Time critical condition data handling in the CMS experiment during the first data taking period

CSC 2010

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What are non-event data?

- **Construction** data;
- **Equipment management** data: history of all items installed at CMS:
  - Detector parts,
  - Off detector electronics;
- **Configuration** data: needed to bring the detector in running mode;
- **Condition** data: describe the state of the detector:
  - Data quality indicators (bad channels…),
  - Sub-detector settings (pedestals…);
- **Calibration** data: needed to calculate the physics quantities from raw data;
- **Alignment** data: needed to retrieve the exact position of each sub-detector inside CMS.

All these data (except construction data) can be grouped by a version and the time range (IOV) in which they are valid.

Golden equation for DB during data taking

Start of the games

with LHC

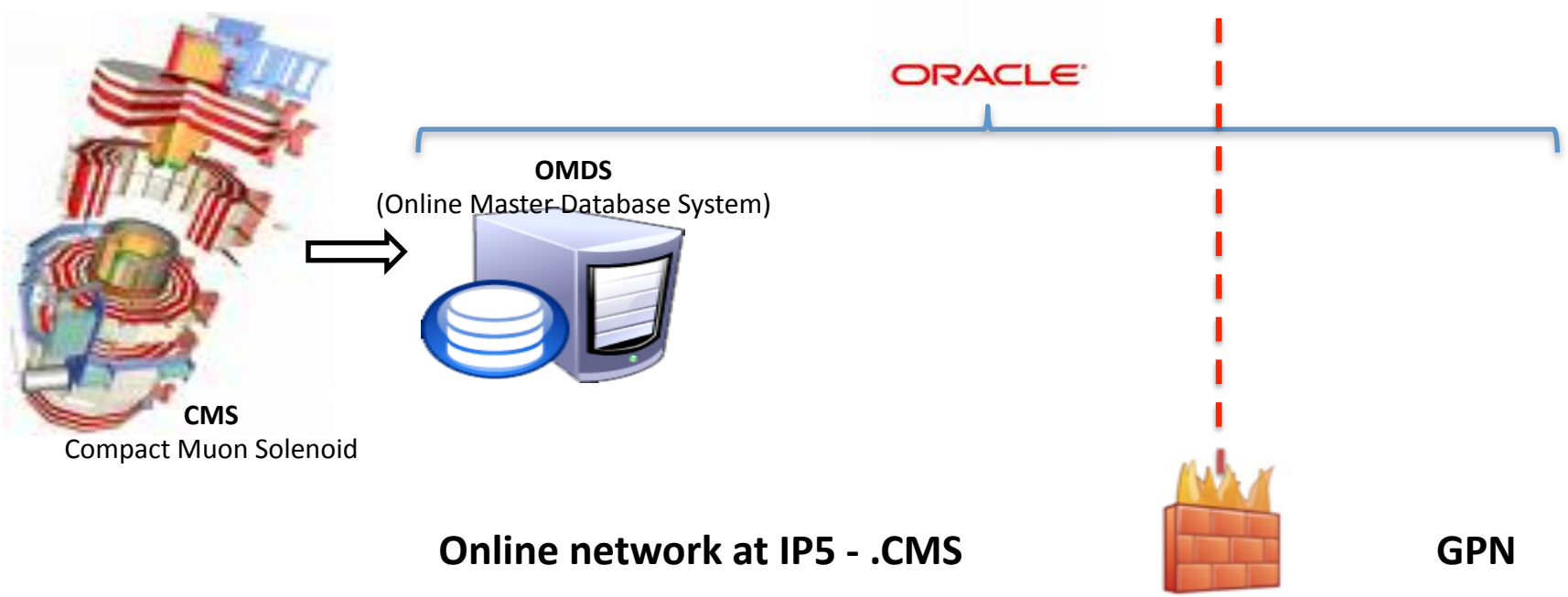
=

Game over

with Condition DB

What is PopCon?

- PopCon (Populator of Condition Objects tool)
  - is an application package fully integrated in the overall CMS framework intended to store, transfer and retrieve data using Oracle-Database.
  - CMS relies on three ORACLE databases for the condition data:



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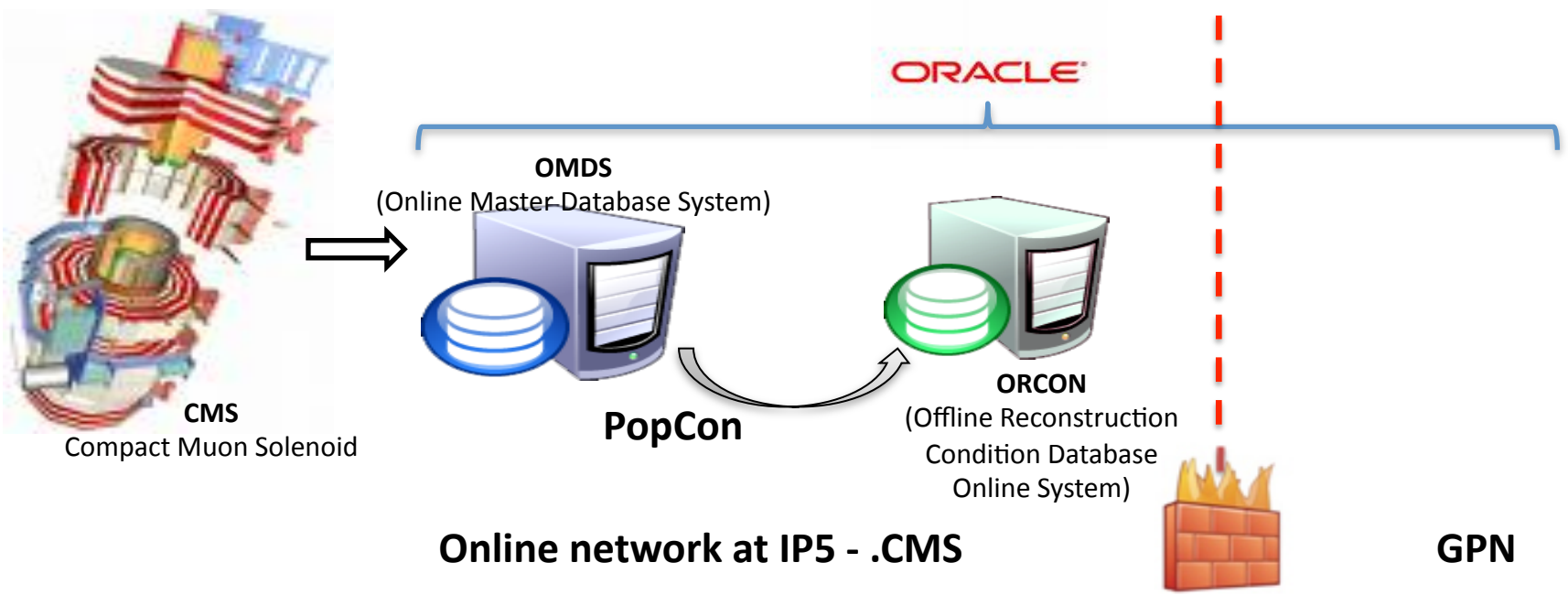

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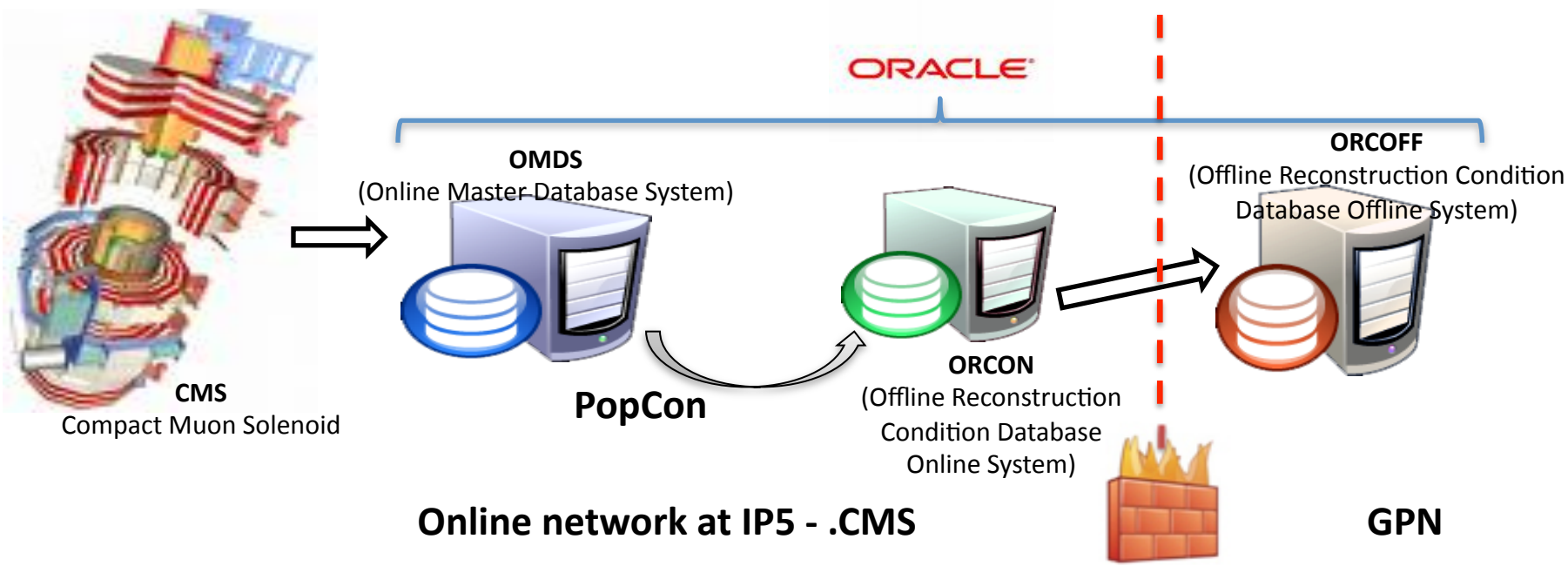

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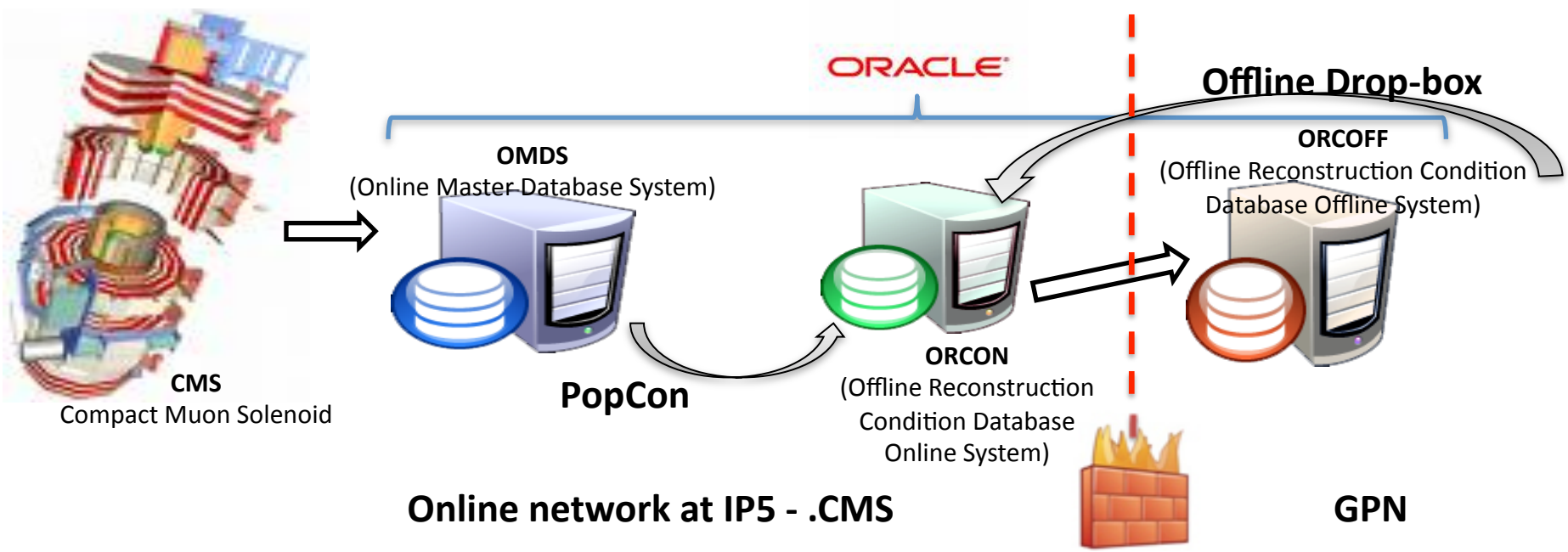
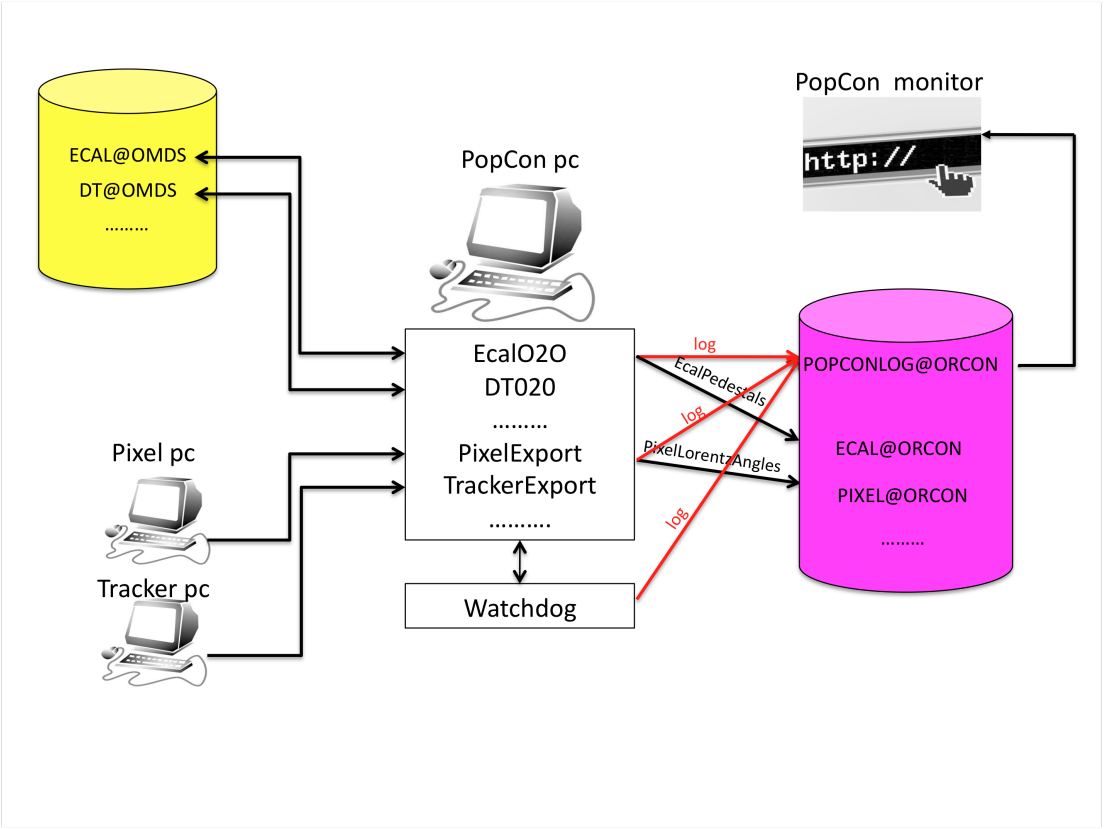


Central Population of Condition DB

- Centralized account in the online network:

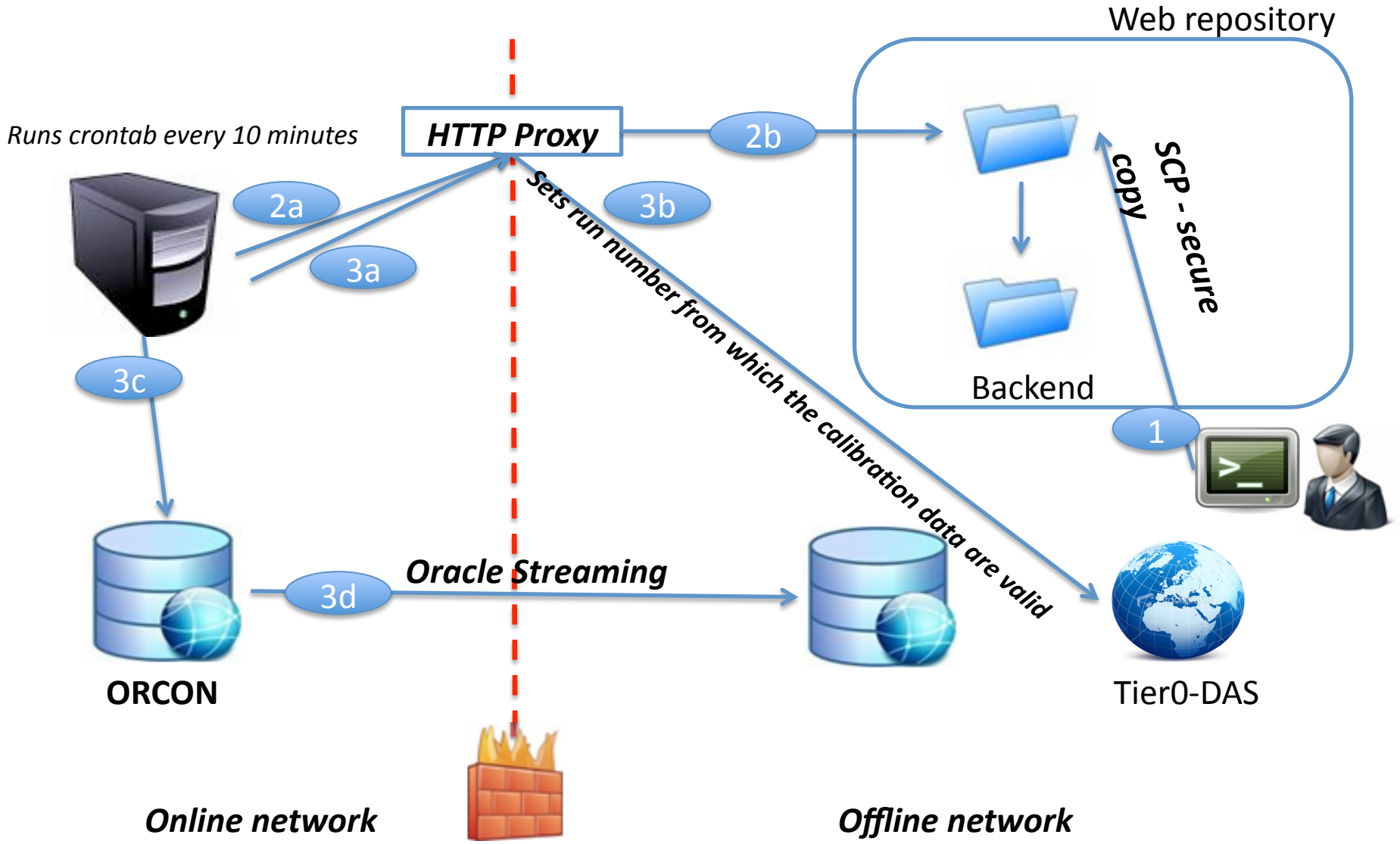
✓Deploy a set of automatic jobs for each sub-detector,
✓Populate ORCON accounts,
✓Monitor any transactions towards them.



What is offline dropbox?

- Infrastructure that, using web applications inside Virtual Machine technology and the Python programming language, allows the automatic exportation of calibration data into the offline condition database accounts.
- Allows the automation of Calibration and Alignment procedures:
  - No need to connect to the online network;
- Simplify the end user work in case he wants to upload calibrations resulting from an offline analysis in the condition databases:
  - No need to have an online account,
    - In many cases, they cannot ask for it;
  - Base knowledge of the Condition Core software;
  - No knowledge of GPN-.CMS network communication,
    - The application is completely transparent to the end user.

Offline dropbox workflow



How the offline dropbox works?

1. The user uploads the SQLite and metadata files on the web repository:
   a. Bash script that encapsulates them in compressed tar ball;
2. Using http_proxy and a Python script (with the standard library URLLib), the files uploaded by users are pulled from GPN to the PopCon SLC5 machine in the online network every 10 minutes;
3. The "run export" script performs the inspection on the exported files:
   a. Checks the metadata values filled by users, in particular if the destination tag is part of one of the production GTs,
   b. Checks if the mapping for the container in the SQLite file is exactly the same as the one in the destination account,
      - ✓ Avoid dangerous "ghost" mappings,
   c. Sets the run number (Begin) from which the calibration data are valid by querying RunInfo (for hlt and express) or Tier0 DAS (for prompt),
      - ✓ If the destination tag is part of a production GT, the synchronization is forced to the GT type,
      - ✓ Ordering of SQLite files according to the run number and/or begin value;
   d. Exports data on the online DB:
      - ✓ If requested, appends the payloads to the HLT and/or express and/or prompt tags by duplicating the IOV with synchronization to RunInfo or Tier0.
      - ✓ Possible only if you want to upload one payload!

How the offline dropbox works?

- Such a complex infrastructure was needed in order to meet the requirements of the .CMS system administrators:
  - Transferring data from GPN to .CMS is not envisaged in the online network design;
  - Strict security policy of .CMS:
    - Files cannot be copied from GPN to .CMS, but they must be pulled in the online cluster from the offline network.
- In order to maintain such tool, we need to monitor many different parts of the infrastructure:
  - Maintained by us:
    - Web service,
    - Cronjobs in the online machine;
  - Non maintained by us:
    - HTTP proxy,
    - T0 Data Service, RunInfo (partially),
    - Oracle Streams.

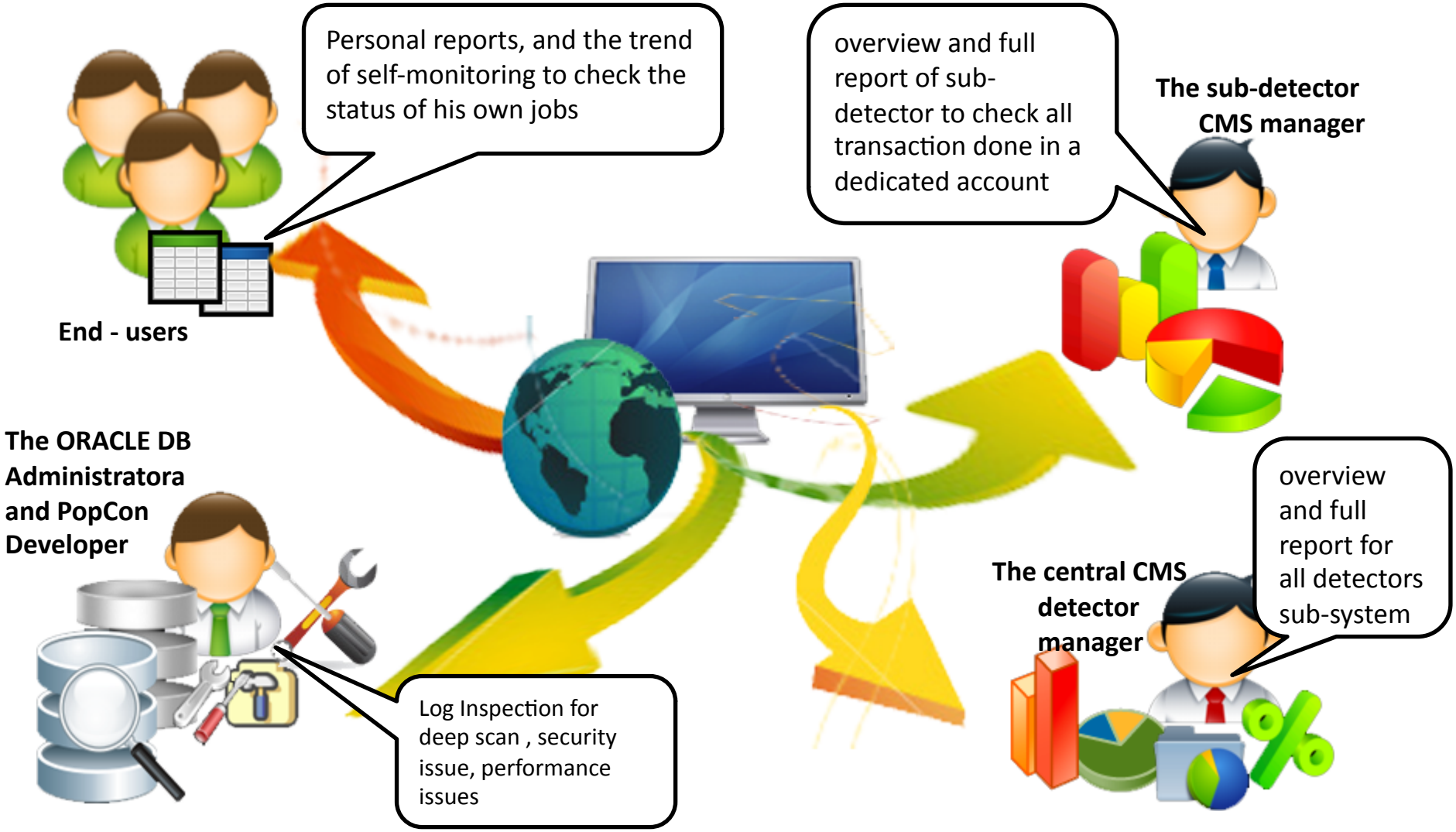
What is PopCon monitoring?

- Open source transaction status web monitoring developed at CERN that provides:
  - Transaction status:
    - Aborted, committed, pending
  - Error monitoring reports
    - Identify any mistakes made by users, application failure, unexpected networks shutdown, etc.
  - Reports from different users' perspectives:
    - Personal view for: Oracle database administrator, CMS detector manager, sub-detector CMS manager, End user.

Why PopCon monitoring?

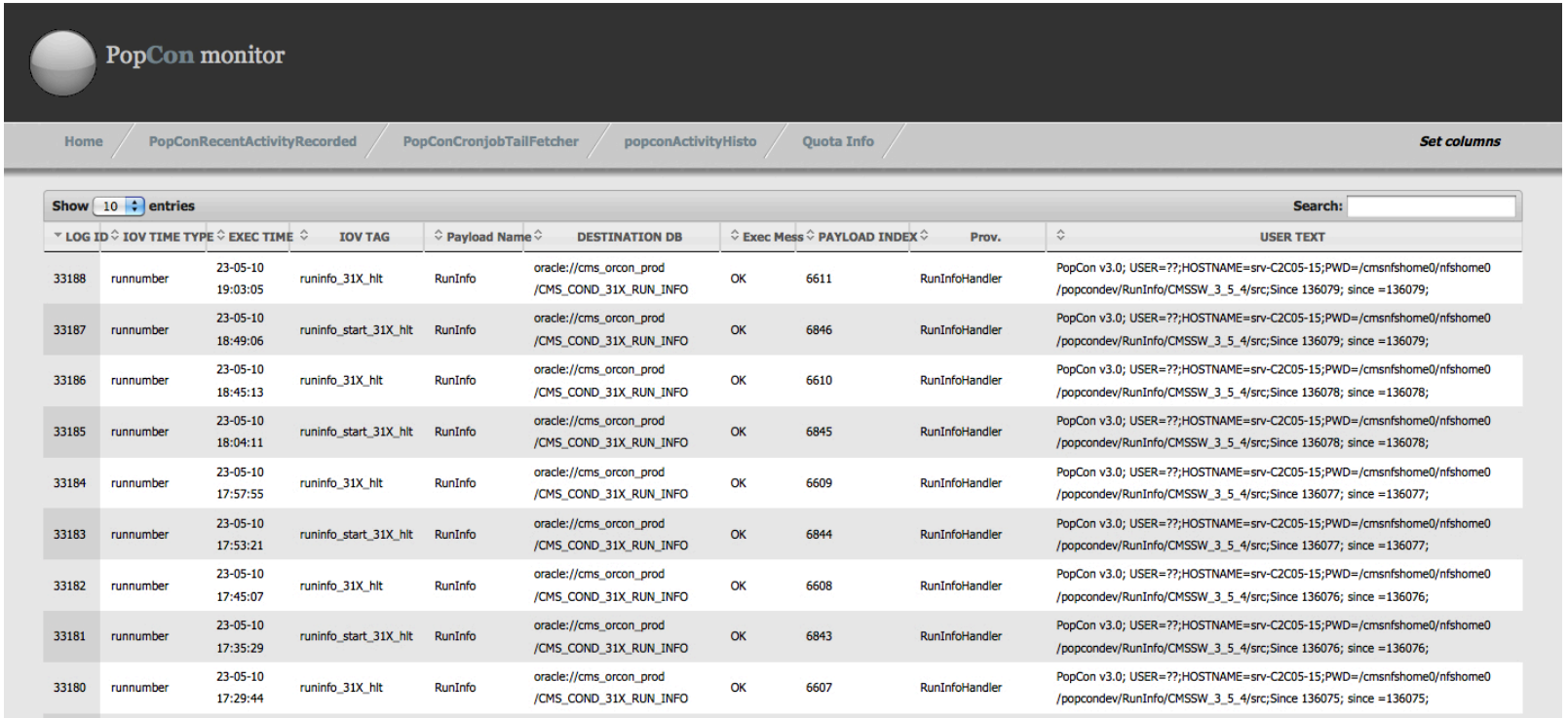
- We might use the existing web monitoring tool for our purpose but we need to fulfill the challenge requirements of CMS experiment:
  - Usage of CMSSW standards
    - Generic CMSSW component to feel comfortable developers and end-users in building and using new package in CMSSW.
  - Monitoring the heterogeneous software environment
    - Oracle DBs, CMSSW framework and other open source packages
  - Open source product
  - CERN Participation in Oracle Technology Beta Programs
    - We need a flexible architecture to handle unexpected error
  - Maximize the performance
    - Stress test of CMSSW infrastructure
    - Avoiding bottlenecks due to Huge Data Access (history and current data)

PopCon from differerent perspectives



Snapshot example: Table reporting

- Recent activity recorded from the Online Run Coordination point of view:
  - it is possible to see the last transactions against the DB account hosting information on run data.
- For each sub-detector, the monitoring system keeps track of all new data transfers.



LOG ID	IOV TIME TYPE	EXEC TIME	IOV TAG	Payload Name	DESTINATION DB	Exec Mess	PAYLOAD INDEX	Prov.	USER TEXT
33188	runnumber	23-05-10 19:03:05	runinfo_31X_hlt	RunInfo	oracle://cms_orcon_prod /CMS_COND_31X_RUN_INFO	OK	6611	RunInfoHandler	PopCon v3.0; USER=??;HOSTNAME=srv-C2C05-15;PWD=/cmsnfshome0/nfshome0 /popcondev/RunInfo/CMSSW_3_5_4/src;Since 136079; since =136079;
33187	runnumber	23-05-10 18:49:06	runinfo_start_31X_hlt	RunInfo	oracle://cms_orcon_prod /CMS_COND_31X_RUN_INFO	OK	6846	RunInfoHandler	PopCon v3.0; USER=??;HOSTNAME=srv-C2C05-15;PWD=/cmsnfshome0/nfshome0 /popcondev/RunInfo/CMSSW_3_5_4/src;Since 136079; since =136079;
33186	runnumber	23-05-10 18:45:13	runinfo_31X_hlt	RunInfo	oracle://cms_orcon_prod /CMS_COND_31X_RUN_INFO	OK	6610	RunInfoHandler	PopCon v3.0; USER=??;HOSTNAME=srv-C2C05-15;PWD=/cmsnfshome0/nfshome0 /popcondev/RunInfo/CMSSW_3_5_4/src;Since 136078; since =136078;
33185	runnumber	23-05-10 18:04:11	runinfo_start_31X_hlt	RunInfo	oracle://cms_orcon_prod /CMS_COND_31X_RUN_INFO	OK	6845	RunInfoHandler	PopCon v3.0; USER=??;HOSTNAME=srv-C2C05-15;PWD=/cmsnfshome0/nfshome0 /popcondev/RunInfo/CMSSW_3_5_4/src;Since 136078; since =136078;
33184	runnumber	23-05-10 17:57:55	runinfo_31X_hlt	RunInfo	oracle://cms_orcon_prod /CMS_COND_31X_RUN_INFO	OK	6609	RunInfoHandler	PopCon v3.0; USER=??;HOSTNAME=srv-C2C05-15;PWD=/cmsnfshome0/nfshome0 /popcondev/RunInfo/CMSSW_3_5_4/src;Since 136077; since =136077;
33183	runnumber	23-05-10 17:53:21	runinfo_start_31X_hlt	RunInfo	oracle://cms_orcon_prod /CMS_COND_31X_RUN_INFO	OK	6844	RunInfoHandler	PopCon v3.0; USER=??;HOSTNAME=srv-C2C05-15;PWD=/cmsnfshome0/nfshome0 /popcondev/RunInfo/CMSSW_3_5_4/src;Since 136077; since =136077;
33182	runnumber	23-05-10 17:45:07	runinfo_31X_hlt	RunInfo	oracle://cms_orcon_prod /CMS_COND_31X_RUN_INFO	OK	6608	RunInfoHandler	PopCon v3.0; USER=??;HOSTNAME=srv-C2C05-15;PWD=/cmsnfshome0/nfshome0 /popcondev/RunInfo/CMSSW_3_5_4/src;Since 136076; since =136076;
33181	runnumber	23-05-10 17:35:29	runinfo_start_31X_hlt	RunInfo	oracle://cms_orcon_prod /CMS_COND_31X_RUN_INFO	OK	6843	RunInfoHandler	PopCon v3.0; USER=??;HOSTNAME=srv-C2C05-15;PWD=/cmsnfshome0/nfshome0 /popcondev/RunInfo/CMSSW_3_5_4/src;Since 136076; since =136076;
33180	runnumber	23-05-10 17:29:44	runinfo_31X_hlt	RunInfo	oracle://cms_orcon_prod /CMS_COND_31X_RUN_INFO	OK	6607	RunInfoHandler	PopCon v3.0; USER=??;HOSTNAME=srv-C2C05-15;PWD=/cmsnfshome0/nfshome0 /popcondev/RunInfo/CMSSW_3_5_4/src;Since 136075; since =136075;

Acknowledgments

- Thanks to François Fluckiger for his suggestions, comments, and feedback!


That's all Folks!