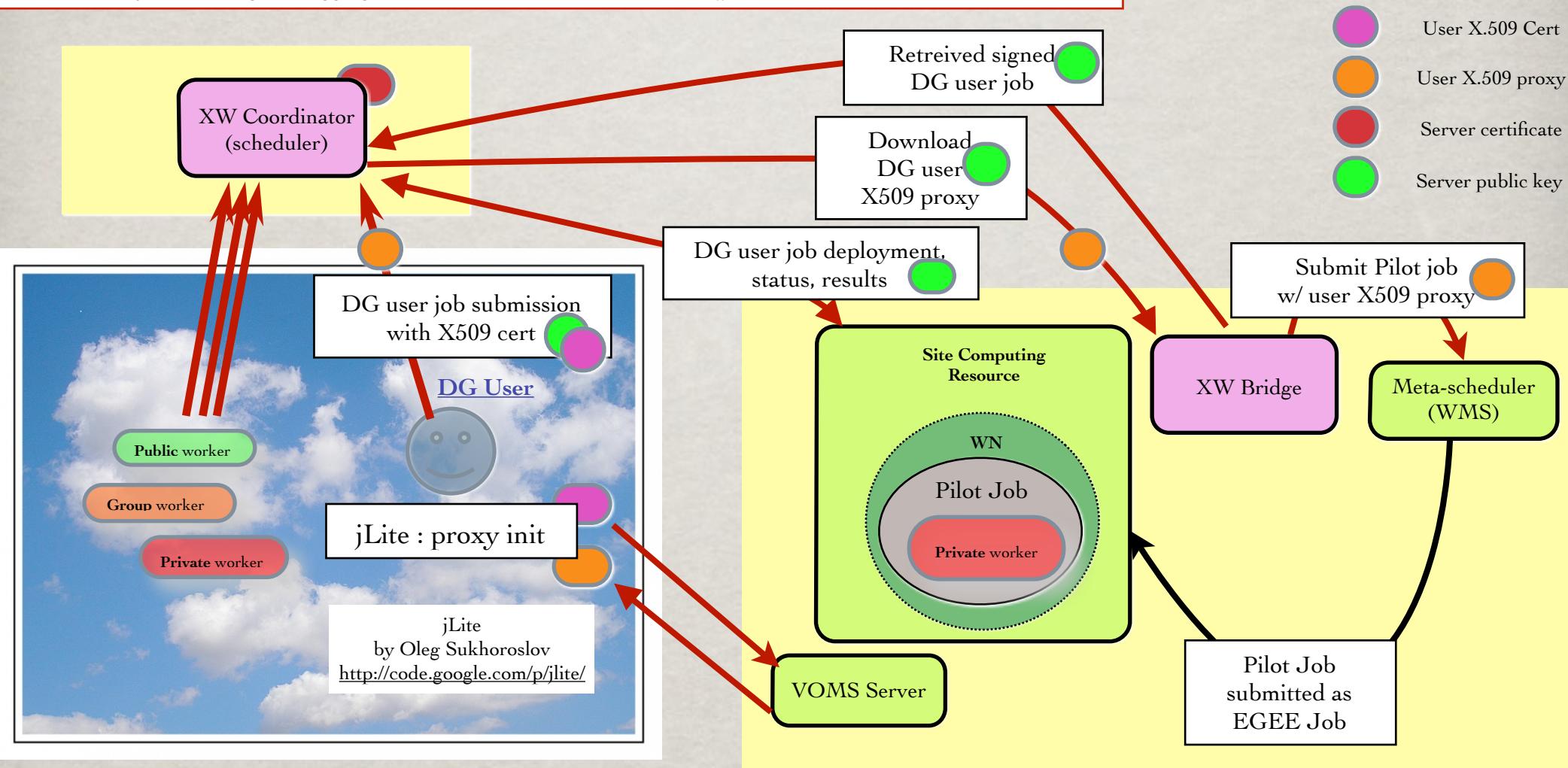
EDGeS & EDGI FP7 projects

- Integrate Service Grids and Desktop Grids
- Enable very large number of computing resources (100K-1M processors)
- Attract new scientific communities
- Provide a Grid application development environment
- Provide application repository and bridges for the execution in the SG-DG system



# PILOT JOBS

Security, monitoring and logging are the main issues in Pilot Jobs. (<http://edms.cern.ch/document/855383>)



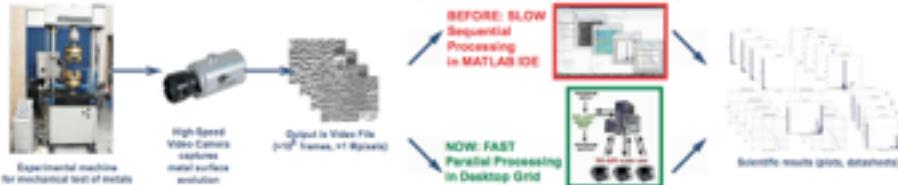
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# APPLICATIONS

## 2.Typical Experimental Workflows: Sequential and Parallel at BOINC and XtremWeb DG platforms

MultiscaleVideoP with 4GL MATLAB-code was successfully ported and tested on BOINC-based local DG at IMP with Windows-workers [2] and on XtremWeb DG [4] at LAL with Linux-workers; now the work is going on delivering it to EGEE through EDGeS XtremWeb->EGEE Bridge [5].

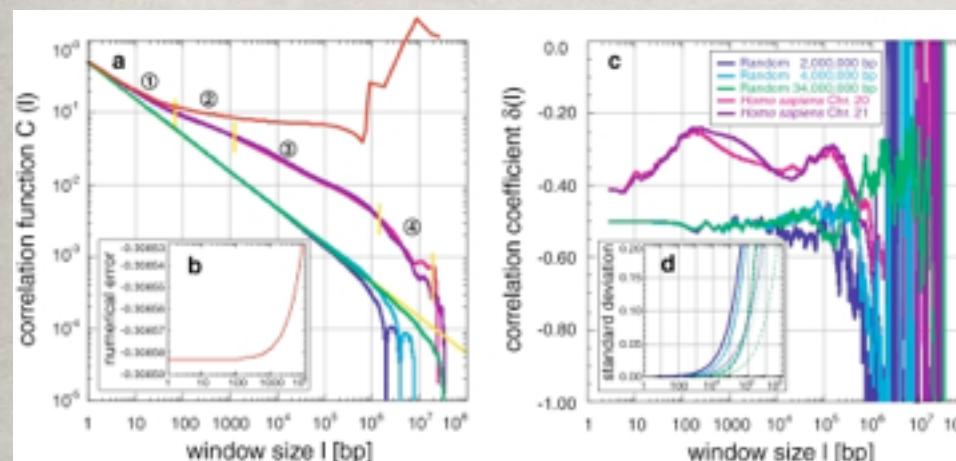


The main achievement: applicability and feasibility of integration of typical scientific application coded in 4GL environments with DCI on the basis of Desktop Grid for high-performance distributed computing were proved, tested and demonstrated.

The further increase of performance is possible by delivering 4GL-based applications to global computing resources of EGEE on the basis of XtremWeb desktop grid platform [4] and EDGeS XtremWeb->EGEE Bridge [5].

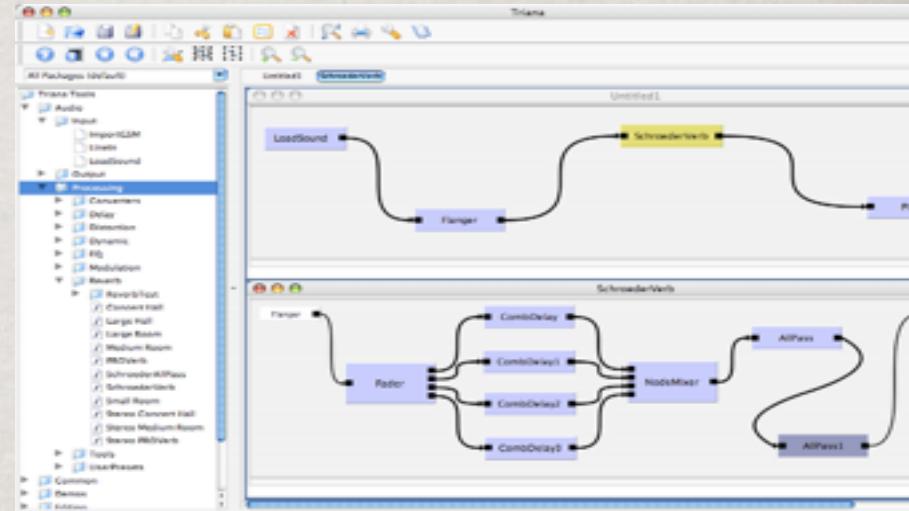
## Porting Multiparametric MATLAB Application for Image and Video Processing to Desktop Grid for High-Performance Distributed Computing

Yuri Gordienko, Institut de Physique du Metal - Kiev - Ukraine



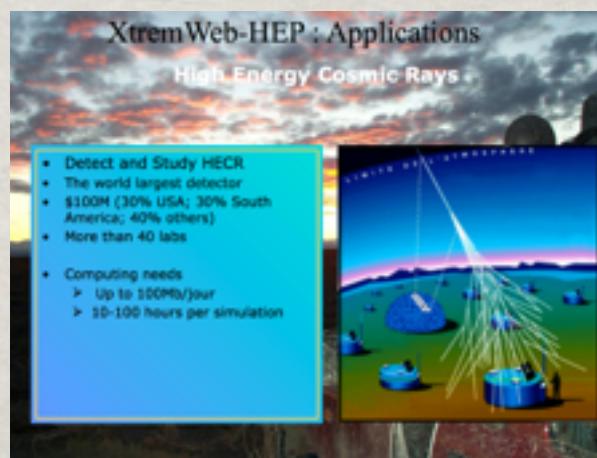
## DNA Correlation Applications

A. Abuseiris, Erasmus - NL



## DART: A Framework for Distributed Audio Analysis and Music Information Retrieval

Eddie Al-Shakarchi, Cardiff University - UK



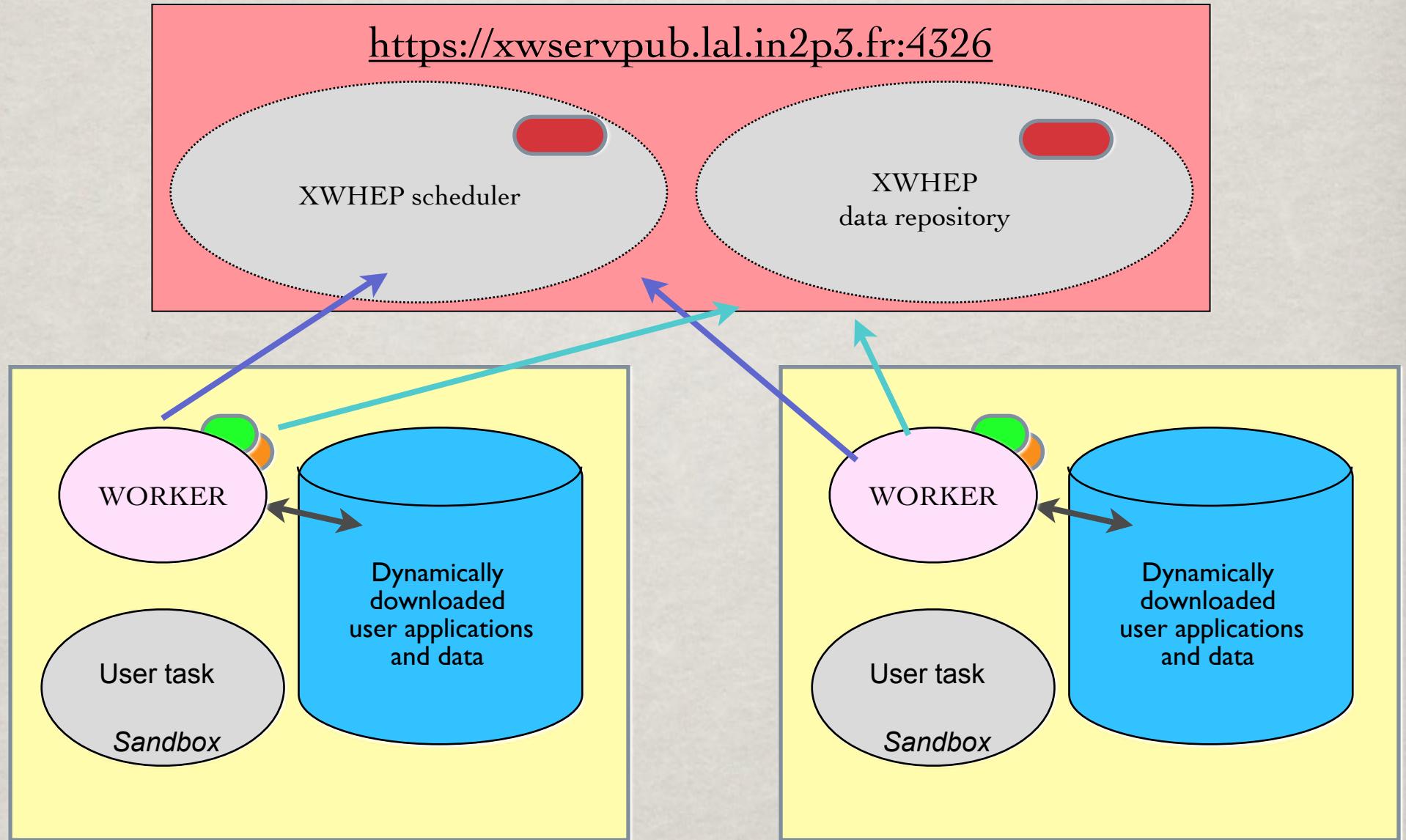
## High Energy Cosmic Rays

A. Cordier LAL - France  
CERN GDB - Nov

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  - ✓ Portal
  - ✓ API
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# OUR PLATFORM



# PORTAL

The screenshot shows a web browser window with the title bar "XtreMWeb-HEP 9.0.5-head". The address bar displays the URL <https://xwserpub.lal.in2p3.fr:4326>. The page content includes the logo of the Laboratoire de l'Accélérateur Linéaire (LAL) and the heading "XtreMWeb-HEP 9.0.5-head". Below this, it says "Logged in as oleg.lodygensky@gmail.com". A navigation menu at the top includes "Overview", "Applications" (which is selected), "Data", "Jobs", "Group of jobs", "Help", and "API". Below the menu are buttons for "Refresh", "Send", "Details", "Delete", and a checkbox for "Web workers". The main area is titled "Applications" and contains a table with the following data:

Select	LID	Name	Type
<input type="checkbox"/>	2803c74c-908e-4414-95ee-81efca1b94c7	moca	DEPLOYABLE
<input type="checkbox"/>	298aa006-3123-4f79-90b-43d4950bd127	correlizer	DEPLOYABLE
<input type="checkbox"/>	48710d6-7618-402b-3403-76011b7540f72	dart.jar	DEPLOYABLE
<input type="checkbox"/>	8e3ebf6c-97a5-416c-9b42-dc7e43063a12	dip	DEPLOYABLE
<input type="checkbox"/>	ad90723a-8210-4b27-b518-cce55bf4d128	larbin-crawler	DEPLOYABLE
<input type="checkbox"/>	bac12136-58e7-499c-a2ec-50d573105e5a	guineapig	DEPLOYABLE
<input type="checkbox"/>	defec799-1d75-4893-9712-356e4b2d3673	ls	DEPLOYABLE
<input type="checkbox"/>	e4d32ca9-4726-48e9-a7a2-1419cc4e8245	guineapig-pp-1.1.1	DEPLOYABLE
<input type="checkbox"/>	f115446c-9175-4714-94d1-164937421756	autodock305.sh	DEPLOYABLE
<input type="checkbox"/>	ff66ed5d-2295-4698-aed9-2c7ef9a2c542	ubuntu-11-dg-2.iso	VIRTUALBOX

At the bottom of the interface, there are links for "Web interface (v 1.1)" and "XtreMWeb-HeP.org".

# API

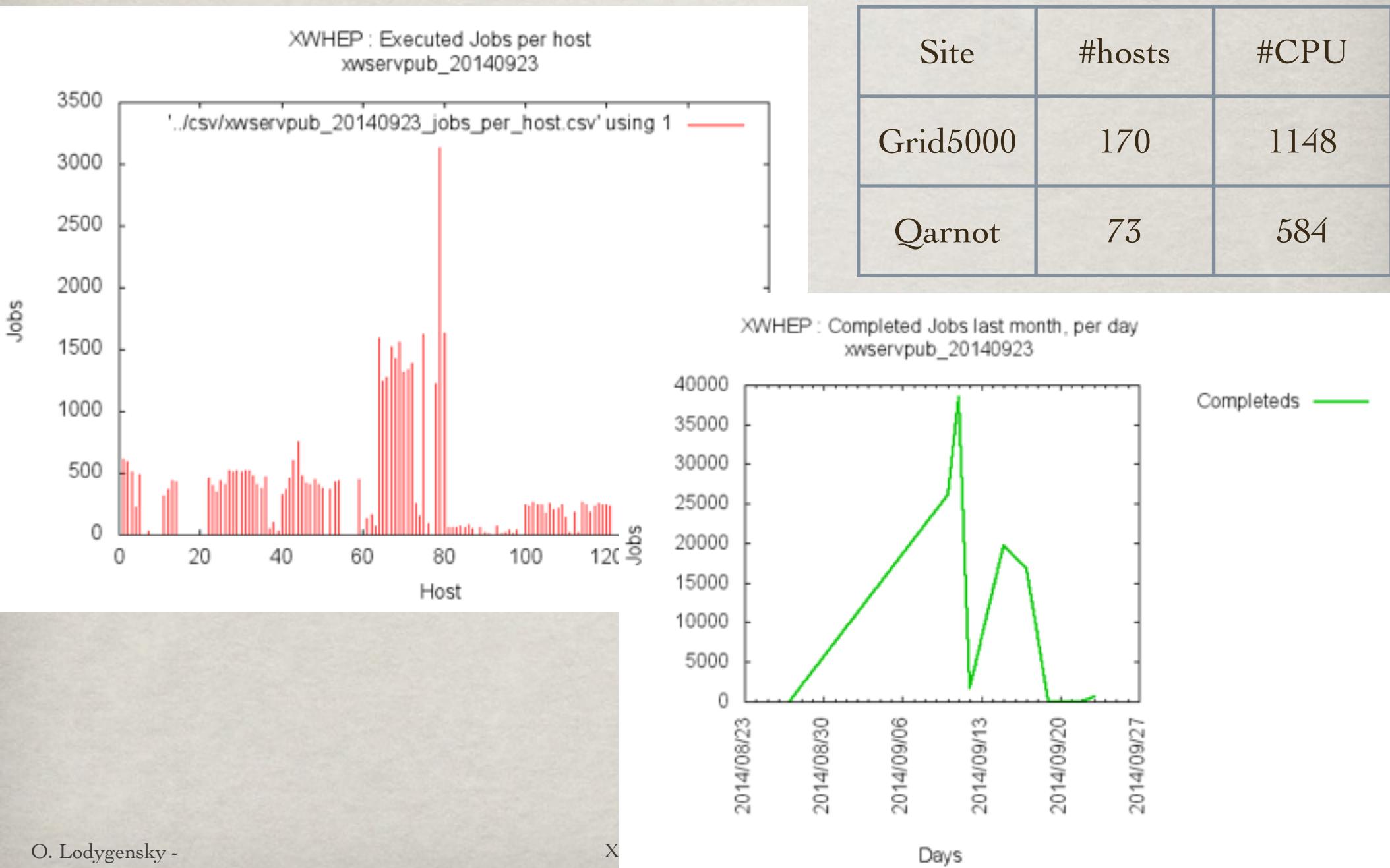
The screenshot shows a web browser window with the title bar "XtreMWeb-HEP API". The address bar contains the URL "https://xwserpub.lal.in2p3.fr:4326/api". The page content displays the heading "XtreMWeb-HEP API" and a message "You are logged as \"oleg.lodygensky@gmail.com\"". Below this, there is a link "Go to the client interface". The browser's status bar at the bottom shows various tabs and icons.

[Go to the client interface](#)

Available interface commands :

- <https://xwserpub.lal.in2p3.fr:4326/NULL> : /NULL : does nothing
- <https://xwserpub.lal.in2p3.fr:4326/DISCONNECT> : /DISCONNECT : disconnects
- <https://xwserpub.lal.in2p3.fr:4326/VERSION> : /VERSION : retrieves server version
- <https://xwserpub.lal.in2p3.fr:4326/GET> : /GET/anUID : retrieves an object
- <https://xwserpub.lal.in2p3.fr:4326/GETTASK> : /GETTASK/anUID : retrieves a task
- <https://xwserpub.lal.in2p3.fr:4326/SEND> : /SEND?XMLDESC=an xml description : sends an object
- <https://xwserpub.lal.in2p3.fr:4326/SENDAPP> : /SENDAPP?XMLDESC=an xml description : sends an application
- <https://xwserpub.lal.in2p3.fr:4326/GETAPPS> : /GETAPPS : retrieves all applications
- <https://xwserpub.lal.in2p3.fr:4326/REMOVE> : /REMOVE/anUID : removes an object
- <https://xwserpub.lal.in2p3.fr:4326/SENDGROUP> : /SENDGROUP?XMLDESC=an xml description : sends a group
- <https://xwserpub.lal.in2p3.fr:4326/GETGROUPS> : /GETGROUPS/anUID : retrieves all groups
- <https://xwserpub.lal.in2p3.fr:4326/GETGROUPWORKS> : /GETGROUPWORKS/anUID : retrieves all group works
- <https://xwserpub.lal.in2p3.fr:4326/SENDHOST> : /SENDHOST : not available
- <https://xwserpub.lal.in2p3.fr:4326/GETHOSTS> : /GETHOSTS/GETHOSTS : retrieves all hosts
- <https://xwserpub.lal.in2p3.fr:4326/ACTIVATEHOST> : /ACTIVATEHOST/anUID?PARAMETER=true/false : activates/deactivates a host
- <https://xwserpub.lal.in2p3.fr:4326/SETWORKERSPARAMETERS> : /SETWORKERSPARAMETERS : not available
- <https://xwserpub.lal.in2p3.fr:4326/GETWORKERSPARAMETERS> : /GETWORKERSPARAMETERS : not available
- <https://xwserpub.lal.in2p3.fr:4326/SETWORKERSNB> : /SETWORKERSNB : not available
- <https://xwserpub.lal.in2p3.fr:4326/SENDSESSION> : /SENDSESSION?XMLDESC=an xml description : sends a session
- <https://xwserpub.lal.in2p3.fr:4326/GETSESSIONS> : /GETSESSIONS/anUID : retrieves all sessions
- <https://xwserpub.lal.in2p3.fr:4326/GETSESSIONWORKS> : /GETSESSIONWORKS/anUID : retrieves all session works
- <https://xwserpub.lal.in2p3.fr:4326/GETTASKS> : /GETTASKS : retrieves all tasks
- <https://xwserpub.lal.in2p3.fr:4326/SENDTRACE> : /SENDTRACE : not available

# LAST MONTH - BEST EFFORT



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# DISCUSSION

Under work

- OpenSAML / Shibboleth
- Map reduce

<http://www.xtremweb-hep.org>