# Oracle for administrative, technical and Tier-0 mass storage services

**openlab Major Review Meeting**

29 September 2009

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Anton Topurov

# Outline

## Main areas of activity

- **Security**
- Oracle Database Virtualization
- Joint Software Testing Program (mostly 11.2 database for the past 6 months)
- Monitoring
  - Web applications monitoring using EM / beacons
  - Database policies

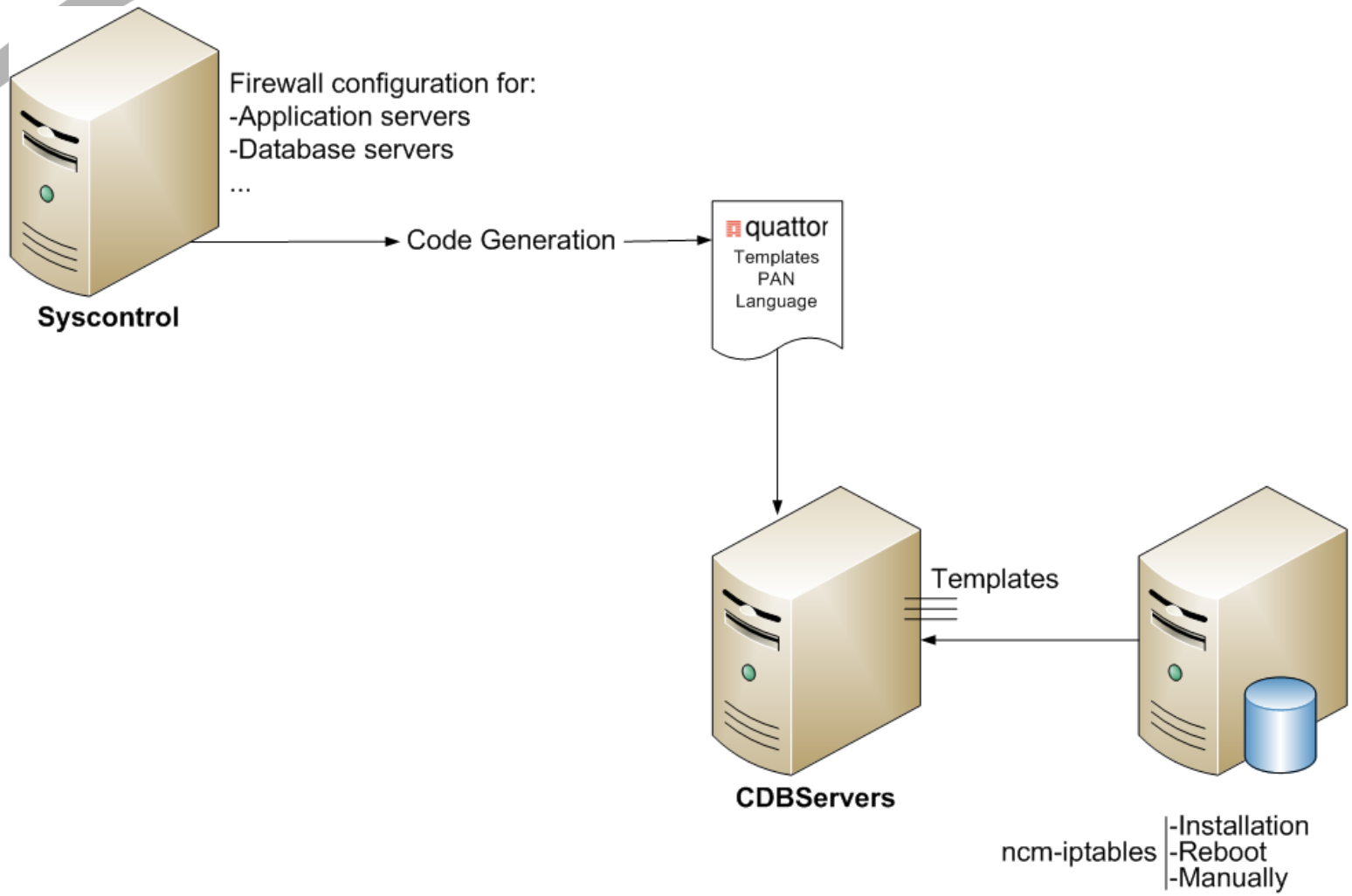
# Acronyms

- **CERN ELFms** (Extremely Large Fabric management system)
- **Quattor** (System installation and configuration toolsuite)
- **Syscontrol** (Management and Inventory)

# Security and Databases

- Use OS firewall (iptables) to protect our data. Another security layer.
- Need to build rules for RACs which run complex environments and are very sensitive, using several network interfaces → Extensive testing
- Need to change Quattor ncm-iptables component
- Also provides a log of “inappropriate” accesses

# Firewall Automatic Generation




**Note: Not auto propagated with every change**

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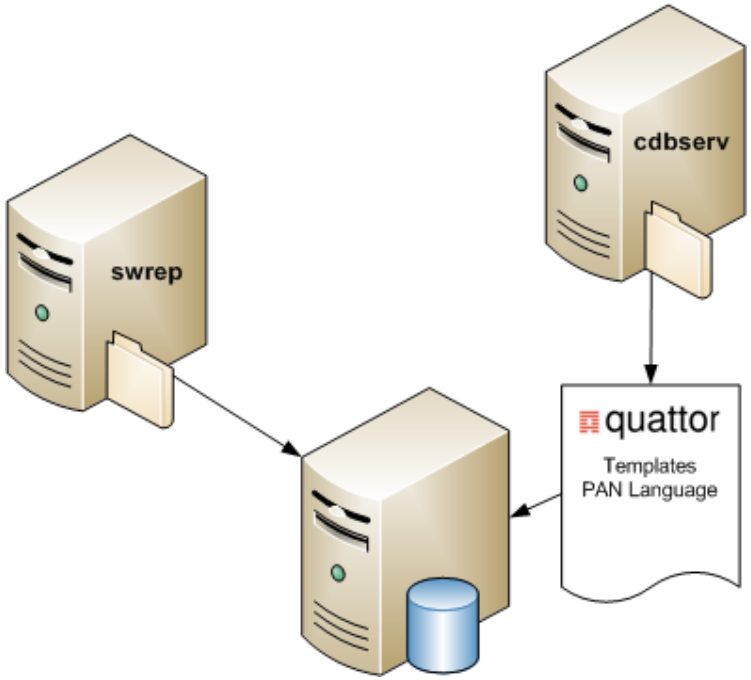
# OracleVM at CERN

- Need to integrate OracleVM within CERN ELFms
- Central Linux installation (PXE) + Quattor




-Manual installation:
OVM + packages ≈ 1-3 h

- Whole automatic installation ≈ 20 min

# OracleVM Future work

- Integration of OracleVM as host already done.
- Integrate the installation of the guest hosts using CERN ELFms
- Installation of the Oracle Database on guest hosts using Quattor

- Special thanks to OracleVM experts from Oracle:
  - Chris Barclay
  - Adam Hawley
  - Madhup Gulati

  for their help

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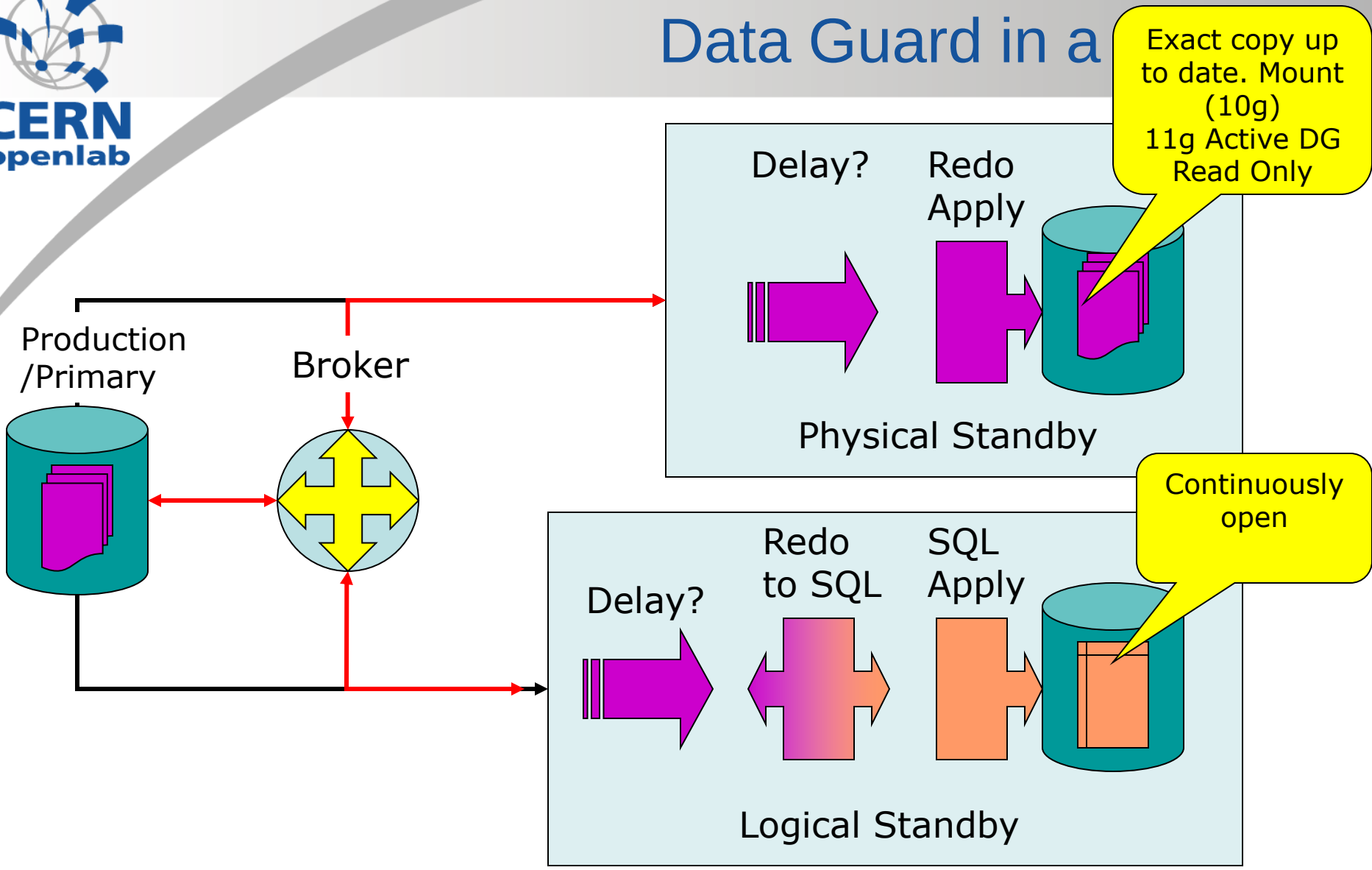
# Data Guard in a nutshell

- What is Data Guard?
  - It’s a technology that establishes and maintains secondary "standby databases" as alternative/supplementary repositories to production "primary databases".
  - Physical standby (Redo Apply)
    - Replicates the exact contents of its primary database across the Oracle Net network layer.
  - Logical standby (SQL Apply)
    - Convert the redo generated at the Primary database into data and SQL and then re-apply those SQL transactions on the Logical standby.

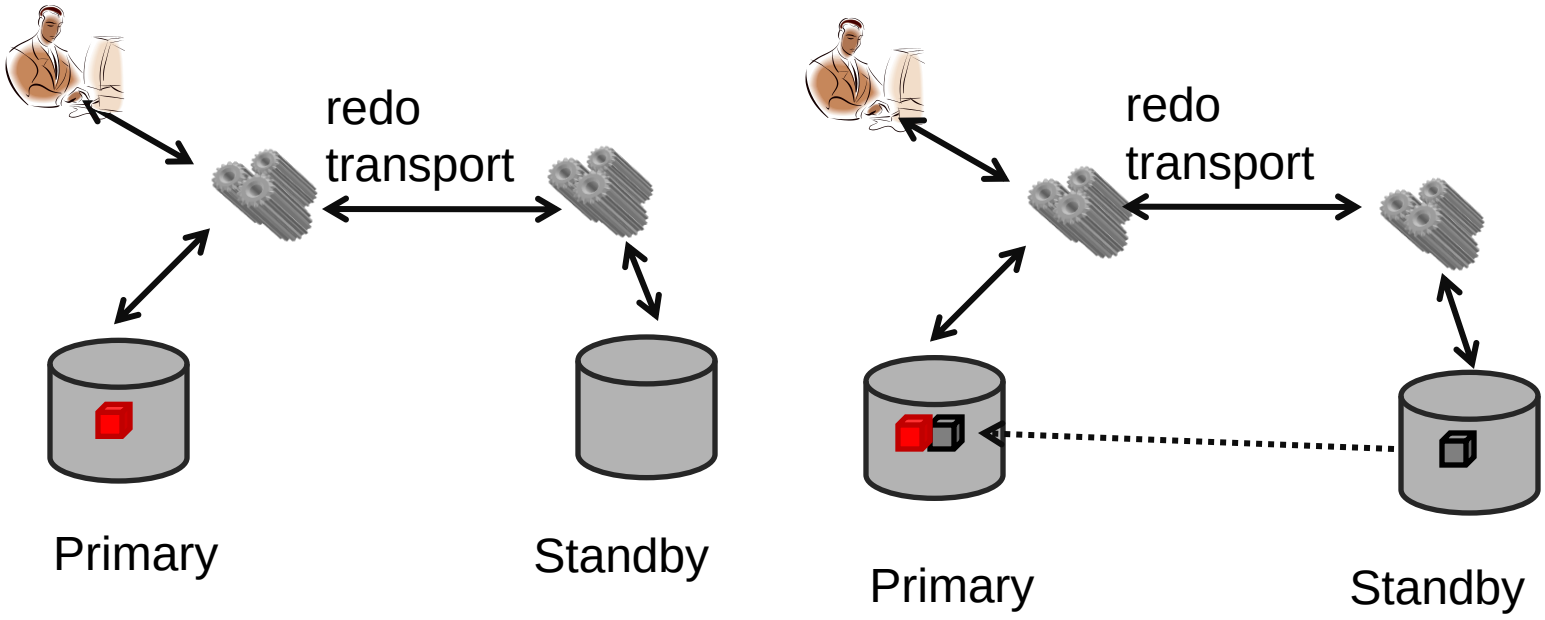
# Data Guard in a



# Data Guard – 11g

- High Interest on this technology
  - Disaster recovery solution
  - Offload primary database:
    - Backups can be done on the physical standby
    - Physical Standby can be used for read-only queries (11g only) i.e. reporting, data warehouse apps, lengthy queries,…
    - Several use cases already identified for the “active dataguard” including CASTOR name server…
  - Hardware migration solution

# DataGuard: automatic block recovery 11gR2




User completes its query. It doesn't get:
ORA-01578: ORACLE data block corrupted

# 11gR2

- Access to binaries via Oracle Joint Software testing program
- High interest on new features
  - Already 2 applications designed based on 11g new features
- Features (full report provided to Oracle)
  - Active duplication ☺
  - Automatic block recovery
    - Primary ⇐ Standby ☺
    - Primary ⇒ Standby in progress
  - DUPLICATE Without Connection to Target Database ☺
  - Configurable Real-Time Query Apply Lag Limit ☺
  - Direct NFS better performance vs Kernel mounts ☺

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# OEM – Service tests and beacons

- OEM has been **migrated** to version **10.2.0.5** following the intensive pre-release testing and feedback (with some highlight on the benefits)
- The **virtualization console** has been intensively tested in the pre-release. This work was mentioned in the **Oracle press release**.
- **Enable** the use of **web transactions monitoring**.

# OEM – Service tests and beacons

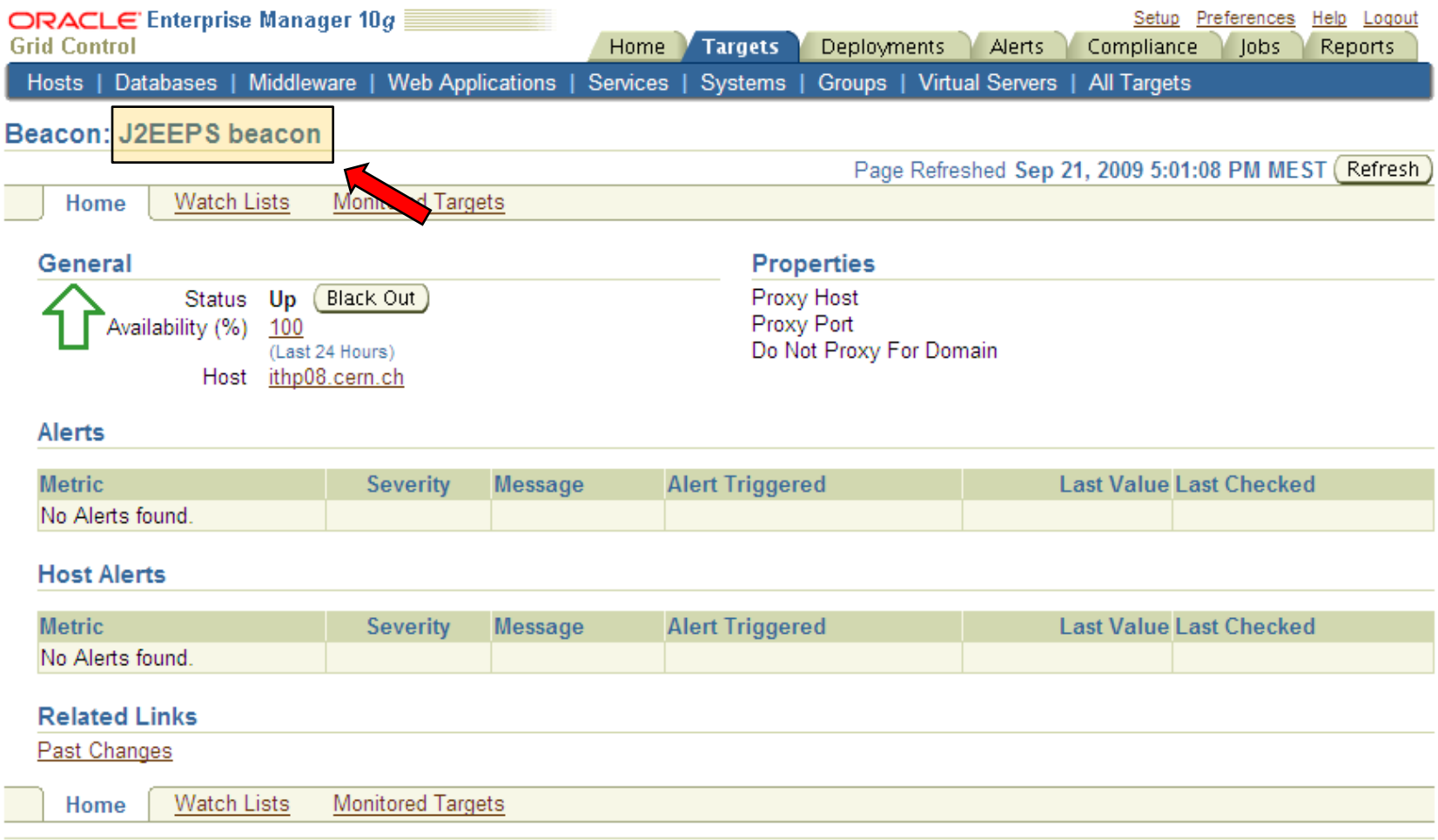
- **AIM**: We need to extend the monitoring provided by Lemon in aspects like the web transactions.
- Decided to take profit of **OEM** Services
- Provided feedback in the **CAB** (Customer Advisory Board)
- Our requirements were included in the last release of OEM (10.2.0.5)
- Satisfied with the tests we plan to deploy them widely.

# OEM – Service tests and beacons

- **Steps** to follow to **create** an "**EM service**":
  - Creation of an "OEM service beacon" (remote piece of software that plays back recorded Web transactions or service tests for various protocols)
  - Creation of an "OEM system" for each CERN service to be monitored
  - Creation of an "OEM service" for each OEM system
  - Creation of a set of "OEM service tests" for each CERN service

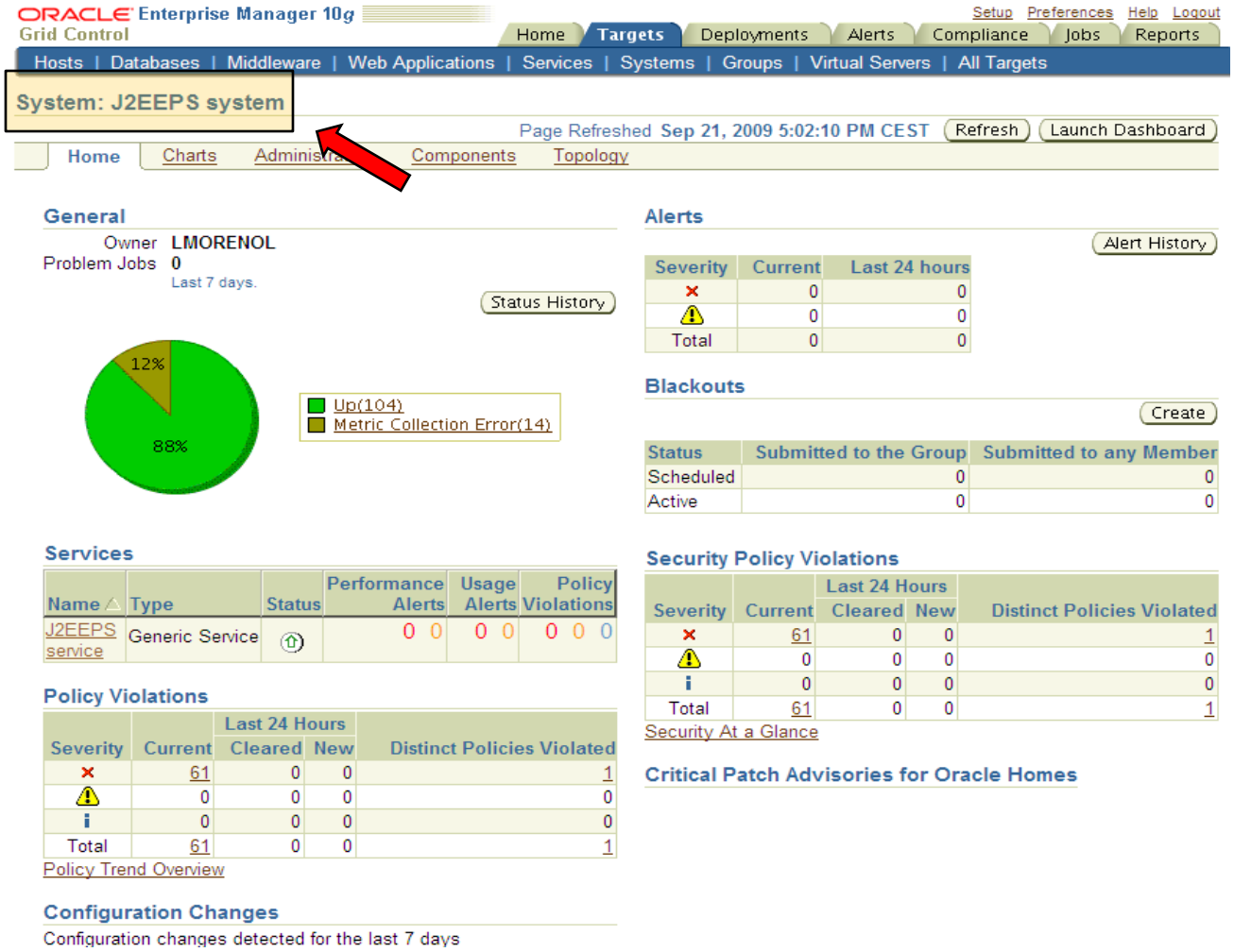
# OEM – Service tests and beacons

- 1st Step: Creation of an OEM beacon



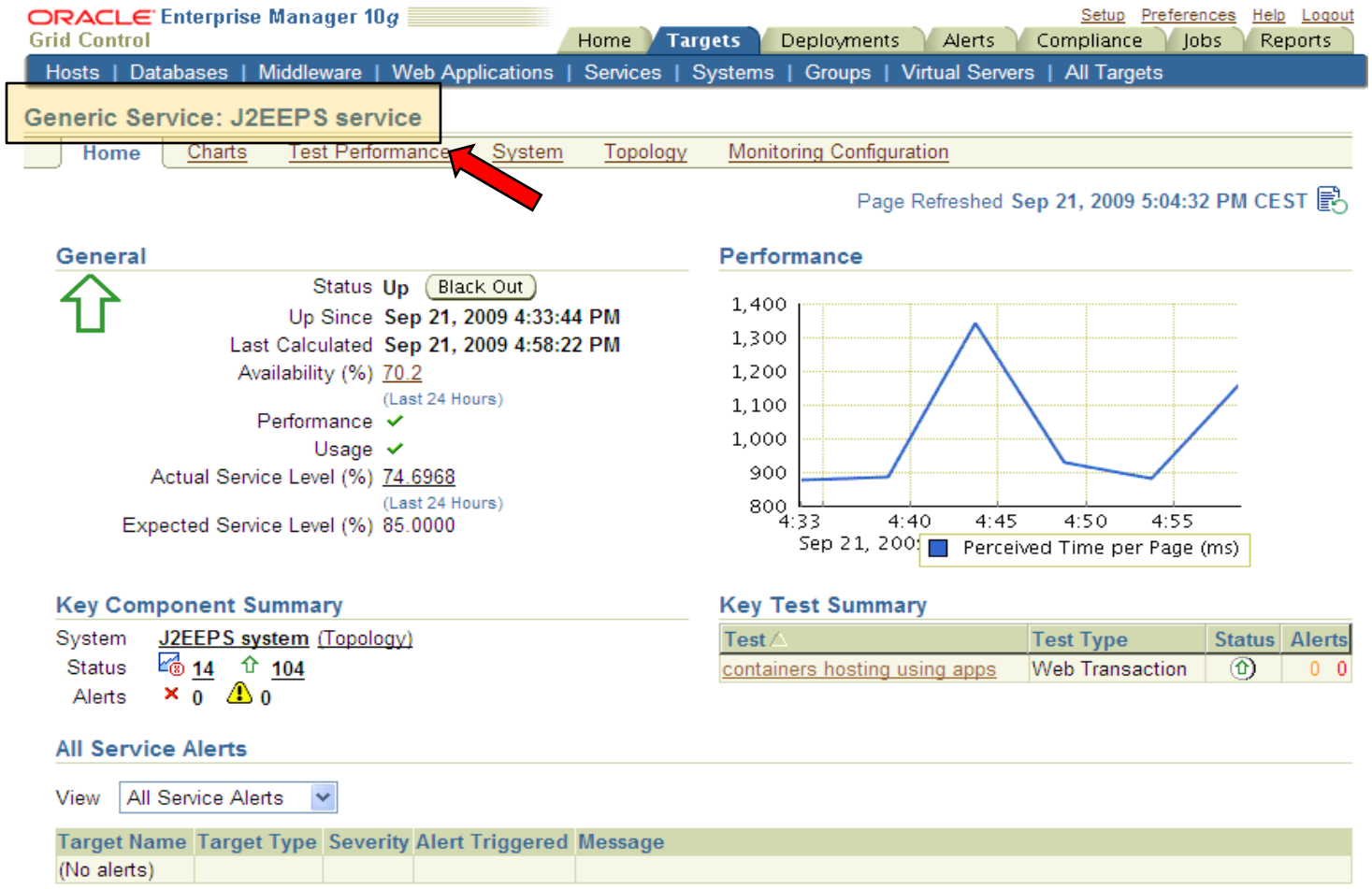
# OEM – Service tests and beacons

- 2nd Step: Creation of an OEM system



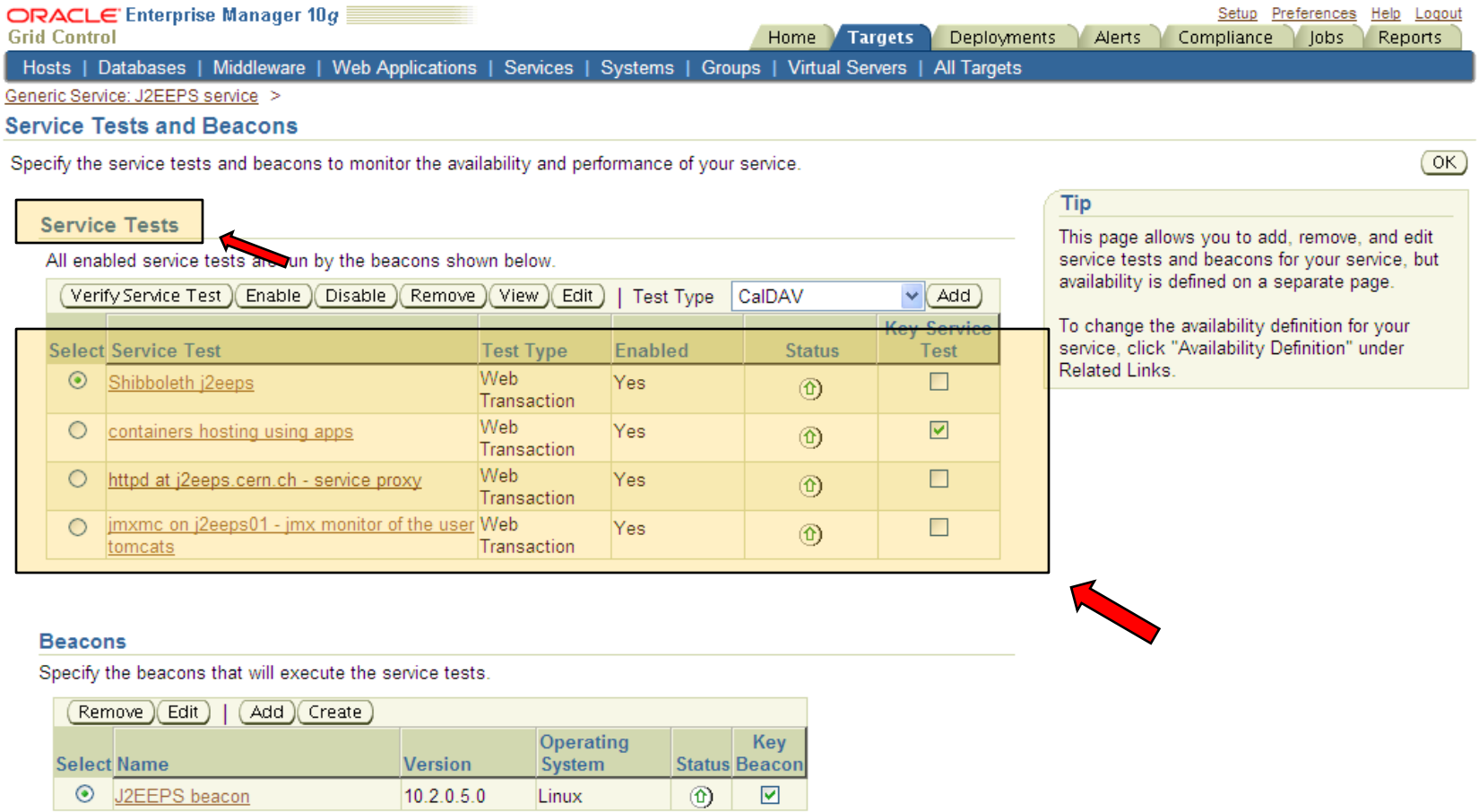
# OEM – Service tests and beacons

- 3rd Step: Creation of an OEM service



# OEM – Service tests and beacons

- 4th Step: Creation of OEM service tests to monitor a CERN service

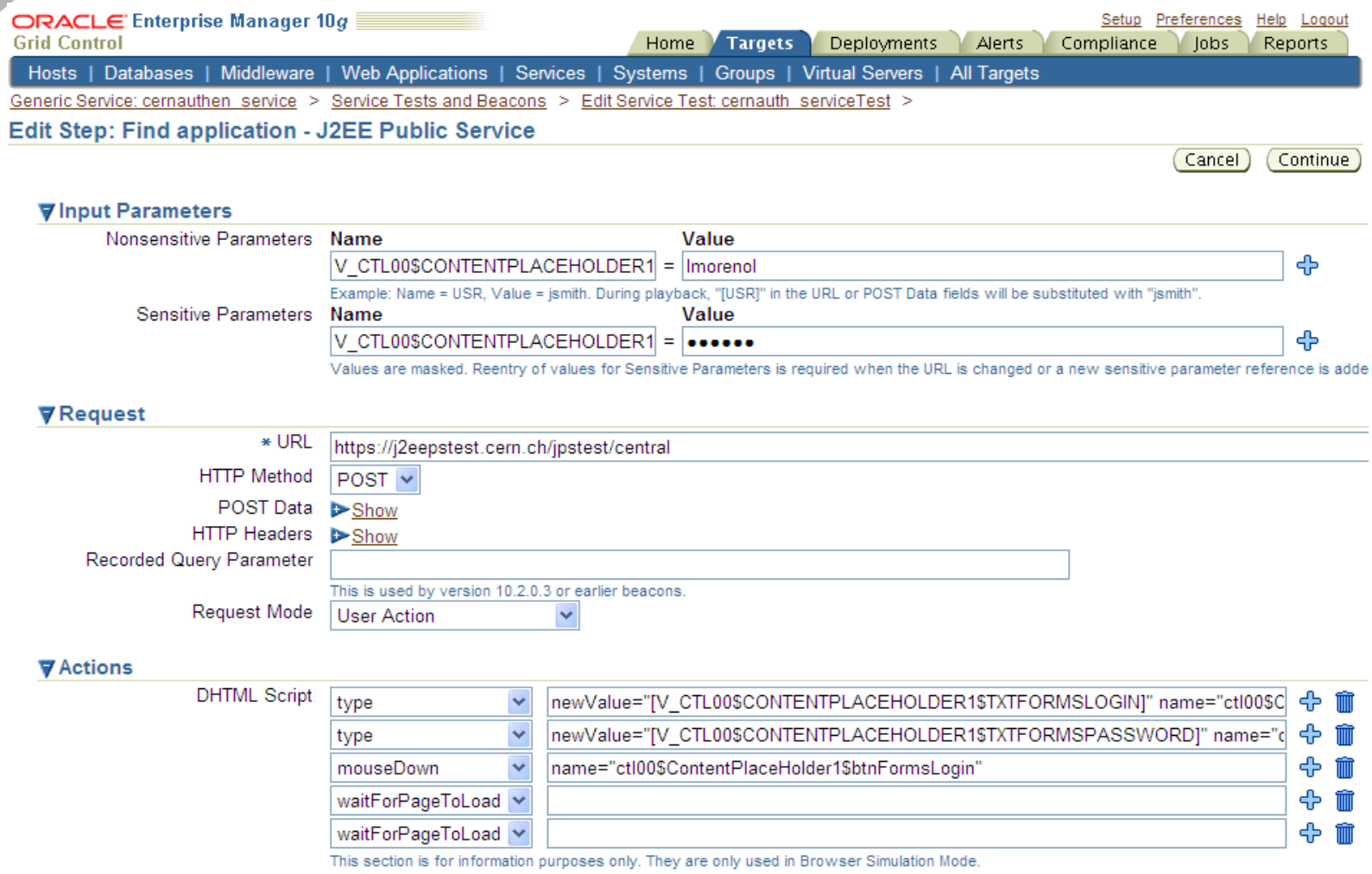


# OEM – Service tests and beacons

- Performed EM service tests – **Test types**:
  - Web Transactions:
    - ✓SSO: CERN authentication
    - ✓Form authentication: AIS login
    - ✓Realm: Tomcat Realm
  - JDBC SQL Timing
  - LDAP

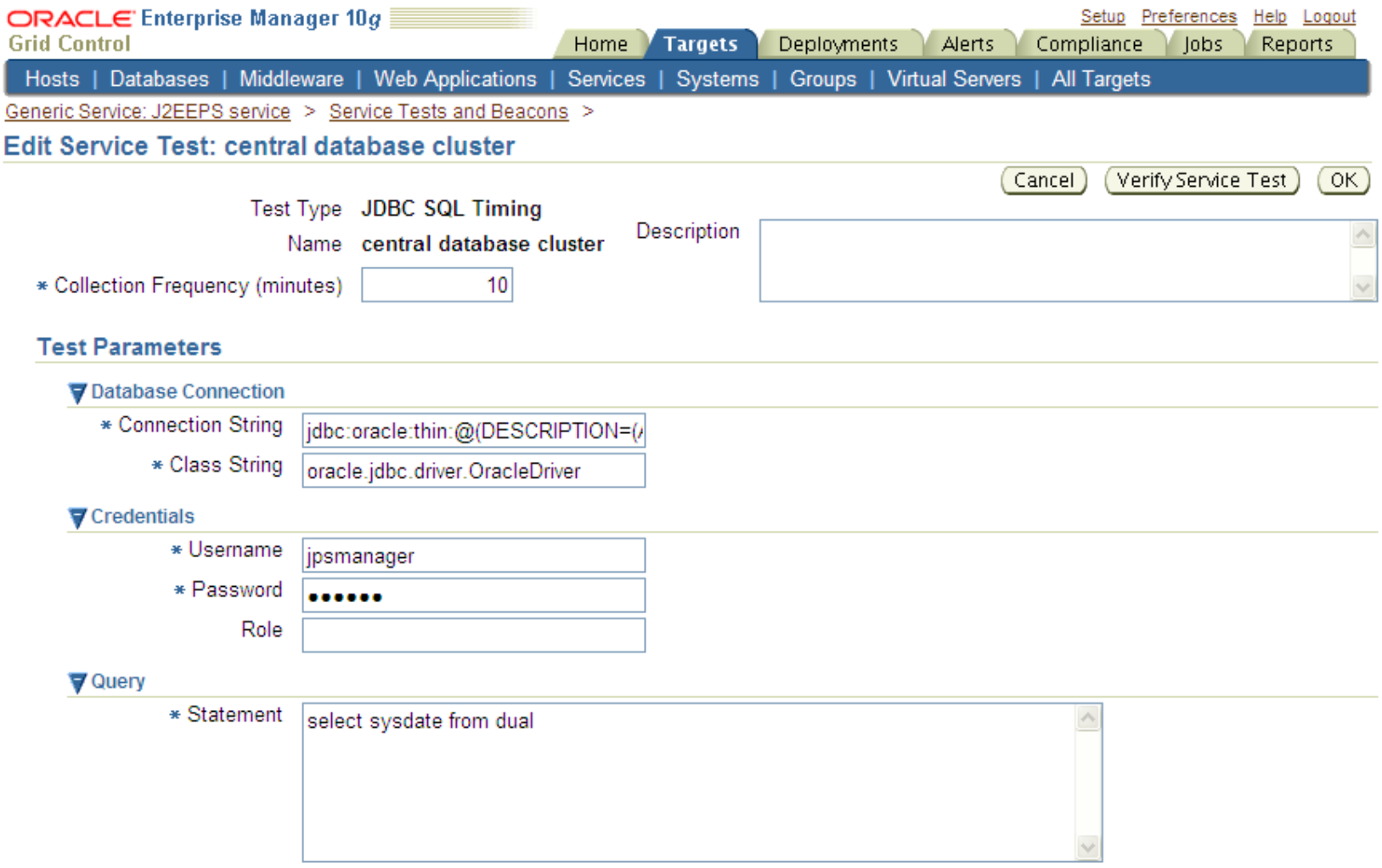
# OEM – Service tests and beacons

- Example of service test – Type Web Transaction



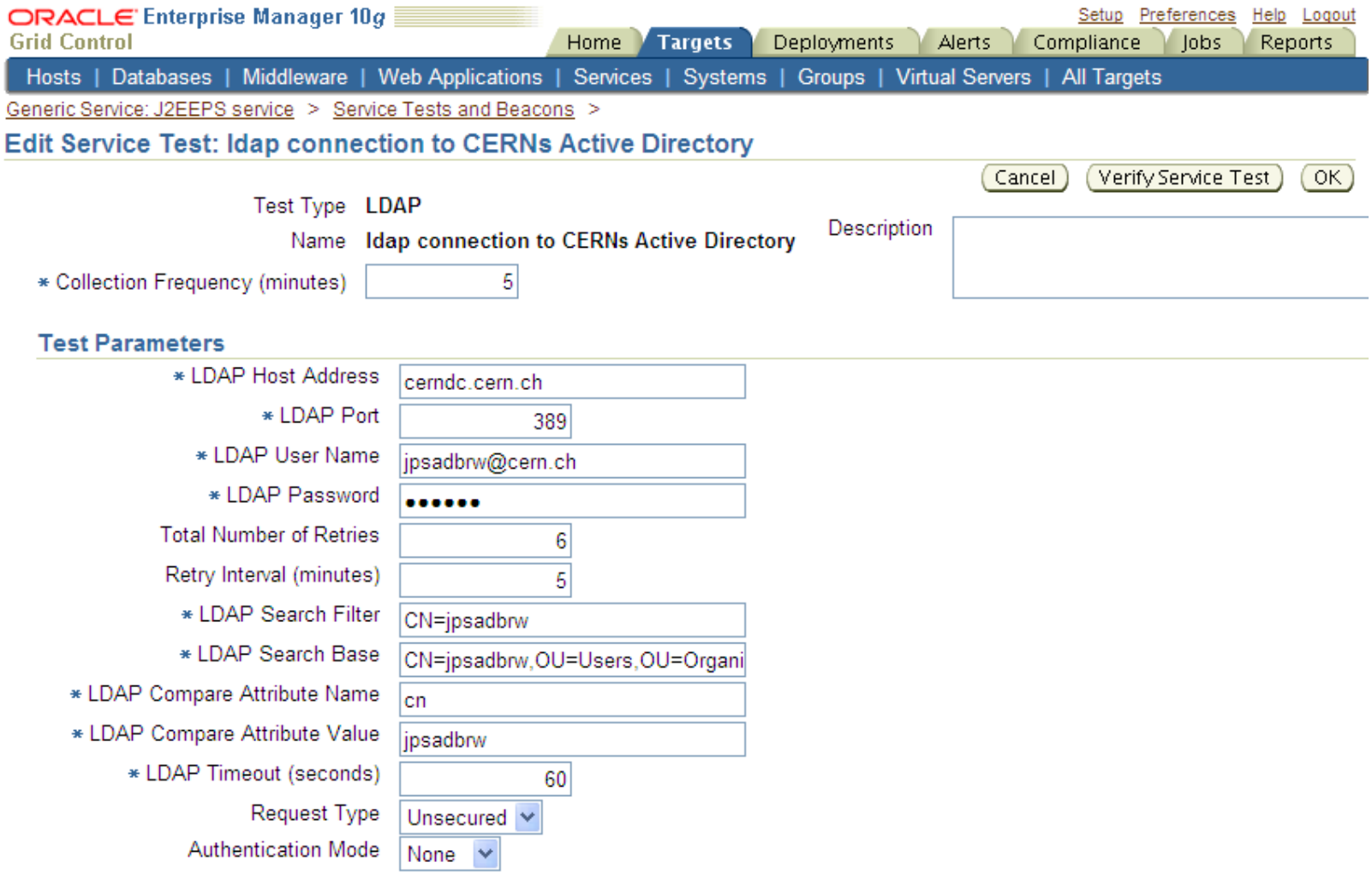
# OEM – Service tests and beacons

- Example of service test – Type LDAP



# OEM – Service tests and beacons

- Example of service test – Type JDBC SQL Timing



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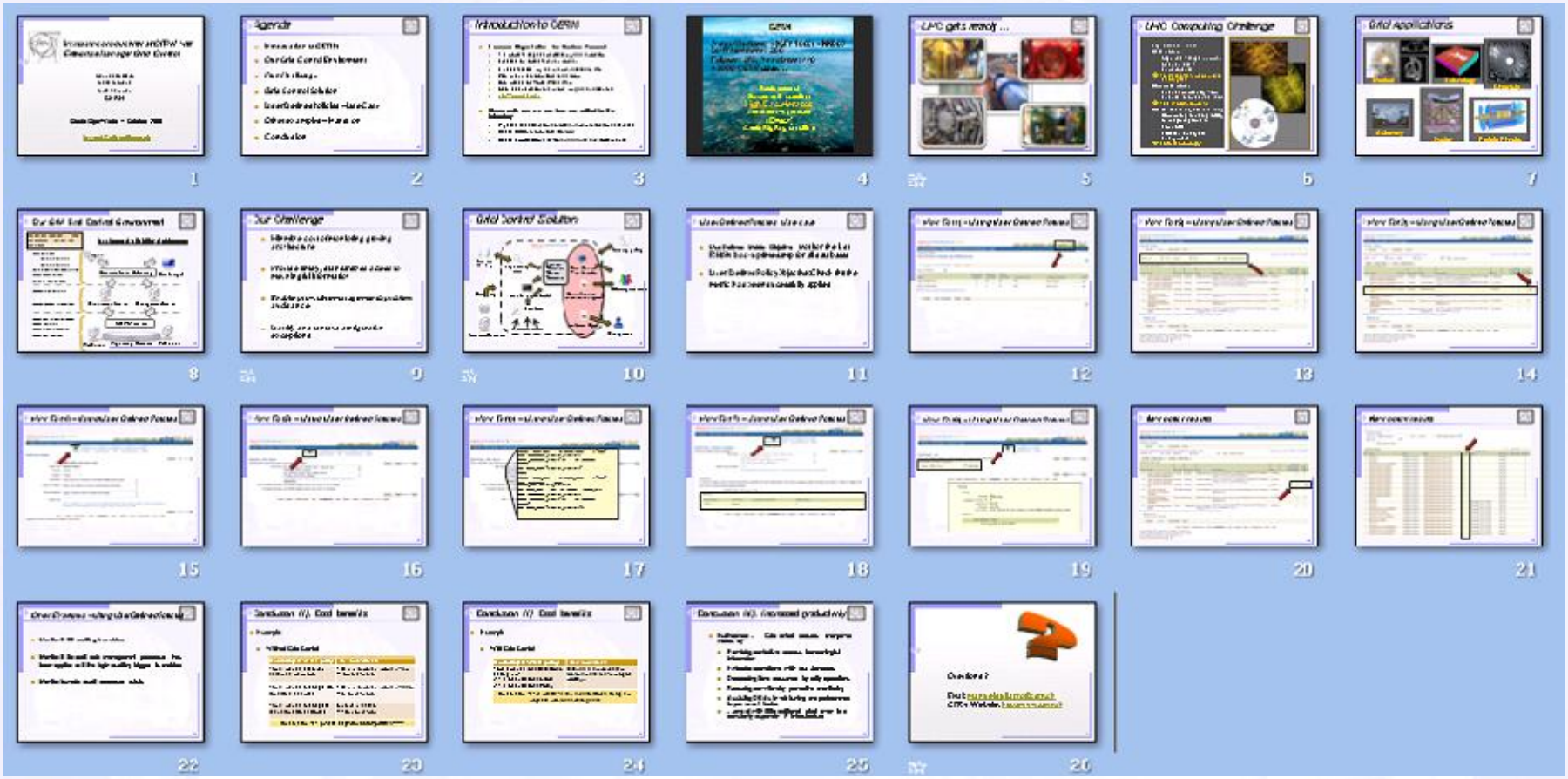
# *Increasing productivity at CERN with Enterprise Manager Grid Control*

Manuel Guijarro
Lucia Moreno
Chris Lambert
CERN

Oracle OpenWorld – October 2009

Manuel.Guijarro@cern.ch

# Snapshots of OOW presentation



# Our Challenge

- **Minimize cost** of monitoring growing architecture
- Provide timely, **standardized access** to meaningful information
- Enable **pro-active management** & **problem avoidance**
- Identify and **remove** configuration **exceptions**

# Conclusion: Increased productivity

- Furthermore… Grid control **reduces manpower** needs by:
  - Providing centralized access to meaningful information
  - Enforcing compliance with our standards
  - Decreasing time consumed by daily operations
  - Reducing downtime by pro-active monitoring
  - Assisting DBAs in their tuning and performance improvement tasks
  - …and all with little additional effort even for a constantly expanding IT infrastructure

# Future

- Beta project around Oracle Weblogic
- Database virtualisation deployment
- 11.2 database deployment start

# Outreach

- 11.2 testing result
- OOW conference
- UKOUG conference
- Phone conferences on OracleVM and EM
- Swiss Oracle User Group on Oracle 11
- CERN Computer Newsletter article
- Oracle Press release about OEM management to OVM server

**Supporting Quotes**

- "Two of the main roadblocks of customer adoption of virtualization technologies has been the high cost and complexity of managing virtual environments and a lack of tools to provide an application perspective," said Richard Sarwal, Oracle senior vice president Product Development. "With added management capabilities for Oracle VM, Oracle Enterprise Manager has taken a major step forward in helping our customers drive down the cost of managing applications in virtual environments."
- "CERN has been searching for a comprehensive virtualization management solution for some time. We recently evaluated Oracle Enterprise Manager's Oracle VM Management Pack and we were impressed with its virtualization dashboard. It simplifies administrators' jobs by providing an integrated solution for monitoring and administration of virtual servers as well as tracking configuration relationships. We especially liked the ability to provision servers within minutes using templates and live-migrate VMs. These management capabilities can greatly simplify virtual infrastructure management, reduce IT operations overhead, provide cost savings, and reduce risk," said Anton Topurov, Database Fellow, openlab, CERN
- "With the latest additions for Oracle VM deployment and management, Oracle Enterprise Manager will enable us to manage both our existing physical environments and new virtualized infrastructure from a single console. The virtualized Oracle grid infrastructure will allow us to maximize the use of server resources while maintaining high levels of system availability and performance," said April Sims, Database Administrator, Southern Utah University.

**Oracle Press Release**

**Oracle® Enterprise Manager Extends Management to Oracle VM Server Virtualization**

**Provides Complete Top-Down Application Management for Virtual Environments with Unique Business Perspective**

Redwood Shores, CA – March 3, 2009

**News Facts**

Continuing to deliver on its top-down approach to application management, Oracle today announced new management capabilities for Oracle® VM through the release of Oracle Enterprise Manager 10g Release 5 (10gR5). See related release dated today.

With the new Oracle VM Management Pack, Oracle Enterprise Manager 10gR5 provides a comprehensive management solution that spans the entire lifecycle of applications and their virtual infrastructure.

The Oracle VM Management Pack helps customers accelerate the adoption of virtualization, enabling them to optimize IT resources, improve hardware utilization, streamline IT processes, and reduce costs – without adding the complexity and cost associated with multiple management tools.

Customers can now manage both physical and virtual environments with a comprehensive top-down approach that provides a unique business perspective, enabling the understanding of user experiences and the business impact of IT issues, in addition to offering the best tools to manage each component in the stack individually.

due to the virtualization layer was at an acceptable level.

In November 2007, Oracle announced its virtualization solution: Oracle VM, which consists of three parts: Oracle VM Server, Oracle VM Manager and Oracle VM Agent (see figure 2).

Based on Red Hat Enterprise Linux (RHEL) and open-source Xen, Oracle VM Server is the base virtualization software to be installed on a bare metal server. The Oracle VM Agent is the application, installed together with the Oracle VM Server and is responsible for communication with Oracle VM Manager Web-based GUI.

Oracle then certified this single instance (November 2007) and RAC (September 2008) databases in the Oracle VM-based virtualized environment, which was the step we were waiting for.

It was decided to continue with our tests and compare RAC performance on Oracle VM versus the native Xen set-up we tested before. Together with openlab summer student Andrei Dumitru in 2008, we created two set-ups on identical hardware, using Oracle VM and pure Xen, included in RHEL 5. The stability of both set-ups proved to be good and the performance of the Oracle VM set-up was 5 to 20% better than on pure Xen, depending on the workload. Tests of live VM migration with an active database showed only a few seconds downtime with no session-state loss. This is an outstanding addition to the high availability features initially provided by RAC.

Following these successful tests, we are now working closely with IT-FIO to integrate this Oracle VM solution into the CERN fabric management system – ELFms.

In summary, these Oracle VM features, their ease of use and the official certification have directed our choice towards Oracle VM as a virtualization solution for our virtualized cluster databases for the future.

**Useful links**

CERN openlab: http://cern.ch/openlab
(with openlab summer student reports in Technical Documents section)
Oracle VM: www.oracle.com/virtualization

Anton Topurov and Eric Grancher, IT-DES

**Technical brief**

## openlab tests Oracle VM for database service virtualization

**Why database virtualization**

There is a combination of factors that leads to increased interest for virtualization of database servers: number of servers, power usage, cost, new platforms with multi/many cores, high availability and ease of management. Database servers often do not use the full CPU/server capacity. This can be for reasons such as separate test-and-development servers or because spare capacity has to be kept available in case of increased load or for high availability.

In addition, several database services can often not be merged onto a single database or physical "machine" as they need to be on different versions of the database software or operating system. We also need to "protect" each of the database instances from the others so that memory can be guaranteed for a given instance.

Having a smaller number of servers will obviously reduce the cost of hardware, maintenance and electrical power. The power usage is especially important due to the constraints on "critical power" in computer centres as well as the impact on a cooling system.

We believe that consolidation with virtualization will become more and more interesting, in particular given that processors will continue to have an increasing number of cores in the medium term future. Another attractive opportunity with virtualization is the possibility to relocate and distribute virtual machines on different nodes depending on the load and intervention needs. This leads to higher availability while having fewer constraints on the operations to be performed.

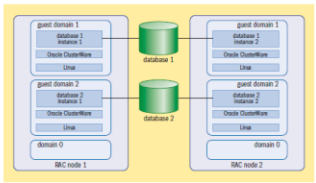



*Fig. 1. Fighting underutilization by combining several clustered databases on two servers.*

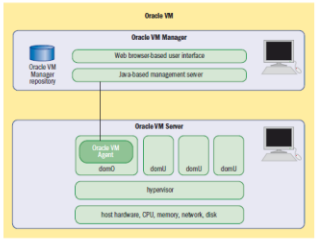



*Fig. 2. Architecture: Oracle VM Manager and Oracle VM Server are installed on separate servers with communication provided by the management server and Oracle VM Agent.*

**Database virtualization at CERN openlab**

In the CERN openlab Database Competence Centre, we started looking at virtualization in early 2006. The first project was aimed at testing the Oracle database in the Xen virtualized environment. The main focus was on the possibility to run a single-instance database in a virtual machine (VM), as well as testing different Xen schedulers to allocate CPU slices to different virtual machines. On successful completion of this project, we decided to expand our tests, and include Oracle Real Application Clusters (RAC) in such an environment.

RAC – an Oracle technology widely used at CERN and in the HEP community – allows several physical machines to work as a single clustered database, thus providing scalability and high availability. High availability is the main driving force behind implementing RAC in less workload-intensive infrastructure databases, which also leads to underutilization of the database nodes. Bearing this in mind, we were attracted to the idea of running RAC in a virtualized environment, thus utilizing more of the hardware without compromising the high availability features (see figure 1).

The concept of RAC on VM was proved to be successful by openlab summer student Maria Leitner in 2007. She created a cluster database inside a single physical host with Red Hat Enterprise Linux 4 as a base operating system. The set-up was quite stable and the performance loss