Bookkeeping and submission tools prototype

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on behalf of distributed computing group

Outline

- General Overview

- Bookkeeping database

- Submission tools (for simulation productions)

- Framework Design and Grid Services

- Latest developments, future work

- Planning

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Overview

- The production tools consist of

    - a bookkeeping database

    - a set of submission tools to the Grid

    - a Web Portal to manage and monitor submissions

- Development started in 2009

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Overview

- Initial version devoted to FullSim, just one database table and a 'simple' submission script to LSF @CNAF (summer 2009)

- Then, FastSim included and initial Web interface provided – LSF @CNAF only (Winter 2009)

- First 'tagged' version in Spring 2010 with FastSim submissions to the Grid

- In Summer 2010 requests and shift interface added

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Overview

- The underlying idea has been to minimize the platform requirements in terms of:
    - hardware and human resources,
    - custom developments,
    - Grid service customization and configuration.

- Keywords: standard and simple

- The prototype framework aimed at supporting the Detector TDR activities
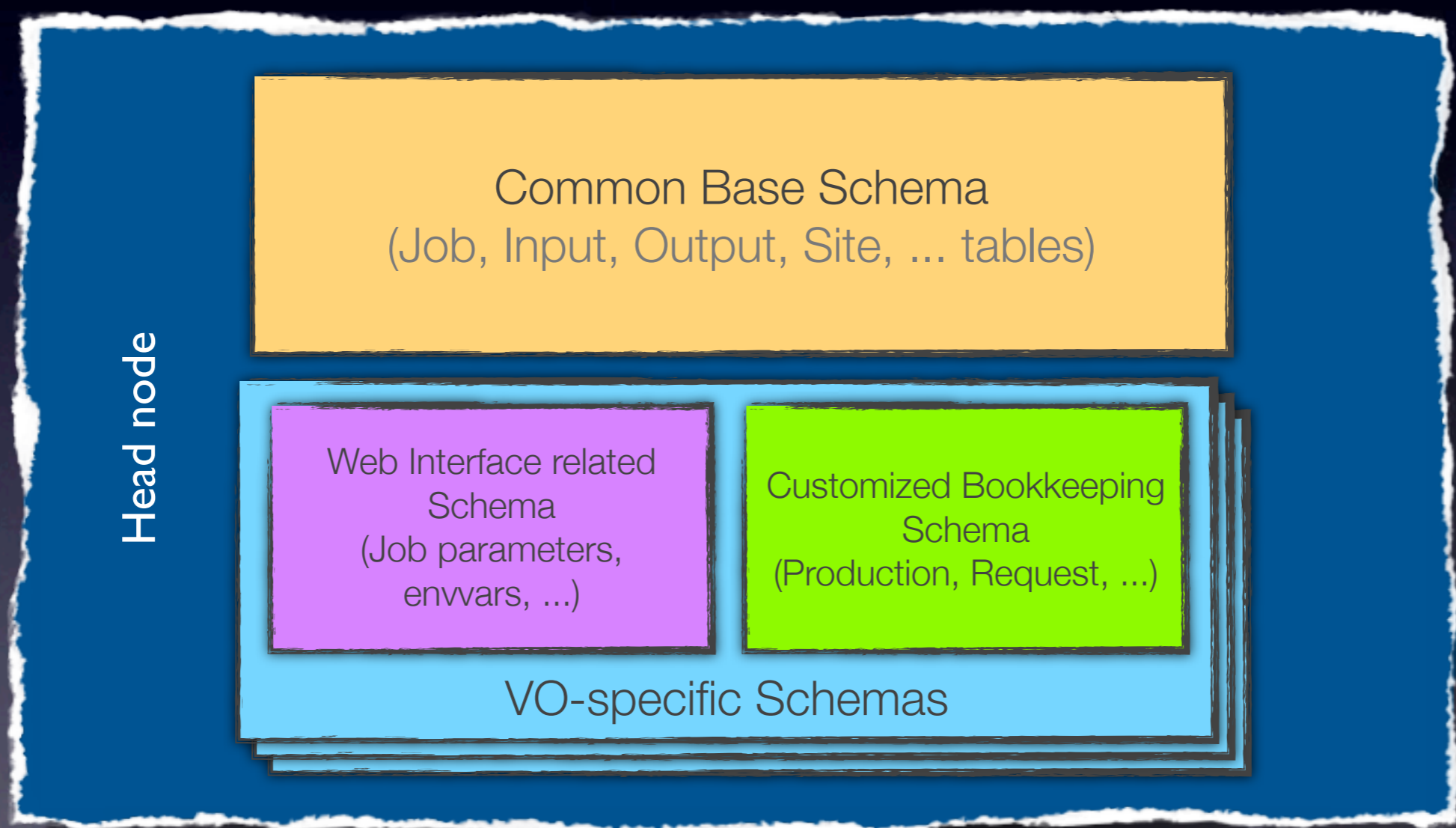
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Overview

- Requirements:

  - superbvo.org enabled and software installed at sites

  - Input files O(10GB), Output files O(1GB), RAM O(1GB)

  - 1 Grid UI, 1 framework head node (it is the same at present)

  - 1 SE to store the results (central data repository)

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Bookkeeping database

- Job description metadata (job parameters, ...)

- Status and system metadata

- Back-end for all the framework sub-services

- Jobs running on remote sites communicate to the database via a RESTful interface (GSI proxy + SSL)

- Database schema partially configurable

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Bookkeeping database

Head node

Common Base Schema
(Job, Input, Output, Site, ... tables)

Web Interface related
Schema
(Job parameters,
envvars, ...)

Customized Bookkeeping
Schema
(Production, Request, ...)

VO-specific Schemas

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Bookkeeping database

- At present, relational data model is in use

- MySQL 5.0.77 (SL5 default)

- Upgrading test to 5.5.10 in next weeks

- Evaluation of No-SQL databases for specific purposes in progress (no plans to abandon relational model)

- rDBMS agnostic design – both schema and interface (tests with PostgreSQL in progress)

Grid services

- **Workload Management System (WMS)**
  Job brokering service and middleware interoperability element

- **Virtual Organization Membership Service (VOMS)**
  Authentication, Authorization and Accounting system

- **LHC Computing Grid File Catalog (LFC, LCG-Utils)**
  File metadata catalog and data-handling solution

- **GANGA**
  Job management system (submissions)

- **Storage Resource Manager (SRM V2.2)**
  Data access protocol/layer

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Grid services ↔ conf

- The **single head node** requires: gLite UI, Framework installation **(GANGA, MySQL, Apache)**

- LFC server: VO shared, **standard,** per site name space

- VOMS: default conf. (Production | Software manager, standard user)

- WMS: CE-queue filter and middleware interop.

- LCG-Utils: Input (site SE to WN) / Output (WN to Repository) transfers

Production Framework

- Central EGI service site

- Web Interface

- Job and metadata management tool for submissions

- Database system to store the distributed production metadata (bookkeeping)

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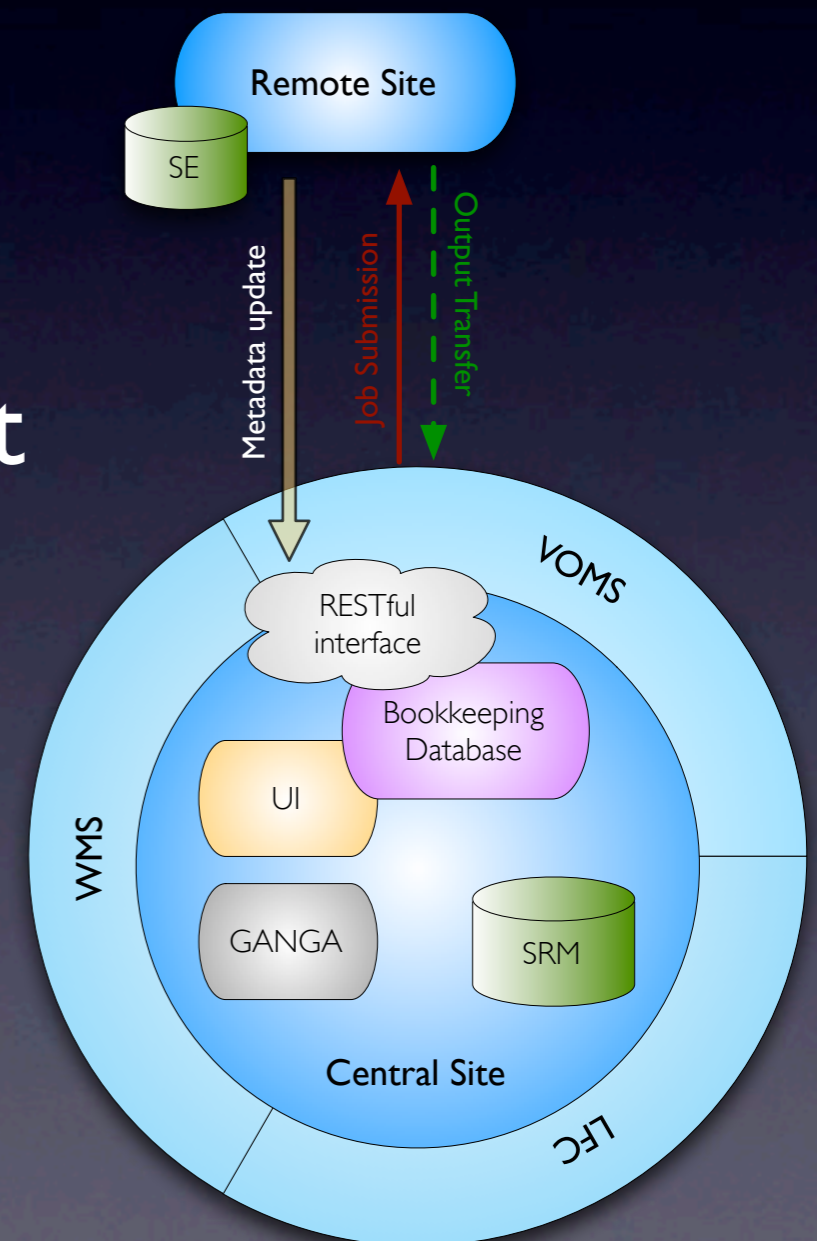
Job structure

- Job for the Grid is a script (Bash or python)

- It takes care of environment preparation, database communications, file transfers, failover conditions, ...

- VO executable launched within the script
  - FastSim (PacProduction) only at present
  - FullSim (Bruno) to be included

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Job workflow

- ## Pre-Production
  Input files and sw transfers to site SEs

- ## Job preparation
  with the Framework Web Interface; launch of submission script from UI or AUTOMATIC from Portal (NEW FEATURE)

- ## GANGA bulk submission via WMS

- ## Output file(s) transfer

- ## Metadata update

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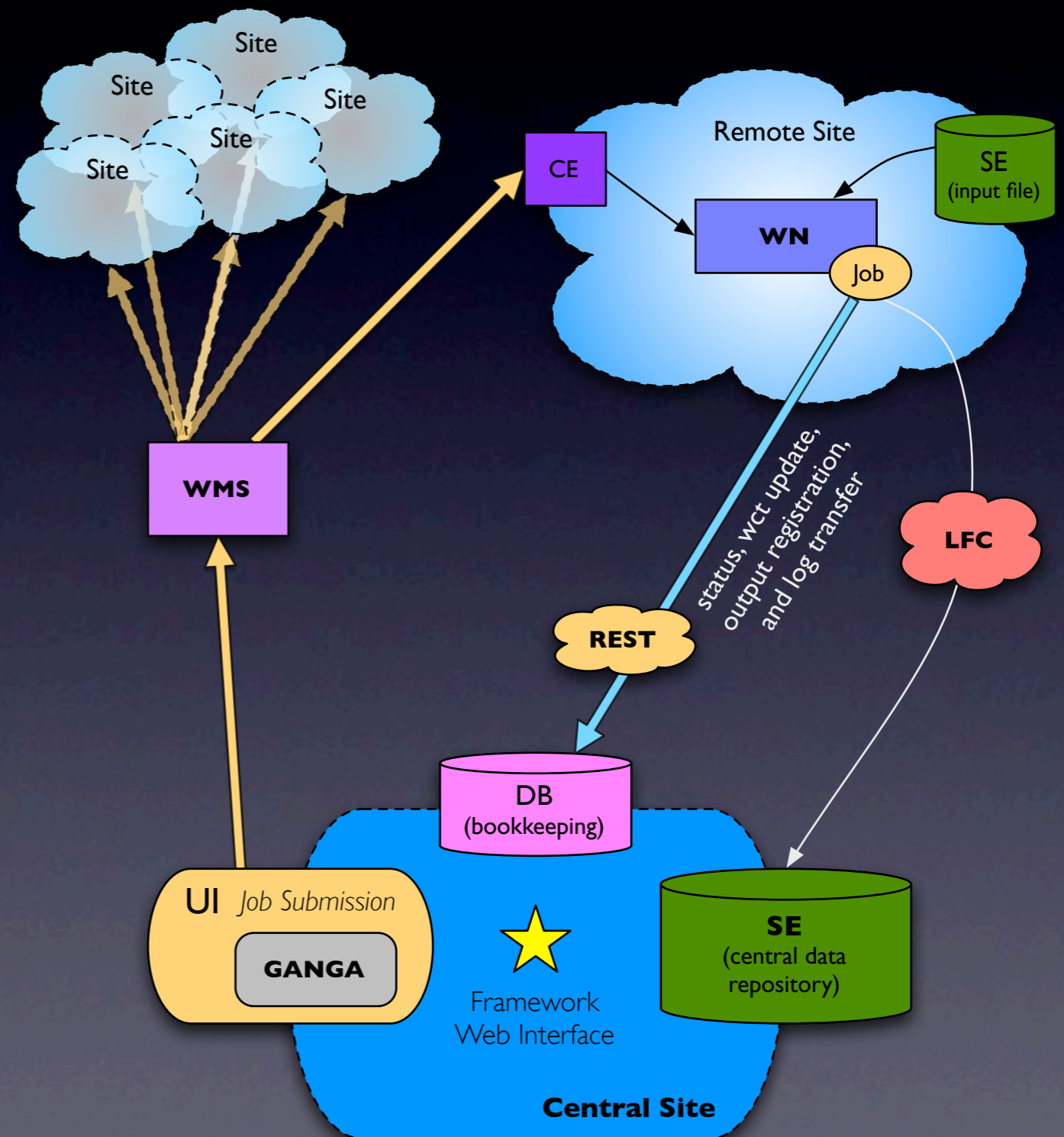
Job script

- Failover chain on output transfers:
  lcg-cr → lcg-cp [rf] → lcg-cp --nobdii [rf]
  → globus-url-copy [rf]

- RESTful communication
  client-side: curl, server-side: php layer
  proxy authentication using mod_ssl and
  mod_gridsite

curl -v --cert $X509_USER_PROXY --key $X509_USER_PROXY --capath /etc/grid-security/certificates
https://bbr-serv09.cr.cnaf.infn.it:8080/restcert1/index.php

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Web Portal

- **Production initialization** $\boxed{\text{Setup for a new production, bookkeeping database initialization}}$

- **Monitor system** $\boxed{\text{Parametric search engine on job metadata, logfile analysis sub-system, job status, job analysis tool, ...}}$

- **Report generator** $\boxed{\text{Production report generator with summaries on parameters, site usage and status graphs, ...}}$

  $\boxed{\text{automatic submission to all the available sites, automatic request selection based on progress}}$

- **Submission interface for shift takers (parametric)**

- **Submission interface for experts (custom)** $\boxed{\text{Fine-grained selection of job submission parameters}}$

- **Request definition** $\boxed{\text{Interface for specifying new production requests (set of job parameters)}}$

- **eLog system**

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# Web Portal

Submissions

- **Productions managed with the customized Framework**

  - Set of users with valid X509 certificates and grid-proxies

  - Automatic preparation of job scripts, configuration files and bookkeeping entries

  - Manual submission (AUTOMATIC submission via myProxy)

- **INFN Tier-1 site hosts the head node**

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Automatic Submission

- issue: proxy certificate must be personal;
  apache (httpd user) should get (securely) a user Proxy of the submitting user

- MyProxy <u>Delegation</u> feature in addition to <u>Renewal</u> already in use

- Each user (VOMS Production Manager role) must store into MyProxy server his Proxy in two ways (until personal certificate expiration):

  - with a Username (== LDAP uid), w/o password, retrievable by bbr-serv09 only (apache user) [<u>delegation</u>]

  - with DN, w/o password, retrievable by his own (expiring) proxy [<u>renewal</u>]

- apache user can retrieve the proxy stored in MyProxy by using his LDAP uid and then execute the submission scripts using the retrieved user proxy - user proxy is then destroyed

Idea discussed with F. Giacomini and V. Ciaschini (CNAF)

Automatic Submission
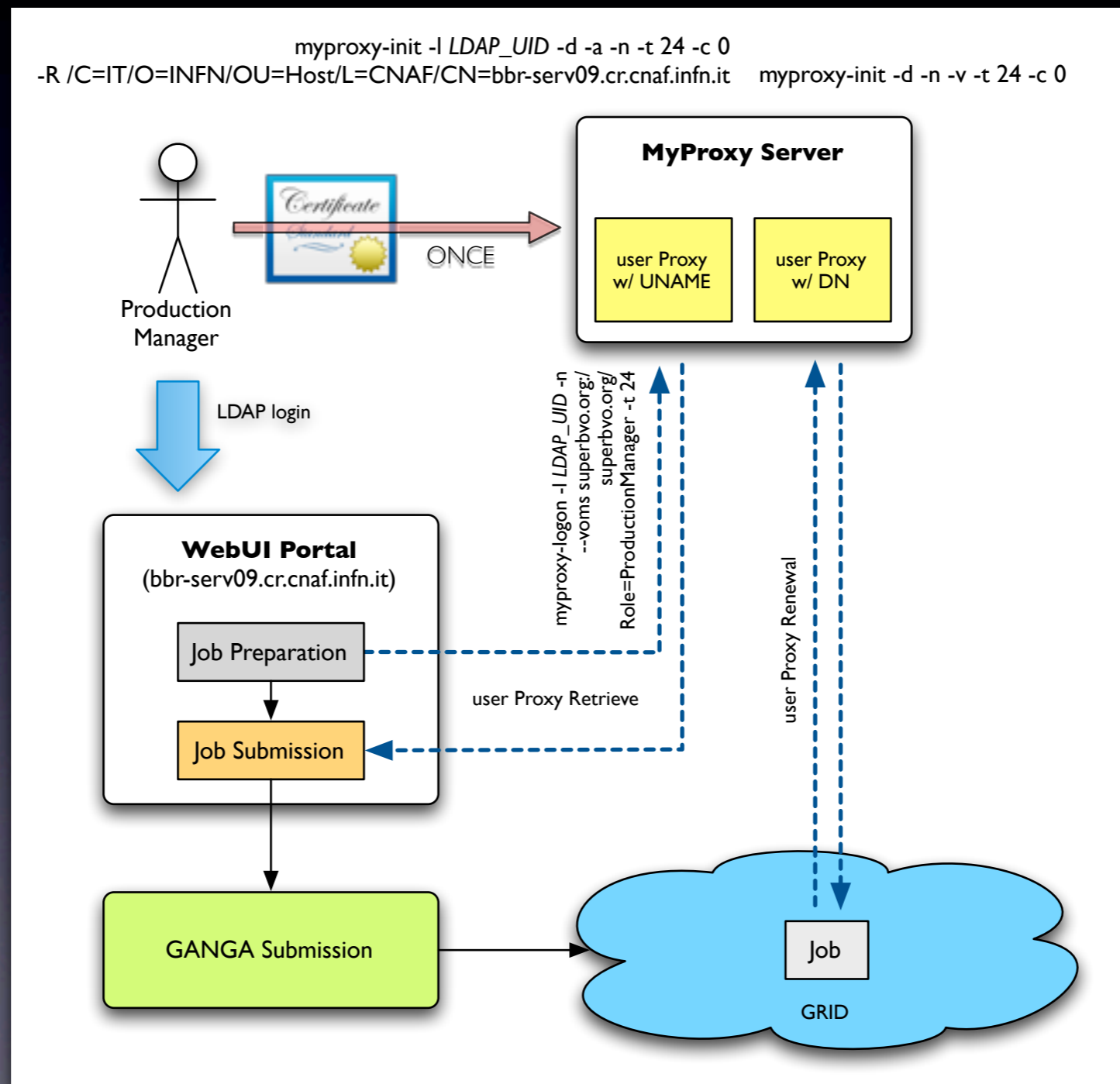
Remote sites

- 15 (+5) sites, two 'flavors' (EGI, OSG)

- Tier-1
  INFN-T1 (Bologna, Italy),
  IN2P3-CC (Lyon, France),
  RAL-LCG2 (Oxford, UK)

- Tier-2
  UKI-LT2-QMUL (London, UK),
  UKI-SOUTHGRID-RALPP (London, UK),
  UKI-SOUTHGRID-OX-HEP (Oxford, UK),
  GRIF (Orsay, France),
  SLAC (Stanford, USA),
  CIT-CMS-T2B / CIT-HEP-CE (Caltech, USA),
  OSC (Ohio, USA),
  VICTORIA-LCG2 (Victoria, Canada),
  INFN-BARI (Bari, Italy),
  INFN-CAGLIARI (Cagliari, Italy),
  INFN-FERRARA (Ferrara, Italy),
  INFN-LNL-2 (Legnaro, Italy),
  INFN-MILANO (Milano, Italy),
  INFN-NAPOLI (Napoli, Italy),
  INFN-PISA (Pisa, Italy),
  INFN-TORINO (Torino, Italy)

- PL-GRID (Poland)
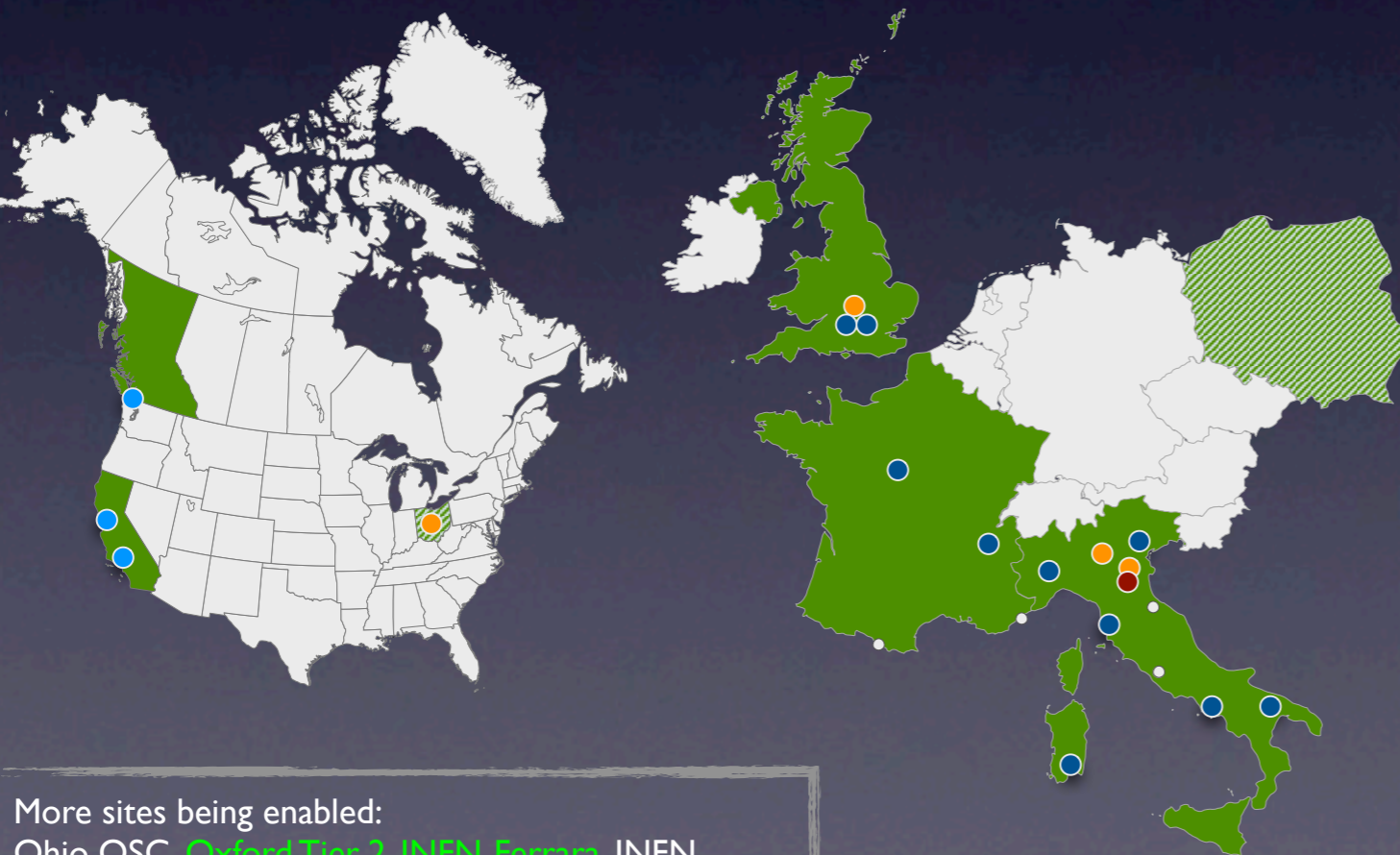
More sites being enabled:
Ohio OSC, Oxford Tier-2, INFN-Ferrara, INFN-
Milano, PL-Grid, ...

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Results

- September 2010: large production cycle

- $> 11 \times 10^9$ events
  (about 180 kjobs in 4 weeks)

- Peak rate of 7000 simultaneous jobs running on the Grid (3.5k on average)

- about 8% failure rate
  executable errors (0.5%), site misconfiguration (2.0%), proxy expiration (4.0%), central site overload during file transfers (1.5%)

- about 195 years of WCT

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Latest Development

- Automatic Submission (to the Grid)

- Bookkeeping database tuning:
  use of triggers to speed-up statistic calculations

- Use of template engine for code/layout separation (in progress)

- JQuery upgrade, datatable plug-in, updated Google API for charting

- Python script, v2 and v3 (testing phase)

- Target site per request (replica at CNAF)

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Future Work

- Bookkeeping database replication (beginning with master/slave configuration)

- Monitor integration with LB service (through direct queries) both on demand and with a daemon

- Integration of packaged FullSim

- Enabling FullSim request interface + submission to Grid

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Planning

- Do we have new feature requests for the production tools?

- Next FastSim productions...

- Next FullSim productions...
  [do we really need Grid exploitation at present?]

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Conclusions

- The SuperB productions proved that the prototype framework is reliable and efficient

- Customization of the Web interface, the bookkeeping database, and the site requirements have been the key points to achieve the goal

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Collaboration

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- L. Tomassetti

- students from Ferrara

- M. Favaro

- G. Fontana

- C. Luzzi

- M. Ronzano

- L. Vettorello

- E. Vianello

Thank You